SAW NOTES

FROM

DIEHL MACHINES

Why use a Straight Line Rip Saw for Edging Panel Stock?

While traditional, high quality American panel manufacturers use a straight line rip saw to prepare panel stock edges, other methods such as a multiple blade rip saw or a moulder are available to the wood processor. A closer look at the process will reveal that, while not appearing to initially offer the most rapid approach to panel stock preparation, the straight line rip saw does represent the optimal method, no matter the clamping method employed.

Sawing or Edging the Panel Stock....Straight Line vs. Multiple Blade Ripping

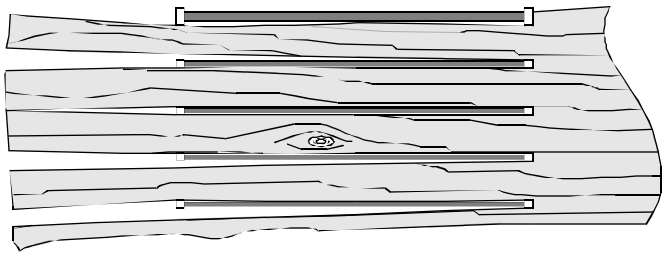
In operation, the straight line rip saw presents several unique characteristics that create the potential for a superior glue line edge. (Glue line edge is a term used to describe a high quality surface on the edge of lumber, making it suitable for panel construction.) First and foremost is the fact that it makes only one cut at a time, limiting and better controlling the stress that is relieved from the lumber in the cutting process. But this unique capability is achieved under these conditions:

a) the saw arbor and collars are running true.
b) the saw blade runs true.
c) the saw design provides a means for separating the stock so that the trailing edge of the blade cannot heel on the board's edge.
d) the saw has a means to create a hollow edge in the cutting process.

Before we address the four characteristics above, we must also explain why the straight line rip saw can best control the lumber stress when edging panel stock. As stock is ripped with a blade, depending on the grain and drying techniques, stress will be relieved. In most situations, the wider and longer the wood, the greater potential for stress relief and stock movement in the machining process. When lumber is machined on a multiple blade rip saw, the individual pieces tend to fan in and out after the sawing process, moving laterally. While the outer pieces have the potential to move away from the blade, the center pieces, no matter their movement, end up contacting a blade and creating additional saw tooth marks. This problem can be even more pronounced at the trailing edge of the lumber when all stress is relieved. At this point stock is no longer controlled on both sides of the blade and the potential for slight fish tailing is greater. This potential problem is depicted in Illustration No. One.

Illustration No. One

The general tendency of stock movement
while being machined by a multiple blade rip saw

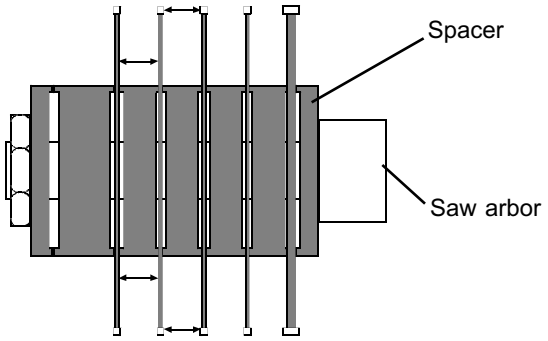


As normal lumber is multiple blade sawn, a greater amount of internal tension is relieved in comparison to a single rip cut, causing the individual pieces to fan out to varying degrees. Depending on the type of feed mechanism, the degree of lumber movement is minimized, but with simultaneous multiple cuts, even the slightest amount of stock movement reduces glue line accuracy.

Now, consider the four characteristics that will most influence a high quality cut when comparing a multiple blade rip saw to a single blade straight line rip saw.

a) Complicating the challenge of creating a glue line cut is the ability to maintain a series of blades consistently parallel to each other and presenting the stock perpendicular to the multiple blades. While the machine arbors can be constructed to achieve that process initially, the varying load placed on individual blades due to varying degree of sharpness and blade movement due to heat and a less efficient chip removal method make it extremely difficult for them to rotate without some degree of run out. (Remember that most multiple blade rip saws are over cutting designs to minimize blade projection/related blade deflection and don't allow for the optimal chip removal path from the saw blade gullet because the saw tooth is buried in the stock/chain as it breaks through the wood.) Combining the natural lumber stress relief with the combined tolerance of the arbor, saw and collar of several blades along with the natural blade movement, presents, in our opinion, conditions that can more easily produce this run-out and a lower quality edge surface. Also consider that the feed mechanism must keep a group of ripped boards parallel to each other as they are pushed into and pulled out of the blades. If any misalignment occurs, the problem is compounded because several pieces are being machined simultaneously. This concern is depicted in Illustration No. Two. *In comparison, the straight line rip saw has only one blade to be concerned with, and uses only the end of the arbor to support the blade and collars, minimizing the run-out. Concurrently, the feed works only has to contend with two pieces of stock that are being pulled apart as the cut is performed.*

Illustration No. Two
Maintaining Consistent Parallelism of blades
and stock travel in a multiple blade rip saw



As the lumber passes through the multiple blade of saws, glue line accuracy is also dependent upon maintaining parallelism between all saw blades and tracking the stock in a straight line path through the blades in addition to contending with varying degrees of tension release in the lumber itself.

