BRITISH STANDARD

BS 3544:1962

Incorporating Amendment Nos. 1 and 2

Methods of test for

Polyvinyl acetate adhesives for wood

Co-operating organizations

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

Adhesive Manufacturers' Association*
Association of British Chemical Manufacturers
Association of British Plywood and Veneer Manufacturers*
Board of Trade
British Carton Association
British Furniture Manufacturers' Federated Associations*
British Gelatine & Glue Research Association
British Paper Bag Federation
British Paper Box Federation
British Plastics Federation*
British Woodwork Manufacturers' Association*
D.S.I.R. — Forest Products Research Laboratory*
Federation of Gelatine and Glue Manufacturers*
Ministry of Aviation
Printing, Packaging and Allied Trades Research Association
Wallpaper Manufacturers' Employers' Association
War Office*
Individual manufacturers

The Government department and scientific and industrial organizations 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:

British Radio Cabinet Manufacturers' Association
British Railways — British Transport Commission
British Rubber & Resin Adhesive Manufacturers' Association
Casein Glue Manufacturers' Association
Cork Trade Association
Federation of British Rubber and Allied Manufacturers
Furniture Development Council
Timber Research and Development Association

This British Standard, having been approved by the Adhesives Industry Standards Committee and endorsed by the Chairman of the Chemical Divisional Council, was published under the authority of the General Council on 28 September 1962

The following BSI references relate to the work on this standard:
Committee reference ADC/6
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Amendments issued since publication

Amd. No.	Date of issue	Comments
5936	November 1966	
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Contents

Foreword

This standard makes reference to the following British Standards:

BS 871, *Abrasive papers and cloths for general purposes.*

BS 1610, *Verification of testing machines.*

BS 1610-1, *Methods of load verification, requirements for elastic proving devices, and verification of machines for tension and compression testing.*

The preparation of British Standard specifications for polyvinyl acetate adhesives has been proposed, but is not yet practicable because there is insufficient information on the quantitative requirements that should be included in such specifications. An essential preliminary step is the preparation of suitable test methods to enable the performance of different adhesives to be compared and related to their behaviour in service.

The methods prescribed in this British Standard have been subjected to trial by various interested organizations, and their general adoption will facilitate the accumulation of data on which to base specifications for this type of adhesive.

Since this British Standard was first published, clause **4**, dealing with strength tests, has been deleted because it has been superseded by the strength tests given in BS EN 205:1991. A number of consequential editorial changes have also been made.

NOTE 1 Where metric equivalents are stated the figures in British units are to be regarded as the standard. The metric equivalents are approximate. More accurate conversions should be based on the tables in BS 350, "*Conversion factors and tables*".

NOTE 2 In place of the customary, but incorrect, use of the pound as a unit of force, the unit called a pound force (abbreviation lbf) has been used in this standard. It is that force which, when acting on a body of mass one pound, gives it an acceleration equal to that of standard gravity. The unit kilogramme force (kgf) has a similar significance.

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 and ii, pages 1 to 8 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.

1 Scope

This British Standard describes methods of testing polyvinyl acetate adhesives intended for use with wood. The methods are suitable for inclusion in specifications for such adhesives.

2 Freeze and thaw treatment

NOTE This method is intended for use in conjunction with a requirement that after such treatment the sample satisfies specified requirements for dry and damp strengths.

a) **Apparatus.** *Freezing cabinet,* capable of maintaining a temperature of – 10 ± 2 °C.

Nickel or stainless steel beaker of 250 ml capacity.

b) **Procedure.** Place the beaker, containing 200 ml of the sample and suitably covered, in the freezing cabinet and leave for 18 hours. Remove the beaker, bring the sample to a temperature of 25 ± 2 °C naturally (without stirring), then replace it in the freezing cabinet. Carry out the cycle of freezing and thawing three times.

3 Test for staining

a) **Reagents.** The reagents shall be of a recognized analytical reagent quality. Distilled water or water of at least equal purity shall be used.

Ammonium ferric sulphate solution, containing 25 p.p.m. of iron. Weigh out 0.216 g of ammonium ferric sulphate, dissolve in water, add 2 or 3 drops of concentrated nitric acid and dilute to 1 000 ml with water.

