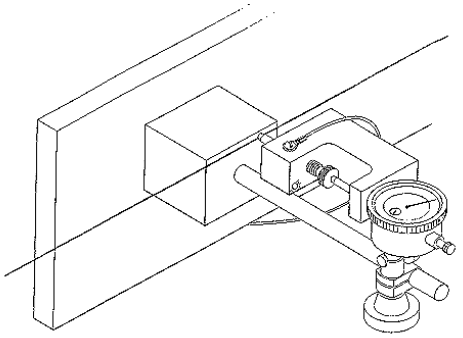
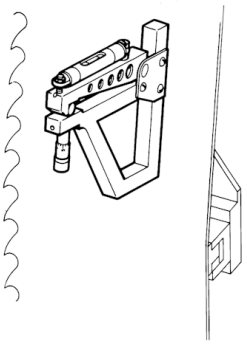
Thin Kerf Technologies Inc.

ALIGNMENT PROCEDURES AND INSTRUMENTS FOR CHIP-N-SAWS AND CANTER LINES

BoardRunner



Sensing Head



Sine Bar

PRECISION ALIGNMENT TOOLS

Measuring Instruments & Tools

Thin Kerf Technologies is your best source for instruments and practical solutions for your sawing, feeding and chipping problems. We have the mill experience, the professional skills, training, and can access the latest developments in sawing and chipping technology. TKT provides your people with training, advice, and instruments to improve the operation of your mill.

This catalogue describes the instruments needed to aligning Canter lines. It also outlines the principles of alignment using these instruments.

- **be easy to use**
- **withstand the sawmill environment**
- **be accurate and repeatable**

if you can't feed it STRAIGHT

Machine alignment requires the proper tools so that it can be done accurately and quickly. The benefits of good alignment are:

- **Correctly sized lumber**
- **Less down-time due to jamming**
- **Reduced maintenance costs because all parts are carrying their designed load.**
- **Fewer unscheduled saw changes**
- **Faster trouble-shooting**

To achieve these benefits, ***Thin Kerf Technologies*** promotes the concept of Maintenance for Accuracy, in

Guarantee: If you are not satisfied with the performance of a TKT product, return it for a full refund

Plan View Measurements

Setting up the Tight Wire

The first step is to run a wire through the system from the start of the log infeed through to the end of the outfeed of the last section of the machine. This wire should be tight and roughly level. Ideally, the wire should run from a winch for quick installation, but a come-a-long or strap winch can also be used. Hanging weights to tension the wire is awkward and dangerous It should be centered about the splined bed plates or sharp chain, and be about 4 - 6 inches above.

> **Tip** Use downrigger wire (150 lb. test) rather than piano wire. It does not kink like piano wire and it lays flat when there is no tension.

Use adjustable supports, as show on page 3, to locate the wire. Avoid using a notch filed into a bar because there will inevitably be other notches, and no one will remember which is the correct notch. Secondly, the adjustable support is designed for making quick and accurate positioning of the wire.

These supports should be bolted and dowel pinned to a substantial frame that, ideally, connects to the foundation. Also, the wire set up will be less sensitive to movement of the supports over time if these points are as far apart as possible. With this set of tools consisting of the supports located by dowel pins, and a winch, the wire should be accurately in place within 20 minutes.

