

BS 5385-1:2009

Incorporating Corrigendum No. 1



BSI Standards Publication

Wall and floor tiling – Part 1: Design and installation of ceramic, natural stone and mosaic wall tiling in normal internal conditions – Code of practice

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Summary of pages

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Foreword

Publishing information

This part of BS 5385 was published by BSI and came into effect on 31 July 2009. It was prepared by Technical Committee B/539, *Ceramic tiles and other rigid tiling*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 5385 supersedes BS 5385-1:1995, which is withdrawn.

Relationship with other publications

This part of BS 5385 is one of a series dealing with the installation of floor and wall tiling, the other parts being:

- *Part 2: Design and installation of external ceramic and mosaic wall tiling in normal conditions – Code of practice;*
- *Part 3: Design and installation of internal and external ceramic and mosaic floor tiling in normal conditions – Code of practice;*
- *Part 4: Design and installation of ceramic and mosaic tiling in special conditions – Code of practice;*
- *Part 5: Design and installation of terrazzo, natural stone, agglomerated stone tile and slab flooring – Code of practice.*

Information about this document

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags **[C1]** **[C1]**.

This is a full revision of this British Standard, and introduces the following principal changes.

- References have been updated to reflect changes in standards documents and in legislation.
- Consideration has been given to recent trends in backgrounds for tiling, and to the increasing variety of tiles in terms of tile type, and of size and thickness.
- Ceramic tile fittings for corners and edges etc., are less readily available than hitherto and are now excluded from the scope of BS EN 14411; details are therefore not included in this British Standard. Individual manufacturers can give advice about the range of types and sizes of fittings they produce, and their availability.

Throughout this British Standard, references to tiles and tiling are intended to apply equally to mosaics and mosaic work, except where the recommendations for mosaics are different.

Additional information regarding the workmanship element of ceramic tiling is contained in BS 8000-11.1 *Workmanship on building sites – Part 11: Code of practice for wall and floor tiling – Section 11.1: Ceramic tiles, terrazzo tiles and mosaics*; and for natural stone tiling and BS 8000-11.2 *Workmanship on building sites – Part 11: Code of practice for wall and floor tiling – Section 11.2: Natural stone tiles*.

Use of this document

As a code of practice, this part of BS 5385 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 5385 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

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

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

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.

Attention is drawn to the following.

- The Construction (Health, Safety and Welfare) Regulations [1];
- The Lifting Operations and Lifting Equipment Regulations [2];
- The Manual Handling Operations Regulations [3].

1 Scope

This part of BS 5385 gives recommendations for the design and installation of ceramic, natural stone and mosaic wall tiling in normal internal conditions; a description of tile types can be found in Annex A. It deals with classes and types of background and their suitability to receive tiling using the following fixing methods.

- a) Bedding in cementitious adhesives on an intermediate substrate or as a direct bedding method.
- b) Bedding in organic-based adhesive (dispersion or reaction resin) on an intermediate substrate or as a direct bedding method.
- c) Bedding in cement:sand mortar on rendering or as a direct bedding method.

Natural stone modular tiles as defined in BS EN 12057 are included within the scope of this British Standard, but natural stone slabs (i.e. units with nominal thickness greater than 12 mm thick) are excluded.

Ceramic tile fittings for corners and edges etc., are less readily available than hitherto, and are now excluded from this British Standard. Specially moulded features, for example trims, are also excluded.

Where the tiling installation needs to meet special functional or environmental requirements, or to assist in counteracting potentially detrimental effects on the installation and/or the structure, see BS 5385-4. The special conditions dealt with in BS 5385-4, for example, swimming pools, shower areas, etc., are listed in Annex B.

Agglomerated stone tiles and slabs are not included within the scope of this British Standard. Dimensionally similar to natural stone tiles, they possess different physical and chemical characteristics as a result of the various natural stone, mineral and binder constituents from which they are manufactured.

