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Compressed straw panels — Specification

Rwanda Standards Board

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In order to match with technological development and to keep continuous progress in industries, Standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board of (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazetted as Rwanda Standards.

RS 319 was prepared by Technical Committee RSB/TC 009, *Building materials and civil engineering*.

In the preparation of this standard, reference was made to the following standard:

BS 4046:1991, *Compressed straw building slabs - Specification*

The assistance derived from the above source is hereby acknowledged with thanks.

This second edition cancels and replaces the first edition (RS 319: 2016), clause 1 of which has been technically revised.

Committee membership

The following organizations were represented on the Technical Committee on *Building materials and civil engineering* (RSB/TC 009) in the preparation of this standard.

Entreprise MUBILIGI Paul (EMP)

Horizon Construction

Institut d'Enseignement Supérieur de Ruhengeri (INES-Ruhengeri)

Integrated Polytechnic Regional College-Kigali (IPRC Kigali)

NPD

RULIBA Clays Ltd

Rwanda Housing Authority (RHA)

Rwanda Public Procurement Authority (RPPA)

University of Rwanda - College of Science and Technology (UR-CST)

Rwanda Standards Board (RSB) - Secretariat

Compressed straw building panels — Specification

1 Scope

This Rwanda Standard specifies requirements for compressed straw panels when used internally and externally in buildings for non-load bearing applications. These include the classification of panel types, their performance characteristics and physical properties, test methods and marking.

2 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

2.1

compressed straw panels

panels consisting of natural straws compressed by heat and pressure, encased in and firmly bonded to facings of paper or other materials to form rectangular panels

2.2

lot

quantity of panels manufactured under conditions which are presumed uniform

2.3

test panel

panel required for testing or from which pieces are cut for testing

2.4

test piece

piece cut from a test panel

2.5

test specimen

piece cut from a test piece to comply with the dimensional requirements specified in any of the appropriate tests

3 Classification

3.1 General

Compressed straw panels are classified according to the composition of the core, the facings used and the profile of the longitudinal edge.

3.2 Composition of core

The composition of the core shall be as follows.

— **Type A**: with a solid core formed of untreated straw.

— **Type B**: with a solid core formed of straw treated during manufacture with boron-based insecticides.

— **Type C**: as A but with continuous voids formed longitudinally centrally in the straw core, not exceeding 23 mm diameter, capable of accepting a conduit of 20 mm overall diameter and as shown in Figure 1.

— **Type D**: as B but with continuous voids arranged as described in C.

All dimensions are in millimeters

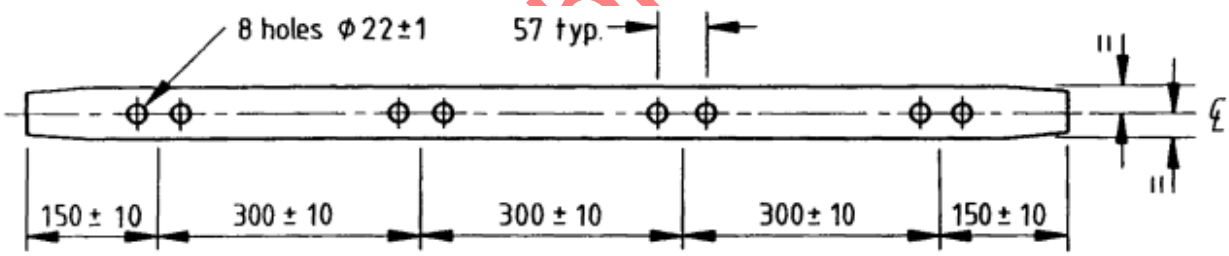


Figure 1 — Typical arrangement of longitudinal voids

3.3 Facings

The facings shall be of the following paper types:

— **Type a**: plain: paper facings suitable for accepting direct decoration.

— **Type b**: plastering: paper facings suitable for accepting gypsum plaster skim coat.

— **Type c**: shower proof: paper facings complying with the requirements for Class A papers.

3.4 Edge profile

3.4.1 The profile of the longitudinal edge shall be of the following types:

— **Type 1:** Square edge.

— **Type 2**: Tapered edge, of which the dimensions of the taper shall be as given in Clause 6 and as shown in Figure 2.

3.4.2 Here is an example of a full classification of a panel type:

Type Db(2), a boron-treated panel with longitudinal voids and plastering type facings and tapered longitudinal edges.

All dimensions are in millimeters

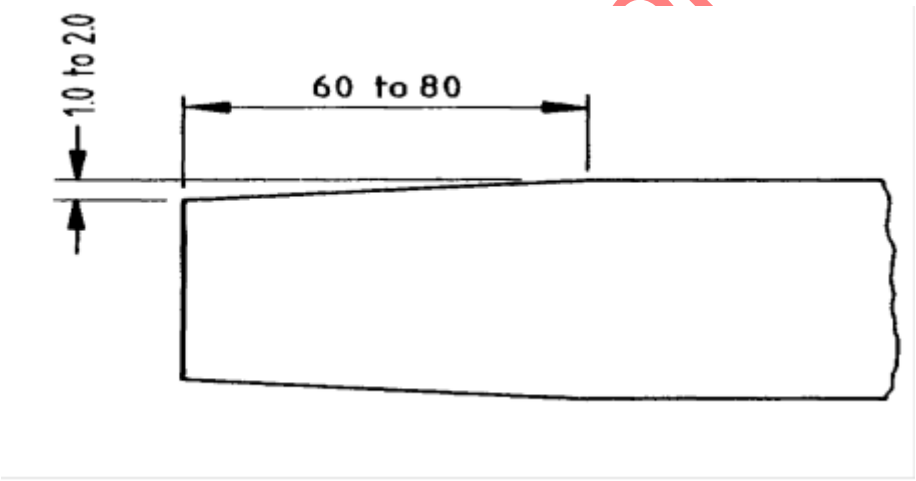


Figure 2 — Profile of taper edged panels

4 Physical characteristics

4.1 Dimensions

When measured in accordance with Annex B, the dimensions of the panel shall be as given in Table 1.

Table 1 — Dimensions and dimensional tolerances

Dimensions	Work size (mm)	Maximum manufacturing (mm)	Minimum manufacturing (mm)
Length	1 800 to 3 600 in 10 mm increments	Work size –1.0	Work size –7.0
Width	1 200	Work size –1.0	Work size –3.0
Thickness	50 and 58	Work size +3.0	Work size –1.0
Thickness variation	The thickness of the centre of the panel shall not exceed that at 100 mm from an edge by more than 1.5 mm.		