Tannic acid, 5 per cent w/v solution in water, prepared on the day on which the tests are to be made.

b) **Procedure.** Prepare test papers by soaking filter papers in the tannic acid solution and allowing to dry.

It is essential that the test papers shall be prepared on the day on which the tests are to be made.

Place three well spaced, separate drops of the ammonium ferric sulphate solution on the test paper so as to obtain three separate standard stains. By means of a glass rod, smear alongside each standard stain a drop of the adhesive to be tested. Compare the intensity of the stain produced by the adhesive with that of the adjacent standard stain.

If the results of the three replicate tests do not agree, repeat the test on a fresh test paper.

c) **Reporting.** Report the stain produced by the adhesive as not darker than, or darker than, the standard stain.

4 *Text deleted.*

5 Test for resistance to sustained load under dry and damp conditions

a) **Apparatus.** The test is carried out by the use of a special jig, as shown in Figure 2, made from ½ inch plywood. With this type of jig, up to 12 samples may be tested with one set of weights.

b) **Procedure.** Support the test piece (prepared and conditioned in accordance with Appendix A) laterally, by means of small packing pieces, between the frames of the jigs, as shown in Figure 2. If necessary use a small gauge to locate the joint correctly. Place the jig and test pieces in the conditioning atmosphere.

Suspend the top frame from a suitable support, apply a load of 50 or 100 lbf (23 or 46 kgf) to the bottom frame, and note the time taken before each joint fails.

c) **Reporting of test results.** Report the mean failing time for a group of ten test pieces. In the report, state also the load used.

NOTE If the failure of the samples is recorded visually during a 9-hour working day, errors of up to 15 hours can occur on weekdays and more at week-ends. If the samples are inspected twice daily including week-ends, the maximum error is $\frac{15 \times 100}{24 \times 7}$ = 9 per cent for an average failing time of 7 days, and 4½ per cent if the average failing time is increased to 14 days. For reasonable accuracy, therefore, the loads applied to the samples should be such that average failing times of greater than two weeks are obtained. Alternatively, some form of automatic recording instrument should be used; a suitable device is described in Appendix B and illustrated in Figure 9.

Appendix A Preparation of test pieces for tests for resistance to sustained load

A.1

a) **Selection of test slips.** Prepare the test slips from European beech (*Fagus sylvatica*) 0.125 ± 0.005 in (3.18 ± 0.13 mm) thick. The growth rings may be at any angle, from 0 to 90° inclusive, relative to the face. Both faces of the slip should be planed.

The slips shall be flat and free from splits, knots, whorls and dote; the angle of inclination of the grain across the face of each test slip shall be not greater than 1 in 9, and the grain shall not be obviously inclined to the face.

i) *Inclination of grain ACROSS the face.* The appearance of the "flower" (growth ring figure) on the face of a slip gives little indication of the straightness of grain (see Figure 3). The small rays, which are darker in colour than the surrounding wood, afford an easy means of determining grain direction. Figure 3 shows straight-grained slips and Figure 4 illustrates the maximum permissible grain inclination of 1 in 9 across the face.

ii) *Inclination of grain TO the face.* The inclination of the grain to the face of the slip is viewed on the edges (see Figure 5) and the long lines formed by the junctions of the growth rings afford the best guide. The areas of darker ray tissue shown diagrammatically in Figure 5 should be disregarded. Immediately before the preparation of the test piece, lightly sand each slip.

NOTE A suitable procedure is to give the appropriate part four double strokes parallel to the direction of the grain with a flat block to which a sheet of suitable abrasive material[1)] has been firmly attached. Take care to hold the block flat on the slip so that the surface is uniformly sanded and rounding of the sides of the slip is avoided.

b) **Moisture content.** The moisture content of the slips at the time of gluing shall be 12 ± 2.5 per cent.

NOTE The specified moisture content of 12 ± 2.5 per cent corresponds with the conditions attained by wood during storage in a normally heated room in the British Isles.