NOTE 1 Agglomerated stone tiles and slabs are natural stone and/or mineral fragments set in a binder subsequently cut to form tiles with a surface that is normally ground and polished to finish.

Metal, plastic, resin or mirror tiles and glass tiles of similar construction are not included within the scope of this British Standard, as these require different techniques, adhesives etc., to traditional tiles.

NOTE 2 Mirror tiles are tiles manufactured from float or plate glass with an applied backing.

For the purposes of this British Standard “normal conditions” means normal environmental temperatures and humidity. However, it is not to be inferred from this that all recommendations made in this British Standard are unsuitable for more extreme conditions. Manufacturers’ instructions contain limitations of their products.

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 410-1, *Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth*

BS 4027, *Specification for sulfate-resisting Portland cement*

BS 4551, *Mortar – Methods of test for mortar – Chemical analysis and physical testing*

BS 5385-2, *Wall and floor tiling – Part 2: Design and installation of external ceramic and mosaic wall tiling in normal conditions – Code of practice*

BS 5385-4, *Design and installation of ceramic and mosaic tiling in special conditions – Part 4: Code of practice*

BS 5974, *Code of practice for temporarily installed suspended scaffolds and access equipment*

BS 6100-6, *Building and civil engineering – Vocabulary – Part 6: Construction parts*

BS 6150, *Painting of buildings – Code of practice*

BS 6213, *Selection of constructional sealants – Guide*

BS 8000-3:2001, *Workmanship on building sites – Part 3: Code of practice for masonry*

BS 8000-11.1, *Workmanship on building sites – Code of practice for wall and floor tiling – Ceramic tiles, terrazzo tiles and mosaics*

BS 8000-11.2, *Workmanship on building sites – Code of practice for wall and floor tiling – natural stone tiles*

BS 8212, *Code of practice for dry lining and partitioning using gypsum plasterboard*

BS 8481:2006, *Design, preparation and application of internal gypsum, cement, cement and lime plastering systems – Specification*

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

BS EN 520, *Gypsum plasterboards – Definitions, requirements and test methods*

BS EN 1008, *Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

BS EN 12002:2002, *Adhesives for tiles – Determination of transverse deformation for cementitious adhesives and grouts*

BS EN 12004:2007, *Adhesives for tiles – Requirements, evaluation of conformity, classification and designation*

BS EN 12811-1 *Temporary works equipment – Part 1: Scaffolds – Performance requirements and general design*

BS EN 13139:2002, *Aggregates for mortar*

BS EN 13279-1, *Gypsum binders and gypsum plasters – Part 1: Definitions and requirements*

BS EN 13888:2002, *Grouts for tiles – Definitions and specifications*

BS EN 13914-2:2005+A1:2006, *Design, preparation and application of external rendering and internal plastering – Part 2: Design considerations and essential principles for internal plastering*

BS EN 14411, *Ceramic tiles – Definitions, classification, characteristics and marking*

BS EN 14647, *Calcium aluminate cement – Composition, specifications and conformity criteria*

3 Terms and definitions

For the purposes of this part of BS 5385, the terms and definitions given in BS 6100-6 and BS EN 14411 and the following apply.

3.1 bond breaker tape

self-adhesive tape, usually polyethylene or polytetrafluoroethylene (PTFE) used to prevent sealant sticking to a substrate

3.2 natural stone tiles

tiles made from rock which has been sorted, dressed or machined to finish

3.3 open time

period of time during which tiles can be adequately bedded after spreading the adhesive

3.4 large tile

tile that has an edge that exceeds 60 cm combined with a surface area of greater than 1 800 cm²

3.5 tile backer board

dimensionally stable and moisture-resistant fibre-reinforced cement-based boards, specifically designed to be used in place of wood-based boards, especially in areas exposed to moisture

NOTE Typically of thickness 12.5 mm.

3.6 lightweight tile backer board

rigid, extruded inert polystyrene foam board with glass fibre reinforced polymer modified cement coating

NOTE Typically available in thicknesses ranging from 5 mm to 80 mm.

