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11 December 2002

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BRITISH STANDARD

BS 4887-2: 1987

Mortar admixtures —

Part 2: Specification for set retarding admixtures

UDC 666.971.165

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Committee (CAB/-) to Technical Committee CAB/3 upon which the following bodies were represented:

Brick Development Association
British Aggregate Construction Materials Industries
British Ceramic Research Limited
British Precast Concrete Federation
British Ready Mixed Concrete Association
Building Employers Confederation
Cement Admixtures Association
Cement and Concrete Association
Cement Makers' Federation
Concrete Society
County Surveyor's Society
Department of the Environment (Building Research Establishment)
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Electricity Supply Industry in England and Wales
Federation of Civil Engineering Contractors
Institution of Civil Engineers
Institution of Structural Engineers
Mortar Producers' Association
Plasterers' Craft Guild
Society of Chemical Industry

This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 May 1987

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The following BSI references relate to the work on this standard:
Committee reference CAB/3
Draft for comment 86/11852 DC

ISBN 0 580 15954 X

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Contents

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Foreword

This Part of BS 4887 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee. BS 4887-1 specifies requirements for air-entraining (plasticizing) mortar admixtures. It is intended to prepare, under the general title "Mortar admixtures", further Parts to cover other admixtures now in use in building mortars.

This Part specifies the requirements for set retarding admixtures for use, both with and without lime, in mortars for bedding masonry units, for plastering and for rendering. Requirements for set retarding admixtures for use in screeding mortars are specified in BS 5075-1.

Mortar admixtures are used in building mortars in small quantities to improve specific properties of the mortar. Those covered by this Part of BS 4887 are designed to extend the working life of fresh mortar. They may also affect other properties so it is necessary to demonstrate that these effects are not adverse. The test methods included cover those properties of mortars likely to be important when they are used in bedding masonry units, plastering and rendering. All test methods have been taken from BS 4551; details of procedures are given in Appendix B and Appendix C.

The set retarding admixture is tested in a mortar containing entrained air. The air-entraining admixture used to produce this is required to comply with BS 4887-1. To reduce the effects of different raw materials on test results, most test methods use a control mix and a mix containing the admixture. In this Part of BS 4887, only mortar complying with designation iii of BS 4721 has been included but both lime and non-lime mortar types are required to be tested to qualify for universal use.

It is known that the properties of different constituent materials as well as the use of different mortar mixes can change the required dosage of an admixture. It is important that the user checks the properties of the mixes to be used on site.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, 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.

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1 Scope

This Part of BS 4887 specifies the requirements for performance and uniformity and methods of test for set retarding mortar admixtures added to extend the working life of building mortars. These are prepared both with and without lime for use in bedding masonry units, plastering and rendering but not normally for use in screeding.

NOTE The titles of the publications referred to in this Part of BS 4887 are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 4887 the definitions given in BS 4049 and BS 6100-6.4 apply.

3 Performance requirements

The admixture shall enable a test mortar to comply with the performance requirements given in Table 1 when test mixes of the mortar, containing representative samples of the admixture taken as described in Appendix A, are prepared as described in Appendix B and subjected to the acceptance tests described in Appendix C.

A test mix mortar of standard consistence, i.e. complying with the requirement given in Table 1 when tested as described in **C.2**, containing the admixture under test shall be compared with a control mix mortar of standard consistence made on the same day under the same conditions and the mean results obtained from two comparisons, not necessarily on the same day, shall be used to assess compliance with the performance requirements for air content and 28 day compressive strength. Part of the text mix mortar shall be stored for 28 h and then tested for consistence, air content and specimens made for testing 28 day compressive strength. The sample to be used to test resistance to penetration shall be stored for a further 24 h and then checked to determine whether the mortar has set.

Batches of the admixture that have the same formulation, as described in **5.1** c) and k) need not be tested individually for acceptance if they have been shown by the uniformity tests in clause **4** to have the same composition as that of the admixture tested for acceptance and complying with the performance requirements.

