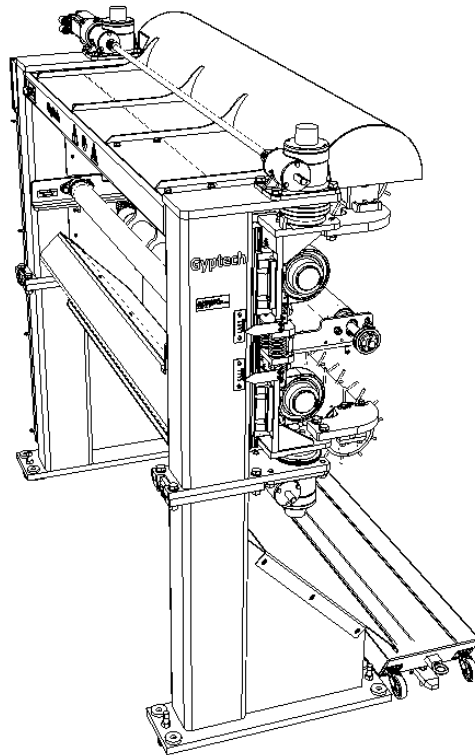


Knife

Maintenance Manual



Gyptech

Proven Technology Worldwide

Revision Date: 9 May 2025

Introduction

This manual contains **Original Instructions** written to provide detailed technical information to assist in the maintenance of the knife. For information regarding normal operation please refer to the Area Operator's Manual. Maintenance should only be performed by qualified, trained personnel.

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1 SAFETY OVERVIEW

Never put yourself at risk.

Many pieces of equipment have the potential to cause serious injury or even death. Be sure to understand the safety concerns related to a piece of equipment before undertaking or performing any maintenance or clean out procedure. Work with your supervisors to address any safety concerns prior to undertaking work.

1.1 General Safety Precautions for Machine Operations and Maintenance

All safety requirements listed below are those generally applicable to this equipment but are not intended to be all-inclusive. They are intended for qualified, experienced personnel who are capable of understanding the maintenance and hazards of machinery operation. Particular types of components may require other precautions as determined by the customer's own safety policies. These precautions should be included in the comprehensive safety program for the particular installation.

These general safety precautions apply to all electrically or mechanically powered equipment and should be observed, as appropriate.

This equipment has been constructed using the highest standards of workmanship with industry accepted state-of-the-art techniques, components and designs. It has been inspected and tested as thoroughly as possible prior to shipment for proper operation and defects in workmanship. However, this equipment, like any other, may develop problems due to normal wear, abuse, or unforeseeable circumstances. The equipment therefore requires proper operation and maintenance. In the course of performing these functions, personnel will be required to work on or near the equipment. The following precautions are given to avoid injury to these personnel.

Warning:

As with many types of equipment, parts of this machine may start moving as soon as the pneumatic circuits are pressurized or electrical connections are energized, which may result in injury to personnel or damage to the machine.

1.2 Knife Safety Guidelines

Warning:

Wear protective gloves when working around knife blades. Blades are VERY sharp.

Never change knife blades or work on the knife without first locking out primary power for all knife motors.

Wear protective gloves and exercise caution when cleaning or working around knife blades. Blades are VERY sharp.

1.3 Set-Up Safety

Avoid locating equipment in any environment for which it was not designed, and which may create a dangerous operating condition such as an explosive atmosphere (i.e. gas, dust) or high moisture.

Avoid the use of unauthorized or substitute parts and materials in servicing the equipment. Substitute parts or materials could produce a hazardous operating condition.

Use only materials of adequate size and strength to suit the flows and pressures which will be present in the operating system. Use safety factors in selecting materials for strength to allow for shock and over-pressure conditions should they occur.

1.4 Start-Up Safety

Ensure all pneumatic and electrical connections which may have been removed, replaced, or disconnected during an equipment shutdown have been reconnected securely before starting any equipment.

Return all valves (manual and control system operated) and movable machine members which may have been changed from their normal start-up condition during shutdown back to their normal start-up condition before starting any equipment.

Ensure that all personnel, product, etc., are clear of machinery prior to starting any equipment.

1.5 During Operation

All safety fencing needs to be secured in position when the knife is in use. Maintain and keep in place all equipment guards. Do not wear loose clothing or jewelry which could get caught in moving parts.

1.6 Shutdown Safety

Prior to any work being done on the knife. **LOCK OUT THE PRIMARY SOURCE OF POWER TO ALL KNIFE MOTORS!**

1.7 General Safety

Refer to section **General Safety** in the Safety System manual.

2 KNIFE OVERVIEW

The rotary cut-off knife is specifically designed for high and low speed operation. The knife cuts wet board to the desired length as it passes thru it. The knife consists of a simple mechanical arrangement with the top and bottom knife shafts being independently driven with servo motors and low backlash gearboxes. This arrangement results in a low inertia, high torque capability that can achieve precise length control with the fast acceleration and braking requirements of high board line speeds.

Both the top and bottom knife shafts are height adjustable with servo motors linked to dual screw jacks to fine tune the depth of penetration of the knife blades into the wet board. There is a scale to determine board penetration visually at the knife.

