

# Plywood

## General Plywood Technical Notes

trade essentials®



## Grades

**A Grade:** Used for Clear finish. Allows filled holes up to 6mm-4 per sheet and filled splits up to 3mm wide and 450mm<sup>2</sup> in area. Also allows for sound pin knots up to 2mm. Any defect filling must be colour matched. Avoid High Gloss finishes as these show dents and other bruises.

**B Grade:** Good Quality Paint finish. Allows for filled holes up to 20mm and splits up to 3mm wide and 750mm<sup>2</sup> in area. Defects are not necessarily filled with colour matched putty. Also allows for sound knots up to 25mm unlimited with a maximum of 4 per sheet up to 40mm. Use 100% Stain blocking Acrylic primer to stop bleed through from knots.

**C Grade:** This grade not generally recommended for aesthetic appearance. Allows for filled holes up to 50mm and splits up to 12mm x 600mm long. Also allows for patches up to 75mm. Filled defects are not colour matched and is used mainly in a structural or non structural application. Ordinary paint finish.

**D Grade:** Allows for open defects up to 75 mm (ie. knot holes) and splits up to 25mm.

## Structural versus Non Structural

Structural plywood contains veneers that have been measured and tested for strength and stiffness. Structural plywood will be branded with an F rating (ie. F8–F11–F22 etc.), and will comply to the AS/NZS 2269 structural standard.

Non structural plywood has veneers that may have no or low strength or stiffness hence cannot be used in a structural application.

Non structural plywood does provide an economical solution where structural performance is not required. The appearance of CD Structural will look the same as CD Non structural hence aesthetically there is very little difference.

Laminex®

# Painting

- ▶ Most plywood will take a paint.
- ▶ Generally satin or matt water based finishes are recommended as gloss will always show dents and bruises.
- ▶ Acrylic or water based paints will move with the wood as temperature changes, whereas oil based paints do not, hence Acrylics are generally recommended particularly in external applications.
- ▶ With clear finishes oil based paint also raises the grain and highlights the grain or swirls a lot more. It also results in a deeper/darker or oilier look to the finish.
- ▶ A stain blocking acrylic primer is recommended to stop bleed through from knots. This is particularly useful if the sheets have many knots across the face.

# Tolerances – General

- ▶ Length and Width  $\pm 1.5\text{mm}$ .
- ▶ Thickness  $\pm 5\%$  for panels up to 7.5mm,  $\pm 4\%$  for panels 7.5 to 17.5mm and  $\pm 3\%$  for thicker panels.
- ▶ Diagonals  $-0.2\%$  of the longer Diagonal (ie. approx. 5mm).
- ▶ Straightness  $-0.5\%$  of the length of that edge.
- ▶ Flatness 50mm for panels up to 7.5mm (10kg weight is used to bring the panel to a flat position).
- ▶ 30mm for panels thicker than 7.5mm (15kg weight).

Refer to the Laminex brochure for more specific details and or the relevant standards as different tolerances apply to different plywoods.

# Weathering/Moisture

- ▶ Plywoods are supplied with a moisture content of between 8% to 15% maximum.
- ▶ Wood and Plywood is hygroscopic and will readily absorb and release moisture. Constant weathering will degrade the wood and cause damage in the form of checks, cracks, splits, raised grain and loose fibres. Fungi will become established when moisture content exceeds 30%. Most fungal activity ceases below 20%. Long term fungal attack will affect the strength and stiffness due to cellular breakdown of the cellular structure of wood fibre.
- ▶ Swelling of plywood =  $-0.011\%$  of movement per % of Moisture (ie. 25% moisture = 2.7mm).
- ▶ General 6% to 7% on thickness and 1 to 2mm in length and width.

# Twist, Buckling, Bowing/Movement

Plywood is a natural timber product that can be affected by changes in ambient weather conditions, possibly causing previously flat sheets to bow or twist. All precautions are taken at time of dispatch to ensure flatness, however once they have left the factory or warehouse, sheets cannot be guaranteed to remain flat unless fixed along all edges. Exposure to changes in weather can cause sheets to bow or twist even with 24 hours.

This is particularly important where free standing kitchen/cabinet doors are concerned. Small doors that are well coated/sealed and hinged can give good results, however can still show some signs of movement. Plywood on its own is not recommended for large doors or for doors used in a sliding application.

# Bonds

**A Bond:** Phenol Formaldehyde – Dark in colour Sets under controlled heat and pressure. Eo. 72 hour boil test at 100°C or 6 hour boil test at 200Kpa of steam pressure. Chisel test 50% minimum wood fibre failure. 50 years full weather exposure.

