

INTERNATIONAL  
STANDARD

**ISO**  
**9383**

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1995-03-01

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**Products in fibre-reinforced cement —  
Short corrugated or asymmetrical section  
sheets and fittings for roofing**

**iTeh STANDARD PREVIEW**

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*Produits en ciment renforcé par des fibres — Plaques ondulées ou  
nervurées courtes et leurs accessoires pour couvertures*

ISO 9383:1995

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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.

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.

International Standard ISO 9383 was prepared by Technical Committee ISO/TC 77, *Products in fibre reinforced cement*.

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

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# Products in fibre-reinforced cement — Short corrugated or asymmetrical section sheets and fittings for roofing

## 1 Scope

This International Standard specifies the technical characteristics of fibre-cement profiled sheets, described as short sheets — the length of which is normally less than or equal to 0,7 m<sup>1)</sup> — the corrugation height of which is between 15 mm and 110 mm and also of fibre-cement fittings, used as roofing materials.

It specifies tests to check them, conditions of acceptance and marking.

It does not apply to short asbestos-cement corrugated and asymmetrical section sheets which are covered by ISO 393-5, nor to long fibre-cement sheets which are covered by ISO 9933, nor to their fittings.

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 390:1993, *Products in fibre-reinforced cement — Sampling and inspection*.

## 3 Definitions

For the purposes of this International Standard, the following definitions apply.

**3.1 acceptance test:** Test 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.

**3.2 type test:** Test concerned with the approval of a new product and/or a fundamental change in formulation and/or method of manufacture from which the effects cannot be predicted on the basis of previous experience.

The test is performed on the as-delivered product. The test is required to demonstrate conformity of a generic product to a specification.

**3.3 acceptable quality level (AQL):** When a continuous series of lots is considered, the quality level which for the purposes of sampling inspection is the limit of a satisfactory process average.<sup>2)</sup>

**3.4 as-delivered:** In the same condition as the producer intends to supply the product after completing all aspects of the process including maturing and, when appropriate, painting.

1) In limited circumstances (e.g. at eaves), sheets up to a maximum length of 0,9 m may be used.

2) A sampling scheme with an AQL of 4 % means that batches containing up to 4 % defective items have a high probability of acceptance.

### 3.5 fibres

- (1) Discrete elements randomly dispersed.
- (2) Continuous strands and tapes.
- (3) Nets or webs.

## 4 Symbols, abbreviations and units

For the purposes of this International Standard, the following symbols and abbreviations are used.

$a$	Pitch of the corrugation, in millimetres
$b$	Length of the specimen in the breaking bending moment test, in millimetres
$e, e_1, e_2$	Thicknesses of the sheet, in millimetres
$h$	Height of the corrugation, in millimetres
$h_{od}$	Height of the edge of the descending corrugation at edge, in millimetres
$h_{om}$	Height of the edge of the ascending corrugation at edge, in millimetres
$L$	Ratio of the estimation $L_1$ to $L_5$
$L_1$	Upper estimation at 95 % confidence level of the result $M_1$ in the warm water test
$L_5$	Lower estimation at 95 % confidence level of the result $M_2$ in the warm water test
$L_1, L_2, L_3$	Lengths of the sheet, in millimetres
$l$	Clear span, in millimetres, between the supports in the breaking bending moment test
$l_1, l_2$	Widths of the sheet, in millimetres
$M$	Breaking bending moment at rupture, in newton metres per metre length
$M_1$	Average value of the test result of the control specimen of the first lot for the warm water test
$M_2$	Average value of the test result of the specimens after the warm water test

$m$	Mass of the specimen, in grams, after drying when determining the apparent density
$P$	Breaking load, in newtons, for the bending moment test
$s_1$	Standard deviation of the specimens with average $M_1$
$s_2$	Standard deviation of the specimens with average $M_2$
$V$	Apparent volume, in cubic centimetres, of the specimen for the apparent density test
$\rho$	Apparent density of specimen, in grams per cubic centimetre

## 5 Sheets

### 5.1 General composition

Sheets and fittings covered by this International Standard consist essentially of an inorganic hydraulic binder<sup>3)</sup> or calcium silicate formed by a chemical reaction of a siliceous and a calcareous material, reinforced by organic fibres and/or inorganic synthetic fibres.

