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IMPROVING ROUGH MILL YIELD AT THE MOULDER

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It is estimated that 2% to 5% material is lost, on average, during production at the moulder. These losses have a major impact on the overall yield and raise the overall cost of materials. These losses, because they are smaller than losses at the primary rough mill cutting stations, are mostly overlooked by rough mill managers and personnel. Losses at the moulder are almost always related to one of the following:

- **moulder allowance**
- **the process of setting up the machine**
- **defects that occur during the machining process**
- **natural defects where the stock was not properly fed into the machine**
- **defects not properly removed in the rough mill**

While it is very unlikely that a 0% rejection rate could ever be achieved, a meager 1% improvement in recovery at the moulder of a firm that produces $6,000,000 annually in sales could lead to a net savings approaching $60,000 per year. The reason for this is because nearly all the expenditures for labor and materials have been spent prior to moulder production. When a part is rejected at the moulder it is almost impossible to reshape or cut the material into another product, so the loss is usually total.

Moulder Allowance

Perhaps the easiest way to decrease waste at the moulder is to simply reduce moulder allowance. Moulder allowance is the amount of material left on the edges of the stock from the rough mill for sizing purposes at the moulder. For many years, the industry standard has been ¼”. In recent years, several companies have started using as little as 1/8”. Part of the reason some companies have been successful using less allowance is because of the increase in gang ripping. A gang ripsaw produces a more uniform width than straight line ripping, thus requiring less stock for the moulder. A general rule of thumb when gang ripping is to use a 3/16” allowance for lengths longer than 36 inches and when moulding pieces shorter than 36 inches use an 1/8”. Some factories may find that they can use an 1/8” allowance on pieces longer than 36” in some instances. Of course, some testing should be done before you change your process to make sure a change will not be detrimental to your operation. Once a change has been made, a good quality control program should be implemented and a check done to make sure that the number of defects generated has not increased do to the change in allowance. An increase in the number of rejects being generated should not be compromised for the sake of reducing moulder allowance.

Set-Up Piece Losses

Another material saving opportunity is to eliminate pieces or parts that are lost during set-up. Traditionally, rough mills have been satisfied losing a certain amount of material during the set-up portion of moulder operations. However, in today's industry new technologies such as mechanical/digital readouts and instruments that measure a tool's cutting circle, are available on new machines. Upgrades (retrofits) for older machines also are available. By using these devices, most if not all of the set-up related losses can be eliminated. This process is referred to by the industry as "axial constant" which was coined by one of the moulder manufacturers. The process works by predetermining the location of all the spindles on the moulder prior to production and manufacturing of the knives.

Those companies that chose not to use a system like this should work to reduce the cost incurred in set-up operations by using inexpensive material (e.g. non-clear pieces) for their setup pieces. This alone can have a major impact on overall material cost in a plant.

Machine Defects

In normal moulder operations, there can be and normally are losses due to the machining process. These losses are generally referred to as rejects. Again, while a zero rejection rate may be impossible to achieve, machining defects can be reduced so that they do not have a significant impact on overall yield. Machining defects, their causes, and typical cures are listed below.

1. **Raised grain –** the roughened surface in wood characterized by the harder summerwood raised above the softer springwood, but not torn from it. <u>This happens when the knives are too dull to properly cut the fibers.</u> The fibers of the summerwood are forced down into the springwood by the cutting action of the knives causing the springwood to be compressed. These fibers may not decompress until there is slight change in the moisture content of the wood, causing the springwood to push the latewood above the surface of the stock. This defect is more prevalent in certain species like basswood and aspen. If this material has already been installed or finished when the raised grain appears, it can be very expensive for the manufacturer to replace. This defect is less likely to occur in lumber between 6% - 10% MC, also keeping the knives sharp will help prevent this defect from occurring.

2. **Fuzzy grain –** loosened ends of fibers that are raised above the surface of the stock after machining. <u>This generally happens when running wet wood.</u> The best circumstance would be to mould stock between 8%–10% moisture content. Keeping the knives sharp and increasing the hook angle and the sharpness angle on the knives can greatly improve the situation, particularly if you are having to machine stock wetter than what is ideal.

3. **Tearout or chipped grain –** characterized by pits or voids below the plane of cut, resulting from the fibers being pulled from the wood instead of being cut. <u>The defect occurs more frequently around knots, grain swirls, and stock where the average moisture content is below seven percent.</u> Making the

hook and sharpness angles more blunt, keeping the knives sharp, feeding the stock with the direction of the grain, moving chipbreakers closer to the cutting circle, taking a smaller cut, slowing down the feed rate, and installing the knives in the cutterhead as close to the circumference of the head as possible can reduce the frequency that this defect occurs.

