INTERNATIONAL STANDARD

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Fibre-cement slates and fittings — Product specification and test methods

Ardoises et leurs accessoires en fibres-ciment — Spécification du produit et méthodes d'essai

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9125 was prepared by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*.

This second edition cancels and replaces ISO 9384:1991[1)] together with the first edition (ISO 9125:1990), which has been technically revised. It also incorporates the amendment ISO 9125:1990/Amd.1:2004 and the technical corrigenda ISO 9125:1990/Cor.1:1993 and ISO 9125:1990/Cor.2:2005.

1) ISO 9384:1991, *Fibre-cement siding shingles*.

Introduction

The purpose of this International Standard is to provide manufacturers and purchasers with uniform requirements for fibre-cement slate products. These requirements are performance based, and have been specified with the objective of ensuring product quality, industry efficiency, and the performance of the product in service.

In the development of this International Standard the technical committee had as an objective the harmonization, where possible, with other national fibre-cement standards, i.e. those of the European Committee for Standardization (CEN), American Society for the Testing of Materials (ASTM), Japanese Industrial Standards Committee (JIS), to facilitate and promote uniform performance benchmarks for the global use of fibre-cement products.

Fibre-cement slates and fittings — Product specification and test methods

1 Scope

This International Standard specifies technical requirements and methods for the inspection and testing of fibre-cement slates and shingles and their fibre-cement fittings, designed to protect the weather-exposed surfaces on roofs and claddings of buildings.

Products covered by this International Standard can be used for other purposes provided they comply with the appropriate national or international application code or standard.

This International Standard applies to fibre-cement slates with a height dimension not exceeding 850 mm for overlapping assembly (see 5.4).

The type tests described in this International Standard are not intended to evaluate the performance of the coating in isolation (colour fastness, adhesion, etc.). Specific performance requirements for coatings are referenced in other ISO or national standards.

This International Standard does not apply to fibre-cement slates reinforced with asbestos fibres.

This International Standard does not include calculations for installation requirements, wind uplift or rain proofing of the installed products.

NOTE National standards for installation requirements can be adopted.

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.

ISO 390:1993, *Products in fibre-reinforced cement — Sampling and inspection*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 12468-1, *External exposure of roofs to fire — Part 1: Test method*

ISO 12468-2, *External fire exposure to roofs — Part 2: Classification of roofs*

3 Terms and definitions

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

3.1
acceptance test
test to establish whether a batch of sheets conforms to a specification

[Adapted from ISO 390:1993, 3.5]

NOTE 1 The test is performed on samples drawn from continuous production or from a consignment.

NOTE 2 Test methods, specifications and limit values are specified in this International Standard. Sampling levels and acceptance criteria are specified in Clause 6.

3.2
acceptable quality level
AQL
maximum percent defective (or maximum number of defects per 100 units) that can be considered satisfactory as a long-term average quality level in a sampling plan

NOTE When a manufacturer's process satisfies a sampling scheme with an AQL of 4 % this indicates that 96 % of the inspected product exceeds the specification. This type of specification provides the consumer with a clearly defined lower quality boundary; this does not occur if acceptance is based solely on the average value of the measured property. Examples of sampling schemes can be found in ISO 390, ISO 2859-1, or ISO 3951-1.

3.3
ambient conditions
ambient laboratory conditions
temperature: 23 °C ± 10 °C
relative humidity: 50 % ± 20 %

3.4
apparent density
dry mass per unit volume based upon the volume of the sample calculated by water displacement or equivalent

NOTE This is an average density of the material and pores coated or uncoated (as delivered).

3.5
as delivered
as the producer intends to supply the product after completing all aspects of the process including maturing and, when appropriate, coating

3.6
reinforcement fibres
organic or inorganic reinforcement fibres for the manufacture of fibre-cement slates complying with this International Standard

(See 5.2.2.)

3.7
type test
test made to demonstrate conformity with the requirements of this International Standard or for the approval of a new product and/or when a fundamental change is made in formulation and/or method of manufacture, the effects of which cannot be predicted on the basis of previous experience

NOTE The test is performed on the as-delivered product, but is not required for each production batch.

3.8
upper face
face normally exposed to the weather

4 Symbols and abbreviations

a nominal length or width of slates, expressed in millimetres

b one of the coefficients of the regression line (refer to Annex D)

ρ apparent density of the slate, expressed in grams per cubic centimetre

e thickness of fibre-cement slate, expressed in millimetres

F load at rupture, expressed in newtons

F_{cor} correlation coefficient between wet and dry values

h dimension of the fibre-cement slate measured perpendicular to the line of fixing that is at or nearest to the horizontal plane of the roof (see Figures K.1 and K.2), expressed in millimetres

i current number of the paired specimen

l length (span) between support centres in bending moment test, expressed in millimetres

l_b dimension of the specimen (length or width) measured parallel to the test machine supports, expressed in millimetres

m mass of the specimen after drying, expressed in grams

M_f bending moment at fracture, expressed in newton-metres per metre

M_{fci} bending moment at fracture of the ith unexposed reference specimen, expressed in newton-metres per metre

M_{fi} bending moment at fracture of the ith exposed specimen after the type test, expressed in newton-metres per metre

P breaking load, expressed in newtons

R_L ratio of the lower mean values of the bending moment for exposed and unexposed specimens

n number of paired specimens

NT new technology (asbestos-free)

R average ratio of the bending moments of exposed and unexposed specimens

r radius of parallel supports in bending moment test, expressed in millimetres

R_{cl} lower estimate of the mean of the ratios at 95 % confidence level of the bending moments at rupture of exposed and unexposed specimens

R_i mean of bending moments of a set of samples for initial type test (see Annex C)

R_{mi} individual ratio of the bending moments of exposed and unexposed specimens of the ith pair of specimens

s standard deviation of the values in the appropriate calculation

V volume of specimen, expressed in cubic centimetres

5 Requirements

5.1 General

Products covered by this International Standard are divided into two categories according to their resistance to frost and into four classes according to their bending moment.

5.2 Composition

5.2.1 General

Fibre-cement slates and fittings shall consist essentially of cement or a calcium silicate formed by the chemical reaction of a siliceous and a calcareous material, reinforced by fibres. Process aids, fillers, aggregates and pigments that are compatible with the fibre-reinforced cement may be added.

5.2.2 Reinforcement

5.2.2.1 Reinforcement material

Reinforcement may be one or a combination of the following materials:

— cellulose fibre;

— synthetic organic fibre;

— glass fibre.

5.2.2.2 Reinforcement pattern

The reinforcement materials may have one or more of the following forms:

— discrete elements, randomly dispersed;

— continuous strands.

5.2.3 Cement

The cement shall comply with the relevant national standards in the country of manufacture.

5.2.4 Manufacture

These products may be formed either with or without pressure, and cured under either natural or accelerated conditions, to meet the physical requirements specified in this International Standard.

5.3 Appearance and finish

The exposed face of the slates may be with or without texture. The slates may be coloured or left in their natural colour. The slates may also receive coatings on their surfaces. Variations of the surface appearance that do not impair the fitness for purpose of the product are permitted.

The fittings shall have a general appearance and finish compatible with the fibre-cement slates with which they are to be used.

5.4 Dimensions and tolerances

5.4.1 General

The manufacturer shall specify the shapes, sizes and configuration of edges of the fibre-cement slates.

Fittings shall have nominal dimensions and shapes determined by the manufacturer and appropriate to the corresponding fibre-cement slates.

5.4.2 Thickness

The manufacturer shall specify the nominal thickness of the slates.

The nominal thickness of the fittings shall be not less than the corresponding nominal thickness of the fibre-cement slates with which the fittings are being used.

The average fibre-cement slate thickness, determined in accordance with 7.2, using the method given in Annex B, shall not be less than that shown in Table 1.