To determine the moisture content, accurately weigh representative samples of the wood and dry them in an oven maintained at a temperature of 105 ± 3 °C until their weight is constant. Take care to prevent change in moisture content between the cutting of the sample and the first weighing, or between removal from the oven and the subsequent weighing.

$$\text{Water, per cent by weight} = \frac{100\ (W - W_1)}{W_1}$$

where W = weight, in grammes, of sample before treatment

and W_1 = weight, in grammes, of dried sample.

c) **Construction of test pieces.**

i) *Test slips.* Prepare each test piece from three slips of beech selected as described above, 4.5 ± 0.01 in (114 ± 0.25 mm) long and 1 ± 0.01 in (25 ± 0.3 mm) wide, joined together with the adhesive under test so as to produce a 0.5 ± 0.01 in (12.5 ± 0.3 mm) overlap joint (see Figure 6).

ii) *Preparation of the adhesive.* Prepare and use the adhesive in accordance with the instructions provided by the manufacturer.

iii) *Preparation of the test pieces.* Prepare the test pieces under ordinary room conditions, except where otherwise directed by the manufacturer. Apply the adhesive uniformly to one of the two faces forming a joint or as prescribed by the manufacturer. Place the slips forming a joint in contact without rubbing, immediately the adhesive is applied, or after such period as may be prescribed by the manufacturer. When the test pieces have been prepared, place them immediately in a suitable clamp, a convenient form of which is shown in Figure 7. Apply sufficient pressure to ensure good contact: normally a load of approximately 50 lb (23 kg), equivalent to a pressure of 100 lbf/in^2, is adequate. A convenient jig for locating the clamp and its contents is shown in Figure 8. Allow the test pieces to remain in their clamps, in ordinary room conditions, for not less than 8 hours, or as instructed by the manufacturer.

[1)] Glass paper complying with Grade No. 1 of BS 871, "*Abrasive papers and cloths for general purposes*", is recommended.

A.2 Conditioning of the test pieces. Release the test pieces from their clamps and place them in a conditioning atmosphere[2)] of 25 ± 1 °C (77 ± 2 °F) and 65 ± 2 per cent relative humidity for not less than 7 nor more than 14 days. Leave the test pieces in the conditioning atmosphere until ready for test.

For the "damp" test, a further conditioning period of 7 days at 25 ± 1 °C (77 ± 2 °F) and 90 ± 2 per cent relative humidity is necessary before testing.

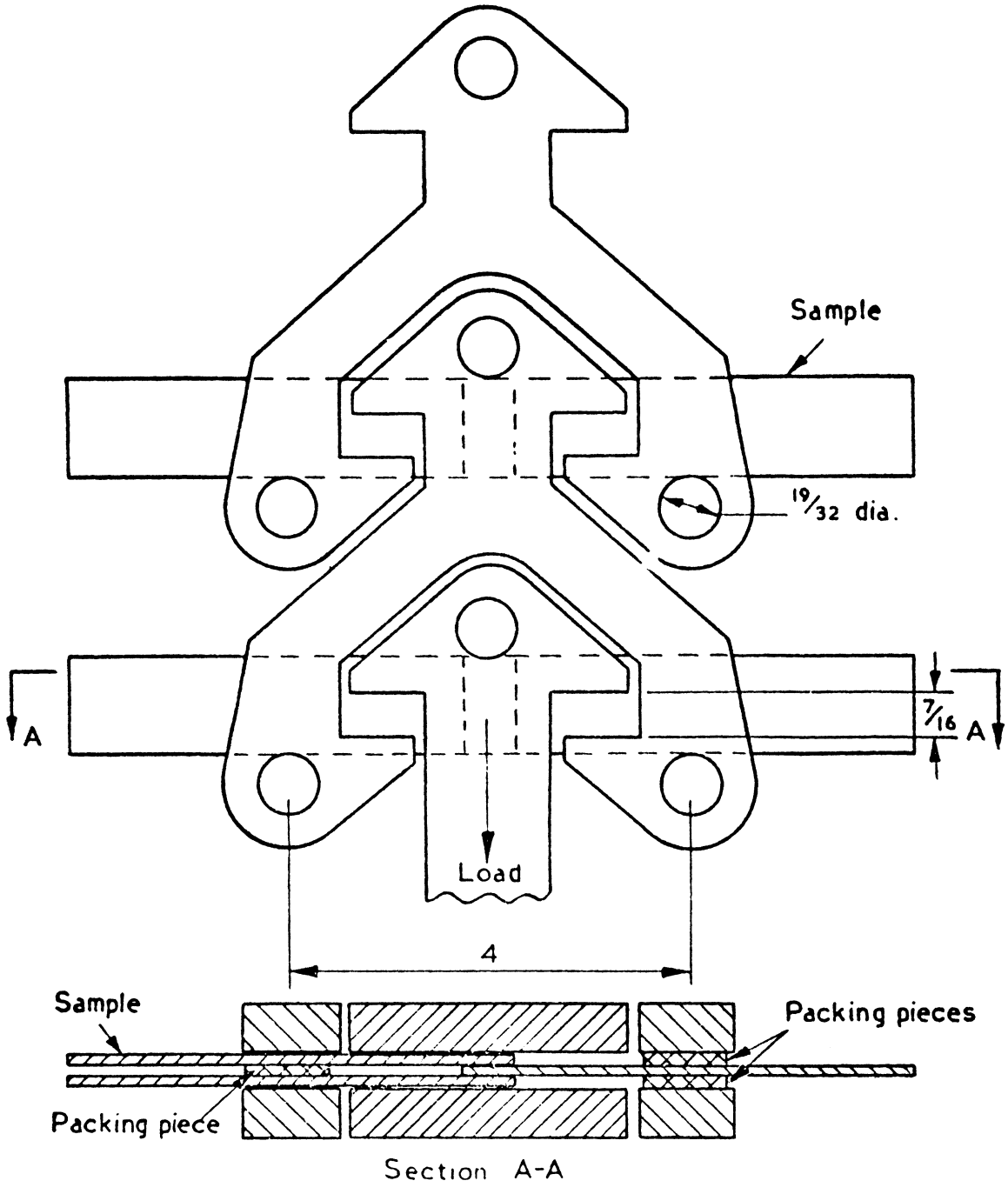
Appendix B Timing device for sustained loading tests

