

23 / 3 / 1962

M University of TASMANIA K/77

301 Sandy Bay

Please Receive from INDUSTRIAL SUPPLY CO.
ENGINEERING 94 CAMERON STREET, LAUNCESTON
TASMANIA 5247 P.O. Box 126

in good order and condition:

Q/W = 8513

1 qty 1/8 Blank Ball Nosed
Slot Drill.

1 " 3/16 " " " "

Despatch Per Post.

These are for forming slot
edges in holes at end of
desiccated wood insulators

Subsidiary Companies and Divisions

W. J. MANUFACTURING DIVISION
DENSIFIED WOODS PTY. LTD.
T. K. STEANES & SON PTY. LTD.
W. J. CHEMICALS PTY. LTD.
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W. J. MANUFACTURING CO. LIMITED

418 MILITARY ROAD, MOSMAN, N.S.W.

Phones: XY 1225 (8 lines)

Telegrams & Cables:
"NOVASTEEN" SYDNEY

Address all mail to:
BOX 59, P.O., SPIT JUNCTION

*H. M. Bamford & Sons Ltd
228. Murray St
Hebert*

CART NOTE

N^o D 6466

DATE *16/4/62*

YOUR ORDER No. *HX. 1413* SALES TAX No. *T 1662* OUR FACTORY ORDER No. *8095*

QUANTITY	RECEIVED IN GOOD ORDER AND CONDITION THE FOLLOWING GOODS:—						
<i>6 Sheets. Woolsteen (25) 18' 36" x 8"</i>							
<i>S/H</i>							

CLAIMS FOR ERRORS AND DISCREPANCIES WILL NOT BE RECOGNISED AFTER 7 DAYS.

DELIVERY ADVICE

TELEPHONE: 33781

H. M. BAMFORD & SONS PTY. LTD.

228 MURRAY STREET, HOBART

212 YORK STREET, LAUNCESTON

	No.
--	-----

Dr. G. Heber
C.S.I.R.O

Stowell Ave

HOBART, *27-4* 19*62*

NET CASH 30 DAYS
PLUS EXCHANGE TO
BOX 426E, HOBART.

Your Order

Sales Tax

ADVICE **H** No. 1549 Despatched Per *Yours* To

MERCURY 61/2803

6 sheets 3' x 18" x 3/8" Woodstock
Grade 40 Type 2.

P Taylor

E. & O.E.

ALL CLAIMS OR OBJECTIONS WITHIN 7 DAYS.

5/2/62

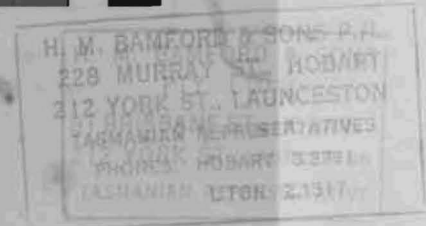
Ordered one circular saw blade from
R. L. Milligan & Son. for cutting $\frac{3}{8}$ "
sheets bakelite, To be 18" O.D., $\frac{3}{4}$ "
hole, $\frac{1}{4}$ " x $\frac{1}{8}$ " keyway. Fine teeth.
arrived on 22/2/62

Ordered from Homecrafters picked up 12/3/62
2000 $\frac{3}{16}$ " solder lugs
1000 $\frac{1}{8}$ " " "

Ordered from Bamford & Co arrived on 22/2/62
100 7" x 2" x $\frac{1}{8}$ " insulite about 1 sticking each

(Ordered from Bamford & Co on 12/3/62
6 sheets Woodstar $\frac{3}{8}$ " x 18" x 36" type 2.)

PERMALI



ELECTRICAL and PHYSICAL PROPERTIES and MECHANICAL CHARACTERISTICS

The details which follow apply to grade "E" "Permal," which is recommended for general electrical and mechanical uses. Other grades are made, with variations in the type of wood and resin used, but in all cases this is done for special applications, most of which relate to emphasising the mechanical characteristics at the expense of the dielectric properties.

A number of different types of "Permal" are available depending upon variations in the grain disposition of the laminations, thus enabling maximum strength to be developed directionally as required. Varying thicknesses of laminae are also used to suit the particular type of wood employed and to ensure economy in production. In general the thicker the finished sheet the thicker the individual laminae. The variations in type do not affect the general physical or electrical properties.

GENERAL APPEARANCE

"Permal" is an extremely homogeneous densified laminated wood. It is available in the form of flat or curved sheets, rods, or machined parts.

The natural surface of finished sheets has a high polish, but various coloured finishes or a matt non-reflecting surface are also available.

