
International Standard



393/3

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

**Asbestos-cement products —
Part 3 : Asymmetrical section corrugated sheets and
fittings for roofing and cladding**

Produits en amiante-ciment — Partie 3 : Plaques nervurées et leurs accessoires pour couvertures et revêtements

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Descriptors : asbestos cement products, asbestos cement roofing, corrugated sheets, fittings, specifications.

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.

International Standard ISO 393/3 was developed by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*, and was circulated to the member bodies in September 1982 (as draft ISO/DIS 394).

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

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

Canada
Denmark

This International Standard constitutes a revision, in part, of ISO Recommendation R 394-1964.

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Asbestos-cement products — Part 3 : Asymmetrical section corrugated sheets and fittings for roofing and cladding

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1 Scope and field of application

This part of ISO 393 applies to straight asbestos-cement asymmetrical section¹⁾ corrugated sheets and their asbestos-cement fittings to be used mainly for roofing and cladding.

It defines characteristics of these products, tests to check them, marking and conditions of acceptance.

Some of these requirements can apply, by agreement between manufacturer and purchaser, to curved asymmetrical section corrugated sheets.

This International Standard does not apply either to corrugated sheets which are covered by ISO 393/1, or to "short" corrugated sheets²⁾ or to trapezoidal sheets which will be covered by future parts of ISO 393.

2 Reference

ISO 393/1, *Asbestos-cement products — Part 1 : Corrugated sheets and fittings for roofing and cladding.*

3 Sheets

3.1 Composition

Asymmetrical section corrugated sheets to which this part of ISO 393 applies consist essentially of an inorganic hydraulic binder³⁾ (ground silica may be added in order to obtain a calcium-silicate reaction) reinforced with asbestos fibres to which other fibres may be added.

Fillers and pigments may be added.

Asymmetrical section corrugated sheets may be left with their natural colour, or colouring matter may be added in the composition; coloured or colourless coatings may also be applied to the surface.

1) The English version of this part of ISO 393 has retained the term "asymmetrical section" in order to express the difference between the section modulus of the sheet when tested with the smooth face up and the smooth face down, which is a fundamental difference in corrugated sheets (see ISO 393/1).

2) These sheets (about 0,60 m long) are closer to small roofing components.

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

3.2 General appearance and finish

The sheets are straight components with at least two pitches, the cross-section of which consists of

- a) identical curved longitudinal corrugations where the inner radius (R_1) and outer radius (R_2) differ by more than 20 % of R_1 (see figures 1 and 2);

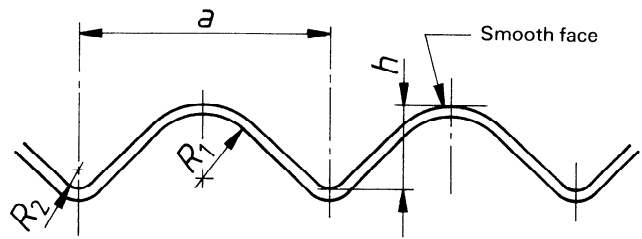


Figure 1

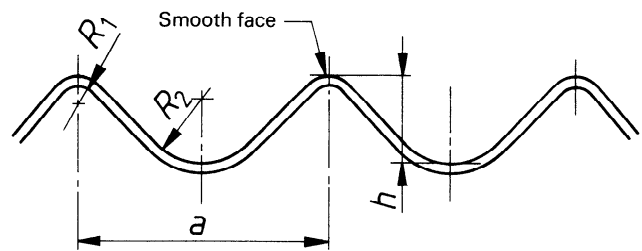


Figure 2

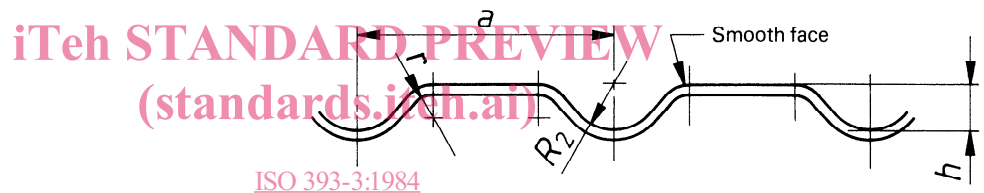


Figure 3

- b) identical curved longitudinal corrugations joined by flats, where the corrugations are in the valley (see figure 3) or at the crown (see figure 4);

