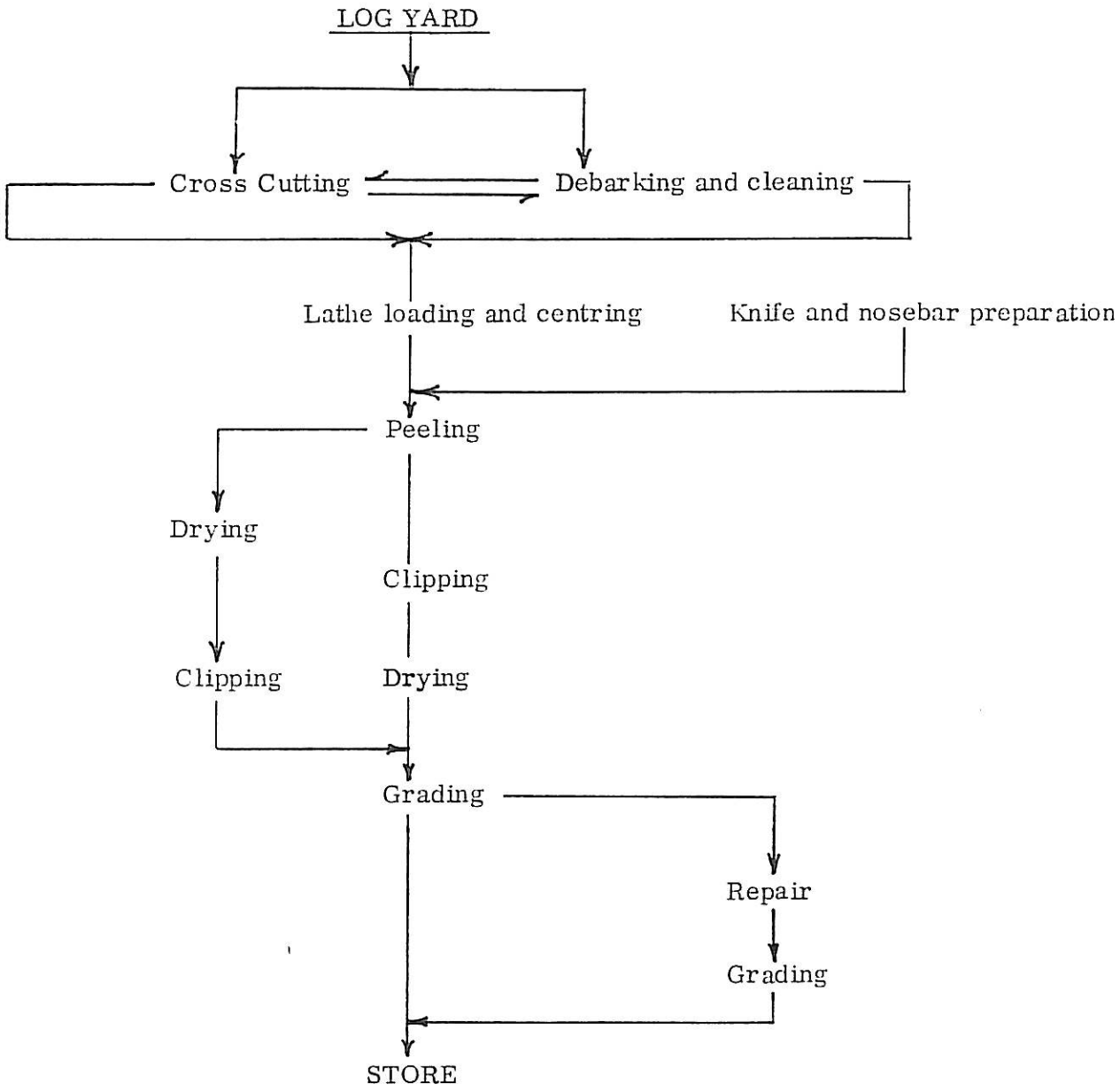
VENEER MANUFACTURE

It is usually accepted that veneer manufacture includes all the processes from the time the log enters the yard to the stage where a dried, graded veneer ready for further processing into plywood has been produced. The line chart below is a simplified process flow diagram of rotary veneer production.

