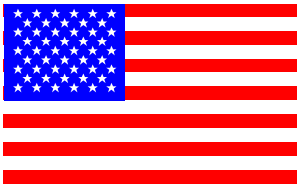
M A N U A L

Key Knife Contact Information

If you have any questions, please consult an authorized Key Knife® representative at:



Key Knife - Western US (Corporate Office)

19100 SW 125th Court
Tualatin, OR 97062
USA
Tel.: (1) 503 403-2000
Fax: (1) 503 691-2240
E-mail: sab@keyknife.com

Key Knife - Northern US

19100 SW 125th Court
Tualatin, OR 97062
USA
Tel.: (1) 503 403-2000
Fax: (1) 503 691-2240 fax
E-mail: mlb@keyknife.com

Key Knife - Southern US

2305-F HWY 378
Conway, SC 29527
USA
Tel.: (1) 843 397-7788
Fax: (1) 843 397-7787
E-mail: mrh@keyknife.com

Key Knife Western Canada

2740 Burrard St.
Vanderhoof, BC V0J 3A0
CANADA
Tel.: (1) 250 567-2447
Fax: (1) 250 567-2468
E-mail:mlb@keyknife.com

Key Knife Eastern Canada

16 Blvd. J.F. Kennedy Suite 600
St. Jerome, Quebec J7Y 4B6
CANADA
Tel.: (1) 450 438-3739
Fax: (1) 450 438-5757
E-mail: mjf@keyknife.com

Key Knife - Chile - Latinoamérica

Americo Vespucio Nte. 800 Dpt. 902
Santiago, Chile
CHILE
Tel.: (56) 9-8829 6578
E-Mail: tlc@keyknife.com

Key Knife Europe

Gewerbegebiet West/Siedlung 79
A-4843 Ampflwang
AUSTRIA
43-7675-3220 phone
43-7675-3584 fax
E-mail to: kke@keyknife.com

Key Knife South Pacific LTD.

PO Box 424
Unit 4 / 26 Isles Drive
Coffs Harbour, NSW 2450
AUSTRALIA
Tel: (61) 2-665-18123
Fax: (61) 2-665-18133
E-mail: tdp@keyknife.com

Brasil

Orion
Dorival Zotz
Rua Milano, 230 - Sao Braz
CEP 82320-420 - Curitiba – PR
Brasil
Tel.: (55) 41 327201154
Email: orion.dorival@orionltda.com.br

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High Yield User Manual • Table of Contents

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Key Knife History

1986 - Bob Bayly and Tom Carpenter joined forces in Portland, OR to design and build a disposal knife for OSB plants. After a year of work, they chose to proceed with the development of a second concept upon the recommendation of Dudley Smith, who along with Bob's mother, Jane Bayly, were two of Key Knife's first financial supporters. The second concept marked the beginning of today's version of the Key Knife.

1987 - Bob and Tom hired Cecil Ostrander to build the first prototype of a chipper system utilizing steel knife stock "borrowed" from a friendly competitor. The first installation occurred at Mountain Fir Lumber of Dallas, OR in a Mobark chipper and ran for all of 30 seconds. Once they resolved the matters of hardness and radiuses, they hired their first employee, Norma Sherratt in June of 1988 and production got underway in Cecil's barn. The achievement of producing one box of knives/day was considered a great day. Only two machines could be operated at a time due to the lack of power to the shop and the grinder was in a lean-to heated by a wood stove where the coolant had to be defrosted every morning before start up.

1989 - The production shop was moved to a 3500 sq. ft. facility in Wilsonville, OR. During this time, the official name of the privately held organization was changed from Commercial Knife to Key Knife. $30,000 in sales for a month was considered record setting at the time. A former saw shop owner and supporter; Herb Frelich became the first production manager and the Chip-n-Saw concept was introduced in 1990. Neil Doherty was hired as the first field rep in January of 1991 and the first CNC machine purchased in 1992.

1993 - The manufacturing and office relocated from Wilsonville to a 20,000 sq. ft. building in Tigard, OR and the first High Recovery system was developed. In 1994, the first Blohm (a computerized grinding machine) was purchased, revolutionizing the knife production process. Two additional CNC machines and another Blohm were purchased in 1995.

1998 - The company relocated again, moving from Tigard to a newly built 50,000 + sq. ft. facility in Tualatin, OR with room for additional expansion. A fourth Blohm and a fourth CNC have since been added along with the establishment of a machine shop center for further expansion into in-house product development. Likewise, in-house production of additional Key Knife system components is taking place on a calculated basis as part of the organization's overall strategic plan.

2004-Key Knife had a record sale year, with sales increasing 26% over 2003. To meet the growing demand for Key Knife products 3 more CNC machines were added. A new R & D test center nicknamed the Big Beaver, was added to help with the theory and design of the next generation Key Knife chipping systems. To continue the growth Key Knife has developed innovative products for the Pulp mill, Particleboard, and OSB industries. The demand for Key Knife products and services has taken the company to new parts of the world, such as South America and Asia.

About this Manual

This manual has been designed to be a user-friendly reference guide for the use and operation of your High Yield System. Included in the manual is information on the installation and operation of the System, in addition information and management tools. It is our hope that this manual becomes a useable tool for you and your mill. As always, your local Key Knife representative is always available to answer any questions that you may have.

Key Knife Patents

The Key Knife High Yield Systems are protected under the following patents: 7,069,969 B2

Safety

The Key Knife conversion is designed to provide safe and dependable service, if operated according to the instructions and intended use, in the chipping of wood material. Any other use could be dangerous and is not recommended.

Be sure to read the entire System Manual before installing the Key Knife system. Failure to do so could result in personal injury or equipment damage.

Key Knives are extremely sharp! When handling the knives, use extreme caution and wear safety gloves.

Observe all equipment shutdown, lockout, and safety procedures as recommended by the equipment manufacturers, as well as your company policies and guidelines.

Key Knife Warranty Policy

Key Knife warrants that on the date of shipment to Buyer and for one year thereafter the Products will be free of defects in workmanship and material. If within one year from date of shipment of the Products, Buyer discovers that the Products are not as warranted above and promptly notifies Key Knife in writing thereof, Key Knife will, at Key Knife's option, repair or replace the item and any affected part of the Products, or refund the purchase price therefore. Buyer shall assume all responsibility and expense for removal and reinstallation in connection with the foregoing remedy. The same obligations and conditions shall extend to replacement items furnished by Key Knife hereunder. Buyer agrees to grant Key Knife access to the Products at all reasonable times in order for Key Knife to determine the existence of a claimed defect in the Products. Key Knife Product systems and accessories require installation by an Authorized Key Knife Representative. Installation by anyone other than an Authorized Key Knife Representative will void the terms of this warranty. This warranty does not cover defects due to misuse, abuse, or improper or inadequate installation, storage, service, modification or repair of the Products.

Chapter One

Introduction

Introduction	Pg. 1
HY Segment	Pg. 3
HY2 Counterknife	Pg. 3
HY2 Clamp	Pg. 5
Dimensioners	Pg. 5
Spacers	Pg. 5
Fasteners	Pg. 6
Ridge XL Knife	Pg. 6

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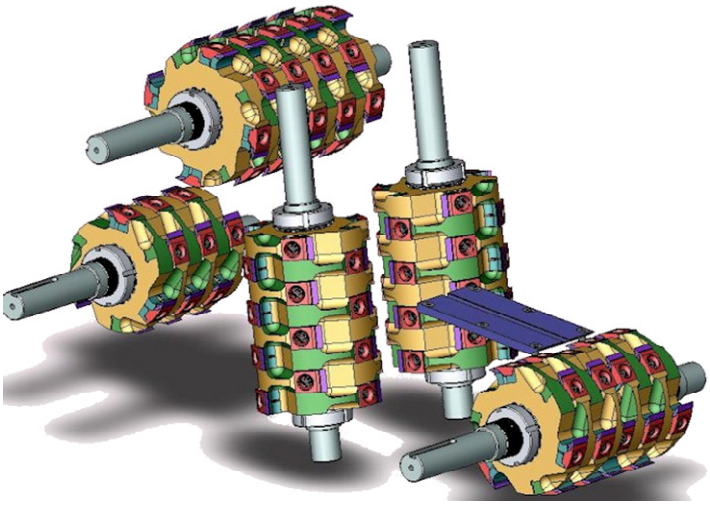
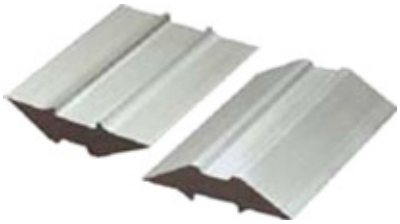


Congratulations on purchasing a Key Knife High Yield System! You have chosen the finest wood chipping technology and equipment in the industry.

