

Wood-Mizer®

OWNER'S/OPERATOR'S MANUAL

August 1993

LTGA Rev. N
*Automatic
Sharpener*

This manual is to replace or to be used with all previous information received on the Wood-Mizer Sharpener. All future mailings will be an addition to or a revision of individual sections of this manual as we obtain new information.

The information and instructions given in this manual do not amend or extend the limited warranties for the equipment given at the time of purchase.

If You Need To Order Parts...

From the continental U.S., call our toll-free Parts/Customer Service hotline at **1-800-525-8100**. Please have your Sharpener serial or model number and your customer number ready when you call. Wood-Mizer will accept these methods of payment:

- *Visa, Mastercard, or Select Purchase*
- *COD*
- *Prepayment*

You also should be aware that there will be handling charges on all orders not picked up. Handling charges are based on size and quantity of order. In most cases, items will ship on the day they are ordered. Second Day and Next Day shipping are available at additional cost.

If your Sharpener was purchased outside of the United States, contact your distributor for replacement parts.

If You Need Service...

From the continental U.S., call us toll-free at **1-800-525-8100**. Ask to speak with a Customer Service Representative.

Please have your customer number and Sharpener serial or model number ready when you call. The Service Representative can help you with questions or schedule you for a service call.

If your Sharpener was purchased outside of the United States, contact your distributor.

Office Hours:

All times are Eastern Standard Time. Please remember that Indiana does not go on Daylight Savings Time in the summer.

Monday - Friday 8 a.m. to 5 p.m.

Saturday 8 a.m. to 4 p.m.



IMPORTANT: Read the entire operator's manual before operating the sharpener. Take notice of all safety warnings throughout this manual and those posted on the machine. Keep this manual with this machine at all times, regardless of ownership.

*MS. 877-866-0667
ONT. 877-357-3373*

TABLE OF CONTENTS

SECTION-PAGE

SECTION 1 GENERAL INFORMATION

- 1.1 Safety 1-1

SECTION 2 ASSEMBLY

- 2.1 Stand Assembly 2-1
- 2.2 Pump Installation 2-2
- 2.3 Coolant Installation 2-2
- 2.4 Electrical Installation 2-3
- 2.5 Blade Support Installation 2-3
- 2.6 Hook Angle Adjustment 2-4
- 2.7 Grinding Wheel Installation 2-4

SECTION 3 SHARPENER COMPONENTS

SECTION 4 SHARPENER OPERATION

- 4.1 Blade Installation 4-1
- 4.2 Grinding Wheel Shape 4-2
 - 4.2.1 Dressing A New Wheel 4-2
 - 4.2.2 Maintaining Wheel Shape 4-3
- 4.3 Sharpener Adjustments 4-3
 - 4.3.1 Overview Of Adjustments 4-3
 - 4.3.2 Face Grind Adjustment 4-3
 - 4.3.3 Tooth Height Adjustments 4-4
 - 4.3.4 Sharpener Operation 4-5
- 4.4 Magnetic Shut-off 4-6
- 4.5 Blade Removal 4-6

TABLE OF CONTENTS

SECTION - PAGE

SECTION 6 SCHEMATICS & PARTS

6.1	LTAGA Wiring Diagram	6-1
6.2	Stand Assembly	6-2
6.3	Index Arm, Cam & Shut-off Sensor Assemblies	6-3
6.4	Grinder Head Assembly	6-4
6.5	Bell Crank Assembly	6-6
6.6	Converter	6-6
6.7	Control Assembly	6-7
6.8	Miscellaneous Parts (Not Shown)	6-7
6.9	Clamp & Cooling System	6-8

APPENDIX A BLADE THEORY & TERMINOLOGY

A.1	Tooth Spacing	A-1
A.2	Tooth Height (Depth Of Gullet)	A-1
A.3	Hook Angle	A-2
A.4	Face Angle	A-2
A.5	Tooth Set	A-2

APPENDIX B BLADE HANDLING

B.1	Coiling The Blade	B-1
B.2	Uncoiling The Blade	B-2
B.3	Inverting The Blade	B-3

SECTION 1 GENERAL INFORMATION

1.1 Safety



This symbol is used to call your attention to instructions concerning your personal safety. Be sure to observe and follow these instructions. This symbol accompanies a signal word. The word **DANGER** refers to hazards that could cause death or serious, irreversible personal injury. The word **WARNING** suggests a safety hazard that could cause personal injury. **CAUTION** refers to hazards that could cause damage to the equipment or property only.

The safety warnings listed below should be observed at all times! Read and understand all safety instructions before operating the saw!



DANGER: For the user's safety, the power cord on this product has a grounded plug. This power cord should only be used with correctly grounded (3-hole) receptacles to avoid electrical shock. To prevent electrical shock hazard, this unit must be connected to a GFI (Ground Fault Interrupter). The National Electrical Code, Article 680-41(A), requires a GFI be installed in the branch circuit supplying fountain equipment rated above 15 volts. See your local electrical supply dealer for various brands of GFI's.



WARNING: Always wear eye protection when operating this equipment.

WARNING: Keep shields in place while operating machine.

WARNING: Replace grinding wheel cover before operating the Sharpener.

WARNING: Check the grinding wheel for cracks or chips before using it. If the wheel is cracked or chipped, **DO NOT USE IT!** Remove the grinding wheel while transporting the Sharpener to prevent cracking or damage due to jarring or bumping of the unit.



CAUTION: Do not run the pump until it is under water. Dry operation will damage the pump!

CAUTION: Always turn off the converter box after you have finished sharpening for the day. **LEAVING THE POWER ON COULD DAMAGE THE WATER PUMP!**

CAUTION: NEVER try to dress the wear area of the grinding wheel by using the dressing stone on the side surface of the wheel.

CAUTION: Always be sure the tip of the back grind adjustment knob stays seated against the lift bracket. The grinding wheel will damage the blade if the tip becomes unseated.

CAUTION: The 110 Volt AC output should only be used to power the coolant pump of the Wood-Mizer automatic sharpener attachment.

SECTION 2 ASSEMBLY

Section 2.1..... Stand Assembly
 Section 2.2..... Pump Installation
 Section 2.3..... Coolant Installation
 Section 2.4..... Electrical Installation

Section 2.5..... Blade Support Installation
 Section 2.6..... Hook Angle Adjustment
 Section 2.7..... Grinding Wheel Installation

The Wood-Mizer Automatic Grinder Assembly (LTAGA) is shipped preassembled. Additional assemblies and parts include:

- Two-height Stand Assembly
- Pump and Coolant
- Blade Support Arms
- Grinding Wheels
- Bag Assembly

Bag Assembly Contents	Qty
Orange Shutoff Magnet	3
Rubber Stop Plug	1
Hose Fitting, 3/8 x 1/4 FPT	1
Blade Support Wheel	1
Dressing Stone	1
Blade Support Half without Post	3
Blade Support Half with Post	3
Bolt, 1/4-20 x 1 1/2 Hex Head	6
Wing Nut, 1/4-20	3
Retaining Washer, 1/4" diameter	1
Keps Nut, 1/4-20	3
10° Angle Template	1
12.5° Angle Template	1
15° Angle Template	1

2.1 Stand Assembly

The stand assembly consists of one tray assembly, three long stand legs and three short stand legs. It may be set at sitting height or standing height.

See Figure 2-1. For sitting setup, insert the three long stand legs into the sockets in the top of the stand tray.

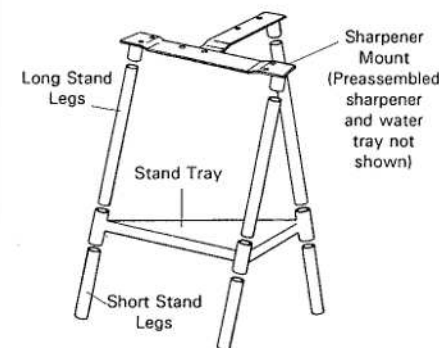


FIGURE 2-1. STAND ASSEMBLY.

For a standing setup, add the three short stand legs to the bottom sockets of the stand tray.

Once you have assembled the stand, lift the sharpener assembly and place the underneath sockets of the mount on top of the three long stand legs.

2.2 Pump Installation

The pump conducts coolant from the water tray through the Loc-line valve and up through an opening in the blade clamp assembly.

First, plug the hole in the water tray with the rubber stop supplied in the bag assembly.

See Figure 2-2. Connect the elbow fitting supplied with the pump to the threaded pump outlet. Install the female hose fitting from the bag assembly to the pump elbow fitting. Lay the pump in the water tray.

