

Particleboard —

Part 1: Methods of sampling, conditioning and test

Committees responsible for this British Standard

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- British Cement Association
- British Plastics Federation
- British Woodworking Federation
- Department of the Environment (Building Research Establishment)
- Department of the Environment (Property Services Agency)
- European Structural Panel Association
- Flat Roofing Contractors Advisory Board
- Furniture Industry Research Association
- International Cement Bonded Particleboard Federation
- National Federation of Roofing Contractors
- National House-building Council
- Timber Research and Development Association
- Timber Trade Federation
- United Kingdom and Ireland Particleboard Association
- Zurich Municipal Building Guarantee

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Foreword

BS 5669 has been prepared under the direction of the Timber Standards Policy Committee. This revision supersedes BS 5669:1979, which is withdrawn.

Since BS 5669:1979 was published, the range of particleboards available has continued to grow. The format of the 1979 edition, which covered only four board types, did not permit the expansion necessary to include additional types of particleboard and this revision therefore comprises a series of Parts of BS 5669 as follows.

- *Part 1: Method of sampling, conditioning and test;*
- *Part 2: Specification for wood chipboard;*
- *Part 3: Specification for oriented strand board (OSB);*
- *Part 4: Specification for cement bonded particleboard;*
- *Part 5: Code of practice for the selection and application of particleboards for specific purposes.*

The methods of sampling, conditioning and test given in this Part of BS 5669 are derived from the now withdrawn BS 1811 and BS 2604, and from Appendix A and Appendix B of BS 5669:1979.

Many of the test methods from Appendix A of BS 5669:1979 have been retained, but the inclusion of a new structural grade of wood chipboard (C5) in BS 5669-2 and the additional type of material specified in BS 5669-4 has required the development of further methods given in this Part of BS 5669. The deletion of types C3 and C4 wood chipboard from BS 5669-2 and their replacement by types C3(M) and C4(M) has also required the addition of a further test method, clause 27, *Determination of moisture resistance under cyclic exposure*, to this Part. Determination of some board properties, e.g. fire properties, is made using methods already given in other British Standards, and in such cases cross-references are given in the appropriate clauses of BS 5669-2 and BS 5669-4.

Not all the methods of test given in this Part of BS 5669 are called up in BS 5669-2 and BS 5669-4. They are given, however, because they have been found useful for purposes of development and research and, in some cases, for comparison of particleboards with other wood-based panel products. To enable the user to distinguish between the tests in BS 5669-2 and BS 5669-4, they are listed in Appendix A, which also indicates tests introduced for the first time in this Part of BS 5669.

The test methods for assessing particleboards given in this Part of BS 5669 can be applied to all the board types specified in BS 5669-2 and BS 5669-4, thus permitting direct comparison of property levels among all particleboards. Grade stresses and moduli derived from the specification for type C5 boards in BS 5669-2 are included in BS 5268-2.

In this revision attention has been paid to comparability and equivalence of test methods with ISO¹⁾ and European (CEN²⁾ standards, and also the recommendations of Technical Committee TIB/26 for uniformity of methods of test for plywood, fibre building boards and particleboards.

The question of providing precision data for the methods of test has been considered by the Technical Committee responsible for this standard, but it is deemed that such data are not applicable to nonhomogeneous materials.

¹⁾ ISO = International Organization for Standardization.

²⁾ CEN = European Committee for Standardization.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 42, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This Part of BS 5669 describes methods for the selection of boards and the sampling and conditioning of such boards and of test pieces, methods for the preparation of test specimens from such test pieces and methods of test for determining specific board properties.

Appendix A gives cross-references for the test methods and the requirements specified in BS 5669-2, BS 5669-3 and BS 5669-4.

Appendix B gives guidance on the use of quality control charts and methods of sampling.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5669 the definitions given in BS 6100-4.3 apply together with the following.

