

Wall and floor tiling —

Part 2: Code of practice for the design and installation of external ceramic wall tiling and mosaics (including terra cotta and faience tiles)

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Committees responsible for this British Standard

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Building Employers Confederation
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Foreword

This code of practice has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee. It is a revision of the 1978 edition, which is withdrawn. The code now recommends that only adhesives should be used for bedding external tiling, although cement : sand mortar remains as an alternative for bedding mosaics, architectural terra cotta and architectural faience tiles. Illustrations of movement joints have been added, the tables for sealants and backgrounds have been revised and a cleaning and maintenance section has been added.

Throughout this code, references to tiles and tiling are intended to apply equally to architectural terra cotta, to architectural faience and to mosaics and mosaics work except where the requirements for mosaics are different as in section 5.

The other parts of BS 5385 are as follows:

- *Part 1: Code of practice for the design and installation of internal ceramic wall tiling and mosaics in normal conditions;*
- *Part 3: Code of practice for the design and installation of ceramic floor tiles and mosaics;*
- *Part 4: Code of practice for ceramic tiling and mosaics in specific conditions;*
- *Part 5: Code of practice for the design and installation of terrazzo tile and slab, natural stone and composition block floorings;*

Assessed capability. Users of this British Standard are advised to consider the desirability of assessment and registration of a supplier's quality systems against the appropriate part of BS 5750 by a third party certification body.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover and a back cover.

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Section 1. General

1 Scope

This part of BS 5385 gives recommendations for the design and installation of external ceramic, architectural terra cotta and architectural faience wall tiling and mosaics in normal conditions. It deals with the types of backgrounds and their suitability to receive tiling using the following fixing methods:

- a) bedding in cementitious or organic adhesives on an intermediate substrate or as a direct bedding method;
- b) bedding mosaics in cement : sand mortar on rendering or as a direct bedding method.

NOTE 1 Cement : sand mortar is seldom used as the bed for external wall tiling but, if required, see 23.3 of BS 5385-1:1990.

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

2 Definitions

For the purposes of this part of BS 5385 the definitions given in BS 6100 and BS 6431-1 apply.

3 Exchange of information and time schedules

NOTE This clause deals with the exchange of information for the whole wall, including tiles, tile bed, background and intermediate substrate (if any).

3.1 Exchange of information

Working drawings and specifications should be prepared in sufficient detail to afford proper guidance in the design and execution of the work. At the tendering stage the following information should be provided.

- a) *Site*. Location and means of access.
 - b) *Building*. Nature of building and particulars of corrosive or other potentially damaging conditions to which the installation may be subjected in service (e.g. mechanical cleaning).
 - c) *Wall(s)*. Type and age of construction, location, type and accuracy of backgrounds and need for intermediate substrate.
- NOTE Permissible deviations from horizontal and perpendicular lines in building construction are usually greater than are appropriate for ceramic tiling or mosaic finishes.
- d) *Associated work*. Elements embedded in or passing through the wall, skirtings and abutments, junctions with other adjacent finishes.
 - e) *Finishes*. Type(s) of tiles and/or mosaics, bedding and jointing requirements and required surface plane.
 - f) *Contract*. Particulars if the work is to be completed in any specific order or in sections.

g) *Health and safety*. Information on articles and substances for use during the work that are liable to be a health risk.

h) *Time schedule*. A time schedule for the progress of the work. (See 3.3.)

i) *Testing*. Details of any compliance testing required.

3.2 Provision of utilities, facilities and materials

To prevent misunderstanding, particularly at the tendering stage, and to avoid possible situations detrimental to installation, it should be made clear whether or not the following will be provided and by whom:

- a) adequate clean, dry, lockable storage space protected from frost if necessary;
 - b) clean water supply adjacent to working areas;
 - c) adequate artificial lighting if required, e.g. for tiling within a protected enclosure;
 - d) safe means of access and places of work, to include, where required, suitable scaffolding and staging, which should comply with BS 5973 or BS 5974;
- NOTE Attention is also drawn to the requirements of the Building and Construction Regulations made under the Factories Act.
- e) unloading and hoisting facilities;
 - f) electric power supply adjacent to working areas;
 - g) protection of work during and after fixing;
 - h) supplies of cement and sand in accordance with clauses 8 and 9.