4 Exchange of information and time schedule

COMMENTARY ON CLAUSE 4

Clause 4 deals with the exchange of information for the whole wall, including tiles, tile bed, background and intermediate substrate (if any).

4.1 Exchange of information

The 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 sought and documented.

- 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 might be subjected in service (e.g. mechanical cleaning).
- c) *Wall(s)*. Type and age of construction, location within the building, type and accuracy of background and need for intermediate substrate.
- d) *Associated work*. Elements embedded in or passing through the wall, skirtings and abutments, junctions with other adjacent finishes. Consideration should also be given to protection work to tiled/mosaic finishes in location with high impact risks, wall bumpers, corner protectors and so on.
- e) *Finishes*. Type(s) of tiles and/or mosaics, bedding and jointing requirements and required surface plane.
- f) *Contract*. Details, 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 4.3).
- i) *Testing*. Details of any compliance testing required.

4.2 Provision of utilities, facilities and materials

4.2.1 General

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 are to be provided and by whom.

- a) Provision of adequate, clean, dry, lockable storage space protected from frost (if necessary) (see 5.1).
- b) Provision of clean water supply adjacent to working area (see 5.6).
- c) Provision of adequate artificial lighting, if required (see 4.2.2).

- d) Provision of safe means of access and places of work, to include where required, suitable scaffolding and staging, which should conform to either BS EN 12811-1 or BS 5974.

NOTE 1 Attention is drawn to the requirements of the Construction (Health, Safety and Welfare) Regulations [1].

- e) Provision of unloading and hoisting facilities.

NOTE 2 Attention is drawn to the requirements of the Lifting Operations and Lifting Equipment Regulations [2] and Manual Handling Operations Regulations [3].

- f) Provision of electric power supply adjacent to working areas.
- g) Protection of work during and after fixing (see 9.1).
- h) Provision of supplies of cement and sand in accordance with 5.3 and 5.4.
- i) Provision of tiles, adhesives, grouts, primers and sealants.
- j) Provision of waste disposal.
- k) Control of site temperature.

Parties should also agree who will ensure that all the materials required for the installation are available.

4.2.2 Lighting on site

Lighting on site should be of similar type, direction and intensity as envisaged for the completed installation. If this condition is not met, then the appearance of the finished wall might be different from that originally intended; it should be appreciated that serious consequences might then result, including the necessity for complete retiling.

4.3 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 responsible for carrying out the work of each of the trades concerned.

In preparing the time schedule, 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.

Before tiling commences, at least six weeks should be allowed under good drying conditions for a new concrete or masonry wall to dry out. Whenever rendering is applied onto old or new concrete, it should be left for at least a further two weeks. New gypsum plasterwork should be left for at least four weeks. These drying times require extension under slow drying conditions and depending on the conditions on site (e.g. low temperatures, high humidity) and the mass of the structure; in conditions of impaired drying, the moisture content of the backing should be checked to determine suitability prior to application.

The schedule should allow time for all cutting of holes and chases and/or other work involving the use of percussion tools in or on the

walls to be tiled and in or on adjacent walls before any intermediate substrate is applied.

The schedule should provide for the completion of all necessary subsidiary work before the fixing of tiles or mosaic 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 bedding, grouting and final cleaning down.

Provision should be made for adjustment to the time schedule to allow for suspension of operations due to unfavourable conditions that jeopardize the success of the installation.

5 Materials

5.1 Transport and storage

The delivery of materials should be arranged to minimize handling. Adequate precautions should be taken to guard against the possibility of damage.

Materials should be stored in clean, dry, frost-free (if necessary), lockable storage to avoid excessive handling, theft and damage.

5.2 Tiles

5.2.1 General

All tiles should be clean and dry before use, except when bedding in cement:sand mortar (see 7.2.3.3).

5.2.2 Ceramic tiles

NOTE 1 Informative Annex A contains information about ceramic tiles.