The electronic servo control system is designed for integration with the PLC system and operator interface graphics terminal. Board speed is measured with an encoder which reads the back of the board on the live roll conveyor.

Board length changes, sample cutting and grouping functions are performed without errors in board length accuracy or group counting and sequencing.

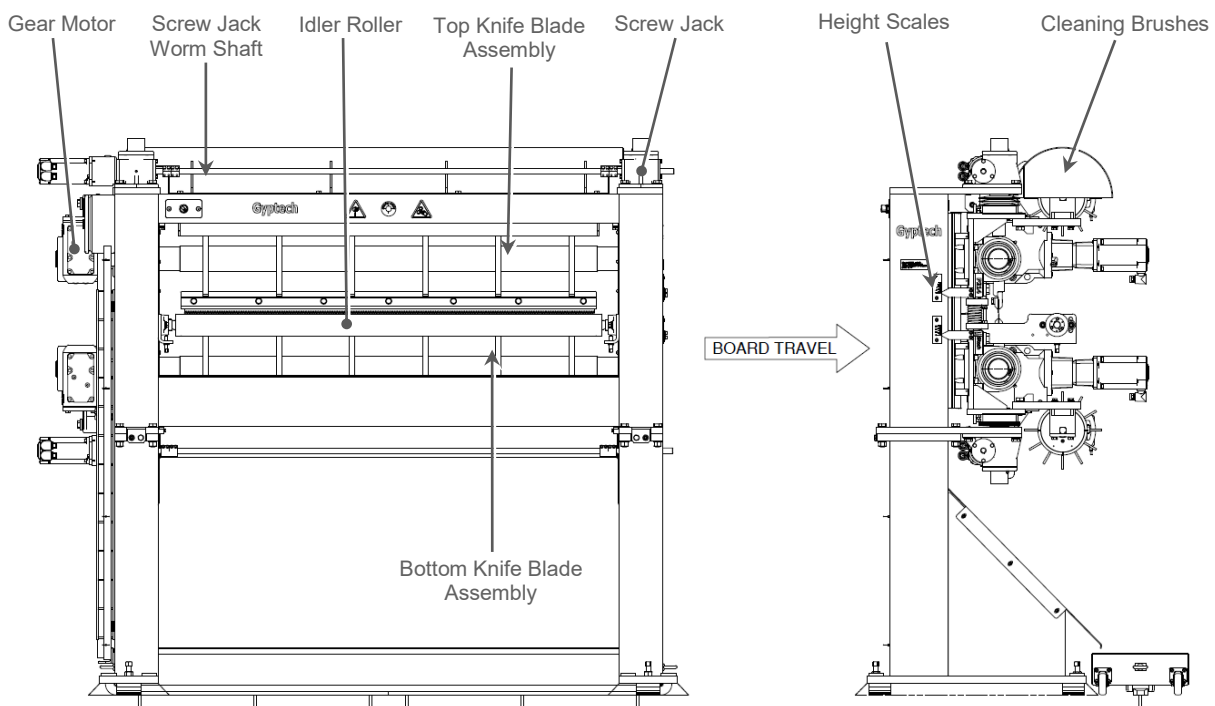


Figure 1: Part Identification – Front View

2.1 Knife Blades (top & bottom)

The knife blade is a removable serrated edge cutter that is replaced when it gets dull. Knife blades can be ordered in various configurations (number of teeth per inch, carbon steel or stainless). The life of knife blades can vary depending upon number of cuts per hour, core composition and top and bottom sheet material (paper, fiberglass) but is typically between 3 days to 1 week. It is up to the production department or the lab quality control staff to determine when blades need to be changed.

2.2 Top Knife Blade Assembly

The top knife blade assembly is the rotating assembly that holds the top knife blade. It is driven by the top servo motor and gear reducer. It is adjustable in height with the top knife blade assembly adjustment servo.

2.3 Top Knife Blade Assembly Adjustment Servo

The top knife blade assembly adjustment servo controls the height of the top knife assembly. Changing the setpoint on the HMI will increase or decrease the depth of cut of the top knife blade. This adjustment is necessary to adjust the depth of cut for different thicknesses of product.

The top knife blade assembly adjustment servo operates both screw jacks equally.

2.4 Bottom Knife Blade Assembly

The bottom knife blade assembly is the rotating assembly that holds the bottom knife blade. It is driven by the bottom servo motor and gear reducer. It is adjustable in height with the bottom knife Blade assembly adjustment servo.

2.5 Bottom Knife Blade Assembly Adjustment Servo

The bottom knife blade assembly adjustment servo controls the height of the bottom knife assembly. Changing the setpoint on the HMI will increase or decrease the depth of cut of the bottom knife blade. This adjustment is necessary to adjust the depth of cut for different thicknesses of product.

The bottom knife blade assembly adjustment servo operates both screw jacks equally.

2.6 Servo Motors and Servo System

There are two servo motors that control the upper and lower blades of the knife assembly. The servo motors are controlled via a servo control system that is interconnected to a PLC. When working with a PLC, position control over a 360-degree arc is achieved. The timing of the servo system is synchronized to the knife product encoder.

