International Standard 880

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Asbestos-cement siding shingles

Bardeaux en amiante-ciment

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Foreword

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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.

International Standard ISO 880 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and was circulated to the member bodies in May 1979.

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

Australia	France	New Zealand
Austria	Greece	Poland
Belgium	India	Portugal
Brazil	Ireland	Romania
Bulgaria	Israel	Spain
Chile	Italy	Switzerland
Colombia	Korea, Rep. of	Thailand
Czechoslovakia	Libyan Arab Jamahiriya	USSR
Egypt, Arab Rep. of	Mexico	Yugoslavia
Finland	Netherlands	

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

Germany, F. R.
Norway

This International Standard cancels and replaces ISO Recommendation R 880-1968, of which it constitutes a technical revision.

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Asbestos-cement siding shingles

1 Scope and field of application

This International Standard specifies the characteristics of, and establishes the testing methods for, asbestos-cement siding shingles.

Siding shingles are flat elements for external cladding, formed by overlapping or juxtaposing of these elements.

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

2 Composition

The asbestos-cement siding shingles to which the present International Standard applies consist essentially of an inorganic hydraulic binder[1] or a chemical combination of silica and an inorganic binder (calcium silicate reaction) reinforced by asbestos fibres to which other fibres may be added.

Fillers and pigments may be added.

3 General appearance and finish

Siding shingles may be left in their natural colour or may be coloured in the mass; they may also receive surface coloured or uncoloured coatings.

The exposed surface may be smooth, granular or ribbed (not even). The edges shall be straight and cut square. Siding shingles may be supplied holed for fixing.

4 Characteristics

4.1 Geometrical characteristics

4.1.1 Size

150 mm × 600 mm

(200 mm × 600 mm)

300 mm × 600 mm

NOTES

1 Sizes not in brackets are preferred.

2 Smaller sizes than 600 mm may be manufactured by agreement between the customer and manufacturer.

4.1.2 Nominal thickness

4.1.2.1 Smooth siding shingles

Preferred thickness : 4 mm

4.1.2.2 Shingles with granular added coating and ribbed (not even) shingles

The thickness is determined by agreement between user and manufacturer.

4.1.3 Tolerances on dimensions

On length and width : ± 2 mm

On thickness :

a) smooth siding shingles : ± 0,5 mm

b) shingles with granular added coating and ribbed (not even) shingles : ± 25 %

The method of measuring the thickness is specified in 5.1.

4.1.4 Tolerance on shape

4.1.4.1 Straightness of edges

On width : ± 1 mm

On length : ± 2 mm

4.1.4.2 Squareness

The tolerance on squareness of the edges is maximum 0,3 %.

4.2 Physical characteristics

4.2.1 Density

When tested in accordance with 5.2.1, the siding shingles shall have a minimum density of 1,2 g/cm^3. The national standards may choose a higher value in function of the climatic conditions.

4.2.2 Watertightness

When tested in accordance with 5.2.2, traces of moisture may appear on the lower surface of the shingles, but in no instance shall there be any formation of drops of water.

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

4.2.3 Frost cracking

In local conditions justify it or if national standards specify it shingles having been tested as provided for in 5.2.3, a visual examination shall not show any sign of cracking, surface alteration or delamination. This specification does not apply to surface coating.

When submitted to frost cracking test, they shall comply with the mechanical characteristics provided for in 4.3.

4.3 Mechanical characteristics

When tested in accordance with 5.3, the siding shingles shall have a minimum unit bending strength in the weak direction as given in the table.

Table

Category	Unit bending strength
	N/mm^2
1	12
2	18

NOTES

1 For ribbed (not even) shingles and those with an added granular coating, the breaking load shall be at least equal to that indicated in the formula in 5.3.3.2.

2 National standards may indicate the category or categories of their choice in function of climatic conditions.

5 Methods of testing

a) Compulsory tests

— Determination of the thickness (method specified in 5.1) for smooth siding shingles.

— Bending test (method specified in 5.3).

— Determination of apparent density (method specified in 5.2.1).

b) Optional tests

— Measurement of the thickness (method specified in 5.1) for shingles with added granular coating and ribbed shingles.

— Determination of the length and width.

— Determination of the straightness of the edges.

— Determination of the squareness.

— Watertightness (method specified in 5.2.2).

— Frost cracking test (method specified in 5.2.3).

5.1 Geometrical control — Determination of thickness

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

The arithmetical average of four measurements taken at one point along each side of the shingle shall be not less than the minimum nominal value given by the manufacturer within the tolerances indicated in 4.1.3.

5.2 Physical tests

5.2.1 Determination of apparent density

5.2.1.1 Procedure

The test piece shall preferably be a specimen used for the bending test.

Determine the mass by drying out the test piece in an oven controlled 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 using a method having an accuracy of 2 %. In the case of immersion in water, the test piece shall be saturated in water beforehand.