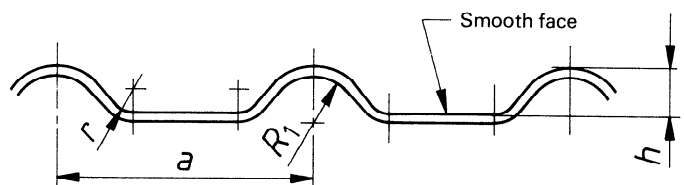


Figure 4

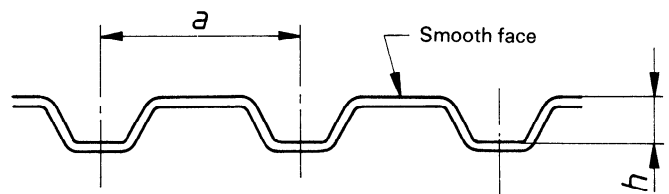


Figure 5

- c) identical longitudinal flat corrugations joined by flats, where the corrugations are in the valley (see figure 5) or the crown (see figure 6).

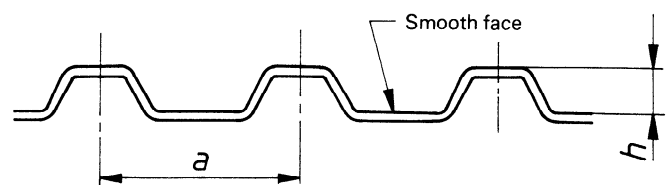


Figure 6

In any case, the corrugations are defined by their pitch a and their height h .

The surface intended to be exposed to the weather shall be of smooth finish. Variations of the surface appearance which do not impair the characteristics of the sheets as defined in this part of ISO 393 are permitted.

Edges must be straight, clean and square. Sheets may have one or two mitred corners and may be drilled for fixing.

3.3 Classification

3.3.1 According to height of the corrugation h (category)

Table 1 — Categories of sheet

Height h mm	Category
< 25	A (shallow corrugations)
26 to 45	B (medium corrugations)
46 to 60	C (deep corrugations)
> 60	D (very deep corrugations)

3.3.2 According to minimum bending breaking load, with the smooth face in contact with the loading beam (class) for 1 m width

The different types of sheets are defined by their category followed by the value of the minimum bending breaking load (see table 2).

National standards or, if not, the manufacturer shall specify the type of the sheet to be used in accordance with table 2.

3.4 Characteristics

3.4.1 Geometrical characteristics

The dimensions listed in this part of ISO 393 are the nominal dimensions defined by national standards, or, if not, by the manufacturer.

3.4.1.1 Width

The width is defined by

- the pitch a ;
- the number of complete corrugations;
- the dimension of overlapping corrugations.

3.4.1.2 Thickness

In any case, the thickness measured according to 3.5.3 shall not be less than the values in table 3.

Table 3 — Minimum thickness

Category	Minimum thickness, mm
A	3,0
B	4,0
C	5,0
D	6,0

3.4.1.3 Tolerances on the dimensions

The tolerances given below apply to nominal dimensions.

- a) on the pitch a and the height h

Tolerances are defined in table 4.

Table 4 — Tolerances on pitch and height

Category	Tolerances	
	on the pitch a mm	on the height h mm
A	± 1,5	± 2,0
B	± 2,0	± 2,0
C	± 2,0	± 3,0
D	± 3,0	± 3,0

- b) on the length L : ± 10 mm

Table 2 — Types of sheet

Class ¹⁾ Category	1 000	1 250	1 500	2 000	2 500	3 000	3 750	4 750	6 000	7 500	10 000
A	A 1 000	A 1 250	A 1 500	A 2 000							
B			B 1 500	B 2 000	B 2 500	B 3 000					
C					C 2 500	C 3 000	C 3 750	C 4 750			
D							D 3 750	D 4 750	D 6 000	D 7 500	D 10 000

1) In newtons per metre width and under test conditions as described in 3.5.5.