NOTE 2 Table 1 provides classification of ceramic tiles with respect to water absorption (E) and shaping.

Large format tiles (3.4) and tiles with length to width ratio exceeding 2:1 might require special bedding procedures in accordance with tile or adhesive manufacturers' recommendations (see also 5.11); before selecting a particular type of tile, advice about its suitability should be obtained from the manufacturer via the supplier.

Table 1 Classification of ceramic tiles with respect to water absorption (E) and shaping, from BS EN 14411:2006

	Group Ia	Group Ib	Group IIa	Group IIb	Group III
Water absorption (E)	$E \leq 0.5\%$	$0.5\% < E \leq 3\%$	$3\% < E \leq 6\%$	$6\% < E \leq 10\%$	$E > 10\%$
A Extruded	A Ia	A Ib	A IIa	A IIb	A III
B Dust-pressed	B Ia	B Ib	B IIa	B IIb	B III

5.2.3 Natural stone tiles

NOTE Annex A contains information about natural stone.

The thickness of natural stone tiles should not exceed the weight restriction requirements of the different background types (see 6.2.4.3 and 6.4.1). The density of natural stone tiles can vary quite considerably and this should be established at the design stage; they are usually prepared and polished by wet processes and consequently they should be allowed to dry in natural ventilation and be clean before use.

Before selecting a particular type of tile, advice about its suitability should be obtained from the supplier.

5.2.4 Mosaics

NOTE 1 Informative Annex A contains information about mosaics.

For a mosaic that has been assembled with a backing material, it is essential that the following are checked.

- a) The backing material and its adhesive do not occupy more than 25% of the area of each tessera; the critical factor is the spread of the adhesive over the backs of the tesserae.
- b) The backing material and its adhesive do not deteriorate in service and that they are compatible with the mortar or adhesive bed in accordance with mosaic suppliers' recommendations.

For wet areas, readers should refer to BS 5385-4, for external areas, see BS 5385-2.

NOTE 2 Annex B describes the contents of BS 5385-4.

Ceramic tesserae should conform to the relevant physical properties given in BS EN 14411:2006, Table 1.

Before selecting a particular type of mosaic, advice about its suitability should be obtained from the supplier.

5.3 Cement

The cement for cement:sand mortar beds to be used for bedding mosaics should be one of:

- a) Portland cement (CEM I) conforming to BS EN 197-1;
- b) sulfate-resisting cement conforming to BS 4027; or
- c) calcium aluminate cement (high alumina cement) conforming to BS EN 14647.

Cement of all types should be used with care, because of the possible risk of adverse skin effects. Suppliers' material safety data sheets obtained at the exchange of information stage described in 4.1 should be used as a basis for assessing and managing the risk associated with its use in a particular application.

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

5.4 Sand

5.4.1 General

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

5.4.2 Sand for cement:sand rendering and mortar beds

Sand conforming to BS EN 13139:2002 recommended European designation 0/2 (CP or MP), category 2 fines, should be used for cement:sand rendering and mortar beds for mosaics.

NOTE For guidance, see the first entry under "Plastering or rendering" in PD 6682-3:2003, Table A.1.

5.4.3 Sand for grouting

5.4.3.1 For joints of nominal widths 6 mm and above

Sand conforming to the grading limits of BS EN 13139:2002, European designation 0/2 (FP or MP), category 2 fines, should be used for grouting joints 6 mm or more in width.

NOTE For guidance, see the second entry under "Plastering or rendering" in PD 6682-3:2003, Table A1.

5.4.3.2 For joints of nominal widths of less than 6 mm wide

Sands for grouts should conform to the grading limits given in Table 2.

Sands conforming to BS EN 13139:2002 recommended European designation 0/2 (FP or MP), category 3 fines might be suitable, but the fraction greater than 2.36 mm should be screened off.

NOTE For guidance see the second entry under "Masonry" in PD 6682-3:2003, Table A1.

For narrow joints below 3 mm, finer grading should be used.