NOTE — For shingles having an added granular coating, this coating shall be removed for the test.

5.2.1.2 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.

It shall be not less than the value given in 4.2.1.

5.2.2 Watertightness test

Watertightness should be controlled on shingles, which have been kept in air with a relative humidity of over 70 %. Seal a vertical transparent tube 300 mm long with a bore of minimum 35 mm to the middle of a test piece placed horizontally on a transparent container. Fill the tube with water and maintain the level at a height of about 250 mm measured from the upper surface of the test piece.

During the 24 h of the test, traces of moisture may appear on the lower surface, but in no instance shall there be any formation of drops of water.

5.2.3 Frost cracking test

The shingles, after immersion for 48 h in water at 23 ± 2 °C are submitted to alternate freezing and thawing between temperatures of −20 °C and + 20 °C. The number of cycles and the duration of the tests at the extreme temperature shall be in accordance with local conditions.

The test is considered to be satisfactory if the sidings meet the requirements of 4.2.3.

5.3 Mechanical test

The test may be carried out on full-size shingles. Before testing, immerse them in water for 24 h.

5.3.1 Test equipment

Load test machine, comprising :

a) two parallel supports with a distance between their centres of 120 or 200 mm in the horizontal plane. The upper faces of the supports which are in contact with the specimen shall be rounded and shall have a radius of from 3 to 25 mm;

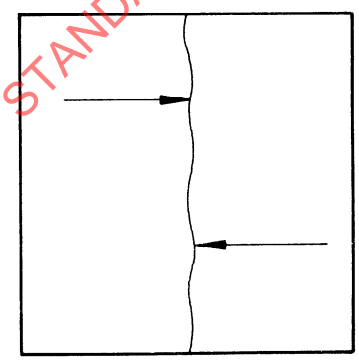
b) loading bar identical to the two supports shall be situated above the specimen so that it is parallel to the supports and at an equal distance from each.

5.3.2 Procedure

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

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

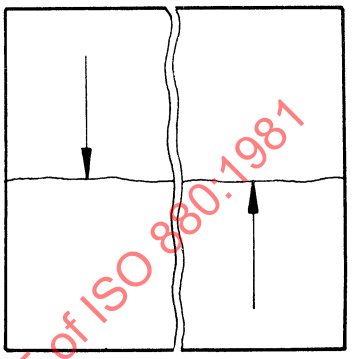
Measure the thickness at two points along the section of breakage as indicated below :[1)]



Reassemble the broken pieces.

Submit the reassembled siding shingle to a second bending test with the line of load application at right angles to that of the first test.

Measure the thickness of the siding shingle in two points along the new section of breakage as indicated below :[1)]



5.3.3 Expression of results

5.3.3.1 Smooth shingles

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

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

where

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

P being the breaking load, in newtons,

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

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

b being the dimension of the board (length or width) measured parallel to the supports, in millimetres;

e being the average value of the thickness of the siding shingle (arithmetical average of four measurements) taken at the breaking sections, in millimetres (see 5.3.2).

The unit bending strength R_f for one shingle board is the lowest value obtained on the same shingle. It shall be not less than 12 N/mm² for category 1 and 18 N/mm² for category 2.

1) Only for smooth shingles.

5.3.3.2 Shingles with an added granular coating or ribbed (not even) shingles

The minimum bending load at rupture P, in newtons, for one shingle is the lowest value obtained from the same shingle. It shall be not less than

$$P = \frac{2R_f\, b\, e^2}{3l}$$

where

R_f = 12 N/mm² or 18 N/mm² according to table 1;

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

e = 3,5 mm;

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

6 Marking

Marking shall ensure that a precise identification of the product and its classification can be made.

The method of marking shall be stated in the manufacturer's catalogue.

7 Sampling, inspection and acceptance

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.

7.1 Inspection of each item of the consignment

7.1.1 The required general appearance and finish (see clause 3), the geometrical characteristics (see 4.1) of the shingles may be verified on each item of the consignment if they do not conform to the acceptance requirements foreseen in ISO 390.

7.1.2 The shingles which do not satisfy the requirements when submitted to inspection of each item of the consignment (see 7.1.1) may be rejected.

7.2 Inspection by sampling

7.2.1 The required mechanical characteristics (see 4.3) and the physical characteristics (see 4.2) of the shingles shall be verified, if requested, by sampling.

7.2.2 The procedure in ISO 390 applies for 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 shingles respectively.

Annex A

Acceptance test

(This annex forms part of the standard.)

A.1 Carrying out of tests

Unless agreed otherwise, the purchaser shall inform the manufacturer, when ordering, which tests (see clause 5) 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 :

— compulsory tests;

— optional tests called for when the order is placed;

— 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 7.1.1) may, at the purchaser's request, be replaced by an inspection by sampling.