Process aids, fillers and pigments which are compatible with the fibre-reinforced cement may be added.

### 5.2 General appearance and finish

The sheets may be left with their natural colour, or colouring matter may be added in the composition: they may also receive adherent coloured or uncoloured coatings on their surfaces.

Short profiled sheets are components, examples of which are given in figure 1. The corrugations are defined by their pitch,  $a$ , and their height,  $h$ .

The surface intended to be exposed to the weather shall have a generally smooth finish. Variations of the surface appearance which do not impair the characteristics of the sheets as defined in this International Standard are permitted.

Edges shall be straight and clean and the sheets shall be square. Sheets may have one or two corners pre-mitred or prepared for mitring and may be predrilled for fixing.

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

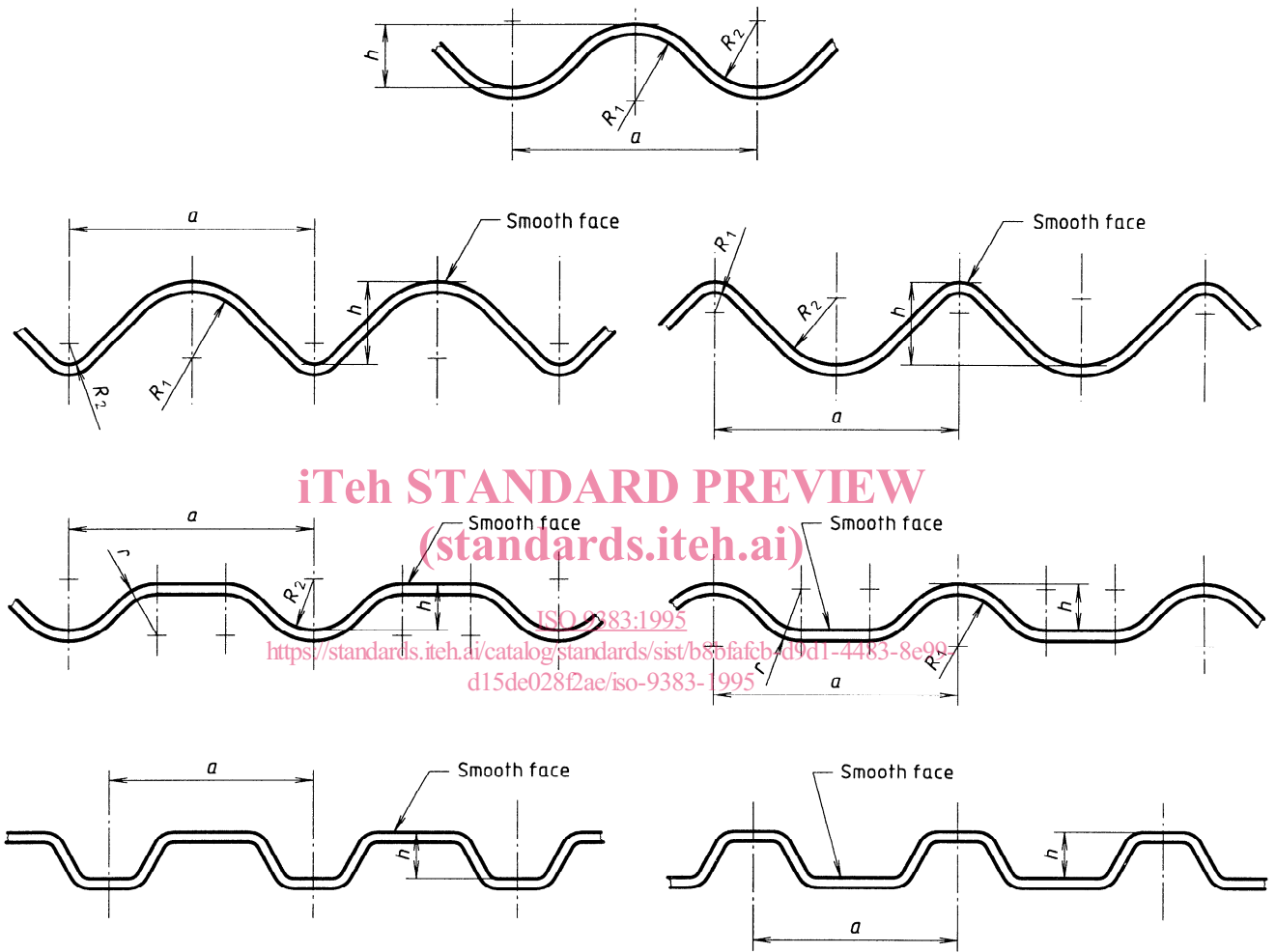


Figure 1

**5.3 Categorization and classification**

**5.3.1 According to thickness**

The thickness of the sheets may (see figure 2):

- either be approximately constant throughout the width of the profile (type A sheets);
- or vary regularly between the valley and the crown for corrugated sheets or between the lower part and the upper part of ribs for asymmetrical section sheets, in the same cross-section (type B sheets).

**5.3.2 According to minimum bending moment at rupture**

Each category of sheet is subdivided into two classes

according to the value of the minimum bending moment at rupture in accordance with table 2.

NOTE 1 National standards may choose to retain only one or two classes, depending on the local conditions of the area in use.