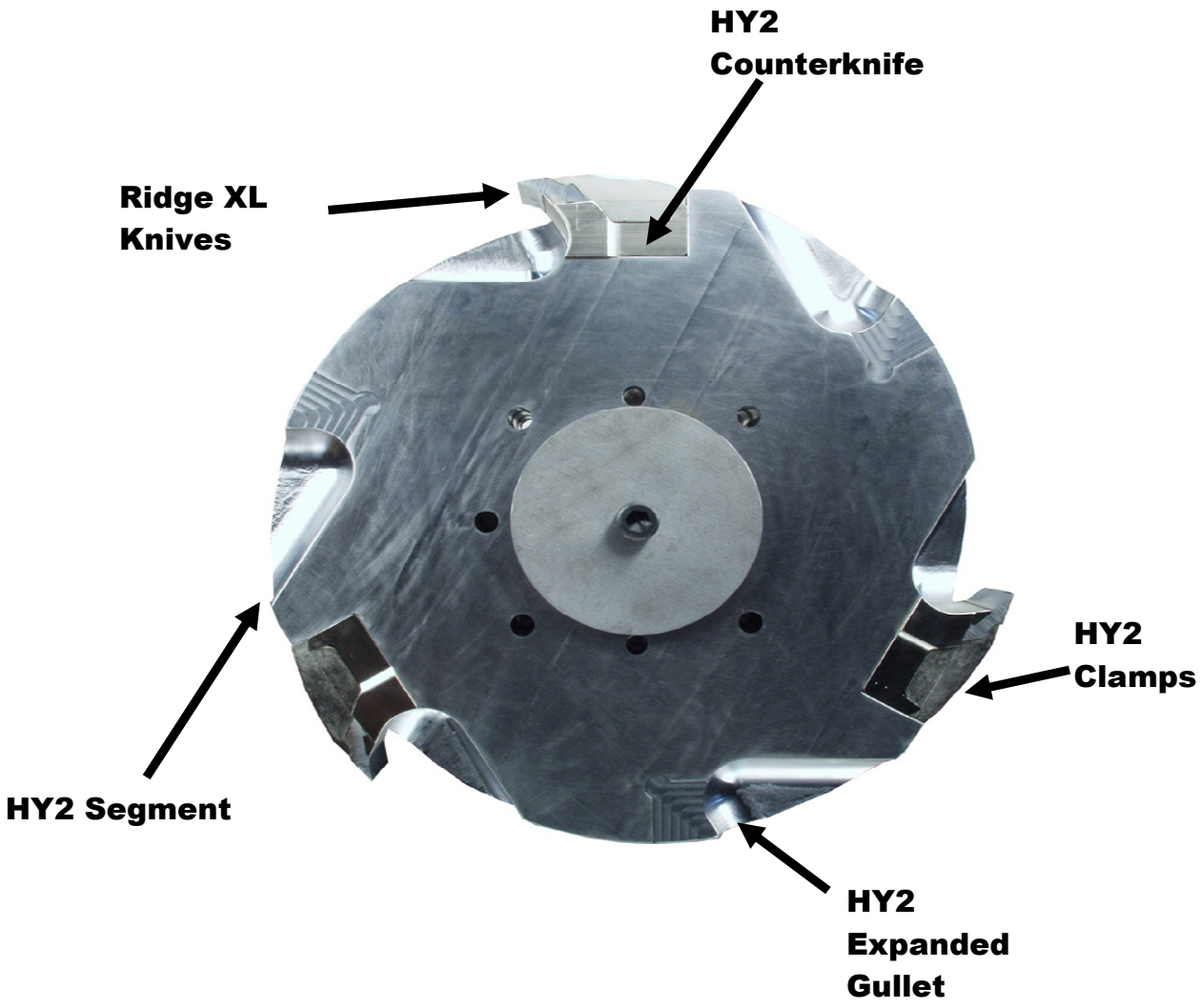
Key Knife developed the High Yield 2 (HY2) drum chipping heads for progressive mills that want to maximize the value of their wood products and improve the operating efficiencies tied directly to the process. The innovative HY2 product line delivers unmatched gains in recovery, surface finish, chip quality, and operating efficiencies.



The knife is indexible and disposable, eliminating the need for grinding and babbitting. The innovative ridge design eliminates problematic packing, protects the counterknife from wear, and improves chip quality by providing chips a smooth transition from knife tip to counterknife.

The unique design of the Ridge Knife XL makes changing knives a quick and safe process.

HY2 Segment


HY2
Counterknife
Ridge XL
Knives
HY2
Clamps
HY2 Segment
HY2
Expanded
Gullet

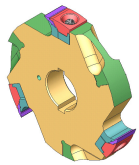
HY2 Segment

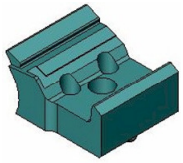
Feature	Advantage
A514 (T1) plate	Mill proven strength and durability.

The segment is the central component of the HY2 system. It is designed with smoother and larger expanded gullets improve chip flow. Knife stops are machined into each segment to lock in both ends of the Ridge Knife XL to eliminate knife twist for precise edge placement.

Each segment is dynamically balanced to minimize system vibration.

HY2 Counterknife



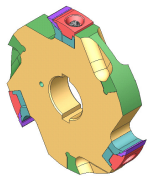
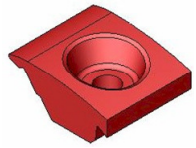


Feature	Advantage
DC 60F Coating	Mill proven to provide twice the component life than traditional spray-on coatings.
A8 Tool Steel (Chipper)	Excellent wear resistance and durability.
Nickel plated	Resistant to corrosion and cracking

The HY2 Counterknife supports the Ridge XL Knife in the head. The counterknife fits between the segment and the knife. The high capacity radius improves chip flow and relieves pressure off the chip, greatly improving chip quality.

The HY2 Counterknife can be equipped with retaining ears that ensure the precise knife placement and retention during a knife change.

HY2 Clamp

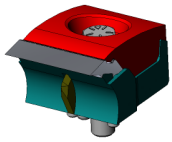
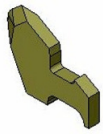



The clamp provides full contact clamping over the entire length of the knife, eliminating packing and knife flutter. A high, medium, and low profile clamp is available for various reliefs and log control needs.

Feature	Advantage
Nickel plated	Resistant to corrosion and cracking

Five Point Clamping: Significantly improves knife stability, for a precise and repeatable cutting path.

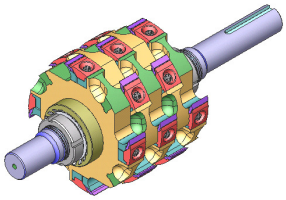
Dimensioners

Dimensioners are vertical blades situated in the counterknife used to split large chips. They are retained in the counterknife with a set screw making them easy to replace when worn or broken.

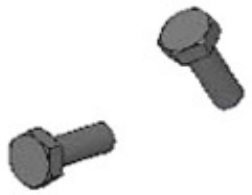
Feature	Advantage
S7 shock resistant steel	Superior strength and durability.
56-58 Rc	For maximum toughness and durability.

Spacers



Some Key Knife conversions require the use of spacers. Spacers are used when the original arbor design is used yet fewer segments are required. They are simply used to take up the extra space left from the original stack width.

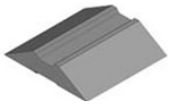
Fasteners

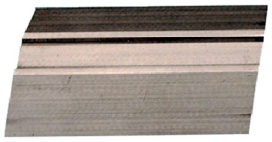


Key Knife uses only Grade 8 bolts in your Key Knife High Yield Head.

Feature	Advantage
Grade 8 Fasteners	Superior strength and durability.

Ridge XL Knife





The knife is indexible and disposable, eliminating the need for grinding and babbitting. The innovative ridge design eliminates problematic packing, protects the counterknife from wear, and improves chip quality by providing chips a smooth transition from knife tip to counterknife.

Feature	Advantage
Chipper Steel (A8)	Mill proven to provide superior strength and durability.
56-60 Rc	For maximum toughness and durability.

The knife is clamped at five points by the clamp and counterknife, significantly improving knife stability, for a precise and repeatable cut. This full surface contact minimizes knife twist and flutter. Through exceptional knife stability the High Yield System with the Ridge XL Knife delivers improved finish, chip quality, and knife life.

Chapter Two

Installation

Introduction Pg. 1

Installing High Yield System Pg. 2

Introduction

This chapter will introduce you to the proper installation of your new Key Knife High Yield Head(s). Detailed instructions for installation can be found in Appendix G.

For a complete list of tools required for installation, see Appendix C.

For appropriate torque values, reference the table in Appendix D.

Some systems might have slightly different designs that require slight adjustments to the steps highlighted below and in Appendix G. Your Key Knife Representative is always available to provide you whatever assistance you desire.

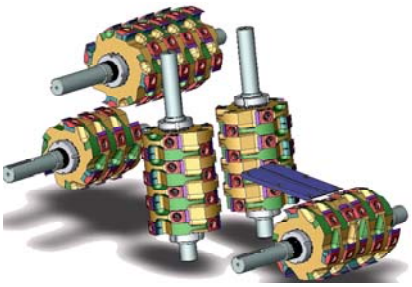
Lubricants and Shim Stock:

Key Knife recommends the use of Nickel-Based Anti-Seize compounds, such as Locktite 771, to help prevent corrosion of components.

Key Knife recommends the use of thread locking compounds, such as Locktite 242, in certain applications.

Key Knife recommends the use of either Brass or Stainless Steel Shim Stock, where shim is required.

Installing Key Knife High Yield Systems



1. Remove existing system	Follow manufacturer's procedures for safe removal. Follow Lockout / Tagout procedures.
2. Install clamps, counterknives and holders (SLICE) onto the segments.	
3. Install the segments onto the arbor(s).	Review the Engineering Prints when installing multiple heads to ensure the correct segments are installed on each given head(s).
4. Install bearings and bearing housing onto the arbors.	Follow the machine OEM and bearing manufacturer instructions.
5. Install the Key Knife heads into the machine	Follow machine manufacturers' procedures.
6. Center the heads in the machine.	
7. Install knives.	
8. Measure and adjust anvil clearance.	
9. Align the spline maker with the rail(s) on the guide.	As Required.
10. Start the machine and run for 4 – 12 hours to work in the bearings.	
11. Run logs through the machine.	
12. Check and retighten locknuts after 1-5 days of operation.	

Chapter Three

Knife Change

Introduction Pg. 1

Knife Change SOE HY2 Pg. 2-3

Introduction

The Ridge XL Knives are double-sided knives providing two cutting edges per knife. The procedure to remove and replace the knives is the same for rotating a knife as it is for replacing the knife.

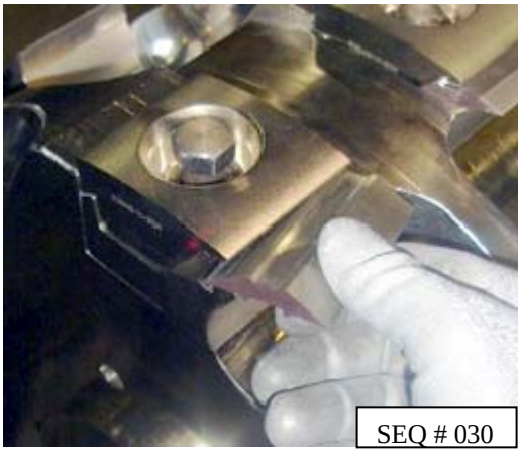
It is highly recommended that a schedule of knife changes be establish and followed. Dull and damaged knives may cause excessive stress on the system and reduce the quality of the cants. By implementing a regular schedule for knife changes, you ensure your knives always maintain optimal performance. Additionally, you will not lose production time for an unscheduled knife change in mid-shift.

