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Aggregates —

Part 3: Aggregates for mortar — Guidance on the use of BS EN 13139

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Contents

Foreword

This Published Document has been prepared under the direction of Subcommittee B/502/1, Aggregates for mortar. It is one of nine parts that give guidance on the use and application of a series of European Standards for aggregates. These European Standards were prepared by CEN/TC 154, Aggregates, and have been adopted as British Standards. Conflicting British Standards relating to aggregates will be withdrawn in June 2004.

This part of PD 6682 gives guidance on the use of BS EN 13139 which specifies requirements for aggregates for mortar. BS EN 13139 supersedes BS 1199 and 1200:1976 which will be withdrawn in June 2004. BS EN 13139 also supersedes the conflicting requirements for levelling screed specified in BS 8204-1:2002. BS 8204-1 will be amended to remove these conflicting requirements at the latest by June 2004.

NOTE Users of BS 1199 and 1200:1976 should contact BSI Customer Services for confirmation of withdrawal. Users of BS 8204-1:2002 should contact BSI Customer Services for confirmation of amendment.

Attention is drawn to the fact that BS EN 13139 fully takes into account the requirements of the European Commission mandate M125, Aggregates, given under the EU Construction Products Directive (89/106/EEC) [1].

Attention is also drawn to the fact that BS EN 13139 uses the term "fine aggregate" instead of the term "sand" which has traditionally been used in the UK. BS EN 13139:2002, **3.7** specifically defines fine aggregates as having an upper sieve size of $D \leq 4$ mm.

Guidance on other European Standards in the aggregate series is given in the following parts of PD 6682.

— *Part 1: Aggregates for concrete — Guidance on the use of BS EN 12620.*

— *Part 2: Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas — Guidance on the use of BS EN 13043.*

— *Part 4: Lightweight aggregates for concrete, mortar and grout — Guidance on the use of BS EN 13055-1.*

— *Part 5: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications excluding concrete, mortar and grout — Guidance on the use of BS EN 13055-2.*[1)]

— *Part 6: Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction — Guidance on the use of BS EN 13242.*

— *Part 7: Armourstone — Guidance on the use of BS EN 13383.*

— *Part 8: Aggregates for railway track ballast — Guidance on the use of BS EN 13450.*

— *Part 9: Guidance on the use of European test method standards.*

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This Published Document is not to be regarded as a British Standard.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover.

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1) Both BS EN 13055-2 and PD 6682-5 are in preparation.

Introduction

This document provides guidance on the use of BS EN 13139 in the UK. BS EN 13139 supersedes the corresponding conflicting British Standard for mortar aggregates BS 1199 and 1200. However, whilst BS EN 13139 describes aggregates for mortar in a different manner to established UK practice, and in some cases uses different test methods to evaluate their properties, there is no change to the essential character of the aggregates in actual use in the UK.

Guidance on the description and grading of fine aggregates that make suitable mortar products is given in Annex A. This includes a full list of established British Standard descriptions alongside their equivalent European designations. Further advice and recommendations on masonry mortar is given in Annex B.

BS EN 13139 specifies a range of categories for properties to enable specifiers and users to select appropriate limiting values for the wide range of aggregates to be used in mortars within Europe. In most instances, provision is also made for producers to identify a declared value for properties when the value is outside indicated categories.

This UK guidance recommends limiting values for aggregate properties within the ranges permitted in BS EN 13139. Where possible, these recommended values are equivalent to those specified in BS 1199 and 1200.

An example specification listing recommended BS EN 13139 aggregate designations for particular properties is provided in Annex C. It can be applied to most general uses of aggregates in mortar.

BS EN 13139 also includes recycled aggregates within its scope and indicates that their suitability should be assessed in accordance with the regulatory requirements in the place of use. However, there is little experience in the use of recycled aggregates in mortar in the UK and no recommendations are included in this guidance.

Fine aggregate sizes in BS EN 13139 are described in a different manner to those described in BS 1199 and 1200. The fine aggregate fraction described in BS EN 13139 is linked to a 4 mm size or less, although with a greater oversize tolerance there will generally be little actual change in gradings in practice. For particular uses, a fine aggregate with an upper 8 mm nominal size is also included. The gradings of fine aggregates in accordance with BS EN 13139 are also based on different principles and place an emphasis on consistency. Namely that the supplier declares the typical grading for the fine aggregate and the tolerances within which it may vary. These tolerances are restricted by BS EN 13139 to given values.

BS EN 13139 also gives requirements for special bedding materials and repair mortars that have not previously been specified in a British Standard.

1 Scope

This part of PD 6682 gives guidance on the use of BS EN 13139 which specifies the properties of aggregates and filler aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in mortar. This includes masonry mortar, floor/screed mortar, plastering mortar, rendering mortar, special bedding materials, repair mortar and grouts.

NOTE Lightweight aggregates for mortar are covered by BS EN 13055-1.

Guidance is also given on the additional requirements in BS EN 13139 for manufactured aggregates.

2 Overview of BS EN 13139

2.1 General requirements

BS 1199 and 1200 specifies requirements for the grading of building sands and the quality of fine aggregates.

