

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 851 (1978): Specification for Synthetic Resin Adhesives For Construction Work (Non-Structural) in Wood [CED 20: Wood and other Lignocellulosic products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



IS : 851 - 1978
(Reaffirmed 2005)

REAFFIRMED

2009

Indian Standard

SPECIFICATION FOR SYNTHETIC
RESIN ADHESIVES FOR CONSTRUCTION
WORK (NON-STRUCTURAL) IN WOOD

(First Revision)

Third Reprint MAY 2009
(Including Amendment No. 1 & 2)

UDC 668.395 : 674.21 : 694.6

© *Copyright* 1978

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR SYNTHETIC RESIN ADHESIVES FOR CONSTRUCTION WORK (NON-STRUCTURAL) IN WOOD

(First Revision)

Wood Products Sectional Committee, BDC 20

Chairman

SHRI A. C. SEKHAR

Representing

Forest Research Institute & Colleges (Timber
Mechanics Branch), Dehra Dun

Members

ASSISTANT DIRECTOR (SPECIFICATION), RDSO, LUCKNOW

Ministry of Railways

SHRI J. BAIN

Indian Tea Association, Calcutta

SHRI P. R. CHANDRASEKHAR

Directorate General of Civil Aviation, New Delhi

SHRI L. N. DOKANIA

Federation of Indian Plywood & Panel Industry,
New Delhi

SHRI M. R. MOTAYED (*Alternate*)

SHRI M. A. ISLAM
DR JOSEPH GEORGE

Forest Department, Government of Assam, Dispur
Indian Plywood Industries Research Institute,
Bangalore

DR V. J. VICTOR (*Alternate*)

SHRI A. K. KADERKUTTY
SHRI K. S. LAULY

The Western India Plywoods Ltd, Baliapatam
The South India Plywood Manufacturers' Association,
Calicut

SHRI THOMAS PAUL (*Alternate*)

SHRI G. R. MAVINKURVA

Forest Department, Government of Karnataka,
Bangalore

CHIEF CONSERVATOR OF
FORESTS (GEN) (*Alternate*)

SHRI P. V. MEHTA

Directorate General of Technical Development, New
Delhi

LT-COL S. A. MOHILE

Ministry of Defence (R & D)

SHRI B. B. MEHTA (*Alternate*)

SHRI M. R. MOTAYED

Plywood Manufacturers' Association of West Bengal,
Calcutta

SHRI S. K. DUTTA (*Alternate*)

(Continued on page 2)

© Copyright 1978

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

IS : 851 - 1978

(Continued from page 1)

Members

DR A. N. NAYER
SHRI D. E. NEALE
DR R. S. RATRA
SHRI P. R. RIJSINGHANI
MAJ M. GOSWAMI (*Alternate*)
SHRI SHARAN SINGH
DR S. M. SINGH

SHRI ARJUN DAS (*Alternate*)
SUPERINTENDING SURVEYOR OF
WORKS (II)
SHRI H. THOMSON
SHRI G. W. M. WHITTLE (*Alternate*)
SHRI D. V. VERMA
SHRI NIRMAL SINGH (*Alternate*)
SHRI D. AJITHA SIMHA,
Director (Civ Engg)

Representing

In personal capacity (C-59 Inderpuri, New Delhi
110012)
United Planters' Association of Southern India,
Cochin
National Buildings Organization, New Delhi
Engineer-in-Chief's Branch, Army Headquarters
Directorate General of Supplies & Disposals, New
Delhi
Central Building Research Institute (CSIR),
Roorkee
Central Public Works Department, New Delhi
Sitapur Plywood Manufacturers Ltd, Sitapur
Ministry of Defence (DGI)
Director General, ISI (*Ex-officio Member*)

Secretary

SHRI J. R. MEHTA
Deputy Director (Civ Engg), ISI

Adhesives for Wood and Wood Products Subcommittee, BDC 20 : 4

Convener

DR R. C. GUPTA Forest Research Institute & Colleges, Dehra Dun

Members

SHRI B. M. BANERJEE Ministry of Defence (R & D)
SHRI V. B. TANDON (*Alternate*)
SHRI P. K. BANERJI Hoechst Dyes & Chemicals Ltd, Bombay
SHRI F. B. KAPADIA (*Alternate*)
SHRI C. S. BHATNAGAR Ciba Geigy of India Ltd, Bombay
DR D. K. DAS National Test House, Calcutta
SHRI A. GHOSH (*Alternate*)
SHRI R. V. DOSHI Doshi Brothers & Co, Anand
SHRI C. V. DOSHI (*Alternate*)
SHRI S. HARIDAS Shaw Wallace & Company Limited, Calcutta
DR JOSEPH GEORGE Indian Plywood Industries Research Institute,
Bangalore
SHRI S. S. ZOOLAGUD (*Alternate*)
DR R. N. KUMAR The Western India Plywood Ltd, Baliapatam
SHRI K. S. LAULY The South Indian Plywood Manufacturers' Associa-
tion, Calicut
SHRI A. K. RAMACHANDRA (*Alternate*)

(Continued on page 21)

AMENDMENT NO. 1 DECEMBER 1987

TO

**IS : 851 - 1978 SPECIFICATION FOR SYNTHETIC
RESIN ADHESIVES FOR CONSTRUCTION
WORK (NON-STRUCTURAL) IN WOOD**

(First Revision)

(Page 9, clause 5.6.1, line 5) — Substitute ' 4 of IS : 1734 (Part 7)-1983* ' for ' Appendix H '.