The servo control system consists of two independent positional servo drives. The rotary profile motions of the two servo control systems (and therefore the knife blades) are electronically geared to ensure that they are synchronized. The bottom knife servo axis is the master axis and the top axis the slave. The final cut point which affects control of cut profile can be offset on the TOP blade from the local HMI.

Any value entered in the trim for the top knife blade is automatically applied as a relative positional move to the top blade axis. When the knife is switched to automatic mode the trim value is automatically applied. The final cut is done in synchronization with the moving board sheet at line speed. This is done via a predetermined and calculated knife

cutting profile CAM (computer assisted motion) profile which controls the master blade axis. Once calibrated and locked to length via the local HMI, the servo system will track the line speed and cut consistent lengths continually.

The knife cuts boards in groups or individually; the number of boards in a group is dependent upon the length set-point and wet transfer operation. At the end of a group the control system sends a signal to the grouping rollers to clear the boards to the on rolls.

2.7 Gear Reducer

Provides speed reduction and torque for cutting action.

2.8 Cleaning Brushes

The top and bottom cleaning brushes are used to remove debris build up on the knife blades. These can be run continuously or intermittently. When running, the brushes alternate between running 20% faster than the knife blades and 20% slower than the knife blades to achieve cleaning action on both sides of the blades.

2.9 Encoder Assembly

An encoder tracks the distance travelled by the board before it is cut. The Encoder counts the distance travelled and sends this information to the controller. The controller then tells the knife to cut based on a predetermined length set point (board length).

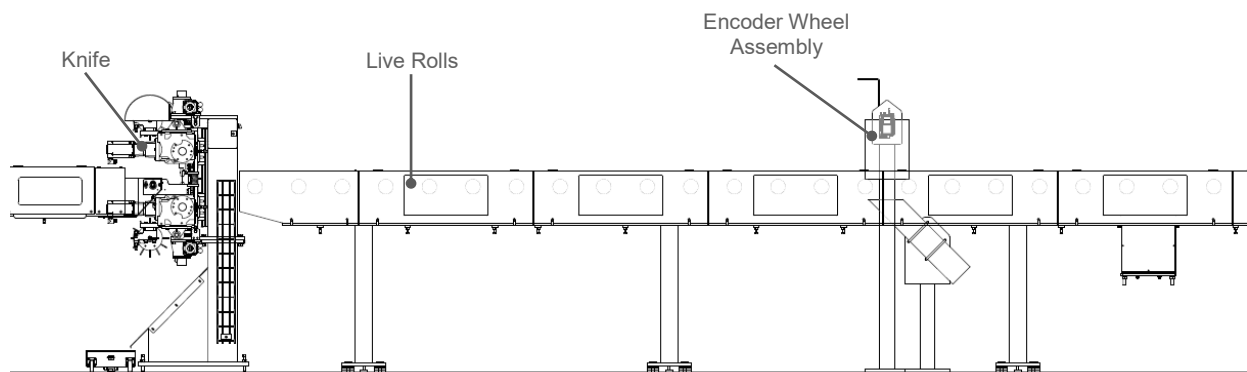


Figure 2: Relationship of Knife and Encoder Assembly

3 INSTALLATION

Note: This section is a generic overview. For more details see Installation Drawings.

3.1 Receiving Your Equipment

As soon as the equipment is received, it should be carefully inspected to make certain the unit is in good condition and all items listed on the packing list are received. Even though the equipment is packaged at our facility, it is possible for it to be damaged in shipment. All damages or shortages should be noted on the Bill of Lading. Purchaser should take immediate steps to file reports and damage claims with the carrier. All damages incurred to the units in transit are the responsibility of the common carrier since it is the manufacturer's policy to make shipment EXW or FOB (INCOTERMS 2010), its factory: i.e., Ownership passes to the purchaser when the unit is loaded and accepted by the trucker. Any claims for in-transit damage or shortage must be brought against the carrier by the Purchaser.

3.2 Pre-Installation

Warning:

Always lift the knife by upper main frame. If the knife cannot be moved into place by using the upper main frame, then mover's rollers should be placed under the legs and the knife rolled into position.

3.3 Installing

At a minimum, installation requires the expertise of a millwright with alignment credentials and an electrician.

3.3.1 Placement of Equipment and Leveling

Set knife assembly so top of idler roller is at same elevation as top of live roll rollers.

Level the knife assembly to have the top corners at the same elevation.

3.3.2 Electrical Installation

Before making electrical connections to the equipment, turn all switches on the control panel to OFF. All wiring should meet local wiring codes and be performed by qualified personnel. Also, ensure that all Gypsum Technologies electrical drawings are strictly followed, and correct voltages applied. Ensure proper grounding of the enclosure.

Upon completion of electrical connections all covers should be kept closed and secure at all times. Disconnect power before opening areas where electrical terminations exist.

Reconnect any electrical, water and pneumatic lines to existing equipment that were disconnected for the knife installation.

Reinstall any guards and covers that have been removed during installation.

Commission the knife and any emergency equipment.