Details for the provision of data on other sand properties requested by the specifier, e.g. group classification, shape, surface texture, relative (particle) density, water absorption and bulk density, are also included.

BS EN 13139 changes and extends these properties and data requirements to include the following when required by the aggregate user:

a) fines content;

b) particle shape and shell content for aggregate fractions coarser than 4 mm;

c) resistance to freezing and thawing;

d) water-soluble chloride ion content;

e) acid-soluble sulfate content;

f) total sulfur content;

g) constituents which alter the rate of setting and hardening;

h) limits for the water-soluble matter and loss of ignition of manufactured aggregates.

2.2 Evaluation of conformity

BS EN 13139:2002, Clause **8** requires that producers undertake and on request declare the results from:

a) initial type tests used:

i) to characterize properties for new sources of aggregates;

ii) when there is a major change in the raw materials or processing which can effect the properties of the aggregates;

b) factory production control to monitor conformity of the aggregates with the relevant requirements and the producer's declared values.

Minimum test frequencies are specified in BS EN 13139:2002, Table E.1.

Guidance on the requirements for attestation of conformity and compliance with the provisions of the EU Construction Products Directive [1] are given in Clause **4**.

3 Requirements of BS EN 13139

3.1 General

Each clause in BS EN 13139 that specifies aggregate properties, i.e. Clause **5**, Clause **6** and Clause **7**, starts with a general subclause which draws attention to the necessity only to specify those properties relevant to the particular aggregate and end use of the aggregate. Where this is the case the wording "when required" is used.

For particular properties, i.e. fines content and acid-soluble sulfate content, tables of specified requirements allow the user to choose an appropriate "category" for each of these properties.

When the value obtained for a particular property is outside the indicated limit or categories, the producer can provide a declared value. For example, if the acid-soluble sulfate content for aggregates other than air-cooled blast-furnace slag exceeds 0.8 % loss by mass, the producer can state the maximum value of AS_{Declared}. Thus if this value were 0.9 % the producer would state $AS_{0.9}$ and users should determine whether this is adequate for their purposes. It should be noted that in the UK a value of 0.9 % for this property would not be acceptable for most mortars and the values recommended in **3.3.3** should be used.

3.2 Geometrical requirements

3.2.1 *Aggregate size (BS EN 13139:2002, 3.5, 3.9 and 5.2)*

The series of European Standards on aggregates specifies the following three options for sieve size ranges for use in the description of aggregate sizes:

a) basic set;

b) basic set plus set 1;

c) basic set plus set 2.

BS EN 13139 does not give requirements for sieve sizes, however, in the UK aggregates will generally be supplied to the basic set plus set 2. For completeness, this set of sieve sizes is given in Table 1.

Table 1 — The basic set plus set 2 range of sieve sizes specified in the series of European Standards for aggregates

Basic set plus 2 mm
0
1
2
4
6.3 (6)
8
10
12.5 (12)
14
16
20
31.5 (32)
40
63

The aggregate size is described in BS EN 13139 in millimetres with the designation *d*/*D*, where *d* is the lower limiting sieve size and *D* is the upper limiting sieve size. The majority of the particle size distribution of an aggregate should lie between these two values and requirements for this are specified in BS EN 13139:2002, **5.3**. The preferred sizes are given in BS EN 13139:2002, **5.2.3** as 0/1 mm, 0/2 mm, 0/4 mm, 0/8 mm, 2/4 mm and 2/8 mm.

In some European countries the addition of a filler aggregate to mortar is permitted in order that a minimum fines content is achieved. This ensures that the occurrence of voids and/or bleeding in the mortar is kept to a minimum. This filler aggregate is defined in BS EN 13139:2002, **3.9** as being an aggregate most of which passes a 0.063 mm sieve. It is described in BS EN 13139 simply as a filler aggregate and not in terms of a *d*/*D* designation.

3.2.2 *Sieve sizes*

BS EN 13139 expresses grading requirements in terms of percentages passing lower (*d*) and upper (*D*) sieve sizes and in percentages passing sieves with sizes which are multiples or fractions of *d* and *D*. When using the preferred sieve sizes given in BS EN 13139:2002, **5.2.3** some of these multiples and fractions are not exact sieve numbers from the ISO 565:1990, R 20 series. Therefore, a footnote to BS EN 13139:2002, Table 1 gives provision for the selection of next nearest sieve sizes in such circumstances.

For the UK, a selection of next nearest sieve sizes from the ISO 565:1990, R 20 series is given in Table 2 to cover such eventualities. It shows how they relate back to the multiples or fractions of the preferred *d* and *D* sieve sizes given in BS EN 13139:2002, **5.2.3**.

The sieve sizes given in Table 2 have been recommended for use in the UK for aggregates for mortar. Using these sieve sizes, the grading table in Annex B has been created.