Connect the hose from the Loc-line valve to the female hose fitting on the pump.

Plug the pump into the top cord on the converter box. Plug the converter into a grounded receptacle.

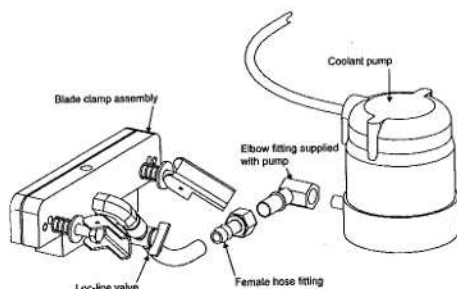


FIGURE 2-2. PUMP ASSEMBLY.

CAUTION: Do not run the pump until it is under water. Dry operation will damage the pump!

CAUTION: The 110 Volt AC output should only be used to power the coolant pump of the Wood-Mizer automatic sharpener attachment.

DANGER: For the user's safety, the power cord on this product has a grounded plug. This power cord should only be used with correctly grounded (3-hole) receptacles to avoid electrical shock. To prevent electrical shock hazard, this unit must be connected to a GFI (Ground Fault Interrupter). The National Electrical Code, Article 680-41(A), requires a GFI be installed in the branch circuit supplying fountain equipment rated above 15 volts. See your local electrical supply dealer for various brands of GFIs.

2.3 Coolant Installation

Coolant is pumped from the water tray through the Loc-line water valve to the grind area. Be sure the rubber stop is properly installed before filling the water tray.

Fill the tray with water to 1" (2.5 cm) from the top. Add about 1/6 bottle of coolant concentrate. (This makes a solution of approximately 1 part coolant to 50 parts water.) Add solution as necessary to keep level 1" from the top of the tray.

2.4 Electrical Installation

Slide the control box into the slots under the water tray. Make electrical connections to the control box as shown in Figure 2-3.

The following is a test for the automatic control mechanisms of the Sharpener.

1. Turn the CONVERTER switch on. The switch should light, showing that the converter is on.
2. Turn the LOC-LINE valve counterclockwise. This opens the valve and starts the water flow, showing that the pump is operating.
3. With the FEED RATE all the way down, push the START button on the control box. This turns on the cam motor.
4. Flip the GRINDER switch on. The Sharpener motor should come on.
5. Turn up the FEED RATE dial. The cam assembly should rotate counterclockwise.

If a control does not work properly, check connections as shown. Also check the circuit breakers on the back of the control box and on the left side of the converter box. To reset a circuit breaker that has kicked out, push in and release. If a control still does not operate properly, contact your nearest service dealer for assistance.

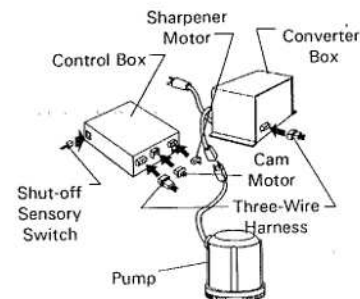


FIGURE 2-3. ELECTRICAL CONNECTIONS.

2.5 Blade Support Installation

The blade support assembly includes three blade support arms and three blade support guide assemblies.

See Figure 2-4. Lubricate the threaded ends of the three blade support arms with grease. Insert a blade support arm in each of the three threaded holes located on the vertical plate of the Sharpener.

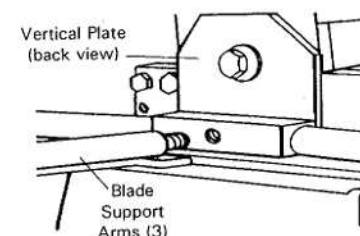


FIGURE 2-4. BLADE SUPPORT ARMS

See Figure 2-5. Each guide assembly includes a blade support with post, a blade support without post, two bolts, a keps nut and a wing nut. Join a blade support guide assembly onto the ends of the left and rear blade support arms with posts facing outward as shown. Bolt from the hexed side of the guide assembly. (These hex-shaped holes will keep the bolts from turning once in place.) Tighten the top bolts with the keps nuts. Tighten the bottom bolts with the wing nuts.

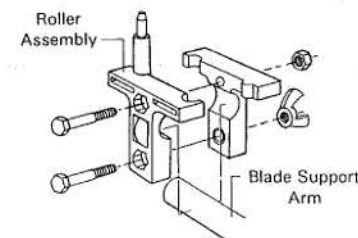


FIGURE 2-5. BLADE GUIDES (LEFT AND REAR).

See Figure 2-6. The guide assembly for the right support arm also includes a plastic roller and lock washer. Place the plastic roller and lock washer over the blade support post. Join the guide assembly onto the end of the blade support arm, post facing inward as shown. Continue assembly as above.

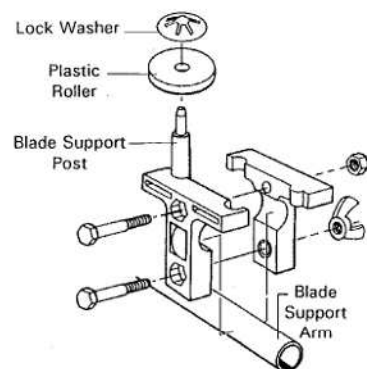


FIGURE 2-6. BLADE GUIDE (RIGHT).

Tilt the guide on the left blade support arm slightly backward, toward the rear of the Sharpener, and adjust to 5° (12.5 cm) from the end of the arm. Tilt the guide on the rear blade support arm slightly to the right and adjust to 1° (2.5 cm) from the end of the arm. Tilt the guide on the right support arm slightly forward and adjust to 3° (7.5 cm) from the end of the arm.

2.6 Hook Angle Adjustment

Angled templates of 10, 12.5 and 15 degrees are provided to check the hook angle. Refer to Table A-1 in Appendix A for recommended hook angles in varying cutting applications.

See Figure 2-7. To adjust, set the straight part of the template on the clamping fixture. Loosen the depth adjustment and/or

the depth stop knob until the Sharpener head rests on the hook angle template.

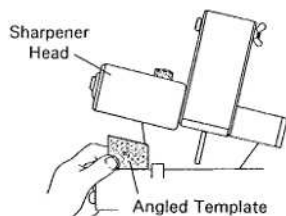


FIGURE 2-7. HOOK ANGLE ADJUSTMENT.

See Figure 2-8. Next, loosen the bolt in the vertical plate of the Sharpener. Tip the Sharpener head until you reach the desired angle. Hold the Sharpener head in place while retightening the bolt in the vertical plate.

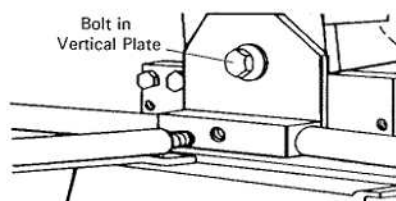


FIGURE 2-8. SHARPENER HEAD ADJUSTMENT.

2.7 Grinding Wheel Installation

For sharpening Wood-Mizer blades, select a 5° (12.5 cm) diameter, 1/4" (6.5 mm) wide grinding wheel with a 1/2" (12.5 mm) bore. Wheels approved for use with the Automatic Sharpener are available from Wood-Mizer. To order, call our toll-free Parts/Customer Service hotline at 1-800-525-8100. If your Sharpener was purchased outside of the United States, contact your distributor for replacement parts.

WARNING: Check the grinding wheel for cracks or chips before using it. If the wheel is cracked or chipped, DO NOT USE IT! Remove the grinding wheel while transporting the Sharpener to prevent cracking or damage due to jarring or bumping of the unit.

Before installing a new grinding wheel, push the START button on the control box and turn the FEED RATE dial up to rotate the cam. Continue operation of the cam until the sharpener head is at its lowest setting. Turn the FEED RATE all the way down and push the STOP button.

To install the grinding wheel, take off the wing nut on the right side cover of the Sharpener head. Remove the cover.

See Figure 2-9. Remove the arbor nut and nylon washer from the motor shaft. Slide a grinding wheel onto the shaft. Replace the nylon washer. Replace the arbor nut with the machined, or grooved, side toward the grinding wheel. Hand tighten. Replace the cover and wing nut.

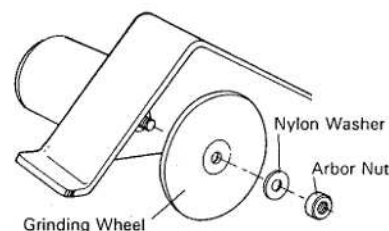


FIGURE 2-9. GRINDING WHEEL INSTALLATION.

WARNING: Replace the grinding wheel cover before operating the Sharpener.

