BS EN 16236:2013

BSI Standards Publication

Evaluation of conformity of aggregates — Initial Type Testing and Factory Production Control

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National foreword

This British Standard is the UK implementation of EN 16236:2013.

The UK participation in its preparation was entrusted to Technical Committee B/502, Aggregates.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Evaluation of conformity of aggregates - Initial Type Testing and Factory Production Control

Évaluation de la conformité des granulats - Contrôle de la production en usine

Bestimmung der Konformität von Gesteinskörnungen - Werkseigene Produktionskontrolle

This European Standard was approved by CEN on 5 February 2013.

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Foreword

This document (EN 16236:2013) has been prepared by Technical Committee CEN/TC 154 “Aggregates”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard is one of a series of standards as listed below.

EN 12620, *Aggregates for concrete;*

EN 13043, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas;*

EN 13139, *Aggregates for mortar;*

EN 13242, *Aggregates for unbound and hydraulic bound materials for use in civil engineering work and road construction;*

EN 13383-1, *Armourstone — Part 1: Specification;*

EN 13450, *Aggregates for railway ballast.*

This European Standard replaces Annex H (normative) of EN 12620:2002+A1:2008, Annex B (normative) of EN 13043:2002, Annex E (normative) of EN 13139:2002, Annex C (normative) of EN 13242:2002+A1:2007, Annex D (normative) of EN 13383-1:2002 and Annex I (normative) of EN 13450:2002.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard has been written as the system for the evaluation of conformity of aggregates. It is designed to be used in conjunction with the aggregate product standards: EN 12620, EN 13043, EN 13139, EN 13242, EN 13383-1 and EN 13450 and is called up by these standards. This European Standard and the corresponding product standards have been written under the Construction Products Directive (CPD).

Evaluation of conformity comprises initial type testing (ITT) and factory production control (FPC).

This standard has been compiled from the ITT and FPC clauses, annexes and tables previously found in the aggregate product standards. A new, separate Evaluation of Conformity standard is currently in preparation, which will provide more detailed ITT procedures and clear, detailed requirements for product conformity (e.g. statistical conformity criteria, number of samples, tolerances, time limits of validity etc).

The initial type testing and factory production control procedures are designed to be applied to European Standards for aggregates. When the appropriate "conformity" clauses are applied, it forms part of the system for attestation of conformity as required by the Construction Products Directive. It provides the minimum level of ITT and FPC for CE Marking.

The testing procedures, using the reference test methods, have the function of providing assurance that a particular aggregate product complies with each of the selected specified requirements in the product standard. The type testing procedure is designed to be applied to all harmonised elements of European Harmonised Standards for aggregates. The system can also be extended to non-harmonised elements.

The factory production control system describes control of the sourcing and processing of the aggregate combined with routine sampling and testing to provide ongoing assurance that the aggregates product continues to conform to those properties determined through ITT. Testing within FPC may use either the standard reference tests called up by the aggregate product standards or other test procedures which have been shown to correlate with those tests.

For commercial and/or contractual reasons, the manufacturer can choose to perform more testing and inspection than the minimum specified.

1 Scope

This European Standard specifies both initial type testing and factory production control requirements for use during the evaluation and production of aggregates.

Additional testing carried out within contracts is beyond the scope of this standard.

This European Standard is applicable to European Standards for aggregates if regulatory marking of conformity is to be applied. It is also applicable to European Standards for aggregates where regulatory marking does not apply.

This European Standard is applicable to the control of aggregates within the scope of EN 12620, EN 13043, EN 13242, EN 13139, EN 13383-1 and EN 13450.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 932-1, *Tests for general properties of aggregates — Part 1: Methods for sampling*

EN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration*

EN 13383-2, *Armourstone — Part 2: Test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
initial type tests
complete set of tests or other procedures, determining the performance of samples of aggregates representative of the product type

3.2
factory production control
permanent internal control of production exercised by the manufacturer where all the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures

This documentation of the factory production control system should ensure a common understanding of quality assurance and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked.

4 Evaluation of conformity

4.1 General

The compliance of aggregates within the scope of EN 12620, EN 13043, EN 13242, EN 13139, EN 13383-1 and EN 13450 with the requirements of those standards and with the declared values (including classes) shall be demonstrated by:

- Initial Type Testing;
- factory production control by the manufacturer.

The manufacturer shall always retain overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance.

NOTE The assignment of tasks to the notified body and the manufacturer is shown in Annex ZA, Table ZA.3 of EN 12620:2013, EN 13043:2013, EN 13242:2013, EN 13139:2013, EN 13383-1:2013 and EN 13450:2013.