Table 2 — Recommended sieves, including next nearest multiples and fractions from the ISO 565:1990, R 20 series

Recommended sieves for the UK[a] mm	Preferred sieve sizes given in BS EN 13139 mm		
	2*D* for *D* =	**1.4*D* for *D* =**	***d*/2 for *d* =**
16	8	—	—
14	—	—	—
10	—	8	—
8	4	—	—
6.3	—	4	—
4	2	—	—
2.8	—	2	—
2	1	—	—
1	—	—	2
0.500	—	—	—
0.250	—	—	—
0.125	—	—	—
0.063	—	—	—

[a] These sieve sizes are multiples or fractions of the preferred *d* and *D* sieve sizes given in BS EN 13139:2002, **5.2.3**. However, where the sieves calculated are not exact sieve numbers in the ISO 565:1990, R 20 series the next nearest sieve size has been used.

3.2.3 *Grading (BS EN 13139:2002, 5.3)*

3.2.3.1 *General*

Aggregates are described in BS EN 13139 in terms of their size and fines content. The choice of which European designation of aggregate size and which European fines content category should be selected can be determined by reference to Annex A. It lists established UK aggregate descriptions alongside their recommended equivalent European designations, e.g. for a BS 1200, Type G sand, the recommended designation would be 0/2, category 3 fines.

3.2.3.2 *Oversize and undersize limit (BS EN 13139:2002, **5.3.1**)*

BS EN 13139:2002, Table 1 specifies a series of limits on sieve sizes 2*D*, 1.4*D* and *D*. These limits control the oversize material percentage for the declared designation of the aggregate (*d*/*D*). These are shown in Annex B alongside the existing UK grading limits given in BS 1199 and 1200, BS 882 and BS 8204-1.

The undersize material present is controlled by the fines content category that limits the percentage passing the 0.063 mm sieve. According to the particular end use, the appropriate category is required to be selected with reference to BS EN 13139:2002, **5.5**. To help with this selection, Annex B lists BS EN 13139 designations alongside existing UK grading limits given in BS 1199 and 1200, BS 882 and BS 8204-1 for some typical end uses.

Additionally, aggregate sizes 2/4 mm and 2/8 mm have limits on sieve sizes *d* and *d*/2 that limit the undersize material as specified in BS EN 13139:2002, Table 1.

3.2.3.3 *Typical grading and tolerances (BS EN 13139:2002, **5.3.2**)*

BS EN 13139:2002, **5.3.2** specifies that when required by the purchaser a producer shall declare the typical grading for each fine aggregate size produced. It also specifies that the grading of the aggregate shall fall within the appropriate tolerances, in percentage passing by mass, specified in BS EN 13139:2002, Table 2 for the producer's declared typical grading.

When an additional description of the coarseness or fineness of an aggregate is required by the purchaser, BS EN 13139:2002, Annex A gives recommendations for describing this coarseness or fineness in terms of either:

a) the percentage of material passing the 0.5 mm sieve; or

b) the fineness modulus of the material.

NOTE Describing the coarseness or fineness of an aggregate in terms of the fineness modulus of the material is rarely used in the UK and is not recommended for adoption.

It should be noted that either a) *or* b) apply but not a) *and* b).

For either of these descriptions of coarseness or fineness, three ranges are given: coarse (*C*), medium (*M*), and fine (*F*). Where coarseness or fineness is described by the percentage of material passing the 0.5 mm sieve, the range letter is suffixed with a *P* giving descriptions of *CP*, *MP* and *FP*. Where the coarseness or fineness is described by the fineness modulus, the range letter is suffixed with an *F* giving descriptions of *CF*, *MF* and *FF*.

For special uses and cases, e.g. for thin layer mortar, and where in some parts of Europe low variability aggregates are available, reduced tolerances may be agreed in accordance with BS EN 13139:2002, Annex B. Users in the UK should note that such aggregates are not readily available on a wide scale from UK sources.

3.2.3.4 *Filler aggregates (BS EN 13139:2002,* ***5.3.3)***

The grading requirements for filler aggregate are specified in BS EN 13139:2002, Table 3. It requires that filler aggregates conform to limits for both:

a) the overall range for individual results; and

NOTE When required by the purchaser, limits for percentage passing are imposed on sieve sizes 2 mm, 0.125 mm and 0.063 mm. These limits control the oversize material percentage.

b) the maximum producer's declared grading range for 90 % of results.

In addition to the overall percentage passing limits for individual results required for filler aggregate passing the 0.125 mm and 0.063 mm sieves, when required by the purchaser the producer is required to declare the typical grading for 90 % of the results. The percentage of grading results on these two sieves should lie within a range of 10 % passing the sieves, e.g. 87 % to 97 % passing a 0.125 mm sieve and 78 % to 88 % passing a 0.063 mm sieve.

3.2.4 ***Particle shape and shell content (BS EN 13139:2002, 5.4)***

It is not usually necessary to specify requirements for particle shape or shell content for fine aggregates and no recommendations are included in this guidance.

Some screed materials include aggregate fractions up to 8 mm. BS EN 13139 does not specify limits for shell content but if specifiers, exceptionally, need to specify shell content for the coarse aggregate 4/8 mm fraction, it is recommended that a maximum limit of 10 % by mass is specified in accordance with BS EN 12620:2002, **4.5** shell content category SC_{10}.

3.2.5 ***Fines (BS EN 13139:2002, 5.5 and Annex C)***

The requirements in BS EN 13139 for fines content are specified in relation to the percentage passing a 0.063 mm sieve, whereas grading requirements specified in BS 1199 and 1200 relate to a 0.075 mm sieve.

