

Screeds, bases and in situ floorings —

Part 3: Polymer modified cementitious levelling screeds and wearing screeds — Code of practice

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Association of Concrete Industrial Flooring Contractors

Association of Lightweight Aggregate Manufacturers

British Cement Association

Concrete Society

Contract Flooring Association

Federation of Plastering and Drywall Contractors

Federation of Resin Flooring Formulators and Applicators

Mastic Asphalt Council

Mortar Producers Association Limited

National Federation of Terrazzo-Marble and Mosaic Specialists

National Specialist Contractors Council

Quarry Products Association

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Foreword

This part of BS 8204 has been prepared by Subcommittee B/507/6.

BS 8204-3:2004+A2:2011 supersedes BS 8204-3:2004+A1:2009, which is withdrawn.

The start and finish of text introduced or altered by Amendment No. 2 is indicated in the text by tags **A2** **A2**. Minor editorial changes are not tagged.

The main changes from the 1993 version are:

- a) the inclusion of levelling screeds to receive flooring;
- b) the specifications for materials have been updated to include the European Standard specifications for cement, aggregates and concrete;
- c) the introduction of classes of abrasion resistance for wearing screeds;
- d) the length of the straightedge, used in the determination of surface regularity, has been changed from 3 m to 2 m. This brings BS 8204 in line with BS 5385;
- e) guidance on formulated products has been added in accordance with BS EN 13813.

Concrete wearing surfaces give satisfactory service under many industrial conditions but become less effective where there are specific requirements for hygiene, cleanliness, and resistance to high impact or abrasion. The main properties of polymer modified cementitious screeds can be summarized as follows:

- a) enhanced adhesion to the concrete base;
- b) much thinner applications than are possible with unmodified systems;
- c) toughness, durability, resilience and resistance to impact, abrasion and dusting;
- d) resistance to cracking;
- e) low permeability and reduced absorption of liquids and greases.

A1 The term “fine aggregate” is used throughout this document in accordance with European Standards, although common usage within the United Kingdom is to use the term “sand”. In most cases these terms are interchangeable. **A1**

The other parts of BS 8204 are as follows:

- Part 1, *Concrete bases and cementitious levelling screeds to receive floorings — Code of practice*;
- Part 2, *Concrete wearing surfaces — Code of practice*;
- Part 4, *Code of practice for terrazzo wearing surfaces*;
- Part 5, *Mastic asphalt underlays and wearing surfaces — Code of practice*;
- Part 6, *Synthetic resin floorings — Code of practice*;
- Part 7, *Pumpable self-smoothing screeds — Code of practice*.

As a code of practice, this British Standard 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.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 30, an inside back cover and a back cover.

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1 Scope

This part of BS 8204 gives recommendations for the design and installation of trowel finished polymer modified cementitious levelling screeds and wearing screeds, where the proportion of polymer solids based on the mass of dry cement is at least 4 %, as bonded screeds applied to direct finished concrete slabs, fine concrete screeds and to existing concrete floors within buildings.

This British Standard does not apply to unbonded screeds, floating screeds, pumpable self-smoothing screeds, or those laid monolithically, neither does it apply to two-component aqueous thermosetting polymer dispersions.

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.

[A1] *Text deleted* **[A1]**

BS 4027:1996, *Specification for sulfate-resisting Portland cement*.

[A1] BS 6100-9:2007, *Building and civil engineering — Vocabulary — Part 9: Work with concrete and plaster*. **[A1]**

[A1] *Text deleted* **[A1]**

BS 7976-2, *Pendulum testers — Part 2: Method of operation*.

BS 8204-1:2003 **[A1]** +A1:2009 **[A1]**, *Screeds, bases and in situ floorings — Part 1: Concrete bases and **[A1]** cementitious **[A1]** levelling screeds to receive in situ floorings — Code of practice*.

BS 8500-2:**[A1]** 2006 **[A1]**, *Concrete — Complementary British Standard to BS EN 206-1 — Part 2: Specification for constituent materials and concrete*.

BS EN 197-1:2000, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*.

BS EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*.

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 12504-2, *Testing concrete in structures — Part 2: Non-destructive testing — Determination of rebound number*.

