International Standard 396/3

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Products in fibre reinforced cement — Part 3 : Cellulose-asbestos-cement flat sheets

Produits en ciment renforcé par des fibres — Partie 3 : Plaques planes en amiante-ciment-cellulose

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (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 set up 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.

International Standard ISO 396/3 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and was circulated to the member bodies in December 1978.

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

Australia	Germany, F.R.	Portugal
Austria	Greece	Romania
Belgium	India	Switzerland
Brazil	Ireland	Thailand
Bulgaria	Israel	Turkey
Canada	Italy	United Kingdom
Czechoslovakia	Korea, Rep. of	USSR
Egypt, Arab Rep. of	Mexico	Yugoslavia
Finland	Netherlands	
France	New Zealand	

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

South Africa, Rep. of
Spain

This International Standard cancels and replaces ISO Recommendation R 396-1964, of which it constitutes a technical revision.

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Products in fibre reinforced cement — Part 3 : Cellulose-asbestos-cement flat sheets

1 SCOPE

This part of ISO 396 specifies the characteristics of cellulose asbestos-cement flat sheets, and establishes the control and testing methods for the verification and determination of the specified values.

The sheets are classified in three categories according to the value of the minimum bending strength.

Asbestos-cement flat sheets are dealt with in ISO 396/1 and silica asbestos-cement flat sheets in ISO 396/2.

2 FIELD OF APPLICATION

This part of ISO 396 is applicable to cellulose asbestos-cement flat sheets consisting essentially of an inorganic hydraulic binder or a chemical combination of silica and inorganic hydraulic binder[1)] reinforced by asbestos and cellulose fibres to which other fibres may be added.

Fillers and pigments which are compatible with asbestos-cement may be added.

It is not applicable to the following products :

a) asbestos-cement flat sheets;

b) silica asbestos-cement flat sheets;

c) non-combustible fibre reinforced boards of calcium silicate or cement for insulation and fire protection (ISO 1896).

3 REFERENCES

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

ISO 1006, *Modular co-ordination — Basic module.*

4 CHARACTERISTICS

4.1 Geometrical characteristics

4.1.1 Dimensions

TABLE 1 — **Dimensions**

Dimensions in millimetres

Length \ Width	900	1 200	1 500
(1 200)			
1 500		X	
1 800	X	X	
2 000		X	
2 100	X	X	
2 400	X	X	
2 500		X	
2 700	X	X	
2 800		X	
3 000	X	X	X
(3 600)			

NOTES

1 Where sheets are for use in dimensionally co-ordinated construction, the tolerances on length and width shall be expressed as negative deviations from the dimensions given in table 1 which shall be regarded as co-ordination dimensions.

2 The dimensions (width and length) shown in table 1 may be increased by 20 mm to 30 mm (oversize sheets) for applications where the sheet is required to be cut by the user.

3 Values which are not in brackets are preferred sizes.

4 Other dimensions may be supplied by mutual agreement between the purchaser and the manufacturer.

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

4.1.2 Thicknesses

The thickness range for standard sheets is :

— Primary series (A series) : 3 - 5 - 8 - 10 - 15 - 20 mm

— Secondary series (B series) : 2 - 4 - 6 - 8 - 10 - 12 - 15 - 20 mm

4.1.3 Tolerances on dimensions

On length and width :

± 0,5 %, with a maximum of ± 8 mm

These tolerances are not applicable to oversize sheets. The method of measurement is given in 5.1.2.

On thickness e :

— from 3 to 5 mm : ± 0,5 mm

— from 6 to 25 mm : ± 0,1 e mm (± 10 %)

The maximum difference between extreme values of the thickness measurements within a sheet shall not exceed 10 % of the maximum measured value.

The method of measurement is given in 5.1.3.

NOTE — Closer tolerances may be adopted by agreement between the manufacturer and the purchaser.

4.1.4 Tolerances on shape

(Not applicable to oversize sheets).

4.1.4.1 Straightness of edges

The tolerance on the straightness of edges is 2 mm/m for the relevant dimension (length or width). The method of measurement is given in 5.1.4.

4.1.4.2 Squareness of edges

The tolerance on squareness of the edges is maximum 3 mm/m. The method of measurement is given in 5.1.5.

4.2 Mechanical characteristics

In the test conditions defined in 5.3, the values of the bending strength which determine the category of the sheet shall be at least equal to the values shown in table 2.

4.3 Physical characteristics

4.3.1 Density

In the test conditions laid down in 5.2.1, the sheets shall have a density at least equal to the value shown in table 3, depending on the category to which they belong.

TABLE 2 — **Bending strength**[1)]

Category of sheet	Bending strength, N/mm² Minimum values	
	Loading parallel to the asbestos fibres of the sheet	Loading at right angles to the asbestos fibres of the sheet
0	6	9
1	12	16
2	16	20

1) In the case where the direction of the fibres is difficult to identify (see 5.3.1), the lower value obtained shall be more than the value of the first column and the higher value shall not be less than the corresponding value of the second column.

