Saw Guides – Increasing Productivity
Information for making an Informed Choice

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Introduction

Sawmills are finding themselves in an increasingly competitive world with immense pressures to increase output and lumber recovery to decrease costs. Many sawmills have not been able to meet these challenges and have closed putting large numbers of people out of work and affecting entire communities who have built around them.

Saw Filers/Doctors go to work every Monday never knowing what complexity they will encounter in the lumber manufacturing business. Their business is to help control the within-part and the part-to-part variability in the size and cosmetics of lumber. This variability is caused by many different problems in the manufacturing process and can dramatically affect the profitability of a sawmill.

Saw Guides for the circular saws of an edger are one of the most critical components of a sawmill. The purpose of this paper is to educate and emphasize the importance of saw guides so that sawmills and saw filers/doctors can make informed choices when it comes to saw guides and the guiding of circular saws in a sawmill edger.

Saw Guides – Why they are needed?

Many years ago sawmills ran saws that were made from thick steel plate so that the saws which were held in place by a collar could remain rigid while they were sawing lumber. The circular saw spacing was achieved in many ways including the use of spacers on the arbors that turned the saws or to tighten the saw collar to the arbor at a predictable distance.

This worked very well but as the circular saws became larger in diameter and thicker, in order to cut larger diameter lumber, this made them heavier and harder to handle. These thicker circular saw blades made for poor recovery since they produced less lumber and more chips due to the thicker plate and wider kerf. The use of saw guides changed this.

Saw guides were designed to increase the rigidity of thinner large diameter circular saw blades while cutting lumber and provide the spacing between saws that generates the dimensional aspect of lumber. The saws turn between the lubricated pads of two saw guides using a slight amount of clearance which enables them to run freely (Figure 1). Saw guides therefore provided the means for increasing recovery through the use of thinner saw blades.
What types of materials are used for Circular Saw Guides?

Many materials have been used in the manufacturing of saw guide bodies, but typically there are only two materials. These are steel and aluminum.

Steel Saw Guides

Steel saw guides have been used for many years and were initially made from just ordinary mild steel. Users found that abrasion from the saw dust and handling issues wore out the critical head area of the saw guide. Rust was also an issue by degrading the surface areas of the saw guide and causing them to be wear down faster. These issues and more decreased the accuracy of the soft steel saw guides and therefore their usefulness in guiding a circular saw.

To compensate for the soft steel saw guides, manufacturers began to harden them through various heat treatment processes where they were either case hardened or through hardened. This decreased the wear of a saw guide from abrasion but the heat treatment tended to warp the saw guides and caused manufacturing difficulties in maintaining their accuracy and fit. These manufacturing difficulties often lead to poorly manufactured saw guides and caused difficulties in the lumber manufacturing process.

Heat treatment of thinner saw guides, especially when these saw guides were through hardened or case hardened, lead in some cases to other problems which involved cracking and breaking. These thinner saw guides were primarily hardened to prevent them from bending during a collision and added abrasion resistance. Many times the collision forces were too high. The high pressure from these forces on the saw guides would crack or in worst case cause them to break off their holding system. Cracking would render the saw
guide useless, but breakage while in use would lead to very devastating and life threatening results when the fragments were thrown around at high velocity.

The next step in steel saw guide evolution was the use of advanced steel alloys which were manufactured for abrasion resistance and hardness (40 RC plus). These alloys worked very well with thicker saw guides but they were also expensive and difficult to manufacture. In the case of thinner saw guides, issues also arose where they naturally bent through the relief of inherent material stress. These bent saw guides were extremely difficult to flatten because of material memory issues. This would lead to great sawmilling inaccuracies and poorly manufactured lumber.

The latest steel saw guides are now a hybrid of lower hardness advance steel alloys (approx 27 – 30 RC) which have less inherent material stress, with the inclusion of propriety impregnating coatings that dramatically increase the hardness of the surface (up to 58 – 60 RC depending on the base material). These coatings also have the benefit of increasing rust resistance by adding surface oxides. These oxides have been tested to 200 hours of salt spray test. Impregnating also means that the coatings do not flake off as it does in the case of chrome plating (which is electro statically applied to the surface) because these coatings are imbedded into the parent steel material and change their structure.

