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Calcium silicate masonry units — Specification

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 527 was prepared by Technical Committee RSB/TC 9, *Civil engineering and building materials*.

In the preparation of this standard, reference was made to the following standard:

BS EN 771-2:2011+A1:2015 *Specification for masonry units Part 2: Calcium silicate masonry units*

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on *Civil engineering and building materials* (RSB/TC 9) in the preparation of this standard.

ASTRIK International

CAMOSAG Ltd

Cleaner Production and Climate Innovation Centre (CPCIC)

Consulting Engineering Group (CEG Ltd)

HOSHAN LTD

Independent Experts

NPD Ltd

Rwanda Housing Authority (RHA)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

Rwanda Transport development Agency (RTDA)

University of Rwanda – College of Science and Technology (UR-CST)

Rwanda Standards Board (RSB) – Secretariat

Calcium silicate masonry units — Specification

1 Scope

This Draft Rwanda Standard specifies the characteristics and performance requirements of calcium silicate masonry units for which the main intended uses are inner walls, outer walls, cellars, foundations and external chimney masonry.

It defines the performance related to strength, density and dimensional accuracy, measured according to the corresponding test methods contained in separate Standards.

It provides for the assessment and verification of constancy of performance (AVCP) of the product to this Standard. The marking requirement for products covered by this document is also included.

This Standard applies to all calcium silicate masonry units, including those of an overall nonrectangular parallelepiped shape, specially shaped and accessory units.

This Standard does not specify standard sizes for calcium silicate masonry units, nor standard work dimensions and angles of specially shaped and accessory units. It does not cover units with more than 60 % volume of voids, nor products made from shale as a major raw material. It does not cover storey height panels.

It does not apply to units intended for use as a damp-proof course, nor units with an incorporated thermal insulation material bonded to the faces of the unit susceptible to be exposed to fire, nor chimney flue units.

2 Normative references

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

RS ISO 12572, *Hygrothermal performance of building materials and products — Determination of water vapour transmission properties*

RS 524, Masonry *units test methods — Determination of thermal properties*

RS 536, *Masonry units test methods — Determination of dimensions*

RS 537, *Masonry units test methods — Determination of compressive strength*

RS 538, Masonry units test methods — Determination of initial shear strength

RS 547, *Fire classification of construction products and building elements — Classification using data from reaction to fire tests*

3 Terms and definitions

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

3.1

masonry unit

preformed component intended for use in masonry construction

3.2

calcium silicate masonry unit

masonry unit made predominantly from lime and siliceous materials, hardened by high-pressure steam

3.3

shale

fine-grained sedimentary rock, finely laminated and consisting mainly of quartz and clay minerals

3.4

co-ordinating size

size of the coordinating space allocated to a masonry unit, including allowances for joints and tolerances

3.5

work size

size of a masonry unit specified for its manufacture, to which the actual size conforms within permissible deviations

3.6

actual size

size of a masonry unit as measured

3.7

regular-shaped masonry unit

masonry unit with an overall rectangular parallelepiped shape

3.8

specially shaped masonry unit

masonry unit, which is not a rectangular parallelepiped

3.9

accessory unit

masonry unit which is shaped to provide a particular function, e.g., to complete the geometry of the masonry

Note 1 to entry: It may be obtained by cutting a large unit. 3.10 interlocking feature shaped matched projections and indentations on masonry units, masonry unit made predominantly from lime and siliceous materials, hardened by high-pressure steam

3.10

interlocking feature

shaped matched projections and indentations on masonry units

3.11

hole

formed void which may or may not pass completely through a masonry unit

3.12

perforation

formed void which passes completely through a masonry unit

3.13

cell

formed void which does not pass through a masonry unit

3.14

frog

depression formed in one or both bed faces of a unit, the total volume of all such depressions which does not

exceed a certain limit of the overall volume of the unit, i.e. length × width × height

3.15

recess

depression or indentation in one or more surfaces of a masonry unit

EXAMPLE Mortar pocket, rendering keyway.

3.16

shell

peripheral material between the hole(s) and the outer surfaces of a masonry unit

3.17

web

solid material between the holes in a masonry unit

3.18

normalized compressive strength of masonry units

compressive strength of masonry units converted to the air-dry compressive strength of an equivalent 100 mm wide and 100 mm high masonry unit

Note 1 to entry: See procedure given in RS 537.

3.19

mean compressive strength of masonry units

arithmetic mean of the compressive strengths of masonry units

3.20

characteristic compressive strength of masonry units

compressive strength corresponding to the 5 % fractile of the compressive strength of masonry units

3.21

declared value

value that a manufacturer is confident of achieving, bearing in mind the precision of the test and the variability of the manufacturing process

3.22

Category I masonry units

units with a declared compressive strength with a probability of failure to reach it not exceeding 5 %

3.23

Category II masonry units

units not intended to comply with the level of confidence of Category I units

3.24

combined thickness of webs and shells

sum of the thicknesses of the shells and webs from one face or header of a masonry unit to the opposite face or header respectively along whichever path, via the formed voids, gives the smallest value, expressed as a percentage of the unit width or length respectively

3.25

grip hole

hole in a masonry unit to enable it to be more readily grasped and lifted by hand or machine

3.26

product group

products from one manufacturer having common values for one or more characteristics

3.27

consignment

shipment from the supplier

3.28

protected masonry

masonry (walls, columns or partitions) which is protected against water penetration and is not in contact with soil and ground water

Note 1 to entry: It can either be masonry in external walls which is protected, (e.g. by a layer of suitable render or by cladding), or it can be the inner leaf of a cavity wall or it can be an internal wall. It may or may not be loadbearing.