2.1

lot

quantity of boards manufactured or produced under conditions that are presumed uniform

2.2

test board

board required for testing or to provide test specimens

NOTE Test boards may be of any size of whole boards available, or may consist of 600 mm widths cut from boards at right angles to the direction of production.

2.3

test piece

piece cut from a test board

2.4

test specimen

piece cut from a test piece to comply with the dimensions required for any of the appropriate tests

Section 2. Methods of sampling, conditioning and preparation of test specimens and determination of dimensions and mass of test specimens

3 Sampling

3.1 Methods of sampling (excluding for determination of extractable formaldehyde)

NOTE Guidance on the use of quality control charts for random sampling during manufacture is given in Appendix B.

When a consignment (lot) is to be tested (for example for compliance of one or more properties with the mean quality levels for a particular board type) the sample shall consist of six boards taken at random from the lot. Six test pieces shall be selected at random from each board.

3.2 Method of sampling for determination of extractable formaldehyde

3.2.1 For quality control. At appropriate intervals, three test pieces selected by random sampling (see **B.2**) shall be cut from a single board. Each test piece shall be conditioned in accordance with clause 4 and further subdivided to provide a mass of test specimens as required by clause 22. The three groups of test specimens shall be placed in a container and mixed thoroughly. A quantity of test specimens having a mass of 160 g to 170 g shall be taken from the mixed sample for each test.

3.2.2 For consignment (lot) testing. The procedure described in 3.2.1 shall be followed except that the sample shall consist of three boards taken at random. Three test pieces selected in accordance with 3.1 shall be taken from each board and conditioned in accordance with clause 4. The appropriate quantity of test specimens shall then be cut and mixed in accordance with 3.2.1. A sample of 160 g to 170 g of test specimens shall be taken from the mixed samples for the determination of extractable formaldehyde.

4 Conditioning of whole boards, test pieces and test specimens

Whole boards, test pieces and test specimens selected in accordance with clause 3 shall be conditioned to constant mass in an atmosphere of 20 ± 2 °C and 65 ± 5 % r.h. (or 45 ± 5 % r.h. in the case of the formaldehyde test described in clause 22).

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

5 Preparation of test specimens

Test specimens shall be cut from test pieces that have been conditioned to constant mass in accordance with clause 4. The dimensions and/or mass shall be as required for the appropriate test method. All edges shall be at right angles to the board surface.

6 Determination of dimensions and mass of test specimens

6.1 Apparatus

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

6.1.2 Micrometer, having flat and parallel measuring surfaces 16 ± 1 mm diameter and means, such as a weight, spring or slipping clutch, to apply a pressure of approximately 0.02 N/mm^2 to the measuring surfaces. It shall be graduated to allow readings to an accuracy of 0.01 mm.

6.1.3 Sliding caliper, with jaws not less than 3.5 mm thick and graduated to allow readings to an accuracy of 0.1 mm.

6.1.4 Steel rule, graduated in divisions of 1.0 mm.

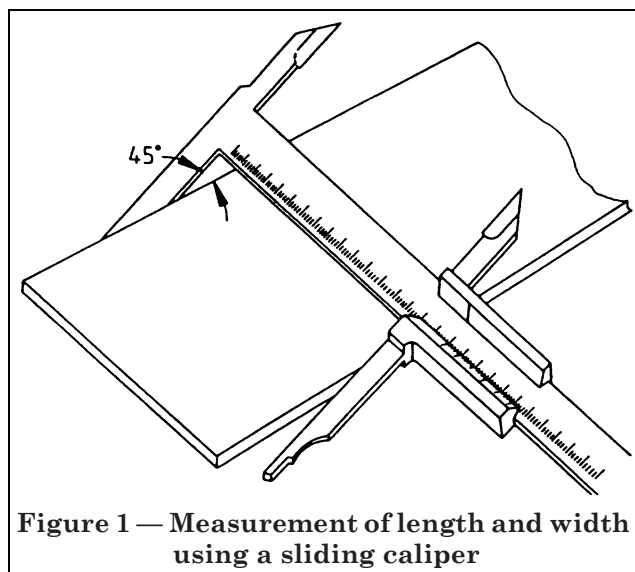
6.1.5 Balance, capable of determining mass to the nearest 0.01 g.