BS EN 13139:2002, **5.5.1** specifies several categories for fines content. Categories recommended for use in the UK are given in Annex A for different mortar types.

Certain expansive clays in fine aggregates can cause disruption of mortar mixes and lead to strength reduction, loss of bond and lack of durability. This problem has been experienced in mainland Europe but there has been very little documented history of such a problem in the UK.

There have not previously been any British Standards that require the testing of harmful fines, although requirements in the existing British Standards for aggregates for mortar, BS 1199 and 1200:1976 and BS 8204-1, specify that the aggregate should not contain any such material. In the UK visual assessment has generally been considered adequate for this assessment, together with limiting the fines content.

BS EN 13139:2002, Annex C introduces a new concept of testing for harmful fines, e.g. clay, when it is required by the purchaser that such testing shall be carried out. It specifies four conditions a), b), c) and d) to ensure no harmful fines are present.

Conditions b) and c) of BS EN 13139:2002, Annex C give the option to assess harmful fines content using the sand equivalent or methylene blue tests. These tests are not considered sufficiently precise for the purpose of determining harmful fines content in fine aggregates for mortar in the UK because there has been no agreement on limits for either of the two tests. It is recommended that aggregates and filler aggregates should be assessed for harmful fines using either the fines content limit given in condition a) of BS EN 13139:2002, Annex C or evidence of satisfactory use as given in condition d) of BS EN 13139:2002, Annex C.

3.2.6 *Particle density and water absorption (BS EN 13139:2002, 6.2.1 and 6.2.2)*

When applicable, the results of tests to assess particle density and water absorption are required to be declared. It is required that the clause number of the test method and equation used shall be stated in order to establish the basis of the determination, e.g. apparent, oven-dried, or saturated and surface dried.

3.2.7 *Resistance to freezing and thawing (BS EN 13139:2002, 6.2.3)*

3.2.7.1 *General*

BS EN 13139:2002, **6.2.3** specifies two options for assessing the resistance to freezing and thawing of aggregates used in mortar. The choice of which requirements to follow is dependent on the size of the aggregate.

3.2.7.2 *Aggregate of 4 mm or less and filler aggregates*

BS EN 13139:2002, **6.2.3** specifies that when the resistance to freezing and thawing of aggregates of 4 mm or less and filler aggregates is required in the end use situation, it shall be derived from a freeze-thaw test on the mortar in accordance with the provisions valid at the place of use and the results declared. In the UK there has not been a demand for such a test and it is recommended that no requirement to test for this property is specified by the purchaser.

3.2.7.3 *Aggregate fractions coarser than 4 mm*

Where it is necessary to assess the freeze-thaw resistance of aggregate fractions coarser than 4 mm, BS EN 13139, **6.2.3** requires testing in accordance with either BS EN 1367-1 or BS EN 1367-2. The magnesium sulfate soundness test specified in BS EN 1367-2 is recommended due to the availability of test equipment and experience in the UK. In this test method the 10 mm to 14 mm aggregate fraction from the same aggregate source is tested.

However, neither test method is sufficiently discriminating in the case of microporous flint aggregates. In such cases the only guide is knowledge of the source and experience of mortar made with microporous flint aggregates that have been exposed to freeze-thaw conditions over several years.

In the UK there has not been a previous demand for a test for freeze-thaw resistance and it is recommended for all normal uses that no requirement is specified by the purchaser.

For any cases where high water saturation or exposure to de-icing salts occurs, reference should be made to BS EN 12620 and its UK guidance document, PD 6682-1.

3.3 Chemical requirements (BS EN 13139:2002, Clause 7)

3.3.1 *General*

BS EN 13139 places limits on total sulfur content and constituents which alter the rate of setting and hardening. It gives categories for acid-soluble sulfate content and provides guidance on chloride ion content.

3.3.2 *Water-soluble chloride ion content (BS EN 13139:2002, 7.2)*

BS EN 13139 does not specify any values for water-soluble chloride ion content, it only requires that it should be determined and declared when applicable. However, it does refer the user to the requirements of BS EN 998-2 that specify the maximum permissible chloride content in masonry mortar.
BS EN 13139:2002, **D.1** states that the chloride ion content requirements of BS EN 998-2 are usually achieved when the water-soluble chloride ion content of the aggregates does not exceed 0.15 % for plain mortar and 0.06 % for mortars with embedded metals. Using these limits as a guide should pose no problem for the UK aggregates that are currently in use.

It is only when the mortar is likely to be in contact with metal, e.g. when using brick ties, lintels, reinforcement or lathing supports, that the total chloride content becomes relevant. It is the responsibility of the specifier and the mortar producer to ensure that the chloride content of the mortar, taking account of all constituents, falls within acceptable limits. In order to ensure that chloride content falls within acceptable limits, it is recommended that the aggregate conforms to the limits specified in BS EN 998-2.

NOTE It is unlikely that any problems should arise if the value does not exceed 0.06 % by mass in a fine or filler aggregate.