During the knife change, remember to look for maintenance issues, such as worn or damaged components. See Chapter 5 for more details.

It is also important to emphasize the need to properly clean the pocket during a knife change. To provide superior results, your High Yield System is designed with precise and exact tolerances. When debris is left in the pocket, the potential for the knife not locating on the keyway exists. With proper cleaning of the pocket, your High Yield System will run safely and efficiently.

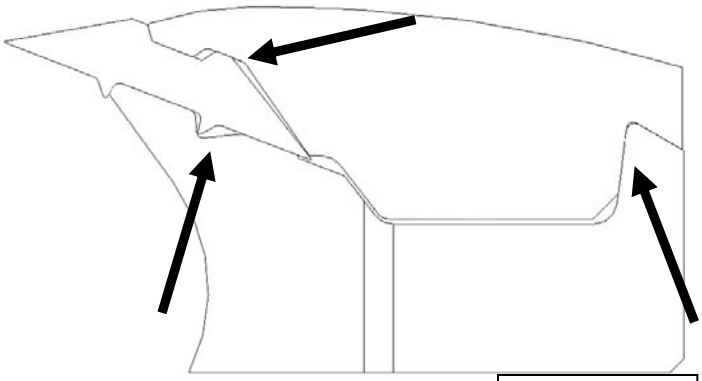
Warning: Key Knives are extremely sharp. When handling the knives, use extreme caution and always wear safety gloves. Eye and ear protection should be worn when operating tools and using compressed air during the knife change.

SEQ # 020



SEQ # 030

SEQ # 040 (a)



SEQ # 040 (b)

SEQ #	Task Description	Additional Information
010	Blow down heads with compressed air to loosen and remove any wood fibers.	
020	Loosen Clamp Bolts in the first row of knives with an impact wrench and the 13/16" socket.	
030	Remove the knives.	
040	(a) Clean all counterknife and clamp surfaces thoroughly, blow away-loosened material.	(b) Clean both the knife clamping surfaces and the shoulder at the back of the clamp/ counterknife.

SEQ # 050

SEQ # 060

SEQ # 080

SEQ #	Task Description	Additional Information
050	Clean all the knives that are to be rotated.	Use a wire brush and compressed air.
060	Position the knives into place and torque the clamp bolt with the impact wrench and torque stick.	Ensure the knives are properly located on the keyway and held firmly against the retaining ear (where appropriate) DO NOT over torque the Bolts
070	Repeat SEQ #020 - 060 for remaining knives.	
080	Spot check the torque on the Clamp Bolts with the torque wrench and 13/16" socket.	Reference Torque Specifications (Appendix D)

Chapter Four

System Set-up and Theory

Theory Pg. 1

Options Pg. 1-2

Settings and Theory Pg. 2-3

Operating Parameters Pg. 4

Theory

Key Knife's cutting edge Research and Development and expert knowledge of the sawmill industry has led to the development of the most advanced indexible knife equipment available for customization to meet your exact needs.

Using the latest testing equipment and research and development facilities, Key Knife has developed the new cutting edge HY2 System designed to add value to both your existing and future operations.

Because of our valuable research and testing, Key Knife has identified the most crucial elements to maximizing board finish, chip quality, and recovery while increasing sawmill efficiencies and uptime. This chapter will share with you some of our findings.

Options

Dimensioners

Drum style chipping heads often create larger chips that are of the appropriate thickness. Because these chips are overly large, they tend to clog chip screens. Key Knife offers dimensioners for mills where this is an issue. They are easy to install in your Key Knife heads, and help to break up those larger chips. This option is available only on HY2 Systems.

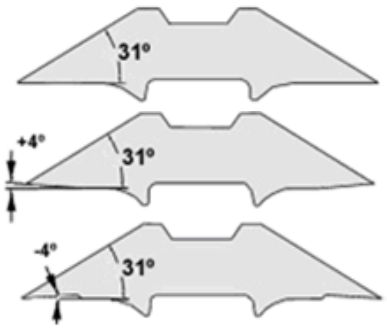
Clamp Options

Based on the specified operating parameters of the machine center and the individual head, the clamps can be custom designed for each head to provide stable surface contact with the log/cant if it begins to surge.

Where it is desirable, Key Knife will design your clamps so that one part number will work in all heads in the machine. This will greatly simplify inventory and maintenance. However, doing this will also minimize the amount of control provided by the chipping heads. If your machine has adequate control without the aid of the chipping heads, then this might be a desirable option.

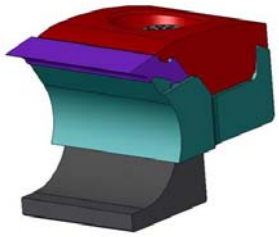
Knife Options

The Key Knife High Yield System provides additional flexibility by simply changing the Ridge XL Knife. By changing the bottom grind on the knife, a 31-degree knife may have different attack angles. These customization features allow a mill to adapt to changes in the operating environment quickly and easily.



- Standard knife with angles of 29°, 31° and 33°
- Bottom ground knives to change attack angle by +2° and +4°
- Bottom ground knives to change attack angle by -2° and -4°

Extended Counterknives



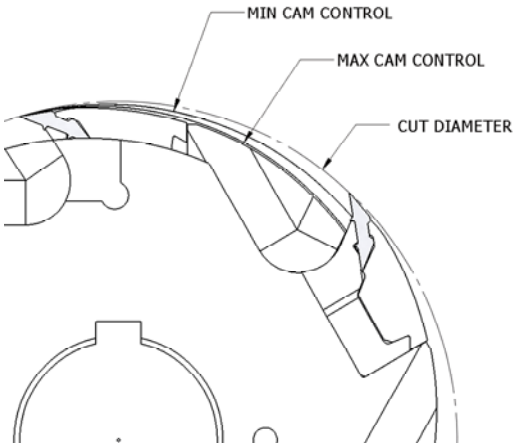
Some chipping operations see a higher rate of wear than others. For these situations, the extended counterknife is offered.

It sits in the high wear zone of the segment and is specially designed to ensure consistent chip flow without jeopardizing the integrity of the expanded gullets.

Where used, the segments must be built, or modified, to accommodate the extended counterknives.

Settings and Theory

CAM

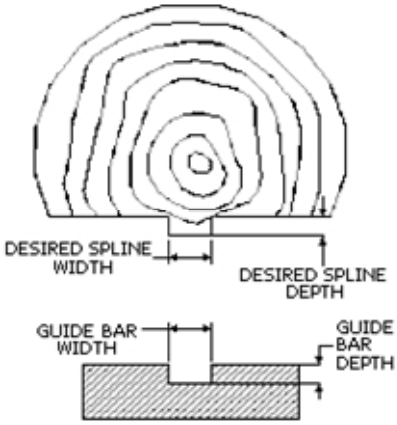


Description: Camed surfaces are the top surface profile designed into the segments to match the operating parameters of the machine center.

Function: Prevents overfeeding (surging) of the cant / log. If the cant / log attempts to surge, the profile of the segment acts as a "brake," limiting the forward movement of the cant.

Measurement: The camed surface is measured as the drop in the segment profile as measured from the knife tip.

Guide Clearance

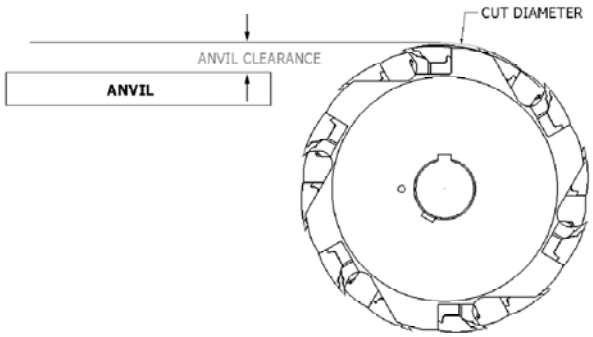


Description: The distance from the spline(s) created by the bottom head and the sides and bottom of the guide bar.

Function: The clearance must be large enough to prevent the cant from sticking in the machine. The clearance must also be small enough to prevent excessive cant movement while in the cut zone of the chipping heads and saws.

Measurement: The clearance is measured as the distance between the spline and the two sides of the guide bar as well as the distance between the bottom of the guide bar and the bottom of the spline.

Anvil Clearance



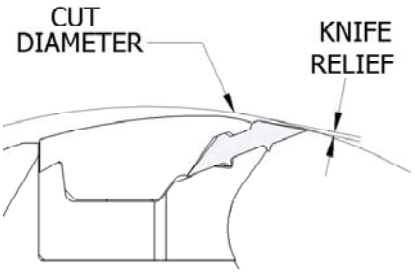
Description: The distance from the cut circle of the drum head to the anvil.

Function: The anvil clearance stabilizes the cant as it exits the cut zone of the chipping head, while providing enough clearance to prevent sticking in the machine.

Measurement: The distance from the anvil to the cut circle of the drum head measured tangent to the cut circle.

Effects of Anvil Clearance: An anvil clearance set to tight will cause excessive cant sticking in the machine causing unnecessary downtime and slowing production. However, an anvil clearance set too loose will allow excessive cant movement while in the cut zone of the chipping heads and the saws leading to inaccurate target sizes and degraded surface finish.

Knife Relief

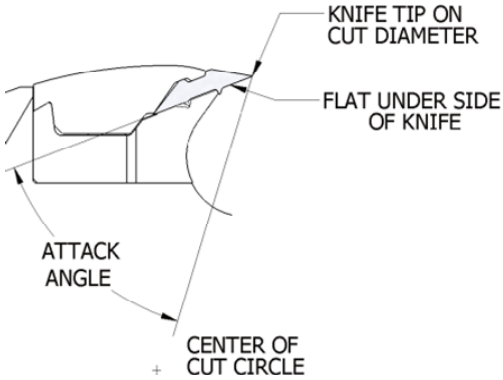


Description: The angle between the top of the knife and the cut line or cut path of the head.

Function: The knife relief provides a clearance for the top of the knife. This clearance prevents heat generation and premature dulling of the knife.

Measurement: The drop from the tip of the knife to the heel of the knife, measured in inches.

Knife Attack Angle



Description: The angle drawn between the center of the head to the tip of the knife.

Function: Attack angle controls the aggressiveness of the chipping action. The aggressiveness is directly related to the surface finish of the cant as well as knife life.