6.2 Procedure

6.2.1 Length and width. Measure the width and length of the test specimen to the nearest 0.1 mm or 1.0 mm, as appropriate to the test method, using either the sliding caliper (**6.1.3**) or the steel rule (**6.1.4**). When using the sliding caliper, apply the jaws slowly to the edge of the test specimen at an angle of approximately 45° , as shown in Figure 1, and record the result.

6.2.2 Thickness. Apply the micrometer (**6.1.2**) to the test specimen at the point(s) indicated in the appropriate test method. The thickness at each point shall be expressed to the nearest 0.01 mm, or the mean thickness shall be calculated and recorded from two or more measurements as required by the test method.

6.2.3 Mass. Weigh the test specimen to the nearest 0.1 g, using the balance (**6.1.5**) and record the result.



Section 3. Methods of test for specific properties

7 Determination of dimensions of boards

7.1 Determination of length and width

7.1.1 Principle. Whole boards are measured with a metal tape or rule.

7.1.2 Test specimens. Test specimens shall be whole boards of any size as supplied by the manufacturer and conditioned in accordance with clause 4.

7.1.3 Apparatus

7.1.3.1 General. The apparatus shall be periodically calibrated.

7.1.3.2 Steel tape or rule, of sufficient length to measure the greatest dimension of the test specimen, graduated to allow a reading to an accuracy of 1.0 mm.

7.1.4 Procedure. Apply the steel tape or rule (7.1.3.2) to each edge of the board in turn on a line approximately 25 mm from, and parallel to, the edge. Measure each edge to the nearest 1 mm and record the results.

7.1.5 Calculation and expression of results. The mean of the two pairs of length and width measurements shall be calculated and expressed to the nearest 1.0 mm as the length and width of the board.

7.2 Determination of thickness

7.2.1 Principle. Whole boards are measured using a micrometer.

7.2.2 Test specimens. Test specimens shall be in accordance with 7.1.2.

7.2.3 Apparatus

7.2.3.1 General. The apparatus shall be periodically calibrated.

7.2.3.2 Micrometer as described in 6.1.2.

7.2.4 Procedure. Apply the micrometer (7.2.3.2) to three points, selected at random, along the long edges of the board and approximately 25 mm from the edge. Measure the thickness to the nearest 0.05 mm and record the results.

7.2.5 Calculation and expression of results. The mean of the six measurements shall be calculated and the board thickness shall be expressed to the nearest 0.05 mm.

7.3 Determination of edge straightness

7.3.1 Principle. A metal straight edge is applied to the edge of the board and the deviation of the board edge from the straight edge is measured using a steel rule (see Figure 2).

7.3.2 Test specimens. Test specimens shall be in accordance with 7.1.2.

7.3.3 Apparatus

7.3.3.1 Steel rule graduated in 0.5 mm divisions.

7.3.3.2 Metal straight edge.

7.3.4 Procedure. Apply the metal straight edge (7.3.3.2) to each edge of the board in turn, as shown in Figure 2. Measure the maximum gap(s) between the straight edge and the board, using the steel rule (7.3.3.1), and record the result to the nearest 0.5 mm.

7.3.5 Expression of results. The maximum deviation from a straight line connecting the corners of the board shall be expressed in millimetres per metre, to the nearest 1 mm. The result shall be designated (+) if the edge is convex or (–) if the edge is concave.