3.3.3 *Acid-soluble sulfate content (BS EN 13139:2002, 7.3.1)*

BS EN 13139:2002, **7.3.1** acid-soluble sulfate category $AS_{0.2}$ is recommended for natural UK fine and filler aggregates and this is unlikely to cause difficulties for UK aggregates in common use. Category $AS_{1.0}$ is recommended if air-cooled blast-furnace slag is to be used.

3.3.4 *Total sulfur content (BS EN 13139:2002, 7.3.2)*

BS EN 13139 limits the total sulfur content to 1 % by mass for natural aggregates. A limit of 2 % by mass is required if air-cooled blast-furnace slag is used.

For current UK aggregate sources, where the measured value of total sulfur content during initial testing is 0.1 % by mass or less, it should be unnecessary to undertake further testing. In this case the total sulfur content can be assumed to conform to the 1 % limit unless there is a significant change in the quarry deposit.

A warning is given in BS EN 13139:2002, **7.3.2** specifying more restrictive limits on sulfur content if pyrrhotite, an unstable form of iron sulfide (FeS), is present. Pyrrhotite is an unusual constituent of aggregate and there is no experience of it occurring in UK mortar aggregates.

3.3.5 *Constituents which alter the rate of setting and hardening of mortar (BS EN 13139:2002, 7.4)*

Some organic and other substances can affect the setting and hardening of cement and lime based mortars. BS EN 13139:2002, **7.4** requires that where these substances are found in aggregates they are assessed in accordance with BS EN 1744-1. Limits are specified for increases in the stiffening time and decreases in the compressive strength of mortar specimens.

In the UK the significant presence of such substances is likely to be rare and routine testing is not normally necessary.

3.3.6 *Additional requirements for manufactured aggregates (BS EN 13139:2002, 7.5)*

For manufactured aggregates, e.g. air-cooled blast-furnace slag or pulverised fly ash (pfa), BS EN 13139:2002, **7.5** specifies requirements for water-soluble matter content and loss on ignition.

BS EN 13139:2002, **7.5** specifies that the water-soluble matter content is required to not exceed 1 % by mass.

For loss on ignition, BS EN 13139:2002, **7.5** permits an increase in the specified limit for pfa. In the UK the recommended limiting values for loss on ignition are:

a) 3 % by mass for air-cooled blast-furnace slag;

b) 7 % by mass for pfa.

Separate requirements are specified in BS EN 13055-1 for lightweight aggregates.

3.3.7 *Effects of some constituents of aggregates on mortar (BS EN 13139:2002, Annex D)*

Guidance is given in BS EN 13139:2002, Annex D on the effects of chlorides, sulfates, staining and pop-outs, damage to exposed surfaces from impurities, other harmful constituents and alkali-silica aggregate reactions.

3.4 Evaluation of conformity

3.4.1 *General*

BS EN 13139:2002, Clause **8** contains requirements for the evaluation of conformity necessary for producers to demonstrate that their products conform to BS EN 13139. The procedures described here are called up by BS EN 13139:2002, Annex ZA as part of the procedure for attestation of conformity to be used for demonstrating compliance with the requirements of the EU Construction Products Directive [1].

3.4.2 *Initial type tests (BS EN 13139:2002, 8.2)*

Initial type testing is a series of tests carried out on the aggregate, relevant to its intended end use, before it is first placed on the market. This testing is used to identify the categories specified within BS EN 13139 to which the aggregate conforms.

Initial type testing is required for new sources, if there is a major change in raw materials or when the aggregate is to conform to a new requirement for which it has not previously been tested.

Where aggregate users require additional data or properties for particular uses of the aggregate, these should be requested prior to ordering, allowing sufficient time for testing.

3.4.3 *Factory production control (BS EN 13139:2002, 8.3)*

Factory production control is the means by which to define the quality system which producers are required to operate to demonstrate ongoing conformity of their product to the relevant European Standard, in this case BS EN 13139.

4 Provisions of the EU Construction Products Directive

BS EN 13139:2002, Annex ZA addresses the provisions of the EU Construction Products Directive [1]. BS EN 13139:2002 and its Annex ZA have been produced under a Mandate given by the European Commission and the European Free Trade Association to CEN.

Annex ZA is described as "informative" but its requirements become mandatory to ensure compliance with the Mandate and/or where CE marking is applicable to aggregates.

Clauses in BS EN 13139:2002 identified in Table ZA.1a and Table ZA.1b indicate the characteristics that are subject to regulatory requirements for the specified application in one or more European Member States. There is no obligation to determine or declare a value for a particular characteristic in a Member State where there is no regulatory requirement for that characteristic unless it is subject to a "threshold" value.

Conformity to these identified requirements confers a prescription of fitness of the aggregate and filler aggregate for the intended uses indicated in the scope of BS EN 13139. However, to meet the provisions of the EU Construction Products Directive [1] fully, aggregates are also required to conform to any transposed European legislation and national laws relating to any dangerous substances referred to in the clauses of BS EN 13139.

Within the notes in BS EN 13139:2002, Table ZA.1a and Table ZA.1b, reference is made to the type of compliance requirement, for example:

— pass/fail threshold value;

— categories;

— declared value.

BS EN 13139:2002, Annex ZA also details the allowed levels for attestation of conformity as "2+" or "4". The requirements of the two levels are summarized in Table 3.