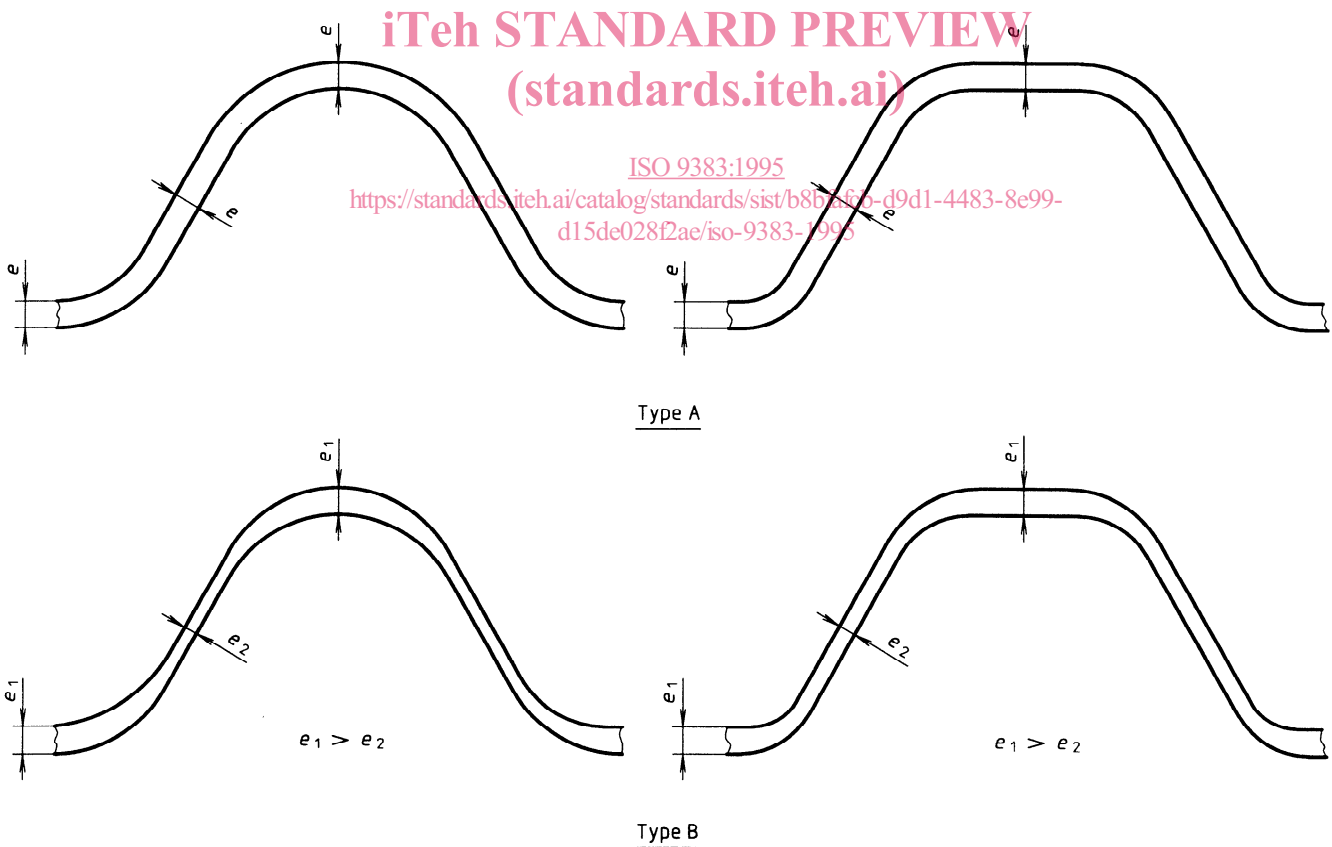
**5.4 Characteristics**

**5.4.1 Dimensions**

The nominal dimensions shall be defined by national standards or by the manufacturer.