4.2 Taper profile

When measured in accordance with Annex C, the tapered edges shall be within the following dimensions:

a) depth of taper: 1.0 mm to 2.0 mm;

b) width of taper: 60 mm to 80 mm.

4.3 Squareness

When measured in accordance with Annex D, the deviation shall be not more than 5 mm/m measured on the 1 200 mm side.

4.4 Mass

When weighed in accordance with Annex E, the mass of panels shall be as given in Table 2.

Table 2 — Test levels for panel mass

Thickness (mm)	Minimum mass (kg/m^2)	Maximum mass (kg/m^2)
50	16.5	22.5
58	18.5	24.5

4.5 Moisture content

When determined in accordance with one of the two methods described in Annex F, the moisture content of the panel when leaving the place of manufacture shall be within the range 10 % to 18 %.

4.6 Modulus of elasticity

When tested in accordance with Annex G, the modulus of elasticity shall be as given in Table 3.

Table 3 — Test levels for modulus of elasticity and bending strength

Direction of test specimen	Minimum modulus of elasticity (N/mm^2)	Minimum bending strength (N/mm^2)
Specimen cut parallel to longitudinal edge of panel	200	0.70
Specimen cut at right angles to longitudinal edge of panel	600	1.20

4.7 Bending strength

When tested in accordance with Annex H, the bending strength shall be as given in Table 3.

4.8 Resistance to impact

When tested in accordance with Annex I, the panel shall not fracture or exhibit residual deflection.

4.9 Screw holding

When tested in accordance with Annex J, the screw holding shall be not less than 175 N.

4.10 Thermal conductivity

When measured in accordance with Annex K, the thermal conductivity shall be not more than 0.108 W/(m·K).

4.11 Boron content

When measured in accordance with Annex L, the mean boron content shall be not less than 0.1 %, with a minimum of 0.06 %.

4.12 Dimensional changes associated with changes in relative humidity

When measured in accordance with Annex M, the increase in length and width after reconditioning at 85 % relative humidity and 35 % relative humidity shall be not more than 0.3 %.

NOTE Thickness swelling with change in relative humidity has not been included because it is insignificant.

5 Marking

Each panel shall be clearly and indelibly marked by the manufacturer on one edge with the following information:

a) the manufacturer's name, trade mark or identification mark, and

b) the panel classification, e.g. type Db(2).

c) the panel nominal thickness

6 Test for performance and physical characteristics

6.1 Sampling

Methods of sampling, conditioning and preparation of test specimens and test pieces are given in Annex A and the methods of test for the various performance and physical characteristics are given in Annex B to Annex M.

6.2 Routine tests

Table 4 lists the routine tests that shall be carried out regularly during production.

6.3 Type tests

Table 4 lists the type tests that shall be carried out whenever a change of method of manufacture is made that may affect the performance characteristics of the product.

7 Use of compressed straw panels

Annex N gives guidance on the use of compressed straw panels. This includes particular reference to the need for proper sealing of the cut edges to provide continuity of the surface covering and protection from moisture, mould growth and insect pests.

Table 4 — Summary of tests for performance and physical characteristics

Performance/physical characteristics	Size of test specimen	Number of tests		Requirement clause reference	Test method
		Routine	Type		
Dimensional tolerances	Whole panel	1 in 20	6	4.1	Annex B
Taper profile	Whole panel	1 in 100	6	4.2	Annex C
Squareness	Whole panel	1 in 100	6	4.3	Annex D
Mass	Whole panel	1 in 20	6	4.4	Annex E
Moisture content	50 g	1 in 100	6	4.5	Annex F
Moisture content	Whole panel	1 in 100	6	4.5	
Modulus of elasticity	1 200 mm × 300 mm	1 in 300	2	4.6	Annex G
Bending strength	1 200 mm × 300 mm	-	2	4.7	Annex H
Resistance to impact	Whole panel	-	2	4.8	Annex I
Screw holding	100 mm × 100 mm	-	4	4.9	Annex J
Thermal conductivity	300 mm × 300 mm	-	2	4.10	Annex K
Boron content	5 g to 10 g	-	6	4.11	Annex L
Dimensional changes	1 000 mm × 1 000 mm	-	2	4.12	Annex M

Annex A
(normative)

Methods of sampling, conditioning and preparation of test specimens and test pieces

A.1 Sampling

A.1.1 Samples for quality control tests during production shall be taken at random, and at a frequency as specified in Table 4.

A.1.2 When a consignment (lot) is to be tested for type testing, six panels shall be taken at random.

A.1.3 In order to enable all tests to be carried out on a consignment, the tests described in Annex B and Annex E shall be carried out first on each panel.

A.1.3.1 Two panels shall be taken and test specimens taken for the tests described in Annex G and Annex H.

A.1.3.2 Two further panels shall be taken and test specimens taken for the test described in Annex I.

A.1.3.3 Two remaining panels shall be taken and test specimens taken for the test described in Annex M.

A.1.3.4 One test specimen shall then be taken from each panel for the tests described in Annex F and Annex L.

A.1.3.5 One test specimen shall be taken from four panels for the test described in Annex J.

A.1.3.6 One test specimen shall be taken from two panels for the test described in Annex L.

A.2 Conditioning

Unless precise conditioning is specified, the test specimens shall be conditioned by freely exposing them for at least 48 h to the atmosphere of a well-ventilated room.

Where precise conditioning is specified, the test specimens shall be conditioned to constant mass in an atmosphere of 20 °C ± 2 °C and 65 % ± 5 %.

NOTE Constant mass is considered to be achieved when two successive weighing operations carried out at an interval of 24 h do not differ by more than 0.1 % of the mass of the board or test piece.

A.3 Preparation of test specimens

Test specimens shall be whole panels, or cut from whole panels. All edges shall be cleanly cut at right angles to the panel surface.

Annex B
(normative)

Determination of dimensions of panels

B.1 Determination of length and width

B.1.1 Principle

The length and width of whole panels are determined by measurement with a metal tape or rule.

B.1.2 Test specimens

The test specimens shall be whole panels of any size supplied by the manufacturer and conditioned in accordance with A.2.

B.1.3 Apparatus

B.1.3.1 Where the accuracy of the apparatus is specified the apparatus shall be periodically calibrated.

B.1.3.2 Steel tapes or rules of sufficient length to measure the greatest dimension of the test specimen graduated to allow a reading to an accuracy of 1.0 mm.