5 Initial type tests

The aggregates shall be subject to initial type tests relevant to the intended end use to show conformity with the relevant product standard in the following circumstances:

a) a new source of aggregates is to be used;

b) there is a major change in the nature of the raw materials or in the processing conditions that may affect the properties of the aggregates.

All samples used for initial type testing shall be representative of the material in question and shall be taken in accordance with EN 932-1 or in the case of armourstone EN 13383-2. The results of the initial type tests shall be documented as the starting point of the factory production control for that material.

The documentation shall specifically include the identification of any components likely to emit radiation above normal background levels and, any components likely to release polyaromatic hydrocarbons or other dangerous substances. If the content of any of these components exceeds the limits in force according to the provisions valid in the place of use of the aggregate, the results of the initial type tests shall be declared.

6 Factory production control

6.1 General

The manufacturer shall have in place a system of factory production control that complies with the requirements of this clause.

The records held by the manufacturer shall indicate what quality control procedures are in operation during the production of the aggregate.

The performance of the factory production control system shall be assessed according to the principles used in this clause.

NOTE The form of control applied to any aggregate depends upon its intended use and the regulations relating to that use.

6.2 Organisation

6.2.1 Responsibility and authority

The responsibility, authority and the interrelation between all personnel who manage, perform and check work affecting quality shall be defined, including personnel who need organisational freedom and authority to:

a) initiate action to prevent the occurrence of product non-conformity;

b) identify, record and deal with any product quality deviations.

6.2.2 Management representative for factory production control

For every aggregate producing plant, a person with appropriate authority to ensure that the requirements given in this European Standard are implemented and maintained shall be appointed.

NOTE The management representative can be responsible for several production facilities.

6.2.3 Management review

The factory production control system adopted to satisfy the requirements of this European Standard shall be audited and reviewed at appropriate intervals by management to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained.

6.3 Control procedures

6.3.1 FPC manual

The manufacturer shall establish and maintain a factory production control manual setting out the procedures by which the requirements for factory production control are satisfied.

6.3.2 Document and data control

Document and data control shall include those documents and data that are relevant to the requirements of this European Standard covering purchasing, processing, inspection of materials and the factory production control system documents.

A procedure concerning the management of documents and data shall be documented in the production control manual covering procedures and responsibilities for approval, issue, distribution and administration of internal and external documentation and data; and the preparation, issue and recording of changes to documentation.

6.3.3 Sub-contract services

If any part of the operation is sub-contracted by the manufacturer, a means of control shall be established. The manufacturer shall retain overall responsibility for any parts of the operation sub-contracted.

6.3.4 Knowledge of the raw material

There shall be documentation detailing the nature of the raw material, its source and, where appropriate, one or more maps showing the location and extraction plan. Maps are not appropriate for manufactured or recycled aggregates, or for natural aggregate raw materials arising from less closely defined locations, such as marine aggregates.

The manufacturer shall ensure that if any dangerous substances are identified, they do not exceed the limits in force according to the provisions valid in place of use of the aggregate.

NOTE 1 Most of the dangerous substances defined in Council Directive 76/769/EEC are not usually present in most sources of aggregates of mineral origin. However, the attention of the user of this standard is drawn to the contents of Note 2 in ZA.1 of Annex ZA of the product standards. Attention is drawn to the existence of local legislation in the place of use of the aggregate regarding the limits of content of dangerous substances.

In addition, for recycled aggregates, there shall be a documented input control of raw material to be recycled.

The input control procedures for recycling should identify:

— nature of the raw material;

— source and place of origin;

— supplier and transporting agent.

NOTE 2 For recycled aggregates, the processing depot will suffice for the source.

6.3.5 Management of production

The factory production control system shall fulfil the following requirements:

a) there shall be procedures to identify and control the materials;

NOTE 1 These can include procedures for maintaining and adjusting processing equipment, inspection or testing material sampled during processing, modifying the process during bad weather, etc.

b) there shall be procedures to identify and control hazardous materials identified in 6.3.4;

NOTE 2 Attention is drawn to the existence of local legislation in the place of use of the aggregate regarding the limits of content of dangerous substances.

c) there shall be procedures to ensure that material is put into stock in a controlled manner and the storage locations and their contents are identified;

d) there shall be procedures to ensure that material taken from stock has not deteriorated in such a way that its conformity is compromised;

e) the product shall be identifiable up to the point of sale as regards source and type.

6.4 Inspection and tests

6.4.1 General

All the necessary facilities, equipment and trained personnel to perform the required inspections and tests shall be made available.