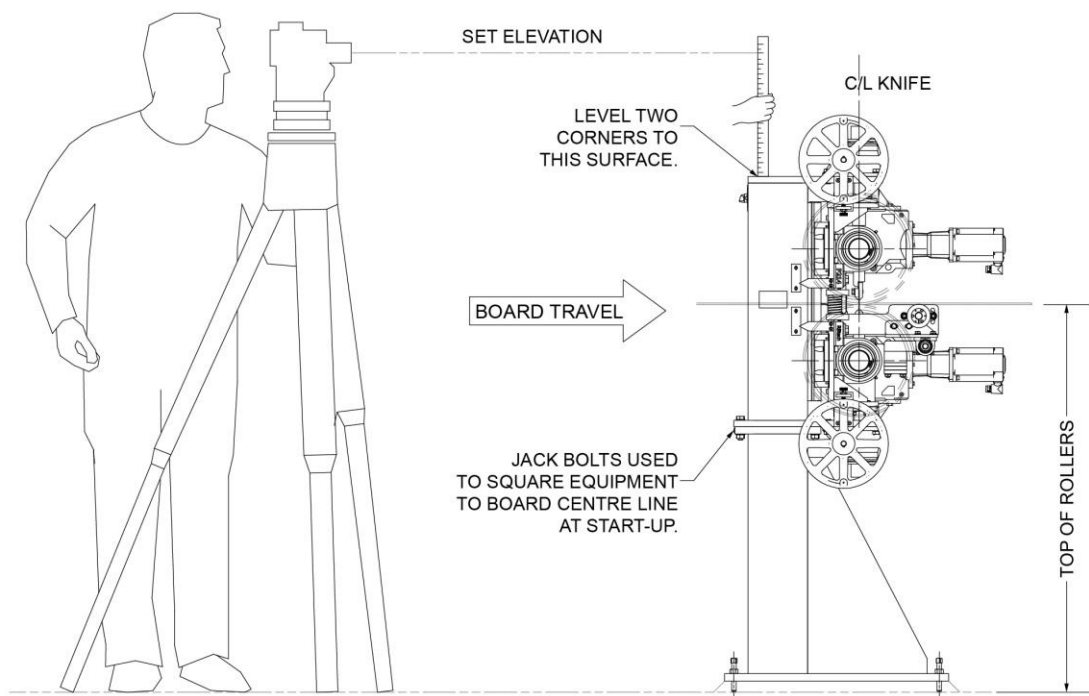
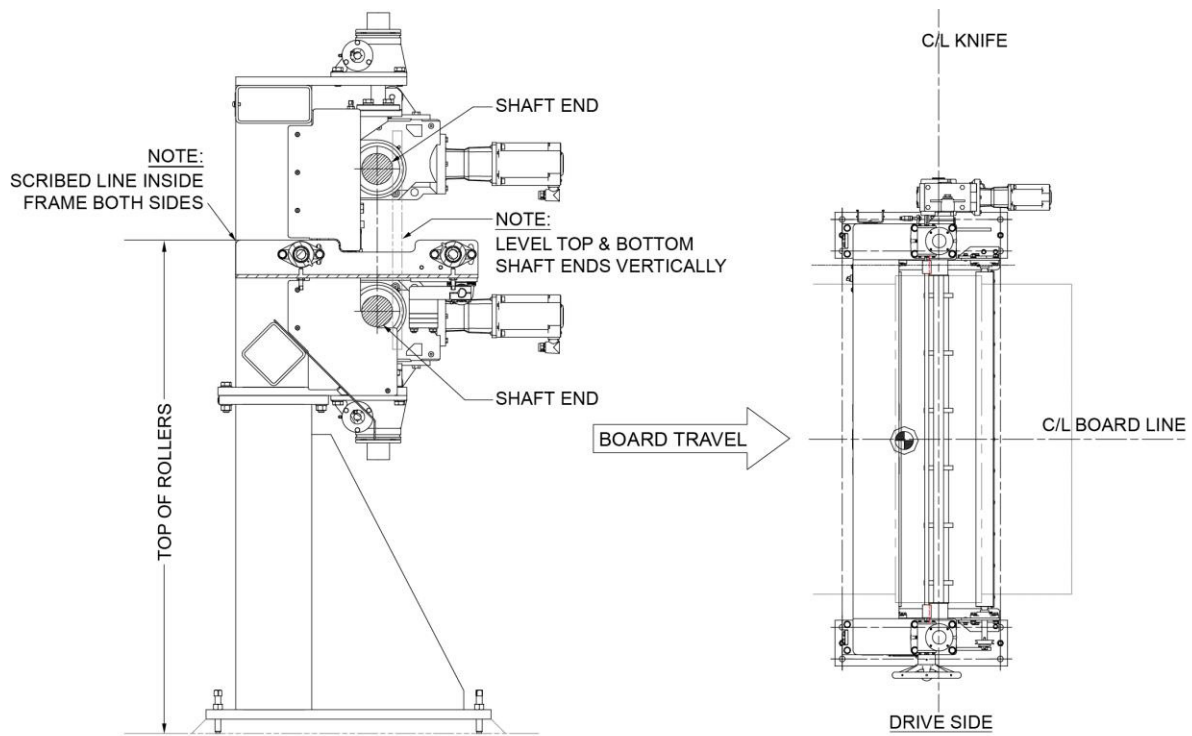


Figure 3: Installation

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4 OPERATION

4.1 Setting the Top Blade Holder Height

The top blade is adjusted for height by the screw jacks by using the top knife assembly height adjustment servo.