3.29

unprotected masonry

masonry (walls, columns or partitions) which may be exposed to rain, freeze/thaw and/or may be in contact with soil and ground water without a suitable protection

Note 1 to entry: It can either be masonry in external walls which is fully unprotected, or which is intended to be provided by a limited protection (e.g. by a thin layer of render). It may or may not be loadbearing.

Note 2 to entry: This may be determined via the mean or characteristic value.

4 Materials and manufacture

Calcium silicate masonry units are produced predominantly from a mixture of lime and natural siliceous materials (sand, crushed or uncrushed siliceous gravel or rock or a mixture thereof), hardened by high pressure steam. Calcium silicate masonry units produced with a majority of other siliceous materials are permitted if these materials have no deleterious effect on the properties of the product. The presence of such a material shall be declared.

5 Requirements for calcium silicate masonry units

5.1 General

The requirements and properties specified in this Standard shall be defined in terms of the test methods and other procedures referred to in this Standard.

It should be noted that the test methods are not always applicable to specially shaped and accessory units as defined in 3.8. and 3.9.

The conformity criteria given in the following subclauses relate to product type determination" (see 8.2) and, when relevant, to consignment testing (see Annex A). For the compressive strength of Category I units, use a 50 % fractile (p = 0,50) for mean values and a confidence level of 95 %.

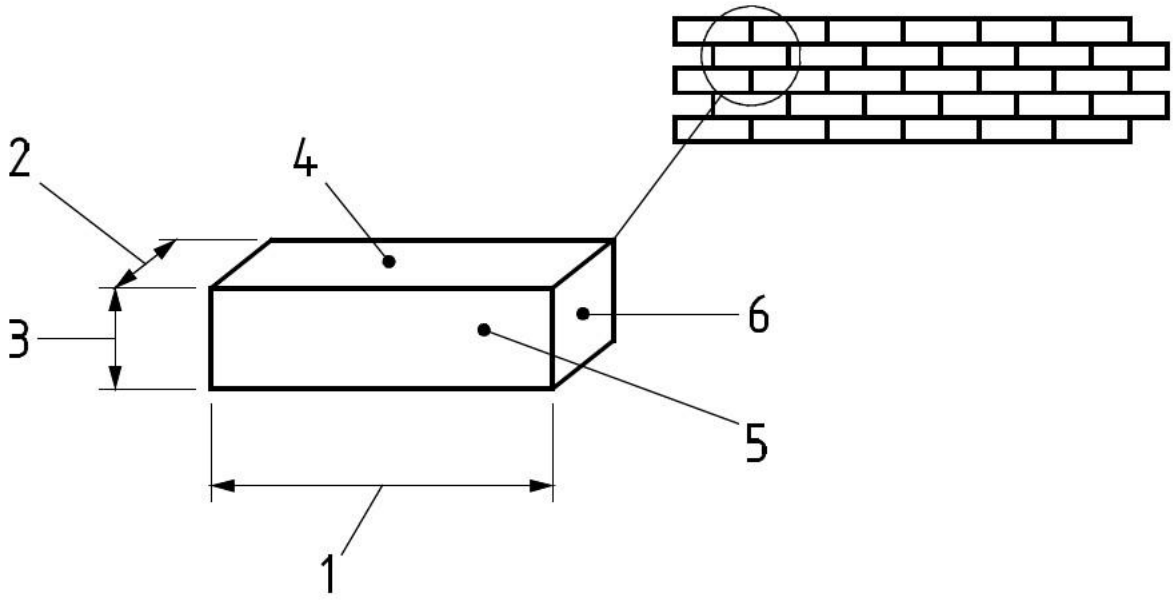
For production evaluation, the manufacturer shall define the conformity criteria in the factory production control documentation (see 8.3).

5.2 Dimensions and tolerances

5.2.1 Dimensions

The dimensions of a calcium silicate masonry unit shall be declared in mm for length, width and height, in that order. They shall be given in terms of work size.

NOTE In addition the co-ordinating size may be given. See Figure 1.



Key

1 Length 2 Width 5 Face

3 Height 4 Bed 6 Header

NOTE This relates to the normal use of the masonry unit in the wall.

Figure 1 — Dimensions and surfaces

When a specified number of calcium silicate masonry units is sampled from a consignment in accordance with Annex A and tested in accordance with RS 536, the tolerances shall be indicated as in 5.2.2.1. The determination of length, width and height shall be by one measurement taken approximately in the centre of each specimen. When there is a need to exclude irregular surfaces (tongues and grooves, grip holes, etc.) in providing the dimension, RS 536 shall be used.

Dimensions and tolerances of accessory units need only be declared by the manufacturer, if the accessory units are placed on the market as individual products and do not form part of a customised consignment. When a specified number of accessory units is sampled from a consignment in accordance with Annex A, dimensions and tolerances shall be as given in Annex C.

5.2.2 Dimensional tolerances

5.2.2.1 Tolerances

The dimensional tolerance category shall be declared in accordance with Table 1. The actual deviations for the mean length, width and height and the actual deviations for individual length, width and height shall not be greater than the permissible deviations as specified in Table 1 for the declared dimensional tolerance category.

Actual deviations for the mean are differences between declared work sizes and the mean measured values. Actual deviations for individual values are differences between the mean measured values and the measured individual values.

These dimensional tolerances shall not apply to the direction perpendicular to a treated face of a sliced, fractured or structured unit.

