BS 373:1957

Methods of testing small clear specimens of timber

UDC 674.01:620.1

Co-operating organizations

The Timber Industry Standards Committee, under whose supervision this British Standard was prepared consists of representatives from the following Government departments and scientific and industrial organizations:—

British Door Association
British Furniture Trade Confederation
British Railways, The British Transport Commission
D.S.I.R. — Forest Products Research Laboratory*
English Joinery Manufacturers' Association (Incorporated)
Flush Door Manufacturers' Association
Institution of Civil Engineers
Institution of Municipal Engineers
Institution of Structural Engineers
Ministry of Housing and Local Government
Ministry of Works
National Federation of Building Trades Employers
Royal Institute of British Architects
Royal Institution of Chartered Surveyors
Timber Development Association*
Timber Trade Federation of the U.K.

The Government department and scientific and industrial organization marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:—

Ministry of Supply

Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

This standard makes reference to the following British Standard:

BS 1610, *Verification of testing machines.*

This second revision of the British Standard methods of testing small clear specimens of timber, which was originally issued in 1929, has been issued under the authority of the Timber Industry Standards Committee and was rendered necessary by the recent introduction into the United Kingdom of the 2 cm system of testing.

The 2 cm system of testing is one of the principal schemes accepted internationally for the testing of small clear specimens. It has a test-piece of 2 cm square cross-section, instead of the original 2 in. standard with its larger test-piece of 2 in. square cross-section. The introduction of the smaller test piece (which will be referred to in this specification as the 2 cm standard), has necessitated modification to much of the existing testing equipment and the techniques now incorporated conform generally to those accepted internationally.

The testing of small clear specimens of timber has as its main purpose the provision of data for the comparison of the strength properties of different species. Timbers should be tested both in the green condition and in the seasoned condition. The test results may be used also to determine the relation between strength and such properties as density, to determine the effect on strength of various treatments, and to assist in the establishment of design functions for structural timbers.

Almost all the mechanical properties of seasoned timber vary with moisture content and it is therefore important that the moisture content of all test pieces be known at the time of test. When comparing results obtained with seasoned material, due allowance must be made for the effects of differences in moisture content.

As the mechanical properties vary with the rate of application of load it is desirable that the specific rates should be adhered to wherever possible in order that comparable results may be obtained. If the testing machine be of a type which does not permit the specified rate of loading, the actual rate employed should be recorded with the results obtained in order that these results may be corrected as and when the relationship between the observed mechanical property and the rate of application of the load has been definitely established.

The rates of strain which are specified for the 2 in. and 2 cm test pieces have in some cases been founded on the established practice of those who have been accustomed to use these sizes rather than on any scientific basis of similarity.

It is recognized that some of the tests specified are of an arbitrary nature and are intended to provide comparative data rather than to measure absolute properties of the material. They have been included because they have been generally adopted and have produced useful results not only in the comparison of species of timber but also in the improvement of the design of timber structures and the general economic application of timber in manufacturing processes.

The results of tests made with the 2 cm standard are not, owing to dimensional effect, directly comparable in all properties with those for the 2 in. standard. A more extensive comparison with the results of tests from laboratories, both at home and abroad, may be obtained if the results of material tested in accordance with the former standard are corrected to the equivalent values for the 2 in. standard.

This specification, however, does not give factors for the conversion of the results of tests made with the 2 cm standard to the equivalent values for the 2 in. standard, nor does it cover the procedure adopted for the sampling of material for test, for the conversion of the log or for the preparation of the test pieces. Such information may be obtained from other publications, such as the Forest Products Research Laboratory's Project 1 and Bulletins No. 28 and 34, as well as from standard D 143-52 of the American Society for Testing Materials and The Sampling of Timber for Mechanical Tests, F.G. Pearson, Australian journal of applied Science Vol 3, No. 1.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24 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.

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1 Scope

This British Standard gives methods of test for the provision of data for the comparison of the strength properties of different species of timber.

2 Moisture content

Immediately after each mechanical test has been made, a small sample for determination of moisture content shall be cut from each test piece. The sample shall consist of a transverse section from near the point of fracture, but for the 2 cm standard the compression parallel-to-grain test piece as a whole shall be used as the sample.

The sample shall be weighed and then dried in an oven at a temperature of 103 ± 2 °C (217 ± 4 °F) until the weight is constant.

The loss in weight expressed as a percentage of the final oven-dry weight shall be taken as the moisture content of the test piece.

The value so obtained shall be recorded with the results of the particular test to which it refers.

NOTE 1   Great care should be taken to prevent any change in moisture content between the cutting of the sample and the first weighing and between removal from the oven and the subsequent weighing.
NOTE 2   If it is required to determine the moisture content of a specimen of timber, apart from its mechanical properties, a transverse sample of the specimen should be taken as a cross section of the piece at a distance $b + h$ from one end, where b and h are the cross sectional dimensions of the piece.

3 Control of moisture content

Before the preparation of test pieces for testing in the seasoned condition, the material shall be brought practically to constant weight by storage under controlled temperature and humidity conditions (20 ± 3 °C) (68 ± 6 °F) and 65 ± 2 per cent relative humidity. Changes in moisture content during the preparation of test pieces should be avoided. The tests shall be made under such conditions that large changes in moisture content will not occur.

4 Control of temperature

To avoid significant changes in strength properties, all test pieces shall be tested within the temperature range 20 ± 3 °C (68 ± 6 °F). The temperature at the time of test shall be recorded.

NOTE   In following the recommendation that the temperature be controlled at 20 ± 3 °C (68 ± 6 °F) it is desirable to maintain the temperature as nearly constant as possible within this range.

5 Specific gravity and weight per cubic foot

In the 2 in. standard, all test pieces shall be weighed and their dimensions determined before test. The specific gravities at test and when oven-dry shall be calculated for each test piece. From these the equivalent densities in pounds per cubic foot can be obtained. For the 2 cm standard, the compression parallel-to-grain test piece which has been used for moisture content control shall subsequently be used for the determination of the specific gravities as for the 2 in. test-piece.

NOTE 1   Conventions for grain direction are illustrated in Clause **8**.
NOTE 2   The 2 cm compression parallel-to-grain test piece has to be end matched with the test pieces used for determining all other strength properties.
NOTE 3   If it is required to know the specific gravity or the density in pounds per cubic foot of a timber apart from any of its other properties, a sample should be taken as a cross-section of the specimen about ¾ in. thick at a distance $b + h$ from one end, where b and h are the dimensions of the cross-section of the specimen.
The density in pounds per cubic foot may alternatively be obtained with sufficient accuracy by weighing a sample 2 in. × 1 in. × 1.9 in. The weight in grammes of this piece is numerically equal to the weight in pounds per cubic foot, from which the specific gravity can be determined by dividing by 62.35.

6 Static bending test

The static bending test shall be carried out by either a the central loading method, or b the four-point loading method. See Figure 1 (Figure 1a and Figure 1b).

NOTE   For general standard testing of timber for the comparison of different species, the central loading method is sufficiently accurate. Where a more accurate determination of the modulus of elasticity is required (as, for example, in some stress calculations) the four-point loading method has to be employed. By this method the beam is subjected to a uniform bending moment over a considerable proportion of its length and the Modulus of Elasticity can be calculated without the necessity of allowing for shear deflection which occurs along the whole length of a beam loaded at the centre.

The dimensions of the central loading test piece shall be 2 in. by 2 in. by 30 in. for the 2 in. standard, or 2 cm by 2 cm by 30 cm for the 2 cm standard, and those of the four-point loading test piece 2 in. by 2 in. by 40 in. In close-grained timber a width of 1 in. may be used for the four-point loading method where a width of 2 in. cannot be obtained. For the 2 in. standard the depth of the beam shall be parallel to the radial face of the test piece. The orientation of the annual rings in the 2 cm standard test piece shall be parallel to the direction of loading.

In the central loading method the distance between the points of support of the test piece shall be 28 in., or 28 cm, according to the standard used, and the load shall be applied as shown in Figure 1a. For the 2 in. standard the loading heads shall move at a constant speed of 0.10 in/min and for the 2 cm standard, 0.26 in/min. The contour of the loading head which is in contact with the beam shall have for the 2 in. standard the same form as that shown for the falling tup in Figure 2 and for the 2 cm standard the same form (but 30 mm radius) as that shown for the falling tup in Figure 3.

For the four-point loading method the distance between the points of support shall be 36 in. and the distance between the points of application of the load and the supports (dimension a, Figure 1b) shall be 6 in. The load shall be applied at such a rate that the loading head moves at a constant speed of 0.13 in/min.

The test pieces shall be supported at the ends in such a way that they will be quite free to follow the bending action and will not be restrained by friction which would resist the bending and tend to introduce longitudinal stresses.

The deflection of the beam at mid length shall be measured with reference to the outer points of loading in the central loading method and to the ends of the gauge length l (Figure 1b) in the four-point loading method.

7 Impact test

The dimensions of the 2 in. standard test piece shall be 2 in. by 2 in. by 30 in. The method by which the test shall be made is shown diagrammatically in Figure 2.

The entire apparatus shall be securely bolted to a solid foundation. The test piece shall be placed in the machine, at 28 in. centres, with the heart side uppermost. The load shall be applied at the centre of the test piece by the impact of a weight (tup) of 50 lb falling freely from successive heights increasing by regular increments. The first drop shall be from a height of 2 in. and this shall be followed by drops from heights increasing by 1 in. at a time until a drop of 10 in. has been reached. The height of each successive drop shall then be increased by 2 in. and the test shall be continued until either complete failure or a deflection of 6 in. has been obtained. The maximum height of release of the tup shall be recorded.

