

# QUALITY ASSURANCE & MANUFACTURE

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The DGI Glulam process uses many quality control procedures to ensure that the final product performs to the highest standards. With the number of gluelines utilised, any failure in glue/adhesion performance is unacceptable.

DGI have been pre-eminent in the Glulam field since starting in 1974 and are founding members of the Glue-Laminated Timber Association of Australia (GLTAA) who use Monash University Engineering for QA accreditation. Our Engineering department and Technical consultants have been used by many areas of Industry for technical advice on Glulam usage as well as timber behaviour, installation and design in many difficult environments.

Although generally seen as "merely sticking bits of wood together", DGI Glulam is much, much more, as can be seen by the following processes.

# 2. MULTI-RIP SAW

DGI only purchase timber and glues from suppliers with QA systems in place.

A) Timber

### I) Moisture Content

Because the correct seasoning of timber is so critical to ultimate glueline performance as well as long term stability, MC checks are carried out at various stages of the Glulam process. Different species will determine the initial MC: for successful gluing, some very dense hardwoods will require lower MC than normal, and many tests are done in our laboratory to determine the best MC/machining/gluing regime so as to maintain required quality levels.

Testing starts when the timber first arrives from the sawmiller. To ensure that MC doesn't vary over time with storage and variances in atmospheric humidity, only enough material scheduled for production is ordered. MC is then rechecked at various stages of the production process.

MC testing is done by pin electronic moisture meters and checked by Oven Dry method. The aim is to ensure that the total product is at Equilibrium Moisture Content (EMC) when manufacture is complete. This means that the external ambient humidity and the internal timber MC are balanced and in harmony. For most of urban Australia, this is about 12% MC.

### ii) Grade

The rough timber laminates are checked for defects. Obvious, extensive defects, which may effect strength or appearance, are docked out.



Multi Rip Saw

## iii) Size

Timber is then checked for the sizes needed for the finished laminate section. Undersized timber is rejected. There is a considerable amount of necessary wastage involved in manufacturing Glulam, which determines the ultimate price. Generally, starting with a 50x25mm nominal laminate  $(1,250m^2)$  the finished laminate size becomes 35x19 ( $665m^2$ ): this is a 47% loss of material before any docking/defect wastage occurs.

**B) Glues** Glue selection is critical to ensure a quality product is produced. No new type or variety of glue will be used unless thorough checks specific to each species are done beforehand.

# 2. MULTI-RIP SAW

When ordered, the timber is usually larger than the required nominal laminate dimension. This material is fed through the Multi-Rip saw, which is a bank of saws set to the correct sizes to produce the laminate sizes required for the specific species. Care is taken to ensure that MC is continuous throughout the slab, as high internal MC (often called `locked in Core Moisture') can cause ultimate checking or even laminate collapse.



Multi Rip Saw

# **3. FINGER JOINTING**

Where it is difficult to obtain long length laminates adequate for the range of lengths required, fingerjointing of laminates is required. This produces a strong joint that holds the pieces together for the machining and gluing processes. It is also utilised to join pieces together after any observed defects are docked out.

DGI has two fingerjointing lines: Structural and Decorative. These produce different design fingerjoints: <u>structural</u> for strength, with longer, strong fingers and a tip gap designed to avoid `bottoming out': <u>decorative</u> for aesthetics, with shorter fingers and no gap at the tip.



Finger Jointer

## 4. MACHINING

The next process takes the laminates in the rough through a moulding machine. Having six cutting heads, the moulder cleans all four sides of the laminate to exact tolerances. Speed of machining is critical, as too fast will create a slightly uneven surface which will show too large a glueline later, and too slow will burn the wood.



Machining laminates to size

## 5. SORTING/PRE-CONDITIONING

Laminates are sorted to corresponding lengths and colours and pre-heated for 12 hours to obtain even internal heat. This aids in the glue curing process.

Because many Australian hardwoods have odd chemistry with an abundance of resins that may return to the surface not long after machining, it is often critical to apply glue directly after machining whilst the surface is fresh and clean.



Pre Assembly Room

# 6. GLUE SPREADER

From the Pre-conditioning room, laminates are fed on a conveyor belt through one of the glue spreaders. Two are used, dependent on the type of glue required for the particular purpose and species being processed.