Table 1 — Dimensional tolerance categories and tolerances for calcium silicate masonry units (in millimetres)

Dimensions	**Dimensional tolerance categories for calcium silicate masonry units**			
	T1	T2	T3	Tm
Mean height of sample	work size height ± 2	work size height ± 1	—	a deviation in mm declared by the manufacturer (may be closer or wider than the other categories)"
Mean length of sample	work size length ± 2	work size length ± 2	work size length ± 2	
Mean width of sample	work size width ± 2	work size width ± 2	work size width ± 2	
Individual height	mean height of sample ± 2	mean height of sample ± 1,0	work size height ± 1,0	
Individual length	mean length of sample ± 2	mean length of sample ± 2	work size length ± 3	
Individual width	mean width of sample ± 2	mean width of sample ± 2	work size width ± 3	
Flatness of bed faces	—	—	1,0	
Plane parallelism of bed faces	—	—	1,0	

5.2.2.2 Flatness of bed faces

When calcium silicate masonry units are sampled from a consignment in accordance with Annex A and tested in accordance with relevant applicable standard, the deviation from flatness of the bed faces shall not exceed the declared value.

5.2.2.3 Plane parallelism of bed faces

When calcium silicate masonry units are sampled from a consignment in accordance with Annex A and tested in accordance with RS 536, the deviation from plane parallelism shall not exceed the declared value.

5.3 Configuration

When relevant to the uses, for which calcium silicate masonry units are put on the market, the configuration shall be declared. The declaration may be made by reference to one or another of the groups defined in relevant design standards and/or it may include one or more items such as those in the following list, as relevant:

— shape and features, including the direction of perforations (by means of a drawing or illustration, whenrelevant);

— volume of all formed voids as a percentage of the length × width × height of the unit;

— volume of the largest of any formed voids as a percentage of the length × width × height of the unit;

— volume of grip holes as a percentage of the length × width × height of the unit;

— thickness of webs;

— thickness of shells;

— combined thickness of webs and shells from face to face;

— combined thickness of webs and shells from header to header;

— area of voids on a bed face as a percentage of the length × width of the unit.

The total volume of frogs shall not exceed 20 % of the overall volume of the unit, i.e. length × width × height. Each declared value shall be stated as either an upper limit or a lower limit or as a range of values.

5.4 Dry density

5.4.1 Gross dry density

The manufacturer shall declare a minimum and a maximum value for the gross dry density. The manufacturer may declare the gross dry density class according to D.2.

The mean gross density shall comply with this declared values or declared density class. Individual values of the sample shall not be out of the declared range of the declared values or the corresponding range of the declared density class by more than 100 kg/m3 for units with a declared gross dry density greater than 900 kg/m3 or by more than 50 kg/m3 for units with a declared gross dry density less than or equal to 900 kg/m^3.

5.4.2 Net dry density

If necessary for the intended use the manufacturer shall declare a minimum and a maximum value for the net dry density. When a specified number of calcium silicate masonry units is sampled from a consignment in accordance with Annex A and tested the mean net dry density shall comply with this declared values.

In addition, the manufacturer may declare the minimum and maximum individual values of net dry density.

5.5 Compressive strength

The mean compressive strength and the normalised compressive strength shall be declared by the manufacturer, e.g. by reference to a class according to D.1.

In addition, the manufacturer shall declare whether the calcium silicate masonry unit is Category I or Category II.

NOTE The declaration shall indicate the orientation(s) of the calcium silicate masonry units and the type of specimen (whole unit or cut prism) as tested, the method(s) of bedding the calcium silicate masonry units and whether voids present are intended to be fully filled with mortar. The declared value shall be not less than 5 N/mm^2.

When a specified number of calcium silicate masonry units is sampled from a consignment in accordance with Annex A and tested in accordance with RS 537, the mean normalised compressive strength shall not be less than the declared value.

When a strength class is declared, the mean normalised compressive strength shall be not less than the value for the strength class declared. Individual values of compressive strength as determined in accordance with RS 537 shall be not less than 80 % of the declared value.

For calcium silicate masonry units with lengths ≥ 500 mm and/or heights ≥ 300 mm representative portions may be cut for determination of compressive strength as specified in Annex B. In all other cases, whole calcium silicate masonry units shall be tested.

The mean value of the compressive strength of three pieces cut according to Annex B from any calcium silicate masonry unit in a sample shall be not less than 90 % of the declared value.

5.6 Thermal properties

When relevant to the uses for which the units are placed on the market and in all cases for masonry units intended to be used in elements subject to thermal insulation requirements, the manufacturer shall provide the mean λ10, dry,unit-value and the determination model as prescribed in RS 524 or alternatively give the gross dry density or net dry density and configuration.

Additionally, another fractile may be provided. In such cases both the additional fractile and the corresponding λ10, dry,unit-value shall be given.

When the calcium silicate masonry units are sampled in accordance with Annex A and tested in accordance with RS 524 following the model provided, then the obtained λ-value of the specified number of calcium silicate masonry units shall be not greater than the provided λ-value.

When relevant to the use for which the units are placed on the market, the value of specific heat capacity given in RS 524 may be provided.

5.7 Durability

For calcium silicate masonry units intended to be used where there is a risk of freezing and thawing while in a wet condition, the manufacturer shall declare the freeze/thaw resistance category according to Table 2."

Table 2 — Freeze/thaw categories for calcium silicate masonry units

Criteria	F1	F2
Freeze/thaw cycles N	≥ 25	≥ 50
Significant visual damages	none	none
Reduction of compressive strength Rc	≤ 20 %	≤ 20 %

When a specified number of calcium silicate masonry units is sampled from a consignment in accordance with Annex A and tested in accordance with applicable standard, the freeze/thaw resistance shall be confirmed.

For calcium silicate masonry units with lengths ≥ 500 mm and/or heights ≥ 300 mm representative portions shall be cut for determination of freeze/thaw resistance as specified in Annex B. In all other cases whole calcium silicate masonry units shall be tested.