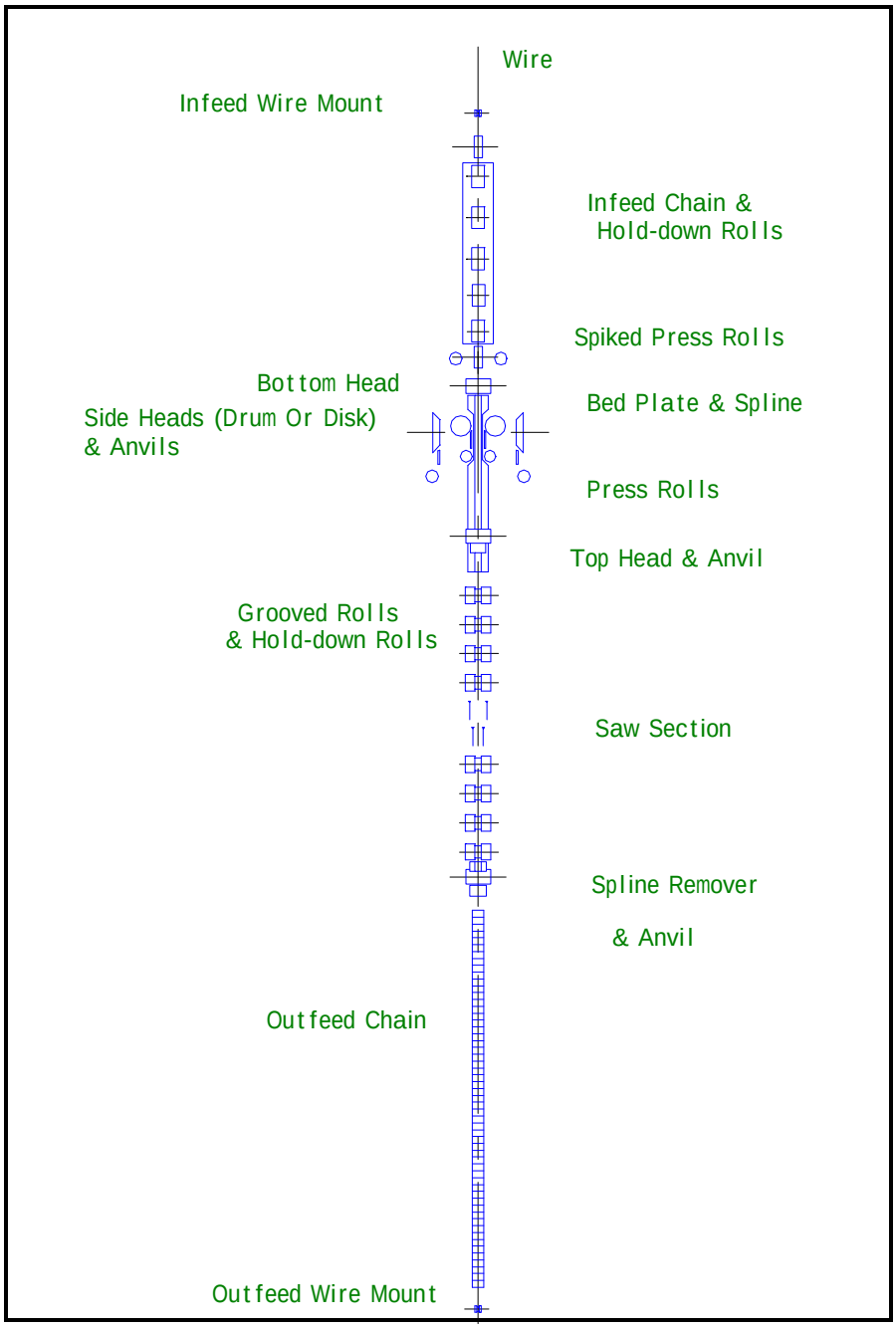
Positioning ("Bucking-in") the Wire

The basis of the wire postition is two reference points on the machine. Theoretically, any two points will work, but it may turn out that the chosen points are not very well aligned to the rest of the machine. Use the manufacturer's alignment references if they are available.

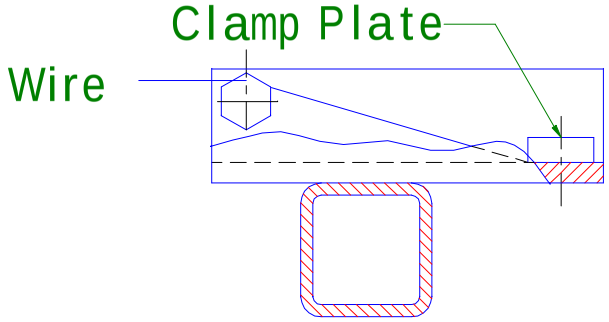
Splined bed	The reference points are the centers of the spline just after the bottom head and the last section of the spline, usually just after the saw box.
Sharp chain	Do not use reference points close to the sprockets as this area is often heavily worn. The best method is to make the wire 90^{o} to the circular saw arbours or bandsaw wheels. (Contact TKT for a description of how to do this.)

1 Set up the wire on its supports and tighten the wire. The wire should be close to the center of the spline or chain.

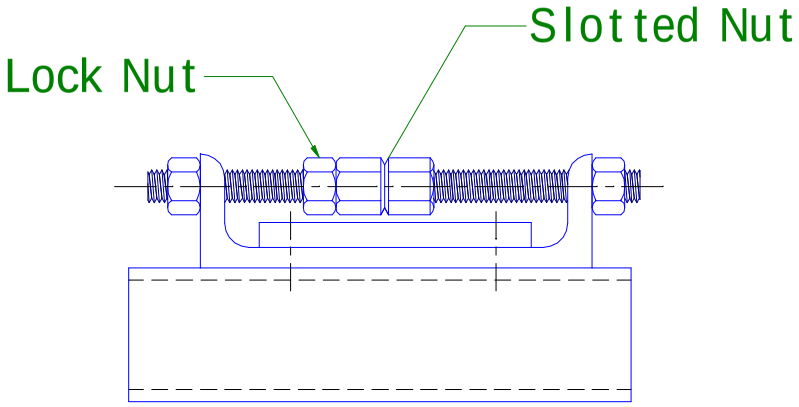
2. At the two reference locations, measure the location of the spline or sharp chain relative to the wire using the **Center Line Instrument.** (See page 5) Record the offset and the direction.



Typical Canter Layout



Side View



Support (Pinned at both ends)

Rear View

Wire Mount

. If the decision is made to move the wire, the following calculation gives the distance one end of the wire has to be moved to make the wire parallel to the spline - no trial and error

Example:

Length of wire = 46ft = 552 ins.
Distance between reference points = 38ft = 456 ins.
Difference in readings = 0.041ins.

$$D = \frac{\text{Reading} \times \text{Length}}{\text{Distance between}} = \frac{(0.041\text{ins.}) \times (552\text{ins.})}{(456\text{ins.})}$$

= 0.050 ins. = distance to move wire

5. To move the wire quickly, set digital calipers from the slotted nut to a fixed point. Zero the calipers. Move the slotted nut and watch the calipers until the distance from step 4 is reached.

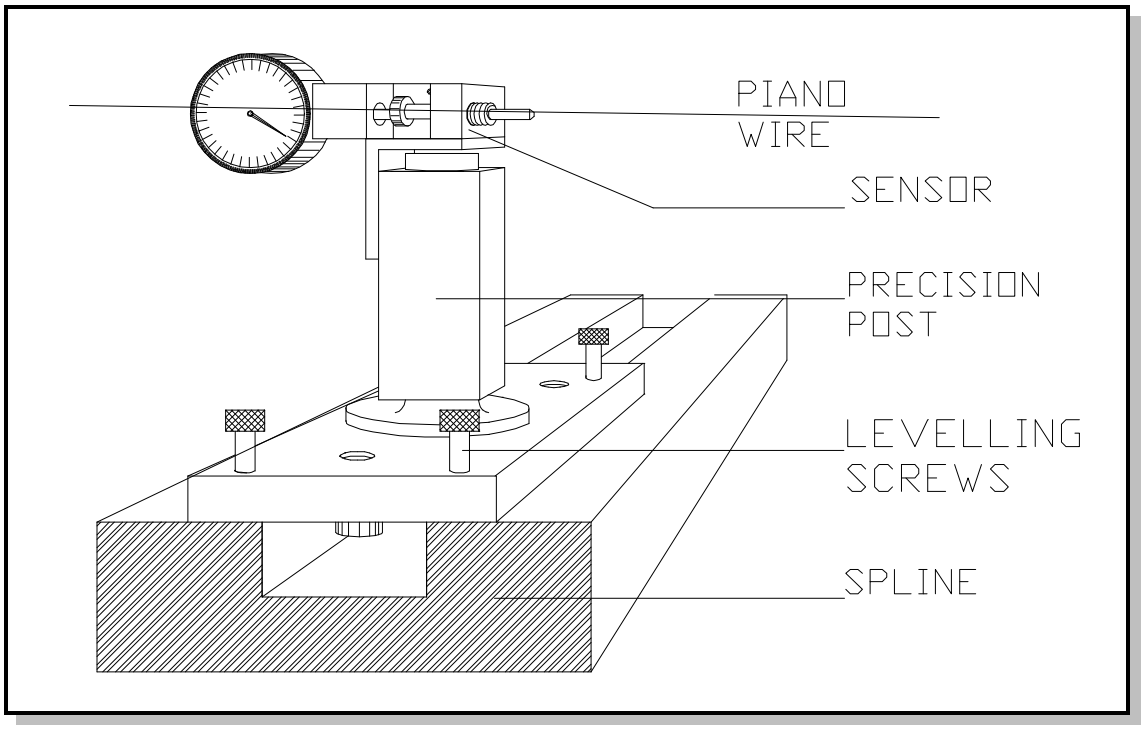
6. Recheck the measurements to ensure the move was correct. The wire will not be centered on the spline yet, but the readings at both reference points should be the same.