7.4 Determination of squareness

7.4.1 Principle. Deviations from the inner edges of a try square are measured (see Figure 3).

7.4.2 Test specimens. Test specimens shall be in accordance with 7.1.2.

7.4.3 Apparatus

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

7.4.3.2 Steel rule as described in 7.3.3.1.

7.4.3.3 Try square with arms not less than 1.0 m in length and an accuracy of ± 0.2 mm/m.

7.4.3.4 Metal straight edges.

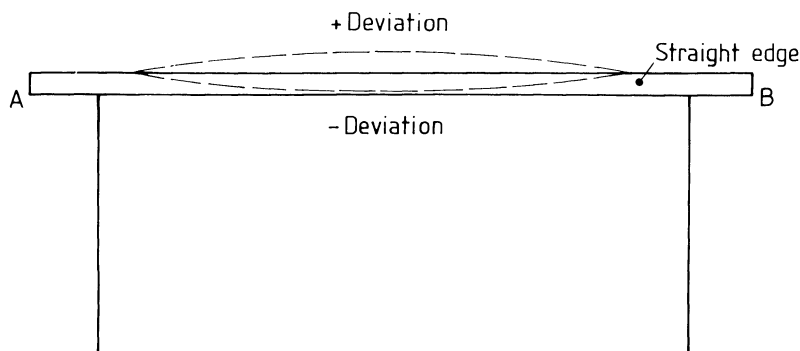


Figure 2 — Measurement of edge straightness

7.4.4 Procedure. Apply the try square (7.4.3.3) to each corner of the board in turn, as shown in Figure 3(a).

The 45° line shall coincide with the corner being measured (point A) and one arm of the try square shall be coincident with the longer edge of the board.

Measure the maximum deviation between the try square and the edge of the board at point B to the nearest 0.5 mm using the steel rule (7.4.3.2). If the side lengths of the board exceed 1 m, use the try square in conjunction with two straight edges as shown in Figure 3(b). Make measurements as previously described in this paragraph.

7.4.5 Expression of results. The maximum deviation between the try square and the edge of the board at any one corner shall be expressed to the nearest 0.5 mm per metre length as the squareness of the board. The designations (+) shall be given if the angle is greater than 90° and (–) if the angle is less than 90°.