- c) on the width l : $\begin{cases} + 10 \text{ mm} \\ - 5 \text{ mm} \end{cases}$
- d) on the thickness e : $\pm 10 \%$ with a maximum of 0,6 mm
- e) on the corrugations of the edges : squareness $\leq 6 \text{ mm}$
- f) height to edges (only for sheets having an ascending corrugation on one side and a descending corrugation on the other side).

Positive or negative tolerances on nominal height of an edge shall be such that the difference between extreme values shall be always less than or equal to 8 mm.

3.4.2 Mechanical characteristics

The bending test is carried out "on the correct side", i.e. with the smooth face in contact with the loading beam. Tested according to 3.5.5 (compulsory test), the sheet shall have, according to the type, a breaking load¹⁾ at least equal to the values indicated in table 2.

For some applications, it is necessary to know the bending strength of the sheet for the opposite side. The manufacturer shall state the minimum guaranteed bending strength with the inner face in contact with the loading beam. This value shall not be used for classification of the sheet.

3.4.3 Physical characteristics

3.4.3.1 Water tightness

When tested as in 3.5.6.1 (optional test), traces of moisture may appear on the lower surface of the sheets, but in no instance shall there be any formation of drops of water.

3.4.3.2 Frost cracking

If local conditions justify it or national standards specify, the corrugated sheets tested as specified in 3.5.6.2 shall not show any visible sign of cracking, surface alteration or delamination. This requirement does not apply to surface coatings.

3.4.3.3 Density

Measured as provided in 3.5.6.3 (optional test), the density shall not be less than 1,40 g/cm³. In countries where local conditions justify it, national standards can reduce this limit to 1,20 g/cm³ minimum.

3.5 Tests

The acceptance tests shall be carried out at the factory on sheets or test pieces cut off the sheets ready for delivery.

- a) Compulsory tests²⁾
 - 1) geometrical characteristics (3.4.1);
 - 2) mechanical characteristics (3.4.2);
- b) Optional tests (at purchaser's request)²⁾
 - 3) water tightness (3.4.3.1);
 - 4) frost cracking test (3.4.3.2) if local conditions justify it;
 - 5) density (3.4.3.3).

3.5.1 Profile check

3.5.1.1 Apparatus

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- a checking area, flat and smooth;
- steel rolls : length 200 mm and diameter approximately twice the external radius R_2 (figures 1, 2 and 3) or R_1 (figure 4) or steel blocks, length 200 mm, the cross-section of which is profiled according to the corrugation of the sheet (figures 5 and 6). The rolls or the blocks have, at their axes on one end, conical points;
- a micrometer accurate to 0,1 mm with a hemispherical head of about 8 mm diameter;
- a metal rule of 1 m length, graduated to 0,5 mm.

1) National standards may prescribe, in addition to the minimal breaking load, the unit bending stress for medium and deep corrugations only, provided the manufacturer

- defines the profile, including the shape of the edge corrugations;
- indicates the method of calculation of the section modulus W_1 .

The unit bending stress, calculated with the thickness measured according to 3.5.3 shall be higher than 14 N/mm².

2) See annex A.