B.1.4 Procedure

Apply the steel tape, or rule, to each edge of the panel in turn taking three measurements of width and length, two measurements approximately 25 mm from each edge and one on the axis of symmetry.

Take each measurement to the nearest 1 mm and record the results.

B.1.5 Calculation and expression of results

The mean value of the three measurements of length and width measurements shall be calculated and expressed to the nearest 1.0 mm as the length and width of the panel.

B.1.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with B.1.5;

c) a statement that this test was carried out in accordance with this standard.

B.2 Determination of thickness

B.2.1 Principle

The thickness of panels is determined by measuring with a micrometer or other measuring device.

B.2.2 Test specimens

The test specimens shall be as specified in B.1.2.

B.2.3 Apparatus

B.2.3.1 General

Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

B.2.3.2 Measuring device

Having flat and parallel measuring surfaces 16 mm ± 1 mm diameter and able to apply a total force of 0.02 N/mm^2 to the measuring surfaces. The device shall be graduated to allow a reading to an accuracy of 0.01 mm, and shall be capable of taking a measurement 100 mm in from the edge of the specimen.

B.2.4 Procedure

B.2.4.1 Take six measurements with the measuring device approximately 40 mm from the end of the panel at the positions shown in Figure C.1.

B.2.4.2 Measure the thickness to the nearest 0.1 mm.

B.2.5 Calculation and expression of results

The mean value of the six measurements shall be calculated and the panel thickness shall be expressed to the nearest 0.1 mm.

The maximum difference in thickness between the measurement at the centre of the panel and the thickness towards the edge shall be expressed to the nearest 0.1 mm.

B.2.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with B.2.6;

c) a statement that this test was carried out in accordance with this standard.

Annex C
(normative)

Determination of taper profile

C.1 Principle

The thickness of the panels over the tapered edge is determined by measuring with a measuring device. The taper width is measured with a steel rule.

C.2 Test specimens

The test specimens shall be as specified in B.1.2.

C.3 Apparatus

C.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

C.3.2 Steel rule, at least 300 mm in length, graduated to allow a reading to an accuracy of 1.0 mm.

C.3.3 Measuring device, as specified in B.2.3.

C.4 Procedure

C.4.1 Taper width

Determine the taper width to an accuracy of ± 2 mm by applying the steel rule to the face of the panel, parallel to the end of the panel at two positions as shown in Figure C.1.

Measure the effective taper on both sides of the panel.

C.4.2 Taper depth

Determine the panel thickness as specified in B.2.4 at two positions corresponding to the edge of the taper and at two positions 8 mm from the edge of the panel as shown in Figure C.1.

Measure the thickness to an accuracy of 0.1 mm and record the results.

C.5 Calculation and expression of results

C.5.1 Taper width

Each measurement of taper width shall be reported to an accuracy of ± 2 mm.

C.5.2 Taper depth

The mean value of the two measurements at each of the measuring positions shall be calculated.

Calculate the depth of taper as half the average difference between the two mean values and express it to the nearest 0.1 mm.

All dimensions are in millimeters

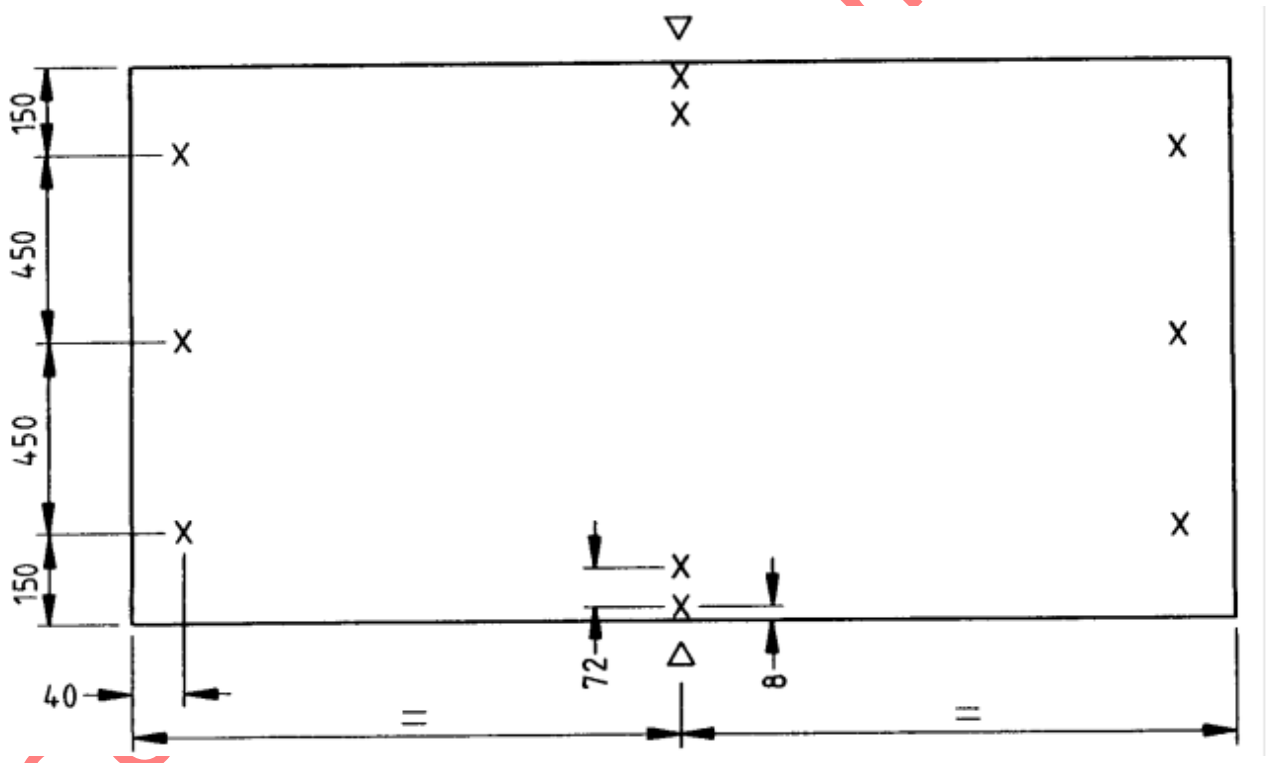


Figure C.1 — Positions for measurements of panel thickness and taper depth

C.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with C.5.1 and C.5.2;

c) a statement that this test was carried out in accordance with this standard.

Annex D
(normative)

Determination of squareness

D.1 Principle

Squareness is determined by applying a try square to the corners of the panel and measuring the deviation of the panel edges from the edges of the square.