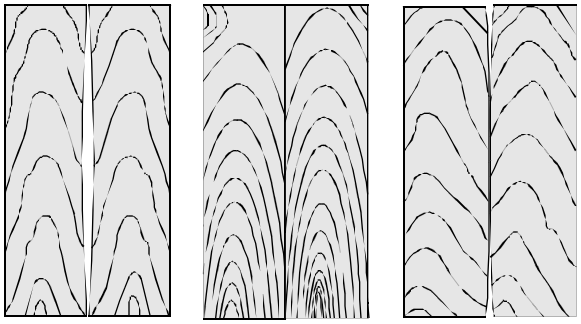
b) The second characteristic is maintaining blade tolerance integrity. As mentioned in item (a), the challenge of maintaining several blades parallel in an arbor is greater than addressing just one. In comparison, the undercutting straight line rip saw also uses a thicker blade and larger stiffening collars, though this design does reduce yield. Here, the ability to control one blade as opposed to several is an advantage for the straight line rip saw, though the straight line rip saw cannot process the volume of a multiple blade saw.

c) As a blade's teeth dull or the saw body warps slightly from heat, a saw tooth marks the stock's edge more readily on a multiple blade rip saw. This marking also occurs when significant tension is released from the lumber being cut. Unlike any multiple blade rip saw or other straight line rip saw, the Diehl saw is arranged with a means to separate the stock ever so slightly as it is carried past the saw blade, preventing lumber from coming into contact with the trailing edge of the blade. This unique characteristic eliminates marking due to all but significant blade dullness/warpage and does eliminate any concern for blade heeling as tension is removed from the lumber.

d) No matter the design of multiple blade rip saw, this kind of saw is not capable of creating a hollow cut such as the Diehl machine. A unique characteristic of the Diehl saw is that it can control the path of its feed chain to produce either a straight, a convex or a concave edge on the lumber. See Illustration No. Three. While the straight line cut is desirable in most primary edge establishing operations, the concave cut is most desirable in the production of panel stock. Since most panels generally fall into the 15" to 30" length category, the machining of a slight concave (about .002") on this edge creates an hour glass configuration of the panel components as they are placed into the clamp. Then, when the panels are clamped, this slight concave creates a built-in, center located spring tension on the panel components which insures that the ends are absolutely tight, eliminating end checking. (Checking is a term that denotes cracks in either the face of the lumber or at the point of two adjacent edges.) The combination of the consistently smooth cut edge and this concave surface provides a superior means of insuring the highest level of panel integrity, no matter the clamping means used.

Illustration No. Three

Diehl's unique ability to create
a concave lumber edge



Diehl's unique chain and chain race design allow it to create either a concave, convex or straight cut line as the material is transported past the blade. For superior panel construction, the concave cut offers the greatest assurance of a continuous glue line bond, especially at the ends of the joint.

Alternative Clamping methods and their effect on Glue Line Quality

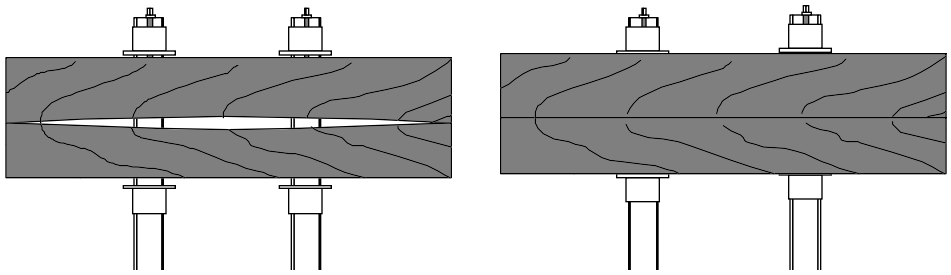
The traditional mechanical clamping system, such as manufactured by the James L. Taylor organization, provides an extremely reliable method of clamping panel stock, but cannot prevent end checking due to poor edge preparation. While it is usually true that this mechanical clamping action can better compensate for some degree of poor quality edge in comparison to high frequency or hot presses, it is better to initially create a proper lumber edge and eliminate the need to compensate for subsequent problems.

The tremendous side clamping force that can be created and maintained by the mechanical clamp process will undoubtedly pull the lumber together at the clamping points. However, no clamp will fully compensate for gaps in the lumber's edge, especially at the ends where the clamp does not focus its force. In a high frequency gluer, the side force is generally not as great as in the mechanical clamp nor is the glue curing cycle. As a result, edge preparation in this situation must be even more accurate because any glue line openings can be closed by nothing more than a facade of surface glue, with a face check developing after the sanding/cleaning process.