Table 1 — Minimum thickness average of fibre-cement slates

Height h mm	**Minimum thickness** [a] e mm
$h \leqslant 350$	2,8
$350 < h \leqslant 450$	3,0
$450 < h \leqslant 600$	3,5
$600 < h \leqslant 850$	4,0

[a] Minimum thickness is the average out of four measurements carried out according to Annex B.

5.4.3 Tolerances on nominal dimensions

The maximum dimensional variations when measured as specified in 7.2, using the method given in Annex B, shall be as follows:

a) on length and width: $\pm$ 3 mm;

b) on thickness: $^{+25}_{-10}$ % of the nominal value.

For fittings that replace fibre-cement slates (e.g. ventilation fibre-cement slates), the tolerances shall be the same as those on the fibre-cement slates.

For other fittings (e.g. ridges), the tolerances shall be specified by the manufacturer.

NOTE National standards can require other tolerances

5.5 Physical requirements and characteristics

5.5.1 General

Mechanical and physical properties are normally determined on product as delivered. The results shall be identified as applying to coated or uncoated material. Failure of the coating does not constitute failure of the product.

5.5.2 Mechanical characteristics

When tested as specified in 7.3.2, using the method given in Annex C, the slates shall have a minimum bending moment in accordance with Table 2. This bending moment shall be the average of the values obtained from testing the test specimen in both directions.

The minimum bending moment at rupture in the weaker direction shall not be less than 60 % of the values specified in Table 2 for the average of both directions.

Table 2 — Minimum bending moments of fibre-cement slates

Height h mm	Class A Nm/m	Class B [a] Nm/m	Test required	Test method
$h \leqslant 350$	25	35	7.3.2	Annex C
$350 < h \leqslant 450$	30	45		
$450 < h \leqslant 600$	35	50		
$600 < h \leqslant 850$	45	60		

[a] The following special class is also available:

Class BS: When higher bending moments are required for batten spacings $\geqslant 250$ mm, the required minimum shall be equivalent to the numerical value of $h/5$.

NOTE 1 Values stated in this table are the minimum values at 4 % AQL. Minimum values (4 % AQL) for this property are declared by the manufacturer.

NOTE 2 For acceptance testing, it is necessary to use the 4 % AQL values.

NOTE 3 For initial type testing, where production variance is not yet known, it is necessary to calculate an estimate of the mean bending moment at the 95 % confidence level to determine the class (see C.6.2).

5.5.3 Apparent density

The manufacturer's literature shall specify the minimum apparent density of the slates. When tested in accordance with 7.3.3, using the method given in Annex E, the density shall not be less than the specified value.

5.5.4 Water permeability

When tested for water permeability in accordance with 7.3.4, using the method given in Annex F, traces of moisture may appear on the underside of the specimen but in no instance shall there be any formation of water drops.

5.5.5 Freeze-thaw performance

Slates are divided into two categories according to their freeze-thaw performance; see Table 3.

For countries where there are, under normal circumstances, no or only occasionally temperatures below 0 °C, determination of freeze-thaw performance is not necessary (category I).

When freeze-thaw testing is required (category II), slates are tested in accordance with 7.3.5, using the test method given in Annex G. After 100 freeze-thaw cycles, the ratio, R_L, of the lower estimate mean values of the bending moments for the exposed and unexposed specimens, determined at the 95 % confidence levels, shall not be less than 0,75.

Table 3 — Number of freeze-thaw cycles

Category	Number of freeze-thaw cycles
I	0
II	100

5.5.6 Heat-rain performance

When tested in accordance with 7.3.6, using the test method given in Annex H, after 50 heat-rain cycles, any visible cracks, delamination or other defects in the slates shall not be sufficient to affect their in-use performance.

5.5.7 Warm-water performance

When tested in accordance with 7.3.7, using the test method given in Annex I, after 56 days at 60 °C, the ratio, R_L, of the lower estimate mean values of the bending moment for the exposed and unexposed specimens, determined at the 95 % confidence level, shall not be less than 0,75.

5.5.8 Soak-dry performance

When tested in accordance with 7.3.8, using the test method given in Annex J, after 50 soak-dry cycles, the ratio, R_L, of the lower estimate mean values of the bending moment for the exposed and unexposed specimens, determined at the 95 % confidence level, shall not be less than 0,75.

5.6 Requirements concerning fire

For the purpose of conformity with national regulations, products can be required to satisfy specific product or system fire tests. The details of the specifications and acceptance criteria shall be defined by national standards and/or regulations. Where no standard or performance requirement has been established, the product shall be tested according to ISO 12468-1 and the results classified in accordance with ISO 12468-2.

5.7 Product performance

The categories and classes of fibre-cement slates defined in this International Standard (see 5.2) cannot be considered to give an indication of the service life of the product. Product service life is influenced by factors such as geographical location, location of product on structure, type and method of installation and applied surface coatings. This International Standard only defines minimum physical performance requirements but does not prescribe material formulations. Therefore, the presumption that the service life of fibre-cement slates of similar category and class made by various manufacturers is similar cannot be made. Service life can be estimated only for clearly specified product applications and products in defined climate zones.

6 Evaluation of conformity

6.1 General

The conformity of fibre-cement slates and fittings with the requirements of this International Standard shall be demonstrated by

— type testing;

— quality control by the manufacturer.

6.2 Type testing

6.2.1 General

Type tests shall be made on products as delivered. If the same composition and production method is used to produce slates of various nominal sizes and thicknesses, it is necessary to make type tests only on the maximum and minimum dimensions.

Table 4 lists the characteristics that shall be subject to type testing with the minimum performance requirements and methods of test. All characteristics listed in Table 5 shall be subject to initial type testing.

Testing of mechanical characteristics is made with the upper face in compression.

Table 4 — Type testing and property evaluation requirements

Physical property	Reference		
	Minimum test performance requirement	Test conditions	Test method
Water permeability	5.5.4	7.3.4	Annex F
Freeze-thaw test	5.5.5	7.3.5	Annex G
Heat-rain test	5.5.6	7.3.6	Annex H
Warm-water test	5.5.7	7.3.7	Annex I
Soak-dry test	5.5.8	7.3.8	Annex J

Table 5 — Number of samples and compliance criteria for type testing

Characteristic	Assessment method	Number of samples	Compliance criteria
Dimensional conformity	7.2	Inspection S3 in accordance with ISO 390	5.4.3
Bending moment	7.3.2	Inspection S3 in accordance with ISO 390	Table 2; apply 4 % AQL
Apparent density	7.3.3	Inspection by variables; method σ or s	5.5.3
Water permeability	7.3.4	3 slates	5.5.4
Freeze-thaw performance	7.3.5	10 samples	5.5.5
Heat-rain performance	7.3.6	$\geqslant$ 3,5 m^2	5.5.6
Warm-water performance	7.3.7	10 samples	5.5.7
Soak-dry performance	7.3.8	10 samples	5.5.8

6.2.2 Initial type testing

Initial type testing shall be performed to demonstrate conformity with this International Standard. Tests that have been made previously (on a product having the same physical characteristics and satisfying similar conformity requirements), using the same test method and sampling procedure specified in this document, may be taken into account.

For initial type testing, where production variance is not yet known, it is necessary to calculate an estimate of the average characteristic at the 95 % confidence level.

Additional type testing shall be made for the approval of a new product or where a fundamental change in formulation or method of manufacture creates effects that cannot be predicted on the basis of previous experience.

The results of all type tests shall be recorded and held by the manufacturer for at least 5 years.

6.2.3 Further type testing

Whenever a change in design occurs that significantly changes one or more of the product characteristics of the fibre-cement slates, the raw materials, or the production process, the type test shall be performed for the appropriate characteristic(s).

6.3 Quality control system

6.3.1 General

The manufacturer shall establish and maintain a documented quality control (QC) system that ensures that the products delivered to the market conform to the stated performance characteristics. The QC system shall consist of procedures, regular inspections and tests and/or assessments of the incoming materials, components, manufacturing equipment, manufacturing process and the product.

A manufacturer who establishes a quality management system according to ISO 9001 is considered to meet the above requirements.