D.2 Test specimens

The test specimens shall be as specified in B.1.2.

D.3 Apparatus

D.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

D.3.2 Try square, with arms not less than 1 m in length and an accuracy of not less than ± 0.2 mm/m, allowing measurement of the deviations from 90° of the panel edge.

D.3.3 Steel rule, graduated in 0.5 mm divisions and accurate to 0.5 mm.

D.4 Procedure

Apply the try square to each corner of the panel in turn as shown in Figure D.1. Measure the maximum linear deviation between the square and the edge of the panel at a distance of 1 000 mm from the corner with a precision of 0.5 mm, using the steel rule.

Express the result to the nearest 1 mm/m.

D.5 Expression of results

The maximum linear deviation between the square and the edge of the panel shall be expressed to the nearest 0.5 mm as the squareness of the panel. The designation (+) or (–) shall be given if the angle at the corner of the panel is greater or less respectively than 90°.

D.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with D.5;

c) a statement that this test was carried out in accordance with this standard.

All dimensions are in millimeters

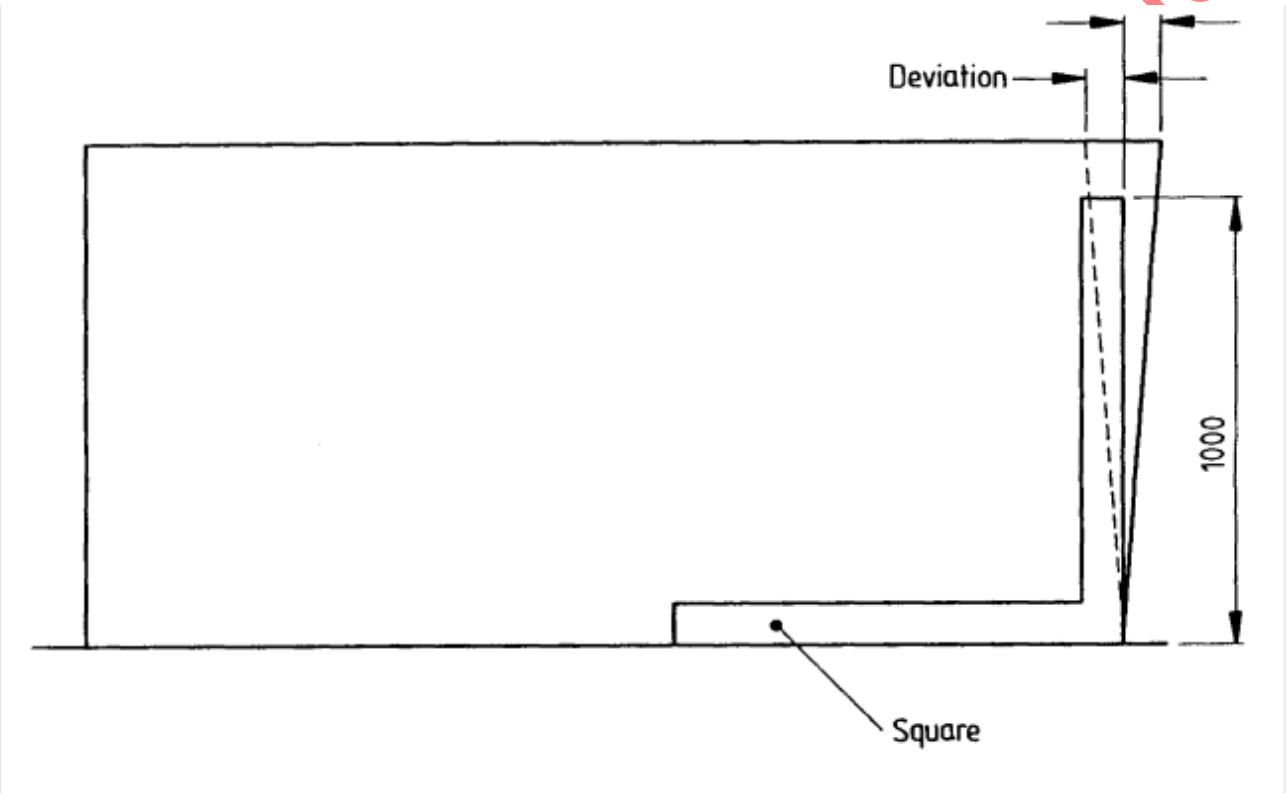


Figure D.1 — Measurement of squareness of boards

Annex E
(normative)

Determination of mass

E.1 Principle

The mass per unit area is determined by weighing and measuring the test specimen.

E.2 Test specimens

The test specimens shall be as described in B.1.2.

E.3 Apparatus

E.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

E.3.2 Balance, capable of determining mass to the nearest 50 g.

E.4 Procedure

E.4.1 Calculate the area of the specimens using the mean length and width measurements as specified in B.1.5.

E.4.2 Weigh the test specimen to the nearest 50 g.

E.5 Expression of results

The mass per unit area of the test specimen shall be expressed in kg/m^2.

E.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with E.5;

c) a statement that this test was carried out in accordance with this standard.

Annex F
(normative)

Determination of moisture content

F.1 Oven drying method

F.1.1 Principle

Moisture content is determined by measuring the loss in mass of a test specimen dried to constant mass at 103 °C ± 2 °C.

F.1.2 Test specimens

Two test specimens weighing 50 g ± 10 g shall be cut at random from each test panel, provided that each test specimen is at least 150 mm from the ends or edges of the panel.

F.1.3 Apparatus

F.1.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

F.1.3.1.1 Balance, capable of determining mass to the nearest 0.1 g.

F.1.3.1.2 Air-circulating oven, capable of maintaining an internal temperature of 103 °C ± 2 °C.

F.1.3.1.3 Desiccator, containing calcium chloride or silica gel.

F.1.3.1.4 Metal container, to accommodate the test piece.

F.1.3.2 The electronic meter shall then be reset to ensure readings are within ± 0.5 % of the result when measured in accordance with F.1.

F.1.4 Procedure

F.1.4.1 Place each test piece in a suitable container, previously dried at 103 °C ± 2 °C to constant weight and allowed to cool at room temperature in a desiccator.

F.1.4.2 Weigh the container and test piece to an accuracy of 0.1 g.

F.1.4.3 Dry the container and test piece in the ventilated oven at a temperature of 103 °C ± 2 °C, until the weight is constant to 0.1 % between two weighings made at an interval of not less than 1 h.

NOTE Container and test piece should be allowed to cool at room temperature in a desiccator before each weighing.

