



BSI Standards Publication

Fences –

Part 16: Specification for powder coatings used as a plastics finish to components and mesh

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Foreword

Publishing information

This part of BS 1722 was published by BSI and came into effect on 31 March 2009. It was prepared by Technical Committee B/201, *Fences*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 1722 supersedes BS 1722-16:1992, which is withdrawn.

Relationship with other publications

BS 1722 is published in parts as follows:

- *Part 1: Specification for chain link fences;*
- *Part 2: Specifications for strained wire and wire mesh netting fences;*
- *Part 4: Specification for cleft chestnut pale fences;*
- *Part 5: Specification for close-boarded and wooden palisade fences;*
- *Part 7: Specification for wooden post and rail fences;*
- *Part 8: Specification for mild steel (low carbon steel) continuous bar fences and hurdles;*
- *Part 9: Specification for mild steel (low carbon steel) fences with round or square verticals and flat horizontals;*
- *Part 10: Specification for anti-intruder fences in chain link and welded mesh;*
- *Part 11: Specification for prefabricated wood panel fences;*
- *Part 12: Specification for steel palisade fences;*
- *Part 13: Chain link fences for tennis court surrounds ¹⁾;*
- *Part 14: Specification for open mesh steel panel fences;*
- *Part 16: Specification for powder coatings used as a plastics finish to components and mesh;*
- *Part 17: Specification for electric security fences – Design, installation and maintenance;*
- *Part 18: Specification for steel mesh site perimeter temporary fencing systems ²⁾.*

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

¹⁾ Obsolescent.

²⁾ Part 18 is published as a Draft for Development (DD).

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

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.

Introduction

This part of BS 1722 has been structured to enable claims for compliance to be made by both the supplier and the applicator. Clause 4 gives requirements for performance under tests carried out by, for, or on behalf of the (coating powder) manufacturer. Clause 5 gives requirements for performance under tests carried out by, for, or on behalf of the (powder coating) applicator.

Fencing components may be made of low carbon steel, hot dip galvanized low carbon steel, metal sprayed low carbon steel, pregalvanized low carbon steel and meshes formed by welding wires or bright or galvanized expanding sheet. All tests are intended to be carried out on material representative of that used in the finished fence.

Experience has shown that preparation and pretreatment of the metal surface are vital to the production of satisfactory finishes. It is therefore necessary to ensure the following.

- a) The component is designed and produced to be compatible with the coating process, especially where the component is to be hot dip galvanized after manufacture, as any dressing after the galvanizing process can reduce the effective corrosion resistance.
- b) The applicator rigidly adheres to the coating powder supplier's recommendations.
- c) The coating process selected is compatible with the substrate.

1 Scope

This part of BS 1722 specifies performance requirements and describes methods for laboratory testing of powder coatings and the applied powder coatings used as a finish to fence components and mesh.

NOTE Annex A gives some guidance on the care and protection of plastics finishes.

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 1199 and BS 1200, *Specifications for building sands from natural sources*

BS 2015:1992, *Glossary of paint and related terms*

BS 3900-F2, *Methods of test for paint – Part F2: Determination of resistance to humidity (cyclic condensation)*

BS EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

BS EN 459-1, *Building lime – Part 1: Definitions, specifications and conformity criteria*

BS EN ISO 1518, *Paints and varnishes – Scratch test*

BS EN ISO 1519 (BS 3900-E1), *Paints and varnishes – Bend test (cylindrical mandrel)*

BS EN ISO 2808 (BS 3900-C5), *Paints and varnishes – Determination of film thickness*

BS EN ISO 3231 (BS 3900-F8), *Paints and varnishes – Determination of resistance to humid atmospheres containing sulfur dioxide*

BS EN ISO 3668 (BS 3900-D1), *Paints and varnishes – Visual comparison of the colour of paints*

BS EN ISO 6272-1 (BS 3900-E13), *Paints and varnishes – Rapid-deformation (impact resistance) tests – Part 1: Falling-weight test, large-area indenter*

BS EN ISO 8130-9, *Coating powders – Part 9: Sampling*

BS EN ISO 8130-14:2004 (BS 3900-J14:2004), *Coating powders – Part 14: terminology*

BS EN ISO 9227:2006, *Corrosion tests in artificial atmospheres – Salt spray tests*

BS EN ISO 11341 (BS 3900-F14), *Paints and varnishes – Artificial weathering and exposure to artificial radiation – Exposure to filtered xenon-arc radiation*

3 Terms and definitions

For the purposes of this part of BS 1722, the terms and definitions given in BS 2015:1992, BS EN ISO 8130-14:2004 and the following apply.