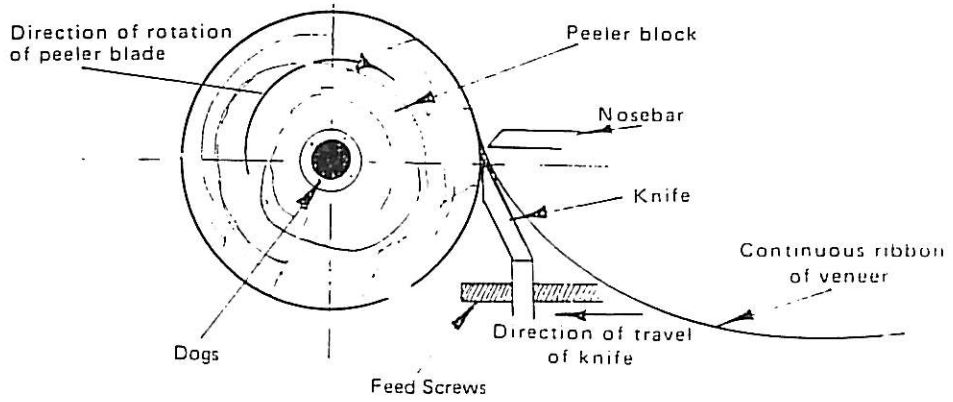


The logs enter the yard green and are kept in this condition by spray stacking or immersion under water in log ponds. The ends are usually coated with a wax emulsion to slow down evaporation of water from the log. These measures are necessary to control log degrade which occurs as a result of drying out (usually in the form of end splitting) and thus increase the recovery of first quality veneer from the log. The logs are then cut into suitable lengths for peeling. These lengths are called peeler blocks or sometimes peeler billets. The bark is removed from the peeler blocks and the surface is thoroughly cleaned to remove objects such as stones which would cause knife damage and subsequent loss of production in the peeling operation.

The lathe loading and centring operation is next. The loading can be done manually with a hoist and log tongs or automatically with mechanical loading and centring devices. The peeler blocks must be centred with the geometrical axis of the log along the centre line of the lathe spindles to obtain maximum veneer recovery.

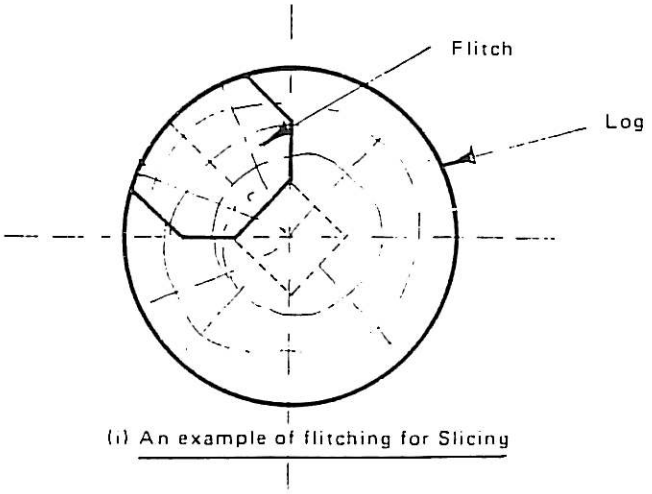
The next operation is veneer cutting and it is here that the first major change in the wood form occurs. In the flow process diagram above rotary veneer manufacture is described, as this represents about 95% of the total produced. There are two other methods of producing veneer which also will be described, these are slicing and semi rotary cutting.