MACHINABILITY

"Permal" may be sawn, planed, turned, drilled, tapped and screwed. These operations may be carried out on standard machine tools, but the best results are obtained on specially adapted high-speed wood-working machines using abrasion resisting cutting tools. The sharp edges of all machined components and panels should be radiussed. Overleaf, are given details of various varnish finishes, which are recommended for the protection of goods during transit and storage. All parts exposed to continuous weathering should be completely varnished.

Sole Manufacturers in Australia under licence from PERMALI LTD., Gloucester, England:—

DENSIFIED WOODS PTY. LTD.

283 MILITARY ROAD, CREMORNE, SYDNEY -- XY5220-1

NOMENCLATURE

In order to assist the user in specifying the exact type of "Permal" and the finish required, we invite the co-operation of Drawing Office and Design Staffs in making use of the following nomenclature. In case of doubt it is of great assistance to our own design staff if customers will submit drawings showing the direction and magnitude of the electrical and mechanical stresses.

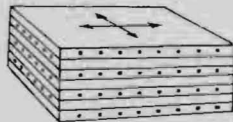
1. The first symbol is the Grade Letter.
2. The second symbol denotes the kind of wood used :—
Beech (H) is recommended for all general electrical and mechanical applications.
3. The third symbol (the Type) indicates the arrangement of grain disposition in the various laminae forming a sheet (see below.)

FOR GENERAL APPLICATIONS

TYPE 5
For tensile, bending and torsional stresses. All grain in direction of axis of load.

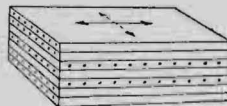


TYPE 6
For rigidity, resistance to compression, and panels of all sizes. Equal proportion of grain parallel to each axis.

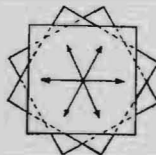


FOR SPECIAL APPLICATIONS

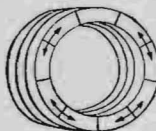
TYPE 2
For tensile applications where pull is taken by bolt holes near ends. 25% grain at right angles to axis.



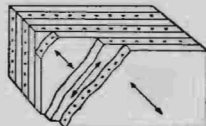
TYPE 3
For silent gears. Grain disposition approximately equal in all radial directions.



TYPE 7
For large diameter rings, rims of wheels and pulleys. All grain substantially tangential to the rim.



TYPE 8
For special E.H.T. applications. As type 6 but grain structure at 45° to axis.



4. The fourth symbol denotes the thickness of laminae employed :—

- 3 = 1/64" thick
- 5 = 1/32" thick
- 7 = 1/16" thick

In general the thickness of laminae increases as the thickness of the sheet. 1/32" thick laminae are used to form sheets up to approximately 1/2" thick. 1/16" thick from 5/8" upwards.

5. The fifth symbol shows the surface finish required.

- P = Platen finish material ex-press.
- M = Machine finished material.

Platen finish material is subject to variations in thickness of the order of ± 0.031 in. Where greater accuracy of thickness is required, or in the case of components required to be machined on all faces, "M" should be specified.

6. The final symbol denotes the type of finishing agent to be employed in accordance with the following table.

Figure	Type of finish and Service
-	Unvarnished.
0	Edges only varnished, for stock panels and strips. (Insulation mounted in air should be finally varnished all over.)
1	Oil dipped finish for screw threads and all standard studs and nuts.
2	Special hot oil finish.
3	Air drying oil base synthetic resin varnish for — (i) Components to a dimensional tolerance closer than .004". (ii) Large screw threads. (iii) White filled engraved components.
4	Standard air drying oil base tropical quality synthetic resin varnish for all electrical insulating components, for use oil-immersed or in air, and for all outdoor service with exceptions as listed under No. 3. (above).
5	Stoving natural resin oil base varnish for bakelised paper tubes and E.H.T. bushings.
6a	Black bakelised paper surface or special panels. Maximum size 40" x 20".
7	Black pigment varnish for special applications.
8	Light brown pigment varnish undercoat for E.H.T. bushings.
9	Dark brown pigment varnish undercoat for E.H.T. bushings.

EXAMPLE OF SPECIFICATION

EH65/P4. Standard electrical purpose, Beech base, cross grain sheet, 1/32" thick laminations. Platen finish (thickness plus or minus 1/32"), coated standard varnish.

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DENSIFIED WOODS PTY. LTD.