BS EN 12620:2002, *Aggregates for concrete*.

BS EN 12878, *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test*.

BS EN 13043:2002, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas*.

BS EN 13139:2002, *Aggregates for mortar*.

BS EN 13318:2000, *Screed material and floor screeds — Definitions*.

[A1] BS EN 13658-1:2005, *Metal lath and beads — Definitions, requirements and test methods — Part 1: Internal plastering*.

BS EN 13658-2:2005, *Metal lath and beads — Definitions, requirements and test methods — Part 2: External rendering*. **[A1]**

BS EN 13813:2002, *Screed material and floor screeds — Screed material — Properties and requirements*.

BS EN 13892-4:2002, *Methods of test for screed materials — Part 4: Determination of wear resistance-BCA*.

BS EN 13892-8:2002, *Methods of test for screed materials — Part 8: Determination of bond strength*.

BS EN 14647:2005, *Calcium aluminate cement — Composition, specifications and conformity criteria*. 

THE CONCRETE SOCIETY. Technical Report 34 (TR 34), *Concrete industrial ground floors: A guide to their design and construction*. 3rd edition. Camberley: The Concrete Society, 2003¹⁾.

3 Terms and definitions

For the purposes of this part of BS 8204, the terms and definitions given in BS EN 13318:2000, BS 6100-6.1:1984, BS 6100-6.2:1986, BS 6100-6.3:1984 and BS 6100-6.4:1986 and the following apply.

3.1

base

building element that provides the support for a screed and floor finishes

3.2

flooring

uppermost fixed layer of a floor that is designed to provide a wearing surface

3.3

direct finished base slab

concrete flooring element that is suitably finished to provide a wearing surface or to receive directly the flooring to be applied without the need for a levelling screed

3.4

screed material

mixture comprising cement, aggregates, water and, in some cases, admixtures and/or additives

3.5

screed

layer of material laid in situ, directly onto a base, bonded or unbonded, or onto an intermediate layer or insulation layer, for one or more of the following purposes:

- to obtain a defined level;
- to carry the final flooring;
- to provide a wearing surface.

NOTE In this document the term “screed” includes both levelling screeds and wearing screeds unless otherwise stated.

3.6

levelling screed

screed suitably finished to obtain a defined level and to receive the final flooring

3.7

wearing screed

screed that serves as a flooring

NOTE This was formerly known as high strength concrete topping or granolithic topping.

3.8

bonded screed

screed that is bonded to the base

3.9

unbonded screed

screed laid either onto a separating layer or onto a base not prepared to ensure bonding

3.10

floating screed

screed laid on an acoustic and/or thermal insulating layer and completely separated from other building elements, such as walls and pipes

¹⁾ Available from Concrete Information Ltd., Riverside House, Station Approach, Camberley, Surrey, GU17 9AB.

3.11**fine concrete screed**

screed consisting of concrete in which the maximum aggregate size is 10 mm

3.12**☐_{A1} cementitious ☐_{A1} screed**

screed consisting of screed material containing ☐_{A1} fine aggregate ☐_{A1} up to a 4 mm maximum aggregate size

3.13**smoothing compound**

material applied to a base or screed to provide a smooth, even surface suitable for the installation of a floor covering

3.14**departure from datum**

deviation in height of the surface of a flooring layer from a fixed datum plane

3.15**surface regularity**

deviation in height of the surface of a flooring layer over short distances in a local area

NOTE Surface regularity is also known as flatness.

3.16**polymer modified cementitious screed material**

mixture of cement, aggregates and water, modified with a polymer dispersion or re-dispersible powder polymer, where the proportion of polymer solids based on the mass of dry cement is at least 4 %

3.17**bonding agent**

liquid product applied to seal and consolidate the surface of a base and aid the adhesion of the screed

3.18**pot life**

period of time after mixing during which a bonding agent can be worked

3.19**open time**

period of time after a bonding agent has been applied to a concrete surface during which it will provide full adhesion for a screed applied over it

4 Exchange of information and time schedule**4.1 General**

It is essential that consultations and exchange of information between all parties concerned with the building operations are arranged at an early date. This will enable each party to have full knowledge of the particulars of the work so that they can cooperate in producing the conditions required to complete a satisfactory job.