**5.4.1.1 Width**

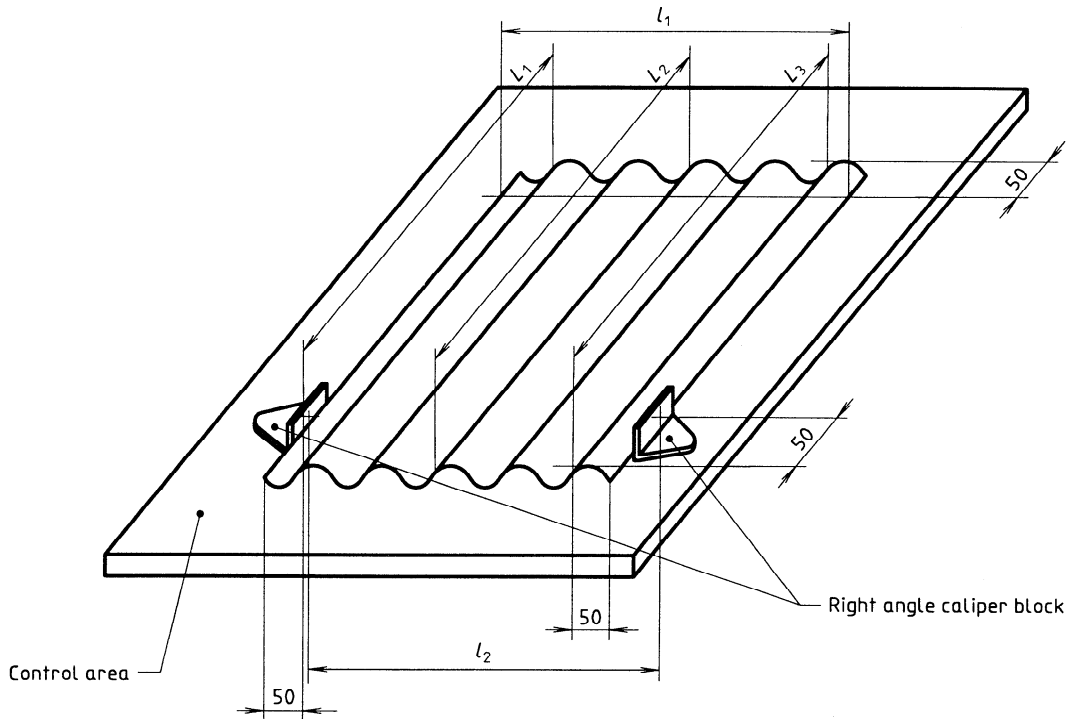
The width is the arithmetic average of  $l_1$  and  $l_2$  as shown in figure 3.