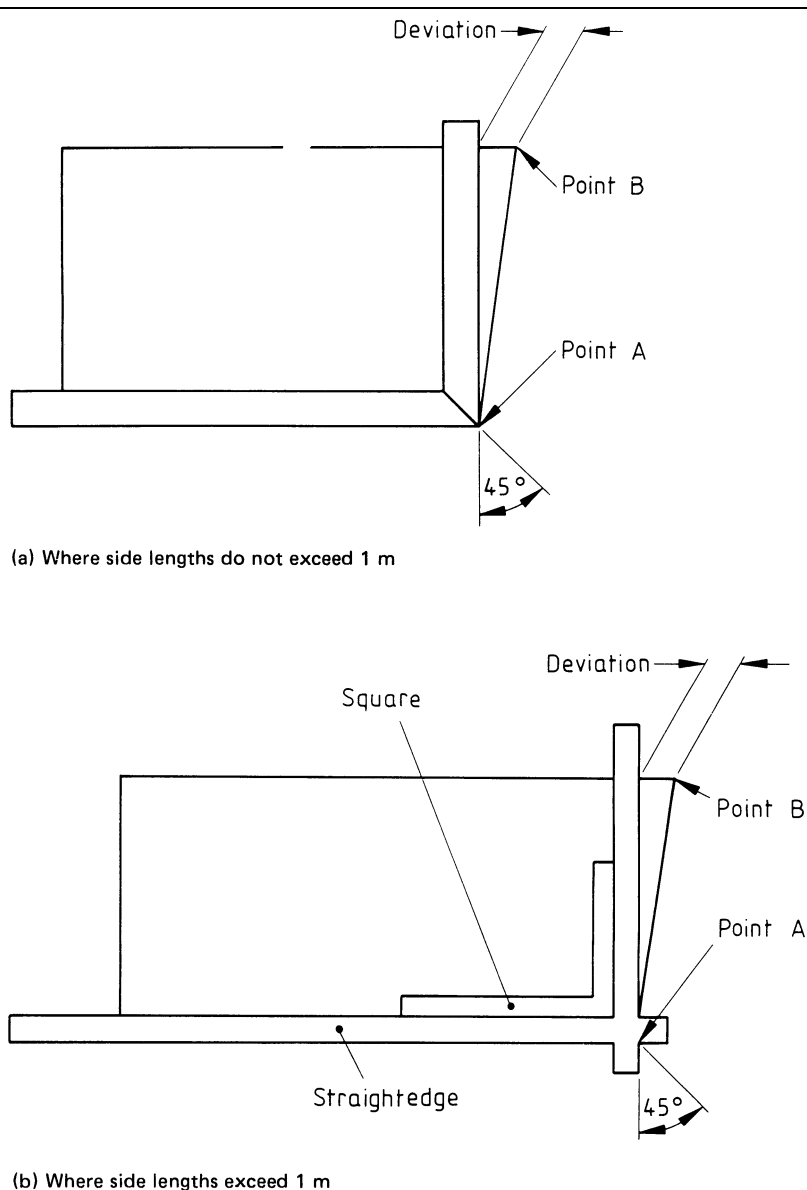


Figure 3 — Measurement of squareness of boards

7.5 Determination of flatness (only applicable to boards greater than 10 mm in thickness)

7.5.1 Principle. The deviation of the board surface from a cord or metal straight edge in contact with both arrises and parallel to either the long edge or short edge is measured. Twist is determined similarly, but along the diagonals of the board.

7.5.2 Test specimens. Test specimens shall be in accordance with 7.1.2.

7.5.3 Apparatus

7.5.3.1 Steel rule as described in 7.3.3.1.

7.5.3.2 Metal straight edge or thin cord.

7.5.4 Procedure. Stand the test specimen upright on a horizontal floor, so that it is unrestrained, with the shorter edges vertical. Place the straight edge (7.5.3.2) (or stretch the thin cord) vertically across the test specimen so that it touches both arrises at points approximately 25 mm from one end.

Measure the maximum distance between the straight edge or cord and the board surface to the nearest 1 mm, using the steel rule (7.5.3.1). Repeat this procedure at the centre of the test specimen and at the opposite end. Record the maximum deviation found at any point to the nearest 1 mm.

NOTE This method measures curvature across the board width. Curvature in the length of the board may be similarly measured by placing the straight edge or cord parallel to the longer dimension. Twist can be measured as deviation from a line connecting the diagonally opposite corners of the test specimen.

7.5.5 Expression of results. The maximum curvature in width and length or twist shall be expressed to the nearest 1 mm.

8 Determination of density

8.1 Principle

Density is determined from the calculated volume of the test specimen and its mass.

8.2 Test specimens

Test specimens shall be 100 mm square × board thickness and shall be conditioned and prepared in accordance with clauses 4 and 5.

8.3 Apparatus

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

8.3.2 Micrometer as described in 6.1.2.

8.3.3 Sliding caliper as described in 6.1.3.

8.3.4 Balance as described in 6.1.5.

8.4 Procedure

Measure the thickness of the test specimen in accordance with 6.2.2 at the four points shown in Figure 4 using the micrometer (8.3.2). Record the mean of the four values as the thickness of the test specimen.

Measure the length and width of the test specimen in accordance with 6.2.1 using the sliding caliper (8.3.3).

Calculate the volume of the test specimen.

Weigh the test specimen to the nearest 0.1 g.