The results of inspections, tests or assessments that require action shall be recorded together with the remedial actions taken.

6.3.2 Acceptance tests

The specifications of acceptance tests apply to the product as delivered, but some of the tests may be made at an earlier stage of maturity.

Sampling from continuous production, testing of slates prior to coating, and/or in conditions other than those in Table 7, is acceptable provided that it has been statistically established (see Annex D) that compliance with the requirements in Table 5 is achieved.

Acceptance tests can also be used to confirm that a batch of slates conforms to this International Standard, e.g. in conjunction with type tests or for receiving inspection.

The tests include

— measurements of dimensions: length, width and thickness (method specified in Annex B),

— measurement of mechanical characteristics: bending moment (method specified in Annex C), and

— measurement of apparent density (method specified in Annex E).

Each limit of specification for the characteristics in Table 6 shall be subject to an AQL of 4 %. The sampling schemes provided in ISO 390, with an AQL of 4 % at inspection level S_3, ensure that, for large batches, approximately 95 % of the items satisfy the requirements.

Table 6 — Minimum sampling schemes

Material	Characteristic	Method/requirements
Fibre-cement slates	Length and width Thickness	**ISO 2859-1** Inspection by attributes Double sampling AQL 4 % Level S_1
	Bending strength Apparent density	**ISO 3951-1** Inspection by variables; method σ or s AQL 4 % Level S_3
Fibre-cement fittings	Length and width Thickness	**ISO 2859-1** Inspection by attributes Double sampling AQL 4 % Level S_1

6.3.3 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

6.3.4 Raw materials and components

The specification of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring conformity.

6.3.5 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of all the characteristics are maintained.

6.3.6 Non-conforming products

Non-conforming products shall be separated and handled according to documented procedures.

6.4 Inspection of a consignment of finished products

Inspection of a consignment of finished products is not a requirement of this document but if, in special cases, this is demanded by the customer, it may be conducted in accordance with Annex A and ISO 390.

7 Test requirements

7.1 General

In 7.2 and 7.3 the requirements for acceptance and type testing are specified.

7.2 Dimensional and geometrical tests

7.2.1 General

The measurements shall be made on slates and fittings as delivered, using the apparatus and procedures given in Annex B.

7.2.2 Number and conditioning of specimens

The test shall be performed on whole fibre-cement slates and fittings, as delivered and without conditioning.

For type testing, 10 slates or fittings shall be taken; for acceptance testing and production control purposes, the minimum sampling scheme (see Table 6) is applied.

7.3 Physical performance tests

7.3.1 General

In 7.3.2 to 7.3.8, details are given for the number, preparation and conditioning of specimens for different tests. Details of apparatus and the carrying out of the tests are contained in Annexes B to J.

7.3.2 Bending moment

7.3.2.1 General

Bending moment tests shall be made using the test method and apparatus detailed in Annex C.

7.3.2.2 Number of specimens

For type testing, 10 slates shall be taken; for acceptance testing and production control purposes, the minimum sampling scheme (see Table 6) is applied.

7.3.2.3 Preparation of specimens

7.3.2.3.1 Shape and dimensions of specimens

The test shall be carried out on full-size slates or cut specimens. The dimensions of the test specimens shall be large enough to ensure that it overlaps each test support by at least 10 % of span when tested in each direction. Specimens may be either square or rectangular.

The preferred dimensions of the test specimens are 250 mm × 250 mm.

7.3.2.3.2 Specimen conditioning

Prior to testing, the specimens shall be conditioned in accordance with Table 7.

Table 7 — Conditioning requirements

Test	Conditioning procedure
Acceptance test (wet)	24 h immersion in water
Acceptance test (dry)	Between 7 days and 14 days at ambient laboratory conditions
Type test	Between 7 days and 14 days at ambient laboratory conditions, followed by 24 h immersion in water

7.3.3 Apparent density

7.3.3.1 General

The apparent density shall be determined using the procedure and apparatus given in Annex E.

7.3.3.2 Number and dimensions of specimens

One specimen shall be tested.

The specimen should preferably be a piece of the slate used for the bending test.

7.3.4 Water permeability

7.3.4.1 General

The water permeability shall be conducted using the procedures and apparatus given in Annex F.

7.3.4.2 Number and dimensions of specimens

The test shall be conducted on three full-size slates.

7.3.4.3 Conditioning

The specimens shall be kept in a controlled environment [ambient conditions — temperature: (23 ± 10) °C and (50 ± 20) % relative humidity] for at least 7 days.

7.3.5 Freeze-thaw test

7.3.5.1 General

The freeze-thaw test shall be performed using the procedure and apparatus given in Annex G.

7.3.5.2 Number and configuration of specimens

From each of the 10 as-delivered slates, cut a pair of specimens conforming to the requirements for the bending moment test (see 7.3.2.3.1). Each pair of specimens shall be cut from one slate. The specimen pairs should be given a form of identification that enables later comparison of test results.

Where it is not possible to cut paired samples out of one slate, it is permitted to take 20 samples from the same production batch and to divide them randomly into two groups of ten samples.

7.3.5.3 Conditioning

Ten specimens (one specimen from each pair) shall be conditioned as detailed in Table 7; these are subjected to bending-moment testing. The remaining 10 specimens shall be immersed in water at ambient temperature (> 5 °C) for 48 h prior to freeze-thaw testing.

7.3.6 Heat-rain test

7.3.6.1 General

The heat-rain test shall be performed using the procedure and apparatus given in Annex H.

7.3.6.2 Preparation of the specimens

The slates shall be selected at random and stored at a minimum of 24 h at ambient conditions prior to assembly for the test.

7.3.6.3 Number of specimens

The number of slates required depends on the specific installation being tested or on the size of the slates. Where possible, maximum-size slates should be used.

7.3.7 Warm-water test

7.3.7.1 General

The warm-water test shall be performed using the procedure and apparatus given in Annex I.

7.3.7.2 Number and configuration of specimens

From each of the 10 as-delivered slates, cut a pair of specimens conforming to the requirements for the bending moment test (see 7.3.2.3.1). Each pair of specimens shall be cut from one slate. The specimen pairs should be given a form of identification that enables later comparison of test results.

Where it is not possible to cut paired samples out of one slate, it is permitted to take 20 samples from the same production batch and to divide them randomly into two groups of ten samples.

7.3.8 Soak-dry test

7.3.8.1 General

The soak-dry test shall be performed using the procedure and apparatus given in Annex J.

7.3.8.2 Number and configuration of specimens

From each of the 10 as-delivered slates, cut a pair of specimens conforming to the requirements for the bending moment test (see 7.3.2.3.1). Each pair of specimens shall be cut from one slate. The specimen pairs should be given a form of identification that enables later comparison of test results.

Where it is not possible to cut paired samples out of one slate, it is permitted to take 20 samples from the same production batch and to divide them randomly into two groups of ten samples.

8 Marking

Product packaging shall contain the following information:

a) trade mark or other means of manufacturer identification;

b) number of this International Standard;

c) size and/or name;

d) product category;

e) product class;

f) date of manufacture;

g) NT (where required).

A minimum of 15 % of the slates in each delivered unit shall be durably marked with at least items a) and f) above. Where required, the same proportion of slates shall be marked with item g).

Annex A
(normative)

Consignment and inspection sampling

A.1 Scope

This annex gives details of a system for inspecting and sampling a consignment of finished products (refer to 6.4), which may, by agreement between the manufacturer and the purchaser, be included in a tender or product order.

NOTE Inspection as described in 6.4 is not a requirement of this International Standard

A.2 Sampling

A.2.1 When specified, the acceptance sampling shall be made on lot(s) of the consignment in accordance with the test programme of this International Standard, unless there is a special agreement. Table 6, therefore, specifies the characteristics for testing.

Details related to the sampling procedure shall be established between the manufacturer and purchaser.

