Synthetic resin adhesives for plywood — specification
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3. University of Nairobi (Department of Architecture and Building)
4. Wood Products (k) Ltd
5. PG Bison
6. J.K.U.A.T (Civil Engineering Department)
7. Ministry of Roads (Materials Testing Laboratory)
8. Kenya Bureau of Standards — Secretariat

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Synthetic resin adhesives for plywood — Specification

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Foreword

This Kenya Standard was prepared by the Plywood and Boards Technical Committee under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Adhesive form one of the most important raw materials use in the plywood industry and wood working 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. The raw materials for adhesive are not all found in this country; a large quantity of raw materials and synthetic resin adhesives is imported. In the context of this background of the industry, it has been found necessary to lay down performance excepted from the prepared glues. Such standards, it is believed, would guide further development of the adhesives industry on sound lines and lead towards the achievement of self sufficiency in regard to the country’s requirements.

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

Acknowledgement is hereby made for the assistance derived from these sources.
Synthetic resin adhesives for plywood — specification

1. Scope

This standard prescribes the requirements for phenolic and aminoplastic synthetic resin adhesives used in the plywood industry.

2. Terminology

For the purpose of this standard, definition given in KS 02-93: 1984* and the following and the 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 the application of the adhesive and assembly of 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 surface 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.

2.1.2.1.1 Gap filling adhesive

An adhesive either for use in those joints where the surface 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, reduce brittleness or a synthetic resin sometimes loosely and incorrectly use as interchangeable with “extender”.

2.1.5 Fortifier

A substance used primarily to increase the boil resistance and durability of hot area resins.

2.1.6 Hardener

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

*Glossary of terms used in timber
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 Self-life

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

2.1.9 Spread of adhesive

The area of surface covered by 1kg 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 now days to chemically modified natural resins. The properties of synthetic resins can vary widely depending upon their basic raw materials, propositions, and conditions for manufacture. All synthetic resins are classified broadly as thermosetting or thermoplastic.

2.1.10.1 A Phenolic synthetic resin

A phonenolic synthetic resin is derived form 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 or theses 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

Depending upon their degree of resistance, synthetic resin adhesives for plywood shall be of the four types as specified in Table 1. The characteristics of each type shall be as given in Table 1. For the guideline of users in selection the grade of resins adhesive satisfying the requirements for particular work, recommended use of each type is also indicated.

Table 1- Characteristics of different types of synthetic resin adhesives

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Type</th>
<th>glue shear strength in dry state (average)</th>
<th>Resistance to micro-organisms (fungi)</th>
<th>Resistance to moisture</th>
<th>time of immersion of test piece</th>
<th>average glue shear strength</th>
<th>Recommended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>BWP (Boiling Waterproof)</td>
<td>Kg 135 Kg 100</td>
<td>100°C H Kg</td>
<td></td>
<td></td>
<td></td>
<td>Adhesives of the type have been proved to make joints highly resistant to weather, micro-organisms, cold and boiling water steam and dry heat.</td>
</tr>
</tbody>
</table>

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4. Keeping qualities

The keeping qualities of adhesives shall be as follows:

(a) Liquid adhesives

The adhesives shall comply with the requirements specified under 6 after the resin and hardener have been stored in the original closed containers, according to the manufacturer's instruction up to the date recommended by the manufacturer.

(b) Film adhesives

The film shall comply with the requirements specified under 6 after it has been stored in accordance with the manufacturer's written instructions up to the date recommended by the manufacturer.

5. Instructions for use

5.1 The manufacturer shall furnish written instructions detailing the manner in which each resin or recommended combination of resin(s), hardener(s), filler, fortifier and extender shall be used. The instructions shall give information in the manner indicated under 5.2 to 5.6, where applicable.

5.2 Self-Life of adhesive or adhesive components

The manufacturer shall specify the shelf-life of the adhesive or adhesive components.

5.3 Preparation for use

The preparation of resin, hardener, fortifier, filler and extender, methods of mixing, recommended types of mixing, apparatus and necessary precautions for any kind shall be stated.

5.4 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 this standard.

5.5 Application

Guidance on the following points shall be given:

(a) Range of moisture content of wood, at the time of gluing:

* The 72 hours may be the aggregate of shorter periods, the test pieces being left in cold water between such period.
(b) Preparation of wood surfaces;
(c) Method(s) 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 kg/cm²;
(g) Post-treatment of finished products;
(h) Cleaning of containers; and
(i) Tests.

5.6 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 flat panels at temperatures within the range shall be stated.

6. Tests

6.1 Sampling

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

6.2 Preparation of test pieces

The test pieces shall be prepared according to the instructions given in Appendix A. Veneers used for the preparation of test pieces shall comply with the requirement specified in A-1.

6.3 Dry strength

The average failing load of a set of six test pieces, prepared in accordance with 6.2, when tested by the method given in KS(Under development) shall not be less than the values specified in Table 1.

6.4 Resistance to water

The resistance to water shall be such that a set of six pieces prepared in accordance with 6.2, when tested in accordance with Appendix B shall show average glue shear strength not less that the values specified in Table 1.