8.5 Calculation and expression of results

The density of the test specimen ρ (in kg/m³) shall be calculated from the equation

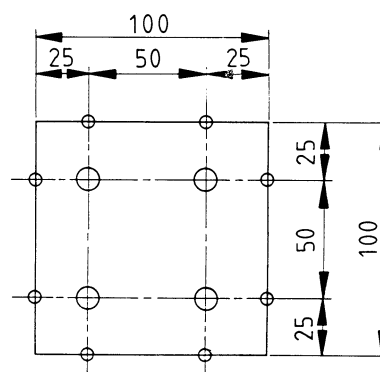
$$\rho = \frac{M}{V} 10^6$$

where

M is the mass of the test specimen (in g);

V is the volume of the test specimen (in mm³).

NOTE The density of the board may be calculated from the mean of the densities of all the test specimens taken from that board and expressed to the nearest 10 kg/m³.



All dimensions are in millimetres.

Figure 4 — Measuring points on the test specimen for determination of density

9 Determination of moisture content

9.1 Principle

The loss in mass of a test specimen dried to constant mass at 103 ± 2 °C is determined.

9.2 Test specimens

Test specimens shall be 100 mm square × board thickness.

9.3 Apparatus

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

9.3.2 Balance, as described in 6.1.5.

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

9.3.4 Desiccator, containing anhydrous calcium chloride or silica gel.

9.4 Procedure

Weigh each test specimen and record the mass to the nearest 0.1 g in accordance with 6.2.3.

NOTE 1 Test specimens should be cut and weighed as quickly as possible after sampling.

Place the test specimens in the air circulating oven (9.3.3) at 103 ± 2 °C, ensuring that they are separated by at least 25 mm on all sides. Dry the test specimens to constant mass, cool in the desiccator (9.3.4), reweigh and record the mass to the nearest 0.1 g.

NOTE 2 Constant mass is considered to be attained when two successive weighings carried out at an interval of not less than 6 h do not differ by more than 0.1 % of the mass.

NOTE 3 Test specimens should be cooled to approximately room temperature in the desiccator before weighing.

9.5 Calculation and expression of results

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

$$\omega = \frac{(M_h - M_o)}{M_o} 100$$

where

M_h is the mass of the test specimen before drying (in g);

M_o is the mass of the test specimen after drying to constant mass (in g).

The result shall be expressed to the nearest 0.1 %.

10 Determination of bending strength by applying a load perpendicular to the plane of the board (flatwise bending: modulus of rupture)

NOTE Certain particleboards have different property levels along the length of the original board and across its width. Where it is required to test the properties of such boards, two sets of test specimens should be prepared. One set should have its major axis parallel to the maximum strength dimension and the other should have its major axis at right angles to that dimension.

10.1 Principle

A load is applied at the centre of a test specimen resting on two supports. The load is increased until fracture occurs.

10.2 Test specimens

Test specimens shall be conditioned and prepared in accordance with clauses 4 and 5. They shall be 100 mm wide, with a length of $25 T + 25$ mm to the nearest 25 mm, where T is the nominal thickness of the board (in millimetres), but shall not exceed a length of 1 025 mm.

10.3 Apparatus

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

10.3.2 Micrometer, as described in 6.1.2.

10.3.3 Sliding caliper, as described in 6.1.3.

10.3.4 Testing machine, fitted with adjustable supports as shown in Figure 5, capable of applying sufficient load to cause the test specimen to fail. The machine shall comply with the requirements for repeatability and accuracy specified for grade 1.0 in BS 1610-1.

10.4 Procedure

10.4.1 Mark the midpoints of each long edge and measure the width of the test specimen between these points in accordance with 6.2.1. Record the width to the nearest 1.0 mm.

Measure the thickness of the test specimen at the mid-length, about 20 mm from each edge, in accordance with 6.2.2 and record the mean of the two values as the thickness of the test specimen to the nearest 0.1 mm.

10.4.2 Support the test specimen on parallel cylindrical metal rollers at a distance apart of $25 T$ to the nearest 25 mm, where T is the nominal thickness of the board (in millimetres), and not exceeding a length of 1 000 mm, and apply the load via a similar bar positioned at centre span, as shown in Figure 5(a). The metal rollers shall be free to rotate on ball, or other, bearings. Set the cross head speed to approximately 5 mm/min and continue loading until the maximum applied load is attained. Record the maximum applied load (in newtons) to the nearest 5 N or 1 %, whichever is the greater.