(Page 9, clause 5.6.2, line 5) — Substitute ' 4 of IS : 1734 (Part 7)-1983* ' for ' Appendix H '.

(Page 11, clause B-1.1, line 1)

(Page 12, clause C-1.1, line 1)

(Page 17, clause F-1.1, line 1)

} Add the words ' Vallapine or
Makai ' after the word ' cana-
rium spp. '

(Page 20, Appendix H) — Delete.

*Methods of test for plywood (second revision).

**AMENDMENT NO. 2 AUGUST 2007
TO
IS 851 : 1978 SPECIFICATION FOR SYNTHETIC
RESIN ADHESIVES FOR CONSTRUCTION
WORK (NON-STRUCTURAL)
IN WOOD**

(First Revision)

*(Page 17, Appendix F, clause F-1.1, third line) — Substitute '3.00 ± 0.15'
for '3.15 ± 0.15'.*

(CED 20)

Indian Standard

SPECIFICATION FOR SYNTHETIC RESIN ADHESIVES FOR CONSTRUCTION WORK (NON-STRUCTURAL) IN WOOD

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 20 February 1978, after the draft finalized by the Wood Products Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Adhesives form one of the most important raw materials used in the plywood industry and wood work and joinery industry. The selection of the adhesive and its correct use are important factors controlling the quality of the plywood or the joinery work produced. In the context of this background of the industry, it has been found necessary to lay down standards governing the quality of the raw materials and the performance expected from the prepared glues.

0.3 The preparation of the adhesive and its correct use are other important aspects. Therefore, for the information of the users, the manufacturers shall furnish all the relevant information for the use of these adhesives in the manner indicated in Appendix A.

0.4 This standard covers both phenolic as well as aminoplastic synthetic resin adhesives. The phenolic resin adhesives are normally classified as BWP and BWR grade. The joints made with this type of adhesives are highly resistant to weather, micro-organisms, cold and boiling water, steam or dry heat. The aminoplastic resin adhesives generally classified as WWR or CWR grade adhesives of urea formaldehyde base, deteriorate rapidly on full exposure to weathering. These are, therefore, not recommended where high level of moisture is experienced. However, UF resins fortified either with melamine, phenol or resorcinol and urea formaldehyde melamine formaldehyde mixes show much improved performance over UF resins.

IS : 851 - 1978

0.5 This standard was first published in 1957. In this first revision, three types of adhesives covered in the earlier version have been re-designated and an additional type (BWR) has been included. The definition requirements and methods of tests as applicable to these types have been modified in light of experience.

0.6 This standard contains clauses 5.3.1 and 5.3.2 which permit the user to use his option for selection to suit his requirements at the time of placing orders.

0.7 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements for synthetic resin adhesives suitable for wood work (non-structural) and joinery.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 707-1976† and the following shall apply.

2.1.1 *Assembly Time*

2.1.1.1 *Open assembly time* — The time elapsing between the application of the adhesive and assembly of joint components.

2.1.1.2 *Closed assembly time* — The time elapsing between assembly of the joint components and the application of pressure.

2.1.2 *Adhesive*

2.1.2.1 *Closed contact adhesive* — A non-gap-filling adhesive suitable for use only in those joints where the surfaces to be joined may be brought into close contact by means of adequate pressure, and where glue line exceeding 0.12 mm may be avoided with certainty.

*Rules for rounding off numerical values (*revised*).

†Glossary of terms applicable to timber technology and utilization (*second revision*).

2.1.2.2 Gap filling adhesive — An adhesive suitable for use in those joints where the surfaces to be joined may or may not be in close or continuous contact owing either to impossibility of applying adequate pressure or to slight inaccuracies in machining.

2.1.3 Extender — A substance added to the adhesive either to reduce the cost of gluing or to reduce penetration through the veneers or both.

2.1.4 Filler — An inert substance, such as wood flour, added to alter the characteristics, for example, to reduce brittleness of a synthetic resin sometimes loosely and incorrectly used as interchangeable with 'extender'.

2.1.5 Fortifier — A substance used primarily to increase the boil resistance and durability of hot setting urea resins.

2.1.6 Hardener — A material used to promote the setting of the resin. It may be either in liquid or powder form. It is an essential part of the adhesive, the properties of which depend upon using the resin and hardener as directed.

