

Coatings for fire protection of building elements —

**Part 1: Code of practice for the selection
and installation of sprayed mineral
coatings**

Committees responsible for this British Standard

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- Association of Metropolitan Authorities
- Association of Specialist Fire Protection Contractors and Manufacturers
- British Steel Industry
- Department of the Environment (Building Research Establishment)
- Department of the Environment for Northern Ireland
- Institution of Structural Engineers
- Marine Safety Agency
- Warrington Fire Research Centre

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Foreword

This Part of BS 8202 has been prepared under the direction of Technical Committee B/209, General building codes. It supersedes BS 8202-1:1987 which is withdrawn. This Part of BS 8202 covers all types of sprayed mineral coatings, with the exception of sprayed asbestos. The eventual aim is to recommend the standard for adoption by ISO as an international standard.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course. This edition brings this standard into line with current approval procedures and clarifies application techniques.

This Part of BS 8202 gives recommendations for the selection and installation of sprayed mineral coatings to enhance fire resistance of building elements. However, the same coatings are used for thermal insulation of buildings, pipework and equipment, for noise level reduction and condensation control in buildings and for lining refractories. BS 8216 gives recommendations for the uses of sprayed lightweight mineral coatings for thermal and acoustical purposes.

There are various methods of assessment of fire resistance which may be based in systematic testing or theoretical considerations. For further guidance, see *Fire Protection for Structural Steel in Buildings* [1].

Throughout this edition the method for determining the fire resistance of a structure is referred to as conforming to BS 476-21 which superseded BS 476-8:1992. It should be noted, however, that BS 476-8 is still available and is referred to in regulations.

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, pages 1 to 20, 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 8202 gives recommendations for the selection and installation of sprayed mineral coatings to enhance fire resistance of building elements. It describes methods of application to various types of surface in varying densities and finishes.

This standard is intended for the guidance of specifiers, application specialists and site inspectors.

Annex A describes a method for determining the dry density of the spray application.

NOTE Maximum approved thicknesses should not be exceeded.

2 References

2.1 Normative references

This Part of BS 8202 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies: any subsequent amendments to or revisions of the cited publication apply to this Part of BS 8202 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This Part of BS 8202 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 8202, the following definitions apply.

3.1

spray

sprayed mineral coating

3.2

adhesive retention

use of an additional material to improve the bond of the spray to a substrate

3.3

mechanical retention

use of mechanical system(s) to retain the spray in situ

NOTE See clause 7.

4 Independent validation

4.1 The appropriate independent validation should be provided as evidence that the recommendations of this standard have been followed. For many applications, particularly those relating to building control, it will be necessary for the specifier, manufacturer and/or applicator to produce test reports (or assessments) from an approved testing laboratory (or consultancy) to show that the required performance criteria can be achieved.

Any changes in the spray system, i.e. primer, spray and surface finish, or its method of application may affect its performance. Ideally, performance tests previously carried out should be repeated to ensure that the level of performance is not affected.

However, in practice this is not always possible because of the cost of some types of test, particularly fire resistance tests conforming to BS 476-21 and because of the range of variables which may occur, e.g. raw materials may be obtained from several sources or a spray may be required to be used with a large number of different primers. Thus changes in the chemical or physical nature of the components of the spray or their relative proportions should be the subject of a full re-test in accordance with the appropriate performance standard whilst detail changes in the spray system may be validated without repeating the appropriate performance test, using analytical laboratory tests and/or reduced scale performance tests. It is important that any reduced scale tests can be shown to correlate with the appropriate performance standard. In many cases the spray manufacturer/supplier would be the only source of this information. The justification for any assessment of changes in the spray system should be available for inspection as appropriate.

Assessments of the performance of spray systems are often required where it is not practical to test the full range of the substrate shapes and/or sizes with which the system may be used, e.g. structural steelwork. In such cases assessments by an appropriate authority, based on relevant test information relating to the specific spray under consideration, may be accepted in addition to fire performance tests.

4.2 Where materials and methods are used that are not referred to by this standard, their use is not discouraged, provided that:

- a) they are proven by test; and
- b) they are such as to ensure a level of performance at least equal to that recommended in this standard.

5 General

5.1 Composition

5.1.1 General

Spray comprises the principal ingredients given in 5.1.2, 5.1.3 and 5.1.4.

5.1.2 Base

The base is as given in either a) or b):

- a) *various man-made mineral wools*, having a length to breadth ratio of at least 3 to 1;

NOTE Man-made mineral wools consist of fibres of inorganic composition, generally manufactured by a smelting process, usually from blast furnace slag or rock.

- b) *exfoliated vermiculite*.

NOTE Vermiculite is the name given to a group of hydrated laminar minerals resembling mica in appearance and composed of hydrated aluminium iron magnesium silicates. When vermiculite is subjected to intense heat, it expands to many times its original volume. This phenomenon is known as exfoliation.

