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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.