7. To center the wire, move both slotted nuts by the amount the reference points are off center.

8. Check the measurements at both reference points to ensure the move was correct. The wire should now be centered at both reference points.

Measurements from the wire

1. If not already done, pull the wire and tighten as described above.
2. Use the **Center Line Instrument,** as shown on page 5, to measure the spline bed plate off-center from the wire. Record (including the direction: left or right) on a work sheet.



CANTER CENTER LINE INSTRUMENT

LEAD AND SWING ARM JIGS

A swing arm is the best instrument for setting up an arbour or feed roll exactly at 90º to the wire.

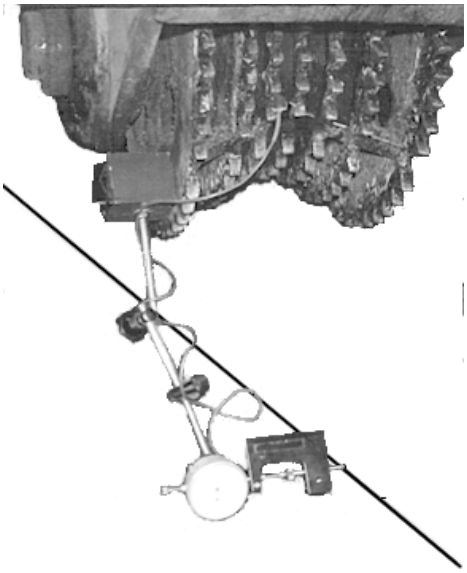
Log infeed hold down rolls

It is important that these rolls are parallel to the wire. Any misalignment will cause the log to roll to one side. The alignment of each hold-down roll is measured using the **sensing head attached to a magnetic base e**as shown on page 6.

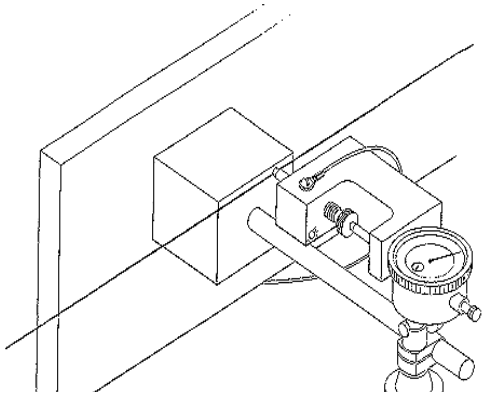
Bottom head alignment

As the bottom head produces the spline which guides the wood through the machine, it is important that the knives are directly in line with the splined bed plates.

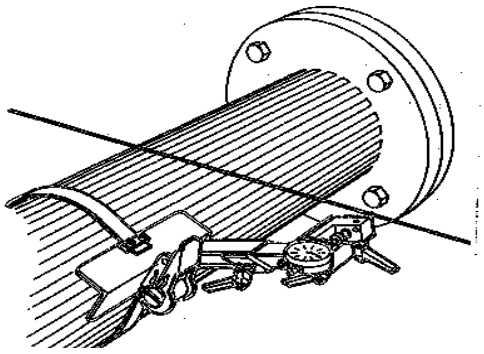
To check this, attach the **magnetic based swing arm jig** to one of the segments in the bottom head and complete steps 1 through 4 (see page 4), as for the log infeed rolls on the previous page.



Checking the infeed hold down rolls



Checking a line bar



Checking a saw arbour or bed rolls

DIFFERENT SENSING HEAD APPLICATIONS

Elevation Measurements

The **Hydro-Level** can be used to measure elevations relative to a chosen datum. The unit consists of a base, the hose, and a vial. The operating principle of the **Hydro-Level** is that the elevation of the fluid at each end of the hose are equal. It can be used to measure elevations of the log infeed chain, the spline bed plates and the vertical arbor guide support pads.

Important

Any high points or kinks in the feed will affect lumber size accuracy.

There will also be more down-time because:

- ***the wood jams or***
- ***the saws are damaged by the wood leaning on them.***

We recommend that the machine is level, and does not run up or down hill. This allows you to use a machinist's level when installing or checking a part.

The following sections describe how to measure the elevation of some of the more important components. The elevation and straightness of all components that support the log while it is being machined must be measured - from the infeed log chain to the final outfeed chain or belt.