4.2 Selection of screed to be applied

It is essential that in the design stage there is full consultation with the manufacturer or supplier of the polymer modified system to ensure that the system selected is suitable for the application and service conditions. Consideration should therefore be given to whichever of the following are applicable:

- a) the intended use of the floor, including the type, extent and frequency of trafficking, impact forces, static loading etc.;
- b) whether in use the area will be dry or damp;
- c) type of flooring to be applied, if any;
- d) thickness of screed required, and any thickness variation to provide a fall;
- e) time available for the application, curing and drying of the screed;
- f) category of screed and in situ crushing resistance required;

- g) class of abrasion resistance required (wearing screeds only);
- h) any requirement for slip resistance (wearing screeds only);
- i) age, specification where known and nature of the base, including information about any previous use which might impair adhesion;
- j) the existence, or otherwise of a damp-proof membrane;
- k) surface preparation necessary;
- l) chemical resistance required: chemical constituents, concentration, temperature and frequency of likely spillage, presence of water and procedures for emergency wash-down, details of regular cleaning procedures, also falls, drainage and sumps to be provided.

4.3 Information to be provided to the screeding contractor

It is essential that all relevant information be provided in good time to the screeding contractor and to others whose work could be affected, including whichever of the following are applicable:

- a) description, situation and address of site and means of access to the site and works;
- b) those conditions of contract that might practically affect this particular work;
- c) degree of weather protection afforded by the structure;
- d) location and area of the polymer modified screed to be installed;
- e) age and nature of the base, including information on any previous use of the floor which could impair adhesion;
- f) survey of the base including surface regularity and departure from datum;
- g) nature and extent of necessary repairs and other preliminary work;
- h) minimum time intervals between stages of work and the application of heat in the building;
- i) date for completion of preliminary work;
- j) dates for start and completion of various sections of the floor;
- k) type and design thickness of screed to be laid;
- l) number of layers;
- m) type of damp-proofing;
- n) finished floor level, falls and maximum permissible departure from datum in each location;
- o) class of surface regularity of the polymer modified wearing screed;
- p) details of curing requirements;
- q) any work consequent upon services passing through the floor;
- r) treatment of joints;
- s) treatment of skirtings and kerbs;
- t) treatment of channels;
- u) treatment of junctions with adjacent floorings and doorway thresholds;
- v) any special requirements relating to underfloor heating;
- w) details of any compliance testing required;
- x) any potential restrictions on working hours;
- y) any limitations on installation due to production or other activities;
- z) any other requirements for materials, design or work on site.

4.4 Information to be provided by the screeding contractor

It is essential that the screeding contractor provides in good time to those responsible for the building, details of the conditions needed for the installation of the polymer modified screed, including which of the following are applicable:

- a) the extent of areas to be provided for the storage of raw materials and whether these are to be weatherproof or temperature controlled;
- b) the extent of areas needed for the siting of mixers etc. and for access by delivery trucks;
- c) ambient conditions required in the area where the polymer modified screed is to be installed;
- d) power and lighting requirements in the area to be screeded;

- e) power, lighting, water supply and other service requirements in the screed mixing area;
- f) protective screening to isolate the work from adjacent facilities;
- g) minimum time intervals after the polymer modified screed is installed before allowing foot traffic, vehicular traffic and water or chemical exposure respectively;
- h) protection necessary for the polymer modified screed between installation and handover.

4.5 Time schedule

In considering the time schedule, in addition to the usual intervals between commencement and completion of work by the various trades involved, allowances should be made for the following:

- a) completion of the building envelope to allow construction of a floor or wearing screed protected from rain, wind and sun;
- b) delays due to frost and cold weather;
- c) laying underfloor services: these should preferably be completed before the base is formed as there is a risk of subsequent cracking if services are embodied in the polymer modified screed;
- d) curing, drying and strength gain of the base concrete and/or fine concrete screed before the polymer modified screed is laid;
- e) surface preparation of the base;
- f) curing of the polymer modified screed;
- g) period of protection of the polymer modified screed from damage by other trades, including restriction of access.