F.1.5 Calculation and expression of results

F.1.5.1 The moisture content of the test specimen, ω, expressed as a percentage by mass shall be calculated from the equation:

$$\omega = \left(\frac{M_H - M_o}{M_o} \right) 100$$

Where,

M_H is the mass of the container and test specimen before drying (in g);

M_O is the mass of the container and test specimen after drying to constant mass (in g).

F.1.5.2 The result shall be expressed to the nearest 0.1 %.

NOTE The moisture content of a panel or batch of panels is equal to the mean of the moisture contents of all the relevant test specimens.

F.1.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with F.1.5;

c) a statement that this test was carried out in accordance with this standard.

F.2 Electronic moisture meter method

F.2.1 Principle

Moisture content is determined by the use of an electronic moisture meter.

F.2.2 Test specimens

The test specimens shall be whole panels.

F.2.3 Apparatus

F.2.3.1 Where the accuracy of the apparatus is specified the apparatus shall be periodically calibrated.

F.2.3.2 Electronic moisture meter, capable of measuring moisture contents in the range of 12 % to 20 % with probes between 20 mm and 40 mm long. The meter shall be calibrated by taking 10 readings in panels covering the moisture content range of 10 % to 18 %, and by comparing the results with results of moisture content tests carried out in accordance with F.1 on the same portions of the panels.

F.2.4 Procedure

Take six readings from each test specimen.

F.2.5 Expression of results

The mean moisture content shall be expressed as a percentage.

F.2.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with F.2.5;

c) a statement that this test was carried out in accordance with this standard.

Annex G
(normative)

Determination of modulus of elasticity

G.1 Principle

The modulus of elasticity perpendicular to the plane in bending is determined by applying a uniform line load at the centre of a test specimen spanning between two supports parallel to the line load and measuring the deflection of the specimen under the load as the load is increased.

G.2 Test specimens

Two test specimens shall be cut from each test panel and shall be 1 200 mm ± 10 mm long and 300 mm ± 5 mm wide. One specimen shall be cut with the 1 200 mm dimension parallel to the longitudinal edge of the panel, and one specimen with the 1 200 mm dimension at right angles to the longitudinal edge of the panel. For panels with longitudinal continuous voids the specimen with the 1 200 mm dimension parallel to the longitudinal edge of the panel shall be cut so that a pair of voids (typically 57 mm apart) is positioned centrally ± 10 mm of the width of 300 mm.

G.3 Apparatus

G.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

G.3.2 Measuring device, as specified in B.2.3.

G.3.3 Steel tape, as specified in B.1.3.

G.3.4 Dial gauge, fitting centrally under the test specimen, with a measuring capacity of 50 mm, and capable of giving a reading to an accuracy of 0.1 mm.

G.3.5 A test apparatus, as shown in Figure G.1, which shall consist of the following:

a) two parallel cylindrical supports at least 300 mm long, spaced 1 100 mm apart, and having a diameter of 30 mm ± 5 mm;

b) a cylindrical loading head 300 mm long and having a diameter of 30 mm ± 5 mm, parallel to and centrally between the supports, and adjustable in the vertical plane.

All dimensions are in millimeters

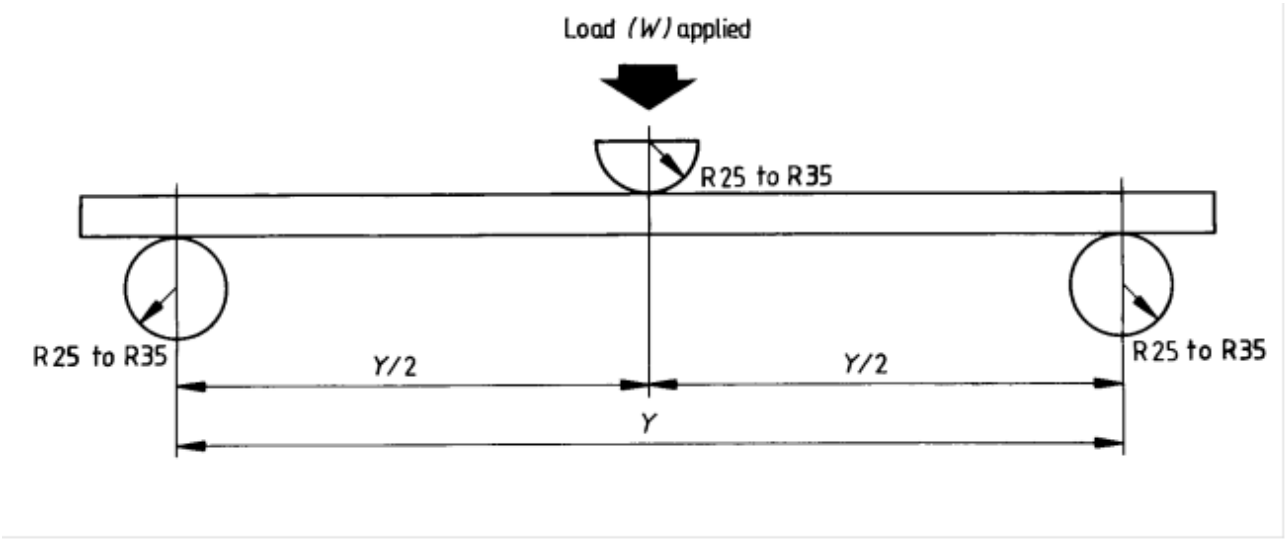


Figure G.1 — Test apparatus for determining the modulus of elasticity and bending strength

G.4 Procedure

G.4.1 Mark the mid points of each long edge of the test specimen and measure the width of the test specimen, between these points, with a steel rule to the nearest 1.0 mm.

G.4.2 Measure the thickness of the test specimen under the load position at about 20 mm in from each edge with the measuring device and record the mean of the two values to the nearest 0.1 mm.

G.4.3 Support the specimen on the parallel supports as shown in Figure G.1.

G.4.4 Apply an increasing load at a rate of 15 mm ± 3 mm/m to the test specimen and measure the deflection under the sample to the nearest 0.1 mm at regular increments of load. For this purpose the load shall be increased up to one-third of the expected breaking load of the test specimen.

G.4.5 Construct a load deflection curve for the data obtained, as shown in Figure H.1.

G.4.6 If the test machine does not provide a continuous load-deflection plot, at least eight data points up to one-third of the expected breaking load of the specimen should be recorded during the test and used to construct the best-fitting straight line through these data points.