Rotary veneer is processed on a 'veneer lathe'. In this machine the log is turned onto a knife nosebar assembly which is fed towards the centre of the log at a constant rate. The result is a continuous ribbon of veneer of uniform thickness.

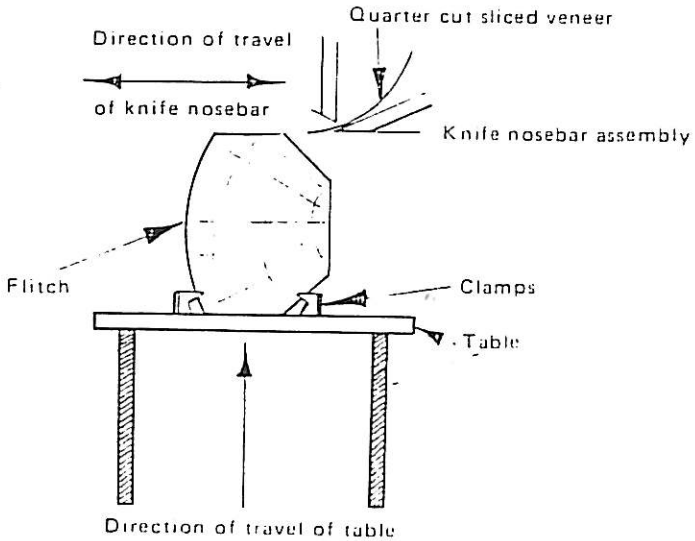


Rotary Veneer Production

Sliced veneer is processed on a different machine called a 'slicer'. In this the strips of veneer are cut in a straight line action. There are two methods, either the flitch is held rigidly and the knife/nosebar moves backwards and forwards over the flitch cutting one veneer each forward pass, or the knife/nosebar assembly is held rigid and the log is passed backwards and forwards over the knife. The first of these methods is usually done in the horizontal plane and the latter in the vertical plane, thus the terms 'horizontal' and 'vertical' slicing.

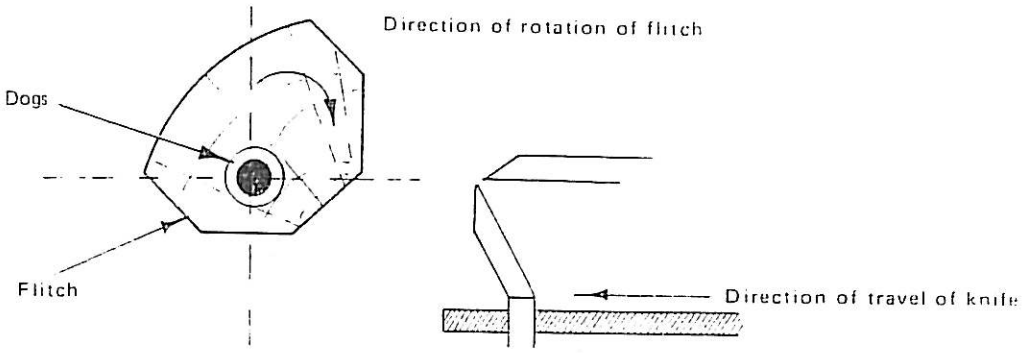


(i) An example of flitching for Slicing



Veneers manufactured by slicing are used for decorative purposes because of the figure obtained (see also section on figure).

Semi rotary veneer is produced on a rotary veneer lathe. It is a combination of slicing and rotary peeling and is used to obtain decorative veneer with figures which vary from quarter to tangential cut throughout the one veneer strip.



After the peeling or slicing operation the veneer is either clipped to size and dried or continuously dried in ribbon form and clipped dry. The equipment is similar, regardless of the sequence, however the latter method is a modern innovation for rotary veneer and in general requires more sophisticated handling equipment.