**Aluminum Saw Guides**

The use of aluminum saw guides began many years ago and have become increasingly popular in recent years. It was widely recognized that aluminum is not as abrasion and impact resistant as steel but the need for the use of aluminum was mainly due to two reasons:

1. There was an engineering need to create larger saw guides but this was restricted by their sheer weight when manufactured from steel. These larger steel saw guides were difficult to handle and caused engineering issues in sawmill edgers where they were required to actively moved within the edger during the manufacturing of lumber such as with shifting or curve saw edgers.
2. The continuous handling of heavy steel saw guides led to injuries such as back injuries. Back injuries in sawmills are very expensive since they cause temporary or permanent loss of skilled employees as well as dramatically increasing insurance costs that are paid out due to these injuries.

With these two points in mind aluminum saw guides have become very popular because they are dramatically lighter than steel so that they reduce injuries while allowing for further engineering advancement in edger technology.

There are many different types of aluminum alloys used today. A great percentage of these alloys are used in the aircraft industry as well so that most aluminum alloys are considered aircraft grade. While it is important that it is of aerospace quality, it does not
ensure that the proper grade is being used. It is important to note that many higher strength aluminum alloys, such as 7000 series of aluminum, are more prone to corrosion because their metal content facilitates this increased corrosion in conjunction with air and water.

Since aluminum in itself is fairly soft, it is not very abrasion resistant. Anodizing is used to increase the surface abrasion resistance of aluminum. Anodizing is the use of an electrical current/acid bath and temperature (electrolytic passivation) to increase the thickness and density of the natural oxide layer on the surface of metal parts. Anodizing increases the hardness of the surface to 9 on the Moh’s Scale (approx. 667 Brinell or 61 RC).

There are basically 3 types of aluminum anodizing:

1. Type I is Chromic Acid Anodizing
2. Type II is Sulphuric Acid Anodizing
3. Type II is Sulphuric Acid HardCoat Anodizing at low temperature

For saw guides, manufacturers have typically used Type II & III. The thicknesses achieved through these two processes are dramatically different.

<table>
<thead>
<tr>
<th>Mil Spec 8625F</th>
<th>Thickness</th>
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<tbody>
<tr>
<td>Type II</td>
<td>1.8µ-25.4µ</td>
</tr>
<tr>
<td>Type III</td>
<td>12.7µ-115µ</td>
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Because Type III is much thicker than Type II it is more abrasion resistant. Type II is typically used for decorative coatings’, since the coating can be easily dyed and does provide some protection. Type II is also used when a thin coat of anodizing is required. Type III (Hardcoat Anodizing) is typically used in the industrial setting where the maximum protection of the aluminum is needed. It is important to note that typically Type III does not allow for color and is usually a dark grayish color when applied and therefore it is easy to recognize that the presence of other colors may indicate the use of Type II.

The thickness of the anodizing build is achieved with 50% of the build being within the parent material and 50% on the surface. This means that the anodized coating of an aluminum component does not typically flake off, because it is begins within the parent material. This is not the case with many other electrostatic coatings such as chrome which have a tendency to flake off.

It should also be noted that although Type III (Hardcoat) anodizing adds a thick hard surface onto the aluminum saw guide body and is very abrasion resistant, the aluminum saw guide is not impact resistant and will dent because the underlying structure is still soft.
Accuracy and Saw guides

Many steel and aluminum saw guides are in use on a daily basis all over the world. The most important aspect of a saw guide is that they are accurate.

To understand what makes the accuracy of a saw guide so important we need to go back to the beginning and look at why we use saw guides. The purpose of a saw guide is to guide the circular saw. The saws run between the lubricated babbit pads (babbit being the typical type bearing material used to support the saw) of two saw guides using a slight amount of clearance. Saw filers/doctors are taught that there should be 0.0015” (0.038 mm) of clearance between the saw blade and the saw guide babbit pad (Figure 2). The reason for this is that less clearance would make the saw guide act as a disk brake due to increased friction between the saw body and the babbit pad. More clearance would make a saw blade wobble due to decreasing support from the babbit pad. Both these extremes affect saw blade performance.