G.5 Calculation and expression of results

The modulus of elasticity perpendicular to the plane of the board in bending, E_m (in N/mm^2), shall be calculated from the equation:

$$E_m - \frac{Y^3 \Delta W}{4 B T^3 \Delta S}$$

Where,

Y is the span between supports (in mm);

ΔW is the increment in load on the straight line position of the load-deflection curve (see Figure G.1) (in N);

B is the width of the specimen (in mm);

T is the thickness of the specimen (in mm);

ΔS is the increment in deflection corresponding to W increment in load (in mm).

G.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with G.5;

c) a statement that this test was carried out in accordance with this standard.

Annex H
(normative)

Determination of bending strength

H.1 Principle

The bending strength perpendicular to the plane in bending is determined by applying a uniform distributed line load at the centre of a test specimen spanning between two supports. The load is increased until failure.

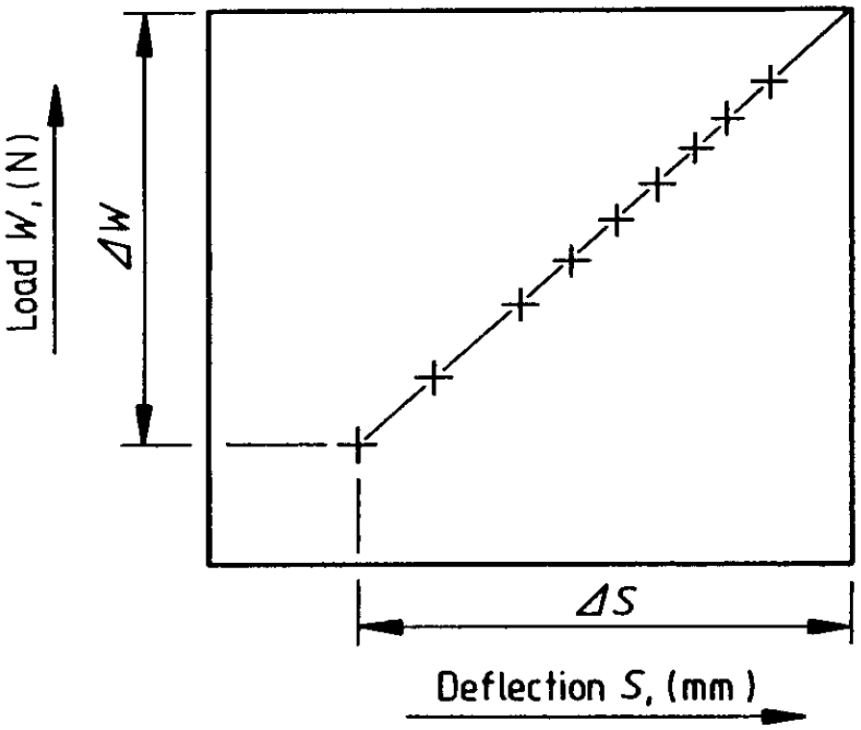


Figure H.1— Load deflection curve for determining the modulus of elasticity

H.2 Test specimens

These shall be as described in G.2.

H.3 Apparatus

H.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

H.3.2 Measuring device, as specified in B.2.3.

H.3.3 Steel tape, as specified in B.1.3.

H.3.4 Test apparatus, as specified in G.3.4.

H.4 Procedure

H.4.1 Determine the width and thickness of the test specimen as specified in G.4.

H.4.2 Support the specimen as specified in G.4 and shown in Figure G.1.

H.4.3 Apply an increasing load through the loading head to the specimen until fracturing of the specimen occurs. The rate of increase in load shall be at a rate of 15 mm ± 3 mm/min.

H.4.4 Record the failing load in newtons to the nearest 5 N or 1 %, whichever is the greater.

H.5 Calculation and expression of results

H.5.1 The bending strength p, in (N/mm^2), is given by the equation:

$$p = \frac{3WY}{2BT^2}$$

Where,

W is the failure load (in N);

Y is the span between supports (in mm);

B is the width of the test specimen (in m);

T is the thickness of the test specimen (in mm).

H.5.2 The bending strength of each test specimen shall be expressed to the nearest 1 N/mm^2.

H.5.3 Bending strength may be determined on test specimens used to determine modulus of elasticity.

H.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with H.5;

c) a statement that this test was carried out in accordance with this standard.

Annex I
(normative)

Determination of resistance to impact

I.1 Principle

Impact strength is determined by allowing a body of defined mass and shape to impact against a firmly supported vertical panel.

I.2 Test specimen

The test specimens shall be as specified in B.1.2.

I.3 Apparatus

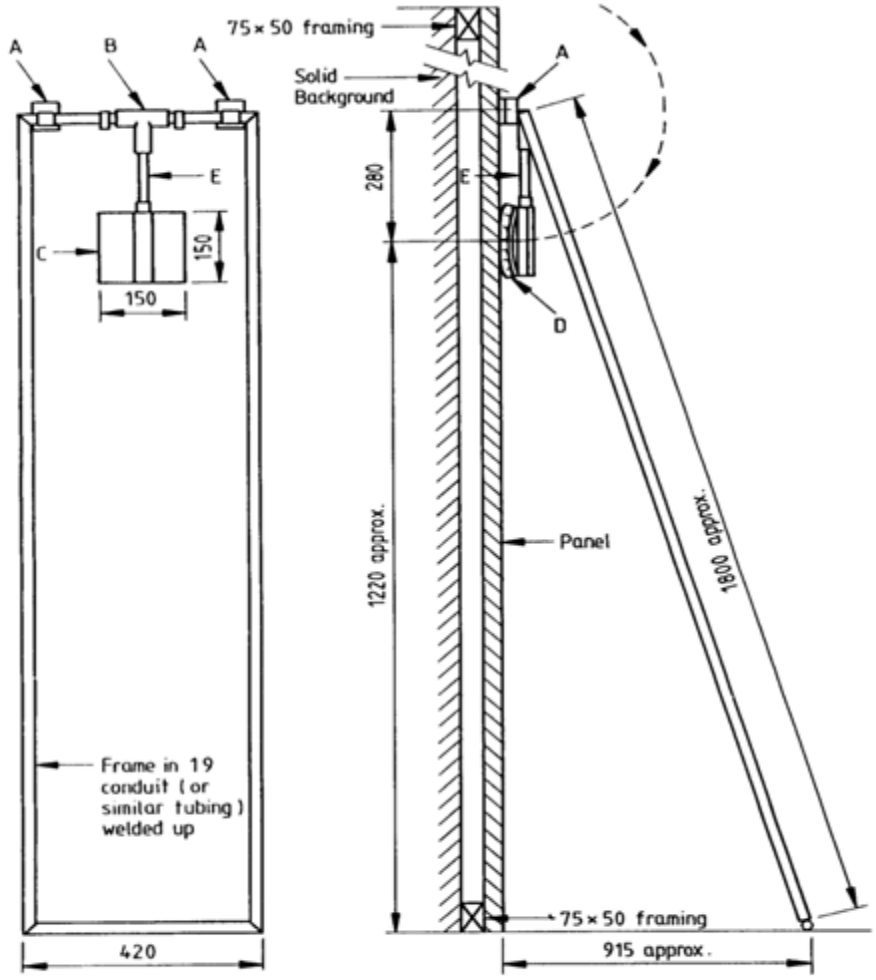
I.3.1 General

The apparatus shall be periodically calibrated for the purpose of the accuracy.