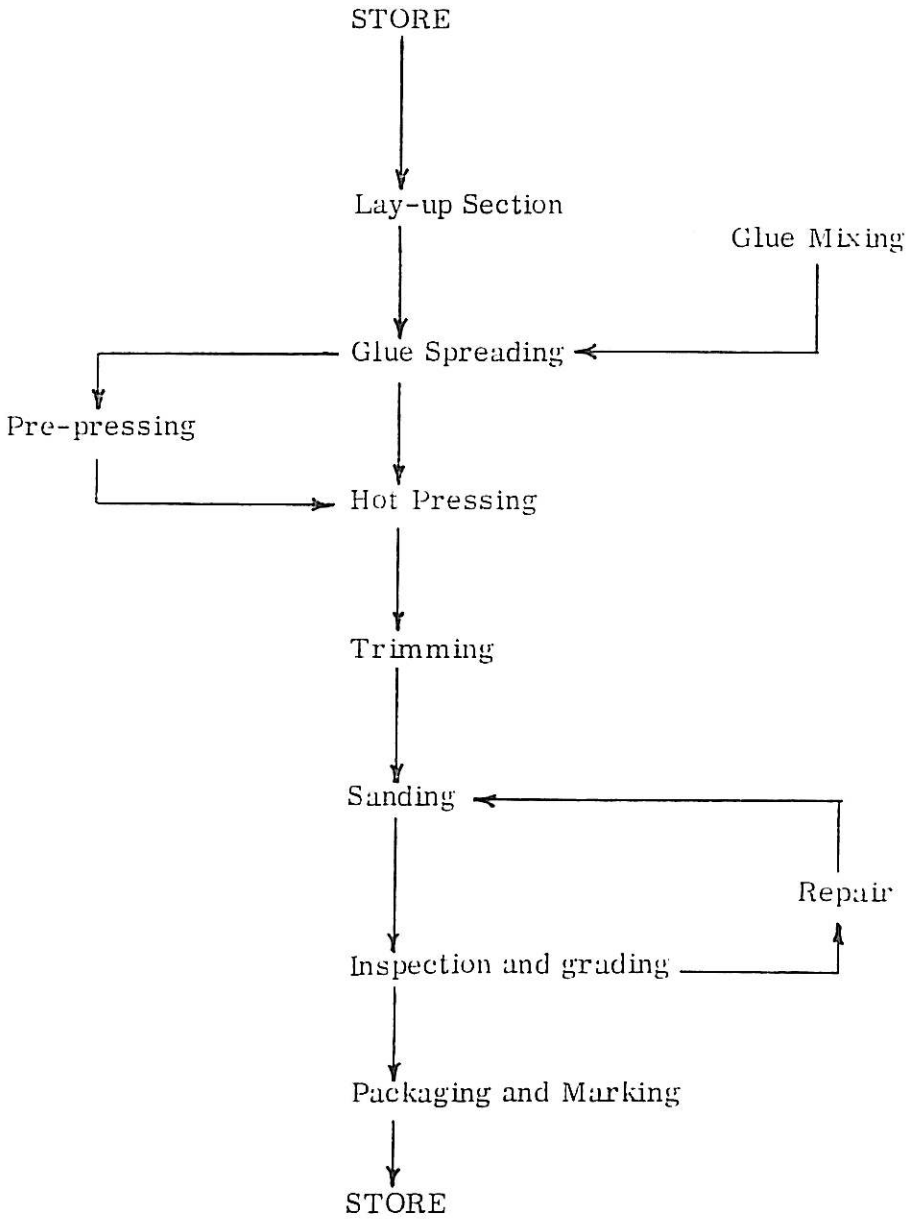
Most veneer produced at present is mechanically dried in jet box type driers. Air at temperatures up to 320^{O}F is blasted onto the surface of veneers at high velocities. Some driers have up to three decks so that a higher volume of veneer can be processed.

The veneer must be dried to within defined limits usually 8 - 12% moisture content, to obtain satisfactory results in the subsequent gluing operation.

Finally the veneer is graded according to standards and (some is upgraded by repairing splits, patching knots etc.) before going into store.