3.3 Time schedules

The time schedule for the whole building work should be planned in the initial stages before operations are begun and, where possible, in consultation with those who will become responsible for carrying out the work of each of the trades concerned.

In preparing the time schedule for the work, each operation should be considered in relation to others. Due consideration should be given to the most economical use of general plant and scaffolding by all trades, also to ensure that the various trades do not interfere unduly with each other's work.

For economic and efficient application of external tiling and mosaics, the work should begin at the highest point of the building. Also, in certain forms of a multistorey construction, some deflection of the building can occur at lower levels as the building increases in height and loading consequently increases. It is important, therefore, that application of tile or mosaic cladding should not commence until the building has been constructed to its full height.

At least 6 weeks should be allowed in the time schedule for the drying out and initial shrinkage of the structural or non-structural fabric before the application of an intermediate substrate, e.g. rendering. If rendering is subsequently to be applied it should be left for at least a further 2 weeks. The schedule should allow also for all cutting of holes and chases and/or other work involving the use of percussion tools in or on the walls to receive a bedded finish, and adjacent walls, to be completed before a substrate is applied. All the time allowances mentioned are equally relevant where a substrate is to be omitted and the tile or mosaic finish bedded directly to the structural background.

The time schedule should also provide for the completion of all necessary subsidiary work before the fixing of tiles or mosaics begins. The schedule should include times for commencement and completion of tiling or mosaic work in the different parts of the building, allowing sufficient time intervals between the operation of the bedding, grouting and final cleaning down.

The time schedule should include a provision for adjustment to allow for suspension of operation due to frost or other unfavourable weather conditions that may jeopardize the safety of workers and/or the success of the installation.

Alternatively, consideration should be given to the possibility of providing a protective enclosure, e.g. cocooning, to enable work to continue during unfavourable conditions. In addition heating may be necessary.

Section 2. Materials

4 Transport and storage

The delivery of materials should be so arranged as to minimize handling. Adequate precautions should be taken to guard against the possibility of damage. Products should be stored in a clean, dry, frost-free (if necessary) lockable storage to avoid excessive handling, theft and damage.

5 Ceramic tiles

Ceramic tiles should have a water absorption of not more than 3 % and should be either extruded tiles type AI as specified in BS 6431-2 or dust-pressed tiles type BI as specified in BS 6431-6.

Ceramic tiles that are to be fixed in locations liable to frost should not be damaged when tested for frost resistance by the method described in BS 6431-22.

Thin tiles are more vulnerable to impact damage and generally tiles should have a minimum thickness of 8 mm.

6 Mosaics

Mosaics are available in glazed and unglazed ceramic, glass and marble and in a variety of shapes and sizes. To facilitate ease of handling, mosaics are assembled as sheets, the individual tessera being glued either face down to paper (paper-faced mosaics) or bed side down to a synthetic mesh or to small tabs.

It should be noted that paper-faced mosaics are preferable since they allow full contact to be achieved with the mortar or adhesive bed. When sheets are assembled by means of a backing mesh it should be made of water-resistant synthetic fabric such as nylon, not cotton or paper.

For a mosaic which has been assembled with a backing fabric or tabs it is essential that:

- a) the fabric or tabs and their adhesive should not occupy more than 25 % of the area of each tessera; the critical factor is the contact of the adhesive with the backs of the tesserae;
- b) the fabric or tabs and their adhesives should be water-resistant, should not weaken when exposed to moisture and should be compatible with the mortar or adhesive bed.

Ceramic tesserae should comply with the relevant physical and chemical properties given in Table 3 of BS 6431-6:1984. For mosaics in locations liable to frost, ceramic tesserae should not be damaged when tested for frost resistance by the method described in BS 6431-22.