The scale and pointer indicate the distance of the top blade points to the bottom of the board. In general, we recommend the top blade penetrates the board by 6mm. Based on this, the top blade would be set at 4mm for 10mm board, 6mm for 12mm board, 9mm for 15mm board, etc. This may require adjustment to suit operating conditions.

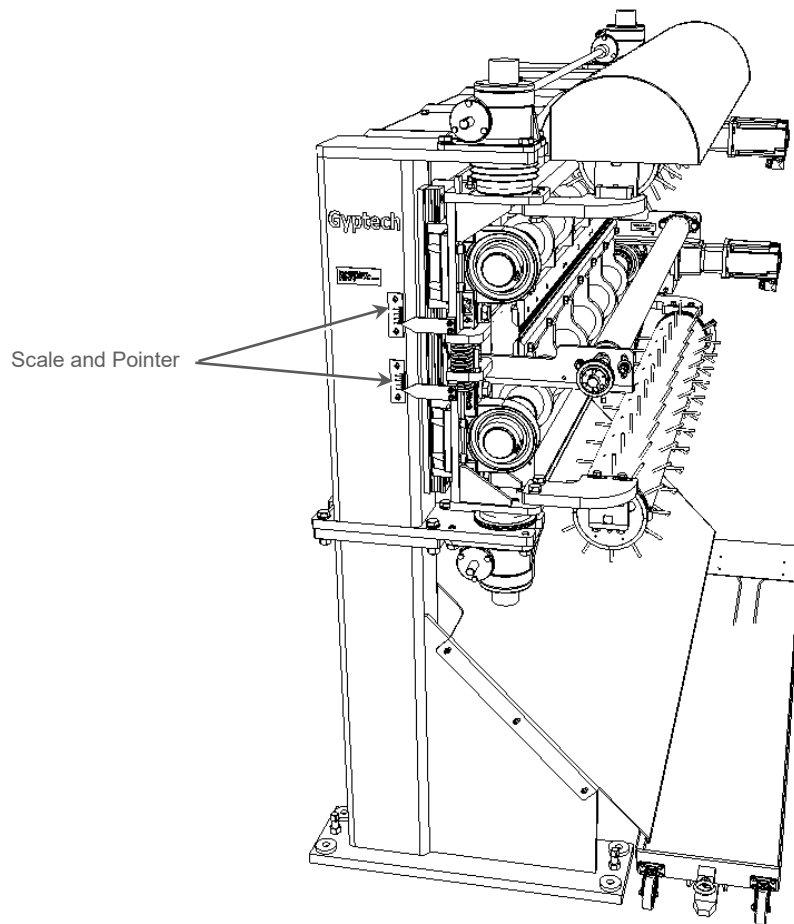


Figure 4: Location of Top Blade Height Adjustment Hand Wheel

4.2 Setting the Bottom Blade Holder Height

The bottom blade is adjusted for height by the screw jacks by using the bottom knife assembly adjustment servo.

In normal operation, the bottom blade is designed to penetrate the bottom of the board by 6mm. If process conditions require a change in the bottom blade, adjust the bottom knife assembly height accordingly.

There is a scale and pointer indicating the amount the bottom blade is penetrating the bottom of the board.

4.3 Cleaning Knife Blades During Production

4.3.1 Automated Cleaning

The top and bottom cleaning brushes can be run at any point during production, either continuously or intermittently. This can be activated and setup via the HMI. When running, the brushes alternate between running 20% faster than the knife blades and 20% slower than the knife blades to achieve cleaning action on both sides of the blades.

4.3.2 Manual Cleaning

The knife's cleaning function allows for interruption of the normal cutting function of the knife in order to clean the top and bottom knife blades manually. To initiate a knife clean, the Knife Blade Clean Request PB (P1601A-HB03) can be pushed at any time during operation. If the knife is in the middle of cutting a group, the knife will finish cutting the group and then will move to the blade clean position for each of the blades (halfway between the ready to cut position and the cut position and clear of the cleaning brushes). If the knife is not running, it will immediately go to the blade clean positions. Once this position has been reached, the Knife Cleaning Windows Gate Switch Release Coil is energized. When the window is opened, the control system puts the knife drives into a safe off state and the blades can be cleaned. Once the window is closed and the button pushed again the knife will resume normal operation. Note: while the blade cleaning is occurring, the lower reject will be activated.

4.4 Taking Board Sample

The sample function is activated by pushing the Sample PB (P1600A-HB09) when the knife is in operation. The sample will be taken at the beginning of the next group. If the button is pressed too late, the knife will wait for the following group to complete before cutting the sample. The sample button indicator will flash until the sample is about to cut. While the sample is being cut, the sample button indicator will be illuminated without flashing. Once the sample has been cut, the sample indicator will turn off.

