
International Standard



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Asbestos-cement slates

Ardoises en amiante-ciment

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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International Standard ISO 395 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and was circulated to the member bodies in January 1982.

ISO 395:1983

It has been approved by the member bodies of the following countries:

[b8e4168fe6ef/iso-395-1983](#)

Austria	India	South Africa, Rep. of
Belgium	Israel	Spain
Brazil	Italy	Switzerland
China	Morocco	United Kingdom
Colombia	Netherlands	USA
Czechoslovakia	New Zealand	USSR
Egypt, Arab Rep. of	Poland	Yugoslavia
Finland	Portugal	
Greece	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
Germany, F. R.

This International Standard cancels and replaces ISO Recommendation R 395-1964, of which it constitutes a technical revision.

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Asbestos-cement slates

1 Scope and field of application

This International Standard specifies the characteristics and establishes methods of control and test as well as acceptance conditions for asbestos-cement slates and their fittings, used mainly as roofing and cladding materials.

It is applicable to slates of dimensions not exceeding 600 mm × 600 mm.¹⁾

The slates are classified in two categories according to their bending strength.

Flat sheets are covered by ISO 396, parts 1, 2 and 3, siding shingles by ISO 880 and non-combustible fibre reinforced boards by ISO 1896.

2 Reference

ISO 390, *Asbestos-cement products — Sampling and inspection*.

3 Slates

3.1 Composition

The asbestos-cement slates to which this International Standard is applicable consist essentially of an inorganic hydraulic binder²⁾ or a chemical combination of silica and inorganic binder (calcium silicate reaction) reinforced by asbestos fibres to which other fibres may be added. Fillers and pigments may also be added.

The slates may also receive coloured or uncoloured coatings on their surface.

3.2 General appearance and finish

The slates shall be smooth on one or both surfaces and shall have regular edges.

The slates may be supplied holed for fixing.

3.3 Characteristics

3.3.1 Geometrical characteristics

3.3.1.1 Shapes and sizes

The preferred shapes and sizes shall be specified in national standards.

3.3.1.2 Thicknesses

The actual average thickness, determined according to 3.4.1, shall not be less than that shown in table 1.

The difference between the largest and smallest thicknesses measured on one slate shall not exceed 10 % of the largest measured value.

Table 1

Dimensions in millimetres

Limiting sizes of slates	Minimum thickness
< 400 × 250	3
> 400 × 250	3,5

The nominal thickness shall be specified in national standards.

3.3.1.3 Tolerances on nominal dimensions

a) On length and width : ± 3 mm

b) On thickness : $\begin{matrix} +15 \\ -10 \end{matrix}$ %

1) Elements having a dimension greater than 600 mm may be used as fittings (see clause 4).

2) National standards may specify the binder to be used.

3.3.2 Mechanical characteristics

When tested as specified in 3.4.2, the slates shall have a minimum unit bending strength according to table 2, obtained on one and the same slate in the weaker direction.

Table 2

Category	Minimum unit bending strength* N/mm ² **
1	16
2	20

* The bending strength may be characterized by a breaking load. However, the corresponding strengths determined in the conditions specified in 3.4.2 shall be not less than the following

Category 1 : 16 N/mm²

Category 2 : 20 N/mm²

** 1 N/mm² = 1 MPa

NOTE — National standards may indicate the category or categories of their choice as a function of climatic conditions.

3.3.3 Physical characteristics

3.3.3.1 Watertightness

When tested as specified in 3.4.5, traces of moisture may appear on the underside of slates, but in no instance shall there be any formation of drops of water.

3.3.3.2 Frost cracking

Unless local conditions or national standards allow a derogation, slates shall comply with the following requirements. When tested as specified in 3.4.4, the slates shall

- a) not show any visible sign of cracking, structural alteration or delamination. This requirement does not apply to surface coatings;
- b) comply with the mechanical characteristics appropriate to the category as specified in table 2.

3.3.3.3 Apparent density

When tested as specified in 3.4.3, the slates shall have a minimum apparent density of 1,5 g/cm³. National standards may contain a higher minimum value, taking into account climatic conditions.

3.4 Tests

a) **Compulsory tests**

- Measurement of thickness (method specified in 3.4.1).
- Bending test (method specified in 3.4.2).
- Measurement of apparent density (method specified in 3.4.3).

b) **Optional tests**

- Frost cracking test (method specified in 3.4.4).
- Watertightness test (method specified in 3.4.5).