Log infeed chain

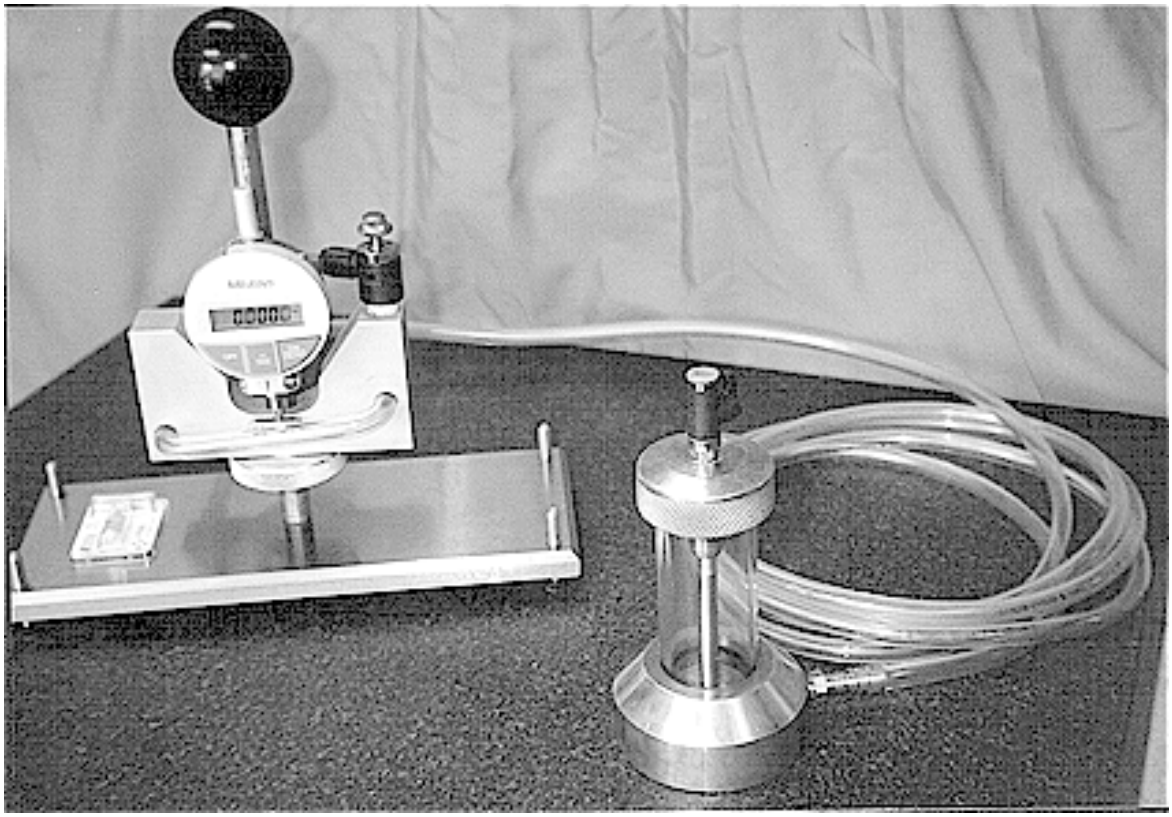
1 Set up the **Hydro-Level** base mid-way along the length of the chain.

Level and Plumb

The level and sine bar are the most useful alignment tools. Most control surfaces of a feed system should be either plumb or level. Many alignment problems can be found with a few quick checks with these instruments. They are also needed when parts are replaced.

Machinist's Level

Only a precision machinist's level should be used for alignment work. The lines on the vials are calibrated for direct reading of the slope. From the slope the amount of shim needed to level a part can be quickly calculated.



HYDRO-LEVEL

Sine Bar

The **Sine Bar** is a level mounted on a square so that the slope of a vertical surface can be measured. Rather than using the divisions on a vial to measure deviations from plumb, a micrometer adjustment is used to set the bubble to zero. The amount of off-plumb over a 5 inch distance is read directly off the micrometer. Measurements should be recorded in units of inches per 5 inches.

T**his instrument can be used to check the plumb of the**

Infeed spike rolls
Vertical anvils of the side heads
Feed rolls
Saw arbors
Guide posts
Guide support pads
Any vertical or horizontal surface.

Use the **Sine Bar** to measure how much press rolls lean forward. One degree corresponds to 0.087 in. on the **Sine Bar** micrometer

Guide support pads

These pads support the guides and determine the alignment of the saws. It is critical that these pads are parallel to the bed plate and are free from nicks and burrs. Use the Sine Bar to measure the slope of the guide support pads in horizontal arbor saws
The pads must be level or plumb to within 0.001 in./ft.

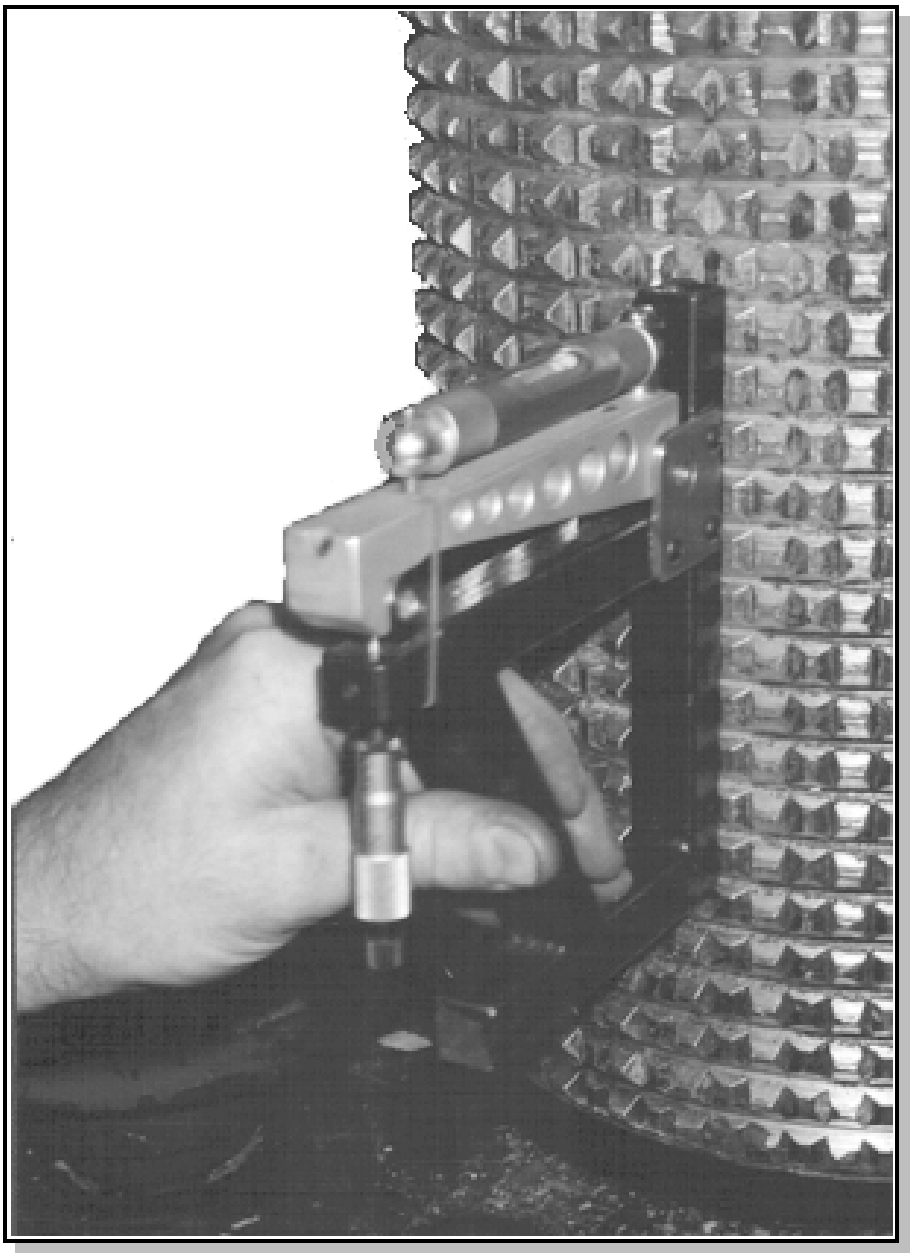
Use the **Hydro-Level** to measure the elevation of the pads relative to the bed plate and relative to each other if the saw section is a double arbor type.