A.2.2 After agreement on the sampling procedure, sampling shall be carried out, in the presence of both parties, from the lot(s) that will be delivered to the purchaser. If the inspection lot(s) are not yet formed, the manufacturer should present to the purchaser the stock(s) from which the inspection lot(s) can be selected and marked. Unless otherwise agreed between manufacturer and purchaser, the maximum and minimum inspection lots shall be 20 000 and 3 000 slates and 1 500 and 200 fittings, respectively, for all dimensions.

A.3 Testing

The tests shall be performed in the laboratory of the manufacturer or by an independent laboratory selected by mutual agreement between the manufacturer and the purchaser. In case of dispute, the tests shall be performed in the presence of both parties.

A.4 Non-destructive tests

When non-destructive tests are performed and the result of the sampling inspection does not meet the acceptance requirements of this International Standard, the tests shall be required on each item of the consignment. The units of the consignment that do not meet the requirements when tested individually can be refused and disposed of, unless otherwise agreed between manufacturer and purchaser.

Annex B
(normative)

Dimensional measurement and geometrical testing procedures

B.1 General

This annex gives the details of the measuring apparatus and procedures that shall be used for carrying out dimensional and geometrical measurements and the determination of compliance with the requirements of this International Standard.

B.2 Principle

Sample slates and fittings, selected from batches of slates and fittings, are measured to determine their compliance with the length, width and thickness requirements of this International Standard.

B.3 Apparatus

B.3.1 Metal rules, short, capable of being read to an accuracy of 0,5 mm.

B.3.2 Micrometer dial gauge, reading at least to 0,05 mm, with flat parallel metal jaws of between 10 mm and 15 mm in diameter.

B.4 Measuring procedures

B.4.1 General

Avoid taking the measurement over a local deformation that can be considered as a visual defect. Smooth any rough areas.

B.4.2 Measurement of length and width

For each dimension, take two measurements.

Take each reading to the nearest 0,5 mm.

Verify that each value is within the tolerance given in 5.4.3.

B.4.3 Measurement of thickness

Make four measurements with a dial gauge, one on each side, approximately 20 mm from the edge in the middle of two adjacent sides (see Figure B.1).

Report the individual results and calculate the arithmetic mean and difference between extreme values.

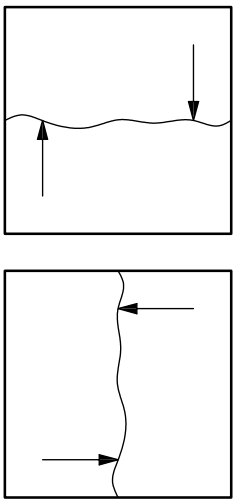


Figure B.1 — Measurement of thickness specimens

B.5 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates or fittings from which the sample slates or fittings were taken;

c) nominal dimensions of the test slates or fittings;

d) test equipment details;

e) test temperature and condition of the test piece;

f) measured values from the tests;

g) date of the test.

Annex C
(normative)

Test method for the determination of the bending moment of fibre-cement slates

C.1 General

This annex gives a method for determining the bending moment of fibre-cement slates

C.2 Principle

A specimen is cut from a sample slate and subjected to a flexural bending load until failure occurs; the failure load is recorded. This test is repeated on the specimen with the bending mode at right angles to the initial test. The average bending moment for the material is calculated from the test results.

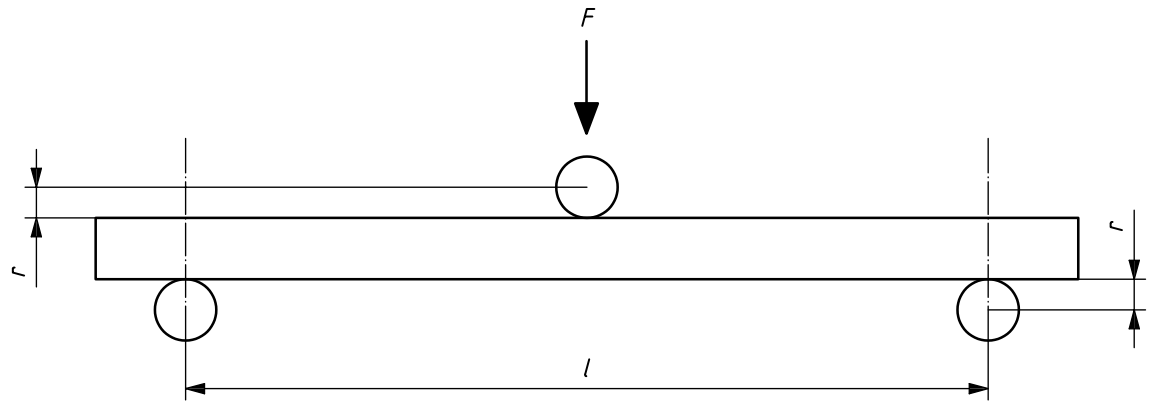
C.3 Apparatus

C.3.1 Bending test machine, capable of applying a load at constant rate of deflection (where this facility is not available, a constant rate of loading is acceptable) with an error of accuracy and an error of repeatability of 3 %, and comprised of the following.

— Two parallel horizontal supports, one fixed and the second free to move to permit alignment with the specimen. The upper face of each support shall be rounded and shall have a radius between 3 mm and 25 mm (see Figure C.1). The distance between the supports shall be 200 mm provided the sample is large enough. For smaller samples, the distance between the supports can be reduced but shall not be less than 18 times the nominal thickness.

— A loading bar having the same edge radius as the supports, located parallel to and equidistant from the supports. The loading bar is attached to the loading mechanism through a flexible connection.

The lengths of the supports and loading bar shall be greater than the width of the test specimen.



F load

l length (span) between support centres, expressed in millimetres

r radius of cross section of supports (3 mm to 25 mm)

Figure C.1 — Bending test configuration

C.4 Specimen preparation

Prepare specimens to conform with the dimensional requirements (see 7.3.2.3.1), and condition samples prior to testing as appropriate for the kind of test (see Table 7).

C.5 Test procedure

The test procedure is carried out as follows.

a) Arrange the supports at the appropriate spacing for the specimen; this is normally 200 mm between bar centres but may be altered according to the specimen characteristics (refer to 7.3.2.3.1).

b) Arrange the specimen with the under face against the supports and the loading bar on the upper face equidistant between, and parallel with, the supports.

c) Load the specimen such that the breakage occurs within 10 s to 30 s. A constant rate of deflection is preferred; if this cannot be achieved, a constant rate of loading is acceptable. Record load at break.

d) Reassemble the broken pieces without turning them over and submit the specimen to a second bending test with the line of load application at right angles to that of the first test.

C.6 Calculation of modulus value

C.6.1 The bending moment at fracture, M_f, expressed in newton-metres per metre, is given by Equation (C.1):

$$M_f = \frac{Pl}{4l_b} \tag{C.1}$$

where

P is the breaking load, expressed in newtons;

l is the distance between the centres of the supports, expressed in millimetres;

l_b is the dimension of the specimen (length or width) measured parallel to the support, expressed in millimetres.

The bending moment, M_f, is the arithmetic average of the values obtained in each of the two directions on the same slate. The result of the test is considered to be satisfactory if it is in accordance with the requirements of 5.5.2.

C.6.2 For initial type tests, it is necessary to determine an estimate of the mean bending moment at the 95 % confidence level for a product class, where production variance is unknown. It is necessary to do this by taking one square sample or two rectangular samples from a minimum of ten individual slates and carrying out the following procedure.

a) For each slate, calculate bending moment as the average of the longitudinal bending moment and the transverse bending moment.

b) Calculate the mean, R_i, and the standard deviation, s, of the combined average bending moment values.

c) Calculate the mean, R_L, of the bending moment values at the 95 % confidence level as given by Equation (C.2) (see ISO 2602):

$$R_L = R_i - 0{,}58s \tag{C.2}$$

d) Determine the product class by comparing the R_L value with the minimum class requirement in Table 2, such that R_L is equal to or greater than the value in Table 2).

C.7 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates from which the samples are taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test temperature and condition of the test piece;

f) breaking loads of the specimens;

g) calculated values of the bending moments;

h) date of the test.