3.1 coating applicator

company applying and fusing, and possibly curing, the coating powder onto a substrate to provide a finish

3.2 coating powder

finely divided particles of resin, either thermoplastic or thermosetting, generally incorporating pigments, fillers (extenders) and additives, and remaining finely divided during storage under suitable conditions, which, after fusion and possibly curing, give a continuous film

[BS EN ISO 8130-14:2004, 2.5]

3.3 coating powder supplier

manufacturer of the coating powder or their representative

3.4 finish

final or only coat of material used in a finishing process on a metallic substrate

3.5 powder coating

protective and/or decorative coating formed by the application of a coating powder to a substrate and fusion (and curing, if necessary) to give a continuous film

[BS EN ISO 8130-14:2004, 2.26]

3.6 pretreatment

chemical treatment of unpainted metal surfaces prior to painting

[BS 2015:1992, term number 51 40]

3.7 significant surface

area of the total surface of a test piece on which a particular requirement for the specified coating is to be assessed

3.8 specifier

person responsible for specifying particular properties required of a powder coating

3.9 test piece

single item of metallic substrate which is representative of the work being processed

4 Coating powder

4.1 Identification

Each container of coating powder shall be labelled with the following information:

- a) coating powder supplier's name;
- b) trade name of the product and reference;
- c) colour;
- d) batch number.

4.2 Storage

Prior to application and after storage between 5 °C and 25 °C in unopened containers for 12 months from date of despatch by the coating powder supplier, the powder shall be in accordance with **4.3**.

NOTE If storage conditions are abnormal, i.e. there are extremes of damp or heat, the coating powder supplier should be informed so that any special recommendations can be made. If powders require storage at a different temperature range, this should be made clear at the time of supply.

4.3 Properties

NOTE Methods of test for the performance of powder coatings are given in Annex B.

4.3.1 Surface and thickness

When tested in accordance with **B.4.2**, no scratches shall show through to the substrate and no blisters, craters, holes or scratches shall be visible from a distance of approximately 0.5 m. When tested in accordance with **B.3.6**, the thickness of coating shall be within the range specified in the technical data sheet.

4.3.2 Colour

When tested in accordance with **B.4.3**, the colour of the coating shall match (see BS 2015) the reference colour previously nominated by the specifier.

NOTE Colours should either be chosen from a colour reference document, e.g. BS 4800, or, when this is not possible, be agreed with use of a reference sample.

4.3.3 Adhesion

When tested in accordance with **B.4.4**, the coating shall not be capable of being lifted by more than 0.5 cm.

4.3.4 Retention of adhesion

When tested in accordance with **B.4.5**, the coating shall not be capable of being lifted by more than 0.5 cm.

4.3.5 Impact resistance

When tested in accordance with **B.4.6**, there shall be no sign of cracking or penetration to the metal.

4.3.6 Scratch resistance

When tested in accordance with **B.4.7**, there shall be no penetration through the coating to the substrate.

4.3.7 Resistance to deformation (cylindrical mandrel)

When tested in accordance with **B.4.8**, there shall be no cracking or delamination of the coating from the substrate when examined using normal or corrected vision.

4.3.8 Resistance to mortar

When tested in accordance with **B.4.9**, the mortar shall be readily dislodged without the use of an implement and there shall be no detachment of the coating and no significant change in its appearance.

NOTE A change in the appearance of the gloss is not considered significant.

4.3.9 Resistance to salt spray

When tested in accordance with **B.4.10**, there shall be no underfilm corrosion or loss of adhesion in excess of 0.5 cm from the scribed line and there shall be no signs of blistering, cracking or crazing on any other part of the specimen.

4.3.10 Weathering

When tested in accordance with **B.4.11**, there shall be no signs of cracking or blistering and no significant colour change.

NOTE A change in the appearance of the gloss is not considered significant.

4.3.11 Resistance to humidity

When tested in accordance with **B.4.12**, there shall be no signs of corrosion of the test panel and no blistering, softening or detachment of the coating and the coating shall not be capable of being lifted by more than 0.5 cm.

4.3.12 Resistance to sulfur dioxide

When tested in accordance with **B.4.13**, there shall be no change in colour in comparison with an unexposed test panel, no blistering of the coating and no signs of corrosion of the substrate.

4.4 Coating powder supplier's certificate

The coating powder supplier shall, on request, issue a certificate stating:

- a) that the powder conforms to 4.3;
- b) the method of pretreatment;
- c) the interval between pretreatment and coating used on test panels and to be used on the final product.