283 MILITARY ROAD, CREMORNE, SYDNEY — XY5220-1

MECHANICAL CHARACTERISTICS

Of different types of "Permal" with details of sizes available

The ultimate mechanical strength figures for "Permal" types 5 and 6 quoted overleaf, represent the minimum performance obtained with the established forms of test specimen. They are based on the results of continuous testing of all materials produced by the Company, backed in many cases by the test results of independent bodies. It should, however, be remembered that ordinary industrial applications rarely allow the material to develop this strength, because methods of fixing through which stress is applied are never ideal. Our Engineering Design Department will be glad to advise on the strength of particular assemblies or methods of fixing.

FOR STANDARD TYPES SEE PAGES B4 AND B5 

SPECIAL TYPES

Details are given below of the general characteristics, main applications and size limitations of the various types of "Permal" which have been developed for special purposes.

TYPE 2



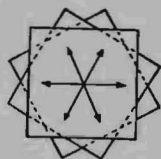
In this material approximately 25% of the grain structure lies at right angles to the direction of mechanical stress.

The mechanical properties are generally as for Type 5, but the introduction of the cross laminations gives greatly improved resistance to splitting. It is specially suited for the manufacture of tensile links where the end fixings are in the form of bolts or rivets, located close to the ends of the component.

Thickness : Type 25—from $\frac{3}{8}$ " to 1".
Type 27—from $\frac{1}{2}$ " to 4".

Sizes : Normally offered in machined (M) finish only and in lengths of under 36" (maximum 72" x 15" wide).

TYPE 3



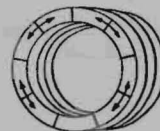
This material has each successive lamination angularly disposed in relation to the last and has been specially developed for silent gears.

Thickness : Type 33—from $\frac{1}{8}$ " to $\frac{3}{8}$ ".
Type 35—over $\frac{3}{8}$ " to 1".
Type 37—over 1" to 4".

Sizes : Maximum diameter 48".

N.B. Face widths greater than 4" are usually obtained by bolting and cementing together discs of a suitable thickness.

TYPE 7

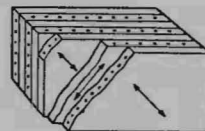


This designation is employed for large diameter rings, rims of wheels and pulleys etc. It is formed from laminae cut in segments whose grain is parallel to the tangent. The joints in the layers of laminae are staggered. Supplied only in machined (M) finish. The mechanical properties are similar to Type 5 where applicable.

Thickness : Type 77 (only)— $\frac{3}{4}$ " to 4".

Sizes : Minimum inside diameter 12".
Maximum outside diameter 60".
Minimum radial wall $1\frac{1}{2}$ ".

TYPE 8



The construction of this material is exactly the same as Type 6, except that the grain direction of the alternate laminae, at right angles to one another, is inclined at 45° to the axis of the component.

Its use is restricted to parts under very high voltage stress. Its mechanical characteristics, which combine those of Types 5 and 6 from the point of view of axial loads, can be interpolated from those given for these types.

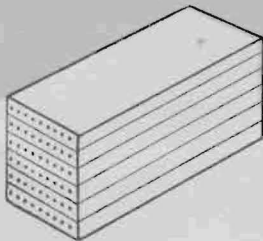
Thickness : Type 85—from $\frac{1}{2}$ " to 1".
Type 87—over 1" to 4".

Sizes : The sum of the length and width cannot easily exceed 30"

PERMAL

IS YOUR ANSWER WHERE HIGH INSULATION
WITH ADDED STRENGTH IS REQUIRED

**MECHANICAL
CHARACTERISTICS
OF
PERMALI
TYPE
5**



This is material with the grain of all the laminae running in the same direction. It is suitable for parts subject to tensile stresses or to bending, and is also highly resistant to torsion and to impact forces. It is easily machined and can readily be threaded or tapped.

Thickness

Type 55—from $\frac{1}{4}$ " to 1".




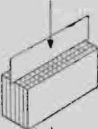


Type 57—from $\frac{1}{2}$ " to 4".

Sizes

Maximum length 14'.

Maximum width 10'.

See notes on sizes page B8.

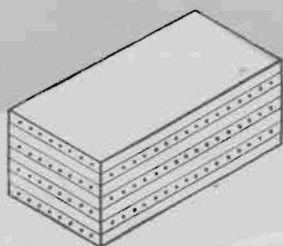
TENSILE STRENGTH	Guaranteed minima:— 28,000 p.s.i.
IMPACT STRENGTH—Izod Type Test (Unnotched Specimen, $\frac{1}{2}$ " x $\frac{1}{2}$ ")  Perpendicular to Laminae  Parallel to Laminae	5.5 ft. lb. (44 ft. lb./ sq. in.) 4.5 ft. lb. (36 ft. lb./ sq. in.)
STATIC BENDING STRENGTH (Specimen 10" x 1" x 1")	28,000 p.s.i.
MODULUS OF ELASTICITY	2.5×10^6 p.s.i. (approx.)
COMPRESSIVE STRENGTH  Parallel to grain and Laminae N.B.—In general, parts subject to large compressive loads should be made in Type 6 material	18,000 p.s.i.
SHEAR STRENGTH  Parallel to grain and Laminae  Perpendicular to Laminae, parallel to grain  Perpendicular to Laminae and grain	2,300 p.s.i. 4,300 p.s.i. 6,000 p.s.i.