4 Uniformity requirements

Any batch of admixture shall have the same composition, as given in **5.1** k), as that of the admixture tested for acceptance. To check this uniformity of composition, a sample of the batch, taken as described in Appendix A, shall be tested in accordance with Appendixes D and E of BS 5075-1:1982 and shall comply with the requirements given in Table 2.

Table 1 — Performance requirements and acceptance tests

Characteristic	Test reference	Requirement (mean of two batches)
Consistence after:		
a) standard mixing	**C.2**	Mean dropping ball penetration of 10 ± 0.5 mm
b) 28 h standing	**C.5**	Not more than 4.0 mm less than the value after standard mixing
Air content after:		
a) standard mixing	**C.3**	14.0 % to 20.0 %
b) 28 h standing	**C.7**	Not less than 70 % of the value after standard mixing
Resistance to penetration after:		
52 h standing	**C.6**	Not less than 5 N/mm^2
28 day compressive strength on cubes made after:		
a) standard mixing	**C.4**	Not less than that of the control mix
b) 28 h standing	**C.8**	Not less than that of the control mix

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Table 2 — Uniformity requirements and tests

Characteristic	Test reference	Requirement
Dry material content	**D.1** of BS 5075-1:1982	a) For liquid admixtures: to be within 3 % (*m*/*m*) of the value stated by the manufacturer[a] b) For solid admixtures: to be within 5 % (*m*/*m*) of the value stated by the manufacturer
Ash content[b]	**D.2** of BS 5075-1:1982	To be within 1.0 % (*m*/*m*) of the value stated by the manufacturer
Relative density	**D.3** of BS 5075-1:1982	For liquid admixtures: to be within 0.02 of the value stated by the manufacturer
Chloride ion content	Appendix E of BS 5075-1:1982	To be within 5 % of the value stated by the manufacturer or within 0.2 % (*m*/*m*), whichever is the greater

[a] The term manufacturer throughout this standard includes the supplier where appropriate.
[b] Not applicable to admixtures containing more than 1 % (*m*/*m*) of chloride ion.

5 Information to be provided

5.1 Test information

The following test information shall be available in writing[1)].

a) The name, trade mark or other means of identification of the manufacturer.

b) The trade designation of the product, i.e. brand name, reference number and/or letter.

c) The description of the material, i.e. set retarding mortar admixture, its physical state (liquid or solid), its colour and the generic type of its main active constituent(s).

d) The name and location of the test laboratory where acceptance and uniformity tests were made and the date of testing.

e) The sources of the cement, lime, sand and air-entraining admixture used in the tests.

f) The mass of air-entraining admixture and of the admixture under test, both calculated on the mass of cement, used in the test mix mortar.

g) The consistence of each control and test mix mortar and the mean values of each pair.

h) The air content of each control and test mix mortar after standard mixing and, for the test mix mortar, after 28 h standing and the mean values of each pair.

i) The resistance to penetration of each test mix mortar after 52 h and the mean values of each pair.

j) The compressive strengths of the individual mortar cubes for the control and test mix mortars made after standard mixing and, for the test mix mortar, after 28 h standing and the mean compressive strengths at age 28 days.

k) The composition, as follows:

1) the dry material content;

2) the ash content;

3) the relative density of liquid admixture;

4) the chloride ion content, expressed as a percentage by mass of total admixture.

5.2 General information

The following general information shall be available in writing[1)].

a) The name, trade mark or other means of identification of the manufacturer.

b) The trade designation of the product, i.e. brand name, reference number and/or letter.

c) The description of the material, i.e. set retarding mortar admixture, its physical state (liquid or solid), its colour and the generic type of its main active constituent(s).

d) Packaging, recommended storage conditions, maximum storage time before use and special precautions at extremes of temperature, including instructions regarding liquids which have become frozen. Where any special requirements on storage life apply, they shall be stated.