5.8 Water vapour permeability

When relevant to the uses for which the calcium silicate masonry unit is placed on the market, the manufacturer shall provide information on the water vapour permeability through the water vapour diffusion coefficient tabulated values given in RS 524 or determined in accordance with RS ISO 12572.

5.9 Reaction to fire

For units intended to be used in elements subject to fire requirements, the manufacturer shall declare the reaction to fire classification of the masonry unit.

For masonry units containing ≤ 1,0 % by mass or volume (whichever is the most onerous) of homogeneouslydistributed organic materials the declaration may be fire Class A1 without the need to test.

Masonry units containing > 1,0 % by mass or volume (whichever is the most onerous) of homogeneously distributed organic materials shall be classified in accordance with RS 547 and the appropriate reaction tofire class declared.

NOTE Attention is drawn to the Commission Decision 96/603/EC, as amended by Commission Decision 2000/605/EC, in which non-combustible masonry units containing not more than 1,0 % (by mass or volume whichever is more onerous) of homogeneously distributed organic materials are classified as reaction to fire Class A1 without testing.

5.10 Water absorption

When relevant to the uses for which the calcium silicate masonry units are placed on the market, the manufacturer shall declare the water absorption of the masonry units. When sampled in accordance with Annex A and tested in accordance with applicable standard, the mean value of the water absorption shall not be greater than the declared water absorption.

5.11 Moisture movement

When required, moisture movement shall be declared by reference to national provisions in place of the use of the product.

5.12 Bond strength

5.12.1 General

For calcium silicate masonry units intended to be used in elements subjected to structural requirements the bond strength of the unit in combination with mortar shall be declared in terms of the characteristic initial shear strength in accordance with RS 538. The declaration may be made either on the basis of fixed values as in 5.12.2 or tests as in 5.12.3. The manufacturer shall declare whether the value of bond strength has been obtained from the fixed values or from test.

NOTE In most cases it is expected that the use of fixed values will be sufficient.

5.12.2 Declaration based on fixed values

When no declaration is made under 5.12.3, the characteristic initial shear strength of the unit in combination with mortar may be declared by reference to the applicable standard.

5.12.3 Declaration based on tests

The characteristic initial shear strength of the unit in combination with one or more specific mortars in accordance with the relevant applicable standard may be declared based on tests on masonry units sampled from a consignment in accordance with Annex A and tested in accordance with RS 538. The characteristic initial shear strength shall not be less than the declared value.

NOTE Bond strength depends on the mortar, the masonry unit and the workmanship. !

5.13 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets. In the absence of harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

6 Description, designation, designation code and classification of calcium silicate masonry units

6.1 Description and designation

The description and designation of a calcium silicate masonry unit shall comprise at least the following:

a) number and date of issue of this Standard;

b) work size dimensions (see 5.2.1); for non-rectangular units the slanting angle may be declared;

c) dimensional tolerance category (see 5.2.2);

d) compressive strength (see 5.5);

e) gross dry density (see 5.4.1);

f) configuration (see 5.3).

When relevant to the uses for which the unit is put on the market the description and designation shall include:

g) net dry density (see 5.4.2);

h) volume of voids intended to be fully filled with mortar, in mm3 (if applicable);

i) thermal properties (see 5.6);

j) durability (see 5.7);

k) water absorption (see 5.10).

6.2 Designation codes

A designation code may be used as part of the designation as shown in Table 3.

Table 3 — Definition of the designation code

Clause in the standard	Characteristic	Position in the designation code	Unit	Code

	unit type	1	–	CS
	intended use	2	–	P or U P: intended to be used for protected masonry U: intended to be used for unprotected masonry
3.22 Category I masonry units 3.22 Category II masonry units	category	3	–	I or II
5.5 Compressive strength	mean compressive strength[a]	4	N/mm^2	**,*/**,* or **,*p**,*
	type of specimen (/ = whole unit or p = cut prism)		–	
	normalized compressive strengtha		N/mm^2	
5.4.1 Gross dry density	min. and max. gross dry density (given as range)	5	kg/m3	xxxx − yyyy
5.2.1 Dimensions	l × w × t	6	mm	llll × www × ttt
5.2.2 Dimensional tolerances	dimensional tolerance category	no fixed position	–	T1, T2 or T3b

Clause in the standard	**Characteristic**	**Position in the designation code**	**Unit**	**Code**
5.3 Configuration	illustration or groupc	no fixed position	–	G1, G1S or G2
5.7 Durability	freeze/thaw category	no fixed position	–	F1 or F2
5.9 Reaction to fire	class	no fixed position	–	A1
5.12 Bond strength	initial shear strength for general purpose (GPM) and/or thin layer mortar (TLM)	no fixed position	N/mm2 or "-"	B**,*/- (GPM only), B-/**,* (TLM only) or B**,*/**,* (both)
5.10 Water absorption	Ws	no fixed position	%	W**
5.8 Water vapour permeability	water vapour diffusion coefficient	no fixed position	–	V*/**
5.6 Thermal properties	thermal conductivity λ10,dry,unit	no fixed position	W/mK	Lx,xx

a by default the direction of load is perpendicular to bed faces, for other directions the designation code is not applicable

b designation code is not applicable in case of category Tm

c by reference to relevant design standards

The characteristics shall be given in the given order (fixed positions) except for those characteristics with no fixed position. “NPD” is expressed by omitting the respective characteristic.

NOTE 1 NPD means ‘No Performance Determined.

NOTE 2 A designation code for a calcium silicate masonry unit (CS) where the following characteristics are declared:

Intended use:	P
Category	I
Mean compressive strength	25,0 N/mm2
Type of specimen cut prism	
Normalized compressive strength	20,0 N/mm2
Gross dry density range	2010 kg/m3 – 2200 kg/m3
Dimensions (length × width × height)	998 mm × 175 mm × 623 mm
Dimensional tolerance category	T3
Unit Group	G1
Reaction to fire	A1

6.3 Classification

Specification of the properties of calcium silicate masonry units may be given by reference to classification systems included in this standard.