After installing the grinding wheel, hold the sharpener head up with your hand and turn the back/depth grind knob in until the grinding wheel stays about 1/2" (1 cm) above the clamp plates as you let go of the head.

SECTION 3 SHARPENER COMPONENTS

This section contains a listing of the Sharpener components and their functions. Figure 3-1 shows their locations.

1. *Converter On/Off Switch.* Controls power for entire unit.
2. *Start Switch.* Starts cam motor.
3. *Stop Switch.* Stops cam motor.
4. *Feed Rate Dial.* Controls cam speed.
5. *Grinder On/Off Switch.* Controls Sharpener motor (Start Switch must be pushed first).
6. *Loc-line Valve.* Controls coolant flow.
7. *Face Grind Adjustment Knob.* Controls amount of metal ground from face of tooth.
8. *Depth Stop Knob.* Can be adjusted to prevent grinding wheel from touching the gullet of the blade.
9. *Depth/Back Grind Adjustment Knob.* Controls how far the grinding wheel comes down against the gullet and back side of teeth.
10. *Magnetic Shut-off Sensor.* Automatically turns off grinder and cam motors by sensing magnet placed on lower inside part of blade band.

NOTE: Circuit breakers (not shown) are located on the back of the control box and the left side of the converter box.

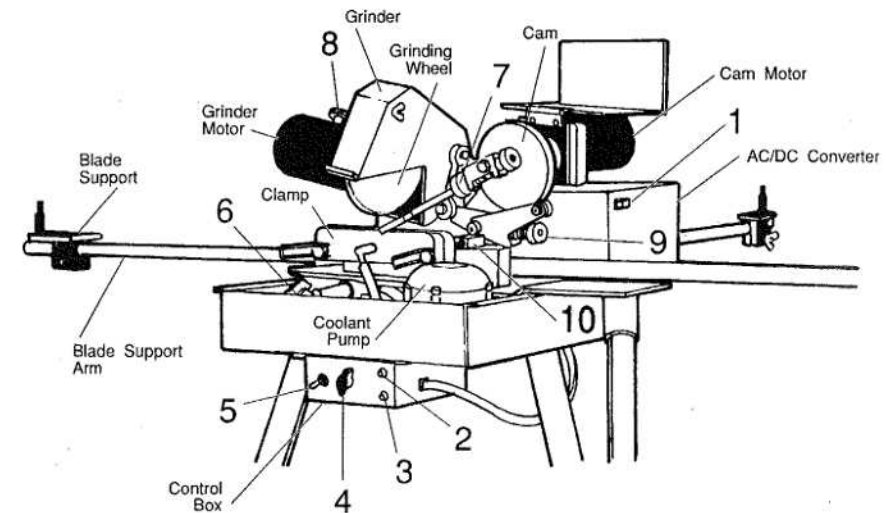


FIGURE 3-1. LTAGA SHARPENER COMPONENTS.

SECTION 4 SHARPENER OPERATION

Section 4.1 Blade Installation

Section 4.2 Grinding Wheel Shape

Section 4.3 Sharpener Adjustments

Section 4.4 Magnetic Shut-off

This section covers operation of the Automatic Sharpener. Refer to Appendix A for blade theory and terminology and for recommended specifications.

A quick-reference guide to sharpener operation also is provided. Use the accompanying two tie wraps to hang the guide on a blade support arm. Refer to the guide when sharpening.

4.1 Blade Installation

See Figure 4-1. Before installing a blade, push START and turn the FEED RATE dial until the cam pivot bolt is at the 2 o'clock position.

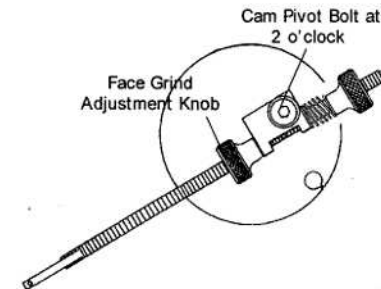


FIGURE 4-1. CAM/FACE GRIND KNOB ASSEMBLY.

Uncoil a blade and position above the three support assemblies around the sharpener. Check to be sure the teeth on the portion of blade that will be under the grinding wheel point to the right as you face the sharpener. If not, remove the blade and invert it.

See Figure 4-2. Position the blade inside the left and rear blade support posts.

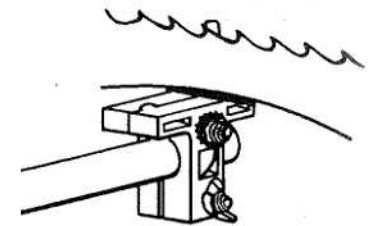


FIGURE 4-2. BLADE SUPPORTS (LEFT AND REAR).

See Figure 4-3. Position the blade outside the right blade guide wheel.

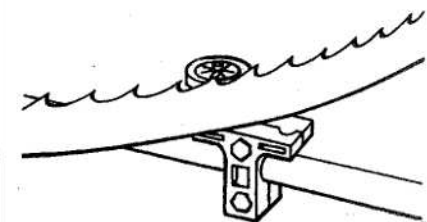


FIGURE 4-3. BLADE SUPPORT (RIGHT).

Holding the blade with your left hand, unclamp the blade clamping fixture. Lift the Sharpener head with your right thumb and the indexing arm with your right fingers (in that order). Press the blade between the clamping plates. Lower the indexing arm, then lower the Sharpener head. Engage the blade clamping fixture.

Make final adjustments to blade support arms and guide assemblies to assure the blade band rests evenly on both the right and left hardened dowel pins located in the blade clamp assembly. The blade should not touch the bottom of either side guide assembly. All three guide assemblies should lean slightly in the direction the blade travels through them.

Bend the blade wiper on the left side of the sharpener so that it touches the blade. The wiper will wipe coolant from the blade into the water tray so it does not drip on the floor.

4.2 Grinding Wheel Shape

WARNING: Always wear eye protection when operating this equipment.

The following section explains how to dress a new grinding wheel and how to maintain the shape of the wheel as you use it to sharpen blades.

4.2.1 Dressing A New Wheel

See Figure 4-4. There are 3 steps in dressing the grinding wheel. They are:

1. Dress bottom of wheel flat.
2. Dress small radius on left corner.
3. Dress right corner at tooth back angle.

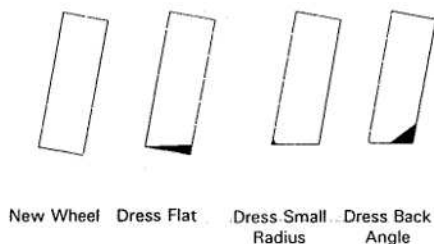


FIGURE 4-4. DRESSING THE GRINDING WHEEL.

Turn the converter switch on, push the START button on the control box. Turn the grinder switch to ON to start the grinding wheel spinning.

NOTE: Keep the FEED RATE dial turned all the way down to prevent the cam from moving while you dress the grinding wheel.

Use the provided dressing stone to shape the wheel as follows:

First dress the bottom of the grinding wheel flat, parallel to the blade clamp.

Next, dress a small radius on the left corner. Blend the radius with the bottom flat.

See Figure 4-5. Dress the right 1/3 of the wheel at the same angle as the back of the tooth.

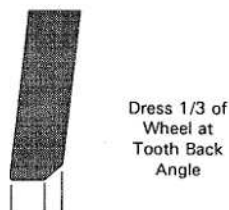


FIGURE 4-5. DRESSING THE BACK ANGLE.

The shape of the wheel will be refined after the sharpener has been adjusted to grind the blade.

Turn the grinder switch to OFF and push the STOP button on the control box.

4.2.2 Maintaining Wheel Shape

See Figure 4-6. The shape at which you have dressed the wheel must be maintained. It is especially important to maintain the small radius on the left corner of the wheel. This is the section that wears quickest. As the radius increases during sharpening, it starts to grind into the tooth face and leaves little or no hook angle in the tooth.

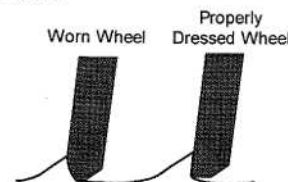


FIGURE 4-6. WORN GRINDING WHEEL

When the radius becomes too large, redress the grinding wheel by redressing the flat. Then, if necessary, redress the left radius and the back angle. Blend the flat and the left radius together.

CAUTION: NEVER try to dress the worn area by using the dressing stone on the left side surface of the wheel.

NOTE: As the wheel becomes smaller in diameter, it has less surface area to grind with and will wear down more quickly. Check the wheel regularly and redress as necessary.