2.1.7 Pot Life — The time between the mixing of the constituent parts of an adhesive and its reaching the age when it is no longer usable.

2.1.8 Shelf Life — The period for which the adhesive or adhesive components may be stored without affecting their suitability for use in accordance with the standard.

2.1.9 Spread of Adhesive — The area of surface covered by 1 kg of adhesive mix prepared in accordance with the manufacturer's instructions.

2.1.10 Synthetic Resin — Amorphous organic materials produced by the polymerization or condensation of one, two or, less frequently, three relatively simple compounds. The term is also applied to chemically modified natural resins. The properties of synthetic resins can vary widely depending upon their basic raw materials, proportions, and conditions of manufacture. All synthetic resins are classified broadly as thermosetting or thermoplastic.

2.1.10.1 Phenolic synthetic resin — A phenolic synthetic resin is derived from the reaction of phenol with an aldehyde.

2.1.10.2 Aminoplastic synthetic resin — An aminoplastic synthetic resin is derived from the reaction of urea, thio-urea, melamine, or allied compounds, or mixtures of these compounds with formaldehyde.

2.1.11 Synthetic Resin Adhesive — A composition, substantially consisting of a synthetic resin of either the phenolic or aminoplastic type but including any hardening agent, fortifier, filler or extender, which may be required to be added before use according to the manufacturer's instructions.

3. TYPES

3.1 Depending upon their degree of resistance to water and micro-organisms, synthetic resin adhesives for wood shall be of the following four types:

Boiling Water Proof	BWP
Boiling Water Resistance	BWR
Warm Water Resistance	WWR
Cold Water Resistance	CWR

3.1.1 Gap-filling and close contact adhesives of the four types shall be distinguished by the following symbols:

<i>Type</i>	<i>Symbol</i>	
	Gap-Filling Adhesive	Close Contact Adhesive
Boiling Water Proof	BWP/GF	BWP/CC
Boiling Water Resistance	BWR/GF	BWR/CC
Warm Water Resistance	WWR/GF	WWR/CC
Cold Water Resistance	CWR/GF	CWR/CC

4. KEEPING QUALITIES

4.1 The adhesives shall comply with the requirements specified under 5 after the resin and hardener have been stored in the original closed containers according to the manufacturer's instructions and up to the date recommended by the manufacturer.

5. TESTS

5.1 **Sampling** — A representative sample shall be drawn from each batch of adhesives. Such samples shall, in each case, be tested separately, and not be bulked with other samples or otherwise averaged.

5.2 **Veneers for Test Pieces** — Veneers used in the preparation of test pieces shall comply with the requirements specified in Appendix B.

5.3 **Test Requirements** — The test requirements for each type of adhesive shall be as given in Table 1. The gap-filling group shall be tested with both gap joints and close-contact joints, but the close-contact group shall be tested with close-contact joints only.

5.3.1 Routine test for each type of adhesive shall be the dry test(s) and the wet test(s) at the temperature appropriate to its type. However, if so required by the purchaser, the adhesives of the BWP, BWR and WWR types shall also be required to satisfy the requirements of the cold water test.

5.3.2 When specifically required by the purchaser, adhesives of the BWP, BWR and WWR types shall satisfy the requirements of the mycological test as given under 5.6.

5.4 Dry Strength

5.4.1 *Gap Joints* — The average failing load of a set of six test pieces prepared by the method specified in Appendix C conditioned appropriately as specified in Appendix D, and when pulled by the method described in Appendix E shall be not less than 205 kg for all types.

5.4.2 *Close Contact Joints* — The average failing load of a set of six test pieces prepared by the method described in Appendix F, conditioned appropriately as specified under Appendix D and when pulled in accordance with Appendix E shall be not less than 275 kg for all types.

5.5 Resistance to Water

5.5.1 *Gap Joints* — The average failing load for a set of six test pieces prepared by the method specified in Appendix C, conditioned appropriately as specified in Appendix D and when pulled in accordance with Appendix E after treatment in the manner specified in Appendix G for the time and temperature given in Table 2 shall be not less than the corresponding value indicated therein.

TABLE 2 RESISTANCE TO WATER (GAP JOINTS)

(Clauses 5.5.1 and G-1.1)

TYPE	TEMPERATURE OF WATER IN WHICH TEST PIECES SHALL BE IMMERSSED	TIME OF IMMERSION	MEAN FAILING LOAD
(1)	(2)	(3)	(4)
	0°C	h	kg
BWP	100 (or at the boiling point of water)	6	100
BWR	do	3	90
WWR	20 ± 2	3	100
CWR	27 ± 2	16 to 24	180

5.5.2 *Close-Contact Joints* — The average failing load for a set of six test pieces prepared by the method specified in Appendix F, conditioned appropriately as specified in Appendix D, and when pulled by the method described in Appendix E, after treatment in accordance with Appendix G for the time and temperature given in Table 3 shall be not less than the corresponding values indicated therein.