Before selecting a particular type of mosaic, advice about its suitability should be obtained from mosaic suppliers or mosaic fixing specialists.

7 Architectural terra cotta and architectural faience tiles

Architectural terra cotta tiles are unglazed, self-coloured, frost-resistant tiles made from a fine clay plastic body or by the cast process. They may have decorative moulded faces.

Architectural faience tiles are glazed frost-resistant tiles made from a fine clay plastic body or by the cast process. They should be glazed over all faces that will be exposed in service. The body may have a coarse texture but it should be uniform without voids.

Architectural terra cotta and faience tiles are generally thicker than tiles manufactured to comply with BS 6431 and facial dimensions may be up to 60 cm. They may be manufactured to fit specific positions on elevations.

Tiles with facial sizes over 20 cm are usually cramped in position as well as bedded with a solid layer of adhesive or cement : sand mortar.

Architectural terra cotta and architectural faience tiles should not be damaged when tested for frost resistance by the method described in BS 6431-22.

8 Cement

Cement should comply with BS 12, BS 4027 or BS 5224.

Cement should be stored under dry conditions and used in order of delivery. Cement which contains air-set lumps should not be used.

9 Sand

9.1 General

All stocks of sand should be protected from rain, frost and any form of contamination.

9.2 Sand for cement : sand rendering and mortar beds

Sand should comply with type A of Table 1 of BS 1199:1976.

9.3 Sand for grouting

9.3.1 For joints of nominal widths 6 mm and above

Sand for grouts should comply with the grading limits of type B of Table 1 of BS 1199:1976.

9.3.2 For joints less than 6 mm wide

Sands for grouts should comply with the grading limits given in Table 1. Sands complying with type G of Table 1 of BS 1200:1976 may be suitable, but the fraction greater than 2.36 mm should be screened off.

Table 1 — Sand for grouts for joints less than 6 mm wide

BS 410 sieve	Percentage by mass passing BS sieves
mm	%
2.36	100
1.18	95 to 100
µm	
600	80 to 100
300	30 to 100
150	0 to 60
75	not greater than 7

10 Water

Water should be fresh and clean. Sea water should not be used. All containers used for storing or carrying water or for soaking tiles should be clean.

11 Adhesives

11.1 Cementitious adhesives (hydraulically-hardened mortars)

Cementitious adhesive should comply with the requirements of type 1, class AA or class A in BS 5980.

11.2 Organic adhesives

Organic adhesives should comply with the requirements for class AA or class A, for the following types given in BS 5980.

Type 3. Dispersion/cement adhesive.

Type 5. Reaction resin adhesive.

11.3 Admixtures to adhesives

A polymer additive or some other liquid or powdered product may be incorporated in adhesives to obtain greater adhesion, improved resilience or some degree of water repellence.

Admixtures should be used strictly in accordance with the manufacturer's instructions, and they should not be added to an adhesive unless approved by the manufacturer of the adhesive.

12 Bonding agents

Bonding agents may be used to improve the adhesion of renderings and/or tile beds to backgrounds. Manufacturers recommend particular grades and methods of application depending on the materials involved, and their instructions should be followed.

Bonding agents are usually mixed with cement and sand or cement only and applied as a wet wash or stipple immediately prior to the application of the mortar. Application of the bonding agent as a neat film should not be attempted with materials such as polyvinyl acetate, homopolymers and other bonding agents that are affected by moisture.

Gypsum plaster should not be used in any circumstances.

13 Sealants and back-up materials for movement joints

13.1 Sealants

Guidance on the selection and application of joint sealants is given in BS 6213.

Materials for movement joints should be non-rigid; they should combine the properties of resilience and/or plasticity within the maximum temperature ranges likely to be encountered and should be resistant to mould growth. Table 2 provides a guide to most of the sealants in general use and a summary of their properties.