3.5.1.2 Measurement of the pitch α

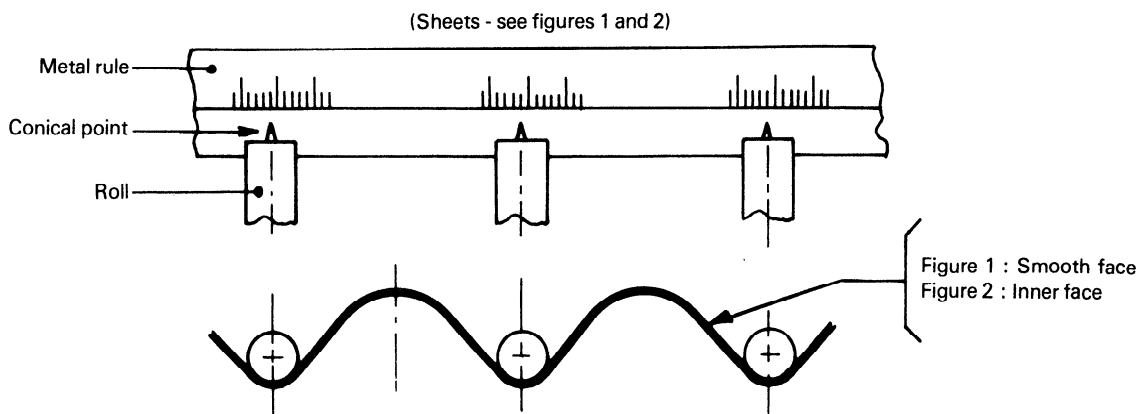


Figure 7

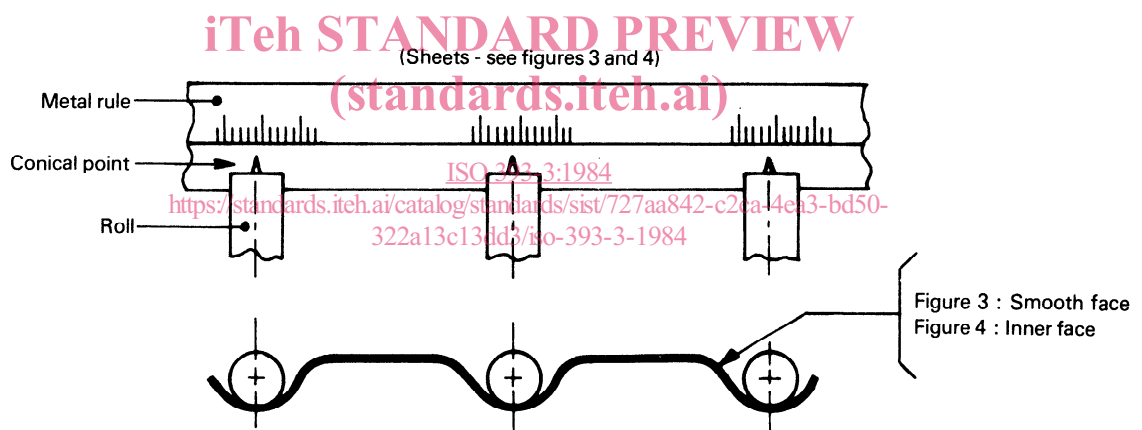


Figure 8

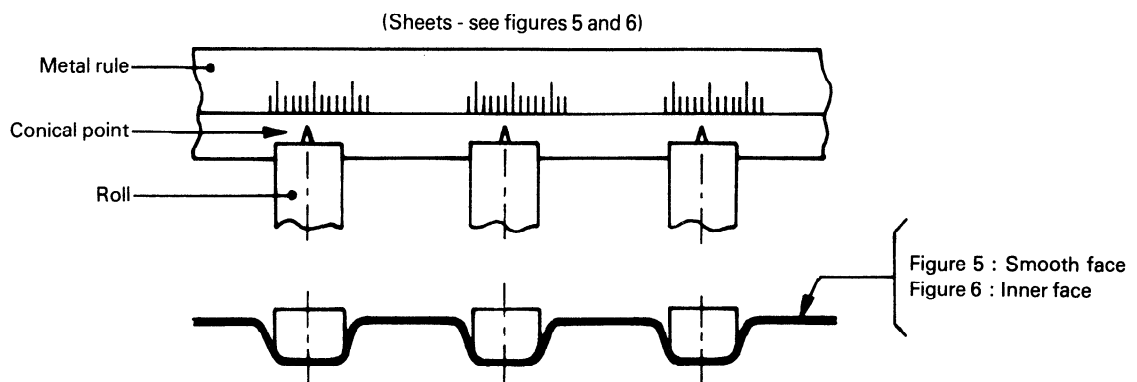


Figure 9

The sheet to be checked is placed on the control surface :

- with its smooth face turned down (figures 2, 4 and 6),
- with its smooth face turned up (figures 1, 3 and 5),

according to the shape of the profile.

At one end of the sheet, lay the rolls or the blocks in each valley of the corrugations, with the conical point of each slightly outside the sheet. Measure the horizontal distance between two consecutive conical points to the nearest 0,5 mm with the graduated rule.

Each measurement for the valleys of the corrugations or ribs shall be in accordance with the specifications of 3.4.1.3 (table 4).

