

BRITISH STANDARD 1088 & 4079 : 1966

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**SPECIFICATIONS FOR
PLYWOOD
FOR MARINE CRAFT**

SPECIFICATIONS FOR PLYWOOD FOR MARINE CRAFT

B.S. 1088 : 1966

Marine plywood manufactured from
selected tropical hardwoods

B.S. 4079 : 1966

Plywood made for marine use and
treated against attack by fungi, insects
and marine borers

Incorporating amendments issued April, 1967 (PD 6127), July, 1974
(AMD 1500) and April, 1980 (AMD 3153)

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THIS BRITISH STANDARD, having been approved by the Timber Industry Standards Committee and endorsed by the Chairman of the Building Divisional Council, was published under the authority of the General Council on 30th November, 1966.

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue. The BSI Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

B.S. 544. Linseed oil putty for use in wooden frames.

B.S. 565. Glossary of terms relating to timber and woodwork.

B.S. 881, 589. Nomenclature of commercial timbers, including sources of supply.

B.S. 1203. Synthetic resin adhesives (phenolic and aminoplastic) for plywood.

B.S. 3842. Treatment of plywood with preservatives.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:

Committee reference T1B/7, T1B/7/1 Draft for comment D64/10610.

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 Plastics Federation
*British Woodwork Manufacturers' Association
Fibre Building Board Development Organization Limited
Forestry Commission
Hardwood Flooring Manufacturers' Association
Institute of Wood Science
Institution of Civil Engineers
*Institution of Municipal Engineers
*Institution of Structural Engineers

*Ministry of Public Building and Works
*Ministry of Technology—Forest Products Research Laboratory
National Federation of Building Trades Employers
National Sawmilling Association
*Royal Institute of British Architects
Softwood Agents & Brokers Association
The Royal Institution of Chartered Surveyors
*Timber Research & Development Association
*Timber Trade Federation of the United Kingdom

The Government departments 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:

Association of British Plywood & Veneer Manufacturers
British Furniture Manufacturers' Federated Associations
British Railways Board
British Wood Preserving Association
Council for Codes of Practice for Buildings
Incorporated Association of Architects & Surveyors

Institution of Electrical Engineers
Lloyd's Register of Shipping
Ministry of Aviation
Ministry of Defence, Air Force Department
Ministry of Defence, Army Department
Ministry of Defence, Navy Department
Ship and Boat Builders' National Federation
Shipbuilding Employers' Federation
Individual Testing Laboratory

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BRITISH STANDARD SPECIFICATIONS FOR PLYWOOD FOR MARINE CRAFT

FOREWORD

These British Standards set out the technical requirements for plywoods for use in the construction of such marine craft as rowing and sailing dinghies, motor and sailing cabin cruisers, and some kinds of ships used by the Service Departments. The craft may be used in fresh and salt water all over the world.

To meet this wide range of applications and conditions with economy as well as efficacy, two specifications are needed, the first (B.S. 1088) limiting itself to plywood made of veneers in the natural state cut only from such species of timber as possess at least a prescribed level of resistance to fungal attack. Long experience has shown that such material is adequate for many applications in boat construction.

Where the risk of attack by fungi or marine borers is more severe than the untreated timber used will withstand, treatment of the plywood with preservatives is recommended. Requirements are set out in B.S. 4079, which gives a range of preservatives and retentions appropriate to the degree of severity of the hazard, so that the product shall be economic as well as effective for its purpose.

The presence of preservative on the surface of the plywood after manufacture may interfere with subsequent gluing operations and users should seek the advice of the adhesives manufacturer. In a like manner not all treated surfaces can be painted satisfactorily and the user should seek advice on the finishes that will be suitable.

Both specifications have in common the same stringent requirement for the quality of veneer used in faces and core, and high standards of workmanship are stipulated in the layup and manufacture of the plywood. Only WBP adhesive is permitted between the plies. This is known to be durable under full exposure to weather and water for many years, and the testing provisions of B.S. 1088, are sufficiently searching to ensure that the bonding is adequate.

No data on the actual strength characteristics of plywood are given in these specifications, and indeed the range of species that can be used and the many combinations of veneer thicknesses employed by manufacturers makes such a compilation impracticable. Appendix F however gives references to publications that will enable such calculation to be made, and the high quality of the veneers used in these specifications will ensure that the maximum strength of the timber will be available to the composite product.

Considerable use is made of B.S. 3842 'Treatment of plywood with preservatives' in B.S. 4079, and marks to denote the treatment given are common to both documents. B.S. 3842 provides for a range of hazards wider than is acceptable in B.S. 4079, which limits the treatments to those effective against severe attack by fungi, insects, and marine borers.

Some of the tests for the compliance of the plywood with the bonding requirement or the retention of the preservative are lengthy to make, and under steady production routine necessary only as periodic checks. The Warranty therefore (See Clause 16, B.S. 1088, below) does not necessarily mean that the manufacturer has carried out all the tests required on every batch, but in cases of doubt, the various appendices to B.S. 1088, B.S. 4079 and B.S. 3842 enable the purchaser or an arbitrator to test the validity of the warranty.