Measurement: Knife attack angle is not easily measured. It will usually be calculated once the knife relief is known.

Key Knife Customization Ability: Key Knife designs the optimum attack angle for each individual system to match the operating parameters of the mill.

Operating Parameters

Target Spline Clearance: 0.032” (1/32”) on both sides and the bottom of the spline. Splines that are to be cut into dimensional lumber will meet the mill’s desired spline dimensions.

Target Anvil Clearance: 0.020” – 0.040” Anvil clearance is dependent upon the wood species and design of the machine.

Knife Relief: Knife relief is designed for each individual system. The designed knife relief for this system can be found on the system design prints in Appendix **H**.

Target Knife Overlap: 0.031”

Chapter Five

Maintenance

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Section B. Routine Preventive Maintenance Pg. 1

Section C. Component Wear Pg. 2-4

Section D. Operating in Frozen Wood Pg. 5

Section E. Parts Rotation Pg. 5

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Section H. Key Knife Services Overview Pg. 6-7

Maintenance

Over time and heavy use, your High Yield 2 System will wear. Worn parts must be replaced as soon as possible to minimize the possibility of component failures. Proper daily knife changes and routine maintenance on the system will help ensure it runs optimally.

Section A. Daily Operations

The routine knife change is an opportune time for operators to note and report potential issues with the machine. Evidence of impact damage should always be noted and the appropriate actions taken to prevent further damage to the system.

Section B. Routine Preventive Maintenance

This section highlights the maintenance requirements for your High Yield System to run efficiently and effectively. Because each mill has different operating conditions, this schedule is considered the minimum requirement. Your Key Knife Representative can work with you to develop a maintenance schedule that fits your mill's needs.

Appendix **E** includes examples of maintenance schedules that can be used to effectively manage your mill's maintenance program.

Weekly Maintenance

- Lubricate the Clamp Bolts with anti-seize.
- Thoroughly clean debris from the keyways between the clamps and counterknives as well as the back shoulder of the clamp and counterknives.
- Visually inspect the counterknives and clamps for impact damage or wear.
- Change, or rotate, damaged components as needed.

Monthly Maintenance or 35 MMBDT, whichever comes first.

In addition to the weekly maintenance checklist, do the following:

- Remove all knives, and clamps from the head(s).
- Thoroughly clean all components.
- Check proper torque on counterknife cap screws.
- Visually inspect segments for wear or impact damage.

Quarterly Maintenance or 100 MMBDT, whichever comes first.

In addition to the monthly maintenance checklist, do the following:

- Measure and set anvil clearance
- Measure and set the guide bar clearances.
- Check the head(s) for excessive bearing movement / play.

Replace the system components, following the installation instructions found in Chapter 2 and Appendix **G**.

Section C. Component Wear

As stated in Chapter 1, your new Key Knife High Yield 2 Chipping System is designed for maximum wear ability. It also has a modular design, allowing for component rotation into and out of the work zone. This allows for longer part life.

There is a critical balance that must be maintained when deciding when / if a component is ready to be changed out. Parts must be run up to, or near their designed life. Changing too early results in waste, changing too late can result in system failure, which can outweigh savings from running a little longer.

The main components that must be watched are:

- ✓ **High Yield Counterknife**
- ✓ **High Yield Clamps**
- ✓ **High Yield Segments**

With all components, impact damage from foreign material is cause for concern, especially when that damage effects the knife clamping. Impact damage is further discussed in the Section **F**: Crash Recovery.

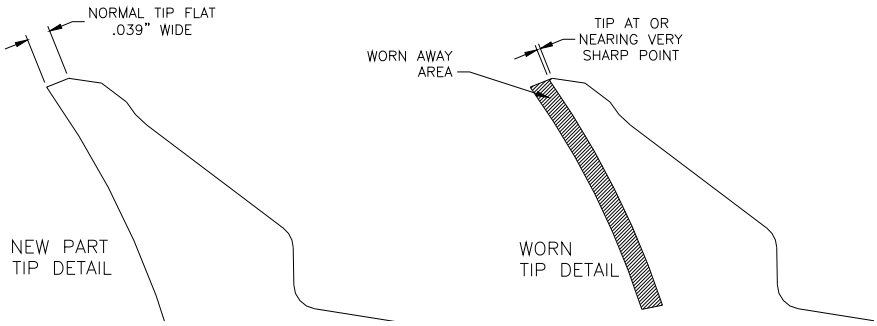
High Yield Counterknife

The counterknife is probably the most important part in the system to monitor. It experiences some of the highest wear and stress in the entire system. Counterknives will wear differently from part to part, and system to system. It is important to learn to visually recognize when a counterknife needs to be replaced, since a precise measurement, is not practical or accurate.

Chip Flow Wear: Chip Flow will eventually break through the hard surface on the face of the counterknife, and begin to remove, and dish out the base metal. This wear does not jeopardize the integrity of the system until it starts to wear into the knife clamping area of the counterknife. When this wear creates a sharp point at the keyway, the part needs to be replaced.

Here are two examples of Counterknife Chip Flow Wear that has not yet jeopardized the integrity of the knife clamping.

When the tip of the Counterknife is worn to a sharp edge, as illustrated to the right, it needs to be replaced.



CAUTION: Rebuilding of Key Knife counterknives is not recommended. The counterknife has a very precise heat treatment and several other processes. Simple rebuilding, or "re hard surfacing" erases the effects of these processes, and will result in a drastically weakened part.

High Yield Clamps

Clamps typically do not experience excessive wear from normal operation. Most damage will result from crashes in the machine center, and this is addressed in Crash Recovery Section. Typical clamp wear to be aware of include:

- **Normal Polishing Wear**
- **Keyway Wear**

Normal Polishing Wear: clamps function to hold the knife in place, and in some cases to prevent cant surging, by limiting the advance of the cant. The clamps will often show polishing wear on the top surface as a result of this limiting action. This is normal and not a cause for concern. Unless evidence of cant surging is found, or the wear appears to be unevenly distributed, this polishing of the clamp does not warrant a worn part.

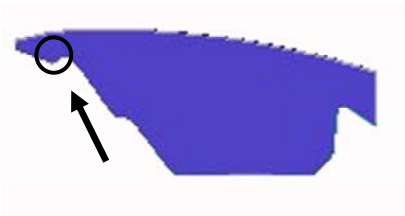
Left Clamp – example clamp that rarely contacts the cant. Note the "gun metal" appearance.

Right Clamp – example clamp that displays normal polishing wear from CAMMING.

Keyway Wear: Although not common, this is a more serious type of wear that deserves immediate attention. After several years of use, the two knife contact points on the top key may start to show wear lines and should be replaced immediately. If not replaced, the knives might not clamp properly and jeopardize the integrity of the system.

Right image – example clamp with keyway wear that needs to be replaced immediately.

Left image – look here for wear lines.



Segments

Segments typically do not experience excessive wear from normal operation. However, the expanded gullets on the segments are designed to enhance chip flow and maximize chip quality by protecting the chips in the smooth, open design. By the very nature of the design, the gullet may show **Chip Flow Wear** as a result of maximizing chip quality.

Chip Flow Wear: Chip Flow could eventually start to remove, and dish out the base metal on the segments after extended use. Normally, this is not critical wear. However, if it is a concern, retrofitting the current segment assemblies with extended counterknives will resolve the issue.

These are two examples of segment chip flow wear. In both of these examples, retrofitting the existing segments with Extended Counterknives will alleviate the problem considerably.

Section D. Operating in Frozen Wood

Operating in extreme cold weather presents many challenges in wood chipping applications. The durability of the Key Knife system has been proven to withstand the rigors of this extreme environment.

As the wood fibers freeze, the wood reacts differently. Often, a mill operating with frozen wood will see their pins and fines increase, in addition to a shift in their distribution towards thinner chips.

Contact your Key Knife representative if you have any questions regarding these conditions.

Section E. Parts Rotation

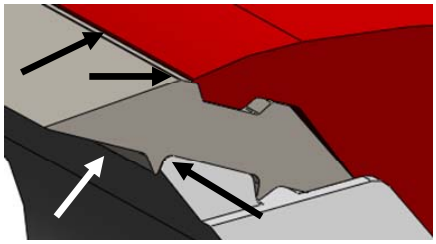
Unlike other drum style chipper systems, Key Knife High Yield parts can be rotated in and out of the high work zone for a longer part life.

When a counterknife in the high work zone is showing chip flow wear, simply rotate the part out of the work zone*. This will prolong the life of the counterknife. Clamps can also be rotated in this manner.

As each individual mill is different, your Key Knife Representative will be happy to assist you in developing a parts schedule that meets your needs and provides you with the most value.

* Note – counterknives may have different retaining ear configurations. Ensure that when replacing or rotating these components, the same configuration gets put back into the head.

Section F. System Crash Recovery



Although Key Knife High Yield Systems are extremely durable, they are not completely" bulletproof". Inadvertent crashes from foreign debris in the mill, is unfortunately a fact of life.

Fortunately, the advanced modular design of your Key Knife System is of significant value when contaminants enter the system. Instead of having to replace the entire assembly, simply replacing the damaged parts saves time and money.

After a system crash simply follow the following guidelines to get your operation up and running in a **safe** and **timely** manner.

1. Inspect all system components in the segments where damaged has incurred. Pay close attention to the components responsible for clamping the knife into place, as highlighted.

2. Replace all damaged components. (Reference Appendix **G** for instructions)
   - Always replace clamp bolts when changing clamps
   - Always replace counterknife Fasteners when changing counterknives.
   - Always replace holder fasteners when replacing the holder(s) (SLICE only).

3. Replace knives and continue operations.

Warning -Bolts and studs often sustain damage that is not readily visible. Hairline cracks are often common after a crash. If these fasteners are then put back into service, you risk another crash when they fail. Always replace bolts and studs when the component they are holding is damaged.

Key Knife is committed to the welfare of your business. If you are unable to determine the exact cause of a crash, set the damaged parts aside and contact your Key Knife Representative who can assist you investigate the cause of the crash.

Section G. Spare Parts Inventory

Maintaining an adequate supply of spare parts is a responsible method of hedging against unneeded down time resulting from a crash.

Your Key Knife Representative will work with you to provide an Operations Model that will show your projected parts usage for the year as well has the recommended quantity of spare parts. From this analysis, you can establish a scheduled deliveries program with Key Knife to ensure you have the right parts in the right place at the right time.