TABLE 3 RESISTANCE TO WATER (CLOSE-CONTACT JOINTS)
(Clauses 5.5.2 and G-1.1)

TYPE	TEMPERATURE OF WATER IN WHICH TEST PIECES SHALL BE IMMERSSED	TIME OF IMMERSION	MEAN FAILING LOAD
(1)	(2)	(3)	(4)
	0°C	h	kg
BWP	100 (or at the boiling point of water)	6	150
BWR	100 (or at the boiling point of water)	3	115
WWR	70 ± 2	3	150
CWR	27 ± 2	16 to 24	200

5.6 Resistance to Micro-Organisms (Mycological Test)

5.6.1 Gap Joints — The average failing load for a set of six test pieces prepared by the method specified in Appendix C, conditioned appropriately as specified in Appendix D, and when pulled by the method described in Appendix E, after the treatment in accordance with Appendix H shall be not less than 180 kg for all types.

5.6.2 Close-Contact Joints — The average failing load for a set of six test pieces prepared by the method specified in Appendix F, conditioned appropriately as specified in Appendix D, and when pulled by the method described in Appendix E, after the treatment in accordance with Appendix H shall be not less than 200 kg for all types.

5.7 Re-Test — In the event of failure to comply with the requirements of any test(s), the batch of material concerned shall be re-tested in respect of such requirement(s). In the event of failure of re-test, the batch shall be rejected.

6. MARKING

6.1 Each container shall be legibly and indelibly marked with the following:

- a) Manufacturer's name or distinguishing mark,
- b) Description of material (see 3),
- c) Manufacturer's reference number,
- d) Batch number,

- e) Date of manufacture,
- f) The date beyond which the adhesive or adhesive components shall not be used when stored under conditions recommended by the manufacturer,
- g) Reference to the manufacturer's instructions for use, and
- h) The words ' to be stored in a cool dry place '.

6.1.1 The product may also be marked with Standard Mark.

6.1.2 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

A P P E N D I X A

(*Clause 0.3*)

INFORMATION TO BE FURNISHED BY THE MANUFACTURER REGARDING THE USE OF ADHESIVES

A-1. GUIDANCE REGARDING USE

A-1.1 The manufacturer shall furnish written instructions detailing the manner in which each resin or recommended combination of resin(s), hardner(s), filler fortifiers and extenders shall be used. The instructions shall give information in the manner indicated under **A-1.2** to **A-1.6**, where applicable.

A-1.2 Storage Life of Adhesive or Adhesive Components — The manufacturer shall specify the storage life of the adhesive components.

A-1.3 Preparation for Use — The preparation of resin, hardener, fortifier, filler and extender, method of mixing, recommended types of mixing, apparatus, and necessary precautions of any kind shall be stated.

A-1.4 Usable Life of Mixed Adhesive or Pot Life— The maximum time shall be stated during which the adhesive maintained at temperatures of 15, 20, 25, 30, 40 and 45°C would remain fit for use so as to comply with the requirements of the specification.

A-1.5 Methods of Use— Guidance on the following points shall be given:

- a) Range of moisture content of wood;
- b) Preparation of wood surfaces;
- c) Methods of application, such as single or double spread;
- d) Normal amounts of spread for single glue line;
- e) Maximum and minimum open and closed assembly times;
- f) Recommended range of pressures in N/m² (kg/cm²);
- g) Post-treatment of finished product; and
- h) Cleaning of containers and test.

A-1.6 Setting Times and Conditions— The recommended range of temperature to which the adhesive in any glue line may be subjected and also the minimum and maximum times for which pressure shall be maintained on unstressed joints at temperatures within the range shall be stated.

APPENDIX B

(Clauses 5.2 and F-1.1)

VENEERS FOR TEST PIECES

B-1. REQUIREMENTS

B-1.1 The Veneers shall be rotary-cut *canarium* spp. 3.00 ± 0.15 mm thick with the growth rings approximately parallel to the face.

B-1.2 Veneers shall be smooth-cut on both faces, straight grained and free from all defects, at least over the area that will form the middle 50 mm length of the test pieces, and may be slightly sanded. Elsewhere, the occurrence of slight defects, such as small uplifts, small live knots and short grain, may be disregarded. The moisture content of the veneers shall be 12.0 ± 2.5 percent for liquid adhesive and 12.0 ± 2.0 percent for film adhesive, as may be recommended by the manufacturer.

APPENDIX C

(Clauses 5.4.1, 5.5.1 and 5.6.1)

PREPARATION OF TEST PIECES FOR DETERMINATION OF FAILING LOAD (GAP JOINTS)

C-1. TEST SLIPS

C-1.1 Each test piece shall be made from two slips of *canarium* spp. veneer complying with the requirements of Appendix B, 150 mm long, 25.0 ± 0.3 mm wide and 3.00 ± 0.15 mm thick, joined together with the adhesive under test and assembled as described in C-3.