IMPORTANT: When sharpening a blade, particles can become lodged in the grinding wheel that can burn or groove the gullet of the blade. Burns or grooves in the gullet create microscopic stress fractures which will eventually cause the blade to break prematurely. Lightly dressing the wheel after sharpening each blade will remove lodged particles and prevent the wheel from burning or grooving the blade.

4.3 Sharpener Adjustments

4.3.1 Overview Of Adjustments

At this point in the instructions, you should have your sharpener completely assembled and operational. The sharpener head should be set at the proper hook angle as explained in Section 2. A blade should be installed around the supports and clamped firmly. A grinding wheel has been installed and dressed properly.

There are three important areas to monitor when sharpening blades:

- Hook Angle
- Tooth Height
- Sharpness of Teeth

The hook angle has already been set and, assuming you maintain proper grinding wheel shape, should remain constant.

The remaining areas, tooth height and sharpness, are controlled by using the face and depth/back grind adjustment knobs.

To make these adjustments inspect the blade carefully with proper lighting.

4.3.2 Face Grind Adjustment

As you operate the sharpener, the cam will rotate causing the index arm to contact a tooth and push it to a position under the grinding wheel. The index arm can be adjusted to leave the tooth closer to or further from the grinding wheel so the tooth face is ground lighter or heavier.

Before adjusting the face grind, turn the cam motor off using the STOP button on the control box. Turn the FEED RATE dial all the way down.

Lift the Sharpener head. Push the START button on the control box and slowly increase the FEED RATE until the next tooth is underneath the grinding wheel. Release the Sharpener head and continue the FEED RATE until the bottom of the grinding wheel reaches the midpoint of the tooth face.

Turn the FEED RATE all the way down and push the STOP button. Spin the grinding wheel by hand to check the amount of face grind on the tooth.

See Figure 4-7. The grinding wheel should lightly contact the face of the tooth all the way up to the tip. If the face grind is too light, turn the face grind adjustment knob out away from the other knob. If the face grind is too heavy, turn the adjustment knob in toward the other knob. Advance the blade and recheck face grind and adjust as necessary.

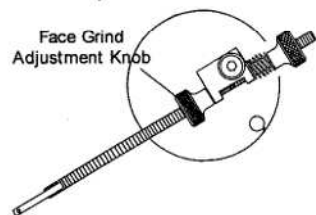


FIGURE 4-7. FACE GRIND ADJUSTMENT KNOB.

4.3.3 Tooth Height Adjustments

Tooth height is determined by how much material is removed from the gullet of the blade. The depth/back grind knob controls how far the grinding head comes down and therefore controls the gullet grind.

It is important to understand that any adjustments of the depth/back grind knob for gullet grind will also affect the back grind. If you use the knob to lower the wheel for more gullet grind, you will have to dress more from the back angle of the wheel to prevent grinding the back of the

teeth too heavy. If you dress the wheel for less back grind, you will have to readjust the depth/back grind knob for the gullet grind.

A. Gullet Grind Adjustment

Advance the blade with the FEED RATE dial until the grinding wheel is positioned over the lowest point of the gullet between teeth. Turn the FEED RATE all the way down and push the STOP button.

Spin the grinding wheel by hand and check how hard the wheel contacts the gullet of the blade.

See Figure 4-8. Use the depth/back grind knob to raise or lower the wheel so it lightly touches the gullet. Turn the knob in to raise the wheel and turn the knob out to lower the wheel.

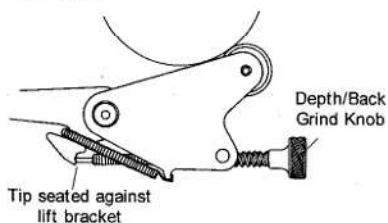


FIGURE 4-8. DEPTH/BACK GRIND ADJUSTMENT KNOB.

CAUTION: Always be sure the tip of the depth/back grind knob stays seated against the lift bracket as shown in Figure 4-8. The grinding wheel will damage the blade if the tip becomes unseated.

How much you need to grind from the gullet will be determined by how much tooth height you need (See Appendix A for tooth height recommendations). If your teeth are tall enough and you do not need to grind the gullet, use the depth stop knob to prevent the grinding wheel from reaching the gullet.

See Figure 4-9. The depth stop knob will override normal cam operation and stop the grinding head before the grinding wheel touches the gullet of the blade.

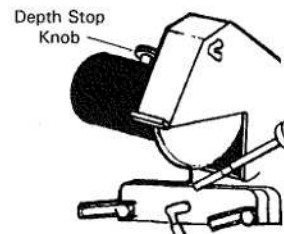


FIGURE 4-9. DEPTH STOP KNOB LOCATION.

With the grinding wheel positioned over the lowest portion of the gullet, turn the depth stop knob in until the grinding wheel no longer touches the gullet. DO NOT adjust the knob so far that the grinding wheel will no longer come all the way down the face of the tooth.

If you need to grind the gullet to regain the desired tooth height, use the depth/back grind knob to lower the grinding wheel into the gullet. Be sure the depth stop knob is backed out so it will not interfere with the grinding operation.

Important: Once you gullet grind a blade the first time, grind the gullet on all future sharpenings. This will provide consistent tooth height and longer blade life.

B. Back Grind Adjustment

When combined with a light face grind, back grind should remove enough material from the tooth to regain a sharp tip (See Section 5 for details concerning blade maintenance).

It is important to realize that you can grind a blade and not sharpen the teeth. You need to closely inspect the tips of the teeth to determine if you are actually getting a new, sharp tip.

With the face grind and gullet grind adjusted, you must now dress the back angle of the wheel to provide the desired back grind.

Hold the grinding head up and push the START button. Increase the FEED RATE to advance the blade until the grinding wheel is above the back of a tooth. Lower the head and check the contact of the grinding wheel against the back of the tooth.

See Figure 4-10. If the back grind is too heavy, dress the angle on the right side of the grinding wheel larger.

If the back grind is too light you will have to redress the flat portion of the wheel, reset gullet grind, then recheck the back grind.

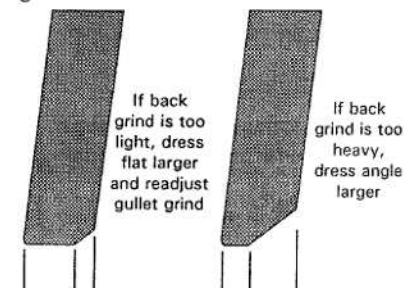


FIGURE 4-10. GRINDING WHEEL SHAPE.

4.3.4 Sharpener Operation

WARNING: Always wear eye protection when operating this equipment.

Now that the adjustments have been made for a light face, gullet, and back grind, you are ready to sharpen the blade.

Push the START button, open the coolant valve, and turn the grinder switch to ON. Slowly increase the FEED RATE to begin the blade moving. Increase the FEED RATE

to a moderate speed. How fast you can grind will be determined by how much material you are removing from the blade.

Continue to make adjustments so the desired grind is achieved.

Adjust the face grind so the entire tooth face is lightly ground from the tip to the base of the tooth.

Adjust the depth/back grind knob so enough gullet is ground to provide the desired tooth height.

Use the depth stop knob to prevent a gullet grind if none is desired.

Dress the back angle of the wheel larger to lighten the back grind. Grind enough from the back of the tooth to sharpen the entire tip of the tooth.

If a heavy grind is required, it is best to go around the blade lightly twice rather than try to grind heavily once. If you try to grind too heavy, the breaker at the back of the control box will pop. Wait 15 seconds and push the breaker in to reset.

Remember that any adjustments of the depth/back grind knob will affect both gullet and back grind. If you use the knob to lower the wheel for more gullet grind, you will have to dress more from the back angle of the wheel to prevent grinding the back of the teeth too heavy. If you dress the flat of the wheel larger for less back grind, you will have to readjust the gullet grind with the depth/back grind knob.

4.4 Magnetic Shut-off

See Figure 4-11. The shut-off sensor bracket is located to the right of the blade clamp assembly. When passed over by a magnet, it automatically shuts down the grinder and cam motors of the LTAGA.

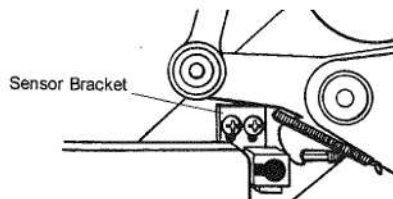


FIGURE 4-11. MAGNETIC SHUT-OFF SENSOR.

To install, take an orange-painted magnet from the bag assembly. Place the black side of the magnet against the bottom edge of the blade on the inside of the fifth face-ground tooth. After the sensor bracket has shut off the cam and grinder motors, flip the GRINDER switch into the OFF position. Remove the magnet.