The dimensions of the 2 cm standard test piece shall be 2 cm by 2 cm by 30 cm. A suitable apparatus is shown diagrammatically in Figure 3. It shall be securely bolted to a solid foundation. The test piece shall be placed in the machine over a span of 24 cm with the growth rings parallel to the direction of the impact blow. The load shall be applied at the centre of the test piece by the impact of a weight (tup) of 3.3 lb falling freely from successive heights, increasing by regular intervals with the same increments as for the 2 in. test piece. The test shall be continued until either complete failure or a deflection of 6 cm has been reached. The maximum height of release of the tup shall be recorded.

8 Compression tests

The resistance to compression shall be determined both a) parallel to the longitudinal grain, and b) perpendicular to the longitudinal grain.

a) *Compression parallel to grain.*

The form and dimensions of the test pieces shall be as given in Figure 4.

The methods by which the tests on both the 2 in. standard and the 2 cm standard test pieces shall be made are shown diagrammatically in Figure 5 and Figure 6.

The load shall be applied to both types of test piece in such a way that the loading plates approach each other at a rate of 0.025 in./min.

NOTE It is essential that the ends of the rectangular test piece are smooth and parallel and normal to the axis and that the testing machines are of such construction that the plates between which the test piece is placed are parallel to each other and remain so during the whole period of test. Unless these precautions are taken, values may be obtained which will be considerably below the true values.
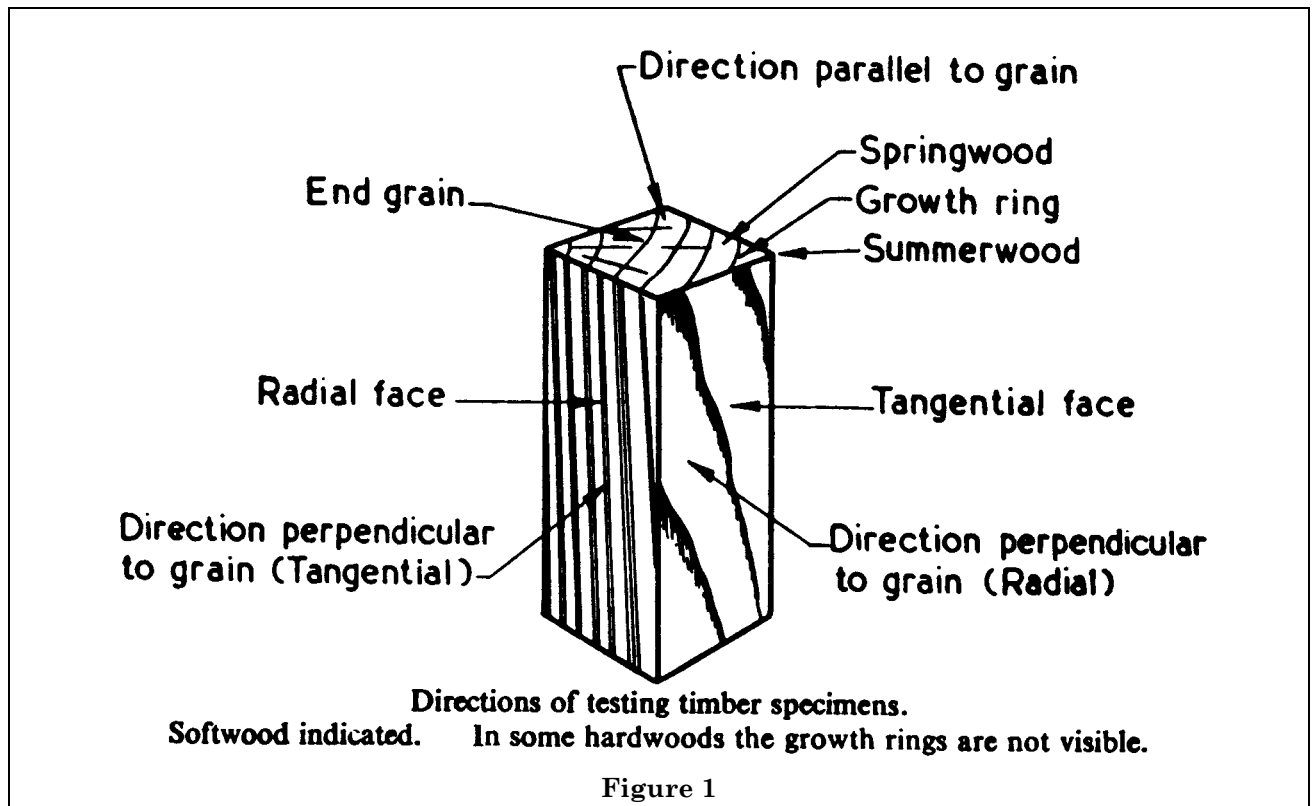
b) *Compression perpendicular to grain.*

The test piece shall be a cube of 2 in. side as shown in Figure 7.

The test shall be made by loading between parallel plates. It shall be made in both the radial and tangential directions. The load shall be applied to the test piece at a constant head speed of 0.025 in./min. The load compression curve shall be plotted to the point when the compression of the test piece reaches 0.1 in. Should a definite maximum load be reached at some lesser value of compressive strain, the maximum load and its associated strain shall both be recorded.

NOTE The compression perpendicular to grain test is confined to the 2 in. standard.

Directions of testing timber specimens.
Softwood indicated.   In some hardwoods the growth rings are not visible.

Figure 1

9 Janka indentation test

In the 2 in. standard the test piece shall be 6 in. long and shall be of square section 2 in. by 2 in., cut radially and tangentially. The test requires the determination of the load necessary to force into the test piece, to a depth of 0.222 in., the hemispherical end of a steel bar, or a steel ball, 0.444 ± 0.002 in. in diameter. A diagrammatical representation of the apparatus to be employed, which shall incorporate a depth indicating device, is given in Figure 8. The same apparatus shall be used for the test on the 2 cm size test piece, which shall be clamped between distance pieces of the species under test to form a block of approximately 2 in. square. The rate of penetration of the hardness tool shall be 0.25 in./min for both the 2 in. and the 2 cm test pieces.

The determination shall be made upon the radial, the tangential and the end surfaces of the 2 in. test piece. For the 2 cm test piece the determination shall be made only on the radial and the tangential surfaces. The radial and tangential surfaces chosen for the test shall be those which most closely approach the true radial and tangential directions of the grain.

The result of each determination on both types of test piece shall be recorded.

10 Shear parallel to grain test

The test piece shall be a cube of either 2 in. or 2 cm side as shown in Figure 9.

Suitable apparatus for making the test on the 2 in. test pieces is shown diagrammatically in Figure 10.

The load shall be applied at a constant rate of crosshead movement of 0.025 in./min. A similar testing speed of 0.025 in./min is used for the 2 cm test piece, which shall be tested in an apparatus of the type illustrated in Figure 11.

The direction of shearing shall be parallel to the longitudinal direction of the grain. The test shall be made with the plane of shear failure parallel to the tangential direction of the grain and also with the plane of shear failure parallel to the radial direction.

11 Cleavage test

The form and dimensions of the 2 in. standard test piece shall be as given in Figure 12. A diagrammatic representation of the apparatus to be employed is given in Figure 12.

The 2 cm test piece (which is of the "Monnin" type) and the apparatus to be used are illustrated in Figure 13.

The load shall be applied for both test pieces at a constant crosshead speed of 0.10 in./min. The test shall be made both radially and tangentially, for which purpose half of the number of test pieces shall be cut so as to give a failure under test along a radial surface and the remainder shall be cut so as to give a failure under test along a tangential surface.

12 Tensile test

The resistance to tension when required shall be determined both a) parallel to the grain, and b) perpendicular to the grain.

a) *Tension parallel to grain.* The form and dimensions of the test piece used in one method[1] for determining the tension parallel to grain strength shall be as illustrated in Figure 14. The test piece shall be so orientated that the direction of the annual rings at the cuboidal section is perpendicular to the greater cross-sectional dimensions. The actual dimensions at the minimum cross-section shall be measured.

The load shall be applied to the 2 cm face of the ends of the test piece by special toothed plate grips which are forced into the wood before the test piece commenced. See Figure 15. These grips shall be designed so as to give axial load. Load extension curves when required shall be taken for a 2 in., central gauge length.

The load shall be applied to the test piece at a constant head speed of 0.05 in./min.

b) *Tension perpendicular to grain.* The form and dimensions of the test piece shall be as given in Figure 16.

Load shall be applied through split grips with suitable precautions for ensuring axial load.

The load shall be applied to the test piece at a constant head speed of 0.01 in./min.

13 Permissible variations

Dimensions. Dimensions of test pieces shall be determined to an accuracy of not less than ± 0.3 per cent but in no instance need measurement be made to less than 0.01 in. (0.2 mm) [except measurements of the radial and tangential shrinkage. These shall be made to the nearest 0.001 in. (0.02 cm).]

Weight. The weights of test pieces and of moisture content samples shall be determined to an accuracy of not less than ± 0.2 per cent.

Rate of testing. The rate of strain of the testing machine used should not vary by more than ± 20 per cent from that specified for a given test but any necessary departure from the specified speed shall be recorded. The crosshead speed shall be taken as the free-running or no-load speed of crosshead for testing machines of the mechanical drive type, and the crosshead speed for testing machines of the hydraulic loading type should be taken with the load applied as under test conditions.

Calibration of testing machine. All test shall be conducted on regularly calibrated testing machines capable of satisfying the requirements for Grade B of BS 1610-1[2].

14 Radial and tangential shrinkage

Radial and tangential shrinkage shall be determined on test pieces 1 in. × 1 in. × 4 in., the 4 in. being the direction for which the shrinkage is to be determined.

The test piece shall be weighed and measured before, drying and after subsequent drying, at both the air-dry and the oven-dry conditions.

The green test pieces shall be allowed to dry on wire racks in well ventilated boxes until a uniform moisture content of approximately 12 per cent is reached. Subsequently they shall be placed in an oven and dried until the weight is constant at 100 – 105 °C (212 – 221 °F).