C-2. PREPARATION OF ADHESIVE

C-2.1 The adhesive shall be prepared and used in accordance with the instructions supplied by the manufacturer. Where the manufacturer's instructions permit separate application of the resin and hardener in joints, 1.0 mm thick, the test pieces shall be prepared by the separate application method.

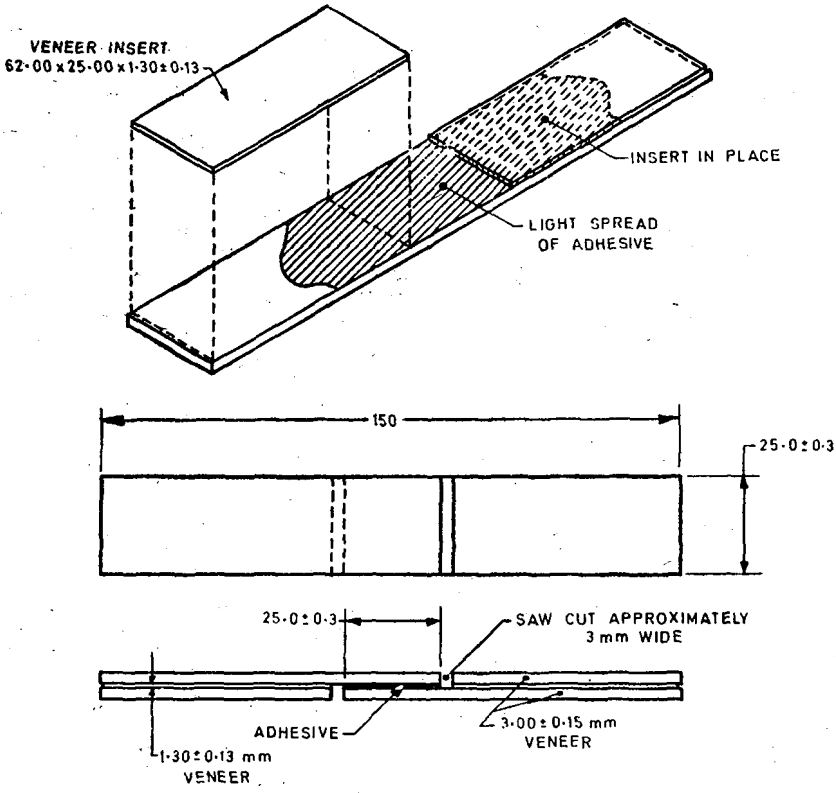
C-3. PREPARATION OF TEST PIECES

C-3.1 The test pieces shall be prepared under ordinary room conditions, except where otherwise directed by the manufacturer. One of the 150 mm slips forming a joint shall be coated with adhesive over the middle third of its length (see Fig. 1) and have inserts of $62.0 \times 25.0 \times 1.30 \pm 0.13$ mm thick, fitted as shown in Fig. 1. The resultant gap shall be filled with an excess of the adhesive. The second slip to make the complete joint shall be coated with adhesive over the middle third of its length and placed in position; excess of adhesive shall be squeezed out when the clamp is tightened.

C-3.1.1 Where separate application of resin and hardener is permitted by the manufacturer, the lower face of the top slip, and, if required, the lower face of the inserts, shall be coated with hardener, the resin being applied to the upper surfaces of the bottom slip and inserts, and to fill the gap.

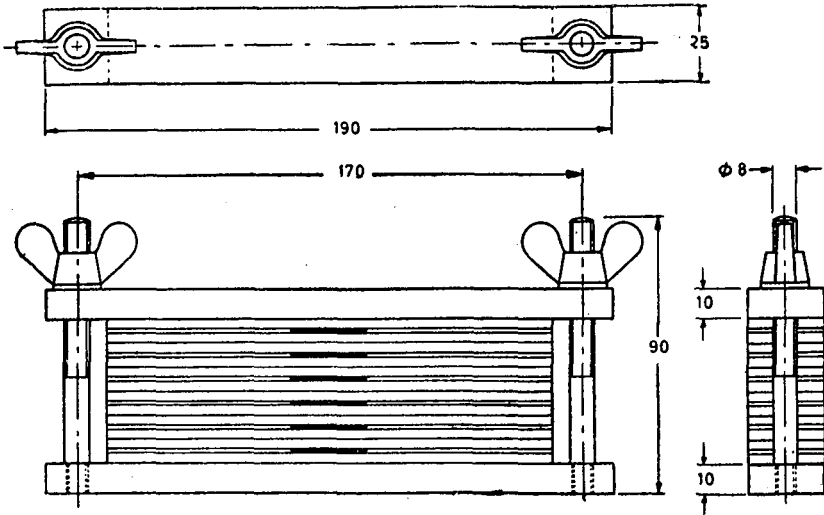
C-3.1.2 After assembly of the test pieces, they shall be placed immediately in a suitable clamp, a convenient form of which is shown in Fig. 2. The clamp shall be screwed down until ' finger tight '.