4.5 Blade Removal

Blade removal is similar to blade installation. First, turn the FEED RATE dial all the way down. Then push START. Turn the FEED RATE dial until the cam pivot bolt is at the 2 o'clock position.

Unclamp blade clamping fixture. Lift the Sharpener head with your right thumb and the indexing arm with your right fingers (in that order). Use your left hand to remove the blade from the Sharpener. Lower the indexing arm, then lower the Sharpener head.

Lightly dress the grinding wheel to remove particles that may have embedded in the wheel. Turn off the CONVERTER switch.



CAUTION: Always turn off the converter box after you have finished sharpening for the day. LEAVING THE POWER ON COULD DAMAGE THE WATER PUMP!

SECTION 5 MAINTENANCE

Section 5.1..... Blade Maintenance
Section 5.2..... Sharpener Maintenance

Section 5.3..... Grinding Wheel Maintenance
Section 5.4..... Blade Sharpening Tips

This section contains information on critical blade maintenance areas and Sharpener maintenance.

See also Appendix A, Blade Theory and Terminology, or the Blade Maintenance Video for blade terminology, recommended specifications and troubleshooting.

5.1 Blade Maintenance

As you use a blade, the teeth of the blade slice away pieces of wood that they contact and carry these pieces in the form of sawdust out the other side of the log.

As the teeth contact the wood (or anything else in their path, such as dirt) the friction begins to wear the teeth down. Specifically, it is the outside corners of the set teeth that wear first. When these corners become round and shiny, it results in a "dull" blade. Dirt, rocks, sand and other foreign materials that may be in the log will wear the teeth considerably faster than the wood you are cutting. Such materials should be removed from the path of the blade before you start cutting.

When the tips start to become round and shiny, the blade can not cut as fast as when the tips were sharp and still maintain a straight cut. The wood will not chip away as quickly and the blade will be forced to move up or down, resulting in a wavy cut. Cutting with a dull blade also will do the following:

- Waste blade life because cutting speeds are slow.
- Slow production time.

- Make the blade harder to sharpen.
- Cause more wear on the grinding wheel.

To regain a sharp tip on the teeth, you must grind the face and back of the tooth until the tip is square again. The amount you have to grind away will depend on how rounded the teeth are. If a heavy amount must be removed to regain a sharp tip, it is best to grind the blade lightly twice, rather than grind heavily once.

When the face and back of the tooth are ground, the resulting tooth is shorter than before it was sharpened. Depending on how tall the tooth was before it was sharpened and how heavily it was sharpened, the tooth may become too short to cut efficiently. A tooth height of 3/16" (4.8 mm) is recommended for most cutting applications. Once you remove enough material from a new blade to cause the tooth height to reach 3/16", you must grind some material from the gullet to maintain the tooth height at 3/16". You should continue to gullet grind every sharpening to maintain adequate tooth height and extend blade life. See Table A-1 in Appendix A for specifications in varying cutting applications.

When grinding material from the back of the tooth, the amount of material bent out from the blade also becomes smaller. On average, 2 to 3 thousandths set is lost from each side of the blade when it is sharpened. The teeth must be bent back out when the set falls below recommended specifications. (See Table A-1 in Appendix A.)

The average life between sharpenings is 300-500 board ft. With proper blade maintenance the average life before a blade breaks is 1500-2000 board ft.

5.2 Sharpener Maintenance

Wipe the sharpener dry after each day's use. Keep clean of dirt, rust and metal filings. Remove the clamp regularly and clean out any buildup that might cause it to not clamp the blade firmly. When replacing the clamp, make sure it is placed flat against the stop block. Change the water and coolant and clean out the water tray as needed. Keep moving parts lubricated. These include: blade clamp, face grind adjustment knob and back grind adjustment knob. See also Section 5.3, Grinding Wheel Maintenance.

5.3 Grinding Wheel Maintenance

An important part of blade maintenance is grinding wheel dressing. When dressing the grinding wheel, dress the flat. Next, dress a small radius on the left corner. Blend these two sections together. Then dress the back 1/3 of the wheel at the same angle as the back of the blade teeth. If gullet grind is desired, dress back angle further across wheel. If shorter tooth height is desired, dress flat larger and reblend flat with radius.

NOTE: If you dress the grinding wheel too heavily, the circuit breaker on the back of the control box may kick out. If this happens, wait 15 seconds. Then push in and release circuit breaker.

Sharpening a blade with a worn wheel will do more damage to the blade than good. The shape at which you have dressed the wheel must be maintained. The small radius on the left corner of the wheel is especially important to maintain. This is the section that does the most grinding. The radius will increase during sharpening. As it becomes larger, it starts to grind into the tooth face and leaves little or no hook angle in the tooth.

To maintain grinding wheel shape, redress the wheel when it becomes worn. Also redress the wheel when it becomes "loaded

up" with metal and no longer sharpens teeth properly. To redress, dress the bottom of the wheel flat. Blend the flat with the small left corner radius. Redress back angle if necessary.

IMPORTANT: When sharpening a blade, particles can become lodged in the grinding wheel that can burn or groove the gullet of the blade. Burns or grooves in the gullet create microscopic stress fractures which will eventually cause the blade to break prematurely. Lightly dressing the wheel after sharpening each blade will remove lodged particles and prevent the wheel from burning or grooving the blade.

Abnormal wear on the grinding wheel may be caused by:

- Improper dressing
- Grinding too fast
- Grinding too heavy
- Grinding too many blades without redressing

Replace the grinding wheel when it becomes too small to properly sharpen blades.

5.4 Blade Sharpening Tips

This section covers some of the common problem areas of blade sharpening.

Before removing from saw, clean blade by running the waterlube on the blade for 15 seconds. This will remove most of the sap buildup that would otherwise have to be scraped off when it dries. Wipe with a clean dry rag.

Make sure a strong flow of water falls directly on the tip of blade tooth while sharpening.

Average sharpening time should take between 5-15 minutes. (Feed rate will vary on different sharpeners.) Blue on the tooth tip

during sharpening and abnormal or excessive wheel wear are signs that you are grinding too fast.

Sharpen the blade when it first shows signs of dullness. If the blade is extremely dull, due to hitting a rock or some form of foreign matter, sharpen the blade twice lightly, instead of trying to remove too much in one grind. Grinding too much material at once may cause the circuit breaker on the back of the control box to kick out. If this happens, wait 15 seconds. Then push in and release circuit breaker.

NOTE: Blade sharpening is only the first step in blade maintenance. Be sure to check blades for proper set for best performance.

SECTION 6 SCHEMATICS & PARTS

Section 6.1..... LTAGA Wiring Diagram
Section 6.2..... Stand Assembly
Section 6.3..... Cam Assembly
Section 6.4..... Grinder Head Assembly
Section 6.5..... Bell Crank Assembly

Section 6.6..... Converter
Section 6.7..... Control Assembly
Section 6.8..... Miscellaneous Parts
Section 6.9..... Clamp & Cooling System

6.1 LTAGA Wiring Diagram

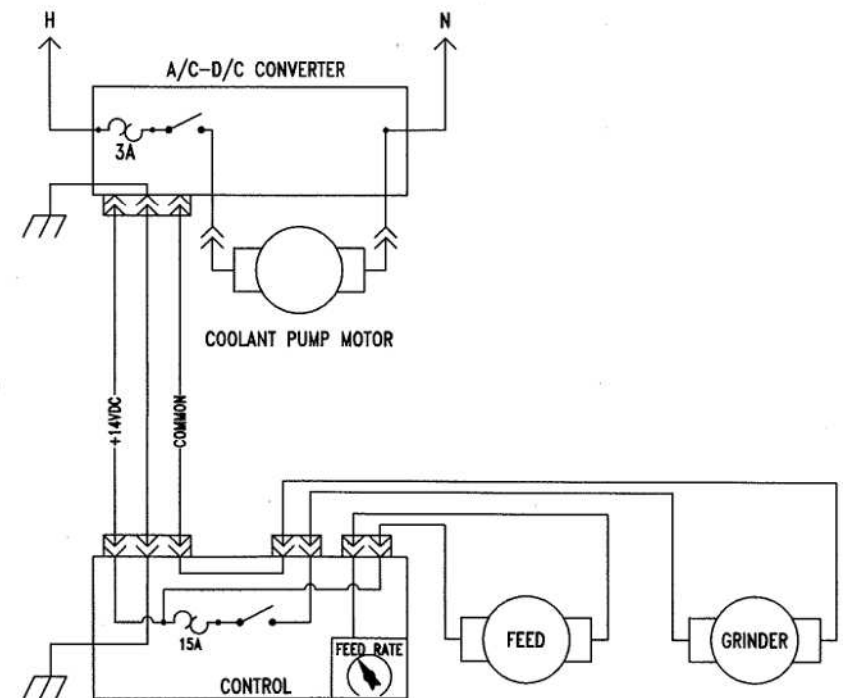


FIGURE 6-1. LTAGA WIRING DIAGRAM.

