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**AMENDMENT 1**  
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## **Fibre-cement siding shingles**

### **AMENDMENT 1**

*Bardeaux en fibres-ciment*

*AMENDEMENT 1*

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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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

Amendment 1 to ISO 9384:1991 was prepared by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*.

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# Fibre-cement siding shingles

## AMENDMENT 1

Page 1, Clause 2

Replace the contents of Clause 2 with the following:

### 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 395:1983, *Asbestos-cement slates*

ISO 2602:1980, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

Page 2, subclause 5.2

Replace the text and table by:

### 5.2 Mechanical characteristics

When tested as specified in 6.1.4, the shingles shall have a minimum modulus of rupture,  $R_f$ , at least equal to the values given in Table 1. This shall be the average of values obtained from testing the test specimen in both directions.

Table 1

Category	Minimum modulus of rupture	
	wet	ambient
I	7	10
II	13	16

Page 2

Add a new subclause, 5.3.6

#### 5.3.6 Soak dry

When shingles are tested as specified in 6.2.5, the limit  $L_i$  of the average ratio,  $r$ , as defined in 6.2.5.4, shall be greater than 0,75.

Page 2

Add a new subclause, 5.4

#### 5.4 Reaction to fire

The details of the specifications and acceptance criteria of reaction to fire may be defined by national standards.

Page 2, subclause 6.1.1

Replace the text by:

##### 6.1.1 General

The objective of an acceptance test is to establish whether a batch of products conforms to a specification. The tests are performed on samples drawn either from continuous production or from a consignment.

NOTE Test methods and specification limit values are defined in this International Standard. Sampling levels and acceptance criteria are defined in national documents or by default, in ISO 390.

Acceptance tests as described in 6.1.2 to 6.1.6. shall be performed on shingles as-delivered.

Page 3, subclause 6.1.4

Replace the text by:

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##### 6.1.4 Bending test (obligatory)

The test shall be carried out on full size shingles or cut specimens. These specimens shall be preconditioned in ambient (above 5 °C) or wet conditions or as specified by national standards. In the absence of national standards, this test shall be carried out on wet conditioned specimens (except for shingles of category 1, where the time of immersion shall be reduced to 2 h). Specimens shall be tested immediately after removal from water.

Page 3, subclause 6.1.4.1.2

Replace the text by:

6.1.4.1.2 **Micrometer**, reading to 0,05 mm with flat metal jaws between 6 mm and 15 mm in diameter.

Page 5, subclause 6.2.1

Replace the text by:

##### 6.2.1 General

A type-test is concerned with the approval of a new product and/or a fundamental change in formulation and/or method of manufacture. The test is performed on the as-delivered product. The test is required to demonstrate conformity of a generic product to a specification but is not required for each production batch.

The temperature and the relative humidity shall be indicated in the test report.

Page 5, subclause 6.2.3.1

Replace the text by:

### 6.2.3.1 Apparatus

The apparatus consists of any suitable construction with a vertical frame into which the shingles shall be mounted and alternately heated uniformly by radiant heat then sprayed with water.

The total area of the shingles to be tested shall be approximately square, between 3 m<sup>2</sup> and 5 m<sup>2</sup>.

The specimen shall be tested at 90° pitch for façades and at any angle defined by national standards for roofs.

**A water-sprinkling device**, with an output of approximately

1,0 l/min/m<sup>2</sup> for façades

2,5 l/min/m<sup>2</sup> for roofing

delivering water at an ambient temperature higher than 5 °C.

The heating device shall be calibrated in order to maintain a uniform black body<sup>7)</sup> surface temperature equal to 70 °C ± 5 °C for roofs and 60 °C ± 5 °C for façades, during the heating period.

It should provide an approximately uniform power output during this period.

Page 5, subclause 6.2.3.2

Replace the text by:

### 6.2.3.2 Procedure

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The test shall be carried out on full size shingles as delivered. The test specimens shall be submitted to a preliminary conditioning as follows:

- immersion for 24 h in water at ambient temperature (> 5 °C);
- storage for 7 d in a laboratory atmosphere with separation to allow air circulation.

The shingles shall be fixed according to national codes or, in their absence, manufacturer's recommendations.