A suitable timing circuit for the sustained loading tests is shown in Figure 9. The basis of the arrangement is that at fixed intervals the mains voltage is applied to a power unit having a d.c. output of about 200 W. This d.c. voltage is applied across suitable contacts on each test piece arranged in series with a solenoid counting relay. Each counter clicks up one at regular intervals, therefore, until the contact in series with it has broken by the failure of the test piece.

NOTE There are a number of ways in which the apparatus may be constructed but the following has been found to be satisfactory:

For regular closing of the a.c. circuit use a micro-switch operated by a sprocket wheel with 36 teeth, mounted on the spindle of a 24-hour autographic clock. The power unit may be made up of a 5 : 1 transformer together with a full-wave copper oxide rectifier. The Post Office counters are 400 ohm, ref. No. 9D.

[2)] A British Standard now in preparation, on "Laboratory conditioning ovens (non-injection type)" will give information on the maintenance of standard conditions by the use of saturated salt solutions. At 25 °C, a relative humidity of 65 per cent may be obtained by use of a saturated solution of sodium nitrite: the relative humidity over a saturated solution of zinc sulphate at this temperature is 88 per cent.



Dimensions are in inches (1in = 25·4mm)

Figure 2 — Jig for assessing the resistance to a sustained load

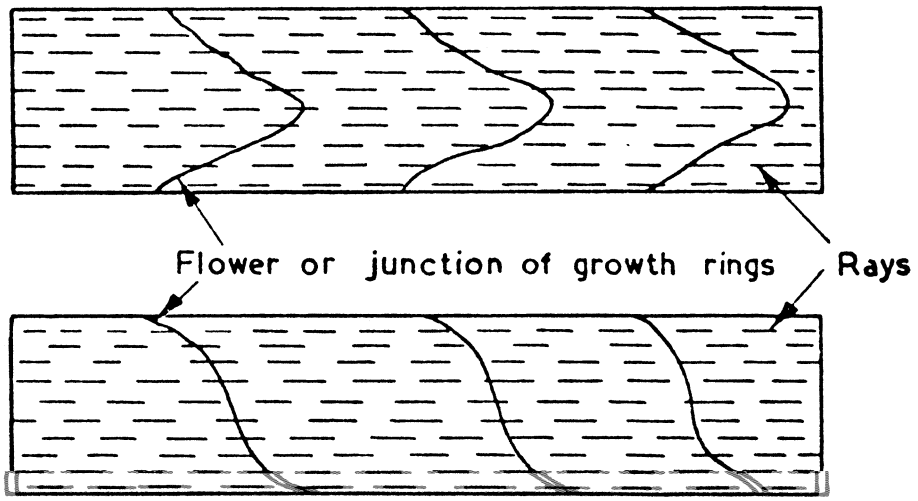


Figure 3 — Straight grain across face

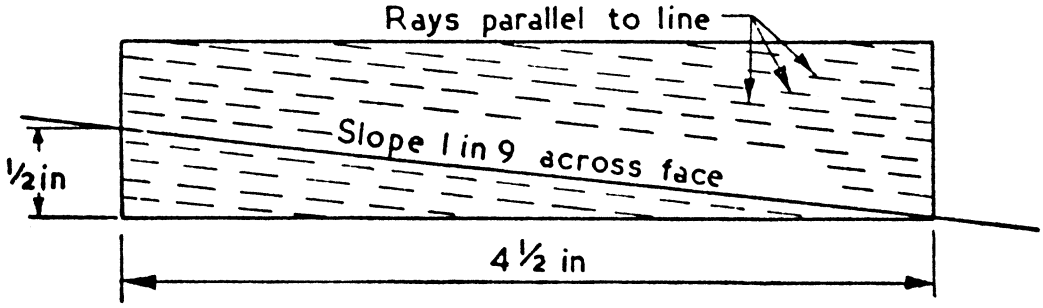


Figure 4 — Grain inclination across face at maximum permissible angle

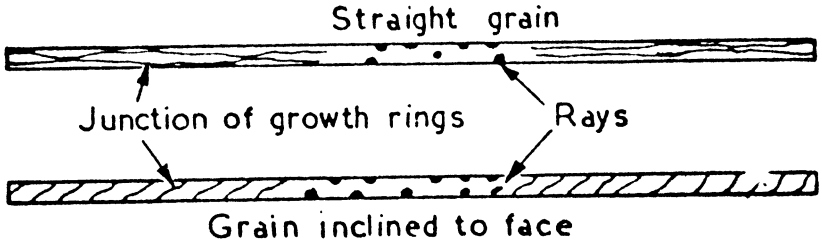
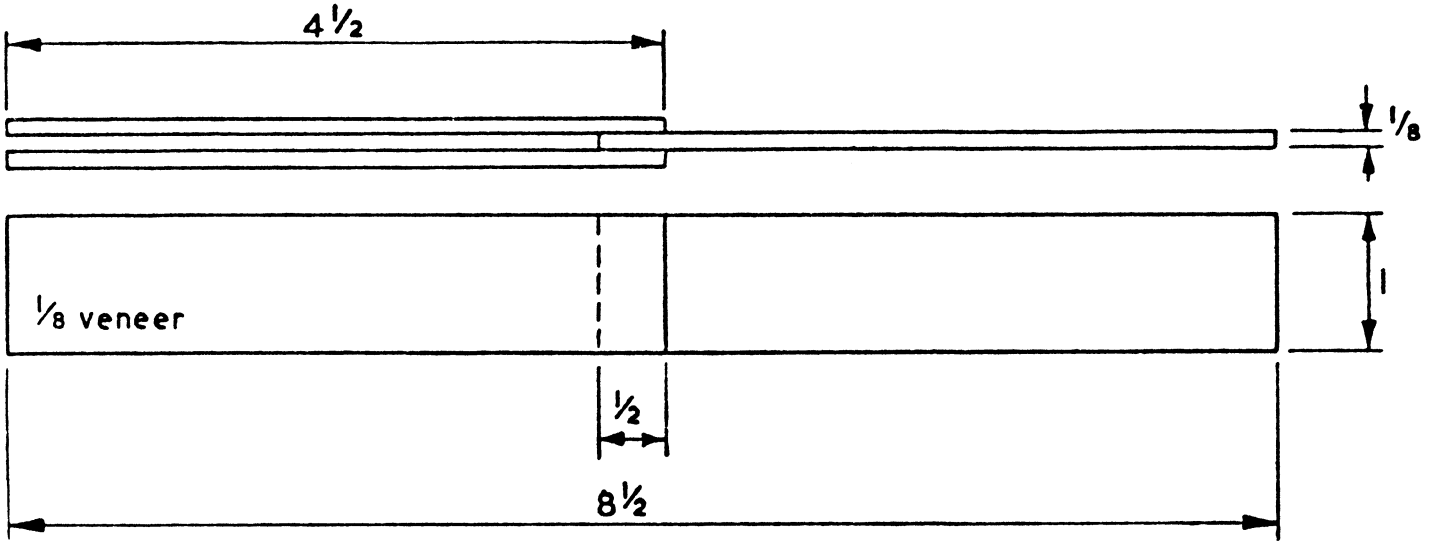