6.2 Stand Assembly

Item	Part #	Description	Qty.
1	W09766	Base, Sharpener Mounting	1
2	F05005-1	Bolt, 1/4-20 x 3/4" Hex Full Thd.	6
3	F05010-9	Nut, 1/4-20 Hex Self-Locking	6
4	W09769	Tray, Sharpener Water	1
5	P09812	Plug, Water Tray	1
6	S09781	Leg, Sharpener Stand, Long	3
7	S09782	Leg, Sharpener Stand, Short	3
8	W09778	Tray, Sharpener Tool	1
14	A10600	Control Assembly, AGA Sharpener	1
13	A10532	Harness, 3-Wire Control/Transformer	1
15	E10698	Breaker, 15 AMP Circuit	1

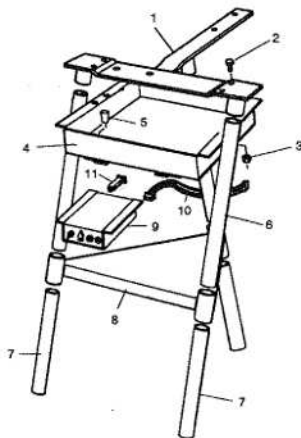


FIGURE 6-2. LTAGA STAND ASSEMBLY.

6.3 Index Arm, Cam & Shut-off Sensor Assemblies

Item	Part #	Description	Qty.
1	A09821	Index Arm Assembly (Includes Items 2, 3, 4, 28, and 29)	1
2	F05012-2	Roll Pin, 1/8" x 1"	1
3	S09733	Knob, Index Arm Adjustment	2
4	S09713	Mounting Block, Index Arm	1
5	S10663	Rod, Cam Break	1
6	S09734	Shaft, Cam Drive	1
7	F04254-4	Retaining Ring, 1.575" I.D.	1
8	P06030-2	Bearing, Cam Drive 6203 2NSL 17 mm	3
9	F05010-11	Jam Nut, 5/8-18	1
10	P09800	Hinge, 2" Cam Cover	1
11	F05010-14	Keps Nut, #10-24	4
15	P06583	Bumper, Rubber	1
13	F05010-17	Hex Nut, 5/16-18	1
14	S09811	Cover Cam	1
15	F05004-26	Screw, #10-24 x 1/2 Sock. Hd.	4
16	A10365	Motor, Cam Gear Replacement	1
	P12568	Gear Kit, Klauber Motor Replacement	1

Item	Part #	Description	Qty.
17	F05006-18	Hex Bolt, 5/16-18 x 1 1/4" FT	1
18	F05004-29	Screw, #10-32 x 1/2" Button Hd.	4
19	P06460	Spring, Cam Brake	1
20	S09838	Bracket, Shut-Off Sensor	1
21	F05004-3	Screw, #10-24 x 3/8" Phillips Hd.	4
22	S10519-1	Magnet, Orange Shut-Off	3
23	A10514	Sensor, AGA Shut-Off	1
24	W10656	Cam Weldment	1
25	P10649	E-Clip, 1/2" Dia., Standard	1
26	F05011-16	Washer, 5/16" Standard	2
27	P08060-1	Bushing, Bronze SF1620-5	2
28	P09816	Spring, Index Arm LC-045G-7SS	1
29	F05006-15	Bolt, 5/16-18 x 1/2", HH GR5	1
30	S10692	Decal, Moving Cam Warning (Not Shown)	1

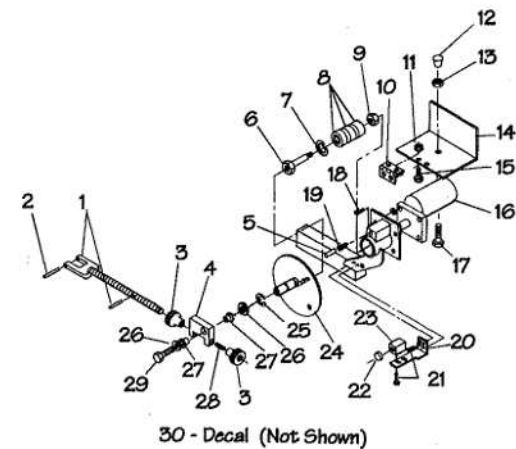


FIGURE 6-3. INDEX ARM, CAM & SHUT-OFF SENSOR ASSYS.

6.4 Grinder Head Assembly

Item	Part #	Description	Qty.
1	A04665	Motor, Grinder	1
2	A07969	Brush Kit, Grinder Motor	1
3	P10689	E-Clip, 3/8"	1
4	A04543	Knob, Grinder Head Depth	1
5	F05010-30	Nut, 5/16-24 Wing	1
6	A04799	Arbor Kit, Includes Male & Female Arbor, Nylon Washer, Set Screw	1
7	P04567-9	Wheel, 1/4" Grinding	1
8	P04527	Washer, Nylon Grinding Wheel	1
9	S10668	Cover, Grinder Head	1
10	F05010-23	Nut, 5/16-18 Wing	1
11	F05011-20	Washer, #10 Split Lock	1
12	F05010-27	Nut, #10-32 Hex	1
13	P03054	Bearing, Grinder Head R62Z	2
14	F05011-18	Washer, #10 SAE Flat	1
15	F05004-29	Screw, #10-32 x 1/2" Buttn. Hd.	1
16	A10653	Blade Fixture Assembly (See Section 6.9 for detail)	1
17	F05008-42	Bolt, 1/2-20 x 1" Hex Head	2
18	F05011-2	Washer, 1/2" SAE Flat	2
19	S10700	Wiper, AGA Blade	1

Item	Part #	Description	Qty.
20	A04550	Arm, Blade Support	3
21	P04587	Coupling, 1/2" EMT w/Screws	2
22	F05010-13	Nut, 1/4-20 Wing	3
23	F05010-9	Nut, 1/4-20 Hex Self-Locking	3
24	S10625	Arm Extension, Blade Support	2
25	S10611	Support, Blade w/ Post	3
26	F05005-5	Bolt, 1/4-20 x 1 1/2" Hex Head	6
27	S10539	Roller, Blade Support	1
28	P10614	Washer, Push Lock	1
29	S10612	Support, Blade w/o Post	3
30	F05005-16	Screw, 1/4-20 x 1/2" Thumb	1
31	D04672	Guard, Mist	1
32	S10691	Decal, Eye Protection Warning	1
	A04545	Blade Support Kit (Includes 3 each #21, #23 - 30)	1
	A20912	Blade Support Arm Extension Kit (Includes 2 each #22 and #25)	1
	A10617	Blade Support Roller Kit (Includes 3 each #23, 24, 26-30)	1

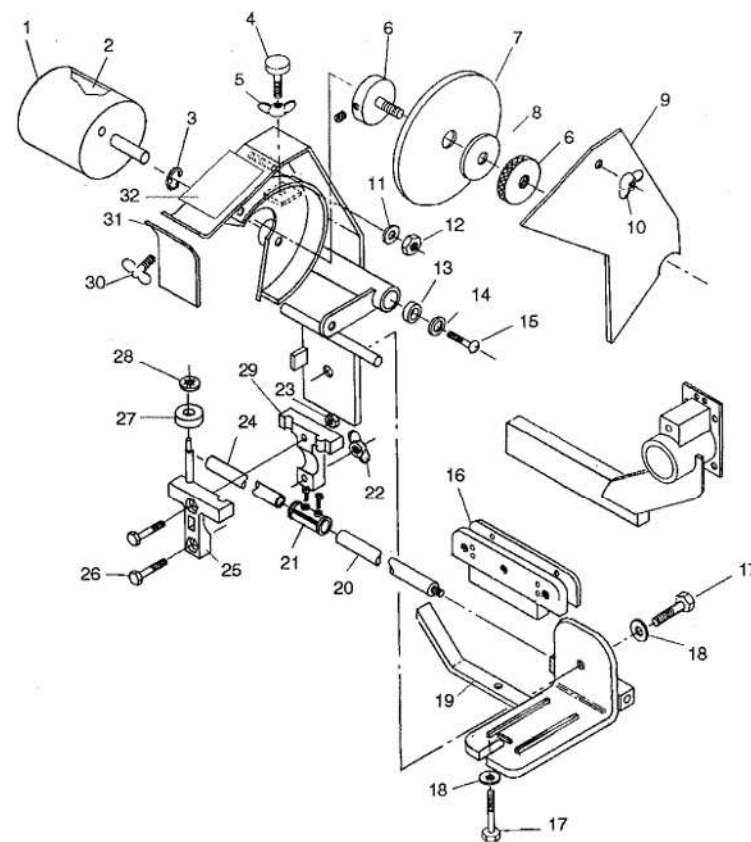


FIGURE 6-4. GRINDER HEAD ASSEMBLY.