This does not remove the requirement that all manufacturers claiming compliance with this standard shall state declared values of the properties of their products, when required.

7 Marking

The following particulars shall be clearly marked on one of the following: the units, the packaging, the delivery note or any certificate supplied with the calcium silicate masonry units:

a) name, trademark or other means of identification of the manufacturer;

b) means of identifying the calcium silicate masonry units and relating them to their description and designation.

8 Assessment and verification of constancy of performance (AVCP)

8.1 General

The manufacturer shall demonstrate compliance for his product with the requirements of this Standard and with the declared performance" for the product properties by carrying out both:

— product type determination" (see 8.2), which can be physical testing, calculation, reference to tabulated values or combinations of these methods;

— factory production control (see 8.3).

Alternative methods of test to the reference methods specified in this Standard may be adopted except for the product type determination tests and in case of dispute, provided that these alternative methods satisfy the following:"

a) a correlation can be shown to exist between the results from the reference method and those from the alternative method; or

b) a safe relationship can be demonstrated when using the alternative method compared to the reference methods; and

c) the information on which the relationship is based is available.

8.2 Product type determination

After completion of the development of a new product type and before placing on the market, appropriate product type determination shall be carried out to confirm that the properties predicted from the development meet the requirements of this standard and the performance of the characteristics to be declared for the product.

Whenever a major change in the source, blend, or nature of raw materials occurs, or when there is a change in processing conditions, leading to what the manufacturer considers will constitute a new product type being produced, the appropriate product type determination shall be repeated.

The manufacturer may define product groups. The product group may differ according to the characteristics in question.

In the product type determination process a manufacturer may take in consideration already existing results. A manufacturer may use the product type determination results determined by someone else (e.g. another manufacturer or a Research, Technology & Development service provider) to justify his own declaration of performance regarding a product that is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind, provided that permission is given by the owner of the results, and the results are valid for both products.

The tests to be conducted shall be the tests or calculations as described in Table A.1 for the properties selected from the following list relevant to the manufacturer's declaration for the product type's intended use:

— dimensions and dimensional tolerances;

— configuration;

— gross dry density;

— net dry density;

— compressive strength;

— thermal properties;

— durability;

— water vapour permeability;

— water absorption;

— bond strength

Sampling for product type determination shall be in accordance with Annex A.

The results of type tests shall be recorded.

8.3 Factory production control

8.3.1 General

The manufacturer shall establish, document and maintain a factory production control system to enable continuing conformity with this Standard and the declared! performance of the characteristics" of the products placed on the market.

The factory production control system may consist of procedures related to the process only (full process control and consequently no finished product testing, i.e. 8.3.6 does not apply), to finished products only (consequently no process control, i.e. 8.3.5 does not apply) or any combination of both. Consequently, conformity criteria depend on the individual factory production procedures.

As appropriate, the responsibility, authority and interrelation of all personnel who manage, perform and verify work affecting the quality of masonry unit products shall be established.

The factory production control system shall describe the control procedure of production, the regular checks by the manufacturer and his testing, depending on the combination of the procedures related to process control and/or finished product testing. Controls and tests may include the characteristics of raw materials and finished products, the procedure of production, the production equipment or the production machines, the test equipment or the testing instruments and the marking of the product.

The test results shall be recorded.

Actions to be taken when the control test values or criteria do not meet those specified should be documented by the manufacturer.

For Category I masonry units the factory production control system shall be designed so that the probability of failure to reach the declared compressive strength is not exceeding 5 % corresponding to 95 % confidence level.

8.3.2 Testing and measuring equipment

All relevant weighing, measuring and testing equipment, that has an influence on the declared values, shall be verified and regularly inspected.

8.3.3 Production Equipment

When the factory production control system includes process control procedures all production equipment, that forms part of these procedures and has an influence on the declared values, shall be regularly inspected.

8.3.4 Raw materials

As appropriate, the manufacturer shall define the acceptance criteria of raw materials and the procedures operated to ensure that these are met.

8.3.5 Production process

As appropriate, the relevant features of the production processes shall be defined giving the frequency of the manufacturer's checks together with the required criteria. Actions to be taken when the criteria are not achieved shall be specified by the manufacturer.

8.3.6 Finished product testing

As appropriate, the factory production control system shall incorporate a sampling plan and the frequency of testing of the finished product. The results of sampling and testing shall be recorded.

The sample shall be representative of the production. Guidance on testing frequencies for the characteristics of the finished products is given in Table E.1. The guidance should only be used if no better information is available.

Depending on the corrective measure nonconformities may result in higher frequencies of testing than the ones used.

8.3.7 Statistical techniques

When reasonably practicable and applicable, the results of checks and testing shall be interpreted by means of statistical techniques, by attributes or by variables, to verify the product characteristics and to determine if the production conforms to the compliance criteria and the product conforms to the declared values.

NOTE One method of satisfying this conformity criterion is to use the approach given in ISO 12491.

8.3.8 Marking and stock control of products

The marking and stock control shall be documented. Individual products or/and a defined quantity of products (e.g. a consignment of products) should be identifiable and traceable.

8.3.9 Traceability

As appropriate, systems of traceability shall be given in the factory production control system.

8.3.10 Nonconforming products

The procedure for dealing with nonconforming products shall be documented. Products that do not conform with the requirements or the performances of the product type shall be segregated and marked accordingly. However, these products may be reassessed by the manufacturer and assigned to a different product type."