This certificate shall relate to a specific coating powder formulation and a new certificate is not required for each batch of coating powder manufactured to this formulation. If changes in the formulation are introduced, the supplier shall issue a certificate covering the new formulation.

Tests in support of this certificate shall be carried out no more than 12 months prior to the date of the certificate.

5 Powder coatings

5.1 Materials

The materials used to form a powder coating on components shall be in accordance with Clause 4.

5.2 Identification

Each package or bundle supplied by the coating applicator containing finished components or mesh shall be clearly and indelibly identified and be supplied with the following information:

- a) coating applicator's name;
- b) trade name and specified thickness range of the product;
- c) colour;
- d) identification number;
- e) date of despatch.

NOTE Recommendations for the care and handling of the finished components are given in Annex A.

5.3 Preparation

Fence posts, gates infill and ancillary components shall be inspected to ensure that they are designed, constructed and, if necessary, dressed to provide the following:

- a) absence of all weld splatter, burrs, rough edges, etc.;
- b) welds ground smooth and edges radiused sufficiently to ensure total coverage by the finish.

NOTE 1 Where components or mesh are not radiused, the coating should be selected to be capable of providing full cover to the edges.

NOTE 2 The coating process temperature should be selected so that the metal surface is unaffected, e.g. gassing of galvanized surfaces does not occur.

5.4 Pretreatment

Components shall be pretreated in accordance with the coating powder supplier's requirements and shall be coated within the time-scale specified (see 4.4).

5.5 Significant surfaces

The test panels shall be inspected to ensure that significant surfaces have been indicated.

NOTE The specifier should provide suitable marked components or technical drawings to this effect.

5.6 Making good

When the coating process produces rough edges, jig marks, etc. the necessary repairs shall be carried out with materials recommended by the coating powder supplier which are in accordance with Clause 4.

5.7 Properties

NOTE Methods of test of powder coated fencing are given in Annex C.

5.7.1 Surface appearance

When tested in accordance with C.3.2, the coating on significant surfaces shall show no scratches through to the substrate and no blisters, craters or scratches shall be visible from a distance of approximately 0.5 m.

NOTE 1 There can be some unevenness of hot dip galvanized mild steel and this should be allowed for when assessing the surface appearance.

NOTE 2 The electrostatic deposition of a coating powder can cause thicker coatings near edges and thinner coatings in recesses.

NOTE 3 A slight degree of "orange peel" might sometimes occur. The maximum extent of "orange peel" allowable should be indicated by the specifier, using suitable reference samples.

5.7.2 Colour

When tested in accordance with C.3.3, the coating on significant surfaces shall match (see BS 2015) the reference colour previously nominated by the specifier (see B.4.3).

NOTE If the significant surface cannot be placed in the colour-matching booth described in BS EN ISO 3668, the colour should be compared under north facing daylight.

5.7.3 Thickness

When tested in accordance with C.3.4, the thickness of the coating on each significant surface shall be within the range specified by the coating powder supplier and the substrate shall not be visible at any edge.

5.7.4 Adhesion

5.7.4.1 Components

When tested in accordance with C.3.5.1, the coating shall not be capable of being lifted by more than 0.5 cm.

5.7.4.2 Mesh

When tested in accordance with C.3.5.2, the coating shall not be capable of being lifted by more than 20% of the perimeter.

NOTE The perimeter is either the circumference of the wire or the sum of the four sides in expanded metal.

5.8 Applicator's certificate

When requested, the coating applicator shall issue a certificate stating that the finish conforms to 5.1 to 5.7.

Annex A (informative)

Guidance on the care and protection of plastics finishes

A.1 Powder coated mild steel, hot dip galvanized mild steel and fencing systems can be damaged in transit (see **A.2**), or on site (see **A.3**) if carelessly packed or handled. It is recommended that an appropriate note to this effect is affixed to each package/bundle of a consignment. This note should state that care is to be taken when handling and particularly when unloading. Wherever possible, coated products should be individually packed, e.g. in polythene sleeving, and additional protection given to corners. Additional care should be taken when materials are handled at low temperatures.

A.2 Building materials containing alkali components (e.g. cement and mortar) should not adhere firmly to finishes. These finishes are generally resistant to other chemical attack. Although the finishes in accordance with this standard have good resistance to impact damage, sharp instruments could cut them. Damage is also likely to be caused if building components are dragged over them. The only effective method of stopping these forms of damage is by exercising reasonable care on site and imposing strict site discipline.