6.5 Bell Crank Assembly

Item	Part #	Description	Qty.
1	F05006-1	Hex Bolt, 5/16-18 x 1"	2
2	P09814	Rod End, 5/16-24, Male	1
3	F05010-28	Hex Nut, 5/16-24	2
4	F05010-6	Lock Nut, 5/16-18	1
5	A09822	Bell Crank Assembly (Includes items 8-12)	1
6	F05008-36	Bolt, Shoulder, 1/2 x 1/2	1
7	P09813	Rod End, 5/16-24, Female	1
8	P08060	Bushing, Bronze SF1620-6	2
9	P06049	Bearing, Bell Crank 629-2NSL	1
10	A09765	Screw, Back Grind Adjustment	1
11	P09816	Spring, Back Grind Knob LC-045G-7SS	1
12	P09817	Spring, Bell Crank LE-031C-8SS	1

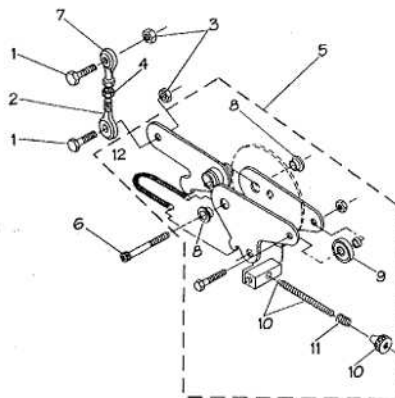


FIGURE 6-5. BELL CRANK & GRINDER HEAD

6.6 Converter

Item	Part #	Description	Qty.
1	A10549-110	Transformer, 110V to 12V AGA	1
	A10531-220	Transformer, 220V to 12V AGA	
2	E10466	Breaker, 3 AMP	1
3	E10473	Switch, On/Off, AGA Transformer	1
4	P10526-110	Decal, GFI 110V Transformer Danger	1
	P10526-220	Decal, GFI 220V Transformer Danger	

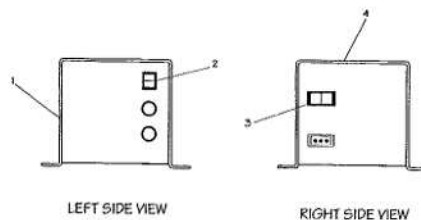


FIGURE 6-6. CONVERTER.

6.7 Control Assembly

Item	Part #	Description	Qty.
1	A10600	Control Assembly	1
2	P03027	Switch, On/Off Toggle	1
3	E20519	Switch, AGA Speed Control	1
4	E10472	Switch, AGA Start, Black	1
5	E10471	Switch, AGA Stop, Red	1
6	P06257	Knob, AGA Speed Control Switch	1
7	E10698	Breaker, 15 AMP	1

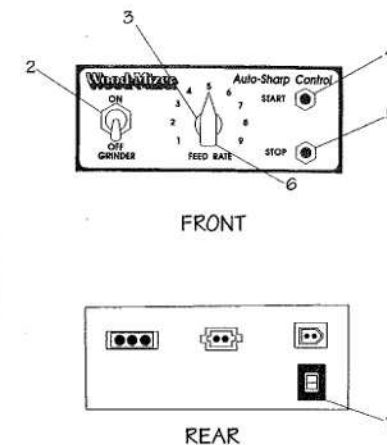


FIGURE 6-7. CONTROL ASSEMBLY.

6.8 Miscellaneous Parts (Not Shown)

Item	Part #	Description	Qty.
1	S10628	Template, 10° Angle	1
2	S10629	Template, 12.5° Angle	1
3	S10630	Template, 15° Angle	1
4	P04570	Stone, Grinding Wheel Dressing	1
5	A04673	Coolant, Grinding Concentrate, 32 oz. bottle	1
6	P10609	Glasses, Safety	1

6.9 Clamp & Cooling System

Item	Part #	Description	Qty.
1	P09836	Pump, AGA Coolant	1
2	P04688	Fitting, 1/4" NPT x 3/8" Tube	1
	A10653	Clamp Ass'y (Includes #3-13)	1
3	R01885	Hose, 3/8" I.D x 1/2" O.D.	.33 ft.
4	P09835	Valve, 1/4" Loc-Line	1
5	P09140	Fitting, 1/4" NPT Male Elbow	1
6	W10650	Clamp Weldment, AGA Fixed	1
7	S10652	Clamp Plate, AGA Moving	1
8	F05010-28	Nut, 5/16-24 Hex	2
9	F05012-10	Pin, 1/4" x 1" Dowel	2
10	P09818	Spring, LC-067GH-4SS Clamp	2
11	F05011-16	Washer, 5/16" Standard	2
	A10527	Handle Assembly, AGA Clamp (Includes #12-14)	2
12	S09839	Bolt, Modified 5/16-24 x 2.5"	2
13	S09793	Handle, Clamp Lock	2
14	F05012-6	Pin, 1/8" x 3/4" Roll	2

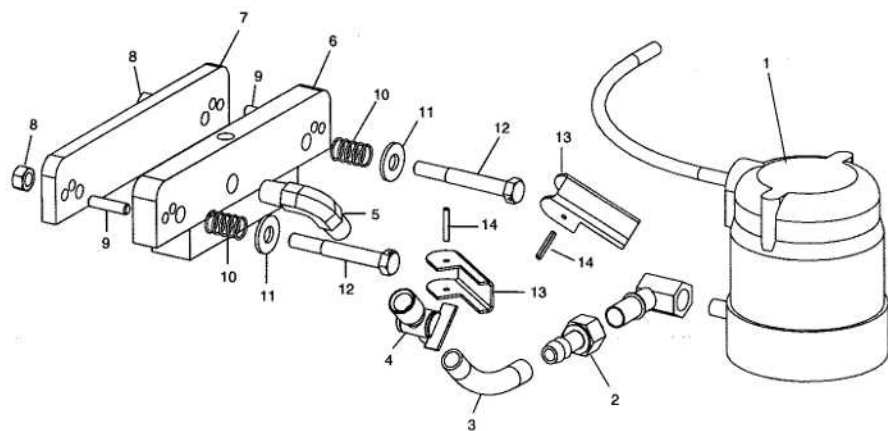


FIGURE 6-8. CLAMP & COOLING SYSTEM.

APPENDIX A BLADE THEORY & TERMINOLOGY

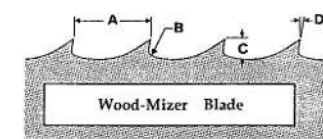
Section A.1..... Tooth Spacing
Section A.2..... Tooth Height (Depth of Gullet)
Section A.3..... Hook Angle

Section A.4..... Face Angle
Section A.5..... Tooth Set

The blade can cause the success or failure of a cutting operation. It is important for sawyers to understand definitions and theories about blades. What our research has shown to be the most productive has not always matched what the textbooks say. We believe this is due to the low horsepower and narrow width of our blades as compared to larger production mills. This section explains blades used with the Wood-Mizer.

See also Section 5, Maintenance and the Blade Maintenance Video for blade sharpening techniques and troubleshooting.

See Figure A-1. Wood-Mizer blades are available in both 0.035" (0.9 mm) and 0.042" (1.1 mm) thicknesses. A Customer Service Representative can help you decide which thickness is best for your cutting application.



A = Tooth Spacing
B = Radius
C = Tooth Height (Depth of Gullet)
D = Hook Angle

FIGURE A-1. TOOTH CONFIGURATIONS.

A.1 Tooth Spacing

Tooth spacing is the space between each tooth from one tip to another. The tooth spacing of Wood-Mizer blades is 7/8" (22.0 mm). Tooth spacing will always remain the same. It is not changed by the sharpening process.

The term "pitch" also is used to describe tooth spacing. Pitch refers to the number of teeth per inch on a bandsaw blade. The pitch of Wood-Mizer blades is 1.14" (29.0 mm).