NOTE — The saw cuts shown in Fig. 1 shall be made after the test pieces have been conditioned (see Appendix D).



All dimensions in millimetres.

FIG. 1 GAP TEST PIECE SHOWING METHOD OF FITTING INSERTS



All dimensions in millimetres.

FIG. 2 CLAMPING DEVICE FOR SIX GAP TEST PIECES

APPENDIX D

(Clauses 5.4.1, 5.4.2, 5.5.1, 5.5.2, 5.6.1 and 5.6.2)

CONDITIONING OF TEST PIECES

D-1. COLD SETTING GLUES

D-1.1 As soon as possible after assembling the test pieces, while still in the clamps, shall be placed in an oven at the room temperature ($27 \pm 2^\circ\text{C}$) and shall remain there in the clamp for 16 to 24 hours. After release from the clamps, the test pieces shall be freely exposed to the air in the oven for a further period of 5 to 8 days or for such other period as specified by the manufacturer.

D-2. WARM SETTING GLUES

D-2.1 As soon as possible after assembling the test pieces, while still in the clamps, shall be placed in a container (*see Note*) which shall then be put into an oven running with $\pm 2^\circ\text{C}$ of a specified temperature where it shall remain for a stipulated period, the precise temperature and

time being in accordance with the instructions of the manufacturer. After treatment in the oven, and as soon as the container and the contents have cooled so that they can be handled conveniently, the test pieces shall be removed from the clamps and stored at room temperature ($27 \pm 2^\circ\text{C}$) for 16 to 26 hours prior to pulling.

NOTE — The purpose of the container is to prevent excessive loss of moisture from the test pieces during the treatment at high temperatures. It shall, therefore, be made of a reasonably impervious material and have a close-fitting lid. A small hole shall be provided for the changes in volume of the air during the heating and cooling.

D-2.2 The manufacturer may prescribe and use any other method of heating and conditioning the test piece, provided details of the process are made available to the user.

APPENDIX E

(*Clauses 5.4.1, 5.4.2, 5.5.1, 5.5.2, 5.6.1 and 5.6.2*)

PULLING TEST PIECES AND COMPUTING THE RESULTS

E-0. GENERAL

E-0.1 Due to the non-axial transmission of load through the prescribed test pieces and the consequent tendency to bend during pulling, the strength which the joints develop on test is influenced by the extent to which the bending is restrained. Testing machines vary widely in this respect, one extreme being represented by the shot loading type of machine, in which the upper grips are suspended through two articulated joints from a lever free to move longitudinally, while the other extreme is typified by the standard high-capacity testing machine with substantial wedge grips in a massive head in which the ends of the test pieces are maintained rigidly in line throughout the test.

E-0.2 At present there is insufficient knowledge about the influence of the various factors involved to enable them to be taken into account for purposes of specifications; nor can any of the existing testing machines be regarded as sufficiently near the ideal to serve as a standard. Pending the development of a standard method of test, control is limited to the rate at which the load is applied to the test piece, to the distance between the grips, and to the accuracy with which the load is measured. The rate of loading mentioned in Method 2 under **E-2.2** is designed to take into account the slip experienced with wedge grips, particularly when testing joints after soaking.

E-1. ACCURACY OF TESTING MACHINE

E-1.1 The test pieces shall be pulled in a testing machine capable of measuring the breaking load with an accuracy of ± 1 percent.

E-2. RATE OF LOADING

E-2.1 In testing machine provided with a means of controlling the rate of increase of load, the rate of increase of load shall be between 135 kg and 270 kg/min.

E-2.2 In testing machines, provided with a means of controlling the rate of separation of the straining heads, one of the following two methods shall be applicable:

Method 1

A device shall be provided, incorporating a pointer moving at constant speed over a scale graduated so as to indicate a rate of increase of load within the limits of **E-2.1**, with which the load indicator of the testing machine shall be caused to move in unison by appropriate manipulation of the rate of strain control. A scale having 45 divisions to the full circle (corresponding to the mean rate of loading of 202.5 kg/min) placed behind the second hand of a clock, would be a suitable device. The necessary limits of accuracy would be maintained by keeping the pointers in agreement within ± 33 percent.

Method 2

The straining rate shall be such that the time taken to pass from one quarter to the full specified minimum load shall be within the limits which would apply under **E-2.1** (for example, in the case of a specified minimum load of 90 kg, the time interval between $90/4 = 22.5$ kg load and 90 kg load, that is in increasing the load by 67.5 kg should be between $67.5/135$ and $67.5/270$ minutes, which is between 0.5 and 0.25 minutes).

E-3. DISTANCE BETWEEN THE GRIPS

E-3.1 The distance between the grips of the testing machine shall be between 65.0 and 70.0 mm in the case of gap joints and between 115 and 120 mm in the case of close-contact joints.