Decorative products are glued with white moisture cure polyurethane glue while structural products are glued with Resorcinol Formaldehyde. This glue is the best glue available, being fully waterproof and in fact the only glue deemed so. It is the only glue allowed in structural Glulam because of its proven long-term Decorative Glulam needs a high level of water and solvent resistance, with minimal long-term creep. As Resorcinol is unsuitable for lighter coloured timbers because of its dark red colour, we use moisture cure Polyurethane.

As all the glues used are two part and mix is critical, accurate glue mixing machines are used to ensure correct catalisation. The glue is then fed into hoppers mounted at the top of the appropriate glue spreader, which spreads the glue at a predetermined rate and consistency.

Other normally efficient wood working glues, such as PVA, Epoxy, and Iso-cyanate, tend to be unsuitable because of deficiencies in moisture resistance, solvent resistance or creep characteristics. Again, because of the large number of gluelines, any poor performance in the glue could affect the finished product.



Glue Spreader

# 7. PRESSING

DGI only use `cold presses'. Tests with various alternative presses, such as RF (Radio Frequency) and Oil Filled have highlighted the difficulties associated with gluing the timbers we commonly laminate; Australian hardwoods, because of their density, resin character or pH, are of course the most difficult of all.

Our presses utilise clamps that are tightened to predetermined torque settings dependant on the density of the species being glued. Spacing between clamps has also been designed to ensure equal pressures along the length of the boards.

a) <u>Static Press</u> - this allows lengths up to 20metres long to be pressed, as well as having the facility for adding camber to structural beams.



Glue Room

b) <u>Multi - arm press</u> - designed for shorter lengths (up to 2.4metres), high production output is given by rotating clamps, that automatically press each layer.



Multi Rip Saw

c) <u>**Curving Jig</u>** - `one off' jig designed to make tops with laminates curved to follow a predetermined radius.</u>

As the glues utilised are heat sensitive, the glue room is maintained to predetermined heat levels, and panels are left in the clamps overnight to ensure sufficient cure prior to further processing.

# 8. PLANNING / SANDING

Boards are first planed top and bottom through a planer, then through a series of wide belt sanders which take the surface to 100-150 grit. Care is taken that boards are cured to the stage where stresses are



Planner



Belt Sander

# 9. TESTING

A) Species Suitability - prior to selection of a species for gluing, various trials are undertaken to determine performance, adhesion and longevity. This process usually takes 8-10 months, and ensures that timbers that are difficult to glue, have poor stability characteristics, or display drying or defect problems, are not released into the marketplace where future problems may ultimately show themselves.



Multi Rip Saw

**B) Proof Testing -** Various tests are done as part of the DGI Quality Assurance program to ensure the products meet relevant Australian standards, and some of the more rigorous criteria established by the DGI laboratory team. These tests are done on pieces cut from actual production slabs, and records are kept of results and processing batches.



Finger Joint Bending Rig

i) Fingerjoint Bending test - this measures the strength of the fingerjoints by putting stress on the joint until breakage occurs.

**ii)** Cleavage test - this tests the adhesion of the glue, measuring the amount of wood failure when the glueline is broken. DGI expect a high degree of wood failure (rather than glueline failure), and the degree of wood failure expected will be determined by the criteria established for each species.

**iii)** Boil/water resistance test - 72 hour boiling water immersion test to determine suitability to high humidity and long term water exposure.

iv) Moisture content test - finished pieces are again checked for accurate moisture content by "Oven Dry" method.

v) Solvent resistance test - after allowing full glueline cure, various solvents and chemicals are used to saturate the surface to determine overall resistance.

vi) Glue quality checks - Glue batches are tested and recorded for `Use by dates' and viability.

vii) Calibration - All tools, gauges, and measuring devices are regularly calibrated by outside experts to maintain accuracy.

# 10. WARRANTY

We at DGI believe that your Glulam product should give years of service; our manufacturing and quality control processes strive to produce items of durability and practicality. Our guarantee on manufacturing defects, which could render the product unserviceable or unfit for normal usage, is for five years. All we ask in return is that the installation, sealing and care instructions are adhered to, and that the product is not used in areas of extreme climatic conditions. Our warranty does not cover external usage, as our products are specifically designed for internal use.

Natural variations in colour or texture of wood are not considered defects, and minor improvements to knots, shakes or gum veins by filling are part and parcel of the joy of living with natural timber.

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