3.4.1 Measurement of thickness

The thickness shall be measured by means of a micrometer reading to 0,05 mm, having flat metal jaws at least 10 mm in diameter.

The arithmetic mean of four measurements taken at one point on each side of the slate shall be not less than the minimum provided for in table 1 and shall be within the tolerances fixed in 3.3.1.3. It shall be verified that the maximum difference between the largest and smallest measured thicknesses does not exceed the tolerances specified in 3.3.1.3.

3.4.2 Bending test

The test may be carried out on full size slates. Before testing, they shall be immersed in water for 24 h.

3.4.2.1 Apparatus

Bending test machine, comprising

- a) two parallel supports in the same horizontal plane, the upper face of each being rounded to a radius of 3 to 25 mm. The distance between the centres of the supports shall be 160 or 200 mm;¹⁾
- b) a loading bar identical to the two supports, situated parallel to and equidistant from the supports.

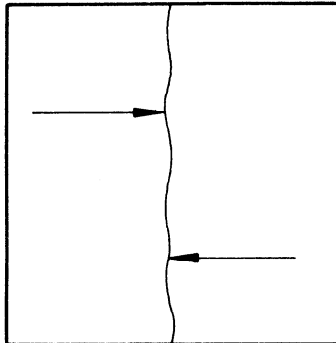
3.4.2.2 Procedure

Arrange the slate with the underside against the supports and load the test piece along its centre line by means of the loading bar.

Increase the load at a constant speed of 100 N/s up to breaking point.

1) For slates with one dimension smaller than 160 mm, the distances between the supports are reduced.

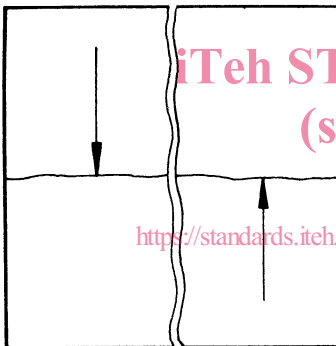
Measure the thickness at two points along the section of breakage as indicated below.



Reassemble the broken pieces.

Submit the reassembled slate to another bending test with the line of load application at right angles to that of the first test.

Measure the thickness of the slate at two points along the new section of breakage as indicated below.



3.4.2.3 Expression of results

The unit bending strength R_f , in newtons per square millimetre, is given by the formula

$$R_f = \frac{M}{W}$$

where

$$M = \frac{Pl}{4}$$

$$W = \frac{be^2}{6}$$

and

P is the breaking load, in newtons;

l is the clear span between the supports, in millimetres;

e is the average value of the thickness of the slate (arithmetic mean of four measurements) taken at the breaking sections, in millimetres (see 3.4.2.2);

b is the dimension of the slate (length or width), measured parallel to the supports, in millimetres.

The test is considered to be satisfactory if it conforms with the requirements of 3.3.2.

3.4.3 Measurement of apparent density

3.4.3.1 Procedure

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

Determine the mass by drying out the test piece in an oven maintained at 100 to 105 °C until the difference between two consecutive weighings made at an interval of not less than 2 h is less than 0,1 g.

Determine the volume by a method having an accuracy of 2 %. In the case of immersion in water, the test piece shall be saturated in water beforehand.

3.4.3.2 Expression of results

The apparent density is given by the formula

$$\frac{m}{V}$$

where

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

V is the apparent volume, in cubic centimetres, of the test piece.

The test is considered to be satisfactory if it conforms with the requirements of 3.3.3.3.

3.4.4 Frost cracking test

After immersion for 48 h in water at ambient temperature (at least 5 °C), the slates shall be submitted to alternate freezing and thawing between temperatures of -20 and +20 °C. The number of cycles and the duration of the test at the extreme temperatures shall be specified in national standards. The test is considered to be satisfactory if the slates satisfy the specifications of 3.3.3.2.

3.4.5 Watertightness test

The watertightness shall be checked on slates, in air with a relative humidity of over 70 %. A vertical transparent tube 300 mm long with a bore of minimum 35 mm is sealed to the middle of a test piece placed horizontally on a transparent container. The tube is filled with water to a height of about 250 mm, measured from the upper surface of the test piece, and the level is maintained constant for 24 h. The test is considered to be satisfactory if it conforms with the requirements of 3.3.3.1.

3.5 Marking

Marking shall ensure that the product and its classification can be precisely identified. The method of marking shall be stated in the manufacturer's catalogue.