In this case, if the inspection results tend toward the 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 7.1.2).

A.5 Period for testing

All tests shall be completed before delivery of the consignment and at the latest 4 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 siding shingles 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.

Annex B

Extracts from ISO 390,

Asbestos-cement products — Sampling and inspection

4 Division of consignment into inspection lots

4.1 Homogeneous consignments

4.1.1 Any homogeneous consignment (or sub-consignment, see 4.2) shall be divided by the manufacturer into inspection lots, the maximum size of which shall be as given in the relevant International Standard.

4.1.2 Any fraction of a consignment remaining after removal of the the highest possible number of maximum inspection lots and any homogeneous consignment (or sub-consignment) smaller than the maximum lot size, shall form an inspection lot if larger than the minimum lot size given in the relevant International Standard.

4.1.3 Consignments or fractions of consignments smaller than the minimum lot size given in the relevant International Standard shall not be submitted to sampling and testing.

4.2 Non-homogeneous consignments

Any consignment which is known to be or is expected to be non-homogeneous as regards any of the properties to be tested by sampling shall be divided by the manufacturer into assumed homogeneous sub-consignments prior to the division into inspection lots in accordance with 4.1.

5 Sampling

5.1 From each inspection lot (4.1.1 and 4.1.2), the purchaser may draw a sample, the size of which is indicated in table 1 (see 5.2 and 5.3).

5.2 The entry to table 1 is the number of units of product in the inspection lot (column 1), the sample size being indicated in column 2.

5.3 For products where all units undergo a compulsory non-destructive test during manufacture[1], the reduced sample size obtained by entering table 1 at column 7 may be applied.

5.4 The possibility mentioned in 5.3 is also available when the manufacturer guarantees his production or has it guaranteed by an independent control organization[2].

5.5 When test pieces are cut from the units of the sample, the cutting shall be carried out by the manufacturer in the presence of the purchaser.

5.6 When the relevant International Standard calls for more than one property to be tested, the sample size shall be appropriately multiplied so as to secure for each test a number of test pieces equal to the sample size (see 5.2 and 5.3). From one unit of a sample, one test piece only shall be cut for a particular test, but for different tests, the necessary test pieces may be cut from the same unit of the sample.

7 Determination of acceptability of inspection lots

7.1 Inspection by attributes

7.1.1 When the number of non-conforming units found in the sample is equal to or less than the acceptance number Ac_1 indicated in column 3 of table 1, the inspection lot from which the sample was drawn shall be considered acceptable.

7.1.2 When the number of non-conforming units found in the sample is equal to or greater than the rejection number Re_1 indicated in column 4 of table 1, this may justify rejection of the inspection lot.

7.1.3 When the number of non-conforming units found in the sample lies between the acceptance number and the rejection number (columns 3 and 4 of table 1), a second sample of the same size as the initial sample (5.2, 5.3 and 5.4) shall be drawn and examined.

7.1.4 The second sample shall be inspected as indicated in 5.5 and 5.6.

7.1.5 The number of non-conforming units found in the initial and in the second samples shall be totalled.

1) Such as the watertightness test for pipes.

2) For example, use of statistical quality control methods in the works.

7.1.6 If the total number of non-conforming units is equal to or less than the acceptance number Ac_2 indicated in column 5 of table 1, the inspection lot shall be considered acceptable.

7.1.7 If the total number of non-conforming units is equal to or greater than the second rejection number Re_2 indicated in column 6 of table 1, this may justify rejection of the inspection lot.

7.1.8 When the relevant International Standard calls for more than one property to be tested, the second sample taken (see 7.1.3) shall only be inspected in accordance with those tests which at the inspection of the initial sample gave numbers of non-conforming units between the acceptance number Ac_1 and the rejection number Re_1.

Table 1[1)]

1	2	3	4	5	6	7	8
Size of inspection lot	**Sample size**	**Initial sample**		**Initial + second samples**		**Size of inspection lot for products tested during manufacture**	**Inspection by variables**[2)]
		Acceptance number Ac_1	**Rejection number** Re_1	**Acceptance number** Ac_2	**Rejection number** Re_2		**Acceptability criterion** k
up to 100	3	0	2	1	2	up to 200	0,29
101 to 200	4	0	2	1	2	201 to 400	0,34
201 to 400	5	0	2	1	2	401 to 800	0,37
401 to 800	7	0	2	1	2	801 to 1 500	0,40
801 to 1 500	10	0	2	2	3	1 501 to 3 000	0,50
1 501 to 3 000	15	0	3	3	4	3 001 to 8 000	0,51
3 001 to 8 000	25	1	4	5	6	8 001 to 20 000	0,52
8 001 to 20 000	35	2	5	7	8	—	0,53

1) For the method of inspection by variables, see ISO 390.

2) For the simultaneous inspection of the two limits of a given property, see ISO 390.