6.4.2 Equipment

The manufacturer shall be responsible for the control, calibration and maintenance of inspection, measuring and test equipment.

Accuracy and frequency of calibration shall be in accordance with EN 932-5.

Equipment shall be used in accordance with documented procedures.

Equipment shall be uniquely identified.

Calibration records shall be retained.

6.4.3 Frequency and location of inspection, sampling and tests

The production control document shall describe the frequency and nature of inspections. The frequency of sampling and the tests shall be performed for the required relevant characteristics as specified in Tables 1 to 3. All samples used in factory production control shall be representative of the material in question and shall be taken in accordance with EN 932-1 or in the case of armourstone EN 13383-2.

NOTE 1 Test frequencies are generally related to periods of production. A period of production is defined as a full week, month or year of production working days.

NOTE 2 The requirements for factory production control can introduce visual inspection. Any deviations indicated by these inspections can lead to increased test frequencies.

NOTE 3 When the measured value is close to a specified limit, the frequency might need to be increased.

NOTE 4 Under special conditions the test frequencies can be decreased below those given in Tables 1 to 3. These conditions could be:

— highly automated production equipment;

— long-term experience with consistency of special properties;

— sources of high conformity;

— running a Quality Management System with exceptional measures for surveillance and monitoring of the production process.

The manufacturer shall prepare a schedule of test frequencies taking into account the minimum requirements of Tables 1 to 3.

Reasons for decreasing the test frequencies shall be stated in the factory production control document.

6.5 Records

The results of factory production control shall be recorded including sampling locations, dates and times and product tested.

NOTE 1 Some characteristics can be shared by several products, in which case the manufacturer, based on his experience, could find it possible to apply the results of one test to more than one product. This is particularly the case when a product is the combination of two or more different sizes. The particle size distribution or the cleanliness should be checked in case the intrinsic characteristics might have changed.

Where the product inspected or tested does not conform to the relevant requirement specified in the product standard, a note shall be made in the records of the steps taken to deal with the situation.

NOTE 2 Such a note could report carrying out of a new test and/or putting measures in place to correct the production process.

Please note the possible existence of local legislation regarding the length of time that such records are kept. “Statutory period” is the period of time records are required to be kept in accordance with regulations applying at the place of production.

6.6 Control of non-conforming product

Following an inspection or test that indicates that a product does not conform to a relevant requirement, the affected material shall be:

a) reprocessed; or

b) diverted to another application for which it is suitable; or

c) rejected and marked as non-conforming.

All cases of non-conformity shall be recorded by the manufacturer, investigated and if necessary corrective action shall be taken.

NOTE Corrective actions can include:

1) investigation of the cause of non-conformity including an examination of the testing procedure and making any necessary adjustments;

2) analysis of processes, operations, quality records, service reports and customer complaints to detect and eliminate potential causes of non-conformity;

3) initiating preventive actions to deal with problems to a level corresponding to the risks encountered;

4) applying controls to ensure that effective corrective actions are taken;

5) implementing and recording changes in procedures resulting from corrective action.

6.7 Handling, storage and conditioning in production areas

The manufacturer shall make the necessary arrangements to maintain the quality of the product during handling and storage.

These arrangements should take account of the following:

a) contamination of product;

b) segregation;

c) cleanliness of handling equipment and stocking areas.

6.8 Transport and packaging

6.8.1 Transport

The manufacturer's factory production control system shall identify the extent of his responsibility in relation to delivery.

NOTE When aggregates are transported in bulk, it might be necessary to cover or contain aggregates to reduce contamination.

6.8.2 Packaging

If aggregates are packaged, the methods and materials used shall not contaminate or degrade the aggregate to the extent that the properties are significantly changed before the aggregate is removed from the packaging. Any precautions necessary to achieve this during handling and storage of the packaged aggregate shall be marked on the packaging or accompanying documents.

6.9 Training of personnel

Procedures for the training of all personnel involved in the factory production system shall be established and maintained. Appropriate records of training shall be maintained.