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[1] A number of methods of determining the parallel to grain strength of wood are in use. All require a test piece waisted so as to induce tensile failure within a parallel minimum section.

[2] BS 1610, "*Verification of testing machines*".

Appendix A Formulae and methods of computing physical properties

Moisture content.

    1) Data:

        W_1 =   Weight of sample at test in grammes.

        W_0 =   Oven-dry weight of sample in grammes.

    2) Property to be computed:

        Percentage – Moisture content

$$X = \frac{W_1 - W_0}{W_0} \times 100$$

Specific gravity.

    1) Data:

        W_1 = Weight of sample at test in grammes.

        W_0 = Weight of sample, oven-dry, in grammes.

        V_1 = Volume of sample at test in cubic centimeters.

        l = Length in inches.

        b = Breadth in inches.

        h = Height in inches.

    2) Properties to be computed:

        i) Specific gravity at test

$$S_1 = \frac{W_1}{V_1} \text{ or } \frac{W_1}{l \times b \times h \times 16.39}$$

        ii) Nominal specific gravity, oven-dry

$$S_0 = \frac{W_0}{V_1} \text{ or } \frac{S_1 \times 100}{x + 100}$$

        iii) Density at test and nominal density, oven-dry, in pounds per cubic foot obtained from i) and ii) by multiplication with 62.35 $(x + 100)/100$ where x is the percentage moisture content.

NOTE   The weight of wood in a given volume changes with the shrinkage and swelling caused by changes in moisture and the term specific gravity as used in the testing of timber is indefinite unless the conditions under which it is determined are specified. The convention of using a "nominal" specific gravity, based on the volume of the test piece when tested and its weight when oven-dried, is observed.

Mechanical properties

Static bending.

    1) Data:

        i) Dimensions of test-piece:

            b =   Breadth in inches.[a]

            h =   Depth in inches.[a]

            l =   Gauge length in inches[a] (method b).

            a =   distance in inches[a] between point of application of load and support = 6 in. (method b).

            L =   span (method a) = 28 in. or 28 cm.

[a] Centimetre measurement may be used with appropriate conversion factors.

ii) Load-deflection curve from which are derived:

P = Maximum load in pounds.

P' = Load in pounds at limit of proportionality.[a]

Δ' = Deflection in inches at mid length at limit of proportionality.

A' = Area in square inches of load-deflection curve to limit of proportionality.

A = Area in square inches of load-deflection curve to maximum load.

A'' = Area in square inches of load-deflection curve when a deflection of 6 in. has been reached or the load after passing a maximum value has been reduced to 200 lb, whichever occurs first (method a: 2 in. standard). For method a: 2 cm standard, the limiting deflection is 6 cm and the limiting load one tenth of the maximum load.

C = Area constant in inch pounds, i.e. the energy represented by 1 sq. in. on the load-deflection diagram; it is equal to the load in pounds represented by 1 in. ordinate multiplied by the deflection in inches represented by 1 in. abscissa.

[a] The limit of proportionality shall be taken as that point in the stress-strain diagram at which the curve deviates from the straight line.

2) Properties to be computed:

		Method a (Figure 1a)	Method b (Figure 1b)
i)	Fibre stress in pounds per square inch at limit of proportionality (F.S. at L.P.)	$\dfrac{3P'L}{2bh^2}$	$\dfrac{3P'a}{bh^2}$
ii)	Equivalent fibre stress in pounds per square inch at maximum load (F.S. at M.L.)	$\dfrac{3PL}{2bh^2}$	$\dfrac{3Pa}{bh^2}$
iii)	Modulus of elasticity in pounds per square inch	$\dfrac{P'L^2}{4\Delta' bh^2}$	$\dfrac{3P'al^2}{4\Delta' bh^2}$
iv)	Horizontal shear stress in pounds per square inch on neutral plane at limit of proportionality (S. at L.P.)	$\dfrac{3P'}{4bh}$	At centre = O At ends $=\dfrac{3P'}{4bh}$
v)	Horizontal shear stress in pounds per square inch on neutral plane at maximum load. (S. at M.L.)	$\dfrac{3P}{4bh}$	At centre = O At ends $=\dfrac{3P}{4bh}$
vi)	Work in inch pounds per cubic inch to limit of proportionality. (Elastic resilience). .	$\dfrac{CA'}{Lbh}$	$\dfrac{CA'}{lbh}$
vii)	Work in inch pounds per cubic inch to maximum load (Wk to M.L.)	$\dfrac{CA}{Lbh}$	Not computed
viii)	Total work in inch pounds per cubic inch. (Total Wk.)	$\dfrac{CA''}{Lbh}$	Not computed

Impact bending.

1) Data:

   i) Dimensions of test piece:

      b = Breadth in inches or cm

      h = Depth in inches or cm

      L = Span (28 in. or 24 cm).

   ii) Weight of tup W = 50 lb.   2 in. standard

                    or = 3.3 lb   2 cm standard

   iii) D = Height of drop in inches to produce complete failure or a deflection of 6 in. (2 in. standard) or 6 cm (2 cm standard).

Compression parallel to grain.

1) Data:

i) Dimensions of test piece:

A = Cross-sectional area in square inches.

L = Gauge length in inches between extensometer points.

The maximum values of L shall be 6 in. for the test piece 8 in. long, and 4 cm for the test piece 6 cm long.

ii) Load-compression curves from which are derived:

P' = Load in pounds at limit of proportionality.

P = Maximum crushing load in pounds.

Δ' = Deformation in inches at limit of proportionality.

2) Properties to be computed:

i) Compressive stress at limit of proportionality (C.S. at L.P.)

$$= \frac{P'}{A} \text{lb/sq. in.}$$

ii) Compressive stress at maximum load (C.S. at M.L.)

$$= \frac{P}{A} \text{ lb/sq. in.}$$

iii) Modulus of elasticity (E).

$$= \frac{P'L}{\Delta'A} \text{ lb/sq. in.}$$

Compression perpendicular to grain

1) Data:

i) Dimensions of test piece:

A = Area of cross-section normal to direction of load in square inches.

ii) Direction of load, either radial or tangential.

iii) Load-compression curve from which is derived

P' = Load at limit of proportionality.

P'' = Load at 0.1 in. compression.

P = Maximum load if reached at a compression less than 0.1 in.

2) Properties to be computed:

i) Compressive stress at limit of proportionality (C.S. at L.P.).

$$= \frac{P'}{A} \text{ lb/sq. in.}$$

ii) Compressive stress at compression of 0.1 in. (strain = 0.05) (C.S.)

$$= \frac{P''}{A} \text{ lb/sq. in.}$$

iii) Crushing strength at maximum load (C.S. at M.L.).

$$= \frac{P}{A} \text{ lb/sq. in.}$$

The direction of loading, either radial or tangential, must be stated.

Shear parallel to grain.

   1) Data:

      i) bh = Area in shear in square inches.

      ii) Surface of shear failure, radial or tangential.

      iii) P = Maximum load in pounds causing shear.

   2) Property to be computed:

   Apparent average shearing stress (A.A.S.S.).

$$= \frac{P}{bh} \text{lb/sq. in.(radial or tangential)}$$

Cleavage test.

   1) Data:

      i) b = Breadth of test piece in inches.

      ii) Plane of cleavage, either radial or tangential.

      iii) P = Maximum load in pounds causing cleavage.

   2) Property to be computed:

      Strength per inch of width to resist splitting, i.e. cleavage

$$= \frac{P}{b} \text{ pounds per inch width (radial or tangential)}$$

Tension parallel to grain.

   1) Data:

      i) A = Minimum area of cross-section of test length.

         L = Gauge length in inches between extensometer points.

      ii) Load-extension curve from which are derived:

            P' = Load in pounds at limit of proportionality.

            P = Maximum load in pounds.

            Δ' = Extension in inches at limit of proportionality.

   2) Properties to be computed:

      i) Tensile stress at limit of proportionality (T.S. at L.P.).

$$= \frac{P'}{A} \text{ lb/sq. in.}$$

      ii) Tensile stress at maximum load (T.S. at M.L.).

      iii) Modulus of elasticity (E)

$$= \frac{P'L}{\Delta A'} \text{ lb/sq. in.}$$

Tension perpendicular to grain.

   1) Data:

      i) A = Area of cross-section of test length in square inches.

      ii) Direction of applied tensile load, either radial or tangential.

      iii) P = Maximum load.

   2) Property to be computed:

      Tensile strength, radial [T.S. (R)] or tangential [T.S. (T)].

$$= \frac{P}{A}$$

Radial and tangential shrinkage.

1) Data:

Width, green	=	L_g inches	
Width, air-dry	=	L_a inches	
Width, oven-dry	=	L_o inches	
Weight, green	=	W_g grammes	
Weight, air-dry,	=	W_a grammes	
Weight, Oven-dry	=	W_o grammes	

2) Properties to be computed:

i)   Percentage radial shrinkage

ii)   Percentage tangential shrinkage

Green to air-dry

$$= \frac{L_g - L_a}{L_g} \times 100$$

iii)   Percentage radial shrinkage

iv)   Percentage tangential shrinkage

Green to oven-dry

$$= \frac{L_g - L_o}{L_g} \times 100$$

v)   Percentage moisture content, green $= \dfrac{W_g - W_o}{W_o} \times 100$

vi)   Percentage moisture content, air-dry $= \dfrac{W_a - W_o}{W_o} \times 100$

Appendix B Tests recommended to indicate the suitability of timber for specific uses

In order to reduce the amount of testing as far as possible the following table has been prepared to indicate the principal and auxiliary tests recommended for selecting the appropriate species of timber for the specific uses shown.

NOTE   This table is not to be considered as complete, but is put forward as covering the more common uses of timber.