3.5.1.3 Measurement of the height of the corrugation h (see table 5)

Select three complete corrugations on a sheet. On each of them, take three measurements regularly spaced over the length of the sheet with a micrometer.

Calculate, for each corrugation, the arithmetic average of the three measurements, which shall be in accordance with the specifications of 3.4.1.3 (table 4).

3.5.2 Length and width check (see figure 10)

The apparatus is composed of a smooth flat surface, with

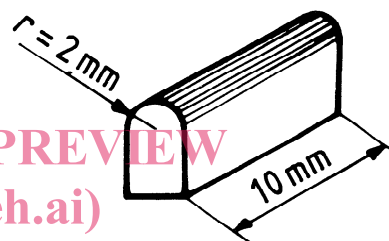
measuring device or a rule graduated to 0,5 mm and two rectangular caliper blocks.

The sheet shall be laid flat and square on the checking area, verifying that the valley of every corrugation is in contact with the surface.

For both width and length take three measurements, in the middle and at approximately 50 mm from each end. Read to the nearest 0,5 mm. The arithmetic average of the three measurements shall be in accordance with the specifications of 3.4.1.3 b) and c).

3.5.3 Thickness check

The apparatus is a micrometer with hemicylindrical plates (see figure 11) of 4 mm × 10 mm, accurate to 0,05 mm.



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Figure 11

dimensions appropriate to dimensions of the sheets. <https://standards.iteh.ai/catalog/standards/sist/727aa842-c2ca-4ca0-b050-322a13c13dd3/iso-393-3-1984>

Dimensions in millimetres

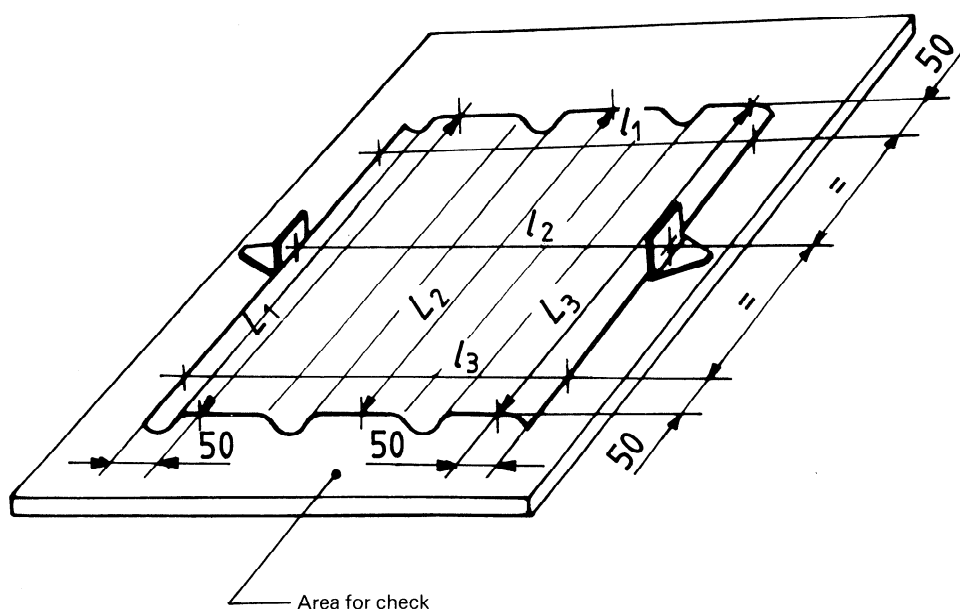


Figure 10

The measurement shall be made at one end of the sheet, in conformity with table 5, at six points chosen at the valley and crown of corrugations, including side corrugations.

Each individual measurement shall be compared with the specifications of table 3 (3.4.1.2) and shall be not less than the minimum value.