5.1.3 Binding agent

Typical examples of binding agents are hydraulic binders, such as Portland cement conforming to BS 12, high alumina cement conforming to BS 915-2 or gypsum plaster conforming to BS 1191-1.

5.1.4 Fillers

Typical fillers are hydrated lime, limestone or other aggregate.

5.2 Choice of product

Sprays are versatile materials which will cover areas of irregular size and shape including complex angles and profiles. However, each product should be chosen carefully so as to meet the particular requirements for a given end use. For example, in an external environment or in damp conditions some products may be unsuitable or may require additional weather protection. The variety of products and application methods available enable a wide range of surface finishes to be obtained, ranging from flat surfaces to highly textured surfaces.

5.3 Decorative and protective surface finishes

Where decorative or protective surface finishes are required either initially or subsequently (owing to change of occupancy or use of buildings), it is essential to ensure that the applied finish is compatible with the spray and does not impair its performance. Attention is drawn to the risk of detachment of the spray brought about by excessive weight of the applied finish. This will depend on a number of factors, e.g. orientation of the substrate, type of coating and type of finish, and is particularly important where dense finishes are being applied to low density coatings.

Any surfacing material should satisfy the appropriate requirements of any approving authority.

NOTE Such requirements may include the following:

- a) non-combustibility, when tested as described in BS 476-4;
- b) fire propagation, when tested as described in BS 476-6;
- c) surface spread of flame, when tested as described in BS 476-7;
- d) heat emission, when tested as described in BS 476-11.

In all applications the properties of the surfacing finish have to accommodate any dimensional movement of the spray.

5.4 Health and safety considerations

This Part of BS 8202 covers a wide range of different types of material. The need for site controls will vary according to the type of material being used. The application of some types of spray may generate levels of dust and particulate matter sufficient to cause irritation of the skin, eyes and respiratory tracts. For guidance on personal exposure and exposure limits reference should be made to the guidance notes published by the Health and Safety Executive and to manufacturers' health and safety data.

6 Substrate preparation

6.1 General

The purpose of substrate preparation is to ensure that:

- a) an adequate bond or retention of the spray is obtained to enable it to perform its required function; and
- b) the spray is compatible with the materials to which it is applied.

The surface condition of any substrate is important when considering bonding of any coating to it, i.e. the surface should be free from oil, grease, dirt, dust, scale, loose paint, mould release agents or other materials or conditions likely to impair adhesion.

When deciding on substrate preparation, which in cases of inadequate bond may involve mechanical retention (see clause 7), it is essential to consider the following:

- 1) nature of surface, including any finishes applied prior to application of the spray;
- 2) geometric shape of the substrate;
- 3) vibration;
- 4) thermal movement;
- 5) properties of the spray;
- 6) evidence of adequate bond between the spray and the substrate;

7) any possible effects of high temperatures on the bonding or retention of the mix to the substrate.

It is not possible to give recommendations for all types of spray and all surface conditions in this standard. Recommendations for common substrates are given in 6.2.

6.2 Common substrates

6.2.1 Painted surfaces

All old, loose and flaking paint finishes should be removed prior to the application of the spray, unless mechanical retention is being used (see clause 7). Newly applied compatible primers should not adversely affect the performance of the coating but other paint finishes may require mechanical retention, unless there is fire resistance data showing that the presence of the paint will not affect the performance of the coating. Where mechanical retention is used, it is still necessary to use an alkali-resistant sealer coat (see 6.3) where the paint is not chemically compatible with the spray.

NOTE Portland cement when wet has an initial pH value of 12 to 12.5 and cement-bound and lime-enriched gypsum mixes may, therefore, attack alkali-sensitive paints, e.g. paints containing alkyd binders. Paints containing water-sensitive binders may also be attacked by sprays.

6.2.2 Concrete and masonry

It may be necessary to reduce the suction of masonry depending upon type by applying a light water spray or a suitable sealer (see 6.3). Normal sound clean concrete surfaces require no particular treatment but very smooth surfaces, as for example concrete cast against a hard impervious form face, are likely to require the use of mechanical retention or other treatment, e.g. abrasive blasting, to provide a suitable key (see also 8.5).

6.2.3 Gypsum plaster and plasterboard

Portland cement-bound sprays should not be applied directly to unsealed gypsum plaster surfaces or plasterboard, as the setting characteristics of the cement can be affected and bond loss may result. Gypsum or lime based sprays may be applied to certain types of plaster based products but guidance should be sought from the spray manufacturer.

6.2.4 Metals

Primers are not usually needed for Portland cement-bound sprays if the building environment is such that it will remain dry after construction. Careful consideration should be given to the need for priming of ferrous metal surfaces, bearing in mind possible changes in use or occupancy of the building following application of the spray. Any primer used has to be compatible with the spray to be applied.