Each guide and guide spacer should be checked for flatness using a dial indicator and a granite block.

Some of the difficulties that could be encountered when measuring level or plumb:

1. Measuring the plumb of the press roll faces because of the knurling.
2. The shaft of a bed roll might be bent. Check by measuring the tilt at points 180^{o} apart. If the readings are equal, but one is positive and one is negative, then the shaft is straight. If the readings are different, then the shaft is bent.
3. The face of a roll or anvil may not be straight. Take the readings where most of the contact with the wood occurs. Make a note of the wear on a work sheet.

The level of the spline bed plates should be checked in the direction at right angles to the feed (cross-level). The level of the top head anvil should be measured with a box level.

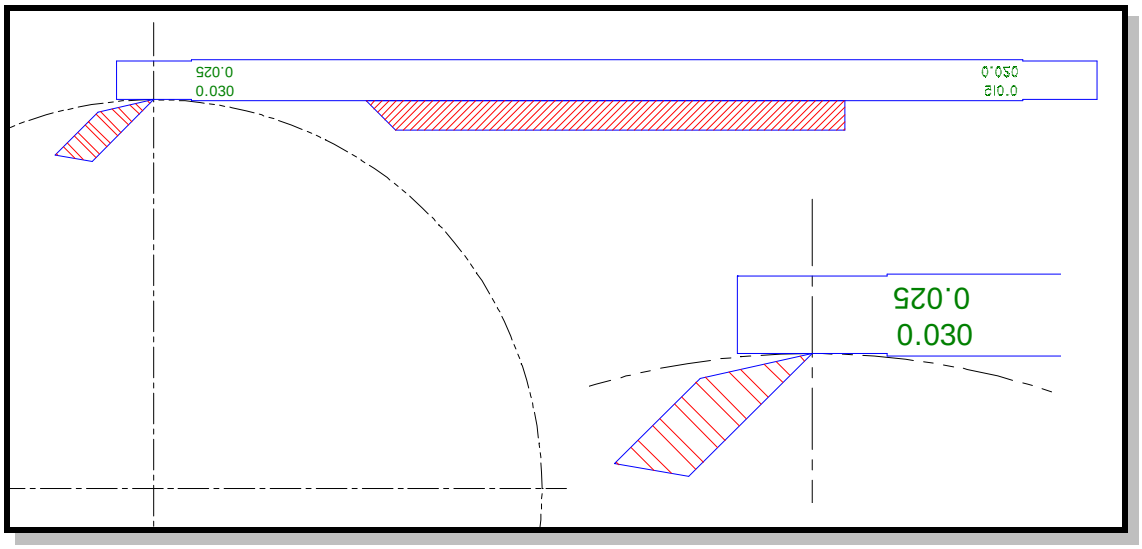


SINE BAR USED ON VERTICAL FEED ROLLLS

Measuring Knife Clearance

Use a **Notch Gauge** for setting up the knife extension from the spline bed plates or anvils. This tool is a straight edge with a notch machined at one end. Most mills target a wood to bed plate clearance of 0.030 inches. The notch is machined parallel to the straight edge, precisely at 0.015, 0.020, 0.025 and 0.030 inches.

Tip If the **NOTCH GAUGE** is too short, it will pivot about the worn front edge and give incorrect readings. Make sure it is long enough to give full support.