5 TROUBLE-SHOOTING

Troubleshooting Knife Problems	
Depth of Cut is not uniform from side to side.	Solved By
Knife blade is damaged or in crooked	Replace or adjust knife blades.
Top blade is not level side to side.	<ol style="list-style-type: none"> 1. Confirm blade is properly installed parallel in the blade holder. 2. The couplings on the connecting shaft between the 2 jacks are a "4 pin type" coupling. <ul style="list-style-type: none"> • To raise or lower one side and not the other, disengage one coupling, turn the worm shaft in the direction desired, and re-engage the coupling. <p>Note: A ¼" turn of the worm shaft on the screw jack results in a .005" vertical movement.</p>
Knife blade is dirty	<ol style="list-style-type: none"> 1. During production use blade cleaning access window in fence. Use wire brush secured to long handle to clean blades. 2. During downtime lockout knife and access blades for cleaning following basic blade change procedure.
Board is not cutting.	Solved By
Board is too soft	Increase setting agents at the mixer to have sufficient set at the knife.
Blades are dull.	Replace knife blades.
Board is cutting crooked. End is not square.	Solved By
Board is not tracking straight through the knife	Correct board tracking
Knife is not square to conveyors.	Use squaring adjusters on Knife to fix Knife perpendicular to boardline.
Cleaning brushes not cleaning	Solved By
Brushes not touching knife blades	Brush assemblies are mounted to slots. Adjust brush assemblies closer to the knife blade and check engagement. If total slot is used and brushes are still not engaging the blades properly a replacement brush should be installed and the position adjusted accordingly.

6 MAINTENANCE SCHEDULE

The following refers specifically to the basic Gypsum Technologies Knife and Encoder package. The instructions below may not encompass any customization or optional components on your machine.

Warning:

When performing any maintenance work always lockout all sources of energy (electrical, pneumatic, mechanical, electromagnetic, chemical, thermal, hydraulic, etc.).

6.1 PREVENTIVE MAINTENANCE SCHEDULE

6.2 Weekly

Task	Notes
Inspect Knife	Check the condition of all adjustments.
Inspect Guards	Check their condition.
Change Knife Blades	At a minimum they should be changed weekly.
Clean machine	Clean-up around the machine and remove build-up.

6.3 6 Months

Task	Notes
Check all moving parts for wear	Replace any parts that are worn.
Lubrication	Lubricate all bearings.

7 MAINTENANCE PROCEDURES

In order to prevent premature failure of the equipment, the following preventative maintenance procedures are recommended:

7.1 Blade Changes on the Knife

7.1.1 Preparation Before Shutdown

Blade Guard Instructions:

(Not done in machine – Bench setup to make knife blade assembly)

Ensure safety gloves are worn, blades are very sharp.

Insert blade fully into blade guard. The blade is to be centered in the holder and teeth positioned by locator pin.

NOTE: For bottom blade the tooth bevel will not be visible in the sight hole. For top blade the tooth bevel will be visible in the sight hole.

Tighten thumb screws

Blade is ready for installation into knife.