4 Fittings in asbestos-cement

4.1 Composition

See 3.1.

4.2 General appearance and finish

The fittings shall have regular edges; they may be supplied holed for fixing.

4.3 Characteristics

4.3.1 Geometrical characteristics

4.3.1.1 Shapes

The dimensions and the shapes of the fittings shall be chosen so as to combine satisfactorily with the slates in order to allow the construction of watertight roofs.

4.3.1.2 Thickness

The nominal thickness of the fittings shall be not less than the corresponding nominal thickness of the slates with which the fittings are to be used.

4.3.1.3 Tolerances on dimensions

- a) On length and width : $\pm 2,5$ % with a maximum of ± 5 mm
- b) On thickness : $\begin{matrix} +25 \\ -10 \end{matrix}$ %

4.3.2 Physical characteristics

4.3.2.1 Watertightness

When tested as specified in 3.4.5 (optional test), traces of moisture may appear on the lower surface of fittings, but in no instance shall there be any formation of drops of water.

4.3.2.2 Frost cracking

If local conditions justify it or if national standards specify it, slates fittings having been tested as provided for in 3.4.4 (optional test), a visual examination shall not show any sign of cracking, surface alteration or delamination. This specification does not apply to surface coatings.

4.4 Marking

The marking of fittings shall be similar to that of the slates (see 3.5).

5 Sampling, inspection and acceptance

5.1 General

Enquiries and orders shall specify whether or not acceptance tests are required and, if so, which tests. Otherwise, the purchaser is presumed not to require acceptance tests.

5.2 Inspection of each item of the consignment

5.2.1 The required general appearance and finish (see 3.2 and 4.2), the geometrical characteristics (see 3.3.1 and 4.3.1) of the slates and fittings may be verified on each item of the consignment if they do not conform to the acceptance requirements foreseen in ISO 390.

5.2.2 Slates and fittings which do not satisfy the requirements when submitted to inspection of each item of the consignment (see 5.2.1) may be rejected.

5.3 Inspection by sampling

5.3.1 The required mechanical characteristics¹⁾ (see 3.3.2) and the physical characteristics (see 3.3.3 and 4.3.2) of the slates and fittings shall be verified, if requested, by sampling.

5.3.2 The procedure specified in ISO 390 applies to the sampling, inspection and acceptance. Each inspection lot shall include only items of the same size. The maximum and minimum inspection lots shall be agreed between the manufacturer and the purchaser; failing such an agreement, these shall be 20 000 and 3 000 slates and 1 500 and 200 fittings respectively.

1) For slates only.

Annex A

Acceptance conditions

(This annex forms part of the standard.)

A.1 Carrying out tests

Unless agreed otherwise, the purchaser shall inform the manufacturer, when ordering, which tests (see 3.4) are required. The tests shall be carried out at a time and place fixed by agreement.

A.2 Access to the works

The purchaser shall have access to the place of testing and to the stocks for the sole purpose of inspecting and testing the materials which he has ordered at any time agreed with the manufacturer.

A.3 Costs of testing

The following tests only should be carried out at the expense of the manufacturer :

- the compulsory tests;
- the optional tests called for when the order is placed;
- the optional tests asked for after ordering and resulting in rejection of the lot.

By agreement between the manufacturer and the purchaser when ordering, additional tests may be carried out at the purchaser's expense, at the works or in an independent laboratory designated by agreement. The manufacturer shall have the right to be represented.

A.4 Inspection of each item of the consignment

In order to reduce the duration and the costs of the acceptance operations in practice, the inspection of the characteristics made on each item of the consignment (see 5.2.1) may, at the purchaser's request, be replaced by an inspection by sampling.

In this case, if the results of the inspection tend to lead to rejection of the lot, the manufacturer may ask for a 100 % inspection on all items of the consignment with regard to the failing characteristic (rejection according to 5.2.2).

A.5 Period for testing

All tests shall be completed before delivery of the consignment and at the latest four weeks after the date of sampling.

A.6 Manufacturer's certificate

A.6.1 Orders with acceptance tests

If the purchaser or his representative is not present at all or part of the tests, the manufacturer shall supply the purchaser with a certificate that the slates and fittings satisfied the tests he was unable to witness.

A.6.2 Orders without acceptance tests

For orders without acceptance tests, the manufacturer is considered to have discharged his obligations on completion of delivery.