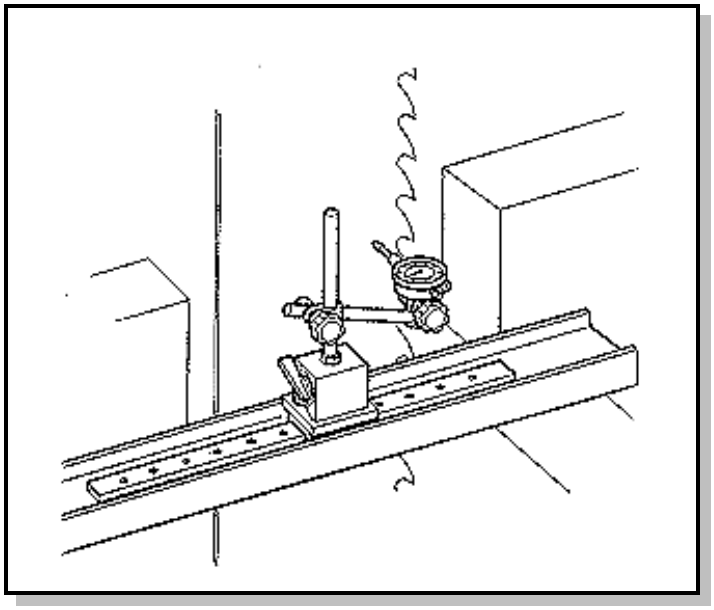


NOTCH GAUGE

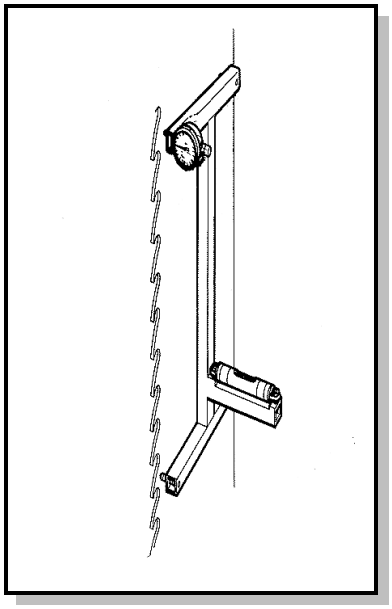
Bandsaw Alignment

If your Chip-N-Saw or canter includes a twin or quad bandsaws, you will need to check the saws for guide offset, saw cross line and level. The **Spider** is designed to check the cross line and level, and the **Sine Bar** is designed to check the guide off set.

Tip To check the parallelism of the bandmill sawguides relative to the center line of the system, set up the **CENTER LINE STRAIGHT EDGE** and take measurements using a magnetic based dial indicator attached to the linear



Center Line Straight Edge for Resaw application

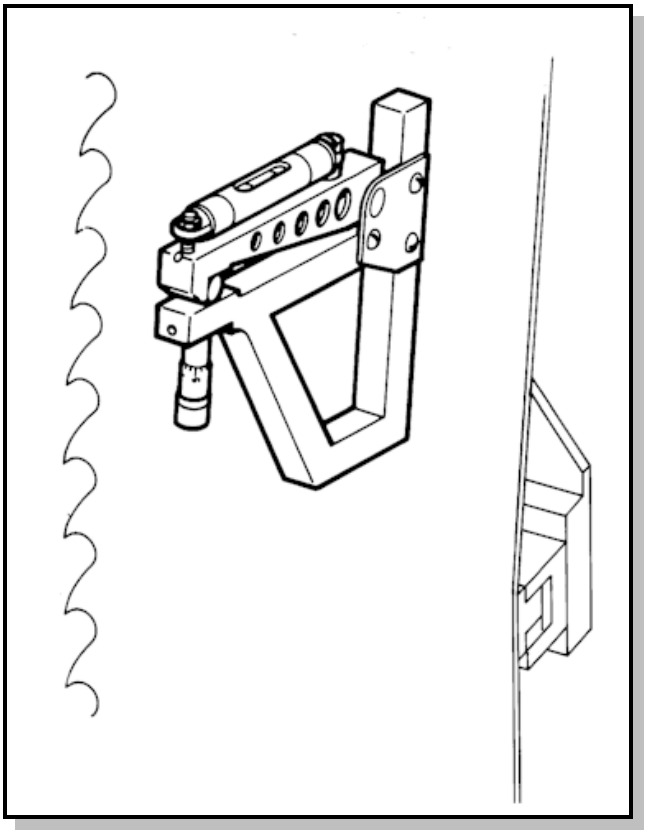


Bandsaw Spider

Bandsaw guide offset

The **Sine Bar** can be used to check both the bandasaw bottom guide offset and guide pressure. This is done by measuring the slope of the blade above the top guide. The larger the offset, the larger the slope.

1. Place the **Sine Bar** on the span between the top guide and the top wheel. Center the bubble in the level by adjusting the micrometer.
2. Record the micrometer reading, the strain and the distance from the guide to the wheel. The formula for guide offset and guide pressure is provided in the Sine Bar Manual
3. The guide pressure can be set by first calculating the required micrometer setting, then adjusting the guides in or out until the bubble is centered in the level.

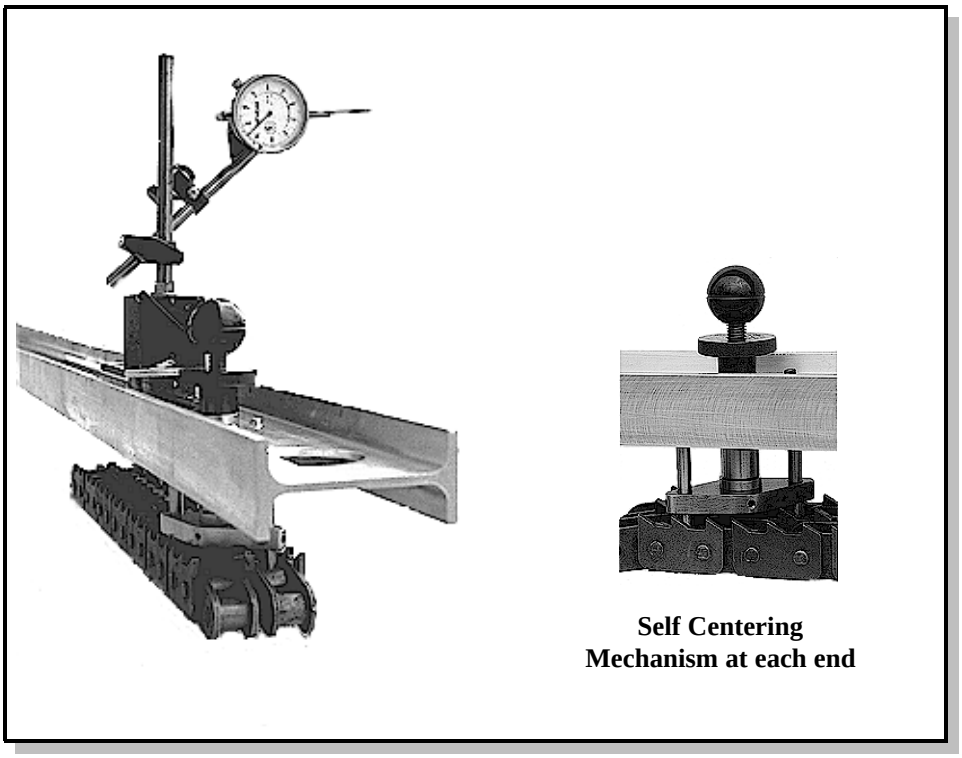


MEASURING GUIDE OFFSET

CENTER LINE STRAIGHT EDGE

When a quick alignment check is needed, and there is no time to set up the piano wire, the **Center Line Straight Edge** can be used.