NOTE. In this standard metric units have been used with approximate British equivalents in brackets; more accurate conversions should be based on the tables in B.S.350, 'Conversion factors and tables'. The metric units are to be regarded as the standard

B.S. 1088 : 1966

BRITISH STANDARD SPECIFICATION FOR MARINE PLYWOOD MANUFACTURED FROM SELECTED TROPICAL HARDWOODS

SPECIFICATION

SCOPE

*As amended
July, 1974*

This British Standard applies to plywood with a bond of WPB quality between the plies and made either wholly from untreated tropical hardwood veneers or from untreated face veneers combined with core veneers, some or all of which may be treated, and all the veneers, treated or untreated, having a suitable prescribed level of resistance to fungal attack*.

DEFINITIONS

2. For the purposes of this British Standard the definitions in B.S. 565† apply with the following modifications:

Bonding. The uniting of two pieces of wood or other material by means of an adhesive. The properties that can be imparted to a joint by the adhesive employed are indicated by a group of letters, WBP, BR, MR or INT.

Bonding WBP. Bonding meeting the test requirements of this British Standard and using an adhesive of the type‡ which by systematic tests and by records in service of the product over many years has been proved highly resistant to weather, micro-organisms, cold and boiling water, steam and dry heat.

Discoloration. Areas, occurring in either streaks or patches, of colour different from that of the surrounding wood and differing from that normally associated with the species.

SPECIES OF TIMBER

3. All tropical hardwoods used in the construction of the plywood shall meet the following requirements:

*As added
July, 1974*

a. Only those species, the *heartwood* of which is classed as Moderately Durable, Durable or Very Durable§, shall be used, and from these heart that is brittle, soft, or containing dote, shall be entirely excluded. Core veneers only may be made from timber of lower durability than that specified in Clause 3, provided that such veneers are treated with preservatives in accordance with B.S. 4079.

* The heating process used in plywood manufacture will destroy any fungi, beetles with their eggs and larvae and forest or marine borers that might have been present in the log, and therefore plywood as manufactured is a sterilized material. Further damage can only result from an entirely new infestation as the result of subsequent influences.

† B.S. 565, 'Glossary of terms relating to timber and woodwork'.

‡ At present only certain phenolic adhesives have been shown to meet these requirements.

§ A classification putting timbers into five groups for natural durability in the presence of wood destroying fungi is given in 'A Handbook of Hardwoods' prepared by F.P.R.L. and available from H.M.S.O. See Appendix E.

b. Although the most desirable veneer would consist of heartwood only, the total exclusion of sapwood is economically unpractical and therefore, provided it is clean and sound, its presence in small proportions** shall not be deemed a defect unless the purchaser specifically requires its exclusion.

c. If so specified by the purchaser, Gaboon or Okou (Aucoumea klaineana), which is classed as Non-durable may be used provided that the name of the timber included in the mark specified in Clause 15.

Properties of some timbers commonly used in manufacture of marine plywood are given in Appendix A. It is emphasized that the list is not exhaustive.

QUALITY OF VENEERS

4. a. **Manufacture.** Veneers may be rotary cut or sliced. The method of cutting is at the option of the manufacturer unless it is specified by the purchaser at the time of ordering. Veneers shall be smoothly cut.

b. **Quality requirements.** Face veneers shall present a solid surface, free from open defects. They shall be free from knots other than sound pin knots, of which there shall be not more than 6 in any area 30 cm square (1 ft square) and not more than an average of 2 per 30 cm square (1 ft square) over the whole area of the board. The veneer shall be reasonably free from irregular grain, due to being taken of the characteristics of the species being used. Isolated†† pin-holes not along the plane of the veneer, and occasional closed splits are permissible. Veneers showing compression failure shall be excluded. Occasional minor discoloration is permissible, provided this is free from dots. There shall be not more than one edge joint in any 30 cm (1 ft) width of the board, unless otherwise agreed between purchaser and supplier, and the veneers shall, when jointed, be matched for colour. There shall be no end joints.

The requirements for core veneers are the same as those for face veneers with the following exceptions: small splits are permitted, provided that the plywood complies with the requirements of Clause 8. There is no limitation on the number of pin knots or edge joints. The number of pinholes may be greater than in the case of face veneers.

¶ In the durability scale, the sapwood of all timbers is Non-durable or Perishable.

** For guidance 'small proportions' is considered to be about 1% of the area of each ply in the size of the board manufactured. As it is economically unpractical to measure the area of the sapwood the proportion may be assessed by visual inspection.

†† Fig. 9 gives guidance as to the interpretation of the term 'isolated'. Not more than one cluster as shown in the plate should occur on one face.