6.5 Resistance to micro-organism

The resistance of adhesive to micro-organism shall be such that a six test pieces when tested in accordance with KS (Under development) after treatment in accordance.

6.6 Acidity and alkalinity (pH)

The pH of the adhesive when set shall be not less than 2.0. The pH shall be determined by the method described in Appendix C.

⁴ Methods of test of plywood part –Determination of glue shear strength.
⁵ Methods of test of plywood part- Mycological test
7 Retest

In the event of failure to comply with any of the requirements specified under 6.3 to 6.6 the batch of materials concerned shall be retested in respect of such requirements. In the event of failure of retest, the batch shall be rejected.

8 Marking

Each container shall be legible and indelibly marked with the following:

(a) Manufacturer’s name or distinguishing mark
(b) Description of material,
(c) Manufacturer’s reference number,
(d) Batch number,
(e) Date of manufacturer,
(f) The date beyond which the adhesive or adhesive components shall not be use 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”.

Appendix A

Methods of preparation of test pieces

A 1 Veneers for test pieces

A 1.1 Veneers shall be rotary cut canarium spp. 1.6 mm thick with the growth rings approximately parallel to the face.

A 1.2 The 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 lightly sanded. Elsewhere the occurrence of slight defects, such as small uplifts, small leaf knots and short grain may be disregarded. The moisture content of the veneers shall be 12.0 \( \pm \) 2.5 percent for liquid adhesive and 12.0 \( \pm \) 2.0 percent for film adhesive, as may be recommended by the manufacturer.

A 2 Preparation of adhesive

The adhesive shall be prepared and used according to the instructions supplied by the manufacturer.

A 3 Construction of test boards

The test board shall be constructed by bonding together three veneers of canarium spp. As specified in A 1. The size of the board shall be such that all the test pieces required for testing can be taken out of the same board leaving a margin of 25 mm on all the four edges. The grain of the core veneer shall be at right angles to that of the two face veneers. The prepared adhesive face veneers, or as directed by the manufacturer, but care shall be taken in all cases to ensure that the adhesive is uniformly spread and the surfaces are completely coated. The veneers shall then be assembled and loaded in a flat platen press within the time specified in the manufacturer’s instructions. The pressing conditions shall be as recommended by the
manufacturer. Film glues shall be employed by simple inter-leaving and in accordance with the manufacturer's instructions.

A 4 Conditions of test boards

A 4.1 Immediately after removal from the press, the boards shall be given a special treatment (such as dipping in water) stipulated by the manufacturer. The boards shall then be exposed at prevailing laboratory atmospheric conditions in a manner to ensure a free circulation of air around them for six to nine days, or for such time as the manufacturer may direct, except in the case of test boards to be employed in the mycological test where the conditioning period shall, in no case, be less than six days.

A 5 Preparation of test pieces

After conditioning of the test boards, six test pieces as shown in Fig 1 shall be prepared for each of the tests required, case being taken that the depth of the saw-cut does not impinge upon the third ply. The length of the test pieces shall be along the directions of the grain of the outer plies.

Appendix B

Water resistance test

B 1 Test pieces

Six pieces shall be prepared by the method ad described in Appendix A.

B 2 Procedure

B 2.1 The test pieces shall be completely immersed in water at the temperature and for the time appropriate to the type (see Table 1) in such a manner that water shall have free access to all the surfaces. While testing WWR and CWR adhesives, care shall be taken to ensure that water circulates freely around them. At the conclusion of the specified time, the test pieces shall be quickly transferred from the boiling water and submerged in cold water. The pieces shall then be plunged into water at 27±2°C and cooled.

B 2.2 The test pieces, while still wet shall be subjected to shear strength test ad described in KS(Under development)*.

Appendix C

Determination of pH valve (hydrogen ion concentration) of liquid or powdered resin adhesives

C 1 Detail

C 1.1 At least 100 g of the adhesives shall be prepared according to the manufacturer's instructions. If water is to be used in the mixing, only distilled water shall be used. The mixture shall be stirred thoroughly. After stirring, about 20 ml of the mixed adhesive shall be spread in a thin, even coat of 0.5 mm on a sheet of clean glass to cover an area approximately 15 x 25 cm. The adhesive shall be cured at the temperature and for the length of time recommended for gluing by the manufacturer, after which the cured film shall be peeled from the glass and ground in a clean mill or mortar to a fineness so as to pass KS sieve 40. Immediately, after grinding, 2.0 g of the ground particles, accurately weighed, shall be placed in a clean vial or small heat-resisting glass flask and 10 ml of freshly boiled, cooled distilled water shall be added and thoroughly stirred. The glass container shall be kept stoppered at all times except when pH value determinations are being made. The mixture shall be allowed to stand for 72 h at room temperatures after which time the mixture shall be stirred and the pH value determined by means of a suitable pH meter. The determination of pH value shall be repeated at intervals of 24 h until the difference between the consecutive readings is not more than 0.05 pH unites. The last reading taken shall be regarded as the equilibrium film pH value for the

This standard covers requirements for materials, manufacture and performance of marine plywood suitable for the construction, repair and maintenance of marine and river craft, pontoons and the like the adhesive..

* Methods of test of plywood part – Determination of glue shear strength.