NOTE A certificate confirming that the storage recommendations have been followed should be provided by the manufacturer.

e) Instructions for use and any necessary safety precautions, e.g. if caustic, toxic or corrosive.

f) Any known incompatibility with other admixtures or with certain types of cements, etc.

g) The manufacturer's recommended dosage or dosages.

h) Effects of underdosage and overdosage.

[1)] Information is normally provided by the manufacturer but may be made available by a supplier after repackaging bulk material.

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6 Marking

When admixtures are supplied in containers they shall be clearly marked for the purposes of identification and indication of compliance with the following information. When the material is supplied in bulk at the point of delivery, the same information shall be provided in writing at the time of delivery.

a) The name, trade mark or other means of identification of the manufacturer.

b) The trade designation of the product, i.e. brand name, reference number and/or letter.

c) The description of the material, i.e. set retarding mortar admixture.

d) The chloride ion content, expressed as a percentage by mass of total admixture.

e) A summary of storage requirements including any special requirement on storage life, as indicated in **5.2** d) which shall be clearly marked, e.g.:

"This admixture shall not be taken to comply with the requirements of BS 4887-2:1987 after (date)."

f) Instructions for use and any necessary safety precautions, e.g. if caustic, toxic or corrosive.

g) The manufacturer's recommended dosage or dosages.

h) The number and date of this Part of this British Standard, i.e. BS 4887-2:1987[2)].

[2)] Marking BS 4887-2:1987 on or in relation to a product is a claim by the manufacturer that the product has been manufactured to the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification should be addressed to the appropriate certification body.

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Appendix A Methods of sampling admixtures

A.1 General

Take samples of admixtures in accordance with the appropriate method given in **A.2** to **A.5**. In all steps of the sampling procedure minimize the exposure of the material to the atmosphere to avoid appreciable absorption of moisture or carbon dioxide, or the evaporation of moisture.

A.2 Sampling of powdered materials from packages

Each sample shall represent not more than 1 t of solid admixture. Sample six packages or 1 % of the number of packages, whichever is the greater, or, where the total number of packages does not exceed six, all the packages. Ensure that the packages sampled are evenly distributed throughout the consignment.

Take a sub-sample from each of the selected sample packages by one or more of the following procedures, as appropriate.

a) Where packages contain 500 g or less, take the whole of the contents of a package.

b) Where packages contain more than 500 g, use either of the following methods.

NOTE The method given in 1) is the preferred method but if a sampling tube is not available use the method given in 2).

1) Insert a sampling tube, which takes a core not less than 25 mm in diameter, into the package so that it takes a core of material substantially the entire length of the package.

2) Empty one of the packages to be sampled on to a clean dry surface and mix the material. Take at least three increments of not less than 125 g each from different parts of the heap.

Repeat the procedure with each of the other packages to be sampled and thoroughly mix the sub-samples obtained to form one bulk sample.

Reduce this bulk sample to about 1 kg, either by coning and quartering or by use of a sample splitter. Place the sample in one or more airtight labelled containers.

A.3 Sampling of liquid from containers

Each sample shall represent not more than 5 000 L of liquid admixture. Sample six containers or 1 % of the number of containers, whichever is the greater, or, where the total number of containers does not exceed six, all the containers. Ensure that the containers sampled are evenly distributed throughout the consignment.

Agitate the containers to disperse all lightly settled material. Disregard all deposits which are not readily brought into suspension by such agitation.

Without delay, take sub-samples from the selected containers by one or more of the following procedures, as appropriate.

a) Where containers hold 0.5 L or less, take the whole of the contents of a container.

b) Where containers hold more than 0.5 L, take 0.5 L of the liquid in each container, combine the sub-samples obtained in this way and mix them thoroughly to form one bulk sample.

Thoroughly mix the bulk sample and take a final sample of not less than 1 L. Place this in one or more clean bottles, labelled and tightly stoppered.