‡‡ Fig. 10 gives guidance as to the frequency of pinholes in core veneers.

and a few may run in the plane of the veneers. Discoloration is permissible, provided this is free from dote. Veneers need not be matched for colour. There shall be no end joints.

c. Inspection. It shall be at the purchasers' option to inspect the veneers before the plywood is assembled, or to accept the manufacturer's warranty as to the quality of the veneer. (See Clause 16, below.)

EDGE JOINTS IN VENEERS

5. Edge joints shall be glued with an adhesive complying with the requirements of type WBP, BR or MR of B.S. 1203*. Where the exigencies of manufacture demand, it is permitted to use non-ferrous metal clips or staples to hold the core veneers together. One such clipped joint shall be allowed in veneers up to and including 244 cm (96 in) wide (measured across the grain) and two if the width exceeds 244 cm (96 in).

NUMBER OF PLIES

6. Multi-ply construction may be used in any thickness; three-ply construction shall not be used in assemblies exceeding 8 mm (0.315 in) thick when bonded but before sanding.

LAY-UP OF PLIES BEFORE PRESSING

7. *a.* The direction of the grain in adjacent plies shall be at right angles except in the case of boards comprising an even number of plies, when the grain of the centre pair shall follow the same direction.

The substitution of one ply by two plies of equal total thickness and with the grain parallel to each other is permissible provided that they are balanced by a similar pair of plies about the central plane of the board.

The veneers forming any one ply and the corresponding ply on the opposite side of the central plane of the board shall be of the same thickness and species or of species known to be similar to one another in physical characteristics, and shall be cut by the same method, i.e., either all rotary-cut or all sliced.

The tight side of face veneers should be turned outwards.

Tapes shall not be used internally. When used for repairing splits in face veneers they shall be removed subsequently.

The thickness of the dry veneers shall comply with the requirements of Subclause *b* or *c* as appropriate, and shall be related to the specified thickness as marked on the board. (See Subclause 15a (4).)

b. Three-ply construction. Each face veneer shall be not thinner than $\frac{1}{3}$ and not thicker than $\frac{2}{3}$ of the total thickness of veneers assembled dry.

c. Multi-ply construction. The combined thickness of the two face veneers and those of the core that run parallel with the faces shall be not less than $\frac{2}{3}$ and not more than $\frac{4}{3}$ of the total thickness of veneers assembled dry. In addition, for boards not less than 4.8 mm (0.19 in) thick, each face veneer shall be not thinner than 1.3 mm (0.05 in) and not thicker than 3.8 mm (0.15 in) and each core veneer shall be not thicker than 4.8 mm (0.19 in).

d. The foregoing ensures that the plywood has the balanced construction essential to most applications. For some particular purposes, however, plywood with an out-of-balance lay-up is advantageous, and such material may be supplied as complying with B.S. 1088 provided that:

(i) it complies in all other respects with the requirements of this standard.

* B.S. 1203. 'Synthetic resin adhesives (phenolic and aminoplastic) for plywood'.

(ii) the word UNBALANCED is added to the marking required by Clause 15c, i.e. 'B.S. 1088 WBP UNBALANCED'.

BONDING

8. Bonding between the veneers shall be Bonding WBP, continuous over the entire area of the board and shall meet the requirements of Clause 11.

MANUFACTURING DEFECTS IN PLYWOOD

9. Manufacturing defects shall be subject to the limitations given in Table 1.

TABLE 1. LIMITS OF MANUFACTURING DEFECTS IN PLYWOOD

Type of defect	Limitation
a. Defective bonding	Not permitted
b. Pleats and overlaps	Not permitted
c. Gaps	(i) <i>In faces.</i> Not permitted. Occasional gaps that occur during manufacture may be repaired by means of well-fitted veneer inserts bonded with an adhesive complying with the requirements of Type WBP of B.S. 1203*. (ii) <i>In cores†</i> In any edge of a board, not more than one gap, which shall be not wider than 0.5 mm (0.02 in)

SCARF JOINTS IN BOARDS

10. When sizes larger than available press sizes are required, scarf joints through the thickness of the board shall be permitted by agreement with the purchaser.

All scarf joints shall be made with an inclination not steeper than 1 in 8 and shall be bonded with an adhesive complying with the requirements of Type WBP of B.S. 1203*.

TESTING THE QUALITY OF THE ADHESION IN THE PLYWOOD

11. When the adhesion in the plywood is tested in accordance with Appendices A, B and C the results of the tests shall be as follows:

a. The wet test in hot water or steam (Appendix B1). No glue line shall have a bond quality less than two, and the average value for all those tested shall be not less than five.

b. The wet test in water at 15°C (Appendix B2). No glue line shall have a bond quality less than two, and the average value for all those tested shall be not less than five.

† The presence of defects in cores can be judged only from the appearance of the edges of the boards. The purchaser, however, has the right under Clause 16 to examine the cores for compliance with this standard before the boards are pressed.

As added
April, 1980