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**MECHANICAL
CHARACTERISTICS
OF
PERMALI
TYPE
6**



This is material with the grain of adjacent laminations at right angles. Its high compressive strength in the direction of its thickness, and rigidity, makes it very suitable for insulating blocks or panels.

Its structure is well adapted to retain maximum strength in complicated machined parts and parts containing large diameter drilled holes, even when these are in close proximity.

Thickness

Type 65—from $\frac{1}{4}$ " to 1".

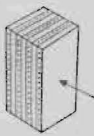

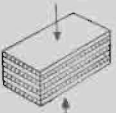
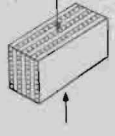
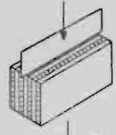
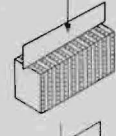
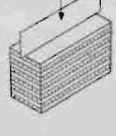
Type 67—from $\frac{1}{2}$ " to 6".

Sizes

Maximum length, 14'.

Maximum width, 4'.

See notes on sizes page B8.

TENSILE STRENGTH	Guaranteed minima:— 14,000 p.s.i.
IMPACT STRENGTH—Izod Type Test (Unnotched Specimen $\frac{1}{2}$ " x $\frac{1}{2}$ ")  Perpendicular to Laminae  Parallel to Laminae	3 ft. lb. (24 ft. lb./ sq. in.) 2 ft. lb. (16 ft. lb./ sq. in.)
STATIC BENDING STRENGTH (Specimen 10" x 1" x 1")	14,000 p.s.i.
MODULUS OF ELASTICITY	2×10^6 p.s.i. (approx.)
COMPRESSIVE STRENGTH  Perpendicular to Laminae  Parallel to Laminae	30,000 p.s.i. 18,000 p.s.i.
SHEAR STRENGTH  Parallel to Laminae  Perpendicular to Laminae on a face which is laminated  Perpendicular to Laminae on a face which is not laminated	2,500 p.s.i. 6,900 p.s.i. 5,300 p.s.i.

PERMALI

COMBINES HIGH DI-ELECTRIC PROPERTIES
WITH OUTSTANDING MECHANICAL STRENGTH

PHYSICAL PROPERTIES

In addition to its value as a dielectric "Permal" is worthy of attention as a material for general engineering applications by virtue of its high strength/weight ratio and other physical properties as detailed below. It is extremely hard wearing, suitable for use in all climates and immune to attack by termites or other wood boring insects.

SPECIFIC GRAVITY. (Grade E.) 1.28-1.32.

(78 lbs. per cubic foot—22 cubic inches per lb.).

WATER ABSORPTION. (Specimen $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times \frac{1}{2}''$).

Average increase in weight after 24 hours' immersion 1.2%.

RESISTANCE TO HEAT.

"Permal" is unaffected by temperatures up to 140°C., and the material is suitable for continuous use in transformer oil at 90°C.

SPECIFIC HEAT. 0.4 (approx.)

HARDNESS

The "Janka" hardness figure for all types of "Permal" is 7,000. This compares with values of 1,200-1,800 for ordinary hardwoods.

RESISTANCE TO CHEMICALS

"Permal" is unaffected by mineral oils and is suitable for exposure to weak acid solutions at temperatures up to 40°C. "Permal" is not suitable for exposure to strong caustic alkali or to oxidising acids especially at high temperatures.

COEFFICIENT OF THERMAL EXPANSION.

(Centigrade units) :—

Types 55 & 57

Along the grain - - - 0.000008

Across ,, ,, - - - 0.000069

Perpendicular to laminae 0.000113

Types 65 & 67

Parallel to laminae - - 0.000015

Perpendicular to laminae 0.000113

THERMAL CONDUCTIVITY

In plane of laminae along grain—

.0056 cal cm/°C/sec.

In plane of laminae across grain—

.00036 cal cm/°C/sec.

Across plane of laminae across grain—

.00034 cal cm/°C/sec.

N.B. The second significant figure is indicative only and may be subject to some error.