I.3.2 The test rig

The test rig shown in annex I.1 shall be used. The impact pad with backing plate C and swing arm E shall weigh a total of 6.8 kg.

All dimensions are in millimetres



Key

A Swivel bearing pads 50 sq: with 25 thick sponge rubber as in D

B Pivot with stops

C Impact pad with backing plate

D 25 thick sponge rubber pad on a steel former, having 12 rise over 150

E Arm 19 conduit screwed at each end into a pivot and impact pad

Figure I.1 — Impact strength test rig

I.4 Procedure

I.4.1 Erect the panel vertically and hold rigid at head and base. The test rig shall be rested against the panel, and restrained during the test just sufficiently to keep the swivel bearing pads in contact with the panel.

I.4.2 Allow the impact pad to fall freely from rest as near as practicable through 180°.

I.4.3 Deliver a single blow at a point approximately 1 200 mm from ground level and midway in the width of the test panel.

I.4.4 After delivery of the single impact, catch the swing arm to prevent any further impact.

I.5 Expression of results

Failure or otherwise of the specimen shall be recorded.

NOTE Failure occurs if the surface of the panel fractures or exhibits residual deflection.

I.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with I.5;

c) a statement that this test was carried out in accordance with this standard.

Annex J
(normative)

Determination of screw holding

J.1 Principle

Face screw holding is determined by measuring the axial force required to withdraw a wood screw from the test specimen.

J.2 Test specimens

Test specimens 100 mm ± 5 m × 100 mm ± 5 mm shall be cut from test panels as specified in A.1 and conditioned as specified in A.2.

J.3 Apparatus

J.3.1 The apparatus shall be periodically calibrated for the purpose of the accuracy.

J.3.2 Test machine, capable of applying an increasing axial load to the underside of the screw head through a suitable stirrup whilst adequately restraining the test specimen.

J.3.3 Steel countersunk wood screws, 38 mm long by no. 10 screw gauge

J.4 Procedure

Screw one 38 mm wood screw into the centre of a face of each specimen and perpendicular to it to a depth of 35 mm ± 2 mm. Support the test specimen in such a way that the surface of the specimen is not supported at any point closer than 25 mm to the axis of the screw and is held perpendicular to the direction of the force applied to the screw.

Apply an increasing axial tensile force to the screw head at a constant rate so that complete pullout of the screw occurs between 30 s and 120 s.

J.5 Expression of results

The maximum load sustained by the test specimen shall, be expressed to the nearest newton.

Annex K
(normative)

Determination of thermal conductivity

K.1 Principle

The thermal conductivity is determined using appropriate methods.

K.2 Test specimens

The test specimens shall be conditioned and shall be 300 mm × 300 mm and of 50 mm or 58 mm thickness. The cut edges shall be sealed with self-adhesive tape which shall not overlap the faces of the panel.

K.3 Apparatus

K.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

K.3.2 Guarded hot plate, with hot and cold plates capable of being maintained at temperatures of 30 °C and 15 °C respectively.

K.3.3 Apparatus for the determination of moisture content as specified in F.1.3.

K.4 Procedure

K.4.1 Use a composite test specimen formed from two test specimens on either side of the guarded hot plate and determine the thermal conductivity.

K.4.2 Weigh the test specimens to an accuracy of 0.01 g as soon as the thermal conductivity test is concluded.

K.4.3 Dry the test specimens to constant mass as specified in F.1.4.

K.5 Expression of results

The thermal conductivity shall be expressed in W/(m·K). The moisture content results shall also be expressed for the same test specimen as specified in F.1.5.

K.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with K.5;

c) a statement that this test was carried out in accordance with this standard.

Annex L
(normative)

Determination of boron content

L.1 Principle

A test specimen is broken into small lengths of straw and extracted with a known volume of boiling water. The boron content of the extract is determined by titration in the presence of mannitol.

L.2 Test specimens

One specimen shall be cut from each test panel, ensuring that the specimens are evenly positioned across the width of the panels. The test specimens shall be conditioned as specified in A.2. The weight of each test specimen shall be from 5 g to 10 g.

L.3 Apparatus

L.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

L.3.2 A 250 mL flat-bottomed flask, with ground glass socket.

L.3.3 Liebig condenser, with ground glass cone to fit flask.

L.3.4 Standard laboratory glassware

L.3.5 Hydrochloric acid, A.R., 2.5 % (V/V).

L.3.6 Sodium hydroxide, A.R. N/10 CO_2 free, standardized, c(NaOH) = 0.1 mol/L.

L.3.7 Mannitol (neutral).

L.3.8 Methyl red indicator, 0.1 % (m/V) solution in ethanol.

L.3.9 Phenolphthalein indicator, 0.1 % (m/V) solution in ethanol.

L.3.10 Balance, capable of determining mass to nearest 0.01 g.

L.4 Procedure

L.4.1 Cut the test specimen into lengths up to 10 mm long. Weigh all the specimen to an accuracy of 0.01 g into a 250 mL flat-bottomed flask and add 125 mL of distilled water.

L.4.2 Connect the flask to the condenser and boil the contents gently under reflux for 30 min. Remove the heat source and allow the flask to cool to about 50 °C with the top of the condenser being covered by an inverted small beaker.

L.4.3 Remove approximately 25 mL of the extract by pipette and use this to wash down the inside of the condenser, returning the washings to the bulk of the extract in the flask. Stop the flask and allow to cool to room temperature.

L.4.4 Pipette a 50 mL aliquot of the extract into a conical flask and add three drops of methyl red indicator.

L.4.5 Add the HCl solution [2.5 % (V/V)] drop wise until the indicator turns red, adding a few drops in excess. Cover the flask with a watch glass and gently simmer the solution for 2 min to remove CO_2.