Although each mill is different, and there is no standard spare parts list, Key Knife recommends that at least one full set of spare parts be maintained on site. Use this general rule of thumb, and the expert knowledge of your Key Knife Representative for establishing proper inventories for success.

Section H. Key Knife Services Overview

Key Knife services are not structured around typical maintenance programs. Instead our services focus on your operation as a whole and on the areas of your operation where we can add the most value.

Your Key Knife Representatives are knowledgeable and skilled in chipping application and chip theory. Most of our Account Managers have extensive backgrounds in the forest products industry and have seen and worked on just about every type of machine running in a mill today. This knowledge is utilized to provide you with the resources necessary to increase your mill's overall operating efficiency.

At no added cost, we provide scheduled deliveries, Operations Model Analysis, benchmark reporting, and frequent checkups of your operation. By taking advantage of these value adding service programs you will lower your purchasing costs, optimize inventory levels, and always receive the right products, in the right place, at the right time.

We also offer regularly scheduled maintenance programs to ensure your Key Knife system always performs at an optimum level. This extra level of service can be customized to meet the needs of your operation, including maintenance and optimization of individual machine centers, machine center performance analysis, mill staff training, inventory analysis, troubleshooting and providing solutions.

Contact your Key Knife Representative for more information on our Service Programs.

Chapter Six

Troubleshoot

Introduction

This chapter provides some commonly seen problems that occur in all chipping operations. Most issues arrive as a result of worn or damaged components or as a result of incorrect torque on critical knife clamping fasteners.

These troubleshooting tools are not meant to be all-inclusive. They are tools to assist you in your chipping-head operation. If you have tried unsuccessfully to fix a problem, or have any questions, call your local Key Knife Representative who will assist you to maximize the operation of your Key Knife System.

Troubleshooting Matrix

Condition	Possible Cause	Corrective Action
Torn Grain	Dull or damaged knives	Replace old knives
		Reduce the number of Rehones
	Log is vibrating in cut zone	Ensure hold down rolls have adequate pressure on cant
		Ensure anvils do not have excessive clearance
	Excessive knife relief	Confirm operating parameters for system design.
Sniping	Excessive / Inconsistent anvil clearance	Ensure anvil clearance is set appropriately
	Infeed system not aligned to the machine causing long/cant to “dive” into the chipping heads	Ensure infeed system is properly aligned to the machine.
Inconsistent Scallops	High Knife causing deep scallop	Ensure there is no packing between the counterknife and knife
	Excessive knife relief	Confirm operating parameters for system design.
	Excessive anvil clearance	Ensure anvil clearance is properly set to recommended clearances
Excessive knot tear	Dull knives	Replace knives
		Reduce number of Rehones
	Excessive Chip Length	Check to ensure head RPM has not changed (slowed down) from system design
		Check to ensure the feed speed has not increased from system design.
	Insufficient knife speed	Check to ensure head RPM has not changed
	Cant is surging in the machine	Confirm operating parameters for system design

Packing between knife and counterknife	Knives not properly installed	Knives should sit squarely on both keyways
		Ensure clamp bolts are properly torque'd
	Counterknives damaged or excessively worn along keyway	Replace counterknives
	Clamps worn and bottoming out	Replace clamp immediately
	Dirt buildup on the bottom of clamp(s)	Ensure proper knife change includes cleaning keyway
		Ensure proper torque is applied to Clamp Bolts
Over-Wide Chips	Need Dimensioners	Install Dimensioners in the head(s)
	Worn or damaged Dimensioner	Replace Dimensioners
	Low knife speed	Check to ensure head RPM has not changed
Cants / boards have started Surging in the machine	Change in operating parameters	Ensure chip length settings are to designed parameters
	Feed Rolls are worn	Replace worn feed rolls
	Feed Rolls are not timed properly	Check timing of feed rolls
	Clamps are too low	Replace old, worn clamps
		Change parts to a higher clamp
	Segment is excessively worn	Check segment CAM relief
Cant sticking in machine	Anvil Clearance set too tight	Check anvil clearance and adjust accordingly
	Spline is not aligned properly with rail (HIGH YIELD)	Check spline width to ensure it is within tolerance
		Check spline clearances to ensure they are within the target parameters
	Excessive knife grinding reducing the anvil clearance	Follow Key Knife's recommended rehoning schedule
	Inadequate pressure on feed rolls	Check the feed rolls to ensure they have adequate pressure
Reduced knife life (unexplained)	Knife flutter from reduced clamping force	Replace worn / damaged counterknives
		Ensure Clamp Bolts are properly torque'd
	Foreign debris, excessive bark, sand, dirt, etc on the logs	Excessive amounts of the listed materials will degrade knife life
	Excessive knife rehoning	Follow Key Knife's recommended rehoning schedule
Chipped knives	Foreign debris, excessive bark, sand, dirt, etc on the logs	Excessive amounts of the listed materials will degrade knife life
Holders (SLICE) moves or raises up during operation	Holder not properly installed	Ensure Holder Bolts have proper torque
		Ensure holder sits square on the segment and that dowel pins seated properly
		Remove burrs, debris from beneath holder
	Segment has excessive wear	Replace worn segments where the holder can not sit squarely on the mounting surface.

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CAMS
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Dimensioners
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Fasteners
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HY2 Clamp
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Wear — Ch 5, pg. 3

HY2 Counterknife
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HY2 Segment
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Ridge XL Knife
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Anvil: A stationary (either vertical or horizontal) knife opposing the main knife assembly. The knife passes the anvil like scissors blades to cut the wood. Anvil is a sawmill term; also known as the cutter bar or bed knife to the Tree Industry.

Application: The task needing to be done with the wood, such as edging, canting, etc.

Assembly: All parts needed for a system setup (segment, clamp, holder, counterknife etc.) and the necessary hardware (bolts, screws, etc.) as a unit.

Babbitting: 1) The molten metal added to the bottom of a non-indexable knife after grinding to correct the height. 2) The process of adding babbitting to the knife.

Band Saw: A saw used as a canter or in primary recovery consisting of a continuous piece of flexible steel with teeth on one or both sides.

Bent Knife: 1)An old bent blade knife design used on conical saw heads 2) Key Knife updated the design by replacing the one knife with two smaller knives set at an angle. This term is now outdated, and the knife/knife systems should be referred to as High Recovery.

Board: A piece of lumber nominally less than 2" thick and 1 " or more wide.

Board Foot: The basic unit of measurement for lumber; equal to a 1 by 12 by 12-inch board. An 18 foot long 2 X4 would be 10 board feet, as would a 9 foot long 2X8.

Bottom Head: A cutting head/saw responsible for processing the bottom of a log.

Bow: A Flatwise deviation along the length of a piece of lumber measured at the point furthest from the optimal shape line. Bowing is the curving of the wood.

Butt: The bottom of the tree after being cut down; this end is wider and directly above the bottom-most cut on the tree (right above the stump).

Butt Log: The first log from the butt of the tree.

Camber: The curve or bend found in lumber not under stress.

Cant: 1) A log with two or more sides squared 2) A log that has gone through primary recovery and is destined for processing by other saws.

Canter: 1) Sawmill application, a) top and bottom already flat; sides are squared. b) all sides are squared 2) A cutting device to square two or more sides of a log.

Cards: Blocks of chips un-separated from each other.

Carriage: A track-mounted vehicle that carries the log through the head saw in a sawmill.

Chip: A small, thin wafer of wood cut at a precise angle to the grain with both side corrugated or striated as a result of being split from the parent wood (a log, slab, etc.) Chips are thicker and coarser than sawdust, and usually headed for a pulp mill.

Chip Accept: Any chip suitable for making pulp; not too wide or small like overs, fines, etc.

Chip 'N' Saw: A type of sawmill knife system; disk shaped segments are stacked to make a drum/barrel shaped head. Each segment has several knife pockets, and the knives are staggered along the head surface. (Note: Originally a brand name of one type of chipping head-rig, it has come to mean all such machines).

Chipper: A machine used solely for converting wood into chips.

Chipper-Canter: A machine that makes cants from logs using only chipping heads (no saws).

Chipping Head-rig: A machine that mills small logs simultaneously into lumber and chips; the outside is chipped away and the inside is sawn, usually into 2X4's.

Chute: A dry trough for moving logs from the logging area to a landing, body of water for rafting/ storage, or a mill. The trough may be wooden or gouged into the earth.

Circular Saw: A round saw with cutting teeth around the perimeter; it has been largely replaced in sawmills by band saws.

Clam Shell: Tilts the upper infeed portion of the gang upward to allow easy access to the saw guides.

Clamp: The clamp is placed on top of the knife, holding it in the knife pocket. It also provides a full length clamping force on the knife.

Clearance Angle: The angle between the ground bevel of the knife and a line tangent to the cutting circle at the knife cutting edge.

Coarse Grain: Wood grain with wide, conspicuous annual rings of less than four rings per inch.

Counterknife: An angled plate used in some knife assemblies to protect the knife assembly and aid in separating the wood. The counterknife is placed under the knife and braces it the knife pocket. Also known in the Tree Care industry as a gib.

Crook: Deviation along the edge of a piece of lumber from end to end, and measured at the point on the deviation furthest from the ideal line of cut.

Cup: Deviation along the face of a piece of lumber, measured at the point(s) not conforming to the ideal line of cut from end to end and edge to edge.

Curve Sawing: Applications performed on a curved log; generally the log remains stationary as the saws move around.

Cutter Head: Rotating planer piece that contains the knives/planers. See HUB.

Cutting Angle: The angle between the ground bevel of a knife and a line tangent to the cutting circle at the knife cutting edge.

Cutting Circle: The range of the knives on a cutting head in motion; diameter measured as the distance from the tip of one knife to the tip of the opposite knife

Cylinder: See CUTTER HEAD.

Depth of Cut: The thickness of material removed by a knife from the surface of a piece of lumber.

Dog: 1)A sawmill machine for gripping a log; for example, a dog holds a log in place prior to sawing. 2) Any device designed to bite into and hold something securely. 3) A spike designed to hold the chains on a log raft to the log.

Disk: A style of cutting heads shaped like a flat, narrow disk.