A.4 Sampling bulk materials

No requirement is specified in this Part of BS 4887 for sampling from single packages or containers whose contents exceed 1 t of solid admixture or 5 000 L of liquid admixture. The method of sampling in such cases will depend upon the circumstances, but the final sample size shall be sufficient to represent the product to be tested.

NOTE Additional guidance on sampling may be found in BS 6002.

A.5 Particulars of the sample

Record the date, place and method of sampling, the identity and quantity of the material represented by the sample and the name(s) of the supervisor(s) present.

Appendix B Preparation of mortars for acceptance tests

B.1 General

To prepare two batches of lime based control mix mortars and their corresponding test mix mortars and two batches of non-lime based control mix mortars and their corresponding test mix mortars needed for testing in accordance with Appendix C, use the constituents, mix quantities, apparatus and procedures given in **B.2** to **B.5**.

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B.2 Constituents

B.2.1 *Cement*

The cement shall be a reference ordinary Portland cement, which is an ordinary Portland cement that has been specially selected for the purpose of admixture acceptance tests, and shall comply with BS 12. It shall be identified as "CAA Reference Cement". It shall be stored in an airtight container which shall only be opened for the minimum time needed to remove the amount given in Table 4.

NOTE CMF Specification Cement complying with the requirements of the Cement Admixtures Association Reference Cement, and its specification can be obtained from Wexham Developments Limited, Wexham Springs, Slough SL3 6PL.

B.2.2 *Lime*

The lime shall be high-calcium hydrated lime complying with BS 890. It shall be stored in an airtight container.

B.2.3 *Aggregate*

The sand shall comply with BS 4550-5 except that the proportions and masses of the fractions given in Table 3 and Table 4 shall be used in each batch of mortar.

Table 3 — Grading of sand

Fraction	Size	Proportion
		%
A	2.36 mm to 1.18 mm	15
B	1.18 mm to 600 µm	15
C	600 µm to 300 µm	20
D	300 µm to 150 µm	25
E	150 µm to 90 µm	25

B.2.4 *Admixture*

The air-entraining admixture shall comply with BS 4887-1 and shall be added in an amount to give 14 % to 20 % of air in both the control and test mix mortars and recorded as a percentage, to the nearest 0.005 % (m/m) of the total dry mass of mortar.

NOTE The dosage of the air-entraining admixtures for the control and test mix mortars may not necessarily be the same.

The retarding admixture under test shall be added in the amount stated by the manufacturer and recorded as a percentage, to the nearest 0.005 % (m/m) of the total dry mass of mortar.

B.3 Mix quantities

The mortars shall have the compositions given in Table 4.

Table 4 — Compositions of mortars

Constituent	Mortar without lime		Mortar with lime	
	Mass	Proportion	Mass	Proportion
	g	%	g	%
Sand fraction[a] A	930	84.2	900	81.4
Sand fraction B	930		900	
Sand fraction C	1 240		1 200	
Sand fraction D	1 550		1 500	
Sand fraction E	1 550		1 500	
Cement	1 160	15.8	1 000	13.6
Lime	—	—	370	5.0

[a] Table 3 defines sand fractions.

The water content of each batch of control and test mix mortar shall be such as to produce a standard consistence. To establish the required water contents, prepare series of trial mixes, varying the water content successively and measuring the consistence of each until the correct values are reached. Reject these trial mix mortars.

B.4 Apparatus

B.4.1 *Mixer*, complying with **8.3** of BS 4551:1980 and fitted with a 10 L or 12 L bowl. To prevent loss of material during mixing a skirt should be fitted to the rim of the bowl.

B.4.2 *Clock*, showing seconds and minutes.

B.4.3 *Dropping ball apparatus*, complying with **10.2** of BS 4551:1980.

B.4.4 *Stiffening time apparatus*, complying with **14.2** of BS 4551:1980.

B.4.5 *Air content apparatus*, complying with **13.2.1** of BS 4551:1980 for the density method.

B.4.6 *Compressive strength apparatus*, complying with **15.2** and **15.4** of BS 4551:1980.