COMPARATIVE TABLES SHOWING RELATIVE VALUES OF TENSILE STRENGTH AND DENSITY FOR VARIOUS MATERIALS

Material.	Tensile Strength tons/sq. in.	Specific Gravity.	Tensile Strength Spec. Gravity.
Steel - - - - -	60	7.8	7.7
Aluminium Alloy - - - - -	30	2.8	10.7
Magnesium Alloy - - - - -	25	1.8	13.9
Spruce - - - - -	4.5	0.5	9.0
Cotton - - - - -	18	1.5	12.0
Paper Based Laminated Sheet - - - - -	8.0	1.4	5.7
Fabric Based Laminated Sheet - - - - -	6.25	1.4	4.5
" PERMALI " - - - - -	12	1.3	9.3

PERMALI

MAY BE SAWN — PLANED — TURNED —
DRILLED — TAPPED — AND SCREWED

STANDARD SIZES

"Permal" is available in any thickness of material from $\frac{1}{4}$ " upwards, but there are practical limits to the sizes available in certain types, as shown in the Mechanical Data notes on each. Extra thick material may either be specially processed or built up from a number of thinner sheets fixed together with a suitable adhesive.

SHEETS are normally manufactured in any size up to a maximum of—

LENGTH 5' 6" } but surface area must not
 WIDTH 4' } exceed 2,300 square inches.

Alternatively sheets may be manufactured up to a maximum of—

LENGTH 14' } but surface area must not
 WIDTH 2' 2" } exceed 3,300 square inches.

The Company prefers to press sheets in sizes to suit the size and purpose of components to be made. Users will appreciate that this method reduces waste to a minimum.

In addition the manufacturers hold stocks of "Permal" in types 3, 5, and 6, from which urgent requirements may be supplied without resort to pressing. Users are, therefore, asked to state wherever possible the exact finished size of the component or panel required. The following tables indicate the standard sizes normally stocked in each type :—

" PERMALI " GEAR BLANKS	
Type	Stock Sizes and Face Widths
33	No stocks maintained. Supplies available at short notice.
35	No stocks maintained. Supplies available at short notice.
37	Diameters : From 3" in steps of $\frac{1}{2}$ " to 6", 7", 10", 12", 14". Face widths : From $\frac{1}{2}$ " in steps of $\frac{1}{4}$ " up to 3 $\frac{1}{4}$ ".

Blanks to other dimensions available on order. Bandsawn finish $+\frac{1}{16}$ " on diameter, or fully machined.

" PERMALI " SHEETS	
Type	Standard Sizes and Thicknesses
55	Up to $\frac{1}{4}$ " thick 48" x 4". Over $\frac{1}{4}$ " " 48" x 6". Thicknesses : $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{7}{8}$ ", 1".
57	All thicknesses : 48" x 7". Thicknesses : $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", in steps of $\frac{1}{8}$ " up to 2", 2 $\frac{1}{4}$ ", 2 $\frac{3}{4}$ ", 3".
65	All thicknesses 36" x 24". Thicknesses : $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{7}{8}$ ".
67	48" x 36". Thicknesses : From $\frac{3}{8}$ " in steps of $\frac{1}{8}$ " up to 2", 2 $\frac{1}{4}$ ", 2 $\frac{3}{4}$ " and in steps of $\frac{1}{4}$ " up to 4".

Intermediate thicknesses available on order. All sheets supplied cut to size with smooth edges.

" PERMALI " ROUND RODS		
Type	Diameter	Length
55	$\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", 1", 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ". Limits on diameter $+.001$ " — $-.003$ ".	43"
57	$\frac{3}{8}$ ", 1", 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 1 $\frac{3}{4}$ ", 2". Limits on size $+.002$ " — $-.008$ ".	24"

NOTE
 Customers are warned that it is not practicable to screw-cut "Permal" rod with a die. A large stock of screwed rods, studs and bolts, etc., is available (see Leaflet "K"). In cases where customers wish to screw-cut "Permal" rodding we recommend high speed thread milling.

Longer lengths and greater diameters available to order. All rods supplied natural finish unless otherwise specified.

ADVISORY SERVICE

Designers are invited to secure the co-operation of "Permal" technicians as early as possible in the development of a new product. Our wide experience in the application of "Permal", both in the mechanical and electrical engineering fields, is freely at your disposal, and it is often possible to anticipate and prevent production delays by recommendations at the drawing board stage as to the type of "Permal" to be used for particular components. A series of leaflets are available on request, which illustrate the actual applications of "Permal" in all branches of electrical and mechanical engineering.

DISTRIBUTOR:



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