This tool is an aluminum straight edge, usually about eight feet long, with a linear bearing mounted precisely parallel to the straight edge machined faces. It has a self centering mechanism at each end which precisely locates the straight edge in the splined bed plates or sharp chain. A magnetic based dial indicator is mounted on the bearing plate.



CENTERLINE STRAIGHT EDGE

Saw Selection Software

If the machine alignment is good and the machine feeds the wood straight, there is the possibility of reducing kerf or increasing feed speeds, or both. **SawSel** is designed to make circular saw specification changes relative to feed speeds, depths of cut and wood species. Just insert the disk and follow the on screen instructions.

SawSel is.....

a tool for sawfilers, maintenance managers, quality control personnel and production supervisors for making decisions about saw design and operations. *SawSel* includes the tried-and-true rules of circular saw design and incorporates the latest developments in sawing technology. *SawSel* is unique. It uses a computer model of the blade to estimate blade stiffness, which is the most important factor affecting cutting accuracy.

Uses for *SawSel*

- Assess how a change in operation affects sawing performance
- Investigate trade-offs between production and recovery
- Give warning when operations are outside accepted conditions
- Trouble shoot sawing problems
- Select saw design and feed speeds for new installations or for rebuilds
- Calculate feeds and speeds
- Teaching aid about saw operation and design
- Print out reports

Calculations

- Required gullet area
- Bite per tooth
- Recommended arbor speed
- Recommended number of teeth
- Power requirement

Uses results from sawing research to calculate:

- ***Load Index (L.I.)*** - A measure of sawing accuracy that considers blade stiffness and cutting forces
- ***Critical Speed*** - The maximum speed to run the saw before vibration instability occurs.

If your machine has bandsaws, ***BandSel*** will lead you through all the steps necessary to allow feed speed changes or kerf and plate changes. It is a complete and comprehensive software program to both teach and to help you make changes to optimize your machine's performance.

***BandSel* is.....**

a tool for sawfilers, maintenance managers and production supervisors for making decisions about saw design and operations. *BandSel* includes the tried-and-true rules of bandsaw design and incorporates the latest developments in bandsaw technology. *BandSel* is unique. It uses a computer model of the bandsaw blade, including the teeth, roll tensioning, bandmill strain, and blade speed to estimate blade stiffness, which is the most important factor affecting cutting accuracy.

Uses for *BandSel*

- Assess how a change in operation affects sawing performance
- Investigate trade-offs between production and recovery
- Give warning when operations are outside accepted conditions
- Trouble shoot sawing problems
- Select saw design and feed speeds for new installations or for rebuilds
- Calculate feeds and speeds
- Teaching aid about saw operation and design
- Store set up data for each bandmill
- Print out reports

Calculations

- Gullet Feed Index
- Bite per tooth
- Gullet area and hook length
- Recommended feed speeds
- Guide pressire
- Power requirement

Built in Factors

- Blade dimension
- Strain
- Wheel speed
- Tooth characteristics
- Wood properties
- Tensioning
- Gullet condition (grinding)
- Wheel condition

Uses results from sawing research to calculate:

- ***Bandsaw Load Index (B.L.I.)*** - A measure of sawing accuracy that considers blade stiffness and cutting forces
- ***Bandsaw Fatigue Index (B.F.I.)*** - An assessment of stresses in the blade that, when they are too high, will lead to excessive gullet cracking

Measuring Lumber

Regular Quality Control programs give you adequate information about the average thickness of the wood. As a maximum of six measurements per edge are taken, it is not possible to get a true picture of what is actually happening to the wood as it passes through the machine.

BoardRunner can take as many as 256 measurements per edge at a walking pace. The display is on board the instrument and gives a picture of the thickness profile of the wood.

Wherever a piece changes thickness, either it has moved in the machine, or the saws or chipping heads have moved. If there is any consistency in these changes in thickness, the **BoardRunner** will identify exactly where the change takes place.

Graph of two edges of a board

BOARDRUNNER

The ***BoardRunner*** not only tells you that there is a problem with lumber sizes....
.....it tells you what caused the problem so you can fix it

Consulting Services

Machine Center Audit

TKT provides specialized consulting services dedicated to improving machine center performance. We believe that before any improvements can be made to an existing system, there has to be a meaningful analysis done about how good a job the machine center is doing at present. Quality and accuracy cutting has to be related to the existing maintenance and alignment procedures. To do this TKT provides a

Method

Establish existing:

- Alignment
- Saw preparation
- Saw specifications
- Feed system functions

BoardRunner

Tooth Inspector

Objectives

Once it has been clearly identified how well the machine operates in its present condition, plans can be developed to:

- Reduce sawing variation
- Reduce Kerf
- Increase production
- Reduce maintenance

Team Training

As machines get more complex, it takes teams of individuals working together to get the best performance from a machine center. A typical machine center will need input from an alignment specialist, millwright, electrician, saw filer, Q.C. personnel, and a machine operator.

Each person in the team must understand how different team members' input effects the performance of a machine center. TKT provides "In House" seminars covering the following issues:

Quality Control
How to read the wood and measure accuracy performance.

Saw Preparation and Performance
Understanding the basics of saw preparation and saw selection.

Alignment
Understanding the issues of alignment.

Consulting Services

Vibration Analysis

TKT has the personnel and the equipment to analyse and solve mill vibration problems. Vibration can show up in many places in sawmills such as:

- Foundations
- Supporting structure
- Machine frames
- Shafts and belts
- Chipping heads
- Saws

Vibration can cause

- Premature bearing failure
- Shaft failure
- Structural cracks
- Noise and health problems
- Saw vibration

To solve vibration problems, the following has to be done:

1. Measure the levels of vibration of the machine or structure. A computer picture of the vibration patterns may be needed for complex structures.