		Compression parallel to grain	Compression perpendicular to grain	Static bending	Impact bending	Indentation	Shear	Cleavage	Tension parallel to grain	Shrinkage
1	Athletic and sporting goods	X	O	X	X	X	O	O	O	O
2	Axles	O	O	X	X	O	O			
3	Beams		O	X	X	O	X		O	
4	Bearing blocks		X			X		O		X
5	Boat building:									
	Frames	O		X	X	O		O		
	Planking		O	X	X	O	O	O		X
	Decks			X	X	O	O	O		X
	Masts and spars		O	X	X			O		
6	Bowls					X		O		X
7	Bolted timbers	X	X			O	X	X		O
8	Boxes			O	X	O		X		O
9	Carving					X		O		O
10	Columns, posts and struts	X		X		O	O	O		
11	Cooperage		O	X	X		O	X		X
12	Crates			X	X	O		X		
13	aTimber finished to size									X
14	Flooring (Strip and plank wood block)		O	X		O		X		X
15	Furniture	X		X	O	O	O	X		X
16	Joints		X			O	O	X		X
17	Joists		X	X	O	O	O		O	
18	Mallets					X	O	O		
19	Nailed timbers					X		X		
20	Notched timbers		X		O	O	X	X		
21	Panelling					X		O		X
22	Patterns					X		O		X
23	Paving blocks	X		O		O	O	O		X
24	Pencils					X		O		
25	Rollers		X	O		X	X			O
26	Sheaves					X	X	O		O
27	Shuttles		O			X		X		X
28	Sleepers	X	X	X		O				
29	Spokes			O	X					O
30	Tool handles	X	X	O	X	X		X		O
31	Wedges	X	X		O	X		O		X
32	Wheelwright's work	O	X	X		X		X		X

X—Principal tests.   O—Auxiliary tests.

a It is important that in timber which is to be finished to size the shrinkage test should be included.

Figure 1a — Beam test. Central loading for 2 in. or 2 cm standard test piece

Figure 1b — Beam test. Four point loading method
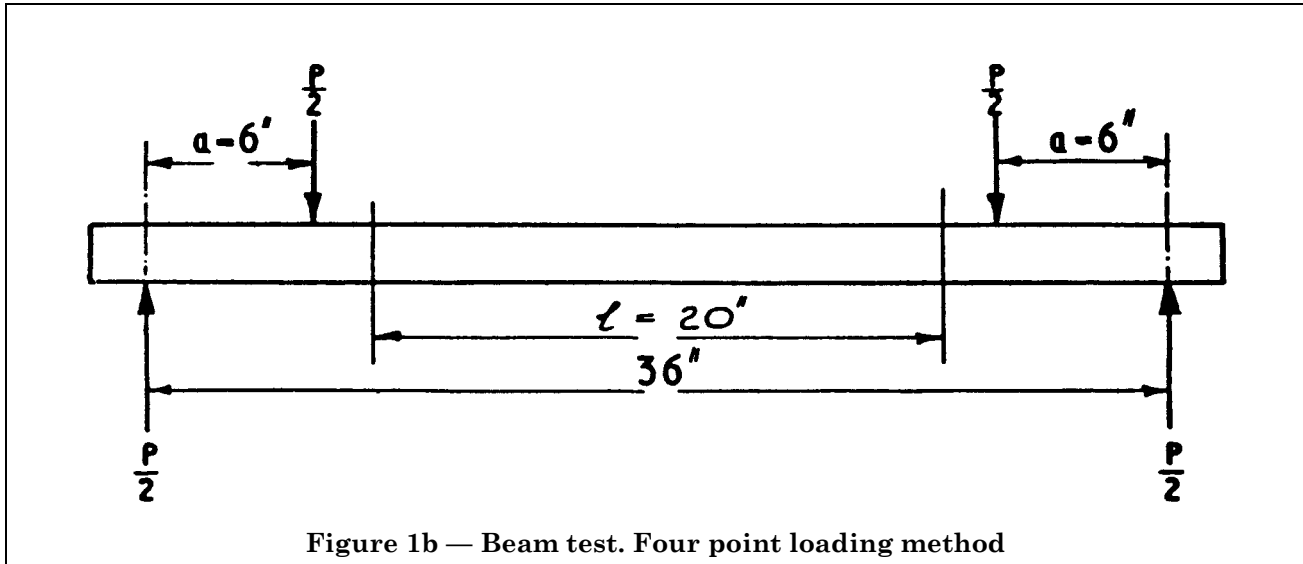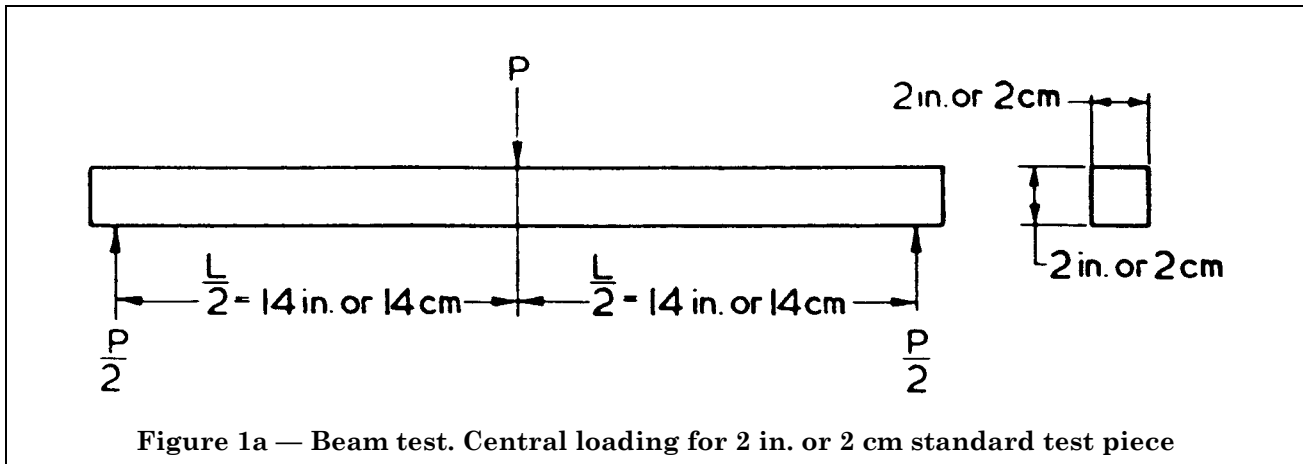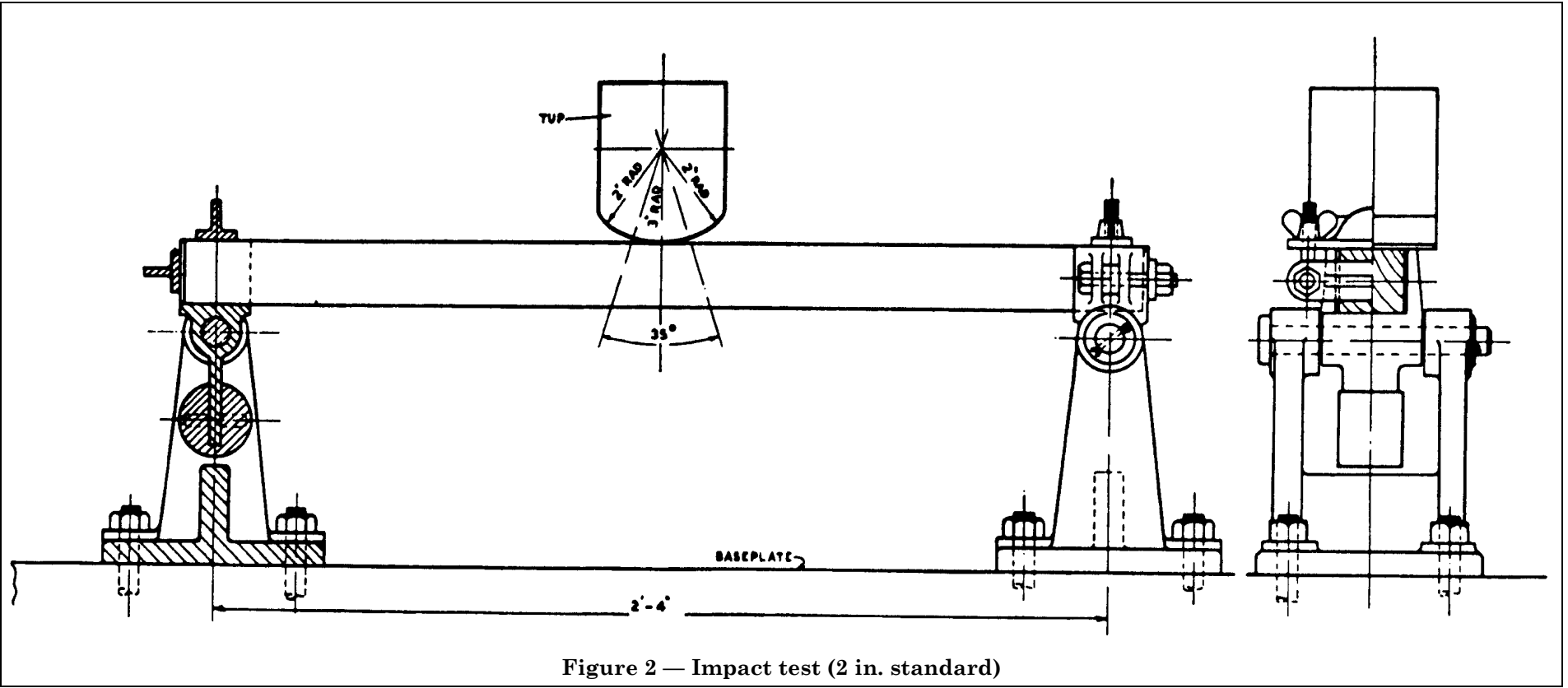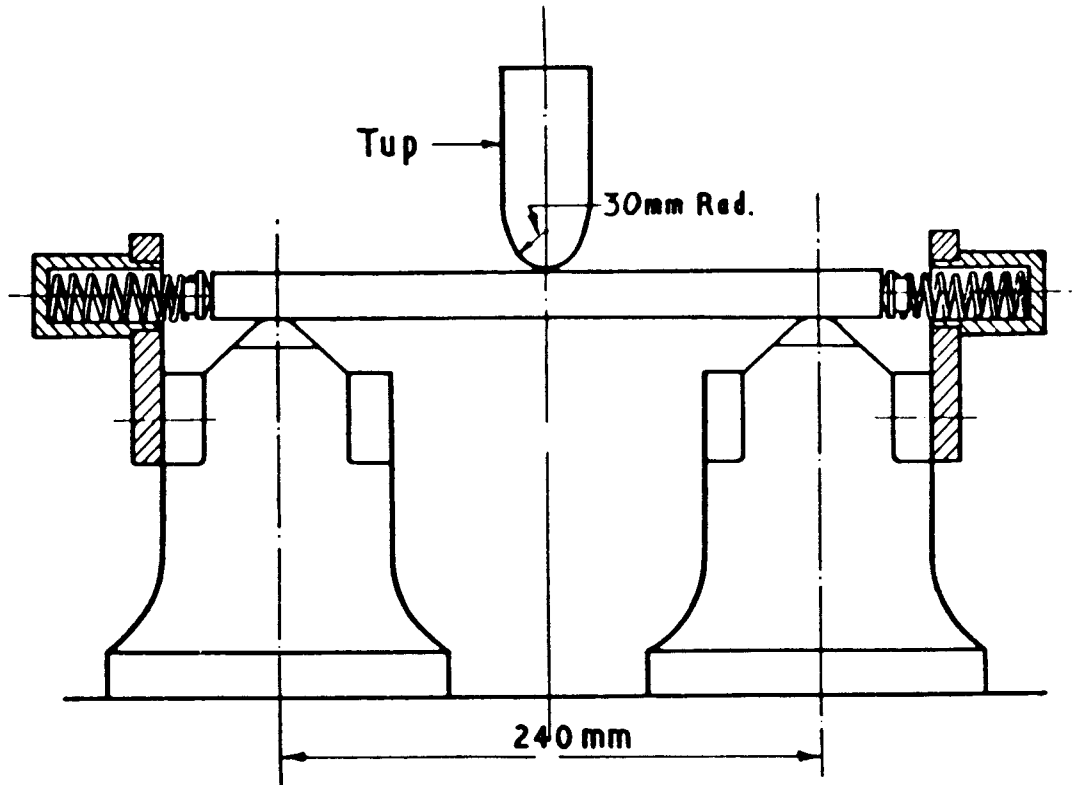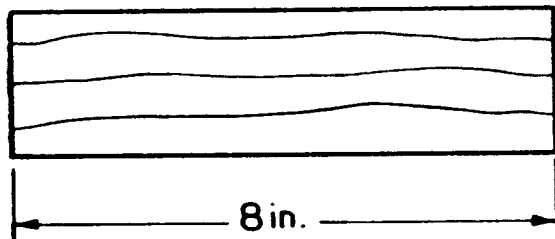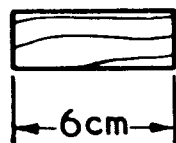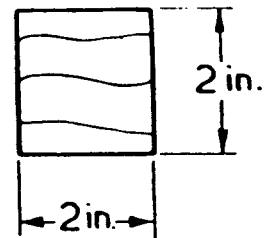
Figure 2 — Impact test (2 in. standard)