5 Materials

5.1 Polymers

5.1.1 *Polymers for screeds*

The polymer should have proven suitability for modifying cementitious systems.

The polymers are initially manufactured in the form of aqueous dispersions. Some of the dispersions, after suitable compounding, can be spray dried to form re-dispersible powders.

The polymers are usually supplied to site as aqueous dispersions except in the case of one-pack systems, where re-dispersible powder polymers are used. In this latter case the polymer powder should form an aqueous dispersion during the production of the bonding agent mix or wet screed mix.

The polymer dispersion should be a stable aqueous dispersion of alkali resistant polymer particles. The polymer dispersion selected should be suitable for use at the ambient temperatures prevailing at the time of application. Under these conditions the dispersion should be capable of drying to form a coherent film.

If the polymer modified cementitious screed is to be applied onto a base with high relative humidity or is to be covered with an impermeable coating then a polymer with an appropriate moisture tolerance should be selected.

Confirmation that the polymer content meets the minimum requirement can be obtained from the proportion by weight of polymer solids in the dispersion which should be indicated in the product data sheet and/or the labels of the containers.

Various types and grades of polymers are available and these provide a range of performance characteristics in the polymer modified screed system. Examples of suitable polymer types include: styrene butadiene (SBR), acrylates, styrene acrylates, vinyl acetate/ethylene²⁾ and vinyl acetate/versatate²⁾.

5.1.2 *Bonding agents*

Any of the polymers listed in 5.1.1 may be used in a bonding agent system. Generally the polymer dispersion is blended with cement powder to form a smooth paste of brushing consistency.

[A₁] Fine aggregate **[A₁]** may be added to the cement in order to ease dispersion and provide texture to the bonding layer. Water may also be added to increase the open time.

Other suitable bonding agents are epoxide dispersions and solvent-free epoxides.

²⁾ Generally used in the form of re-dispersible powders.

For information on the use of bonding agents see 6.5.

Under laboratory conditions bonding agents should be capable of achieving a tensile bond strength of not less than 1 N/mm² after 3 days and not less than 2 N/mm² after 14 days, when tested in accordance with the adhesion test method given in BS EN 13892-8.

The open time of the bonding agent after application should be compatible with the technique used on site to lay the flooring.

Cement or **A1** cementitious **A1** bonding coats without polymer modification are not recommended as they might not achieve the required tensile bond strength.

5.2 Cement

A1 In recent years an increasing number of cements have become widely available. The user should establish that the type of cement is appropriate for the intended use.

Cements (Portland cement or a composite Portland cement conforming to BS EN 197-1) and combinations (Portland cement combined at the batching plant with an addition, conforming to BS 8500-2:2006, Annex A), are treated as being technically equivalent by BS 8500-2. For most applications a cement or combination of strength class 42,5 N is applicable. Lower strength classes used either in concrete bases or in cementitious levelling screeds might need an increase in cement or combination content to obtain similar properties and performance. For example, a cement of strength class 32,5 N would probably require an increase in cement content of about 10 %. An additional period of curing might also be necessary. **A1**

CAUTION 1 Portland cement grades that are designed to entrain air might react adversely with polymer additions and should only be used after site trials.

CAUTION 2 Calcium aluminate cement (high alumina) should be used with care. Guidance on the correct use of calcium aluminate cement should be sought from the manufacturers and current specialized publications.

WARNING 1 When Portland cement is mixed with water, or even becomes damp, alkalis are released that can be harmful to the skin and eyes. The effect depends on the length of contact, any abrasion, the individual and the part of the body involved. Suitable protective clothing should be worn. If eyes are affected, they should be washed out without delay and medical advice sought.

WARNING 2 Polymer modified cementitious screed material and concrete might until set cause both irritant and allergic contact dermatitis.

— Irritant contact dermatitis is due to a combination of the wetness, alkalinity and abrasiveness of the constituent material.

— Allergic contact dermatitis is caused mainly by the sensitivity of an individual's skin to hexavalent chromium salts. **A1** Cement should be used within the period declared on the packaging or on the delivery note for bulk cement. **A1**

5.3 **A1** Fine and coarse aggregates **A1**

A1 Fine and coarse aggregates **A1** for screeds and wearing surfaces should conform to the following grading limits as appropriate.

a) **A1** Fine aggregate **A1** should conform to BS EN 13139:2002 0/4 mm (MP) category 1.