PLYWOOD MANUFACTURE

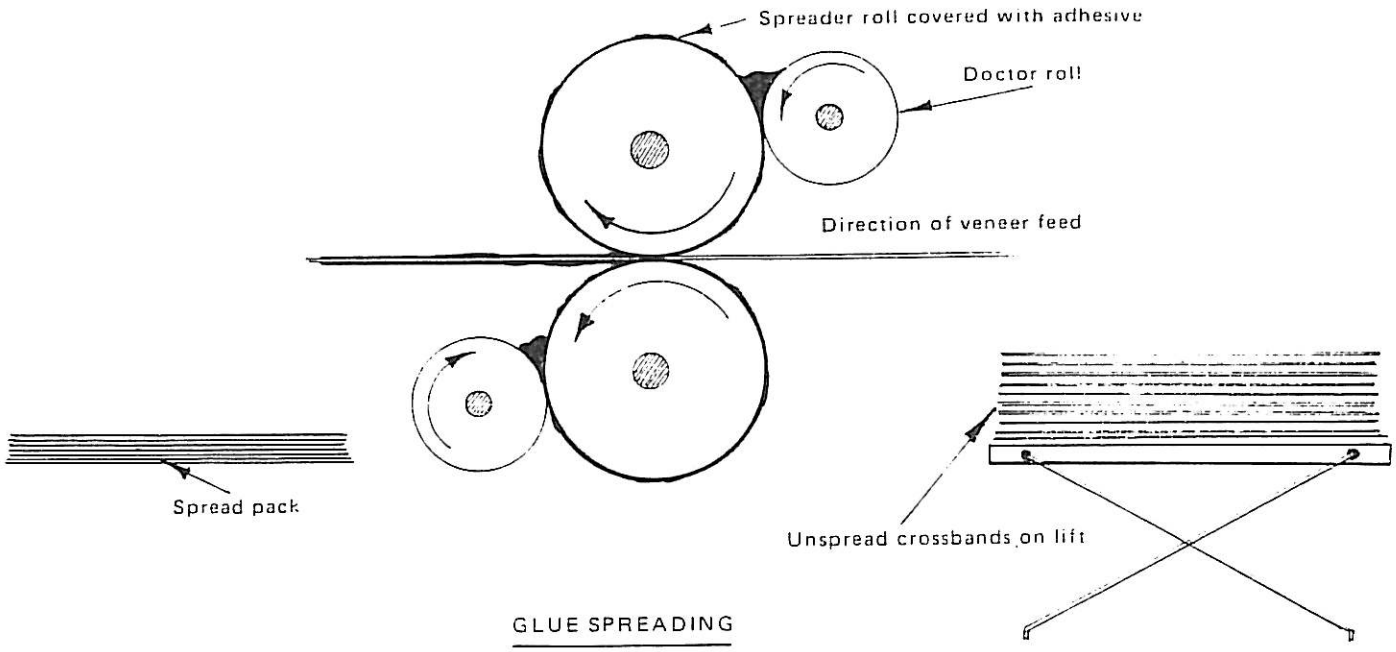
Although all the processes involved in veneer manufacture are necessary for plywood manufacture it is usually accepted that plywood manufacture starts at the lay up stage and finishes with the packaging and storage of the finished plywood product. The line chart below is a simplified process flow diagram typical of plywood production.



The dried, graded veneers are assembled in two bundles in preparation for the spreading operation. In one bundle the graded faces and long bands are assembled and the other consists of the cross bands or in the case of three ply, the cores. It is these cross bands or cores which are run through the glue spreader. Different grades of plywood are made from various grades of faces, backs, cross bands and cores according to standard specifications. In a three ply construction only the centre veneer passes through the glue spreader. The glue is transferred to the adjacent veneers in the pressing operation.

At the same time the various adhesive mixes are prepared. These adhesives are discussed in detail in the section on the glues used in plywood.