13.2 Back-up materials

These should be compressible materials that will not be extruded when the joint closes. Suitable materials include closed cell cellular polyethylene which is available in sheet strip, and circular cord forms of various sizes.

14 Grouts

14.1 General

Grouts should have good working characteristics, low shrinkage and good adhesion to the sides of the joints. When selecting a grout the specifier should establish that it is suitable for external conditions.

14.2 Types of grout

14.2.1 Proprietary grouts

These are generally one of the following types:

- mixes based on cement and sand but modified by the inclusion of various additives, including pigments, that require only the addition of clean water to obtain the desired consistency;
- mixes based on epoxide resin; these are supplied as two or three separate components, in pregauged proportions, which have to be mixed together immediately before use.

NOTE Epoxide resin mixes are more expensive than those based on cement and the treatment of joints using these compositions is slower.

Proprietary grouts should be stored and used in accordance with the particular manufacturer's instructions but, in general, they do not require prior wetting of the tile joints before use.

Table 2 — Flexible sealants: summary of properties

Type	Movement accommodation factor (See note 2)	Service temperature limits	Hardness (See note 3)	Cure time before serviceable (e.g. washing down, etc) (See note 4)
	%	°C	IRHD (°)	Days
Epoxide polysulfide and flexibilized epoxide (two-part)	5 to 10	– 20 to + 80	70 to 95	1 to 7 Chemical cure. Rate of cure depends on temperature
Acrylic (solution type)	20	– 35 to + 90	25 to 30	3 to 14 Set by solvent loss
Polysulfide (one-part)	25	– 20 to + 80	15 to 40	7 to 21 Moisture cure. Rate of cure depends on temperature and relative humidity
Polysulfide (two-part)				1 to 7 Chemical cure. Rate of cure depends mainly on temperature
High modulus	20	– 20 to + 80	40 to 60	
Low modulus	35	– 20 to + 80	15 to 20	
Polyurethane (one-part)	25 to 35	– 40 to + 70	15 to 40	3 to 14 Moisture cure. Rate of cure depends on temperature and relative humidity
Silicone				1 to 14
High modulus	25	– 60 to + 180	20 to 30	Moisture cure. Rate of cure depends on temperature and relative humidity
Low modulus	50 to 100	– 50 to + 120	10 to 20	

NOTE 1 Under favourable conditions the expected service life of the sealants listed is 15 to 20 years for the acrylic solution type and not less than 20 years for the others.

NOTE 2 The values quoted are average values varying within wider or narrower limits according to manufacturer: Where the movement accommodation factor (see BS 6213) is below 15 % the sealant is not to be used over structural movement joints.

NOTE 3 The figures quoted are as measured on an IRHD meter (see BS 903-A26). Low figures indicate that the sealant is soft, high figures that the sealant is hard, e.g. tyre tread would have a hardness of 60° to 70° on this scale. Ranges are shown for each sealant in the table, reflecting variations encountered in practice according to the manufacturer of the product. Hardness measured in Shore “A” units is similar in value to that measured in IRHD units.

NOTE 4 Cure times vary according to environmental conditions, but the ranges shown in the table also reflect variations between different manufacturers' products.

14.2.2 Cement : sand mortar grouts

These are sometimes used for grouting joints over 3 mm wide. Mixes of this kind require dampness in the joint cavities to promote good adhesion and are best suited for use with cement : sand mortar bedding systems where, if necessary, the joints can be rewetted without affecting the bed.

NOTE The physical properties of a cement : sand mortar grout are likely to be inferior to those of proprietary grouts, which offer the advantages of controlled formulations and consistency.

Neat cement mixed with water is not a satisfactory grout, except for mosaics, and should not be used.

14.2.3 Admixtures to grouts

A polymer additive or some other liquid or powdered product may be incorporated in a cement : sand mortar grout mix to obtain greater adhesion, improved resilience or some degree of water repellence.

Admixtures should be used strictly in accordance with the manufacturers' instructions, and they should not be added to a proprietary grout unless approved by the manufacturer of that product.