Drum: A style of cutting heads shaped like a cylinder. The head may be one piece, or made up of many segments stacked together .

Edger: 1) A sawmill application; cutting the sides off of tapered or misshapen boards. 2) A cutting device that performs this application.

Edging: Waste wood cut from misshapen lumber by an edger.

Extended Counterknife: A continuation of the counterknife designed to protect High Yield segments from chip flow wear.

Extension: See KNIFE EXTENSION.

Face: 1) A flat, rather than rounded, side of a cutting head, where the axle runs through. 2) The best looking side of a piece of lumber; the side from which the grade is determined.

Feed Speed: The rate lumber passes through a cutting assembly or assemblies. Usually measured in Feet Per Minute (FPM).

Feed Rolls: Any rolling piece of machinery, usually power driven, for moving wood up to and/or through a cutting machine at a specified speed.

Fines: Any chips very short in length, and/or less than 5.3 mm in cross-sectional measurement. Coarser than sawdust, but not big enough for accepts.

Fine Sawn: A term to describe surfaced lumber that has been passed through a saw to gain a textured face. Rougher than actual surfaced lumber, but smoother than unsurfaced lumber.

Gang: A machine designed to cut a cant into multiple boards. Usually a guided machine with multiple saw heads; to begin cutting, the cant is rotated, or the saws rotate around the cant.

Gang-saw: 1) A saw used in a gang to cut the cant into boards. 2) A number of saws on a common arbor.

Grain: A general term referring to the appearance, direction, and arrangement of wood fibers; examples include fine, coarse, spiral, vertical, and curly.

Gullet: The place on a cutting head between the cutting edge of the knife and the saw one head below; where any resulting chips/wood particles strike. This area of the cutting head wears out quickly.

Head: The entire body of the cutting assembly, hub/segments etc. and the knife assembly.

Head Rig: A carriage on rails that can transport a variety of saws/cutter heads.

Hood: In planers; part of the blower pipe that fits over the cutting head.

Holder: Is the support for the base for the counterknife, knife and clamp. It also provides a means to attach the assembly onto the hub.

Hub: The main body of a cutting assembly. The knife assemblies mount to special pockets on the hub, and as the hub turns on an axle, the knives spin to cut or chip the wood.(See HEAD). A hub can be called a cutting head, but the head can not be called a hub. Also called Rotor in the tree care industry; Segment or Drum in Chippers and Chip 'N' Saws.

Infeed: The end of the edger, gang, or planer where the wood enters the machine.

Kerf: The width of a saw cut; the amount of wood lost to sawdust after each pass of the saw (For example; 3/32 of an inch is considered narrow kerf).

Knife Extension: The amount a knife projects beyond the cutter head body/hub.

Lead Bar: See MAIN GUIDE.

Live Rolls: Powered rollers used to move lumber or cants in a sawmill.

Main Guide: A straight metal bar extending from the first bottom infeed roll to the inside saw head. The main guide directs lumber flow precisely in to the inside head.

Multi-spline: Sawmill application. A number of splines are cut into the bottom of a log to control it during processing.

OEM: Original Equipment Manufacturer.

Outfeed: Refers to the discharge end of the edger, gang, or planer.

Overs: Oversize and/or overly thick chips; any completely separated material over 76mm long and/or 10mm thick.

Pins: Very narrow chips; any material within the normal length range but less than 9.5mm and over 5.3mm wide. May also include very short chips.

Pocket: The location on a cutter machine hub where knife assemblies are mounted ('pockets' are cut into the hub).

Primary Breakdown: 1) Sawmill application; the whole log is round, cut off all sides. 2) The first processing the log experiences after being in log form.

Roll: A series of long large cylinders on individual axles mounted side by side lengthwise. Logs, lumber, and wood scraps can roll or be rolled (as in an electricity powered live roll) from one location to another.

Screening: Passing chips through a wire mesh or similar type screen in order to separate accepts from unacceptable chips.

Segment: A round, disk shaped foundation of metal that can be stacked with other segments to form the main body of a cutter head.

Setup: The preparation of a series of cutting assemblies designed to cut a specific size and pattern of lumber (planer, gang) prior to cutting a batch, including aligning and adjusting the equipment.

Shim: A thin piece of metal for filling spaces between machine parts, adjusting part extension, or bracing two pieces (i.e., filling the gap between a converted cutting head pocket and the new holder).

Side Head: A cutting assembly in a mill placed to process one side of a log.

Side Head Hold down Shoe: An adjustable metal bar positioned directly above the matcher plates at the side heads. The hold down shoe prevents lumber from moving vertically as it passes the side head knives.

Slab: A side of a log that has been cut off. See SLABBER

Slabber: Sawmill application; whole log is round, one side is cut off.

Snipe: When a log moves laterally in the machine, creating a tapered end.

Snatching: When a log jumps or surges as it goes along the mill line and does not feed through at an even rate.

Spline: A 'track' that can be sawn into the bottom of a log to make it easier to lead the log down the log line. The splines can be chipped off later.

Sweep: The curvature in a log, pole, or piling, classified as a defect.

System: A type of knife assembly used for certain applications, such as basic High Recovery, Chippers, or Chip 'N' Saw.

Tear-out: When wood splits or pulls out deeper than the knife depth of cut while being processed; resulting in a ragged, uneven surface.

Top Head Reman: Sawmill application; board is round on top or too thick; cut off top.

Torn Grain: An irregularity in the surface of a piece of wood or log.

Warp: Any variation from a true or plane surface. See CROOK, BOW, or CUP.

Wastewood: 1) Unusable wood such as ends, edges, scraps, etc. 2) The wood industry application for processing this type of waste and scrap wood into useable chips. The chippers used can be very large; free standing monoliths in sawmills, or very small; truck mounted portable chippers for arborists in the field.

Tool List

This appendix lists the tools required to install and operate a High Yield System in your mill. Table One lists the tools needed to install your system and Table Two lists the tools needed during the daily operation of the system*.

To ensure fast and smooth knife changes, and change out of wear components, Key Knife recommends that two air-lines be available at the chipper to operate pneumatic tools.

Vendor names and part numbers are provided for your convenience only and do not represent any endorsement by Key Knife, Inc.

* Note that some of the tools needed for installing your High Yield System can also be used during the daily operations of the system.

Installation of High Yield System

Item Description	Key Knife Order Number	Store Name	Order Number
Torque wrench, 1/2" drive, 50-250 ft/lbs	27802	GRAINGER	4LY37
5/32" Allen Wrench *		GRAINGER	4R615
1/4" Allen Wrench *		GRAINGER	4R615
1/4" Hex Bit Socket, 1/2" Drive *		GRAINGER	4JX16
3/8" Hex Bit Socket, 1/2" Drive *		GRAINGER	4JX16
Socket, 13/16", 1/2" drive	13407	GRAINGER	1AW41
Impact Wrench, 1/2" drive		GRAINGER	3Y495
Torque Stick, 120 ft/lb	16568		
Anti-seize, Nickel Based		GRAINGER	4KM51
Rubber Mallet / Dead Blow Hammer		n/a	
Spanner Wrench (for arbor locknuts)		n/a	
Hammer		n/a	
Center Punch		n/a	
Rags		n/a	
Machinist Level		n/a	
Notch Gauge		n/a	

* The listed part numbers are for multiple-piece sets.

Operation of High Yield System

Item Description	Key Knife Order Number	Store Name	Order Number
Impact Wrench, 1/2" drive		GRAINGER	3Y495
Socket, 13/16", 1/2" drive	13407	GRAINGER	1AW41
Wire brush		NAPA	SER 2310
Torque wrench, 1/2" drive, 50-250 ft/lbs	27802	GRAINGER	4LY37

Torque Values

Part	Description	KK Part #	Torque ft/lbs	Torque Nm
HY2 Clamp Bolt	Hex Bolt 5/8-11 UNC KK*	21667	120 - 160*	163 - 216*
Counterknife Bolt	Cap Screw Socket 5/16-18 UNC	10977	23-29	31-39
Slice Clamp Bolt	Hex Bolt 5/8-11 UNC KK*	15124	120 - 160*	163 - 216*
Holder Bolt	Cap Screw Socket 7/16-14 UNC	25403	61-76	83-103

*** KK Special Torque Recommendation**

Key Knife High Yield Monthly Maintenance Schedule

Month: _____ Machine Center: _____

Task	Week 1	Week 2	Week 3	Week 4
Clean debris from the keyways between the clamps and counterknives as well as the back shoulder of the clamp and counterknives				
Lubricate the Clamp Bolts with anti-seize.				
Inspect the counterknives and clamps for impact damage or wear. Change, or rotate, damaged components as needed.				
Remove all knives, and clamps from the head(s).				
Check proper torque on counterknife cap screws.				
Visually inspect segments and SLICE holders for wear or impact damage.				

Week 1 Notes: Conducted By: _____	Week 2 Notes: Conducted By: _____
Week 3 Notes: Conducted By: _____	Week 4 Notes: Conducted By: _____

Key Knife High Yield Quarterly Maintenance Schedule

Date: _____ Machine Center: _____

Conducted By: _____

Task	Yes	No	N/A
Clean debris from the keyways between the clamps and counterknives as well as the back shoulder of the clamp and counterknives			
Lubricate the Clamp Bolts with anti-seize.			
Inspect the counterknives and clamps for impact damage or wear. Change, or rotate, damaged components as needed.			
Remove all knives, and clamps from the head(s).			
Check proper torque on counterknife cap screws.			
Visually inspect segments and SLICE holders for wear or impact damage.			
Measure and set anvil clearance			
Measure and set the guide bar clearances			
Check the alignment of the spline maker head			
Check the head(s) for excessive bearing movement / play.			

Anvil Clearance (Right Head):		Anvil Clearance (Bottom Head):	
Anvil Clearance (Left Head):		Anvil Clearance (Top Head):	
Spline Clearance (sides):		Anvil Clearance (Spline Remover):	
Spline Clearance (bottom):			

Notes:

LESSON PLAN

Basic Operator Training for the Key Knife High Yield Systems

The following training checklist and testing materials are meant to serve as a tool for supervisors and shift leads to use in conducting new employee training, or refresher training on the Key Knife High Yield System.

The training checklist should be used in conjunction with the content of this System Manual. Next to each topic is the chapter and section identification where the instructor can find the information to be taught.