Therefore consider the clamping action that occurs when panel stock is edged with a slight concave - or hour glass configuration. On a nominal 25" long panel, two mechanical clamps are generally utilized, one positioned about 8" inches from either end. The result is a slight "spring resistance force" in the center, completely overcome by the mechanical clamp and causing a slightly greater force in the ends. This assures a tight glue joint all along the glue line! This mechanical clamping action, both outside and within the panel itself, is then permanently sealed and maintained by the longer curing time associated with this particular process. Illustration No. Four depicts this traditional mechanical process.

Illustration No. Four

Clamping action that occurs in a
traditional mechanical system

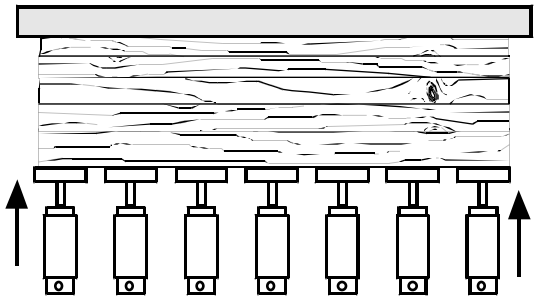


The bonding action in the center of the stock is assured due to the mechanical clamping points, and the concave edges create a compressing spring at the ends of the stock, insuring a tight "check free" joint all along the glue line.

When clamping panels with a high frequency or hot press system, the clamping method causes an alteration in the type of edge preparation provided by the saw. Since most hot press or high frequency systems provide continuous clamping force along the edge, it is generally more appropriate to edge the stock straight and not in the hour glass configuration. This straight line edge eliminates the spring tension resistance in the center of the panel. In turn, this eliminates any chance of internal panel forces overcoming a glue line that was not sufficiently cured in the charging cycle to maintain glue line integrity. The straight line cut provides equal resistance to clamping all along the glue line and will help insure complete bonding as the curing process continues outside the press. Illustration No. Five depicts this process of using a straight line cut where continuous edge clamping is used in panel construction.

Illustration No. Five

Panel construction with a straight edge to
accommodate high frequency or hot press clamping systems



Because the clamping action with a high frequency or hot press is usually continuous, (and not in points like mechanical clamps) a straight line cut is used to insure equal clamping force along the entire glue line.

Moulding or Jointing lumber edges for panel stock in comparison to Straight Line Ripping

While a moulder can be, and often is used for panel stock edge preparation, it is not the most efficient or effective process. The moulder is a less efficient process because it is not designed to process random width stock and is most productive when machining four sides off the material. In general, the moulder will cause a significant compromise in yield. Additionally, the milling action of a moulder does not provide the most desirable lumber edge in preparation for the gluing process. In particular, consider that:

a) Moulding is a more complicated and expensive process because of the: 1) lumber yield loss due to preliminary ripping, 2) need to use more skilled labor, 3) investment in a more expensive machine that should be used for operations requiring machining on all four sides of the stock simultaneously, and 4) inability of the moulder to match the consistent edge quality of the rip saw, especially in shorter pieces.

b) Moulding requires more effort and the labor of a more skilled individual. The preparation of machinery or set up time to create a straight edge is greater on a moulder and must be performed by an individual with greater skill than that of a rip saw. The moulder tooling will cost more than the rip saw. Throughout the actual machining cycle, the moulder will require more monitoring and attention to assure a quality finish that can more easily and consistently be achieved on a rip saw. Remember that in moulding, the stock is not held as securely compared to a straight line rip saw. This is because the moulder is attempting to both “machine out” the irregularities on four surfaces simultaneously and create a finish. After processing 100 pieces on both machines, the saw’s quality will be higher because lumber irregularities will not affect the saw where as they will cause the moulder to either snipe or burnish lumber.

c) No matter the design of the moulder, it is not capable of creating a concave lumber edge which provides a superior component for panel construction.

d) To mould or joint lumber, the operation is almost always preceded by a sawing operation to create at least one straight edge and probably two to create a uniform width of lumber. Thus, a preliminary ripping operation is an unnecessary loss of valuable material and time.

e) In the moulder milling process, the lumber grain is always beat down slightly, with a “burnishing” more likely to occur due to a dull knife. In comparison, the cutting action of a saw tooth creates an edge that provides for better glue penetration than the more glazed edge of the moulder knife.

Diehl’s performance in producing a consistently high quality glue line edge will create a superior panel construction in comparison to multiple blade ripping, jointing or moulding the lumber’s edge. Though one straight line rip saw cannot be as quantitatively productive as one multiple blade rip saw, it offers higher quality and more rapid versatility of performance. And, while one moulder may be able to edge two sides of a piece of lumber simultaneously, the straight line saw can more consistently create a higher number of defect free edges that present a more favorable surface for glue penetration and lumber bonding. We invite you to more carefully examine the characteristics and performance of our straight line rip saw, concluding for yourself that superior lumber preparation and panel construction begins with a Diehl.

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