Table 2 Sand for grouts for joints less than 6 mm wide

BS 410-1 sieve mesh size	Percentage by mass passing BS 410-1 sieves
2.36 mm	100
1.18 mm	95 to 100
600 µm	80 to 100
300 µm	30 to 100
150 µm	0 to 60
75 µm	not greater than 7

5.5 Plaster

Plaster backgrounds to receive tiles are usually based on gypsum building plasters and should be in accordance with BS 8481. Gypsum plasters should conform to BS EN 13279-1.

Proprietary materials should be used in accordance with the manufacturer's instructions.

5.6 Water

Water should be fresh and clean and free of materials deleterious to mortar beds in their fresh and hardened states (see BS EN 1008).

NOTE Drinking water is suitable; seawater is not suitable.

All containers used for storing or carrying water or for soaking tiles for cement:sand bedding as in 7.2.3.3 should be clean.

5.7 Adhesives

5.7.1 General

Cementitious adhesives (C), dispersion adhesives (D) and reaction resin adhesives (R) should all conform to BS EN 12004:2007.

NOTE For each type it is possible to have different classes, related to the different characteristics. These classes are designated with the following abbreviations.

1: Normal adhesive.

2: Improved adhesive (meets the requirements for additional characteristic).

F: Fast setting adhesive.

T: Adhesive with reduced slip.

E: Adhesive with extended open time.

The designation of the adhesive comprises the symbol of the type (C, D or R), followed by the abbreviation of the class or classes it belongs to.

5.7.2 Admixtures to adhesives

A polymer additive, or other liquid or powdered product, can be incorporated in to cementitious adhesives to obtain greater adhesion, improved resilience or some degree of water resistance; such admixtures should be used only with adhesives approved by the manufacturer (alternatively, the use of admixtures can be eliminated by use of adhesives with additional characteristics such as those given in BS EN 12004:2007 under Type C Class 2 and Type R Class 2).

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.

Cementitious adhesives can be further characterized as either S1 or S2 depending upon the values achieved in the transverse deformation test BS EN 12002:2002; the following should be considered.

- a) S1 and S2 categories are normally achieved by polymer modification of the adhesive. Transverse deformation indicates the extent to which the polymer content of the adhesive has modified the inherent brittle character of the cement, allowing it to deform further before cracking. This is often taken as an indication that the adhesive will prevent localized stresses in the installation by absorbing any stresses that occur between the adhesive and the background.

- b) Adhesives in the S1 and S2 category are sometimes described as flexible or resilient. The term “flexible” is not correct since flexibility implies deformation under a relatively low load, and what is being measured here is the deformation at which failure occurs, not the deformation at a particular load; nor is the term “resilient” correct, since resilience refers to elastic deformation (i.e. it will reverse itself if the load is released) whereas the transverse deformation measured by BS EN 12002:2002 could well be plastic (i.e. permanent). It is probably better to think of such materials as less brittle.

EXAMPLE

It is possible that an S2 adhesive could require a much higher load to achieve a given degree of deformation than an S1 adhesive, in which case this particular S2 adhesive can be thought of as being less flexible, since it requires a higher load to deform it.

NOTE *This classification is not available for non-cementitious adhesives, even though they might still be equally (or more) deformable.*

- c) Regardless of whether transverse deformation measures flexibility, even when highly flexible fixing materials are used, unstable backgrounds might still cause the installations to fail, the mode of failure then probably being via broken tiles rather than adhesion failure or breakdown of the adhesive layer. Furthermore, an adhesive which accommodates more movement in the background will also accommodate more flexing movement in the tile above it under load or impact, reducing the resistance of the installation to impact damage and cracking under load, since the flexing of the poorly-supported tile could cause stresses which exceed its breaking strength.

It should therefore always be ensured that backgrounds are sufficiently rigid and stable, so that the tiling does not become subjected to excessive stresses leading to failure.