B.5 Mixing procedure

Bring all the materials to a temperature of 20 ± 2 °C before starting the mixing of the mortar. Carry out the mixing in a room having a temperature of 20 ± 2 °C and a relative humidity of not less than 50 %.

Add all the cement and sand to the mixing bowl and carry out the operations given in Table 5 at the times and during the intervals indicated.

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Appendix C Acceptance tests on control mix and test mix mortars

C.1 Testing procedures

Carry out all the tests in this appendix in the order of the following clauses on samples from the duplicate batches of control mix mortar and the test mix mortar. Use batches with standard consistence for all tests. Reject the mortar from the trial mixes (see **B.3**) that did not have standard consistence.

C.2 Standard consistence

Immediately after completion of mixing of each mortar, make three tests for consistence by the method described in clause **10** of BS 4551:1980. After each test for consistence, return the mortar to the mixing bowl using a palette knife to remove the mortar from the mould.

Then remix with the palette knife for 10 s before taking samples for the tests given in **C.3** to **C.8**.

Report the mean of the three tests to the nearest 0.1 mm as the standard consistence.

Table 5 — Mixing procedure

Time	Procedure
0 s	Start the clock and the mixer.
0 s to 30 s	Mix the dry constituents.
30 s to 60 s	Add one quarter of the water to the bowl.
60 s to 90 s	Continue mixing.
90 s to 120 s	Add a second quarter of the water containing the air-entraining admixture.
120 s to 150 s	Rinse the air-entraining admixture container with a small part of the third quarter of the water and add the rinsings to the bowl.
150 s to 180 s	Add the fourth quarter of the water. In the case of the test mix mortar, this water shall contain the retarding admixture under test.
180 s to 210 s	Rinse the retarding admixture container with the remainder of the third quarter of the water and add the rinsings to the bowl. In the case of the control mix mortar, add the remainder of the third quarter of the water directly to the bowl.
210 s to 240 s	When testing with lime, stop the mixer and add the lime by spreading it over the mix.
210 s to 330 s	When testing without lime, continue mixing. Then stop the mixer.
240 s to 360 s	When testing with lime, restart the mixer and continue mixing. Then stop the mixer.
5.5 min to 12.5 min or 6 min to 13 min with lime	Lower the bowl and clean all material from the skirt, paddle and sides of the bowl down into the mix with a scraper. Using the hand tool, turn the whole mix over in the bowl taking particular care to leave no unmixed materials at the bottom of the bowl. Cover the bowl to prevent loss of moisture, using an impermeable plastics film or a damp cloth, and leave it to stand.
12.5 min to 13.5 min or 13 min to 14 min with lime	Remove the cover, replace the bowl, restart the mixer and continue mixing for a final 60 s. Stop the mixer and the clock.

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C.3 Air content

Determine the air content of the control mix mortars and the test mix mortars using the density method given in **13.2** of BS 4551:1980. Calculate the relative density, D, of each mortar to the nearest 0.001 and then calculate the air content, A, (in %) from the formula:

$$A = 100(1 - KD)$$

where for non-lime mortars

$$K = \frac{2710 + M}{7360 + M}$$

or for mortars with lime

$$K = \frac{2747 + M}{7370 + M}$$

where

M is the mass of water (in g)

NOTE The numerical values for K are based on the mix quantities given in **B.3** with a relative density of 3.13 for the cement and of 2.65 for the sand.

After completing the test, return the mortar to the mixing bowl and remix with a palette knife for 10 s.

Report these air contents to the nearest 0.1 %.

If the air contents of the pair of control mix mortars are not within 3 % of each other and the air contents of the pair of test mix mortars are not within 3 % of each other, repeat the mixing procedure with a different amount of the air-entraining admixture. Calculate the mean value of these pairs to the nearest 0.1 %. If the mean air content of the pair of control mix mortars is not within 3 % of the mean air content of the pair of test mix mortars, repeat the mixing procedure with a different amount of the air-entraining admixture.