A.2 Tooth Height (Depth Of Gullet)

Tooth height is the distance from the bottom of the gullet to the tip of the tooth. The gullet is the area between teeth that carries sawdust out of the cut. Tooth height must be tall enough to allow the gullet to carry out all of the sawdust from the cut.

The tooth height of the Wood-Mizer blade is tall enough for most cutting applications. However, as the blade is sharpened, tooth height decreases. To maintain adequate tooth height for most cutting applications, you will need to slightly grind the gullet when tooth height reaches 3/16" (4.8 mm).

See Table A-1 at the end of this section. A 3/16" (4.8 mm) tooth height should be used for most cutting applications. A slightly shorter tooth height (5/32" or 4.0 mm) may be used on extremely hard or frozen woods. A slightly taller tooth height (1/4" or 6.4 mm) may be used on extremely softwoods.

A.3 Hook Angle

Hook angle, tooth set and sharpness of tooth are the three most important factors in the cutting ability of a blade. All three have an important effect on cutting quality and production.

See Figure A-2. The hook angle is the number of degrees that the tooth face leans forward of 90 degrees. The hook angle allows the teeth to "hook" themselves into the wood. The teeth must take out enough wood so that the blade feeds itself into the log. If the hook angle is too large compared to the feed rate, it causes chatter, a rough cut and poor cut quality. If the hook angle is too small, the blade must be forced into the log so that the saw will cut.

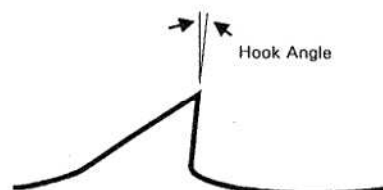


FIGURE A-1. HOOK ANGLE.

The size of the hook angle is determined by the type of wood and the production rate. In most cutting applications, the smaller the hook angle, the slower the mill's cutting capacity.

See Table A-1 at the end of this section. The recommended hook angle for most cutting applications is 10-12.5 degrees. A hook angle of 8-10 degrees may be used on extremely hard or frozen woods. A hook angle of 12.5-15 degrees may be used on extremely softwoods.

A.4 Face Angle

The face angle is the angle of the tooth face in relation to the body of the blade. The

face angle is ground to 90 degrees when the Sharpener is correctly aligned. The setting process bends the teeth a few degrees past 90 degrees.

A.5 Tooth Set

Tooth set is an important factor in the cutting ability of a blade.

See Figure A-3. The tooth set is the distance that a tooth is bent compared to the body of the blade. The more a tooth is set, the wider the cutting path of the blade and more horsepower required.



FIGURE A-3. TOOTH SET.

See Table A-1. The recommended tooth set for most cutting applications is 0.016-0.018" for 0.035" blades and 0.019-0.021" for 0.042" blades.

Less set may be used on extremely hard or frozen woods (0.013-0.015" set for 0.035" blades and 0.016-0.018" set for 0.042" blades).

More set may be used on extremely softwoods for 0.042" blades (0.021-0.023" set). The 0.035" blade is not recommended for this cutting application.

Remember that as you sharpen teeth and decrease tooth height, the set also will decrease and the blade will need resetting.

HOOK ANGLE	TOOTH HEIGHT	SET DIMENSION	EXTREMELY HARD OR FROZEN WOODS	AVERAGE WOODS	EXTREMELY SOFT WOODS
			8 - 10 degrees	10 - 12.5 degrees	12.5 - 15 degrees
			5/32" (4.0 mm)	3/16" (4.8 mm)	1/4" (6.4 mm)
		0.035" BLADES	0.013 - 0.015	0.016 - 0.018	Not recommended.
		0.042" BLADES	0.016 - 0.018	0.019 - 0.021	0.021 - 0.023

TABLE A-1. BLADE SPECIFICATIONS.

APPENDIX B BLADE HANDLING

Section B.1.....Coiling the Blade
Section B.2.....Uncoiling the Blade

Section B.3.....Inverting the Blade

This section covers coiling the blade, uncoiling the blade and inverting the blade.



WARNING: Always wear gloves and eye protection when handling bandsaw blades. Keep people away from work area when coiling or moving blades.

B.1 Coiling The Blade

1. See Figure B-1. Raise the blade in front of you, with the teeth pointed upward. (About 1/3 to 1/4 of the blade should be between your hands.) Hold your hands about shoulder-width apart. Place your thumbs on the outside of the blade and your fingers on the inside of the blade. Squeeze the blade inward, making it oval-shaped.

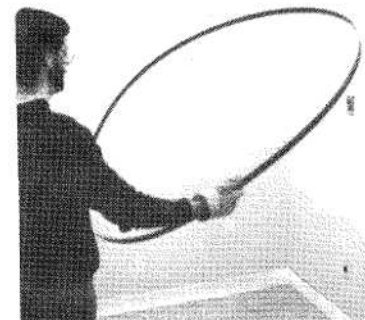


FIGURE B-1. BLADE COILING STEP #1.

2. See Figure B-2. Keeping your wrists locked in position, turn your forearms upward and inward. (The teeth will rotate inward and the bottom of the blade will rotate outward.)

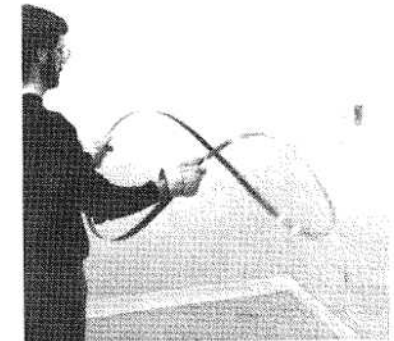


FIGURE B-2. BLADE COILING STEP #2.

3. See Figure B-3. Bring your hands together. The blade will form three loops. Snap the bottom loop upward and catch the three-loop coil in your hands.

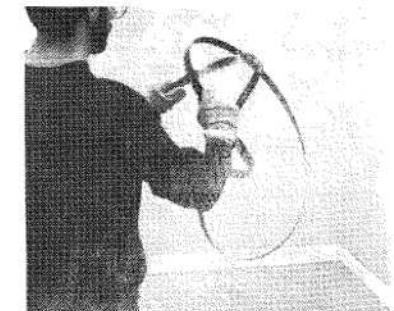


FIGURE B-3. BLADE COILING STEP #3.

B.2 Uncoiling The Blade

See Figure B-4. Take the three-loop coil in your right hand. Place the band against your palm with the blade teeth pointing outward toward your fingers. Slide the top loop off and let drop.



FIGURE B-4. BLADE UNCOILING STEP #1.

See Figure B-5. The remaining two loops of the blade will form a cross. Hold this crossed section out in front of you with the blade teeth pointing toward you. If the right side is crossed OVER the left, hold the crossed section with your right hand. (If the left side of the blade is crossed OVER the right, hold the crossed section with your left hand.)



FIGURE B-5. BLADE UNCOILING STEP #2.

See Figure B-6. Keeping the blade in its crossed position, take hold of the side crossed UNDER with your other hand. Use your right (or left) hand to hold only the side crossed OVER. Place your thumbs on the top side of the blade. Put your fingers on the underneath side of the blade.



FIGURE B-6. BLADE UNCOILING STEP #3.

See Figure B-7. Hold the blade out and away from you. Slowly move your hands apart while rotating your forearms down and outward.

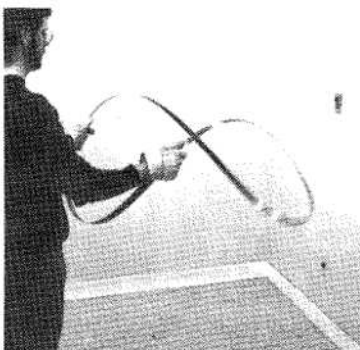


FIGURE B-7. BLADE UNCOILING STEP #4.

B.3 Inverting The Blade

See Figure B-8. Hold the blade in front of you. Let one side rest on the ground, teeth pointing toward you. Place your thumbs on the outside of the blade. Put your fingers on the inside of the blade.



FIGURE B-8. BLADE INVERTING STEP #1.

See Figure B-9. Hold the blade with your hands a little farther than shoulder-width apart. Then bring your hands toward each other while rotating your thumbs downward. This causes the middle of the blade to curve downward.



FIGURE B-9. BLADE INVERTING STEP #2.

See Figure B-10. Keeping your hands close together, rotate the curved section of the blade up and away from you. The blade will be in an oval shape, but twisted.



FIGURE B-10. BLADE INVERTING STEP #3.

See Figure B-11. Slowly move your hands apart, allowing the blade to untwist.



FIGURE B-11. BLADE INVERTING STEP #4.