5.8 Bonding agents

NOTE 1 *Bonding agents are available to improve the adhesion of renderings and/or tile beds to backgrounds, the most commonly used type being a water-based dispersion of styrene butadiene copolymer (SBR).*

Bonding agents are usually mixed with cement and sand, or more commonly with neat cement, and should be applied as a wet slurry or stipple immediately prior to the application of the mortar.

NOTE 2 *For optimum results the bonding agent could also be used as an admixture in the mortar if recommended by the manufacturer. This gives improved compressive and tensile strength, allowing mortars to be applied in thinner sections, thus reducing the weight of the construction.*

The manufacturer's recommendations for the particular type of bonding agent to be used and its method of application should always be strictly followed.

5.9 Sealants and back-up materials for movement joints

5.9.1 General

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.

5.9.2 Sealants

Joint sealants should be selected and applied in accordance with the guidance given in BS 6213.

Sealant manufacturers' advice should be taken into account as the properties of individual sealants can vary. A sealant should be capable of accommodating the anticipated amount of movement without loss of adhesion to the sides of the joints and be able to withstand the normal service conditions affecting the installation, e.g. resistant to water, ultraviolet light etc.

Where movement joints are intended to cover structural joints, and frequent movement is possible, class 25 sealants should be used. For joints undergoing smaller and less frequent movement, classes 20 or 12.5 should be considered.

NOTE 1 A given extent of movement can be accommodated either by a wider joint or by the use of a more flexible sealant, or a combination of the two; however, where the class number is less than 20, the sealant might not be suitable over structural movement joints. For a given extent of movement the narrower the joint, the higher the sealant class needed to accommodate the movement.

NOTE 2 Information on sealant installation is given in 6.5.4.

5.9.3 Back-up materials

The compressible back-up material should be a material to which the sealant can not adhere, or one which can be covered with a bond breaker tape to prevent adhesion.

The back-up material in the lower part of the joint should be compatible with the sealant used, should recover after compression and should support the sealant. It should not exude bituminous or oily products and should not absorb excessive amounts of moisture. In particular, its compressibility should be such that when the joint closes, the sealant is not forced out. Typical materials that should be used include closed cell cellular rubber and plastics, such as cellular polyethylene, some fibre building boards, cork boards and mineral or synthetic ceramic cords or blankets

NOTE 1 Back-up materials are available in sheet, strip and cord form in a range of sizes.

NOTE 2 For further information on installing back-up materials see 6.5.3.

5.10 Grouts

5.10.1 General

Grouts should have good working characteristics (e.g. ease of cleaning off the face of the tiles) as well as low shrinkage characteristics and good adhesion to the sides of the tiles. The class stated for a grout should not be taken as any indication of deformability; BS EN 12002 describes test methods for determining the deformability of adhesives and grouts and so on.

5.10.2 Types of grout

5.10.2.1 Proprietary grouts

Proprietary grouts should conform to BS EN 13888:2002, type CG or RG and should be one of the following types.

- a) Mixes based on cement and mineral fillers but modified by the inclusion of various additives, including pigments and organic additives, that only require to be mixed with clean water to the recommended consistency (CG).
- b) Mixes based on cement and mineral fillers and additives to be mixed with aqueous synthetic polymer dispersions to the recommended consistency (CG).
- c) Mixes based on epoxide resin consisting of separate pre-gauged components to be mixed together immediately before use (RG).

Manufacturers' instructions for safe handling and use should be strictly adhered to.

NOTE Epoxide resin grouts are more expensive and some might take longer to apply and clean off than cement based grouts. Ready-mix dispersion grouts are not covered by BS EN 13888:2002.

5.10.2.2 Cement:sand mortar grouts

Mortar grouts are sometimes used for grouting joints that are over 3 mm in width; in order to promote good adhesion and strength development, there should be dampness in the joint cavities.

Mixes of this type should be used for mosaics in cement:sand mortar beds that are thick enough to retain sufficient dampness when re-wetted.

NOTE The physical properties of cement:sand mortar grouts are generally inferior to those of proprietary grouts, which provide performance and properties that are more consistent.