C.4 Compressive strength of hardened mortar

For each batch of the control and test mix mortars prepare three 70.7 mm cubes by the procedure given in **15.2.6** of BS 4551:1980. Reject the remainder of the control mix mortar.

Cure the specimens in moist air for 7 days (**15.2.7.2** of BS 4551:1980) at a temperature of 20 ± 2 °C, then demould them and cure hydraulically (**15.2.7.1** of BS 4551:1980) at a temperature of 20 ± 2 °C. After 28 days total curing, test each set of three cubes for compressive strength, using the procedure given in **15.4.2.2** of BS 4551:1980. If one result within the set of three obtained on specimens tested at the same age varies by more than 10 % from the mean of the set, discard that result and recalculate the mean of the remaining results. If more than one result varies by more than 10 % from the mean, discard the set of results and repeat the tests on the mortar. Calculate the mean strengths and report them to the nearest 0.1 N/mm^2.

C.5 Consistence after 28 h standing

Place the remainder of the test mix mortar in a clean dry container which is not readily attacked by cement paste and seal it to prevent the loss of water. Store at 20 ± 2 °C for 28 ± 0.5 h. Mix the mortar in the container for 10 s with a palette knife. Make three tests for consistence by the method given in clause **10** of BS 4551:1980. After each test for consistence return the mortar to the container and mix it into the mass with the palette knife for 10 s.

Report the mean of the three tests to the nearest 0.1 mm as the consistence after storing for 28 h.

C.6 Resistance to penetration after 52 h standing

Fill a rigid open topped mould (**14.2.2** of BS 4551:1980) with the stored test mix mortar and cover the mould to prevent loss of water and store at 20 ± 2 °C for a further 24 h. At 52 ± 1 h after the original mixing determine the resistance to penetration by the method given in **14.3.6** of BS 4551:1980.

Report the resistance to penetration to the nearest 0.1 N/mm^2.

C.7 Air content after 28 h standing

Determine the air content of the test mix mortar that has been stored for 28 h by the density method given in **13.2** of BS 4551:1980.

Report the air content to the nearest 0.1 %.

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C.8 Compressive strength of hardened mortar after 28 h standing

For each batch of the test mix mortar that has been stored for 28 h prepare three 70.7 mm cubes by the procedure given in **15.2.6** of BS 4551:1980.

Cure the specimens in moist air for 7 days (**15.2.7.2** of BS 4551:1980) at a temperature of 20 ± 2 °C, then demould and cure hydraulically (**15.2.7.1** of BS 4551:1980) at a temperature of 20 ± 2 °C. After 28 days total curing, test each set of three cubes for compressive strength, using the procedure given in **15.4.2.2** of BS 4551:1980. If one result within the set of three obtained on specimens tested at the same age varies by more than 10 % from the mean of the set, discard that result and recalculate the mean of the remaining results. If more than one result varies by more than 10 % from the mean, discard the set of results and repeat the tests on the mortar. Calculate the mean strengths and report them to the nearest 0.1 N/mm^2.

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Publications referred to

BS 12, *Specification for ordinary and rapid-hardening Portland cement.*

BS 890, *Specification for building limes.*

BS 4049, *Glossary of terms applicable to internal plastering, external rendering and floor screeding.*

BS 4550, *Methods of testing cement.*

BS 4550-5, *Standard sand for concrete cubes.*

BS 4551, *Methods of testing mortars, screeds and plasters.*

BS 4721, *Specification for ready-mixed building mortars.*

BS 4887, *Mortar admixtures.*

BS 4887-1, *Specification for air-entraining (plasticizing) admixtures.*

BS 5075, *Concrete admixtures.*

BS 5075-1, *Specification for accelerating admixtures, retarding admixtures and water reducing admixtures.*

BS 6002, *Specification for sampling procedures and charts for inspection by variables for percent defective.*

BS 6100, *Glossary of building and civil engineering terms.*

BS 6100-6, *Concrete and plaster.*

BS 6100-6.4, *Admixtures.*

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