E-4. COMPUTATION OF RESULTS

E-4.1 The average failing load for each test shall be computed from the corresponding group of six test pieces.

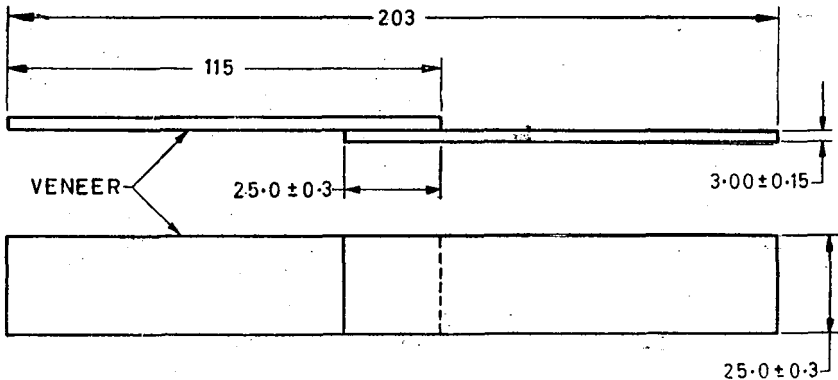
APPENDIX F

(Clauses 5.4.2, 5.5.2, 5.6.2 and B-1)

PREPARATION OF TEST PIECES FOR DETERMINATION OF FAILING LOAD (CLOSE-CONTACT JOINTS)

F-1. TEST SLIPS

F-1.1 Each test piece shall be made from two slips of *canarium* spp. veneer complying with the requirements given under B-1. It shall be 115 mm long, 25.0 ± 0.3 mm wide and 3.15 ± 0.15 mm thick, joined together with the adhesive under test so as to produce a 25.0 ± 0.3 mm overlap joint (see Fig. 3).



All dimensions in millimetres.

FIG. 3 CLOSE-CONTACT TEST PIECE

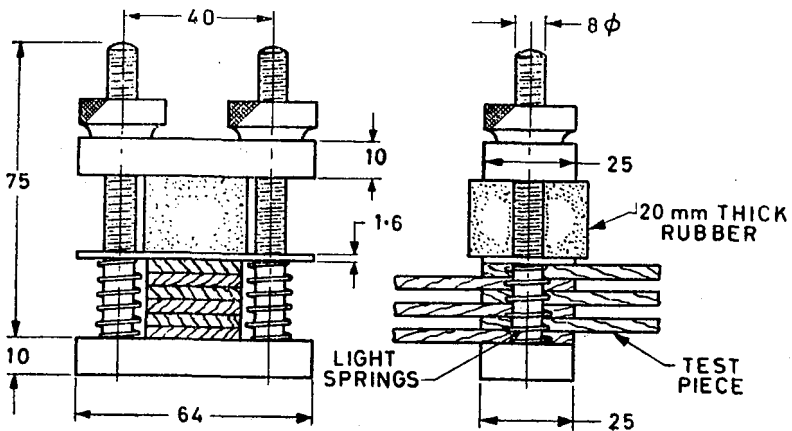
F-2. PREPARATION OF ADHESIVE

F-2.1 The adhesive shall be prepared and used in accordance with the instructions supplied by the manufacturer. Where these instructions permit both separate application of the resin and hardener and the use of mixed adhesive, the test pieces shall be prepared by the separate application method.

F-3. PREPARATION OF TEST PIECES

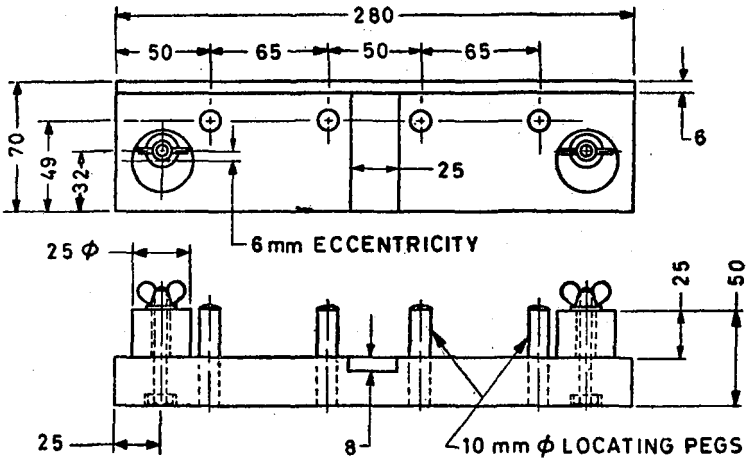
F-3.1 Test pieces shall be prepared under ordinary room conditions, except where otherwise directed by the manufacturer.

F-3.2 The adhesive shall be applied uniformly to one of the two faces forming a joint or as prescribed by the manufacturer. The joints shall be made between the smooth faces of the veneers. The slips forming a joint shall be placed 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, they shall be placed immediately in a suitable clamp, a convenient form of which is shown in Fig. 4. Sufficient pressure shall be applied to ensure good contact and generally about 50 kg is adequate. With the form of clamp shown in Fig. 4, this pressure may be obtained by screwing down until 'finger tight'. A convenient jig for locating the clamp and its contents is shown in Fig. 5.