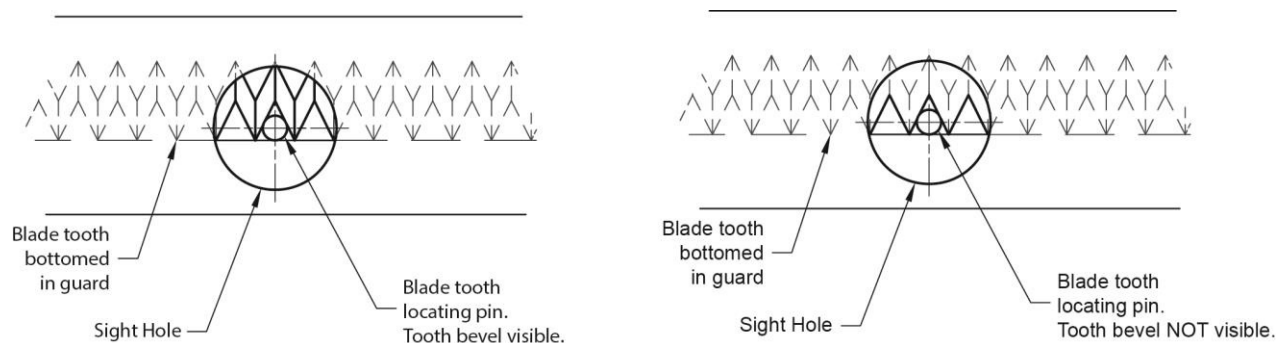


Figure 5: Blade Guard Instructions

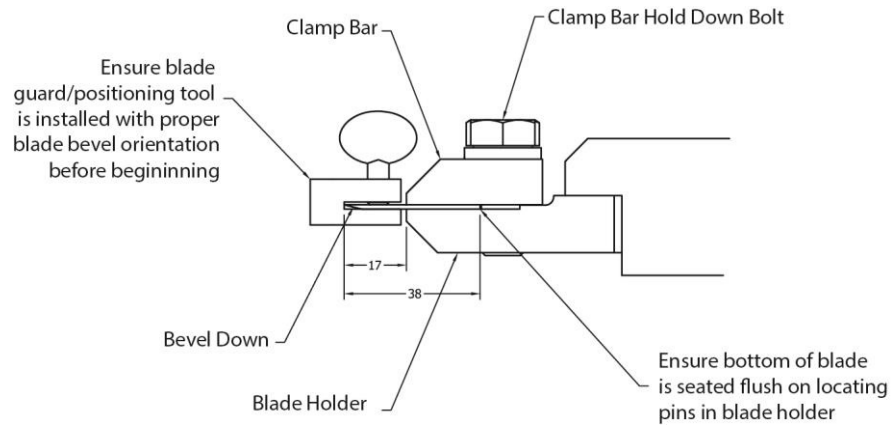


Figure 6: Knife Blade Assembly

7.1.2 During Shutdown

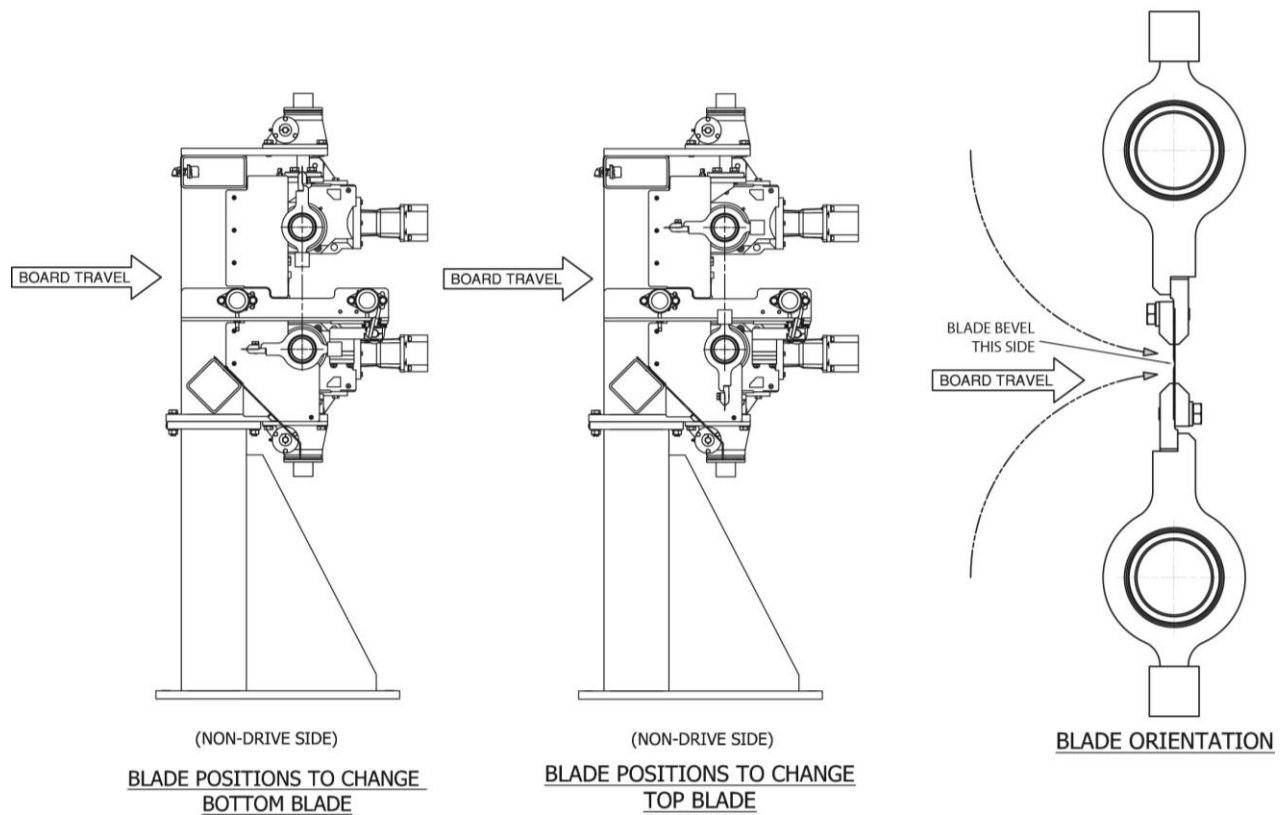


Figure 7: Blade Change Set up

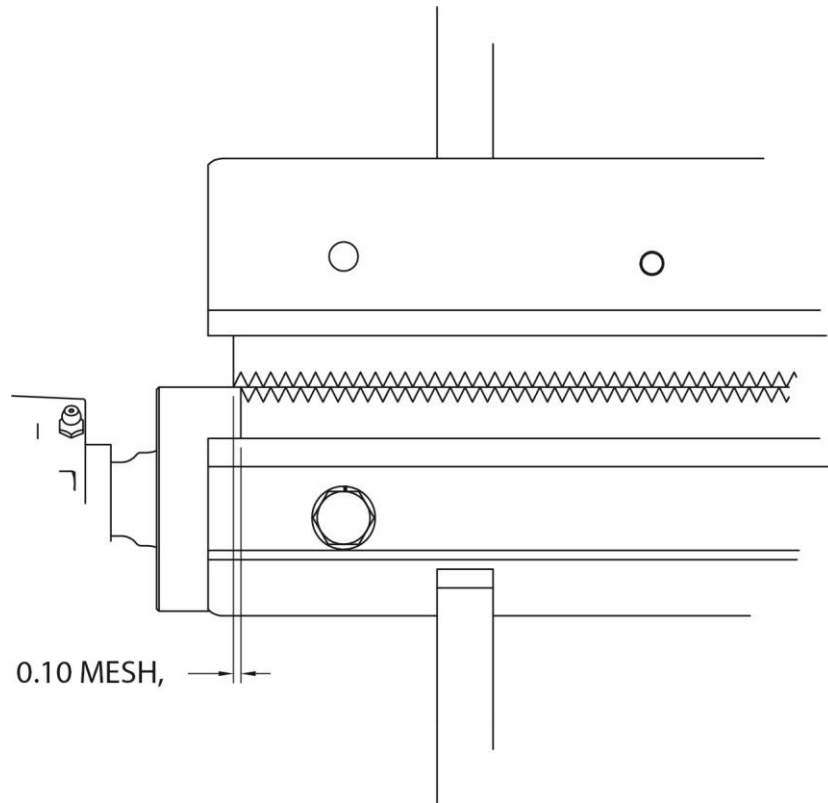


Figure 8: Teeth Mesh detail

Setup Procedure (blade removal & installation):

1. LOCK OUT POWER TO MACHINE!
2. Ensure safety gloves are worn. Blades are very sharp.
3. Ensure blade guards are installed on used blades before beginning.
4. Put brake selector switch to OFF position.

To change bottom blade, rotate top blade unit to top vertical position – See the above Figure: Blade Change Setup.

1. Manually rotate the bottom blade to the horizontal position and turn the brake ON.
2. Loosen blade holder bolts. Use deep socket wrench to minimize risk of slippage.
3. Remove the blade.
4. Install replacement blade that is properly set in a bottom blade guard – See Figure: Blade Guard Instructions. Ensure blade bevel is down and thumb screws are up. The blade guard has a locating angle that fits onto the end of the blade clamp bar.
5. Tighten bolts.

To change top blade, release the brake and manually rotate the top blade to the horizontal position.

1. Rotate bottom blade unit to vertical down position and turn brake ON – See Figure: Blade Change Setup.
2. Loosen blade holder bolts. Use deep socket wrench to minimize risk of slippage.
3. Remove the blade.
4. Install replacement blade that is properly set in a top blade guard – See Figure: Blade Guard Instructions. Ensure blade bevel is up and thumb screws are up. The blade guard has a locating angle that fits onto the end of the blade clamp bar.
5. Tighten bolts.
6. Carefully remove blade guards.
7. Release the brake and slowly, manually rotate the top and bottom blades to bring the blades to the mesh position.
8. Check the alignment of the teeth mesh. See Figure: Teeth Mesh detail.
9. Using the blade depth adjustment handle to raise or lower the top blade until the proper penetration is achieved.
10. Replace all safety guards on the knife and live rolls. (Make sure blade guards are removed)
11. Leave brake selector switch in OFF position
12. Remove safety locks.

Energize machine, the knife blades are automatically set to the correct starting position when “AUTO” mode is selected. Knife is ready to use.

7.1.3 Setting the Minimum Blade Gap (During Shutdown)