Annex D
(normative)

Statistical method for determining the corresponding wet values or revised dry specifications for the bending moment when conducting the dry method of test or when tested prior to coating for quality control purposes

D.1 Procedure

Sample at least 20 slates. Cut them into paired specimens for the bending strength test as described in Annex C.

Both specimens of a pair shall be cut from the same slate and each given the same number.

Test one set of specimens wet and one set of specimens dry for bending, in accordance with Annex C.

For the paired results, determine whether there is a correlation between them at a 97,5 % confidence level, using the method in Clause D.2.

If there is no significant correlation, then dry testing cannot be used. If the correlation is positive then continue as follows.

a) Determine the regression line, using the method described in Clause D.3.

b) Determine either of the following:

— wet value for each specimen from the obtained dry value, using the method described in Clause D.4;

— revised minimum value for use as the specification for dry testing corresponding to the appropriate minimum value for wet testing as specified in this International Standard, using the method described in Clause D.5.

D.2 Determination of the correlation between the results of testing wet and dry specimens

Calculate the coefficient of correlation, F_{cor}, between wet and dry values, using Equation (D.1):

$$F_{\text{cor}} = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)\left(y_i - \bar{y}\right)}{\left[\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2 \sum_{i=1}^{n}\left(y_i - \bar{y}\right)^2\right]^{1/2}} \qquad \text{(D.1)}$$

where

n is the number of paired specimens;

x_i is the individual value of the ith specimen tested dry;

y_i is the individual value of the ith specimen tested wet;

$\bar{x}$ is the mean value of y_i for $i = 1$ to n;

$\bar{y}$ is the mean value of y_i for $i = 1$ to n.

Calculate the value of t from Equation (D.2):

$$t = \left| \frac{F_{cor}}{\sqrt{1 - F_{cor}^2}} \right| \sqrt{n-2} \tag{D.2}$$

Compare t to the Student's coefficient, $t_{0,025/n-2}$.

If $t > t_{0,025/n-2}$, then there is a significant relationship between the results of wet and dry testing and the regression line is straight. Dry testing can be carried out for quality control purposes:

— when $n = 20$, then $t_{0,025/n-2} = 2{,}101$;

— for $n > 20$, refer to Student's t tables.

D.3 Determination of the regression line

The regression line can be expressed as given in Equation (D.3)

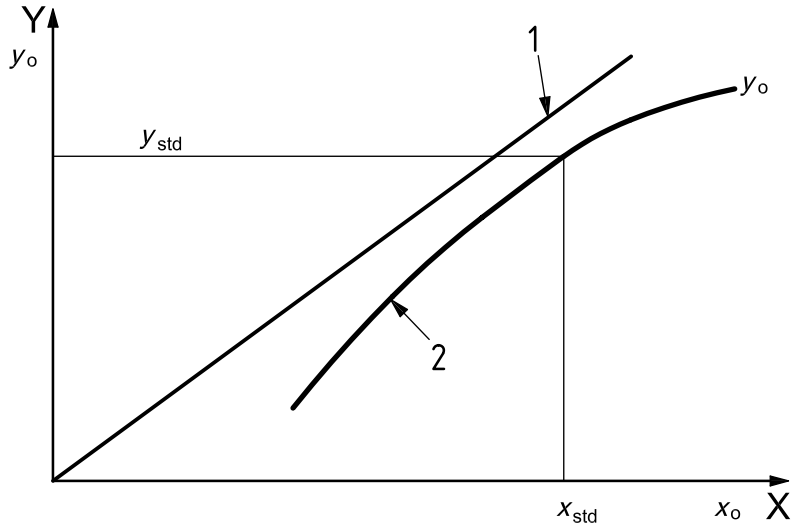
$$y = a + bx \tag{D.3}$$

Calculate the values of b and a from Equations (D.4) and (D.5), respectively:

$$b = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2} \tag{D.4}$$

$$a = \bar{y} - b\bar{x} \tag{D.5}$$

A plot of the progression line is shown in Figure D.1.



Key

X dry values

Y wet values

1 regression line for the lower confidence level

2 line calculated from Equation (D.5)

Figure D.1 — Regression line for wet/dry values with lower confidence level

D.4 Determination of a value for wet testing from an obtained value for dry testing

Calculate the residual standard deviation, s (also called the standard error of the estimate), from Equation (D.6):

$$s = \sqrt{\frac{\sum_{i=1}^{n}\left(y_i - a - bx_i\right)^2}{n-2}} \tag{D.6}$$

Calculate the value, y_o, for wet testing from Equation (D.7) using the obtained dry value, x_o;

$$y_o = \left(a + bx_o\right) - st_{0,025/n-2}\sqrt{\frac{n+1}{n} + \frac{\left(x_o - \bar{x}\right)^2}{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}} \tag{D.7}$$

where

x_o is the actual result obtained when dry testing;

y_o is the value calculated from x_o that is the estimate at the lower 97,5 % confidence level of the value expected from wet testing, such that

— when $n = 20$, then $t_{0,025/n-2} = 2{,}101$;

— for $n > 20$, refer to Student's t tables.

For routine quality control testing, individual values of y_o can be calculated each time or, alternatively, by substituting a suitable range of values for x_o in Equation (D.7), a plot of x_o vs. y_o can be made (see Figure D.1) from which future values can be read.

D.5 Determination of the minimum value, x_{std}, specified for dry testing corresponding to the minimum value, y_{std}, specified for wet testing

Plot the line for x_o, y_o by substituting a suitable range of values for x_o into Equation (D.7).

Read the value for x_{std} corresponding to the value for y_{std} from the graph (see Figure D.1) where

y_{std} is the minimum value specified in this International Standard for wet testing;

x_{std} is the minimum value to be specified for dry testing calculated from y_{std} at the 97,5 % lower confidence level.

Annex E
(normative)

Test method for the determination of the apparent density of fibre-cement slates

E.1 General

This annex gives the test method for determination of the apparent density (see 5.5.3) of fibre-cement slates. This is the average density of the material and its pores.

E.2 Principle

The volume of a saturated specimen is determined by immersion in water. The specimen's oven-dry weight is then measured. The apparent density is determined by calculation from the measured values.

E.3 Apparatus

E.3.1 **Oven**, ventilated, capable of achieving a temperature of 100 °C ± 5 °C with a full load of specimens.

E.3.2 **Balance**, accurate to within 0,1 % of the specimen mass and equipped to determine both the immersed mass and the non-immersed mass of the specimen.

E.4 Test procedure

The test procedure is carried out as follows.

a) Immerse specimen in water for at least 24 h.

b) Take a saturated specimen, remove excess water from surfaces and then determine the volume of the water (V) displaced by the saturated specimen when placed into a water bath. Record this value.

c) Remove specimen from water bath and place it into a ventilated oven which is maintained at a temperature of 100 °C ± 5 °C. After 24 h remove specimen from the oven and measure its mass (m). Record this value.

E.5 Calculation of apparent density

The apparent density, ρ, expressed in grams per cubic centimetre, is given by Equation (E.1):

$$\rho = \frac{m}{V} \tag{E.1}$$

where

m is the mass, expressed in grams, of the test piece after drying;

V is the volume of the specimen, expressed in cubic centimetres.

E.6 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of sheet(s) from which the sample slate was taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test temperature and condition of the test piece;

f) measured displacement and weight of the specimen;

g) calculated value of the apparent density;

h) date of the test.

Annex F
(normative)

Test for the determination of water permeability of fibre-cement slates

F.1 General

This annex gives details of the test procedure and apparatus required to determine that fibre-cement slates comply with the water permeability requirements of this International Standard (see 5.5.4).

F.2 Principle

A specified depth of water is applied to the upper face of a horizontally positioned slate specimen for a prescribed period of time. Visual examination of the test specimen determines compliance with the requirements of this International Standard.

F.3 Apparatus

F.3.1 Transparent tube, vertical, 300 mm long, with a minimum bore of 35 mm.