The manufacturer shall take action to avoid a recurrence of the nonconformity.

Annex A
(normative)

Sampling for determination of product type and for independent testing of consignment

A.1 General

This sampling procedure shall apply for product type determination tests and in the event that there is a requirement for an assessment of product compliance.

Only those characteristics declared by the manufacturer shall be assessed by this procedure.

The number of calcium silicate masonry units required to determine compliance with the specification shall be sampled from a consignment no greater than 20 m3 (see Table A.1)

A.2 Sampling procedure

A.2.1 General

NOTE: The choice of the method of sampling will normally be dictated by the physical form of the consignment in

question.

A.2.2 Random sampling

Whenever possible, the random sampling method shall be used, in which every masonry unit in the consignment has an equal chance of being selected for the sample. The appropriate number of masonry units shall be selected at random from positions throughout the consignment without any consideration being given to the quality of those selected except that units damaged in transit shall not be selected.

NOTE In practice, random sampling is normally only convenient either when the calcium silicate masonry units forming the consignment are being moved in a loose (unpacked) form from one place to another or when they have been split into a large number of small stacks, e.g. on scaffolding awaiting laying.

A.2.3 Representative sampling

A.2.3.1 General

When random sampling is impracticable or not convenient, e.g. when the calcium silicate masonry units form a large stack or stacks with ready access to only a limited number, a representative sampling procedure shall be used.

A.2.3.2 Sampling from a stack

The consignment shall be divided into at least six real or imaginary sections, each of a similar size. An equal number of masonry units shall be selected at random from within each section in order to give the required number without any consideration being given to the quality of those selected except that units damaged in transit shall not be selected.

NOTE It will be necessary to remove some sections of the stack or stacks in order to gain access to masonry units within the body of such stacks when taking samples.

A.2.3.3 Sampling from a consignment formed of banded packs

At least six packs shall be selected at random from the consignment. The packaging shall be removed and an equal number of calcium silicate masonry units shall be sampled at random from within each of the opened packs in order to give the required number without any consideration being given to the quality of those selected except that units damaged in transit shall not be selected.

A.2.4 Dividing the sample

When the sample is to provide calcium silicate masonry units for more than one test, the total number shall be collected together and then divided by taking masonry units at random from within the total sample to form each successive sub-sample.

A.2.5 Number of masonry units required for testing

The sample size for each test shall be in accordance with Table A.1.

Table A.1 — Number of units required for tests

Property	Clause No.	Test method			
			Number of units required for sample. If Annex B is applicable, the number of units in brackets is to be used.		
Dimensions	5.2	RS 536	6		For accessory units no minimum requirement
Configuration	5.3	RS 536			–
Flatness of bed faces	5.2.2.2		3		–
Plane parallelism of bed faces	5.2.2.3	RS 536	3		–
Dry density	5.4		6 (3)		–
Compressive strength	5.5	RS 537	6 (3)	10 (5)	If the coefficient of variation is known to be greater than 15 %, the number of units shall be 10.

Thermal properties	5.6	RS 524	3	–
Durability against freeze/thaw	5.7		12 (6)	Only half of the sample will be tested. The other half of the sample is for eventual testing of loss of compressive strength
Water absorption	5.10		6 (3)	–
Moisture movement	5.11	National provision in place of use of unit	–	–

Property	Clause No.	Test method	Remarks		
Bond strength	5.12	RS 538 Procedure A Procedure B	Type I Specimen 27 18	Type II Specimen 18 12	–
Dangerous substances	5.13	National provision in place of use of unit	National provisions		–
NOTE: Additional units should be taken to allow for any damage that may occur in transit to the testing laboratory. If appropriate, e.g., when the units are not affected by a test procedure, the same units may be used for different tests.					

Annex B
(normative)

Cutting scheme

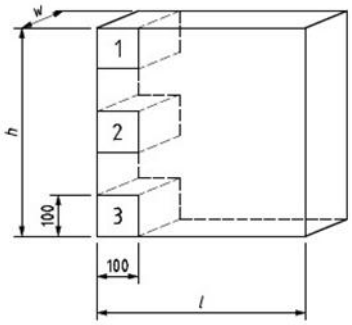
B.1 General

For calcium silicate masonry units with lengths ≥ 500 mm and/or heights ≥ 300 mm representative portions shall be cut for determination of compressive strength and/or freeze/thaw resistance.

B.2 Representative portions for compressive strength determination

In the case of calcium silicate masonry units with lengths ≥ 500 mm and/or heights ≥ 300 mm the compressive strength of a whole unit shall be determined on three specimens taken from the unit. The cutting scheme is given in Figure B.1. Cutting of specimens is done so that grooves and tongues will be removed. Specimens obtained by this cutting may be used for net dry density determinations.

Dimensions in millimetres



Key
h height
l length
w width

Figure B.1 — Cutting scheme for compressive strength

The specimen shall have the dimensions 100 mm × 100 mm × width of unit. The vertical direction should be marked on the specimen. After cutting the specimen shall be conditioned according to the applicable test method. The compressive strength of the entire unit is obtained by taking the mean value of the compressive strength of the three specimens. The normalised compressive strength is obtained by making correction for the moisture condition during testing.

B.3 Representative portions for determination of freeze-thaw resistance

In the case of calcium silicate masonry units with lengths ≥ 500 mm and/or heights ≥ 300 mm the freeze/thaw resistance shall be determined on two specimens taken from the unit. Smaller units may be cut as well, according to the same principle. The test specimen should be completely solid.

The cutting scheme is given in Figure B.2.