The shingles shall be submitted to 25 test cycles of heat-rain, each part of the cycle having the duration as given in Table 2.

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7) For the definition of a black body see ASTM E 638-78. For this test an aluminium plate of 1 mm thickness painted with matt black paint is used as a black body.

The measurement device is a thermocouple or a similar device fixed on the surface of the aluminium plate.

Table 2 — Heat-rain cycle

Operation	Duration
Water spray 1,0 l/min/m <sup>2</sup> for façades 2,5 l/min/m <sup>2</sup> for roofs	2 h 50 min
Pause	10 min
Radiant heating 60 °C ± 5 °C for façades 70 °C ± 5 °C for roofs	2 h 50 min
Pause	10 min
Total	6 h

Page 6

Add a new clause, 6.2.5

**6.2.5 Soak dry** (optional)

**6.2.5.1 Preparation of specimen**

Sample 10 shingles, as delivered by the producer. Cut 10 sets of paired specimens to suit the bending test described in 6.1.4. Each pair of specimens shall be given the same number for later comparison of results.

**6.2.5.2 Apparatus**

The apparatus includes the following items:

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**6.2.5.2.1 ventilated oven**, capable of attaining a temperature of 60 °C ± 5 °C and a relative humidity ≤ 20 % with a full load of specimens.

**6.2.5.2.2 bath**, filled with water at ambient temperature of more than 5 °C.

**6.2.5.2.3 testing equipment**, for determination of bending strength as defined in 6.1.4.1.1.

**6.2.5.3 Procedure**

Divide the paired specimens to form two lots of 10 specimens each. After the conditioning procedure, submit the first lot of 10 specimens to the bending tests as described in 6.1.4.

At the same time submit the second lot to 25 soak dry cycles consisting of

- immersion in water at ambient temperature (above 5 °C) for 18 h;
- drying in a ventilated oven at 60 °C ± 5 °C and relative humidity < 20 % for 6 h.

If necessary, an interval up to 72 h between cycles is allowed. During this interval, the specimens shall be stored in immersed conditions.

After 25 cycles, place the specimens in a laboratory atmosphere for 7 d.

At the end of this period, carry out the wet bending test as specified in 6.1.4.1.1.



#### 6.2.5.4 Expression and interpretation of results

For each pair of specimens  $i$  ( $i = 1$  to  $10$ ), calculate the individual ratio,  $r_i$ , as follows:

$$r_i = R_{fi} / R_{fci}$$

where

$R_{fi}$  is the modulus of rupture of the  $i$ th test specimen after the soak-dry cycling;

$R_{fci}$  is the modulus of rupture of the  $i$ th reference test specimen (from the first lot).

Calculate the average,  $\bar{r}$ , and standard deviation,  $s$ , of the individual ratios,  $r_i$  (see ISO 2602). Calculate the 95 % lower confidence limit,  $L_i$ , of the average ratio  $\bar{r}$ , as follows:

$$L_i = \bar{r} - 0,58s$$

Assess the ratio against the specifications of 5.3.6.

*Page 6, subclause 8.1*

Replace the text by:

### 8.1 Conformity with requirements

The manufacturer shall establish and maintain an effective documented quality control system developed, e.g., on the basis of the standards of the series ISO 9000.

For the acceptance tests, 90 % of the delivered products shall fulfil the requirements of 5.1. to 5.3. In the absence of national documents, the sampling schemes prescribed in ISO 390 with an AQL of 4 % and an inspection level  $S_3$  ensure that for large batches approximately 90 % of the items fulfil these requirements. Other methods may be used provided they give the same level of quality.

For each type-test, in the absence of a fundamental change to the formulation and/or method of manufacture, results from one test performed should be taken as a reference of conformity to the specification.

### 8.2 Evidence of conformity of consignment of finished products

When tenders and/or orders do not specify receiving inspection, the lots delivered are presumed to be in conformity with this International Standard.

Inspection of a consignment of finished products should take place only where there is no third party certification.

It is conducted, e.g., in accordance with ISO 390, which gives an AQL of 4 % with an inspection level  $S_3$  and in accordance with Annex A.

For special applications, different levels of quality may be applied after agreement between manufacturer and purchaser.