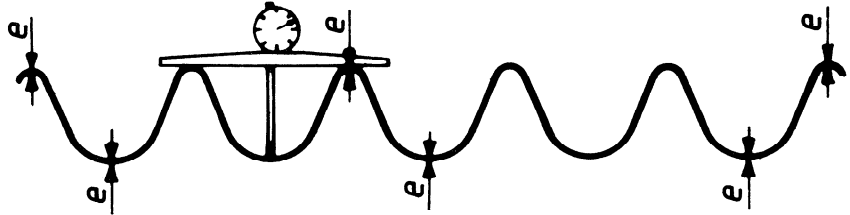
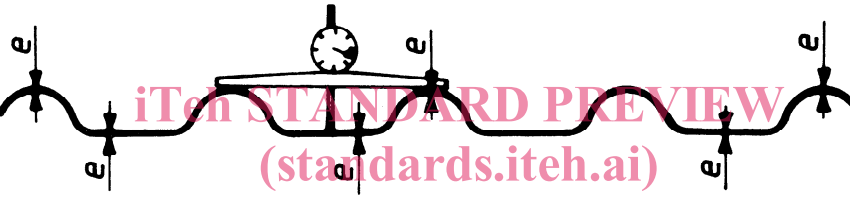
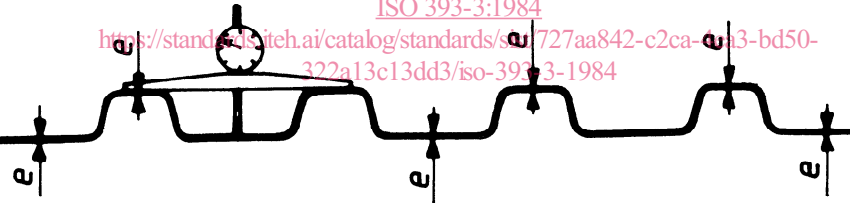
The average of the six measurements shall be compared with the specifications of 3.4.1.3 d) and shall meet these tolerances.

3.5.4 Edge check

3.5.4.1 Square (see figure 12)

The apparatus is a rectangular frame with two profiled ends and two straight sides or any other appropriate device. The out of squareness shall be in accordance with the specifications of 3.4.1.3 e).

Table 5 – Measurement of the height of the corrugation and thickness

Transverse section	Figure
	1 and 2
	3 and 4
	5 and 6

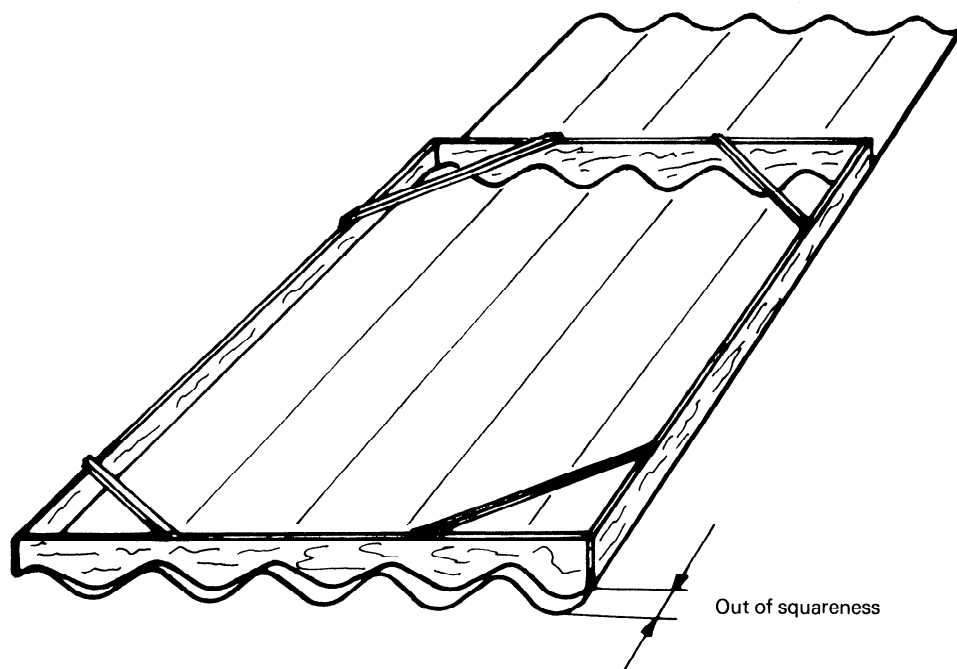


Figure 12