Table 1 — Minimum test frequencies (FPC) for EN 12620, EN 13043, EN 13139, EN 13242 *(1 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency
Geometrical requirements									
1	Grading		1 per week		1 per week		1 per week		1 per week
2	Fines content		1 per week		1 per week		1 per week		1 per week
3	Fines quality	Only when the fines content of fine aggregate, or all-in aggregate 0/*D* with $D \leq 8$ mm, exceeds the value specified	1 per week	Only when the fines content of fine aggregate, or all-in aggregate 0/*D* with $D \leq 8$ mm, exceeds the value specified	2 per year	Only when the fines content of fine aggregate, or all-in aggregate 0/*D* with $D \leq 8$ mm, exceeds the value specified	1 per week	Only when the fines content of fine aggregate, or all-in aggregate 0/*D* with $D \leq 8$ mm, exceeds the value specified	1 per week
4	Shape of coarse and all-in aggregate	Test frequency applies to crushed or broken aggregate. Test frequency for rounded gravel depends on the source and may be reduced	1 per month	Test frequency applies to crushed or broken aggregate. Test frequency for rounded gravel depends on the source and may be reduced	1 per month			Test frequency applies to crushed or broken aggregate. Test frequency for rounded gravel depends on the source and may be reduced	1 per month
5	Shell content	Coarse and all-in aggregate of marine origin	1 per year				1 per year		

Table 1 — *(2 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	**Minimum test frequency**	**Notes**	**Minimum test frequency**	**Notes**	**Minimum test frequency**	**Notes**	**Minimum test frequency**
6	Percentage of crushed or broken and totally rounded particles			For gravel only	1 per month			For gravel only	1 per month
7	Angularity of fine aggregate				1 per month				
8	Harmful fines			For filler aggregates only	2 per year				
Physical requirements									
9	Resistance to fragmentation	For high strength concrete	2 per year		1 per year				2 per year
10	Resistance to wear		1 per year		1 per year				2 per year
11	Particle density and water absorption		1 per year		1 per year	When required			1 per year
12	Particle density of filler aggregate				1 per year				
13	Bulk density	When required						When required	
14	Water suction height							When required	

Table 1 — *(3 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	**Minimum test frequency**	**Notes**	**Minimum test frequency**	**Notes**	**Minimum test frequency**	**Notes**	**Minimum test frequency**
15	Resistance to polishing for surface courses (PSV)	For surface courses only	1 per year	For surface courses only	1 per year				
16	Resistance to surface abrasion (AAV)	For surface courses only	1 per year	For surface courses only	1 per year				
17	Resistance to abrasion from studded tyres to be used for surface areas	For surface courses only in regions where studded tyres are used	1 per year	For surface courses only in regions where studded tyres are used	1 per year				
18	Affinity to bituminous binders				1 per year				
19	Water content			For filler aggregate only	2 per week				
20	Stiffening properties			Voids of dry compacted filler (Rigden)	2 per year				
				Delta ring and ball	2 per year				
21	Consistency of filler production			For filler aggregate only	1 per week				
Chemical requirements									
22	Petrographic description		1 per 3 years		1 per 3 years		1 per 3 years		1 per 3 years

Table 1 — *(4 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency
23	Dicalcium silicate disintegration of air-cooled blast furnace slag		2 per year		2 per year				2 per year
24	Iron disintegration of air-cooled blast furnace slag		2 per year		2 per year				2 per year
25	Volume stability of steel slag				2 per year				2 per year
26	Drying shrinkage		1 per 5 years						
27	Chloride content: — non marine aggregate		1 per 2 years				1 per 2 years		
	— for marine aggregate		1 per week				1 per week		
28	Sulfur containing compounds	For air cooled blast furnace slag only	2 per year				1 per year and in case of doubt		
		Aggregates others than air cooled blast furnace slag	1 per year						

Table 1 — *(5 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency
29	Organic substances/ Constituents which alter the rate of setting and hardening — humus content /sodium hydroxide test		1 per year			In case of doubt	1 per week		1 per year
	— fulvo acid	When indicated humus content is high	1 per year			In case of doubt	1 per week	When sodium hydroxide test fails	1 per year
	— comparative strength test - stiffening time		1 per year			When required	1 per week		1 per year
	— lightweight organic contaminators		2 per year	Aggregate $D > 2$ mm in case of doubt	1 per year				
30	Carbonate content	For fine and all-in aggregate for concrete surfaces	1 per year	For filler aggregate only	1 per year				
31	Calcium carbonate content			For limestone filler only	1 per year				
32	Calcium hydroxide content			For mixed filler only	1 per year				
33	Water solubility			For filler only	1 per 2 years				

Table 1 — *(6 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency
34	Water susceptibility			For filler aggregate only	1 per 2 years				
35	Loss on ignition			For coal fly ash only	1 per 2 years	For pulverized fly ash and air cooled blast furnace slag only	1 per week		
36	Dangerous substances[a], in particular: — emission of radioactivity — release of heavy metals — release of poly polyaromatic hydrocarbons	See Note							

a Unless otherwise specified, only when necessary for CE marking purposes (see Annex ZA of EN 12620:2013, EN 13043:2013, EN 13139:2013, EN 13242:2013).