NOTE For guidance on protective measures, see BS 5493.

Most plastic coated metals have a smooth surface, which can cause adhesion problems. Mechanical retention will normally be necessary and specialist advice should be sought.

“White rusting” of zinc coated steel, which can result in corrosion of the base steel, may occur in continually damp conditions and where ventilation is poor. Under these conditions it is advisable to prime steel surfaces which have been zinc coated, e.g. galvanized, using a primer system compatible with both the coated steel and the cement based spray. Specialist advice should be sought.

On large flat steel surfaces mechanical retention (see clause 7) should be used.

Aluminium, aluminium alloys and aluminium coatings should be sealed (see 6.3) before applying alkaline sprays.

6.2.5 Plastics materials (including glass reinforced and foam materials)

Specialist advice should be sought. Many plastics materials are flexible and temperature sensitive.

6.2.6 Timber and wood-based materials

Timber and wood-based materials are subject to high drying shrinkage and moisture movement. A water resistant sealer should be used before applying the spray (see 6.3). Galvanized clout nails and galvanized spider web wiring can be used to aid retention.

6.2.7 Gaps and joints

Sprays are suitable for bridging gaps provided an appropriate supporting material, e.g. galvanized expanded metal is fitted before applying the spray.

6.2.8 Movement joints

Where movement joints are incorporated into a structure it is essential to ensure the spray does not bridge the joint, as there will be a risk of the movement causing cracking and/or local bond failure of the coating. It is recommended that proprietary stop beads (or similar) are fitted either side of the joint and the spray terminated against them.

6.3 Sealers and bonding agents

Alkali resistant and water resistant sealers may be needed to prime particular surfaces. It is essential to check that the sealer to be used is compatible with the surface to which it is being applied.

Adhesives or key coats may be used to improve bonding of sprays to various substrates.

Special care should be taken to ensure that any primers, adhesives or key coats will not adversely affect the performance of the spray (see 8.5).

7 Methods of mechanical retention

7.1 General

7.1.1 The need for mechanical retention, and the type and extent to be used, will depend on a number of factors, e.g. proposed use, substrate details, environmental factors and properties of sprayed material. Some particular circumstances in which it is necessary to include mechanical retention are given in clause 8. Details of the different techniques available for providing mechanical retention are given in 7.2.

7.1.2 Consideration should be given to the need for mechanical retention to ensure adequate retention to the substrate and/or cohesion within the spray. (Certain types of mechanical retention may not always perform both functions.) If necessary, specialist advice should be sought, e.g. see reference [1].

Lack of adhesion to the substrate can be caused by:

- a) the nature of the substrate, e.g. chemical composition, surface texture, orientation and shape; or
- b) contamination of the substrate, e.g. by oil; or
- c) the existing surface finishes; or
- d) environmental factors, e.g. vibration.

Lack of cohesion within a spray can arise in certain circumstances, e.g. where the coating exceeds the approved specified thickness.

7.2 Types of mechanical retention

7.2.1 Introduction

A wide range of mechanical retention systems and components are available (see Table 1). The most common of these are described in this clause but other systems or components may be acceptable (see clause 4). In certain circumstances a combination of systems may be necessary.

The properties of the materials from which the various components are made should be taken into account when deciding on the most appropriate system, e.g. strength, rigidity, resilience, temperature resistance, weather resistance, chemical compatibility, resistance to corrosion.

Galvanized steel components are most commonly used, particularly for fire protection purposes, where good temperature resistance is necessary. Galvanic (bi-metallic) corrosion arising from the use of dissimilar metals is not significant in most cases.

NOTE For further guidance see Appendix A and Table 3 of BS 5493:1977.

Plastics components and organic adhesives are suitable for applications at ambient temperature. Some organic adhesives have been tested and approved for use in fire protection applications.

7.2.2 Mesh

7.2.2.1 Mesh categories

Wire mesh is commonly used for mechanical retention and can be conveniently classified into the following categories.

- a) *Keying mesh*, typically of relatively small aperture size, i.e. 10 mm to 25 mm, which allows some penetration by slurry sprays in order to produce a good key. It is installed in close proximity to the substrate [see Figure 1 a), Figure 1 b) and Figure 1 c)] or to provide a background for the spray to bridge gaps between structures, e.g. to provide a fire barrier or to encase a column.
- b) *Reinforcing mesh*, typically of relatively large aperture size, e.g. 50 mm, which allows full penetration by the spray and thereby provides reinforcement. It is located within the spray so as to reinforce the spray [see Figure 1 d)]. It is important that the aperture size is not too small and that the mesh material is not too thick, for otherwise a plane of weakness may be formed within the spray.

NOTE Advice should be sought from the spray manufacturer.