TABLE 3 — **Densities**

Category of sheet	Minimum density, g/cm³
0	0,8
1	1
2	1,3

5 METHODS OF TESTING

5.1 Geometrical controls

5.1.1 Equipment

5.1.1.1 Smooth, flat inspection surface large enough to take the sheet.

Two metal rules may be fixed at right angles along the edges of the inspection surface. The straightness of each metal rule shall be at least 0,3 mm/m and the right angle shall be accurate to at least 0,1 % (less than 1 mm deviation from normal per metre of length) or 0,001 rad.

Alternatively, a portable square may be used. The same requirements for straightness and angularity apply.

5.1.1.2 Suitable metal rulers, capable of being read to 0,5 mm.

5.1.1.3 Micrometer, reading at least to 0,05 mm with flat metal jaws at least 10 mm in diameter.

5.1.2 Measurement of width and length

For each dimension, carry out three measurements, avoiding taking the measurement over a local deformation which could be considered as a visual defect.

Smooth any rough areas.

Verify that the temperature is 23 ± 5 °C and the relative humidity (50 ± 10) %.

Take each reading to the nearest 0,5 mm.

Verify that each value is inside the tolerances given in 4.1.3.

5.1.3 Measurement of thickness

Carry out three measurements at one end over width with the micrometer as indicated below.

Verify that the arithmetic mean of the three measurements is inside the tolerances given in 4.1.3.

Verify that the maximum difference between extreme values of the measurement is inside the tolerances given in 4.1.3.

5.1.4 Measurement of the straightness of edges

Apply the edge to the relevant arm of the square.

Measure to the nearest 0,5 mm, by means of a steel rule, the greatest separation between the edge of the sheet and the arm of the square. Tolerances given in 4.1.4.1 shall be taken into account.

5.1.5 Measurement of the out-of-squareness of the sheet

Place each of the four corners of the sheet in succession between the arms of the square keeping on the one hand the large side against the large arm and on the other hand the small side in contact with the small arm.

In this position, measure the distance of the apex of the corner from the small arm of the square. Consider the tolerance given in 4.1.4.2.

5.2 Physical tests

5.2.1 Determination of density

For preference, use as a test piece a specimen from bending test or, instead, a sample of equivalent dimensions.

Determine the mass by drying out the test piece in an oven at 100 to 105 °C until the difference between two consecutive weighings in an interval 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.

5.2.2 Expression of results

The density is given by the formula

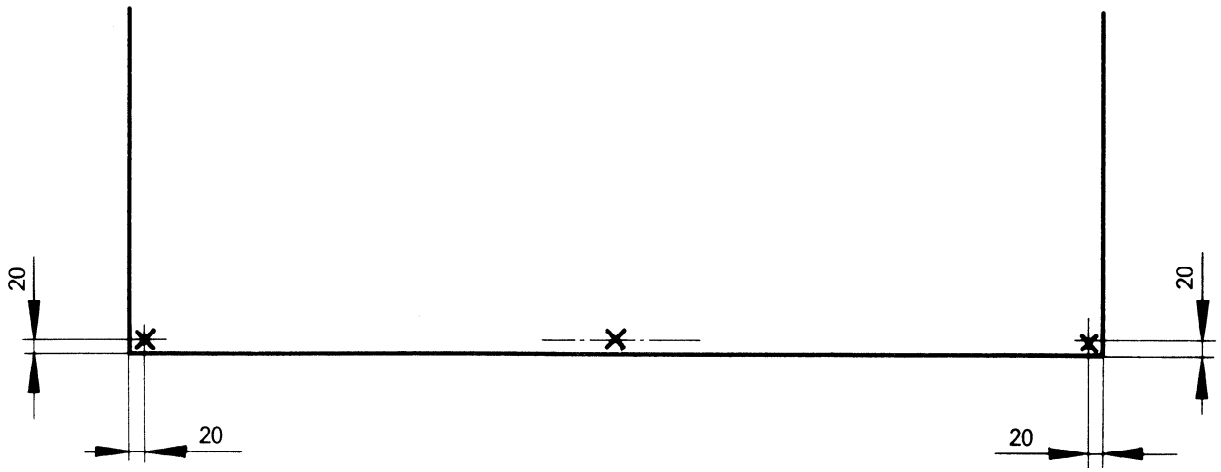
$$\frac{m}{V}$$

where

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

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

It shall not be less than the values specified in table 3.