NOTE See National requirements.

Table 1 — *(7 of 7)*

Property		EN 12620		EN 13043		EN 13139		EN 13242	
		Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency	Notes	Minimum test frequency
Durability									
37	Magnesium sulfate soundness		1 per 2 years		1 per 2 years	When required	1 per 2 years		1 per 2 years
38	Water absorption as a screening test for freeze-thaw resistance				1 per 2 years	In case of doubt	1 per 2 years		
39	Resistance to freezing and thawing		1 per 2 years		1 per 2 years	In case of doubt	1 per 2 years		1 per 2 years
40	Resistance to freezing and thawing in the presence of salt (extreme conditions)		1 per 2 years		1 per 2 years				1 per 2 years
41	“Sonnenbrand” of basalt			In case of doubt where signs of “Sonnenbrand” are known	2 per year			In case of doubt where signs of "Sonnenbrand" are known	2 per year
42	Resistance to thermal shock				1 per year				
43	Alkali-silica reactivity		See Note				See Note		

NOTE See National requirements.

Table 2 – Supplementary minimum test frequencies (FPC) for recycled aggregates

Property		Minimum test frequencies	Minimum test frequencies
		Level 1	Level 2
1	Particle density and water absorption for EN 12620, particle density only for EN 13242	1 per week	1 per month
2	Acid soluble chloride content for EN 12620 and EN 13139	2 per month	2 per year
3	Influence on initial setting time of cement for EN 12620	4 per year	2 per year
4	Constituents of coarse recycled aggregates for EN 12620 and EN 13242	2 per month	1 per month
5	Water soluble sulfate for EN 12620 and EN 13242	1 per week	1 per month
6	Sulfur containing compounds for EN 12620	2 per year	2 per year

NOTE Table 2 allows a selection of 2 levels of minimum test frequencies depending on the end use application.

Table 3 — Minimum test frequencies (FPC) for EN 13383-1, EN 13450 *(1 of 3)*

Property		EN 13383-1		EN 13450	
		Notes	Minimum test frequency	Notes	Minimum test frequency
Geometrical requirements					
1	Particle size distribution	Coarse gradings	1 per 20 000 t and immediately after a production break of at least 6 months		
2	Mass distribution	Light mass gradings Heavy mass gradings	1 per 20 000 t and immediately after a production break of at least 6 months		
3	Grading				1 per week
4	Content of fine particles				1 per week
5	Fines content				1 per week
6	Shape	Length to thickness ratio	1 per 20 000 t and immediately after a production break of at least 6 months		1 per month
7	Particle length				1 per month
8	Percentage of crushed or broken and totally rounded particles	Only for armourstone used in structures, in which rounded pieces could lead to instability	1 per 20 000 t		
Physical requirements					
9	Resistance to breakage	Compressive strength test	1 per 5 years		
10	Resistance to fragmentation			Los Angeles test	2 per year
11	Resistance to impact				2 per year

Table 3 — *(2 of 3)*

	Property	EN 13383-1		EN 13450	
		Notes	**Minimum test frequency**	**Notes**	**Minimum test frequency**
12	Resistance to wear	Only for armourstone for a top layer, which is known to be subject to abrasion by sediment	1 per 2 years		2 per year
13	Particle density and water absorption		1 per year		2 per year
Chemical requirements					
14	Petrographic description	Durability	1 per 5 years		
15	Dicalcium silicate disintegration	For air-cooled blast furnace slag only	2 per year		
16	Iron disintegration	For air-cooled blast furnace slag only	2 per year		
17	Volume stability	Disintegration of steel slag	2 per year		
18	Impurities	Visual	Each batch		
19	Dangerous substances[a], in particular: — emission of radioactivity — release of heavy metals — release of polyaromatic hydrocarbons		See Note		See Note

a Unless otherwise specified, only when necessary for CE marking purposes (see Annex ZA).

NOTE See National requirements

Table 3 — *(3 of 3)*

Property		EN 13383-1		EN 13450	
		Notes	Minimum test frequency	Notes	Minimum test frequency
Durability					
20	Magnesium sulfate soundness	Resistance to salt crystallisation	1 per 2 years		2 per year
21	Resistance to freezing and thawing		1 per 2 years		2 per year
22	Resistance to freezing and thawing in extreme conditions	When required			
23	“Sonnenbrand” of basalt	In case of doubt where signs of “Sonnenbrand” are known	2 per year		2 per year

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