10.5 Calculation and expression of results

The bending strength P (in N/mm^2) shall be calculated from the equation

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

where

- W is the maximum applied load for the test specimen (in N);
- Y is the span between the centres of supports (in mm);
- B is the width of the test specimen (in mm);
- T is the mean thickness of the test specimen (in mm).

NOTE Where the supply of material is limited, bending strength may be determined on the test specimens used to determine modulus of elasticity. Furthermore, 100 mm lengths cut from the failed bending strength specimens, remote from the point of failure, may be used for the determination of density and/or moisture content.

The result shall be expressed to the nearest 1 N/mm^2 .

11 Determination of modulus of elasticity

NOTE Certain particleboards have different property levels along the length of the original board and across its width. Where it is required to test the properties of such boards, two sets of test specimens should be prepared. One set should have its major axis parallel to the maximum strength dimension and the other should have its major axis at right angles to that dimension.

11.1 Determination of modulus of elasticity perpendicular to the plane of the board in bending

11.1.1 Principle. A load is applied at the centre of a test specimen resting on two supports and the deflection of the test specimen for a given load is measured.

11.1.2 Test specimens. Test specimens shall be in accordance with 10.2.

11.1.3 Apparatus

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

11.1.3.2 Micrometer as described in 6.1.2.

11.1.3.3 Sliding caliper as described in 6.1.3.

11.1.3.4 Testing machine as described in 10.3.4.

11.1.3.5 Dial micrometer or displacement transducer, capable of measuring to 0.01 mm.

11.1.4 Procedure. Determine the width and thickness of the test specimen in accordance with 10.4.1.

Support the test specimen in accordance with 10.4.2 and as shown in Figure 5. Set the cross head speed of the testing machine (11.1.3.4) at approximately 5 mm/min and apply an increasing load to the test specimen. Measure the vertical deflection S as shown in Figure 5(b) at midspan relative to the two positions of support. Increase the load up to one-third of the anticipated failing load of the test specimen.

When using machines that automatically plot load-deflection, the deflection recorded shall be that of the test specimen and shall not include indentation or movement within the loading head, linkages and test specimen support.

Construct a load-deflection curve for the data obtained, as shown in Figure 6.

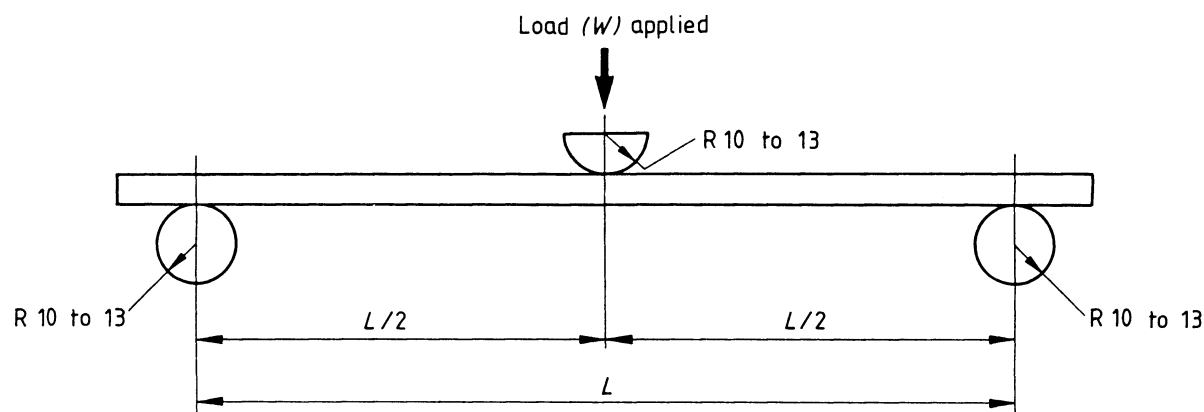
11.1.5 Calculation and expression of results. The modulus of elasticity perpendicular to the plane of the board in bending E_m (in N/mm^2) shall be calculated from the equation