5.3 Mechanical tests

5.3.1 Bending strength

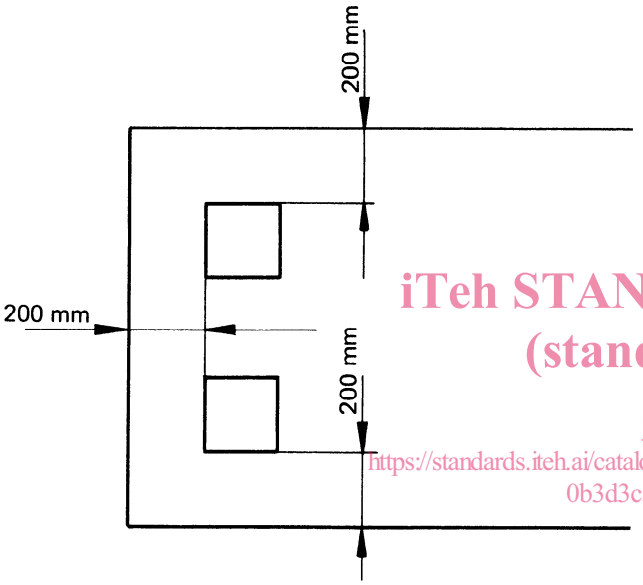
5.3.1.1 Test pieces

a) Preparation

Cut two square test pieces at least 250 mm × 250 mm from each sample sheet.

b) Cutting

The test pieces shall be cut from the same part of the sheet, as shown in the drawing below (the distance of 200 mm is typical).



The fibre direction shall be marked on each of the test pieces.[1)]

c) Conditioning

Place the test pieces for at least 4 days ($e \leqslant 10$ mm) or at least 7 days (10 mm $< e \leqslant 20$ mm) in a controlled atmosphere of 23 ± 2 °C and (50 ± 5) % relative humidity, and in such a manner that all faces are correctly ventilated[2)].

NOTE – Other methods of drying out may be used, provided that it is possible to establish compatibility between the values obtained by that method and the minimum specified by the present International Standard.

5.3.1.2 Test equipment

5.3.1.2.1 Load test machine fitted with a bending test attachment as detailed below.

a) The bending test attachment shall have two parallel supports with a distance between their centres of 215 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 mm to 25 mm.

b) A 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.

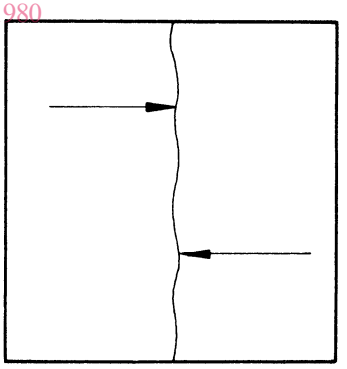
5.3.1.2.2 A micrometer reading to 0,1 mm with flat metal jaws not less than 10 mm in diameter.

5.3.1.3 Method of operation

Arrange the test piece 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, so that breaking occurs after not less than 5 s.

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



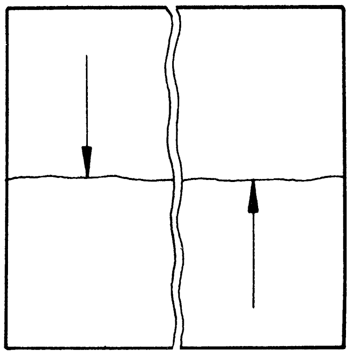
Re-assemble the broken pieces.

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

1) When the direction of the fibres is difficult to identify, it is permissible to carry out the bending test with the loading bar successively put on two perpendicular directions.

2) For thicknesses greater than 20 mm which are outside the scope of the present International Standard, conditioning shall continue until constant mass is obtained. The mass is considered to be constant if the difference between two consecutive weighings, carried out at an interval of 48 h, is less than 0,1 g.

Measure the thickness of the test piece in two points along the new section of breakage as indicated below.



5.3.1.4 Expression of results

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

$$R_f = \frac{3\,Pl}{2\,be^2}$$

where

P is the breaking load, in newtons;

l is the distance between supports, in millimetres;

b is the width of the test piece, in millimetres;

e is the average thickness of the test piece (arithmetical average of the four measurements taken), in millimetres.

Express the results separately for each test. Consider the minimum values specified in table 2.

6 MARKING

Marking shall comply with national standards of the producing country which 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 should 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 geometrical characteristics of the sheets should be verified on each item of the consignment if they do not comply with the acceptance requirements of ISO 390.

7.1.2 The sheets which do not satisfy the requirements when inspected as in 7.1.1 may be rejected.

7.2 Inspection by sampling

7.2.1 The required mechanical characteristics and the physical characteristics of the sheets should be verified, if requested, by sampling.

7.2.2 The procedure in ISO 390 applies for the sampling, inspection and acceptance. Each inspection lot should include only items of the same category and of the same thickness. The maximum and minimum inspection lots are agreed between the manufacturer and the purchaser; failing such an agreement these should be 3 000 and 400 sheets respectively.