L.4.6 Cool the flask to room temperature and neutralize with standard NaOH solution from a burette until the colour turns pink.

L.4.7 Add 10 g mannitol followed by 10 drops phenolphthalein indicator and titrate with standard NaOH solution until the colour turns pink. Record this titre (T1).

L.4.8 Determine a reagent blank and record the titre (T2).

L.5 Calculation and expression of results

L.5.1 The value of boron, B, expressed as a percentage in the test specimen sample shall be calculated from the equation:

$$B = \left(\frac{T \times N \times 1.082 \times 2.50}{W} \right) 100$$

Where,

T is the corrected titre, i.e. *T1 – T2*;

N is the normality of sodium hydroxide solution;

W is the weight of air dry straw sample.

L.5.2 Both the mean and minimum boron content shall be expressed to the nearest 0.05 %.

L.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with L.5;

c) a statement that this test was carried out in accordance with this standard.

Annex M
(normative)

Determination of dimensional changes associated with changes in relative humidity

M.1 Principle

The differences in length and width of the test specimens after conditioning at 20 °C and 65 % relative humidity followed by reconditioning at either 25 °C and 35 % relative humidity or 25 °C and 85° relative humidity are expressed as a percentage increase (+) or decrease (–) of the original value.

M.2 Test specimen

M.2.1 One test specimen shall be cut from each panel and shall be 1 000 mm ± 10 mm × 1 000 mm ± 10 mm × board thickness. All cut edges shall be resealed with 100 mm wide waterproof tape.

M.2.2 Round metal pins of 10 mm in diameter and 65 mm long shall be inserted and cemented into a predrilled hole in one face of the specimen to a depth of 45 mm.

M.2.3 The pins shall be positioned 100 mm in from the edge to define the principal dimensions of length and width which shall be approximately 800 mm.

M.2.4 Sufficient pins shall be inserted to allow for two measurements of length and width to be taken on each test specimen.

M.3 Apparatus

M.3.1 Where the accuracy of the apparatus is specified, the apparatus shall be periodically calibrated.

M.3.2 Measuring device, capable of measuring dimensions to an accuracy of 0.05 min.

M.3.3 Controlled humidity room, or airtight vessels capable of maintaining the required relative humidities.

M.3.4 Calibrated hygrometer, to measure and record relative humidity to an accuracy of ± 2 % in test room or each vessel.

M.3.5 Balance, capable of reading up to 30 kg to an accuracy of 0.01 kg.

M.4 Procedure

M.4.1 Condition the test specimens at 65 % ± 5 % relative humidity and 20 °C ± 2 °C, to constant mass as specified in A.1.2. Measure the length and width between the pairs of metal pins to an accuracy of 0.05 mm.

M.4.2 Repeat the measurements after conditioning the specimens to constant mass at 35 % ± 5 % relative humidity and 25 °C ± 2 °C, and 85 % ± 5 % relative humidity and 25 °C ± 2 °C.

NOTE The preliminary equilibrium measurement is made at 65 % relative humidity so that it can be seen what proportion of the observed dimensional changes in the 35 % to 85 % relative humidity range takes place above or below this figure. 65 % relative humidity is taken to represent the average conditions to which the boards will be exposed in normal use.

M.5 Calculation and expression of results

M.5.1 The increases in length and width after reconditioning to 85 % relative humidity, I_L and I_W, and the decreases in length and width after reconditioning to 35 % relative humidity, D_L and D_W, expressed as percentages, shall be calculated from the equations:

$$I_L = \left(\frac{\Delta L_1}{800}\right)100$$

$$I_W = \left(\frac{\Delta W_1}{800}\right)100$$

$$D_L = \left(\frac{\Delta L_2}{800}\right)100$$

$$D_W = \left(\frac{\Delta W_2}{800}\right)100$$

Where,

ΔL_1 is the average difference in length at 20 °C & 65 % relative humidity and 25 °C & 85 % relative humidity;

ΔW_1 is the average difference in width at 20 °C & 65 % relative humidity and 25 °C & 85 % relative humidity;

ΔL_2 is the average difference in length at 20 °C & 65 % relative humidity and 25 °C & 35 % relative humidity

ΔW_2 is the average difference in width at 20 °C & 65 % relative humidity and 25 °C & 35 % relative humidity

M.5.2 The result shall be expressed as a positive value (+%) for I_L and I_W and as a negative value (–%) for D_L and D_W to the nearest 0.05 %.

M.6 Test report

The test report shall contain the following information:

a) the type of board as defined in Clause 3;

b) the result expressed in accordance with M.5;

c) a statement that this test was carried out in accordance with this standard.

Annex N
(informative)

Guidance on the use of compressed straw building panels

N.1 Compressed straw panels should be stored on flat and level ground by supporting on at least three equally spaced bearers positioned parallel to the short edges of the panels, with bearers at the ends of the panels.

N.2 Panels should be well protected from rain or dampness or accidental damage.

N.3 As with other organic building materials, compressed straw panels should not be used in permanently damp situations, or when continuous high humidity conditions exist. The guidance of the manufacturer should be sought if it is intended to use panels in high humidity conditions.

N.4 The compressed straw panels referred to in this standard are for use in building construction for such purposes as roof lining or ceilings; as partitioning with or without framing; or as inner lining to external walls of brick, metal or other materials.

N.5 For internal applications in unheated buildings, or for temporary application, panels types A or C are suitable. For all other internal applications, types B or D are suitable.

N.6 For domestic partitioning application, panels of type D.b (2) should be used. Panels may be fixed together at the edges and erected without framing. Type (b) facings are suitable for plastering with neat board finish plaster, type class B (b2) to a minimum thickness of 3 mm.

N.7 When panels are cut, the cut edges should be adequately sealed as recommended by the manufacturer to prevent the ingress of moisture insects or mould growth. Polyvinyl Acetate (PVA)-based liquid sealers and self-adhesive tapes should be used. In addition cut edges across the width of the panel (which being cut in the direction of the straw fibres tend to be looser) should be sealed with 100 mm self-adhesive tape.

N.8 Where the panel surface is cut to accommodate electrical services, outlet boxes should be fixed to the panel in accordance with the manufacturers' instructions. Any exposed straw surfaces around the box or where the electrical cable enters the box should be effectively sealed.

N.9 Compressed straw panels should not be used as self-supporting roof decking. When used for internal wall or roof lining, a grade of panel with a shower proof facing, i.e. facing type (c), should be used with this facing adjacent to the cavity between the panel and the roof or wall.

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