Figure 5 — Inclination of grain to the face



Dimensions are in inches (1in = 25·4mm)

Figure 6 — Test piece

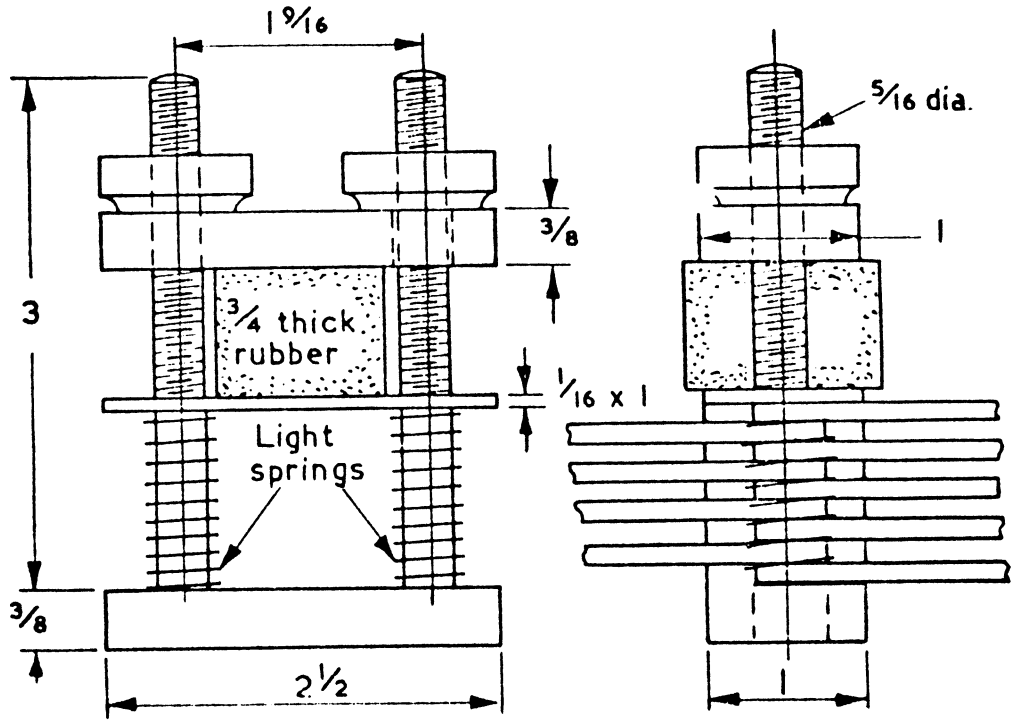
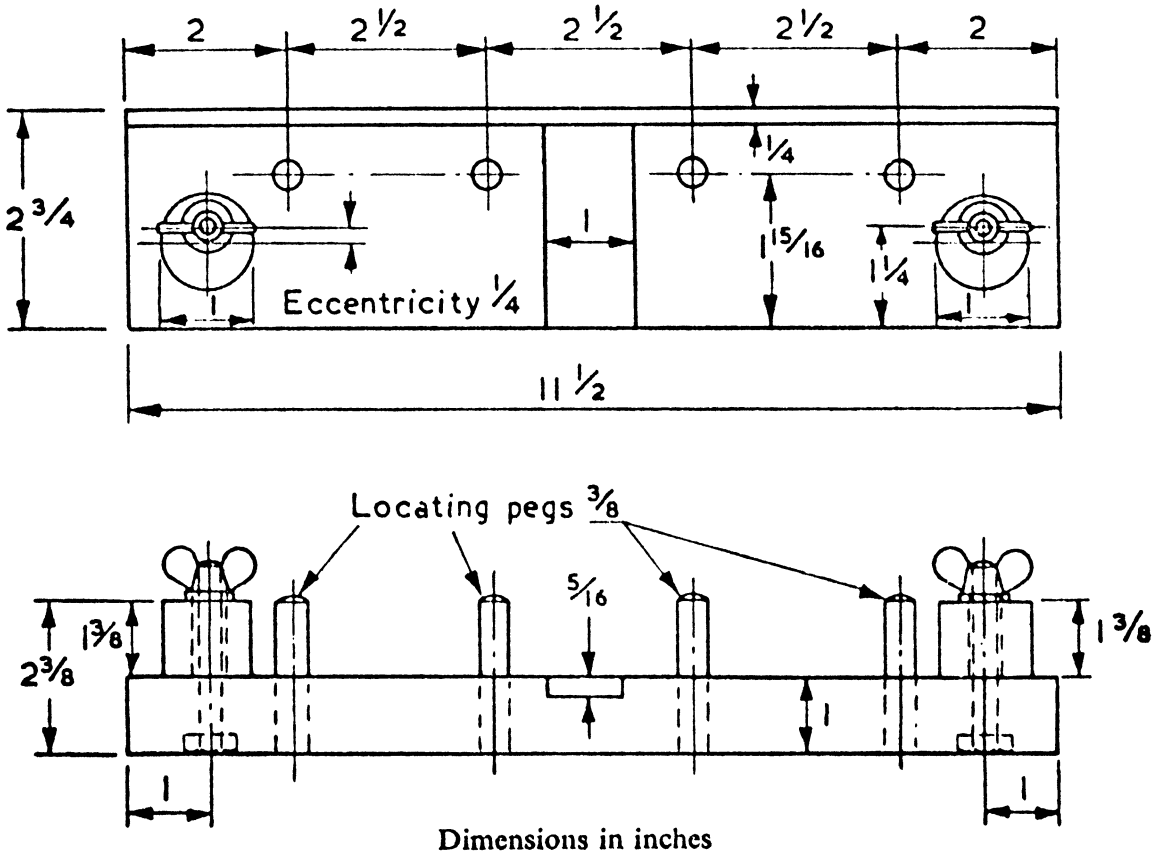