Each item on the checklist is deemed critical knowledge for operators to safely and effectively operate your High Yield System.

The Test in section two is another tool Key Knife has provided for use by the instructors to ensure that the presented material has been understood and retained by the operator(s).

Revised: ____date_____

High Yield Basic Operator Training Checklist

1. Review the System Components. Identify the name and purpose for the following items (Chapter 1):
    a. Segments
    b. Counterknife
    c. Clamps
    d. Holders (SLICE only)
    e. Clamp Bolts
    f. Ridge XL Knife

2. Installing and Replacing Clamps and Counterknives (See Appendix G "Install High Yield Clamps and Counterknives")
    a. Review procedures for removing and installing components
    b. Emphasize the use of Anti-Seize on all fasteners
    c. Emphasize the proper Torque Value for the Clamp Bolts.

3. Knife Change (See Knife Change Procedures, Chapter 3)
    a. Review the required tools to conduct a knife change.
    b. Review the procedures for removing and replacing Key Knives.
    c. Emphasize the proper cleaning of the keyway during the knife change.
    d. Emphasize proper knife location on the keyway(s).
    e. Emphasize the proper Torque Value for the Clamp Bolts.

4. Component Wear (Chapter 5)
    a. Review normal wear patterns for counterknives and clamps.
    b. Review when a counterknife and clamp should be replaced.
    c. Review the normal wear patterns for the SLICE Holder (SLICE only).

5. Proper torque values (Appendix D)
    a. Clamp Bolts
    b. Counterknife Bolts
    c. Holder Bolts (SLICE)

6. Troubleshoot the system (Chapter 6)
    a. Review the Troubleshooting Matrix in Chapter 6.
    b. Review common board finish issues and corrections.
    c. Review common maintenance issues and corrections.

7. Procedures to inspect and replace components after a crash (Chapter 5).
    a. Review the critical areas to inspect on components
    b. Review part replacement procedures (including fasteners)

Test: Basic Operator Training for the Key Knife High Yield System

Written Test

Q1 – Explain the importance of cleaning the counterknife thoroughly during a knife change.
(a) A dirty counterknife will decrease knife life.
(b) The knife will not locate on the keyway properly with excessive debris in the pocket.
(c) To increase component life.
(d) All of the above
(e) None of the above

Q2 – The purpose of the counterknife is:
(a) To support the knife in the head.
(b) To split larger chips.
(c) To provide log / cant control.
(d) All of the above
(e) None of the above

Q3 – The Counterknife should be replaced:
(a) When the chip flow finally breaks through the hard surface.
(b) When the tip of the counterknife is worn to a sharp edge.
(c) Every three months.
(d) All of the above
(e) None of the above

Q4 – After a crash, the clamp bolts should:
(a) Assumed to be fine and kept in the machine.
(b) Replaced only when the segment(s) needs to be replaced.
(c) Replaced when the corresponding clamp and / or counterknife is replaced.
(d) All of the above
(e) None of the above

Q5 – When tightening Clamp Bolts with the impact wrench and torque stick during a knife change, you should always:
(a) Spot Check the clamp bolts with the torque wrench to ensure proper torque.
(b) Check the torque on each clamp bolt with the torque wrench.
(c) Assume the clamp bolts are properly torqued.
(d) All of the above
(e) None of the above

Q6 – Give the proper torque value for the Clamp Bolts:
(a) 120 ft / lb
(b) 490 ft / lb
(c) 350 ft / lb
(d) All of the above
(e) None of the above

Q7 – The Clamps should be replaced:
(a) Whenever you feel like it.
(b) When a wear line appears on the bottom of the keyway.
(c) When normal polishing wear is uneven.
(d) Both (b) and (c)
(e) All of the above

Q8 – A recent reduction in knife life can be explained by:
(a) Foreign debris, excessive bark, sand, dirt, etc on the logs.
(b) Knife flutter from insufficient clamp bolt torque.
(c) Excessive rehoning of the knives.
(d) Both (b) and (c)
(e) All of the above

Q9 – The Keyway on the Ridge XL Knife is designed to:
(a) Index the knives into place consistently.
(b) Increase chip quality.
(c) Makes packaging easier.
(d) All of the above
(e) None of the above

Q10 – The proper torque value for the counterknife Bolt is:
(a) 25 ft /lb
(b) 70 ft / lb
(c) 120 ft / lb
(d) All of the above
(e) None of the above

Practical Application Test

PA #1 – Demonstrate a knife change

Answer Key

Written Test

Q1 – Explain the importance of cleaning the counterknife thoroughly during a knife change.
(b) The knife will not locate on the keyway properly with excessive debris in the pocket

Q2 – The purpose of the counterknife is:
(a) To support the knife in the head.

Q3 – The Counterknife should be replaced:
(b) When the tip of the counterknife is worn to a sharp edge.

Q4 – After a crash, the clamp bolts should:
(c) Replaced when the corresponding clamp and / or counterknife is replaced

Q5 – When tightening Clamp Bolts with the impact wrench and torque stick during a knife change, you should always:
(a) Spot Check the clamp bolts with the torque wrench to ensure proper torque

Q6 – Give the proper torque value for the Clamp Bolts:
(a) 120 ft / lb

Q7 – The Clamps should be replaced:
(d) Both (b) and (c).

Q8 – A recent reduction in knife life can be explained by:
(e) All of the above

Q9 – The Keyway on the Ridge XL Knife is designed to:
(a) Index the knives into place consistently

Q10 – The proper torque value for the counterknife Bolt is:
(a) 25 ft /lb

Practical Application Test

PA #1 – Provide the trainee with the necessary tools to change the knives in the Key Knife HY2 or SLICE System. Ensure the trainee properly follows the knife changing procedures as shown in Chapter 3. When the trainee has completed the procedures, check to ensure the knife is properly located on the keyway and that the Clamp Bolts are properly torqued.

Appendix G

- Installation – Segments onto Arbor Pg. 1-3
- Installation – Clamps & Counterknives Pg. 4-5
- Center – Heads in Machine Pg. 6-7
- Allign Spline Maker Pg. 8-9
- Dimensioner Pg. 10
- Tighten Locknuts on Arbor Pg. 11-12

Table of Contents

SEQ #	Task Description	Additional Information
010	Install one lock nut onto the arbor opposite the drive side.	First, determine where the nut should be located to properly locate the segments on the arbor. Top & Bottom heads should be centered. Side Heads should be installed approximately 1/4" high on the arbor to facilitate easier adjustments in the machine.
020	Stand the arbor on end, with the drive side of the arbor facing up.	
030	Install the keyway(s) onto the arbor, using a rubber mallet or dead blow hammer to ensure it is fully seated.	
040	Wipe down the arbor to ensure it is clean and devoid of burrs. Apply a thin coat of anti-seize to the arbor to assist installing the segments.	

SEQ # 050

SEQ # 060

SEQ # 070

SEQ #	Task Description	Additional Information
050	Install the first segment onto the arbor, ensuring the knife direction is correct for the rotation of the head. Slowly lower the segment down to the lock nut: DO NOT let it slam onto the lock nut.	Reference the engineering prints for proper segment count and alignment. See Appendix **H**. Lightly jiggle the segment if it doesn't easily slide onto the arbor.
060	Install the remaining segments onto the arbor, ensuring that each alternating segment is installed opposite the previous.	Allow these subsequent segments to slam into place. Install spacers onto the arbor as referenced on the engineering prints. See Appendix **H**.
070	Install the lock ring on the drive side of the arbor. Bend down one locking tang so that it extends into the tang hole on the segment and the ring lays flat and centered on the segment.	

SEQ #	Task Description	Additional Information
080	Install the remaining lock nut onto the drive side of the arbor and tighten.	Ensure the lock ring remains centered on the arbor, and on the nut itself.
090	Lay the arbor down on it's side. Remove the first locknut and install the lock ring and lock nut per SEQ #070 - 080.	
100	Tighten the locknut on the arbor with a spanner wrench or center punch to snug the segments into place.	**Do Not push down the locking tang until heads are properly centered in the machine.**

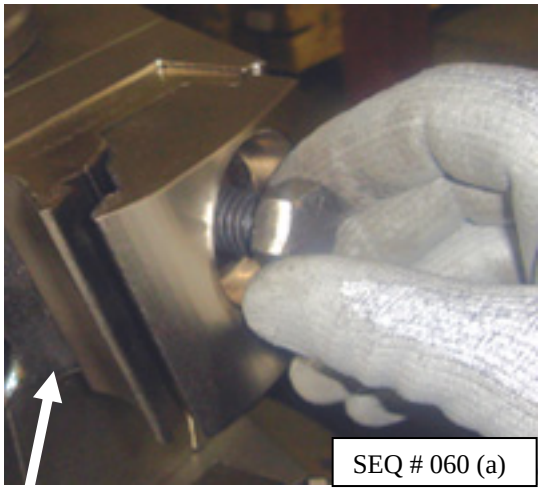
SEQ # 030 (a)

SEQ # 030 (b)

SEQ # 040

SEQ #	Task Description	Additional Information
010	Inventory on-hand components.	Reference the system prints located in Appendix **H**.
020	Thoroughly clean the segment mounting surface (s).	Remove all debris and burrs.
030	Position the counterknives on the segment.	Use a plastic hammer to seat the counterknives flush on the segment (as required).
040	Install the Counterknife cap screws and tighten until snug.	Use nickel-based anti-seize on bolts.