A.3 It is recommended that neither protective tapes, unless of the "low tack" variety, nor clear lacquers should be used directly to minimize damage, as some of these materials can adversely affect the properties of the finish. However, if the use of such tape for protection on site is required, the tapes should be specifically designed for the protection of the finish. Also, if they are to be used, these materials should be approved by the specifier with the agreement of the applicator.

A.4 Any drilling or cutting of the finished components after coating should be avoided wherever possible. Any repairs of minor damage to the finish should be effected by using only the materials recommended by the coating powder supplier. These materials should, however, be confined to the repair of minor scuff marks or small scratches and their general use over large areas is not recommended, principally because the majority of such materials have different weathering properties from the original coating.

Annex B (normative)

Methods of test of the performance of powder coatings

B.1 Principle

These tests establish the various properties of the powder coating used as a coating for fences by, for, or on behalf of the supplier of the coating powder.

B.2 Materials

B.2.1 *Test panel*, rectangular, 150 mm × 100 mm in area and nominally 2.5 mm in thickness, unless otherwise stated. Prepare from mild steel, unless otherwise indicated by the specifier.

B.2.2 *Coating powder*, sampled in accordance with **B.3.1**.

B.2.3 *Distilled or demineralized water*.

B.2.4 *Sharp pointed knife.*

B.2.5 *Protractor or angle-measuring device (for use in B.4.4)*

B.3 Preparation of test panels

B.3.1 Sampling

Take a representative sample of the coating powder using the method described in BS EN ISO 8130-9.

B.3.2 Preparation

The test panels shall be prepared with the same substrate as the final product. The test panels or test sections shall be coated with the coating powder by the method specified and to the thickness specified by the coating powder supplier.

B.3.3 Pretreatment

The pretreatment of the test panels shall be as specified in 5.4.

B.3.4 Determination of thickness

The thickness of the powder coating over hot dip galvanized or pregalvanized surfaces shall be obtained by difference. Location of position on the test panel or test piece shall be achieved by the use of a suitable template.

NOTE In order to facilitate the accurate measurement of the thickness of the coating on either test panels or sections, it is necessary to predetermine the zinc thickness if the test panels or sections have been hot dip galvanized, or pregalvanized. As a result of the nature of the hot dip galvanizing process, the hot dip galvanizing thickness can vary significantly over relatively small areas, and it is therefore necessary to determine both the hot dip galvanizing thickness and the thickness of the total coating in exactly the same location.

B.3.5 Determination of zinc thickness (if applicable)

Identify, without damaging the galvanizing, two positions on the uncoated test panel or uncoated test section. The positions shall be approximately 50 mm and 100 mm from one end and shall lie approximately on the centre line of the panel or the widest face of the test section.

Determine the thickness of the galvanizing using the eddy current method described in BS EN ISO 2808 and record the readings together with the locations.

B.3.6 Thickness of the powder coating

Determine the thickness of the total coating using the eddy current method described in BS EN ISO 2808. Determine the thickness of the total coating using the same instrument and at the same locations identified in B.3.5.

B.3.7 Conditioning

Condition the panels at $23\text{ °C} \pm 2\text{ °C}$ and 60% relative humidity for at least 1 h, before carrying out the specified tests.

B.4 Test procedures on coated test panels

B.4.1 General

Carry out the tests in duplicate.

B.4.2 Surface

Illuminate the surface of the test panel in accordance with BS EN ISO 3668 and examine at an oblique angle with normal or corrected vision.

B.4.3 Colour

Test in accordance with BS EN ISO 3668 and check colour match.

B.4.4 Adhesion

Using a sharp pointed knife make two cuts in the coating of the test panel, penetrating through to the metal, which intersect at an angle of 30°. Lift a 30° peak with the point of the knife.

B.4.5 Retention of adhesion

Immerse the test panel in distilled or demineralized water at 50 °C for 7 days. After this period, condition as in B.3.7 and test adhesion in accordance with B.4.4.

B.4.6 Impact resistance

Test in accordance with BS EN ISO 6272-1 for indirect impact at 23 °C and direct impact at –5 °C using in each case an impact of at least 12 kg/cm.

B.4.7 Scratch resistance

Test in accordance with BS EN ISO 1518 using a load of 4 000 g on a tungsten carbide ball of 1 mm diameter and check for penetration.

B.4.8 Resistance to deformation (cylindrical mandrel)

Test in accordance with BS EN ISO 1519 using a 13 mm mandrel and a test panel (B.2.1) which is not more than 1.0 mm thick.

B.4.9 Resistance to mortar

B.4.9.1 Principle

A pat of wet lime mortar is applied to the dry coating and after allowing the mortar to set and dry the effect of the mortar on the surface of the coating is assessed.