Figure 3 — Impact test (2 cm standard)

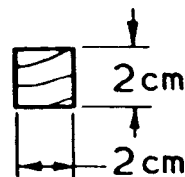

(a)   2 in. standard

(b)   2 cm standard

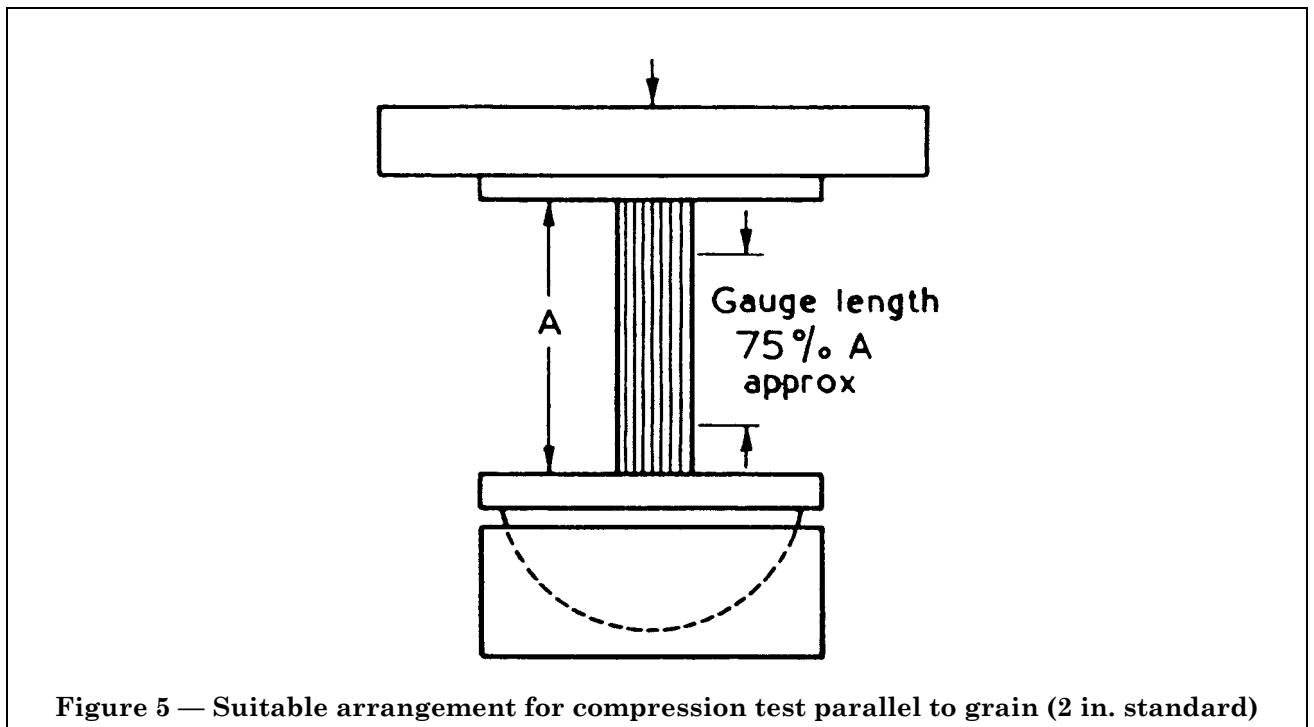Figure 4 — Form of test pieces for compression parallel to grain

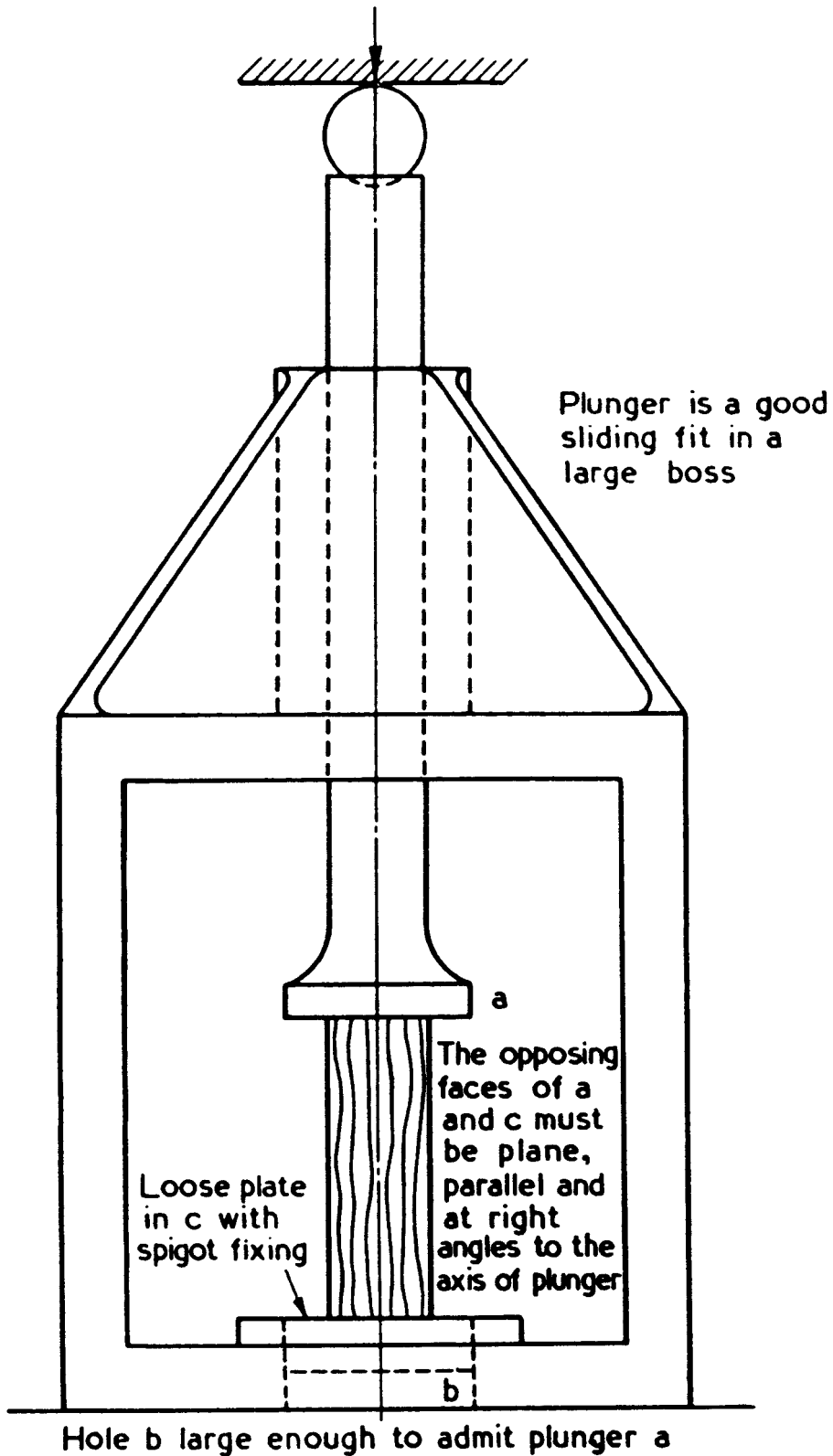Figure 5 — Suitable arrangement for compression test parallel to grain (2 in. standard)