All dimensions in millimetres.

FIG. 4 CLAMPING DEVICE FOR HOLDING SIX TEST PIECES



All dimensions in millimetres.

FIG. 5 WOODEN JIG FOR LOCATING TEST PIECES IN CLAMP

APPENDIX G

(Clauses 5.5.1 and 5.5.2)

WATER RESISTANCE TEST

G-1. TEST SAMPLES

G-1.1 The test pieces shall be completely immersed in water in accordance with the conditions of Tables 2 and 3, as may be required.

G-2. PROCEDURE

G-2.1 By the use of suitable racks to hold the test pieces, water shall have free access to all surfaces, and shall be at the temperature stipulated when the test pieces are initially immersed. After treatment at the higher temperatures; the test pieces shall be cooled immediately to approximately room temperature by immersing in cold water, in which they shall remain until mechanically tested, and the test shall be carried out within 24 hours of the initial cooling. Test pieces undergoing the cold water test shall be pulled immediately after removal from the water.

APPENDIX H
(Clauses 5.6.1 and 5.6.2)

MYCOLOGICAL TEST

H-1. TEST

H-1.1 Fill a rectangular dish of enamelled iron, glass or porcelain to a depth of about 25 mm with saw dust of non-durable timber like semul, previously moistened with a sufficient amount of an aqueous solution, containing 12 g of cane sugar per litre of water. The quantity of sugar solution added shall just be enough to moisten completely the saw dust and shall be not so much as can be squeezed out by hand pressure. To attain this condition with dry saw dust, it is usually necessary to add three times its weight of water. The saw dust shall be loosely pressed in the dish and the test specimens shall be so placed and pressed over the saw dust that the upper surfaces of the specimens are level with the surface of the saw dust.

H-1.2 The dish shall then be covered with a sheet of glass and the edges of the dish sealed against the glass with a strip of material, such as modelling clay or plasticine so that the atmosphere round the sample shall remain saturated. The dish and contents shall be maintained at $27 \pm 1^\circ\text{C}$ for three weeks, after which the samples shall be removed, washed in cold water and pulled immediately.

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 23230131, 23233375, 23239402 Fax: 91+011 23239399, 23239382

E-Mail : info@bis.org.in website : http://www.bis.org.in

Central Laboratory:

Plot No. 20/9, Site IV, Sahibabad Industrial Area, SAHIBABAD 201010

Telephone

277 0032

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 2323 7617

*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054 2337 8662

Northern : SCO 335-335, Sector 34-A, CHANDIGARH 160022 260 9285

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 2254 1984

†Western: Manakalaya, E9, MIDC, Behind Marol Telephone Exchange,
Andheri (East), MUMBAI 400093 2832 9295

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 560 1348

Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 839 4955

Commercial-cum-Office Complex, Opp. Dushera Maidan, Arera Colony,
Bittan Market, BHOPAL 462016 242 3452

62-63, Ganga Nagar, Unit VI, BHUBANESHWAR 751001 240 3139

5th Floor, Kovai Towers, 44 Bala Sundaram Road, COIMBATORE 641018 221 0141

SCO 21, Sector 12, Faridabad 121007 229 2175

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001 286 1498

53/5 Ward No. 29, R.G. Barua Road, 5th By-lane, Apurba Sinha Path,
GUWAHATI 781003 245 6508

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 2320 1084

Prithavi Raj Road, Opposite Bharat Overseas Bank, C-Scheme, JAIPUR 302001 222 3282

11/418 B, Sarvodaya Nagar, KANPUR 208005 223 3012

Sethi Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road,
LUCKNOW 226001 261 8923

H. No. 15, Sector-3, PARWANOO, Dist. Solan (H.P.) 173220 235 436

Plot No A-20-21, Institutional Area, Sector 62, Goutam Budh Nagar, NOIDA 201307 240 2206

Patliputra Industrial Estate, PATNA 800013 226 2808

Plot Nos. 657-660, Market Yard, Gultkdi, PUNE 411037 2427 4804

Sahajanand House 3rd Floor, Bhaktinagar Circle, 80 Feet Road,
RAJKOT 360002 237 8251

T.C. No. 2/275 (1 & 2), Near Food Corporation of India, Kesavadasapuram-Ulloor Road,
Kesavadasapuram, THIRUVANANTHAPURAM 695004 255 7914

1st Floor, Udyog Bhavan, VUDA, Siripuram Junction, VISHAKHAPATNAM-03 271 2833

*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, KOLKATA 700072 2355 3243

†Sales Office (WRO) Plot No. E-9, MIDC, Rd No. 8, Behind Telephone Exchange,
Andheri (East), Mumbai-400 0093 2832 9295