**Figure 2**



Dimensions in millimetres



**Figure 3**  
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**5.4.1.2 Thickness**

Each individual thickness measured according to 5.5.5 shall not be less than the values in table 1.

**Table 1 — Thickness**

Dimensions in millimetres

Height of corrugation, $h$	Thickness, $e$ min.
$15 \leq h \leq 30$	3
$30 < h \leq 110$	4

**5.4.1.3 Number of corrugations or ribs**

The number of corrugations or ribs to be considered for designation is the number of complete corrugations or ribs of the sheet.

**5.4.1.4 Height of edges**

The nominal height of edges of both the ascending and descending edges (see figure 8) shall be specified in national standards. This requirement applies only for sheets having an ascending corrugation on one side and a descending corrugation on the other side.

**5.4.1.5 Tolerances on dimensions**

The following tolerances apply to nominal dimensions given by the manufacturer:

- a) Tolerance on pitch,  $a$ :
 

$a \leq 75$ mm	$\pm 1,5$ mm
$75 \text{ mm} < a \leq 180$ mm	$\pm 2$ mm
$180 \text{ mm} < a \leq 260$ mm	$\pm 2,5$ mm
$260 \text{ mm} < a$	$\pm 3$ mm
- b) Tolerance on height,  $h$ :
 

$15 \text{ mm} \leq h \leq 45$ mm	$\pm 2$ mm
$45 \text{ mm} < h \leq 110$ mm	$\pm 3$ mm
- c) Tolerance on length:  $\pm 10$  mm
- d) Tolerance on width:  $^{+10}_{-5}$  mm
- e) Tolerance on nominal thickness,  $e$ : The average thickness measured according to 5.5.5 shall be within  $\pm 10$  %, but no more than  $\pm 0,6$  mm, of the nominal thickness.
- f) Out-of-squareness of sheet:  $\leq 6$  mm

- g) Tolerance on height of edges: The producers shall specify this tolerance in their literature when it is necessary to ensure the weathertightness of the roof, only for sheets having an ascending edge on one side and a descending edge on the other side.

#### 5.4.2 Mechanical characteristics

When tested in accordance with 5.5.8, sheets shall have a bending moment per metre width at rupture at least equal to the value indicated in table 2.

**Table 2 — Bending moment at rupture**

Class	$M$ , min. N·m/m	
	$15 \text{ mm} \leq h \leq 30 \text{ mm}$	$30 \text{ mm} < h \leq 110 \text{ mm}$
1	12	20
2	20	30

#### 5.4.3 Physical characteristics

With the exception of 5.4.3.3, these characteristics shall be determined on products as-delivered whenever practical. The results are identified as applying to coated or uncoated materials. Failure of the coating does not constitute failure of the product.

##### 5.4.3.1 Impermeability

When tested as specified in 5.5.9.1, traces of moisture may appear on the underface of the sheet but in no instance shall there be any formation of water drops.

##### 5.4.3.2 Frost resistance

This test shall be carried out if local climatic conditions justify it or national standards specify it.

When tested as specified in 5.5.9.2, any visible cracks, delamination or other defects in the sheets shall not be of a degree as to affect their performance in use.

##### 5.4.3.3 Apparent density

The manufacturer shall indicate the nominal value of the apparent density of the sheets.

When measured in accordance with the provisions of 5.5.9.3, the sheets shall have an apparent density equal to this value with a tolerance of  $\pm 10 \%$ .

##### 5.4.3.4 Warm water

When tested as specified in 5.5.9.4, any visible cracks, delamination or other defects in the sheets shall not be of a degree as to affect their performance in use.

The finished product shall exhibit a ratio  $L$  as defined in 5.5.9.4 not less than 0,70. This is equivalent to a decrease in load of no more than 15 % when the coefficient of variation is 15 %.

##### 5.4.3.5 Heat-rain

When tested as specified in 5.5.9.5, any visible cracks, delamination or other defects in the sheets shall not be of a degree as to affect their performance in use.