Table 3 — Levels of attestation of conformity in accordance with the EU Construction Products Directive and referred to in BS EN 13139

Tasks	Conformity attestation EU numbering system	
	2+	4
Tasks for the producer		
Factory production control	Yes	Yes
Further testing of samples taken at a factory according to a prescribed test plan	Yes	No
Initial type testing	Yes	Yes
Tasks for third party notified accreditation body		
Certification of factory production control	Yes	No
Surveillance of factory production control	Yes	No

In the UK, the level of attestation for aggregates for mortar is "4".

For other applications where the specifier or purchaser has particular concerns that the integrity of the aggregate will have a major impact on:

a) safety when in use;

b) other performance properties of an installation (for example screed applications involving the storage of dangerous substances);

the specifier or purchaser should adopt appropriate contract specific quality assurance procedures or acceptance testing regimes to give the required degree of confidence. It is not appropriate to expect higher attestation of conformity requirements, as these are general national requirements related to the demonstration of fitness to be placed on the market for general use and are not readily flexible to meet specific contract needs. However, wherever possible such additional requirements should follow the same basic format as those in BS EN 13139.

BS EN 13139:2002, Annex ZA describes the requirements for CE marking and labelling.

The UK and two other EU Member States do not currently consider that there is a mandatory requirement to CE mark products. Consequently there is no current legal requirement to CE mark aggregates supplied within the UK or to or from Ireland and Sweden. CE marking will be required for aggregates supplied to or within other Member States translated into the language of the Member State supplied.

If producers voluntarily or otherwise decide to CE mark their aggregates, the producers need to strictly comply with the indicated requirements. Where the CE mark identifies a particular characteristic, the supplier is required to indicate the category or declared value appropriate to the aggregate. The user is responsible for confirming that the declaration of properties on the CE mark conforms to their particular requirements.

It should also be noted that, where aggregates are placed on the market in a European Member State where there is no regulatory requirement for a particular characteristic, the supplier is not required to determine the performance for this characteristic. In this case "No performance determined" may be stated in the CE marking information.

Annex A (informative)
Established UK aggregate descriptions and recommended equivalent European designations

Guidance on the description and grading of aggregates that produce suitable mortar products are shown in Table A.1.

Table A.1 — Aggregate descriptions and recommended European designations

Mortar type	British Standard equivalent	Recommended European designation	Additional reference
Masonry	BS 1200, Type S	0/2 (*FP* or *MP*), category 2 fines	Annex C
	BS 1200, Type G	0/2 (*FP* or *MP*), category 3 fines	
Plastering or rendering	BS 1199, Type A	0/2 (*CP* or *MP*), category 2 fines	Annex C
	BS 1199, Type B	0/2 (*FP* or *MP*), category 2 fines	
Levelling screed[a]	BS 882, finer range of Type *C* or coarser range of Type *M*	0/4 (*CP* or *MP*), category 1 fines	Annex C
Levelling screed >50 mm[b]	1:3:1 parts of CEM I 42.5 cement: fine aggregate (*C* or *M*): 10 mm *SS*	0/8 (*CP* or *MP*), category 1 fines	
BS 8204 levelling screed[c d]	BS 8204-1, Table 1	0/4 (*CP* or *MP*), category 1 fines	

NOTE Aggregates for levelling screeds have performed satisfactorily when the percentage passing the 0.5 mm sieve is of the order indicated below for the levelling screed types[a b] and [c] identified in this table:

[a] (20 – 60) %;
[b] ≥ 25 %;
[c] (20 – 66) %.

The European Standard only provides the three following classifications for the percentage passing the 0.5 mm sieve:

CP (5 – 45) %;
MP (30 – 70) %;
FP (55 – 100) %.

Accordingly, users and specifiers need to assess the suitability of the aggregate from the declared typical grading and tolerances of the aggregate.

[d] It should be noted that BS 8204 is a code of practice and therefore only contains recommendations.

Annex B (informative)
Comparison of the grading and fines content of aggregates in BS EN 13139 with established UK practice

B.1 Masonry mortar

Compared to the fine aggregates specified in BS 1199 and 1200, a BS EN 13139 0/2 fine aggregate has fewer coarse particles. Table B.1 compares BS EN 13139 designations with fine aggregates in current use in the UK. It should be noted that a BS EN 13139 0/2 fine aggregate with fines category 4 allows a greater percentage of fines for fine aggregates produced from crushed rock compared with the requirements of BS 1200.

It is recommended that a BS EN 13139 0/2 fine aggregate, covering ranges *FP* or *MP*, with fines category 2 should be considered for use where a BS 1200, Type S sand is currently used. A 0/2 fine aggregate, covering ranges *FP* or *MP*, with fines category 3 should be considered for use where a BS 1200, Type G sand is currently used.

NOTE *FP* and *MP* denote ranges of percentage passing the 0.5 mm sieve as given in BS EN 13139:2002, Annex A.

B.2 Plastering and rendering mortar

Compared to the fine aggregates specified in BS 1199 and 1200, a BS EN 13139 0/2 fine aggregate has fewer coarse particles. Table B.1 compares BS EN 13139 designations with fine aggregates in current use in the UK. It should be noted that a BS EN 13139 0/2 fine aggregate with fines category 4 allows a greater percentage of fines for fine aggregates produced from crushed rock compared with the requirements of BS 1199.