**B Bond:** Melamine Urea formaldehyde (30% Melamine) White or clear in colour E0 and E1. 6 hour boil test @ 100°C. 2 years full exposure. 50 years semi exposure. Chisel test 50% min wood fibre failure (MUF reverses at 50 degree Celsius and 40% moisture MC). B Bond can attain a structural rating but is not recommended for long term loads or long term structural application.

**C Bond:** Low extended Urea Formaldehyde – White in colour -3 hour boil test @ 70°C. Interior use only and in humid conditions (ie. Bathrooms). E0 and E1. Non Structural. White or clear in colour.

**D Bond:** High extended Urea formaldehyde – White in colour. 24 hours @ 20°C (ie. 24 hours in normal water temperature). Interior use only Low Humidity.

**WBP:** Water Boil proof. Phenol Formaldehyde. Dark in colour. 24 Hour boil test.

# Treatments

**H1:** Lyctid treated Mainly Glueline and only for Hardwood. Lyctid borer needs starch which is not present in softwood pines. Also Pines have cells and Harwood has pores. The female borer lays eggs in the pores of hardwood.

**H2:** Termite treatment Either glueline for H2s or pressure impregnated for other. Bifenthren/Permethrin in glueline or LOSP or other in cylinder pressure treated. T2 = Synthetic Pyrethroid insecticide/Above ground non exposed conditions.

**H3:** Fungus and Termite treatment Pressure impregnated LOSP (Light Organic Solvent Preservative – spirit based), CCA- Copper chrome Arsenic (water based), ACQ-Ammoniacial Copper Quaternary (water Based), Copper Azole (Tanalith Copper, Tebuconazole and boric acid (water Based). Uses Hot dipped Galvanised fasteners for all except ACQ – must be Stainless steel.

**H4:** Plywood in Horizontal/Vertical external applications.

**H5:** Plywood ground contact.

**Notes:** T2 Blue = H2F South of the tropic of Capricorn. T2 Red =H2 North of the tropic of Capricorn.

**Note:** water based treatments may cause the sheets to buckle or twist.

# Formply

Class of finish after concrete pour:

**Class 1:** Monuments and small areas subject to close scrutiny. No formply can achieve this class of finish.

**Class 2:** Architectural usage designed to be viewed at a distance. A test pour should be done and sign off on that test pour finish is usually required. Most formply can achieve class 2 on the first pour when the formply is new provided no damage or bruising is caused by the formworker during construction.

**Class 3:** Standard off form finish for Car parks. Walls and general building work. Most formply can achieve this class of finish.

**Class 4:** Columns and general boxing or areas not for visual purposes, eg. rendered or tiled surfaces.

**Phenolic film:** 40/120, 60/150, 60/180, 80/240, 240/425.

# Bracing

- ▶ Wall frames are 4 pin arch's which without bracing can easily fall over.
- ▶ Forces on the bottom floor of a domestic home are 3 times that of the top floor, hence usually 3 times the amount of bracing is required.
- ▶ Timber or metal angle/strap bracing is effective @ 45°C as this gives triangular strength. Anything above 60°C is ineffective.
- ▶ Plywood bracing can be cut and used in narrow walls to a min of 400mm wide.

# Certification/Branding

**JAS/ANZ:** Joint accreditation system for Australia and New Zealand.

Approved auditing bodies are:

**EWPA:** Using their own stamp and testing with their own laboratories.

**SAI Global:** Their brand or mark is the 4 ticks. Testing is done via UTS University of Technology Sydney.

**Benchmark:** Not as widely known.

# Marine Grade Plywood

Two types of marine grade plywood are available:

1. **BS1088:** British Standard made from Sustainable mixed hardwoods that can be mixed within the same sheet (ie. Meranti, melapi, mesawa). A Bond Glue line A/A faces with A or B grade centres. F Rating not required under this standard however expected to make F17 to F22. Colour will vary from a light white/light pink to a dark red.
2. **AS/NZS 2272:** Australian standard using species such as Hoop, Klinki, Birch, Kauri, Maple, Cedar, Coachwood, Sapele, Solkwood, Teak, Silver Ash. Allowable core veneers are Slashpine, Sassafras, Doi, Damanu, Tarawan, Taun. Has an A bond glue line and must be a minimum of F14 F rating. Produced to defined strength properties for impact, modulus of rupture/stiffness/ water absorption etc.

# Kilogram/KPA

- ▶ Kilogram is a unit of mass.
- ▶ KPA is a unit of pressure.
- ▶ The two units cannot be directly converted, however if you mean Kilogram force per square centimetre, ie. (KgF/cm<sup>2</sup>) 98.1 = Kilopascals (KPA).
- ▶ 1 KPA is approx. 100kg/m<sup>2</sup>.
- ▶ 2.2KPA is approx. 220kg/m<sup>2</sup>.
- ▶ 1 KPA = 1000 PA.
- ▶ 2.2lb = 1 Kilogram.