When blades are changed, the minimum allowed blade gap should be checked and updated if necessary to ensure that top and bottom blade contact cannot result from adjustments made on the HMI. Once blades are installed and setup up according to the previous section, the following procedure can be carried out to be sure blade contact does not occur. The blade height servos must be homed before carrying out this procedure. This procedure involves manual adjustment of the knife blade height. Each turn of the input shaft only moves the blade 0.01” (0.25mm), so it is best if the blade height positions are close together to begin with.

1. Manually move the blades to the cutting position (top blade to 6 o'clock position, bottom blade to 12 o'clock position).
2. Turn the screw jack input shaft that ties the top screw jacks together to close the gap between the top and bottom blades (assuming the blades have some gap between them to begin with, if not then jump to step 5).
3. When the blades get close, swing the blades back and forth a small amount through the cut position to check that there is no contact between the top and bottom blades.

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4. Continue to manually lower the top blade in 1 turn increments, then check for contact until contact is made.
5. Once contact is made, manually raise the top blade until the blades do not make contact. For dual blade knives, check both sets of blades. From this point, lift the top knife blade by one full rotation of the screw jack input shaft.
6. While the knife remains powered down, go to the HMI “Knife Diagnostics” (sometimes labeled “Knife Setup”) screen. Press the “Manual” button for Knife Height adjustment. This should cause a “Set Minimum Gap” button to appear. Press that button to make the current blade gap the minimum. Note that this function does not require the bottom blade to be in a particular position, it just goes by the difference between the top and bottom blade height positions.
7. The Minimum Blade Gap is now set. Any adjustments to the blade heights will now be limited to respect this minimum gap.

7.2 Adjusting For Square at the Knife

This is normally a onetime adjustment done at commissioning.

1. On each side, at the base, are 2 jacking bolts and 2 locking bolts.
2. Loosen the locking bolts and use the jacking bolts to set the square adjustment required.
3. Recheck dry board for square after any adjustment.

7.3 Lubrication

Minimal lubrication is required for the knife. All bearings should be lubricated per manufacturer specifications but not less than once every six months.

END OF THE DOCUMENT