Where the intended thickness of the screed is 20 mm or less, consideration should be given to adopting a finer grade such as 0/3 mm (MP) category 1. However this is not a preferred grade in BS EN 13139:2002, and if it is not available consideration should be given to using the 0/2 mm (MP) category 1 material.

b) **A1** Fine aggregate **A1** for making good imperfections in stair risers (6.11) should conform to BS EN 13139:2002 0/2 (CP or MP) category 2.

c) 3 mm aggregate should conform to BS EN 13139:2002 aggregate size 2/4 with 100 % passing a 5.6 mm sieve.

d) 6 mm aggregate should conform to BS EN 12620:2002 aggregate size 2/6.3 or to BS EN 13043:2002 aggregate size 2/5.6.

e) 10 mm aggregate should conform to BS EN 12620:2002 aggregate size 4/10 or to BS EN 13043:2002 aggregate size 4/8.

Aggregates for heavy duty flooring should be either:

1) aggregates conforming to BS EN 12620 with a Los Angeles coefficient of not less than LA₄₀ and an Aggregate Abrasion Value not exceeding AAV₅; or

2) any other type provided it has established suitability with regard to strength, density, shrinkage, durability and the abrasion resistance of the screed.

[A1] *Text deleted* **[A1]**

Aggregates should not contain any deleterious material in sufficient quantity to affect adversely the durability or appearance of the screed or wearing surface. For example, lignite, coal and iron pyrites can cause “pop-outs”. **[A1]** BS EN 12620:2002, **G.4**, gives the limits for the lignite content in aggregates for concrete which should not normally be exceeded and states: “Where appearance is an essential feature of the concrete, aggregates should not contain materials in proportions that adversely affect surface quality or durability. **[A1]** Some aggregates exhibit higher than average drying shrinkage and should not be used, as they can give rise to a greater risk of cracking (see BRE Digest 357 [1] and BS EN 1367-4).

5.4 Pigments

Pigments, if used, should conform to BS EN 12878 and should be compatible with the polymer dispersion selected.

5.5 Admixtures

Admixtures, if used, should conform to BS EN 934-2. Other types of admixture should only be used with the agreement of the polymer supplier. Compatibility between the admixture and polymer should be confirmed by reference to both the admixture and polymer suppliers.

5.6 Water

Water should be clean and free from materials deleterious to screeds in their fresh and hardened states. In general, drinking water is suitable for this use. In cases of doubt the water should conform to BS EN 1008.

5.7 Formulated products

Pre-packed **[A1]** screeds and ready-mixed screeds **[A1]** should conform to the requirements of BS EN 13813.

[A1] Pre-packed screeds **[A1]** are commonly available as follows.

- a) “Two-pack”, in which one pack consisting mainly of cement, graded aggregates and additives, is mixed with a second pack containing the corresponding dose of polymer dispersion. In some cases the second pack contains sufficient liquid to mix with the dry component, otherwise a recommended additional quantity of water has to be added.
- b) “One-pack” consisting mainly of a blend of cement, dried and graded aggregates, additives and powder polymer, which is mixed with water on site.

In some cases part or all of the aggregate is supplied in a separate pack.

Each type of pre-packed material should be used in accordance with the manufacturer’s instructions.

Confirmation that the polymer content meets the minimum requirements can be obtained from the proportion of polymer solids to cement by mass in the mixed product which should be indicated in the product data sheet and/or the labels of one or two pack systems.

5.8 Metal lathing to skirtings

Metal lathing should conform to designation L3 as given in Table 1 of BS 1369-1:1987³⁾.

6 Design

6.1 Selection parameters

Factors influencing the selection of a polymer modified cementitious screed should include the following parameters:

- type and amount of traffic;
- whether it is a wearing screed or a levelling screed;
- the characteristics and profile of the existing base (see 7.1).

³⁾ BS 1369-1 will eventually be superseded by BS EN 13658 which is yet to be published.