In the glue spreading operation the cross bands are spread on both sides simultaneously as shown in the diagram. Close control over the amount of adhesive spread is obtained by adjusting the spreader-doctor roll gap.



GLUE SPREADING

The packs of spread veneers are now ready for the pressing operation. They can either go directly to the hot press or more usually they first undergo a prepressing operation. The prepressing is carried out in a cold press which has one large daylight (or opening). A pack of spread veneers, usually enough for two or three hot press loads, is placed under pressure at normal atmospheric conditions. The aims of this process are to transfer the adhesive from the spread to the unspread surface of the veneer to obtain a better glue bond and to develop some strength in individual panels to make subsequent handling to the hot press easier. This decreases the amount of degrade due to handling between spreading and hot pressing.

In the hot press the spread sheets are bonded together under high temperature and pressure. It should be noted that a small amount of cold pressed plywood is still manufactured. The normal hot press temperatures range between 220^{o} and 300^{o} F and the pressures range between 120 and 200 lbf/in^2. The packs remain under the prescribed conditions of temperature and pressure until curing of the glue takes place. The result is plywood which requires sanding and trimming and is then ready for despatch.

The normal hot press has from six to thirty daylights.

Finally the plywood is trimmed to size, sanded and stamped with type and quality and packaged ready for despatch.

The adhesives used currently in the manufacture of plywood are based on synthetic resins and are all thermo-sets (including cold pressed plywood in which the adhesives are modified to cure at room temperature). As the name implies the adhesives are cured or set by the action of heat and once cured are not replasticised by any subsequent heating. It is in this way that the plywood adhesives differ from most conventional wood working adhesives. Commonly used PVA's, PVC's contact adhesives and animal glues are thermo-plastic. One cold setting adhesive commonly used in the boat building industry is resorcinol formaldehyde. This is a thermo setting adhesive.

The principal difference between the adhesives used in plywood manufacture is the degree to which they are waterproof. To ascertain the degree of waterproofness of a glueline the Standards Association of Australia, under close direction from the plywood industry and CSIRO, have defined a series of bond tests ranging from Type A to Type D in descending order of permanence.

Type of Bond	Description	Required Adhesive
A	72 hour boil (or 7 hours at 30 psi steam pressure)	Resorcinol/phenol formaldehyde Phenol formaldehyde Tannin formaldehyde
B	6 hour boil	Urea/melamine formaldehyde
C	3 hour at 70°C	Low extended urea formaldehyde
D	16 to 20 hours cold soak - 20°C	High extension urea formaldehyde

After the soaking as prescribed above, the glueline is opened with a testing chisel and visually examined for wood failure. The basic requirement concerning wood failure is that 50% of the failure must occur in the wood for the sample to pass. If this standard is reached the result is a plywood in which the glueline is always equally as strong as the parent wood.

Type A Bond

Plywood manufactured to Type A Bond has a glueline which will not deteriorate under the action of water or extremes of heat and cold. It will withstand long term stresses without degrading in any way. Plywood manufactured to Type A Bond therefore has a permanent fully waterproof glueline which can be used under long term stress in exposed conditions. It is readily recognised by the black colour of the glueline and the "Tested PAA Plywood" mark. Marine, Exterior and Structural PAA plywoods have this Type A Bond.

Type B Bond

Type B Bond plywood is incorporated within the exterior standard. However, this type of glueline due to the adhesives used, will in time break down under the action of water or when placed under long term stress. The glueline therefore cannot be termed fully permanent. For example, the Standard suggests that Type B Bond plywood can be used for concrete formwork with limited life expectancy.

Type C and D Bond

Plywoods manufactured to Type C and D Bonds are for interior use only. Products made with this bond must not be recommended for exterior use or for structural applications involving long term stresses, even in interior applications. The glueline can be readily recognised by its light colour and the "PAA Approved Interior Plywood" mark.