F.4 Test procedure

The vertical transparent tube is sealed to the middle of a test piece placed horizontally on a transparent container. The tube is filled with water and maintained at a height of about 250 mm, measured from the upper surface of the test piece, and the level is maintained constant. Place the specimens in a controlled environment of 23 °C ± 10 °C and (50 ± 20) % relative humidity so that the underside of the sheet can be viewed without moving the specimen during the test. After 24 h, examine the under face for the presence of water drops. Report the visual condition of the specimen.

F.5 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates from which the sample slate is taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test temperature and condition of the test piece;

f) visual condition of the test specimen at conclusion of test;

g) date of the test.

Annex G
(normative)

Test method for the evaluation of the freeze-thaw performance of fibre-cement slates

G.1 General

This annex gives the details of the apparatus and testing procedure required to evaluate the freeze-thaw performance of fibre-cement slates.

G.2 Principle

Paired fibre-cement slate specimens are taken from sample slates. One specimen of each pair is subjected to a number of test cycles comprising a period of immersion in warm water followed by freezing. A comparison is made of the bending moments of the specimens exposed to freeze-thaw test cycling with those of the unexposed specimens.

G.3 Apparatus

G.3.1 Freeze unit, having forced-air circulation, with air temperature control capable of reaching the temperature of −20 °C ± 2 °C within 1 h to 2 h with a full load of specimens.

G.3.2 Water-bath, filled with water at a temperature of 20 °C ± 4 °C.

The water in the water bath should be saturated with soluble salts derived from the fibre-cement slates.

G.3.3 Test equipment, for determining the bending moment (see Annex C)

G.4 Test procedure

The test procedure is carried out as follows.

a) Divide the slate specimen pairs (see 7.3.5.2) to form two sets of 10 specimens each.

b) Condition one set of 10 specimens to the type test conditioning requirements detailed in Table 7. Following the conditioning period, determine the bending moments of these specimens according to the test method given in Annex C. Record the results.

c) Immerse the second set of 10 specimens in a water bath at ambient temperature (> 5 °C) for 48 h.

d) Remove samples from the water bath and subject the specimens to 100 freeze-thaw test cycles consisting of

   1) cooling in air to −20 °C ± 2 °C in not less than 1 h and not more than 2 h; the specimens shall be held at this temperature for 1 h, and

   2) thawing in water to reach 20 °C ± 2 °C within 1 h to 2 h maximum and holding in this condition for 1 h; if necessary, the specimens shall be maintained in water at 20 °C ± 2 °C before recommencement of the cyling.

Each freeze-thaw cycle shall take between 4 h and 6 h in total.

An interval between cycles of up to 72 h is permissible. During such an inverval specimens should be stored in warm conditions above 20 °C.

An alternative method in which the saturation of the specimen is ensured by sealing the saturated specimens in plastic bags may be used where suitable automatic equipment for the preferred method is not available.

NOTE During the cooling and heating (freezing and thawing) cycles, position the specimens to allow the circulation of the heat-conducting medium (i.e. air or water) around them.

e) Repeat d) for the prescribed number of freeze-thaw cycles.

f) When e) has been completed, condition the immersed specimens to the conditioning requirements detailed in Table 7, then determine the bending moments of these specimens according the test method given in Annex C. Record the results.

G.5 Calculation of results

For each pair of specimens, i (i = 1 to 10), calculate the individual ratio, R_{mi}, from Equation (G.1):

$$R_{mi} = M_{fi} / M_{fci} \quad \text{(G.1)}$$

where

M_{fi} is the bending moment at fracture of the ith test specimen after the freeze-thaw cycling;

M_{fci} is the bending moment at fracture of the ith reference test specimen (from the first batch).

Calculate the average, R, and standard deviation, s, of the individual ratios, R_{mi}.

Calculate the lower estimation, R_L, of the mean of the ratios at the 95 % confidence level (see ISO 2602) from Equation (G.2):

$$R_L = R - 0{,}58s \quad \text{(G.2)}$$

Record the result and assess the ratio against the specifications of 5.5.5.

G.6 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates from which the sample slates are taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test conditions and the number of cycles;

f) bending moments of exposed and unexposed specimens;

g) calculated individual ratios and the lower estimate of the mean of ratios at the 95 % confidence level of the bending moments of exposed and unexposed specimens;

h) date of the test.

Annex H
(normative)

Test method for the evaluation of heat-rain performance of fibre-cement slates

H.1 General

This annex gives the details of the apparatus and testing procedure required to evaluate the heat-rain performance of fibre-cement slates.

H.2 Principle

Sample slates are fixed to a framing system to simulate a typical roof installation system. The test assembly is subjected to a number of test cycles comprised of a water spray and radiant heating. A visual assessment of the slate performance is made.

H.3 Apparatus

H.3.1 Apparatus, with an inclined frame to which the slates shall be fixed.

Spacing of framing members and type of material used shall be specified by the manufacturer. The inclination of the frame shall be 35° ± 10°. The total area of the slates to be tested shall be approximately square, from 1 m^2 to 3 m^2 depending on the slate size, and shall contain not less than 11 full slates.

H.3.2 Water-spray system, capable of completely wetting the slate faces, having a water flow rate of approximately 1 l/(m^2 min).

H.3.3 Device, capable of heating and uniformly maintaining the surface temperature of the test elements within the following specified temperature requirements.

a) The heating device shall be controlled via a black-body sensor positioned at the central area of the test rig where the maximum temperature is expected. It should provide an approximately uniform power output during the heating period.

b) The temperature at the sensor location shall be maintained at 70 °C ± 5 °C and this temperature shall be reached within 15 min of the commencement of heating.

c) The difference between the black-body temperature in the centre of the rig and the edges of the rig shall not exceed 15 °C.

H.3.4 Control system, capable of providing test cycles complying with Table H.1.

H.4 Test procedure

The test procedure is carried out as follows.

a) Assemble the test rig in accordance with national standards or codes or, in their absence, manufacturer's recommendations.

b) Subject the assembled frame to the water spray and drying cycle given in Table H.1.

c) Repeat b) for the prescribed number of cycles (refer 5.5.6).

d) Visually inspect the test assembly and record its condition.

Table H.1 — Heat-rain cycle

Cycle	Duration
Water spray Pause Radiant heat Pause	2 h 50 min ± 5 min 5 to 10 min 2 h 50 min ± 5 min 5 to 10 min
Total cycle	5 h 55 min ± 15 min

H.5 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) details necessary for complete identification of the batch of slates from which the sample slates are taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test temperature and condition of the test pieces;

f) visual condition of the test specimens at conclusion of test;

g) date of the test.

Annex I
(normative)

Test method for the warm-water evaluation test for fibre-cement slates

I.1 General

This annex gives details of the test procedure and apparatus required to perform the warm-water evaluation test for fibre-cement slates.

I.2 Principle

Paired fibre-cement slate specimens are taken from sample slates. One specimen of each pair is subjected to a period of immersion in warm water. A comparison is made of the bending moments of the warm-water-immersed specimens with those of the “un-immersed” specimens.

I.3 Apparatus

I.3.1 **Water bath**, capable of being controlled to 60 °C ± 3 °C.

Water in the water bath should be saturated with soluble salts derived from fibre-cement slates. The pieces of product used shall be broken down to such a size, and be of sufficient quality, to ensure saturation is complete.

I.3.2 **Test equipment**, for determining the bending moment (see Annex C).

I.4 Procedure

The test procedure is carried out as follows.

a) Divide the slate specimen pairs (see 7.3.7.2) to form two sets of 10 specimens each.

b) Condition one set of 10 specimens to the conditioning requirements detailed in Table 7. Following the conditioning period, determine the bending moments of these specimens in accordance with the test method given in Annex C. Record the results.

c) Immerse the second set of 10 specimens in the water bath at a temperature of 60 °C ± 3 °C for a period of 56 days ± 2 days.

d) When c) has been completed, condition the immersed specimens to the conditioning requirements detailed in Table 7.

e) Determine the bending bending moments of these specimens in accordance with the test method given in Annex C. Record the results.