B.4.9.2 Materials

B.4.9.2.1 *Sand*, dry, conforming to BS 1200.

B.4.9.2.2 *Hydrated lime*, conforming to BS EN 459-1.

B.4.9.2.3 *Portland cement*, conforming to BS EN 197-1.

B.4.9.3 Procedure

Prepare a mortar by mixing 15 g of lime, 41 g of cement and 244 g of sand with sufficient tap water to make a soft paste. Apply four portions of the mortar, approximately 15 mm diameter and approximately 6 mm thick, to a test panel which has been prepared and conditioned in accordance with **B.3**.

Allow the panel to stand for 24 h at $38\text{ °C} \pm 3\text{ °C}$ and $95\% \pm 5\%$ relative humidity.

At the end of this period, dislodge the mortar by hand from the surface of the coating and remove any residue with a damp cloth. Allow the test panel to dry and examine the coating using normal or corrected vision, for detachment of the coating and for change in appearance due to the effect and removal of mortar.

B.4.10 Resistance to salt spray**B.4.10.1 Materials**

B.4.10.1.1 *Scribing tool.*

B.4.10.1.2 *Ruler or linear measuring device.*

B.4.10.2 Procedure

In the middle of the test panel scribe a cross using a scribing tool to expose bare metal. The cross shall be a rectangular diagonal cross in which each of the diagonals has a length of 5 cm. Place the coated test piece in a spray cabinet conforming to BS EN ISO 9227:2006, **4.2**. Maintain the cabinet at a temperature of $35\text{ °C} \pm 2\text{ °C}$. The salt solution shall consist of a 5% solution of sodium chloride dissolved in water. After 500 h continuous salt spray, remove the sample carefully from the test cabinet, wash in clean water at a temperature not in excess of 35 °C , and immediately dry. Attempt to lift the coating from the scribed line with a sharp tool. Examine the area around the scribed cross.

B.4.11 Weathering

Place a test panel in a QUV accelerated weathering tester conforming to BS EN ISO 11341. Then after 1 000 h of light, examine the coating for signs of cracking or blistering and significant colour change.

B.4.12 Resistance to humidity

Test in accordance with BS 3900-F2 for 1 000 h and check for blistering, softening or detachment of the coating or signs of corrosion of the test panel, leave to normalize for 24 h at $23\text{ °C} \pm 2\text{ °C}$ and then carry out the surface test procedure in accordance with **B.4.2**.

B.4.13 Resistance to sulfur dioxide

Test in accordance with BS EN ISO 3231 (with a smaller cabinet as necessary) for 240 h.

Annex C (normative) Methods of test for coatings**C.1 Principle**

These tests establish the various properties of the coated fence components by, for, or on behalf of the (coating) applicator.

C.2 Materials

C.2.1 Significant surface, portion of the component which has been selected as appropriate for testing.

C.2.2 Micrometer.

C.3 Test procedures on components**C.3.1 General**

Carry out the tests in duplicate.

NOTE Some of these tests are destructive; planning can restrict test damage. Damage should be made good, see 5.6.

C.3.2 Surface appearance

Illuminate the significant surfaces in accordance with BS EN ISO 3668 and examine at an oblique angle with normal or corrected vision.

C.3.3 Colour

Test in accordance with BS EN ISO 3668 and examine significant surfaces for colour match.

NOTE If the significant surface cannot be placed in the colour-matching booth, the colour should be compared under north facing daylight.

C.3.4 Thickness

Determine the thickness of the coating on each significant surface by one of the following.

- a) The eddy current method described in BS EN ISO 2808 with a minimum of three determinations. Inspect the edges for visibility of substrate.

NOTE Where determination by difference is required, see B.3.4, B.3.5 and B.3.6.

- b) With a micrometer, measure the wire diameter before coating, M_1 , and after coating, M_2 , in two directions at right angles at each of three locations. Determine the coating thickness by the difference between M_1 and M_2 . Establish the exact position of each test location by the use of a template.

NOTE This test may be carried out during manufacture or when coating is complete.

C.3.5 Adhesion**C.3.5.1 Components**

On a significant surface using a sharp pointed knife make two cuts, penetrating through to the metal, which intersect at an angle of 30°. Lift a 30° peak with the point of the knife.

C.3.5.2 Mesh

With a sharp pointed knife cut away a 20 mm sliver of finish to expose the substrate. Lift the coating from the sliver edge with the point of the knife.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4800, *Schedule of paint colours for building purposes*

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