Figure 7 — Clamping device for holding three test pieces



Dimensions in inches

Figure 8 — Jig for locating test pieces in clamp

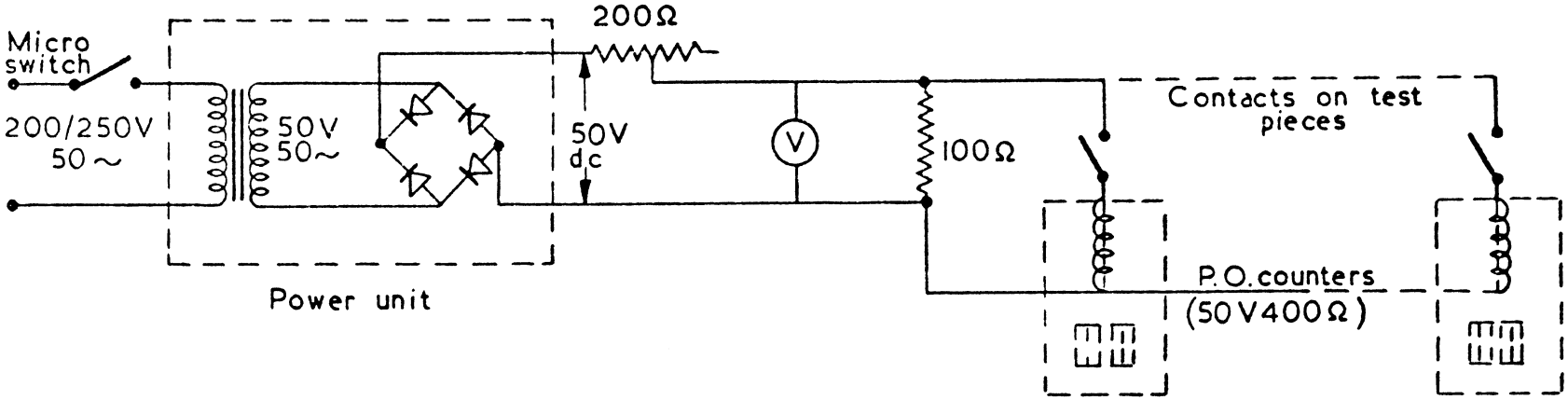


Figure 9 — Timing circuit for sustained loading tests on PVA adhesives

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