4. **Chip bruising or chip marks –** characterized by shallow dents in the surface of the stock. <u>This defect is caused from chips that are lying on the end of the knife tip being embedded in the finished surface of the stock by the rotating cutterhead, resulting in a dent.</u> The most effective way for reducing or eliminating this defect is to provide better vacuum from the dust system so the chip is sucked away from the knife tip. Sharpening the knives and changing the chip size/type by increasing or decreasing the feed and the depth of cut can also have a positive effect.

5. **Glazed surface –** characterized by burnishing the surface of the stock to the point that it will not finish properly. This is caused from having too many knives in the finished cut. <u>This usually is a problem for jointed machines where the machine is running at too slow of a feed rate.</u> Increasing feed rate, removing knives from the cut, or not jointing the knives can fix this. Sharpening the knives can also help.

6. **Burn marks –** characterized by an extreme case of glazing where there is so much heat generated by the knives that it actually burns the fibers on the surface of the material. <u>This is normally caused from the stock not being fed continually through the machine.</u> This defect can also happen on hardwoods like oak and maple during normal operation. Increasing feed rate, grinding relief angle on knives, removing knives from the cut, and sharpening the knives can eliminate this defect. It may take one or more of these actions to completely remove the defect

7. **Chatter –** characterized by inconsistent knife marks. <u>This is usually caused from the stock not being held properly as it is fed through the machine; however, it can also be due to spindle bearing wear, loose dovetail slides, or unbalanced cutting tools.</u> Normally, repositioning the pressure shoe and chip breaker so that there is the right amount of consistent pressure across the work piece can eliminate this defect.

8. **Snipe –** characterized by a deep cut a few inches from the end of the stock on the top, bottom, or edges of the part. A snipe on the inside edge of the stock occurs when the right side of the cutterhead is not positioned tangent to the outfeed fence or the fence is not set close enough to the cutterhead. Asnipe on the outside edge of the stock occurs when the chip breaker is not close enough to the cutterhead or an inadequate amount of pressure is applied by the chipbreaker. The guide fence could also be setting out of position. A snipe on the top of the stock on the front end is either due to the pressure shoe or chipbreaker setting too far away from the cutterhead or the chipbreaker not touching

the surface of the stock. A snipe on the bottom is a result of the cutterhead not setting tangent to the outfeed table or the outfeed table not positioned close enough to the cutting circle of the head. All fences and hold-downs should be set to within 1/8” of the cutting circle.

A rejected load of mouldings can create more anxiety in a woodworking plant than any other yield related issue. One rejected load can wipe away an entire year of profits for some companies. In order to prevent this situation, all tolerances and specifications should be explicitly written on the purchase orders and then precisely followed by all moulder personnel. There are several associations, such as The Wood Components Manufacturers Association and The Wood Moulding & Millwork Producers Association, that publishes standards for buying and selling moulded products. The number of knife marks per inch should also be specified on every purchase order where moulder products are sold. These marks can be counted by measuring an inch on a piece of moulded stock and then counting the number of marks contained within the inch. There is also a formula for calculating the number of knife marks per inch that will be created at a certain feed rate.

KMPI = (Spindle RPM * Number of knives in the finished cut) / (12 * feed rate)

Example:

$$16.7\ (\text{KMPI}) = \frac{(6000(\text{rpm}) * 4\ (\text{knives in the finish cut}))}{(12\ (\text{converting feet into inches}) * 120\ \ (\text{feed rate}))}$$

Naturally Occurring Defects

There may also be defects left in the stock from the rough mill that require the parts to be oriented in a certain way when they are fed through the moulder. For instance, parts that may specify clear one face with a sound back can have defects left in them from the cutting operations that are acceptable only on one surface. Do to the profile required the parts may have to be turned a particular way in order to get the clear side on the correct surface. Manufactures that are running jointed machines (running high speed) and manufactures that run shorter stock (less than 48”) may not have time to orient these parts properly at normal operating speeds. At this stage in the manufacturing yield should not be sacrificed for production. All effort should be given to either have the parts oriented properly prior to moulder operations or provide extra personal at the moulder when production time is a concern.

Again, the rejection rate at the moulder probably can never be zero, however, significant improvement normally can be made. In most woodworking plants, materials account for 45% or more of the cost of operations, so a small recovery improvement at the moulder can have a very positive impact on overall costs in a plant.

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