$$E_m = \frac{Y^3 \Delta W}{4BT^3 \Delta S}$$

where

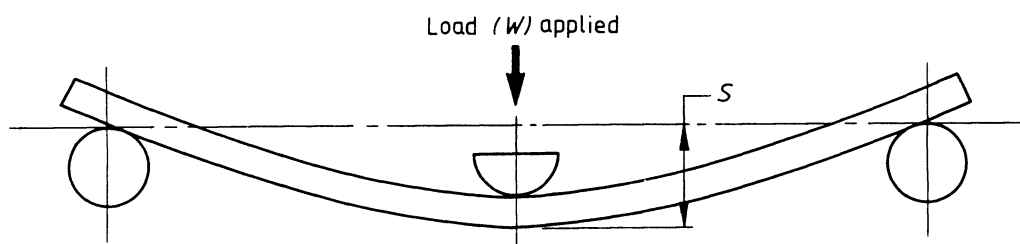
- Y is the span between the centres of supports (in mm);
- ΔW is the increment in load on the straight line portion of the load deflection curve (in N) (see Figure 6);
- B is the width of the test specimen (in mm);
- T is the mean thickness of the test specimen (in mm);
- ΔS the increment in deflection corresponding to ΔW increment in load (in mm).

The result shall be expressed to the nearest 10 N/mm^2 .



All dimensions are in millimetres.

(a) Test specimen under load for determination of bending strength.



(b) Test specimen under load showing position of maximum deflection S for determination of modulus of elasticity

Figure 5 — Method of supporting test specimens under load

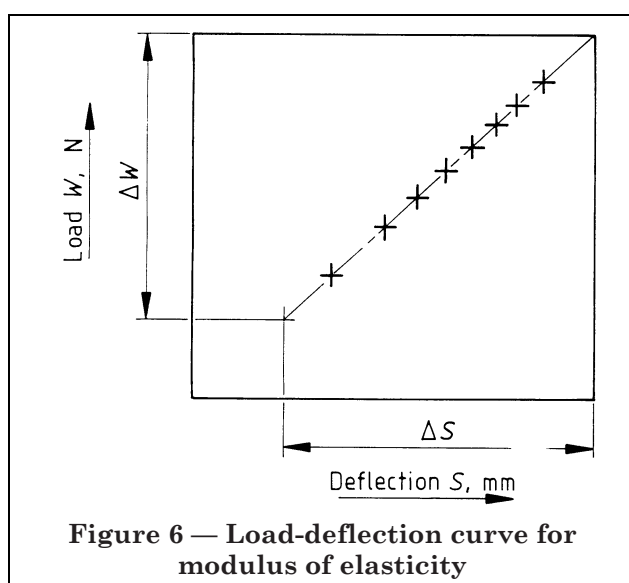


Figure 6 — Load-deflection curve for modulus of elasticity

11.2 Determination of modulus of elasticity parallel to the plane of the board in tension

11.2.1 Principle. A tensile load is applied to a test specimen and the extension of the test specimen for a given load is measured.

11.2.2 Test specimens. Test specimens shall be the full thickness of the board, of the form shown in Figure 7(a), conditioned and prepared in accordance with clauses 4 and 5.

NOTE Test specimens may be shaped using a template in conjunction with a vertical spindle moulder.

11.2.3 Apparatus

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

11.2.3.2 Sliding caliper as described in 6.1.3.

11.2.3.3 Testing machine as described in 10.3.4, fitted with wedge-grips to hold the test specimen. The grips shall be attached to the test machine cross heads with universal joints, to ensure alignment of the load with the axis of the test specimen.