Neat cement mixed with water should not be used as a grout for tiling except for pre-grouting paper-faced mosaics with narrow joints (see 8.5.1).

5.10.3 Admixtures to grouts

COMMENTARY ON 5.10.3

Admixtures, normally in the form of aqueous dispersions, can be incorporated in grout mortars based on cement and sand to enhance adhesion in the tile joints, whilst improving the resilience and reducing the water permeability of the hardened grout mortar. Proprietary aqueous admixtures are available for incorporation in proprietary grouts to provide improved characteristics.

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

5.11 Mechanical fixing

Where large format ceramic tiles are required to be fixed above first floor height, especially above pedestrian walkways, they should be secured by mechanical means. In other circumstances where the background is not sufficiently robust to support the load of the tile installation, it might be considered necessary to provide mechanical reinforcement. For such cases, which are much more common for external fixing, reference should be made to BS 5385-2, which gives details regarding appropriate materials and procedures.

6 Design

6.1 Backgrounds

6.1.1 General

The nature of the background should be established before choosing any intermediate substrate or other preparatory treatment necessary before tiling.

NOTE 1 Table 3 contains methods of preparation and choice of materials for the various backgrounds covered in 6.1.

NOTE 2 Some backgrounds might limit the choice of tile.

6.1.1.1 Porosity and suction

COMMENTARY ON 6.1.1.1

Porosity and suction affect the adhesion of cement:sand rendering; the amount of wetting required to reduce suction and to ensure uniformity of suction depends upon the nature of the background, the type of mix, the method of application and the ambient conditions.

Wetting should be carefully controlled and only the necessary amount of water applied.

6.1.1.2 Mechanical key

If a mechanical key is necessary but not afforded by the nature of the background, it should be artificially provided.

6.1.1.3 Trueness of construction

COMMENTARY ON 6.1.1.3

The trueness of the background construction also affects the final appearance of the tiling particularly where the tiles are fixed directly to the background because the tile fixing methods are not designed to correct background irregularities. Excessively thick applications of cement:sand render and/or gypsum plaster can lead to prolonged shrinkage and extended drying times.

The trueness of the background construction should be controlled because of the limitations in the thickness and the number of coats of any in situ applied intermediate substrate (see 6.3.3 and 6.4.3).

6.1.1.4 Moisture movement and thermal movement

NOTE Stresses might develop between the background and the tiling system from differential expansion and contraction movements and are potential causes of failure.

Where it is suspected that moisture movement or thermal movement of the background and/or tiling threatens the stability of the installation, special precautions or provisions of additional movement joints should be considered. Adhesives conforming to the requirements of BS EN 12004 should be used and the choice of adhesive discussed with the manufacturer.

6.1.1.5 Soluble salts in backgrounds

6.1.1.5.1 Chemical action

NOTE Soluble sulfates are present in some backgrounds such as brickwork; if these backgrounds become wet, soluble sulfates can migrate into cement-based mortars in sufficient quantities to cause damage from sulfate attack. This type of damage is likely to affect the adhesion of cement:sand renders/beds and cement-based adhesives.

Gypsum plaster (calcium sulfate) based materials should not be used as backings for ceramic tiling in wet or damp conditions.

6.1.1.5.2 Staining

Moisture migrating from bedding mortar or adhesive and from temporally wetted backgrounds can carry soluble materials to the surface of some natural stone tiles and this can result in staining; a trial fixing should be carried out to see if the tiles are affected by moisture from the bedding mortar or adhesive. Where staining is likely, the backgrounds should be dry and effectively sealed before natural stone tiles are fixed.

6.1.1.6 Contamination

Any laitance on the surface, contamination by oil, grease or any other substances that inhibit adhesion of the intermediate substrate or tiling or both should be cleaned or removed.

Backgrounds previously treated with decorative coating, e.g. lime wash or paints, could also cause failure and should be cleaned off. Any loose material on the surface should be brushed off.