I.5 Calculation of results

For each pair of specimens, i (i = 1 to 10), calculate the individual ratio, R_{mi}, from Equation (I.1):

$$R_{mi} = M_{fi} / M_{fci} \quad \text{(I.1)}$$

where

M_{fi} is the bending moment at fracture of the ith specimen after the warm immersion;

M_{fci} is the bending moment at fracture of the ith reference specimen (from the first batch).

Calculate the average, R, and standard deviation, s, of the individual ratios, R_{mi} (see ISO 2602). Calculate the lower estimation, R_L, of the mean of the ratios at the 95 % confidence level (see ISO 2602) from Equation (I.2):

$$R_L = R - 0{,}58s \quad \text{(I.2)}$$

Record the result and assess the ratio against the specifications of 5.5.7.

I.6 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates from which the sample slates are taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test conditions;

f) bending moments of exposed and unexposed specimens;

g) calculated individual ratios and the lower estimate of the mean of the ratios at the 95 % confidence level of the bending moments of immersed and un-immersed specimens;

h) date of the test.

Annex J
(normative)

Test method for the soak-dry evaluation test for fibre-cement slates

J.1 General

This annex gives the details of the apparatus and testing procedure required to perform the soak-dry evaluation test for fibre-cement slates.

J.2 Principle

Paired fibre-cement slate specimens are taken from sample slates. One of each specimen pair is subjected to a number of test cycles comprising a period of immersion in warm water and drying in an oven. A comparison is made of the bending moments of the specimens exposed to soak-dry test cycling with those of the unexposed specimens.

J.3 Apparatus

J.3.1 **Oven**, ventilated, capable of maintaining a temperature of 60 °C ± 3 °C and a relative humidity of less than or equal to 20 % with a full load of specimens.

J.3.2 **Water bath**, at ambient temperature (> 5 °C).

The water in the water bath should be saturated with soluble salts derived from fibre-cement slates.

J.3.3 **Test equipment**, for determining the bending moment (see Annex C)

J.4 Test procedure

The test procedure is carried out as follows.

a) Divide the specimens pairs (see 7.3.5.2) to form two sets of 10 specimens each.

b) Condition one set of 10 specimens to the type test conditioning requirements detailed in Table 7. Following the conditioning period, determine the bending moments of these specimens according to the test method given in Annex C. Record the results.

c) Submit the second set of specimens to the following cycles:

   — immersion in water at ambient temperature (> 5 °C) for 18 h;

   — drying in a ventilated oven at 60 °C ± 3 °C and a relative humidity of less than 20 % for 6 h. The 20 % humidity shall be achieved for at least 3 h prior to the conclusion of the drying period.

d) Repeat c) for the prescribed number of soak-dry cycles. If necessary, an interval of up to 72 h between cycles is allowed. During this interval, the specimens shall be stored in immersed conditions.

e) When d) has been completed, condition the immersed specimens to the type test conditioning requirements detailed in Table 7, then determine the bending moments of these specimens according to the test method given in Annex C. Record the results.

J.5 Calculation of results

For each pair of specimens, i (i = 1 to 10), calculate the individual ratio, R_{mi}, from Equation (J.1):

$$R_{mi} = M_{fi} / M_{fci} \quad \text{(J.1)}$$

where

M_{fi} is the bending moment at fracture of the ith specimen after the warm immersion;

M_{fci} is the bending moment at fracture of the ith reference specimen (from the first batch).

Calculate the average, R, and standard deviation, s, of the individual ratios, R_{mi} (see ISO 2602). Calculate the lower estimation, R_L, of the mean of the ratios at the 95 % confidence level (see ISO 2602) from Equation (J.2):

$$R_L = R - 0{,}58s \quad \text{(J.2)}$$

Assess the ratio against the specifications of 5.5.8.

J.6 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) all details necessary for complete identification of the batch of slates from which the sample slates are taken;

c) dimensions of the test specimens;

d) test equipment details;

e) test conditions;

f) bending moments of exposed and unexposed specimens;

g) calculated individual ratios and the lower estimate of the mean of the ratios at the 95 % confidence level of the bending moments of immersed and un-immersed specimens;

h) date of the test.

Annex K
(informative)