It is recommended that a BS EN 13139 0/2 fine aggregate, covering ranges *CP* or *MP*, with fines category 2 should be considered for use where a BS 1199, Type A sand is currently used. A 0/2 fine aggregate, covering ranges *FP* or *MP*, with fines category 2 should be considered for use where a BS 1199, Type B sand is currently used. It is also possible to use a 0/4 instead of 0/2 fine aggregate with fines category 2 rendering and plastering mortars for both Type A and Type B rendering and plastering mortar sands, with similar recommendations on the limitations on use of ranges *CP*, *MP* and *FP*.

B.3 Levelling screed

Compared to the fine aggregates specified in BS 882, a BS EN 13139 0/4 fine aggregate with fines category 1 has fewer coarser particles. Table B.1 compares BS EN 13139 designations with fine aggregates in current use in the UK. The use of gradings from BS 1199 had already been discarded in the UK in favour of the gradings for C and M of BS 882 shown in Table B.1. However, in practice the coarse end of grade C is too coarse for a levelling screed mortar to be laid "semi-dry". Mixes tend to have poor workability, particularly if the sand has irregular shaped particles. The limits on the percentage passing the 0.5 mm sieve in BS EN 13139 are narrower when compared with the UK limits specified in BS 882. However, in the UK, the limits for Type M sand specified in BS 882 have allowed too much fine material.

Taking account of these issues it is recommended that the nearest grading for UK levelling screeds in BS EN 13139 is a 0/4 fine aggregate with fines category 1 with the range *MP*, which should ideally have a grading between 20 % to 66 % passing a 0.5 mm sieve.

For fine concrete levelling screeds over 50 mm thick, a typical mix with a ratio of 1:3:1 of CEM I 42.5 cement: BS 882 C or M fine aggregate: 10 mm single size BS 882 coarse aggregate, is often used in the UK. There may be some use for a BS EN 13139 0/8 aggregate to achieve this type of mix. For the 0/8 designation, the amount of material greater than 1.4*D* is limited to 0 % to 2 %. Specifiers and users of the 0/8 designation for levelling screeds are recommended to consider the grading they require for this type of mix in terms of limiting the percentage passing two additional sieve sizes, 2.0 mm and 0.5 mm, to no more than 25 %.

BS 8204-1 was revised in 2002 and recommends that the sand for levelling screeds falls within the new grading limits given in BS 8204-1:2002, **5.3.4** and Table 1. The use of gradings C or M of BS 882 is no longer recommended.

The effect of this change in recommendations, compared to that previously recommended, i.e. grading M of BS 882, is given in Table B.1. In practice, it can be seen that the same recommendation is relevant for the nearest BS EN 13139 designation which is a 0/4 fine aggregate of fines category 1 with the range *MP*, having a grading between 20 % to 66 % passing a 0.5 mm sieve.

Table B.1 gives a comparison of BS EN 13139 with established UK grading and fines content limits for fine aggregates used in mortars and levelling screeds.

Table B.1 — Comparison of the grading and fines content limits of aggregates in BS EN 13139 with established UK practice (% passing by mass)

Sieve aperture mm		Masonry mortar			Plastering and rendering mortar			Levelling screeds				
		BS EN 13139 designation	BS 1200		BS EN 13139 designation	BS 1199		BS EN 13139 designation		BS 882		BS 8204-1
European	UK	**0/2**	S	G	**0/2**	A	B	**0/8**	**0/4**	C	M	—
16.00		—	—	—	—	—	—	**100**	—	—	—	—
10.0	10.0	—	—	—	—	—	—	**98 to 100**	—	100	100	100
8.00		—	—	—	—	—	—	**90 to 99 (±5)**	**100**	{96 to 100}	{96 to 100}	{96 to 100}
6.3	6.3	—	100	100	—	100	100	—	**98 to 100**	—	—	—
	5.0	—	98 to 100	98 to 100	—	95 to 100	95 to 100	—	—	89 to 100	89 to 100	90 to 100
4.00		**100**	{96 to 100}	{96 to 100}	**100**	{84 to 100}	{90 to 100}	—	**85 to 99 (±5)**	{80 to 100}	{82 to 100}	{82 to 99}
2.80		**98 to 100**	{92 to 100}	{92 to 100}	**98 to 100**	{68 to 100}	{83 to 100}	—	—	—	—	—
	2.36	—	90 to 100	90 to 100	—	60 to 100	80 to 100	—	—	60 to 100	65 to 100	65 to 97
2.00		**85 to 99 (±5)**	{85 to 100}	{85 to 100}	**85 to 99 (±5)**	{52 to 100}	{78 to 100}	**(±10)**	—	—	—	—
	1.18	—	70 to 100	70 to 100	—	30 to 100	70 to 100	—	—	30 to 90	45 to 100	40 to 90
1.00		**(±20)**	—	—	**(±20)**	—	—	**(±10)**	**(±20)**	—	—	—
	0.6	—	40 to 100	40 to 100	—	15 to 80	55 to 100	—	—	15 to 54	25 to 80	24 to 75
0.5		**30 to 70 (*MP*)**	{31 to 92}	{35 to 97}	**5 to 45 (*CP*)**	{12 to 72}	{42 to 94}	**5 to 45 (*CP*)**	**5 to 45 (*CP*)**	{12 to 50}	{20 to 71}	{20 to 66}
		55 to 100 (*FP*)	{31 to 92}	{35 to 97}	**30 to 70 (*MP*)**	{12 to 72}	{42 to 94}	**30 to 70 (*MP*)**	**30 to 70 (*MP*)**	{12 to 50}	{20 to 71}	{20 to 66}
		—	—	—	**55 to 100 (*FP*)**	{12 to 72}	{42 to 94}	—	—	—	—	—
	0.3	—	5 to 70	20 to 90	—	5 to 50	5 to 75	—	—	5 to 40	5 to 48	8 to 40
0.25		**(±25)**	—	—	**(±25)**	—	—	—	**(±20)**	—	—	—
	0.15	—	0 to 15	0 to 25	—	0 to 15	0 to 20	—	—	0 to 15	0 to 15	0 to 10
	0.075	—	0 to 5 (10)	0 to 8 (12)	—	0 to 5	0 to 5	—	—	0 to 4	0 to 4	0 to 3
0.063		**0 to 5 category 2 (±5)**	{0 to 5 (10)}	{0 to 8 (12)}	**0 to 5 category 2 (±5)**	{0 to 5}	{0 to 5}	**0 to 3 category 1 (±2)**	**0 to 3 category 1 (±3)**	{0 to 3}	{0 to 3}	{0 to 2}
		0 to 8 category 3 (±5)	{0 to 5 (10)}	{0 to 8 (12)}	—	—	—	—	—	—	—	—
		0 to 30 category 4 (±5)	{0 to 5 (10)}	{0 to 8 (12)}	—	—	—	—	—	—	—	—