2. Find the driving force causing the vibration, such as rotating machines or fibrating conveyors.

3. Decide if the driving force and/or the structure should be modified.

4. Build a mathematical model of the structure for designing the best method of modification. If the structure is very complex, then a Finite Element Analysis will be needed.

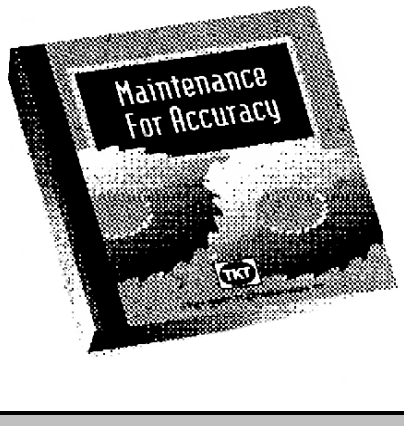
5. Specify the required changes that will reduce or eliminate the vibration.

Maintenance for Accuracy

Method

This manual is developed using the information gathered from the “Machine Audit” and it defines:

How to check alignment
When to check alignment
Alignment working tolerances
Special alignment tools
Saw specifications
Saw preparation
Guide tolerances
Filing room equipment checks
Saw change schedules
Knife change schedules
Cutting accuracy monitoring
Knife preparation
Chip quality monitoring.



BandSel and SawSel are supplied with this package

Objectives

To set up work sheets, schedules and tolerances that are realistic and achievable to keep the machine

TROUBLE-SHOOTING GUIDE

Chipped Surfaces

Knot Tear-out

- Most knot tear out is directly related to chip length. The longer the chip, the more knot tear out. For slabbing head facing knives, knot tear out usually occurs at the point where the path of the knife is 90° to the grain. The more parallel the knife is to the grain, the less the tear out.

Tip **To reduce knot tear out:**

- Increase the number of knives

- W**ood surface step lines**

When a step line appears along the surface of the chipped face, the extension(height) of knives on adjacent segments are not equal. Use a **Notch Gauge** from the anvil to measure the height from each segment.

Uneven Scallop marks.

Use a dial indicator to check and set up the knife extension(height). Keep the knife extension within 0.005" for each segment.

Tip **Causes of uneven knives:**

- Runout of knife seats in and between segments.
- Irregular babbitting.

Sawn Surfaces

Snaking

Snaky lumber is usually caused by overheated saws. Check the GFI (see formula page 24), the side clearances, the guide clearances and the lubrication system.

Bevel or Mismatch

Usually caused by saws deflecting in the cut due to too large a depth of cut relative to the feed speeds (see ***SawSel*** on page 15 to check the Saw Load Index).

When a log rolls sideways, it pushes on the top arbor saw causing it to bend out of line with the bottom saw. Check the vertical anvil clearances.

Snipe

Check the level of the infeed chain and outfeed system. Check the alignment and pressure on the infeed press rolls. Check all anvil clearances.

Formula Sheet

Saw and Tooth Shape

d	Circular saw diameter or bandmill wheel dia.(inch)
P	Tooth pitch (inch)
n	Number of teeth
k	Kerf
h	Thickness of saw plate
s	Side clearance (inch)
s_{MIN}	Minimum recommended sice clearance (inch)
a	Gullet area (square inch)

Operating Conditions

N	Shaft speed (rpm)
c	Blade (or rim) speed (sfpm)
b	Bite per tooth (inch)
D	Depth of cut (inch)
f	Feed speed (fpm)
f_{MAX}	Maximum recommended feed speed (fpm)
f_{MIN}	Minimum recommended feed speed (fpm)

Performance Prediction

GFI	Gullet Feed Index
GFI_{MAX}	Maximum allowable Gullet Feed Index 0.3 for circular saws 0.7 for bandsaws

Power Consumption

E	Estimated power required (hp)
C	Energy factor depending on wood properties C = 35 for North American softwoods 40 for dry fir 70 for hardwoods

Evidence from the Wood

X	Distance taken by 'm' bites on the board
m	The number of bites in distance X

$$c = \frac{3.14 \times d \times N}{12} \quad \text{or} \quad N = \frac{12 \times c}{3.14 \times d}$$

$$b = \frac{X}{m} \quad \text{or} \quad X = m \times b$$

$$f = \frac{b \times c}{p} \quad \text{or} \quad b = \frac{f \times p}{c}$$

$$GFI = \frac{b \times D}{a} \quad \text{or} \quad b = \frac{GFI \times a}{D}$$

$$f_{MAX} = \frac{GFI_{MAX} \times a \times c}{D \times P}$$

$$f_{MIN} = \frac{s \times c}{P}$$

$$s = \frac{k - h}{2} \quad \text{or} \quad k = h + 2 \times s$$

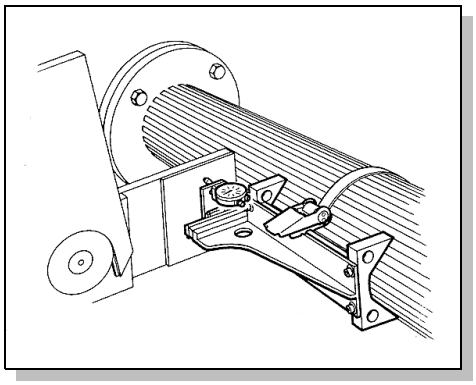
$$E = \frac{C \times k \times f \times D}{144}$$

For Circular Saws Only

$$P = \frac{3.14 \times d}{P} \quad \text{or} \quad n = \frac{3.14 \times d}{P}$$

$$b = \frac{12 \times f}{N \times n} \quad \text{or} \quad f = \frac{b \times n \times N}{12}$$

THIN KERF TECHNOLOGIES INC.



Sales Agents and Distributers in Canada, USA and New Zealand

Thin Kerf Technologies Inc.	Surrey, B.C. Canada Phone: (604) 576-9455 Fax: (604) 576-8449 Email: info@thinkerf.com Web: www.thinkerf.com
Affutage Economique Ltee.	St. Raymond, PQ Canada Phone: (418) 337-2177 Fax: (418) 337-2752
Annett Saw & Tool Ltd.	Quesnel, B.C. Canada Phone: (250) 992-9119 Fax: (250) 992-2737