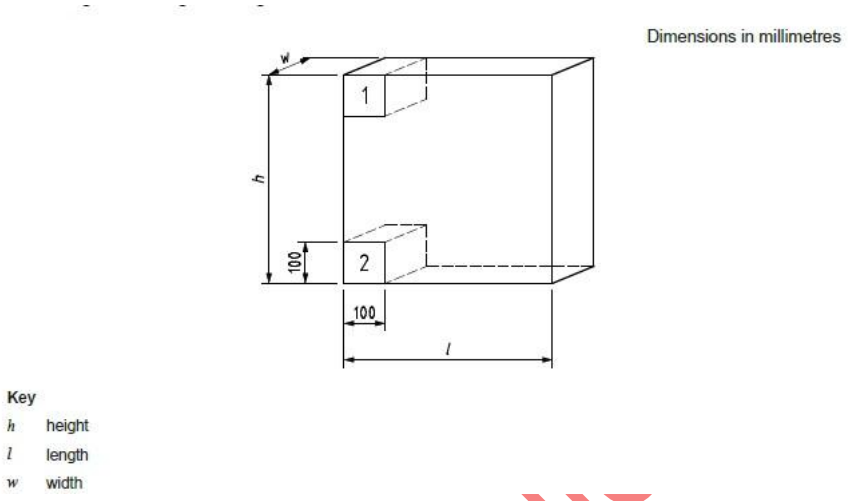


Figure B.2 — Cutting scheme for freeze-thaw resistance testing

The vertical direction should be marked on the specimen.

The dimensions of each specimen will be 100 mm × 100 mm × width of large units.

Annex C
(normative)

Tolerance on accessory units

C.1 Dimensions of rectangular and non-rectangular accessory calcium silicate masonry units

Dimensions of accessory units which are placed on the market as individual products and do not form part of a customised consignment shall be tested in accordance with RS 536. For dimensions between parallel faces one measurement over the centre of the shortest face is taken. For dimensions between non-parallel faces a calliper is used.

Measurement errors shall be less than 0,2 mm for dimensions with a tolerance of 1 mm, and less than 0,5 mm for all other tolerances.

The dimensions of accessory units obtained by cutting large units, shall be stated in mm for length, width and height in that order. If the unit is not rectangular parallelepiped it may be required to state two length and/or two height values. For all units that are not rectangular parallelepiped the slanting angle (α) should be declared or calculated in degrees.

Depending on the shape the following dimensions should be stated:

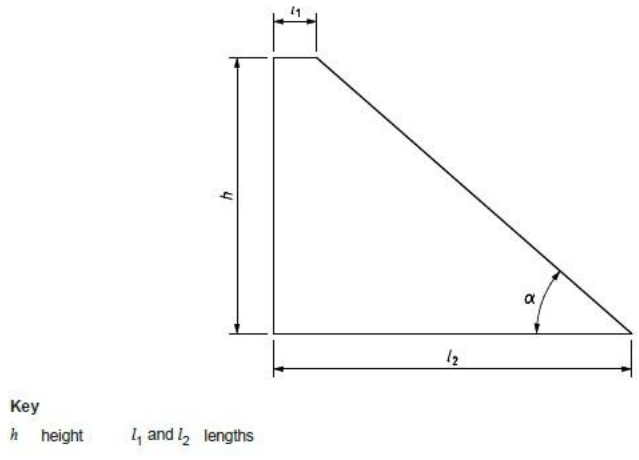
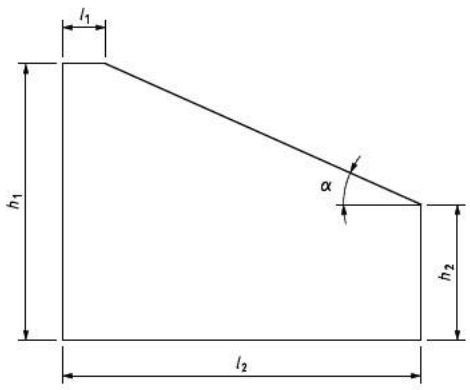


Figure C.1

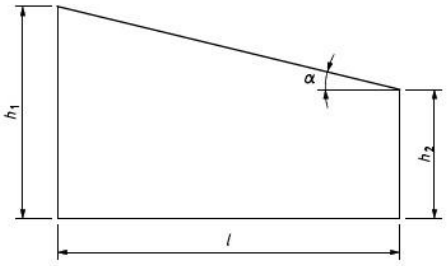


Key

h_1 and h_2 height

l_1 and l_2 lengths

Figure C.2

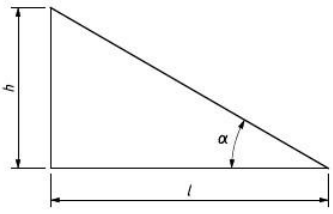


Key

h_1 and h_2 heights

l length

Figure C.3



Key

h height

l length

Figure C.4

Figure C.4

C.2 Tolerances for accessory calcium silicate masonry units

The permissible deviations shall be as given in Table C.1. These tolerances apply to all individual dimensions of each individual accessory unit.

For dimensions unaltered by cutting, the same tolerances apply as for the declared dimensional tolerance category in Table 1.