Plunger is a good
sliding fit in a
large boss

a

The opposing
faces of a
and c must
be plane,
parallel and
at right
angles to the
axis of plunger

Loose plate
in c with
spigot fixing

Hole b large enough to admit plunger a

b

Figure 6 — Compression parallel to grain (2 cm standard)
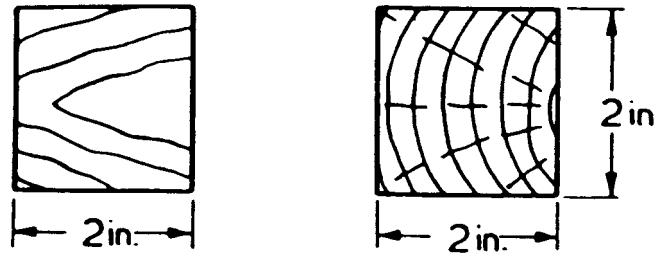
Figure 7 — Test piece for compression perpendicular to grain

Micro switch set to operate an indicating device when indentation is 0·222 in.

0·222 in. spherical radius
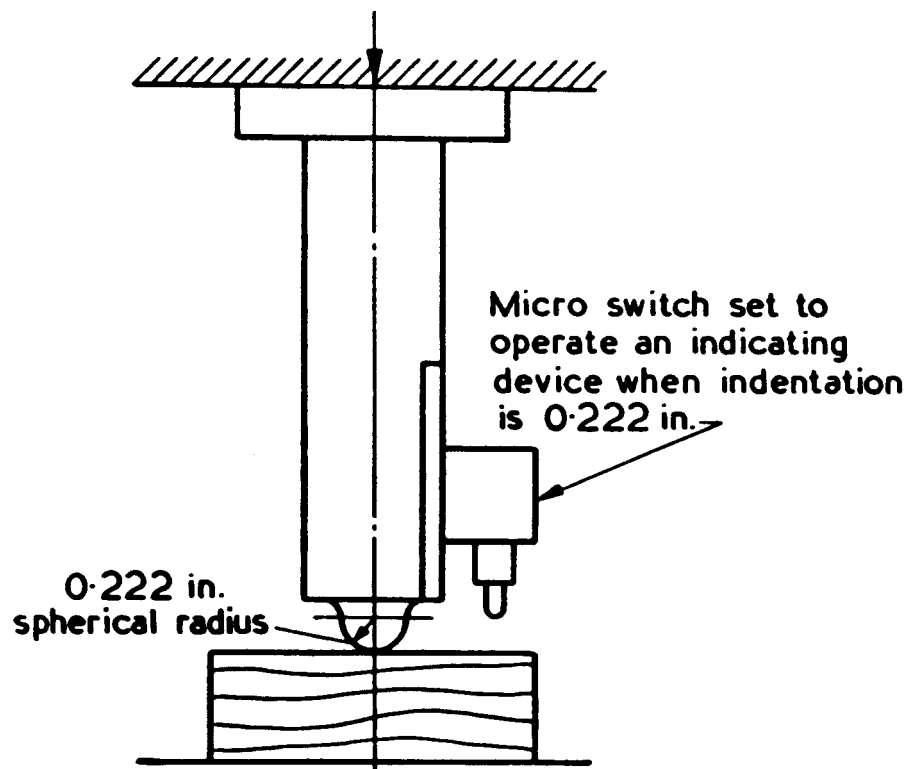
Figure 8 — Janka indentation test
(For 2 in. or 2 cm standard test piece)