Examples

K.1 Examples for dimension *h*

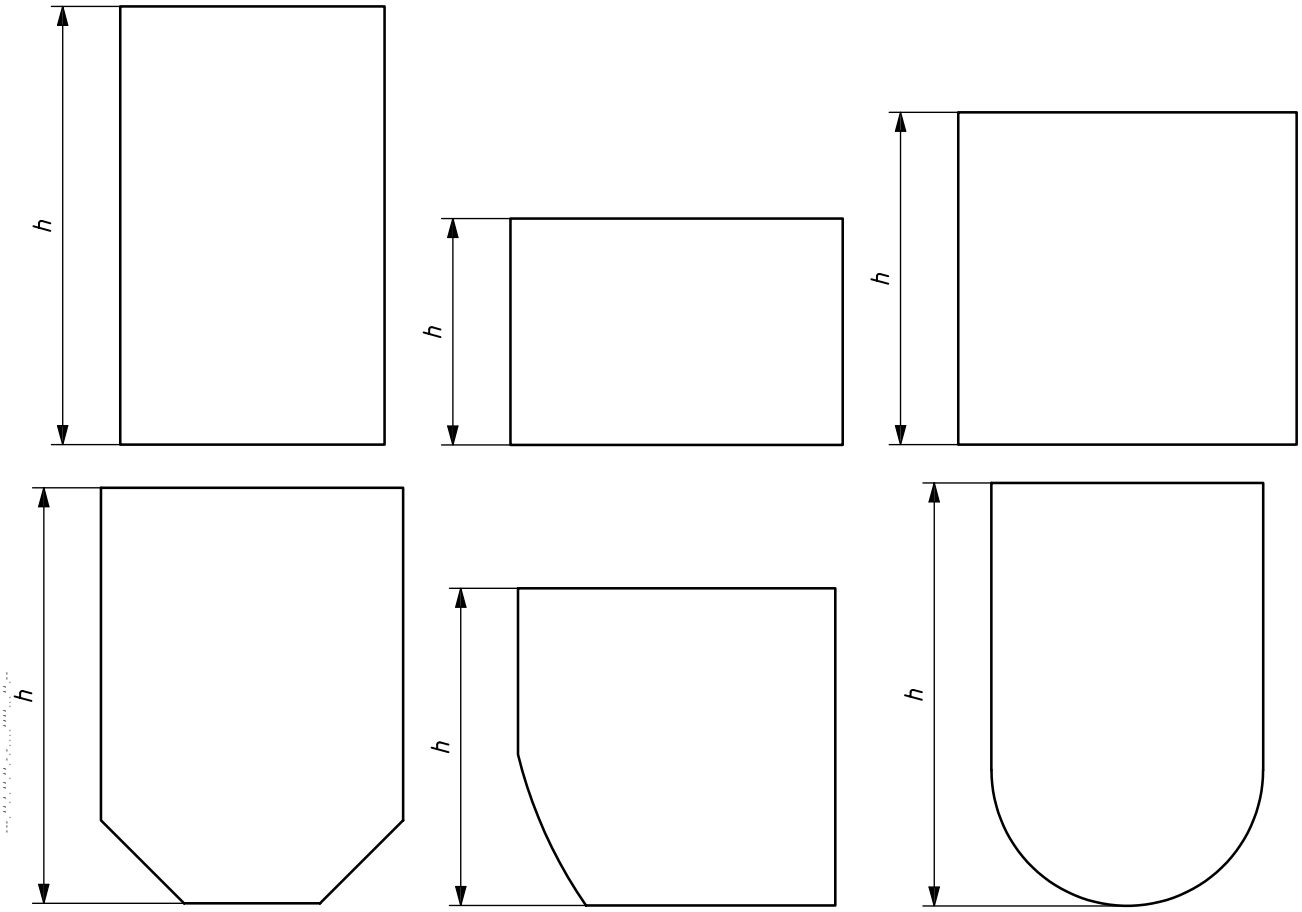


Figure K.1 — Examples of dimension *h* *(continued)*

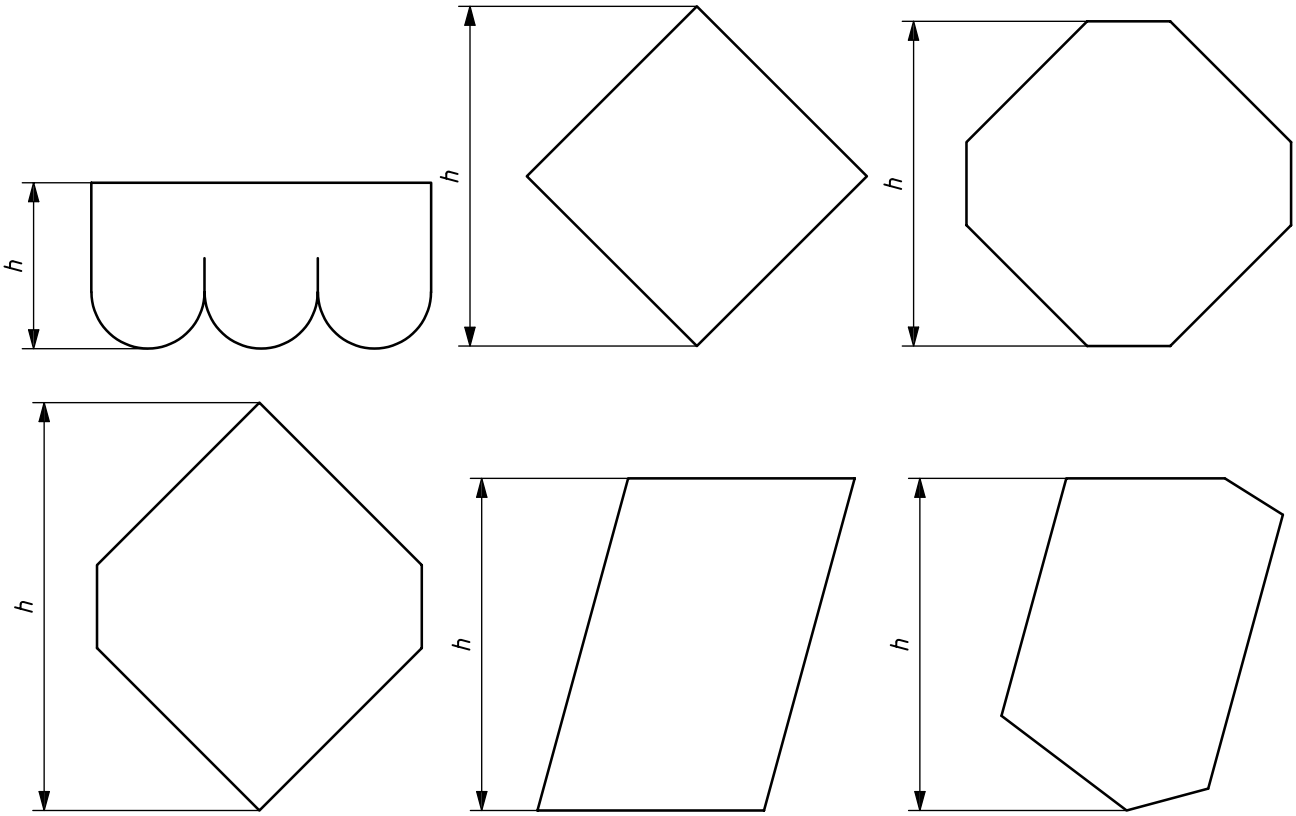


Figure K.1 — Examples of dimension h

K.2 Examples of installed fibre-cement slates showing the line of fixing

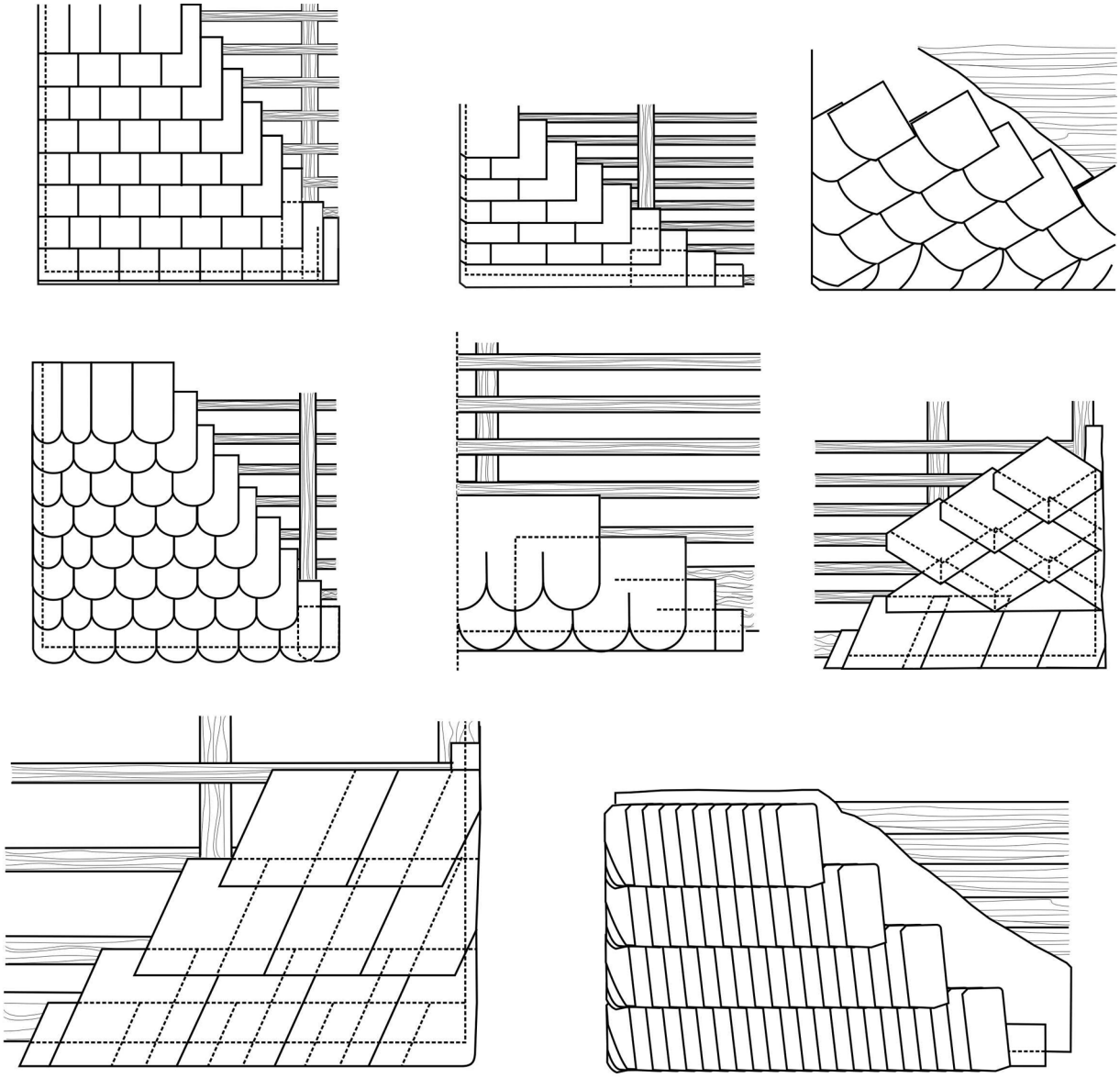


Figure K.2 — Examples of installed fibre-cement slates showing the line of fixing

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[1] ISO 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

[2] ISO 9001, *Quality management systems — Requirements*

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