Table C.1 — Dimensional tolerances for accessory units

Dimensions	Figure	Height(s)	Width(s)	Length(s)
Rectangular accessory units		work size height −4 mm to work size height +2 mm	not applicable	work size length −4 mm to work size length +2 mm
Non-rectangular units	Figure C.1	−4 mm to +2 mm	not applicable	l_1 and l_2 $\frac{-4}{Sin\alpha} mm$ to $\frac{+2}{Sin\alpha} mm$
	Figure C.2	h1 −4 mm to +2 mm h_2 $\frac{-4}{cos} \propto mm$ to $h_2 + \frac{2}{cos} \propto$ mm	not applicable	$l_1 \frac{-6}{Sin\alpha} mm$ to l_2 $\frac{+2}{Sin\alpha} mm$
	Figure C.3	h_1 and h_2 $-\frac{4}{cos\propto}$ mm to $+\frac{2}{\cos \propto} mm$	not applicable	l −4 mm to +2 mm

Dimensions	Figure	Height(s)	Width(s)	Length(s)
	Figure C.4	$-\frac{4}{cos \propto} mm$ to $+\frac{2}{cos\propto}$ mm	not applicable	$L - \frac{4}{sin\propto}$

Annex D
(normative)

Classification system

D.1 Classification based on compressive strength

Calcium silicate masonry units may be classified in accordance with the normalised compressive strength classes given in Table D.1.

Table D.1 — Classification of calcium silicate masonry units based on normalised compressive strength

Compressive strength class	Normalized compressive strength N/mm2
5	5,0
7,5	7,5
10	10,0
15	15,0
20	20,0
25	25,0
30	30,0
35	35,0
40	40,0
45	45,0
50	50,0
60	60,0
75	75,0
NOTE When a strength class is declared, the mean normalised compressive strength shall not be less than the value for the strength class as defined in this table.	

D.2 Classification based on gross dry density

Calcium silicate masonry units may be classified in accordance with the gross dry density classes given in Table D.2.

Table D.2 — Classification of calcium silicate masonry units based on gross dry density

Gross dry density class	Density range kg/m3
3,0	> 2 800
2,8	2 610 – 2 800
2,6	2 410 – 2 600
2,4	2 210 – 2 400
2,2	2 010 – 2 200
2,0	1 810 – 2 000
1,8	1 610 – 1 800
1,6	1 410 – 1 600
1,4	1 210 – 1 400
1,2	1 010 – 1 200
1,0	905 – 1 000
0,9	805 – 900
0,8	705 – 800
0,7	605 – 700
0,6	505 – 600
0,5	≤ 500

Annex E
(normative)

Guidance for test frequencies for designing a FPC system to demonstrate conformity of finished products with the requirements of the standard and the declaration of the manufacturer

Table E.1 — Checking of finished products

Subject	Purpose of checking	Reference method [a]	Frequency of checking by the manufacturer for product range
Dimensions	Conformity with the declared dimensions and the permissible dimensional deviations	RS 536	— Weekly of 6 units and — At least each 1 000 m3 (for units smaller than 500 mm × 300 mm) or 5 000 m3 (larger units) or — As given in the FPC documentation
Flatness of bed faces[b]	Conformity with the declared value and the deviation		— Once a year or — As given in the FPC documentation
Gross dry density	Conformity with the declared gross dry density (value or class)		— Weekly of 6 units and — At least each 1 000 m3 (for units smaller than 500 mm × 300 mm) or 5 000 m3 (larger units) or — As given in the FPC documentation
Compressive strength	Conformity with the declared compressive strength	RS 537	— Weekly of 6 units and — At least each 1 000 m3 (for units smaller than 500 mm × 300 mm) or 5 000 m3 (larger units) or — As given in the FPC documentation
Freeze/thaw resistance [c]	Conformity with the declared freeze/thaw resistance		— Once a year or — As given in the FPC documentation
Water absorption **C**	Conformity with declared value		— Once a year or — As given in the FPC documentation
Thermal conductivity [c]	Conformity with declared value	RS 524	— Once a year or — As given in the FPC documentation

Water vapour permeabilityc	Conformity with declared value	RS ISO 12572	— Once a year or — As given in the FPC documentation
Moisture movement[c]	Conformity with declared value	National test methods	— Once a year or — As given in the FPC documentation
Bond strength [C]	Conformity with declared value	RS 538	— Once a year or — As given in the FPC documentation

Subject	**Purpose of checking**	**Reference method [a]**	**Frequency of checking by the manufacturer for product range**
Reaction to fire [C]	Conformity with declared value	RS 547	— Every five years or — As given in the FPC documentation
The manufacturer does not necessarily have to declare a value against every property and some may be on the basis of,for example, tabulated values. Where the declared value is from a tabulated value no testing is required. In these cases certification can be based on evidence that the tables are being used correctly.			
a The tests should be carried out in accordance with the reference methods mentioned in the standard or by applying alternative test methods with a proven correlation or a safe relationship to the reference methods. b Applies only where units of tolerance category T3 are used. c Only when declared by the manufacturer based on testing.			

Bibliography

[1] EN 772-1, *Methods of test for masonry units — Part 1: Determination of compressive strength*

[2] EN 772-2, *Methods of test for masonry units — Part 2: Determination of percentage area of voids in aggregate concrete masonry units (by paper indentation)*

[3] EN 772-9, *Methods of test for masonry units — Part 9: Determination of volume and percentage of voids and net volume of clay and calcium silicate masonry units by sand filling*

[4] EN 772-13, *Methods of test for masonry units — Part 13: Determination of net and gross dry density of masonry units (except for natural stone)*

[5] EN 772-16:2011, *Methods of test for masonry units — Part 16: Determination of dimensions*

[6] EN 772-18:2011, *Methods of test for masonry units — Part 18: Determination of freeze-thaw resistance of calcium silicate masonry units*

[7] EN 772-20, *Methods of test for masonry units — Part 20: Determination of flatness of faces of aggregate concrete, manufactured stone and natural stone masonry units*

[8] EN 772-21, *Methods of test for masonry units — Part 21: Determination of water absorption of clay and calcium silicate masonry units by cold water absorption*

[9] EN 1052-3, *Methods of test for masonry — Part 3: Determination of initial shear strength*

[10] EN 1745, *Masonry and masonry products — Methods for determining thermal properties*

[11] EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

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