Figure 9 — Test pieces for shear parallel to grain

Figure 10 — Test for shear parallel to grain (2 in. standard)
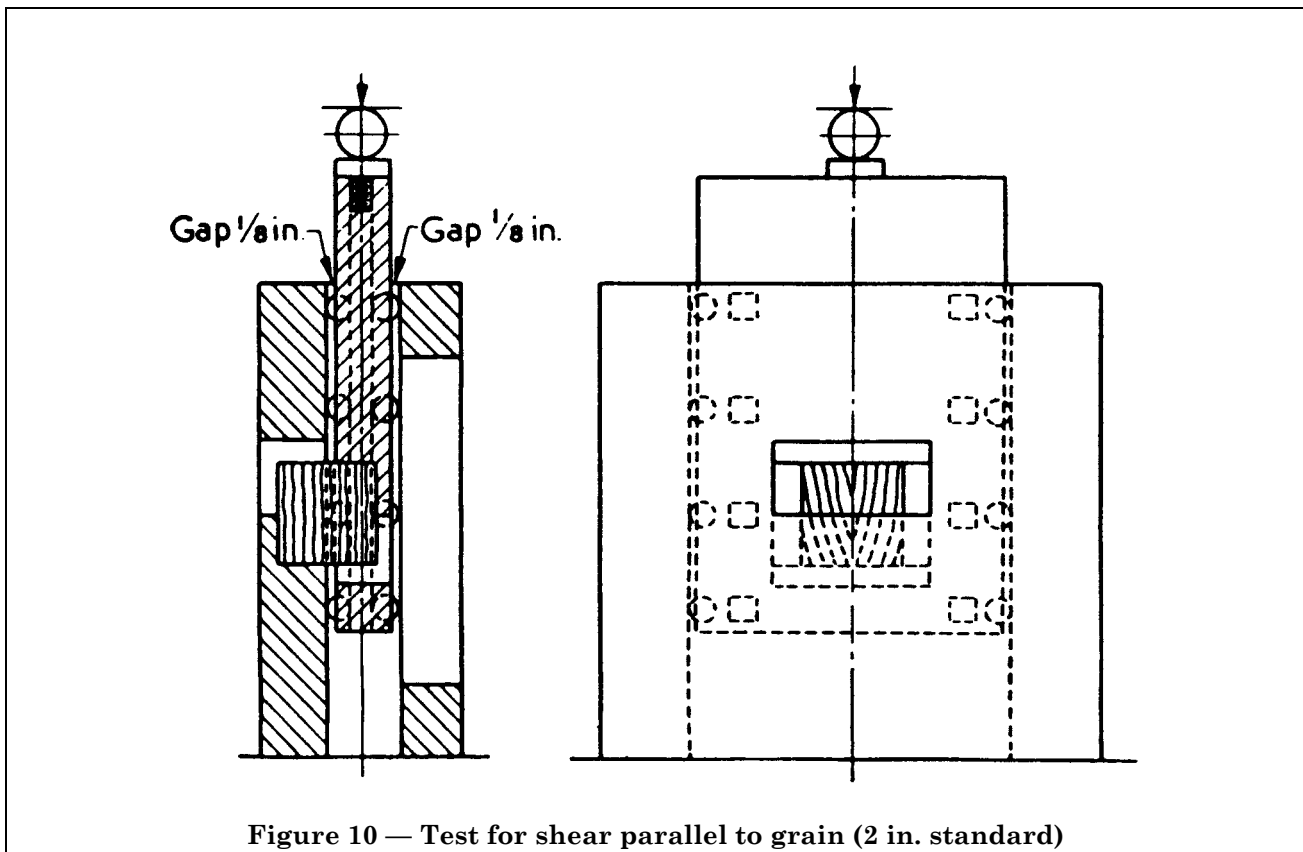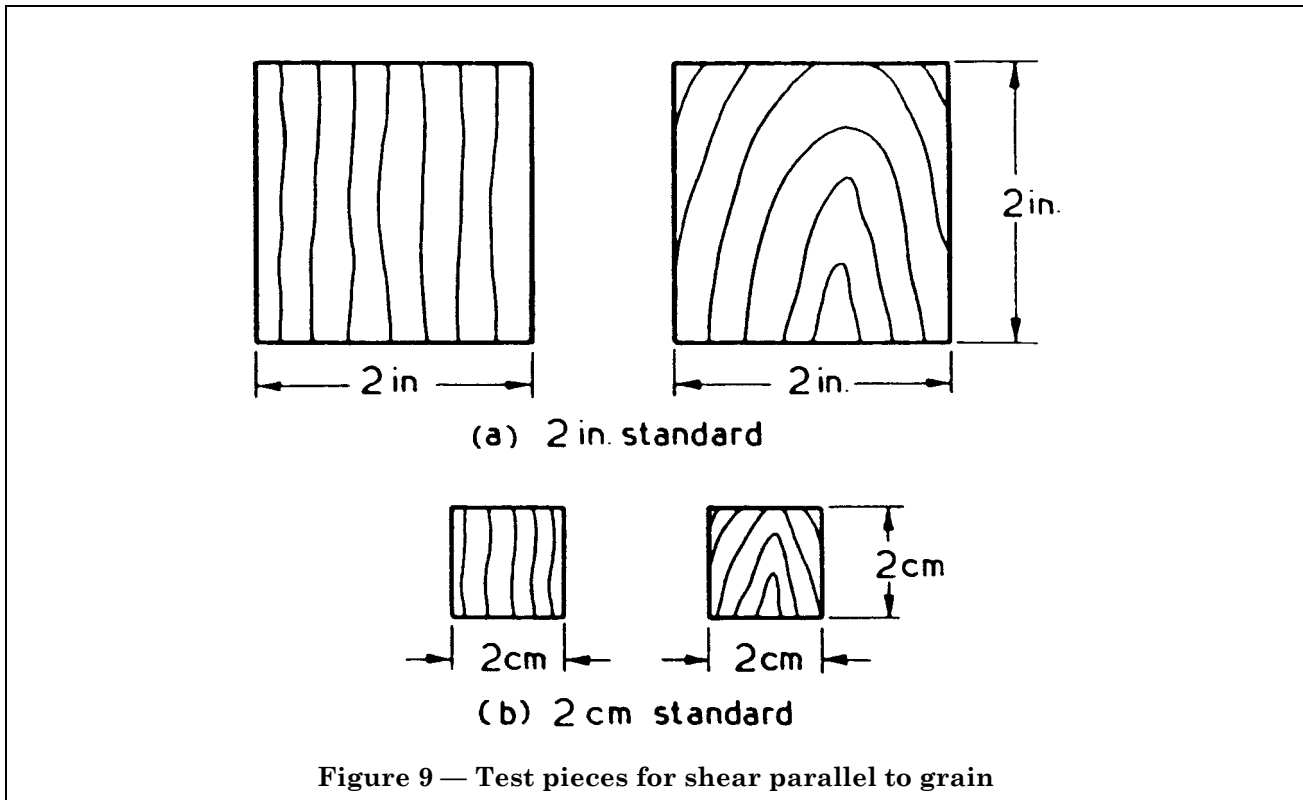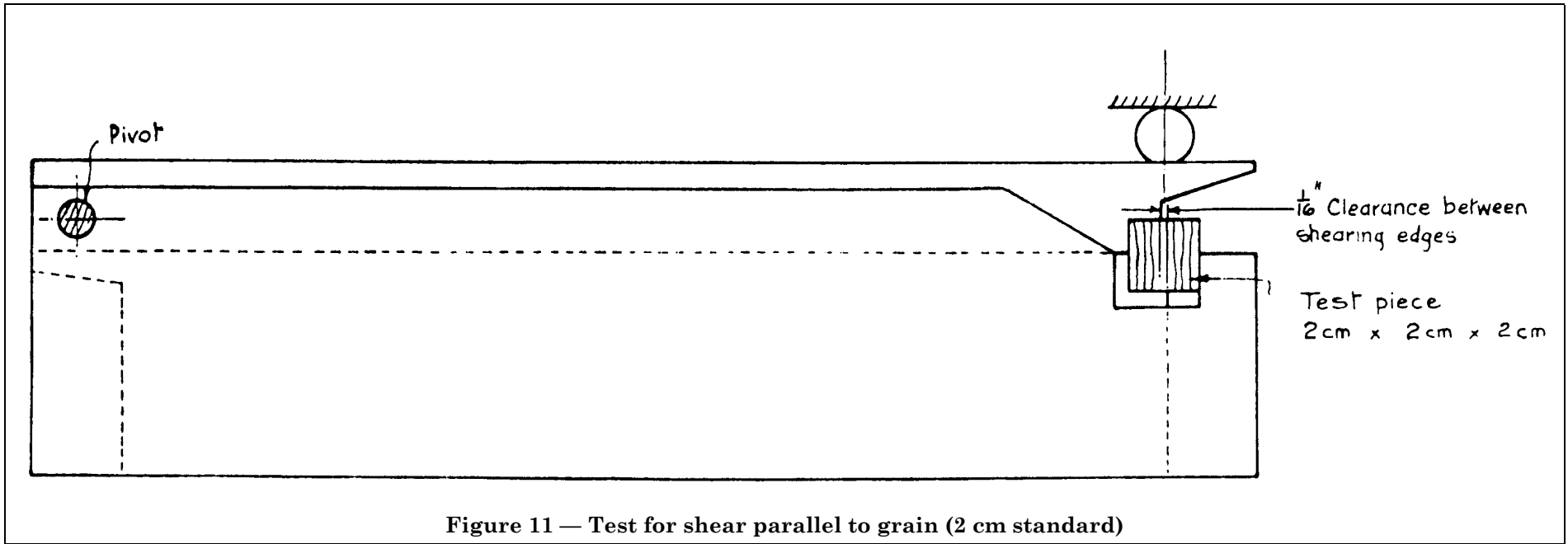
Figure 11 — Test for shear parallel to grain (2 cm standard)
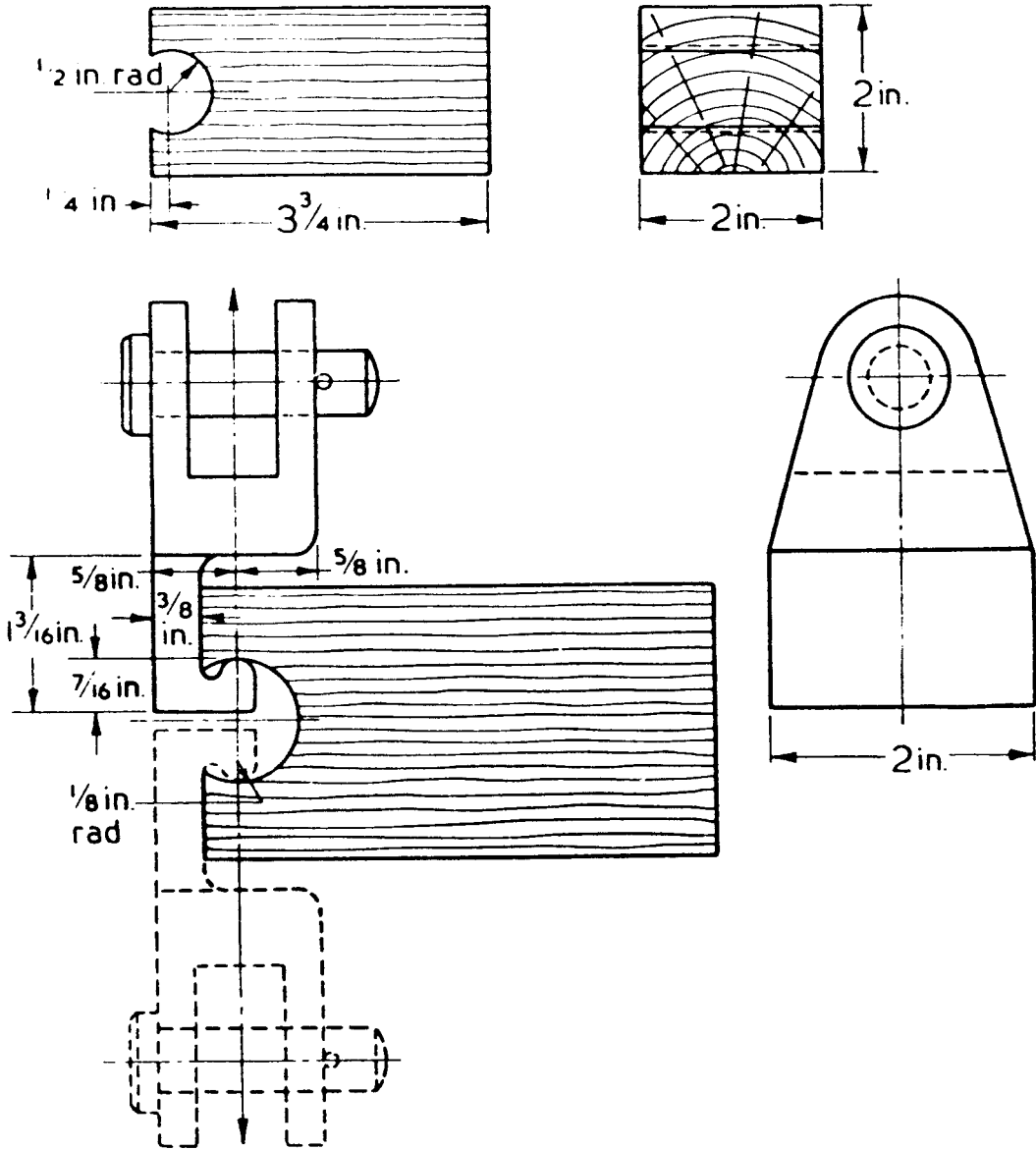
Figure 12 — Test for cleavage (2 in. standard)