A lack of clearance applies a disk brake affect to the saw and will cause it to heat up from the increased friction. This heat build up is slowed down by the lube or coolant system of an edger system, but not eliminated. The saw will continue to heat, and then suddenly lose tension and fold over. This folding over causes expensive sawmill downtime while the saw is replaced and may lead to possible damage of edger components in the process.

In the case of too much clearance the saw begins to wobble. We see the effect of this as within board deviation. If the deviation is too large and gets out of control, money is lost because:

- The lumber will not clean up at the planer, therefore decreasing its value.
- Target sizes have to be increased to maintain the proper size at the planer, but at the cost of using more fiber.
To tightly control clearances, a saw guide must be accurate. Variation in manufactured saw guide thickness accuracies can range from and extreme of “+/-.005 (0.127mm) or worse” to between “+/-.0005” (0.0127 mm) and “+/-.001 (0.0254mm)”. The latter is typical of standard manufacturing processes found today. This accuracy may seem fairly good until it is examined.

In a typical sawmill the person responsible for maintaining the saw guides (traditionally in North America it has been the saw filer/doctor) will take a saw guide from the stack and set his babbit grinder (guide dresser, etc.) up to remove the excess babbit from the babbit pad area in order to give the saw guide an accurate clearance (0.0015” (0.038 mm)). Then the rest of the saw guides are put through the grinder at this setting. If the saw guide thickness varies +/-.0005” (0.0127mm) then the total variation in sawguide clearance will vary by 0.001” (0.0254mm) within a stack of saw guides. This means that the clearance may be increased or decreased by almost 70% in some of the saw guides. This then leads to the problems associated with too much or not enough clearance. Starting with +/-.001” (0.0127mm) or worse for saw guide accuracy will only increase the problem of too much or not enough clearance. Major sums of money have and will be lost in downtime and fiber because of these accuracies (+/-0.0005 to +/-0.001 (+/-0.0127 to 0.0254mm)).

The accuracy of a saw guide should be the best that can be manufactured so as to decrease clearance issues. Today we can see accuracies of +/-0.0002” (0.005mm). This accuracy will only increase or decrease clearance by 27% as compared to the previous example and therefore decrease clearance issues. Increased accuracy also provides for a greater payback in investment, since the more accurate saw guide will result in:

- Fewer saw blades folding over, and therefore less down time.
- More accurate sawing which allows for target size reductions and increased recovery.

**Saw Guides and the Sawmill**

Saw guides have often been described as the micrometer of a sawmill. Their continued accuracy helps to ensure that a sawmill runs smoothly. To ensure this accuracy the saw guides need to be handled carefully.

Using a good chemical pitch remover to take care of build up (pitch/resins and dirt) on a saw guide is far better then the use of rotary wire brushed and other coarse methods of cleaning that can be observed today. These coarse methods have a tendency to affect the accuracy of the saw guide by removing material from the critical surfaces.

Saw guides should also be stored and worked on in a clean area so that foreign materials are not causing abrasion and damage. The area of storage as well as the work area should have a soft surface such as plastic or wood so that the saw guides are not damaged when moved around.
When handling saw guides, they should be given the same respect as any high valued precision instrument because improper handling will also decrease their useful life expectancy exponentially.

In time as with all components, saw guides do wear out. Some good indicators of worn saw guides are:

- Increased within board deviation in the sawn lumber.
- Increased overheating and folding of saws causing downtime.
- A need to increase the saw guide clearance to get the saws to run.

It is important to remember that the above indications are only a few of the indicators of worn saw guides but the problems associated with them make it cheaper to buy new saw guides.

**Conclusion**

Saw guides have advanced the lumber manufacturing industry’s’ ability to increase recovery but there is an ever increasing need for greater recovery to remain competitive. This has driven an increased need for more accurate and repeatable saw guides.

Accurate saw guides allow sawmills to control the sawing process and generate calculated target size reductions. Accurate saw guides also allow sawmills to go to thinner saws to even further increase recovery. Increasing recovery does not only mean generating more lumber and less chips but also more revenue in the lumber manufacturing process that can help ensure the very survival of a sawmill in these ever challenging times.

**Reference**

Brown, T, D. 1986 Lumber size control. Special Publication No. 14, Forest Research Laboratory, Oregon State University, Corvallis, OR. 16pp