# Machining Marks/Defects

- ▶ Knife striations are cutting blade tears, scrapes, streaks, scratches or grooves, usually evident in soft species of wood such as Balsa, Poplar, Falcatta, Ceiba, Western Red Cedar, etc.
- ▶ Soft species often do not machine as well as hard species and either a furry or streaky appearance can occur.
- ▶ Tearing and splintering of edges can also occur with drilling (eg. Acoustic holes and grooves) in some soft species.
- ▶ Increasing the RPM of the machinery can help alleviate this, but may not be possible.
- ▶ Slowing the rate of infeed may also be required.
- ▶ Keeping blades well maintained and sharp is critical in achieving better finish.
- ▶ Sanding can rectify tearing and splintering but care is required not to sand through the veneer thickness.

# Certification/Branding

- ▶ **17157** (ie. 17mm with 1.5 faces and 7 ply. Properties = I-220, Z-25, I per-190, Z per-20)
- ▶ **17247** (ie. 17mm 2.4 faces 7 ply. Properties = I-285, Z-34, I per-120, Z per-19)
- ▶ I is Moment of inertia, Z is Section of modulus Parallel to face grain.
- ▶ Per is perpendicular to face grain.

# Guide to gluing HPL or CPL laminates to plywood

## Plywood properties

The surface of plywood is generally more porous than MDF and the porosity can vary across even one face. This is due to the fact that plywood can contain both sapwood and heartwood in the one sheet which has different densities. Also most plywood is sanded using drum sanders. These sanders can leave minute highs and lows on the surface and due to this unevenness, the surface of plywood can often telegraph small defects or undulations through to the laminate. Air can sometimes be trapped in low spots which can result in bubbling.

This is particularly accentuated if gloss laminates are used. Due to their high reflective surface, all high gloss laminates have an inherent tendency to display undulations. Therefore matt or textured laminate finishes are generally recommended when used on plywood.

## Glue types

The type of glue used also can give different results. **Contact adhesive** generally has no filler and therefore is not a gap filling adhesive. If the adhesive cannot fill the small lows or pockets that may be on the plywood surface, air can be trapped and as it has nowhere to go, it will show as a bubble on the surface. This is also more evident with hot pressing as the air will warm up and the pressure created can break the bond forcing a bubble to form. Contact adhesive is not the preferred glue type when using High gloss laminate finishes on any substrate, including plywood.

The spread of glue also is critical to achieving an optimum finish. It is sometimes good practice to give the substrate or plywood a priming or sealing coat with a 50 /50 mix of the adhesive. Applying one heavier coat only is not recommended as a skin may form drying the adhesive at a different rate and bubbling may occur due to trapped solvents or moisture trying to escape after pressing. Too much adhesive will also give a weak bond. Both the substrate and the laminate must have an even spread covering the whole surface of each component when using contact adhesive.

**Cross link PVA (CPVA)** adhesive is generally preferred when gluing laminates to plywood however CPVA is water based and when applied to a substrate can cause the wood fibre to swell. Heat from the pressing process may produce steam which exacerbates the swelling and high gloss laminates will show this through to the top surface. Too much glue also will add to the unevenness due to the higher content of water in the glue. Using a **poly urethane glue (PUR)** which has no water should produce the best surface finish with laminates on all substrates, including plywood.

## Conditioning

High pressure laminates also expand and contract with changes in humidity. It is good practice to pre condition or acclimatise the laminate and substrate for at least two days prior to bonding by exposing them to similar conditions as the fabricating site. High levels of humidity can also affect the glue viscosity and porosity in the plywood veneer.

## Professional tips

Telegraphing of defects from the underlying substrate is a common problem particularly with gloss finishes. This can also be the case with MDF or particleboard hence is not isolated to plywood alone.

- ▶ Cold curing creates less telegraphing than heat curing
- ▶ To eliminate some telegraphing, better surface preparation is usually recommended. Fine sanding each surface or crossbanding with a close grained veneer free of defects will help.
- ▶ Ensure that there is sufficient glue and sufficient pressing time and pressing pressure. Low temperatures and lower pressure on the press bonding equipment usually provides better results. Experimenting with test panels first is good practice.
- ▶ Check glue for foreign matter and evenness of spread.
- ▶ Check for foreign matter or dust on each sheet of the substrate and laminate prior to applying glue.
- ▶ If possible pressing from the centre out would also assist in releasing trapped air pockets.
- ▶ Choosing plywood that has veneer with a close grain and high face grades of A or B or overlay and better will also help in minimising telegraphing of defects.
- ▶ If possible avoid gloss finishes onto plywood and use matt or textured finish laminates instead.