NOTE 1 *FP*, *MP*, *CP* come from the permitted percentage passing the 0.5 mm sieve as defined in BS EN 13139:2002, Annex A (informative):
F = fine grading, *M* = medium grading, *C* = coarse grading, *P* = % passing 0.5 mm sieve.

NOTE 2 { } = Interpolation of equivalent grading limits from UK specifications.

NOTE 3 ( ) = Required BS EN 13139 tolerances on producer's declared typical gradings.

Annex C (informative)
Example specification

An example specification, which can be applied to most general uses of aggregates in mortar, is given in Table C.1.

NOTE For lime based mortars and other/special materials the requirements in this specification should be reviewed using expert advice.

Table C.1 — BS EN 13139 categories recommended for aggregates in mortars and levelling screeds for general use in the UK

Properties	BS EN 13139 category
Grading[a]	In accordance with the requirements for the specified European designation[b]
Acid-soluble sulfate content:	
Aggregates other than air-cooled blast-furnace slag	$AS_{0.2}$
Air-cooled blast-furnace slag	$AS_{1.0}$
Total sulfur:	
Aggregates other than air-cooled blast-furnace slag	≤ 1 % by mass
Air-cooled blast-furnace slag	≤ 2 % by mass
Water-soluble content:	
Air-cooled blast-furnace slag and pfa (only)	≤ 1 % by mass
Loss on ignition:	
Air-cooled blast-furnace slag (only)	≤ 3 % by mass
pfa (only)	≤ 7 % by mass

[a] When necessary, specifiers may additionally limit the coarseness/fineness of aggregates using the classifications *CP*, *MP* or *FP*, or assess suitability from the producer's declared typical grading and tolerances. See Annex A and Annex B.
[b] Guidance is given in Annex A and Annex B.

Bibliography

Standards publications

BS 882:1992, *Specification for aggregates from natural sources for concrete.*

BS 1199 and 1200:1976, *Specifications for building sands from natural sources.*

BS 8204-1:2002, *Screeds, bases and in-situ floorings — Part 1: Concrete bases and cement sand levelling screeds to receive floorings — Code of Practice.*

BS EN 998-2:2002, *Specification for mortar for masonry — Part 2: Masonry mortar.*

BS EN 1367-1:2000, *Tests for thermal and weathering properties of aggregates — Part 1: Determination of resistance to freezing and thawing.*

BS EN 1367-2:1998, *Tests for thermal and weathering properties of aggregates — Part 2: Magnesium sulfate test.*

BS EN 1744-1:1998, *Tests for chemical properties of aggregates — Part 1: Chemical analysis.*

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

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

BS EN 13055-1:2002, *Lightweight aggregates — Part 1: Lightweight aggregates for concrete, mortar and grout.*

BS EN 13055-2, *Lightweight aggregates — Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications, excluding concrete, mortar and grout.*[2)]

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

BS EN 13242:2002, *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.*

BS EN 13383 (all parts), *Armourstone.*

BS EN 13450:2002, *Aggregates for railway track ballast.*

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ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

Other publications

[1] EUROPEAN COMMUNITIES. 89/106/EEC. Council of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products. Luxembourg: Office for Official Publications of the European Communities (EUR-OP), 1988, www.eur-op.eu.int.

[2)] In preparation.

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