### 5.5 Tests

#### 5.5.1 Acceptance tests

The following acceptance tests shall be carried out at the manufacturer's works on sheets as delivered, the maturity of which is guaranteed by the manufacturer. Sampling levels and acceptance criteria shall be as defined in ISO 390, and the minimum value of any parameter is subject to an AQL of 4 %.

##### 5.5.1.1 Compulsory tests (see annex A)

- geometrical characteristics (5.5.3 to 5.5.7);
- mechanical characteristics (5.5.8).

##### 5.5.1.2 Optional tests (at purchaser's request — see annex A)

- apparent density (5.5.9.3).

#### 5.5.2 Type tests

These type tests should be repeated every five years but are not necessarily required for each production batch.

These tests are

- impermeability (5.5.9.1);
- frost resistance (5.5.9.2) if local conditions justify it or if national standards specify it;
- warm water (5.5.9.4) (optional for national standards);
- heat-rain (5.5.9.5).

### 5.5.3 Checking profile

#### 5.5.3.1 Preparation of specimen

The specimen shall be a complete sheet as-delivered without conditioning.

#### 5.5.3.2 Apparatus

**5.5.3.2.1 A smooth flat surface** with dimensions appropriate to the dimensions of the sheets.

**5.5.3.2.2 Steel cylindrical bars**, length 200 mm and diameter large enough to touch the sides of the valleys, with conical points, shall be fitted at the axis on one end.

**5.5.3.2.3 A micrometer** with hemispherical head accurate to 0,1 mm.

**5.5.3.2.4 A graduated metal ruler** reading to 0,5 mm.

#### 5.5.3.3 Procedure

Lay the sheet flat and square on the flat surface in accordance with figure 3, ensuring that the valley of every corrugation is in contact with it.

##### 5.5.3.3.1 Measurement of pitch, $a$

At one end of the sheet, lay the cylindrical bars in each valley of the corrugations with the conical point of each cylindrical bar slightly outside the sheet (see figure 4). With the graduated ruler, measure to the nearest 0,5 mm the distance between consecutive conical points.

Any other measurement method with an accuracy equal or higher may be used.

##### 5.5.3.3.2 Measurement of corrugation height, $h$

Choose three complete corrugations on a sheet. On each of them, with the micrometer, take three measurements regularly spaced down the length of the sheet in accordance with figure 5.

Any other measurement method with an accuracy equal or higher may be used.

### 5.5.3.4 Expression and interpretation of results

#### 5.5.3.4.1 Pitch

Each measurement of the pitch, expressed in millimetres, shall be compared with the specification in 5.4.1.5 a).

#### 5.5.3.4.2 Corrugation height

Each result is the arithmetical average of the three measurements on each corrugation, expressed in millimetres, to the nearest 0,1 mm. The three results shall all comply with the specification in 5.4.1.5 b).

### 5.5.4 Measurement of length and width

#### 5.5.4.1 Preparation of specimen

The specimen shall be a complete sheet as-delivered without conditioning.

#### 5.5.4.2 Apparatus

**5.5.4.2.1 A smooth flat surface** with dimensions appropriate to the dimensions of the sheets.

**5.5.4.2.2 A ruler** graduated in millimetres.

**5.5.4.2.3 Two rectangular caliper blocks.**

#### 5.5.4.3 Procedure

Lay the sheet flat on the surface in accordance with figure 3, ensuring that the valley of every corrugation is in contact with it.

To measure the length, take three measurements: one in the middle and one approximately 50 mm from each side or further to avoid mitred corners (see figure 3).

To measure the width, take two measurements, approximately 50 mm from each end or further to avoid mitred corners (see figure 3).

#### 5.5.4.4 Expression and interpretation of results

Read each measurement to the nearest 1mm. Calculate the arithmetic average of the length and width which shall comply with the specifications in 5.4.1.5 c) and 5.4.1.5 d), respectively.

The results are considered to be satisfactory if they conform with the requirements.