Figure 13 — Test for cleavage (2 cm standard)
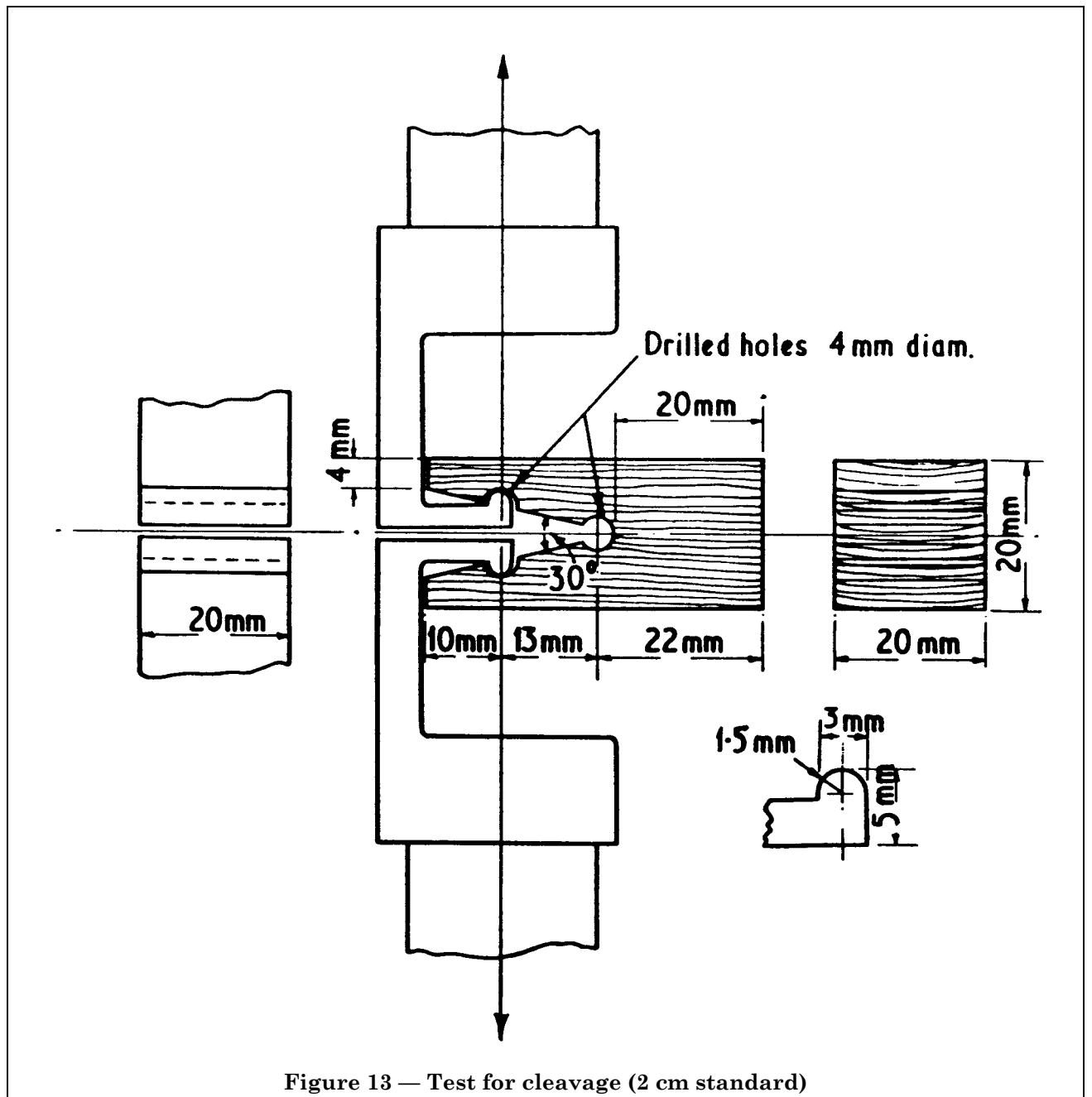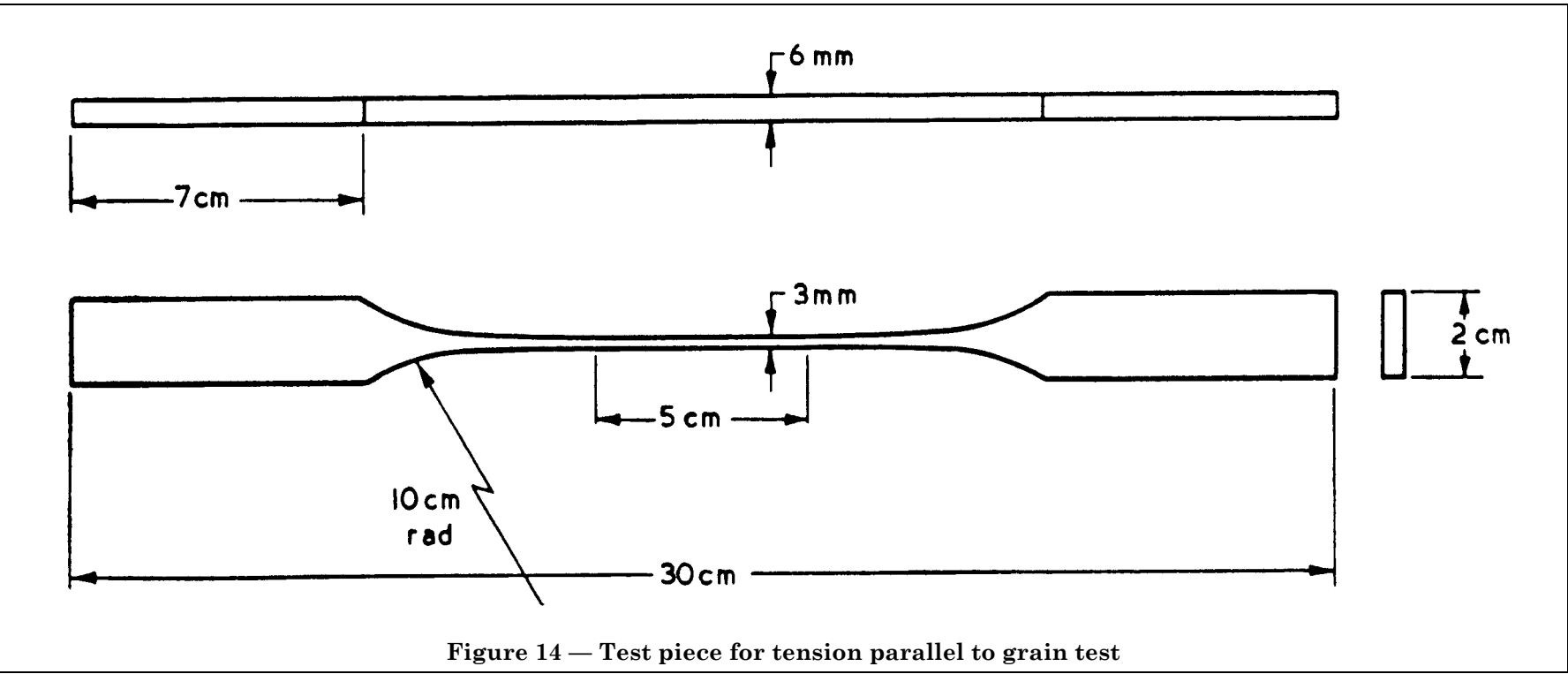
Figure 14 — Test piece for tension parallel to grain test
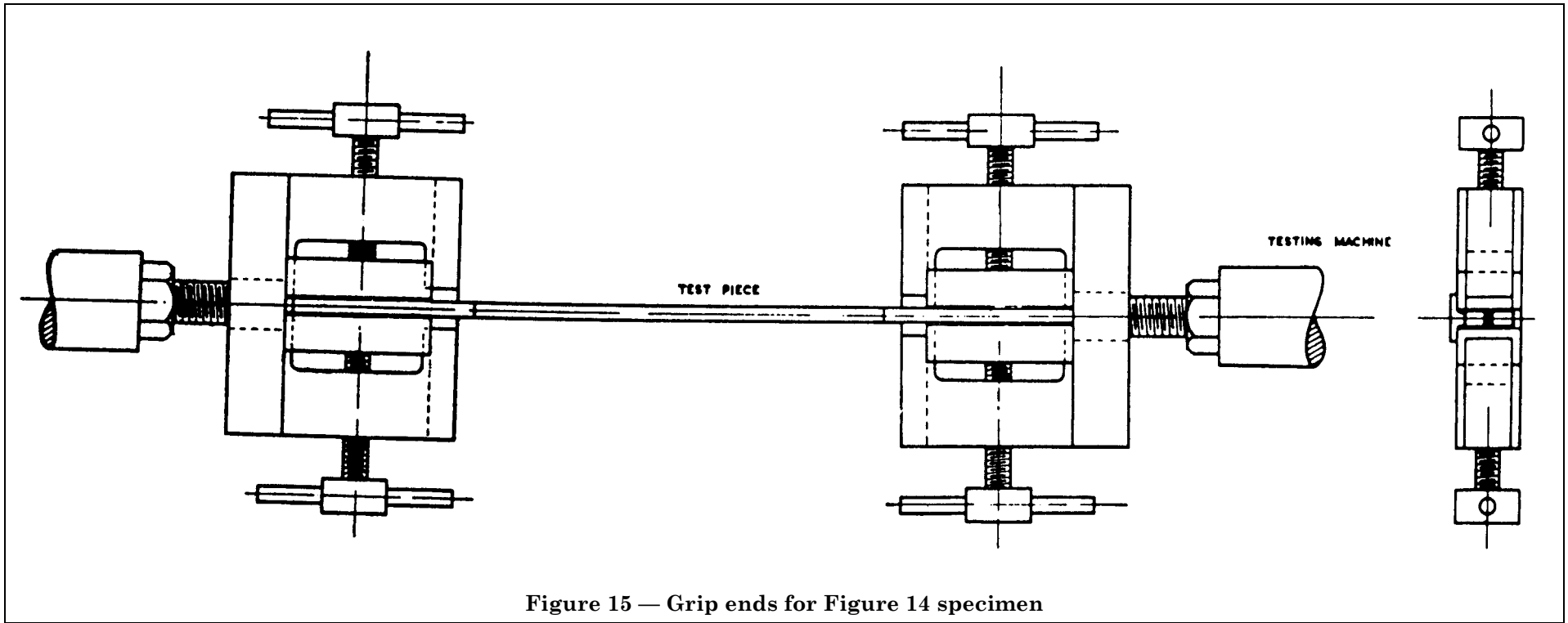
Figure 15 — Grip ends for Figure 14 specimen

TEST PIECE

TESTING MACHINE
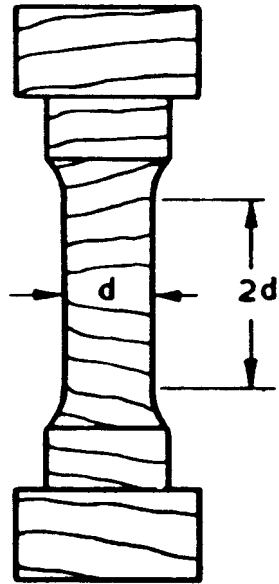
Figure 16 — Test piece for tension perpendicular to grain

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