SEQ # 050

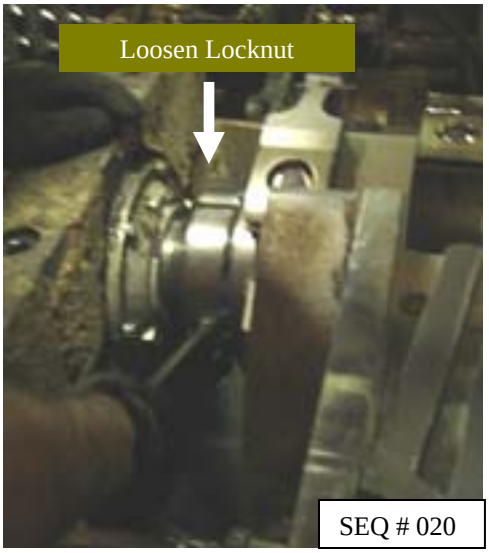


SEQ # 060 (a)

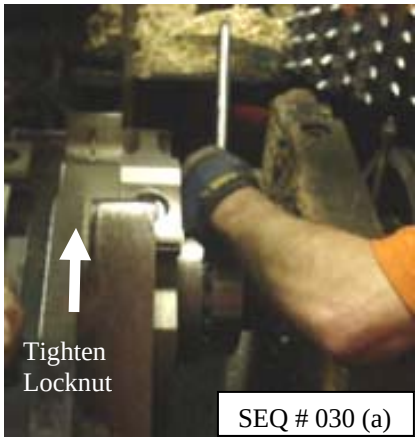
SEQ # 060 (b)

SEQ #	Task Description	Additional Information
050	Torque the counterknife cap screws with the torque wrench and 1/4" Hex Bit Socket.	Reference Torque Values Appendix **D.**
060	Position the clamps on the counterknife surface and hand tighten the clamp bolts. Ensure the clamp is seated properly on the back of the counterknife.	Use nickel-based anti-seize on bolts.

SEQ # 010



SEQ # 020

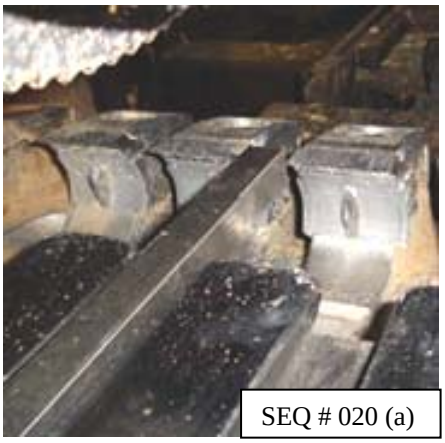


SEQ # 030 (a)

SEQ # 030 (b)

SEQ #	Task Description	Additional Information
010	Determine the position of the head and which direction it needs to be moved.	Top / Bottom Heads - should be centered between the frame and end segments. Spline makers should be centered on the rail (see “Align Spline Maker” Appendix **G** pg. 8-9) Side Heads - the bottom segment should be positioned approximately 1/4" - 1/2" below the rail.
020	Loosen the lock nut (with hammer and spanner wrench) on the side of the arbor that the segments need to move.	Ensure the lock ring stays centered on the arbor and nut.
030	Tighten the opposing locknut, moving the segments in the desired direction on the arbor.	Tighten with spanner wrench and hammer until nut does not advance further.
040	Continue SEQ #020 - 030 until head is properly centered / positioned in the machine.	

SEQ #	Task Description	Additional Information
050	Ensure both lock nuts are tight.	Tighten with the spanner wrench and hammer.
060	Push down a tab on the lock ring in the lock nut on both heads with a center punch and hammer.	Ensure the tab is positioned to prevent any movement / slippage of the locknut.


SEQ # 020 (a)

SEQ # 020 (b)

SEQ # 020 (c)

SEQ # 020 (d)

SEQ #	Task Description	Additional Information
010	Visually center the spline maker with the rail.	
020	Measure the side clearance between the edge of the knives and the edge of the rail, on both sides of the center rail with the Notch Gauge. Ensure the Notch Gauge is held flush to the side of the rail.	Determine the clearance to the nearest 0.005" measurement increment.
030	Determine the distance and direction the head needs to be moved to create the required clearance between spline maker and the rail.	See Chapter 4 “Operating Parameters” for appropriate spline clearance.
040	Adjust the head, as required. It is best to make several small adjustments verses one big adjustment.	See "Center Heads in the Machine" Appendix **G** for procedures to center the heads.

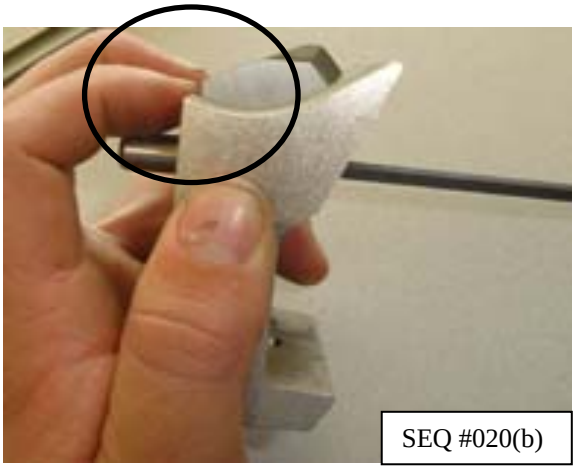
SEQ # 060 (a)

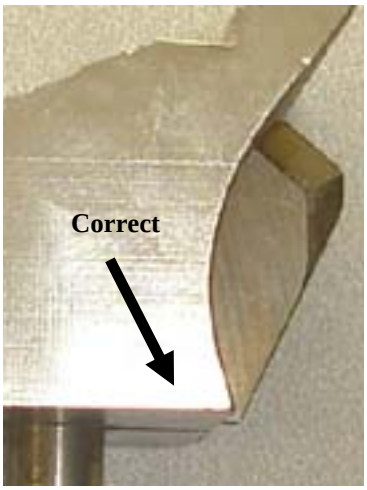
SEQ # 060 (b)

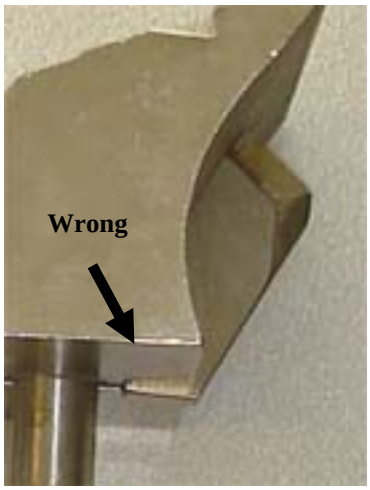
SEQ # 060 (c)

SEQ # 070

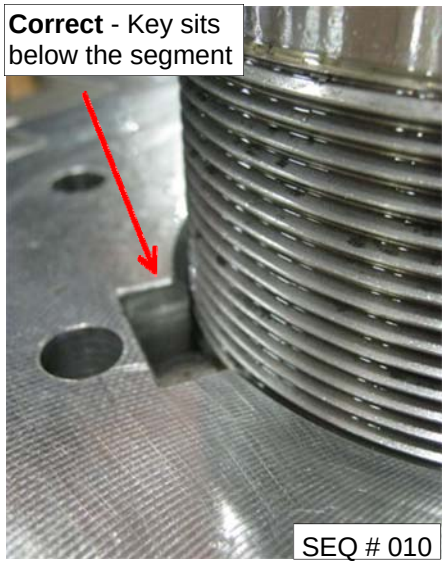
SEQ #	Task Description	Additional Information
050	Repeat SEQ # 020 - 040 until the required side clearance has been achieved.	Once the head is centered properly, push down a tang on the lock ring in the lock nut on both locknuts.
060	Position the Notch Gauge on the bottom of the rail, and measure the spline clearance at the bottom of the rail. Rotate the head backwards so that the knife passes the recessed portion of the notch gauge at the highest point of the cut circle.	- The clearance is properly measured when the knife tip just barely brushes the Notch Gauge so that it is not pushed up, but the knife can be felt. - Determine the clearance to the nearest 0.005" measurement increment.
070	Position the Notch Gauge on top of the rail, and measure the clearance.	Determine the clearance to the nearest 0.005" measurement increment.
080	Determine if the head needs to be moved up or down to create the required clearance.	See Chapter 4 “Operating Parameters” for appropriate spline clearance.
090	Adjust the head up or down, as required. Use mill personnel and the OEM machine manual.	As Required. Use the machine OEM Manual for making head height adjustments.

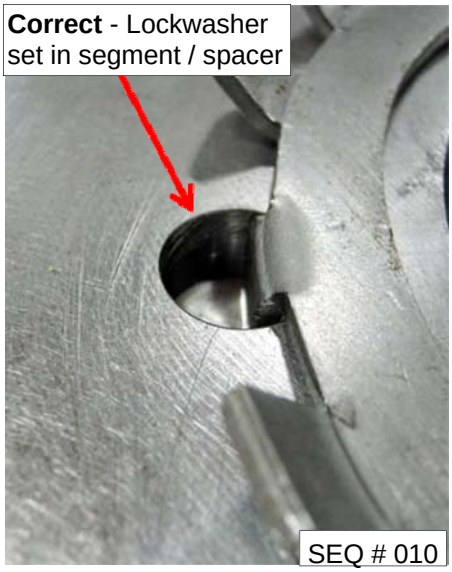


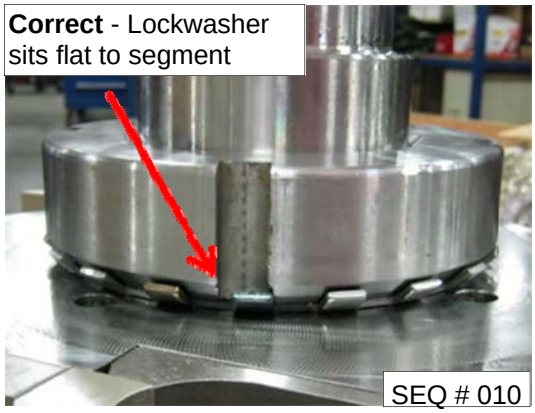




SEQ #	Task Description	Additional Information
010	Insert the dimensioner into the counterknife. The dimensioner fits over the dowel pin.	
020	Insert and tighten the set screw with a 5/32" Allen Wrench until it is snug against the dimensioner. The dimensioner should sit just below the bottom of the counterknife. The set screw does not need to be installed tightly to keep the dimensioner from coming out.	**CAUTION** - The counterknife will not sit on the segment correctly if the dimensioner is installed where it sticks out past the bottom of the counterknife.







SEQ #	Task Description	Additional Information
010	Inspect the head before tightening the locknuts.	**Segments** properly positioned on the arbor. **Key** is NOT proud of the segments / spacers. **Lockwasher** properly installed on arbor.

SEQ #	Task Description	Additional Information
020	Tighten Locknut(s) with Spanner Wrench and 10lb hammer	Locknuts can NOT be over tightened
030	Push down a locking tab on the Lockwasher with a punch.	Ensure the tab is positioned to prevent any loosening of the Locknut.