Jupiter ATI Series 5 Mower Grinder Operation and Maintenance Manual

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Contents

SECTION 1 - SAFETY

General Safety Precautions

WARNING! Read these safety instructions before using the equipment

- ⚠ Never use this equipment unless properly trained and authorised. Keep children away from the work area.
- ⚠ Eye protection manufactured to the current European Safety Standards must be worn when operating this equipment. Everyday glasses do not have impact resistant lenses, and are not safety glasses.
- ⚠ Always check for damage before using this equipment. Any damage should be properly repaired. Until the damage has been repaired the equipment must be isolated to prevent use.
- ⚠ Always ensure that all safety guarding in place, and free from damage. Do not alter guarding.
- ⚠ Always ensure that adequate lighting is available. Ensure that the lighting is adjusted so that the work area is not in shadow.
- ⚠ Always use a face or dust mask if the operation is particularly dusty.
- ⚠ Always isolate the equipment from the power supply before servicing and when changing accessories.
- ⚠ Should access to the main electrical control box be required, the machine must be isolated from the mains power supply. Under no circumstances enter the control box with the power connected as this could result in electric shock.
- ⚠ Do not use the equipment in damp or wet locations or if exposed to rain.
- ⚠ Do not use if exposed to an explosive atmosphere, such as paint or solvent fumes, or flammable liquids.
- ⚠ Always keep the work area clean and clear.
- ⚠ Always wear the proper apparel. Secure loose clothing and jewellery. Wear a protective hat to contain long hair.
- ⚠ Never operate the equipment whilst under the influence of drugs, alcohol or certain medications.
- ⚠ Do not use the equipment for any other purpose than that for which it was designed.
- ⚠ Always switch off the equipment in the event of excessive vibration, and investigate the cause before proceeding.
- ⚠ Avoid prolonged contact with cooling fluids and lubricants. Wear suitable gloves or use barrier creams to limit contact. Discontinue use and seek medical advice if skin irritation is caused.
- ⚠ After switching off, always allow sufficient time for the grinding wheel to stop before touching.
- ⚠ Never place hands on or near the grinding wheel when it is rotating.
- ⚠ Never touch the cylinder, drive mechanism, or motor hand wheel when they are rotating.

⚠ Always wear suitable gloves when handling cylinders and bottom blades, especially when they have been sharpened

Grinding Safety Precautions

⚠ Eye protection manufactured to the current European Safety Standards must be worn when operating this equipment. Everyday glasses do not have impact resistant lenses, and are not safety glasses.

⚠ Grinding wheel dressing, truing and replacement should only be carried out by operators correctly trained in the safe use of abrasive wheels as detailed in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)

⚠ Always replace a cracked wheel immediately.

⚠ Never operate without the wheel guarding in place.

⚠ Do not remove the wheel guard except when replacing a wheel or carrying out maintenance.

⚠ Always use a grinding wheel suitable for the speed of the grinder. Replacement wheels should be approved for their purpose.

⚠ Do not over stress the grinding wheel.

⚠ After switching off, always allow sufficient time for the grinding wheel to stop before touching.

⚠ When grinding is complete always switch off the machine and wait until the grinding wheel has come to a complete stop before removing the cylinder or bottom blade from the machine.

Safe Operation of Machine

The machine has been designed to function in a safe manner. The guard system and emergency stops are interlocked to disconnect all drives. Operation of the emergency stops or opening of the access doors will bring all drives to an immediate and complete stop.

Removal of the front guard will disable the spin drive only all other drives will remain operational and can be used as normal. The front guard MUST be in place in order for the spin drive to operate.

The rear guard is not interlocked however and is held in place by two M10 studs and nuts. This guard needs to be removed if you are to grind units in-situ.

The rear guard MUST be in place and the nuts fully tightened it you intend to grind cylinders out of the mower. As the rear guard is not interlocked it is the sole responsibility of the operator to ensure the guard is fitted correctly in accordance with this instruction.

DECLARATION OF CONFORMITY

Certificate of Incorporation: 93/44/EEC

Standards used:

EN 60 204-1 (1993)	Safety of Machinery – Electrical equipment of machines
EN 292/1 and 2 (1991)	Safety of Machinery – Terminology, methodology and specifications
EN 418 (1992)	Safety of Machinery – Emergency stop equipment, functional aspects
EN 5304 (1988)	Safety of Machinery
BS 7671 (1992)	IEE Wiring Regulations – Sixteenth Edition

Description of Product: Cylinder & Bottom Blade Grinding Machine.

Name; type or model: Jupiter ATI Series 5

Declaration
We declare, the above information in relation to the supply/manufacture of this product is in conformity with the stated standards and other related documentation following the provisions of 93/44/EEC directives.

Hunter Grinders

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SECTION 3 - GRINDING MACHINE OVERVIEW

Description of features

The Jupiter Series 5 cylinder and bottom blade grinder is capable of grinding in both ‘spin’ and ‘relief’ modes. Spin grinding is completely automatic and involves grinding the blade faces into the form of a true cylinder. Relief grinding requires an operator but turns out superior results and the quality of cut lasts longer. The blade face is angled away from the cutting edge to give a true shearing action. Bottom blade grinding is semi automatic. The Jupiter is capable of grinding most mower cylinders from the smallest domestic unit up to the largest 42 inch professional cylinders mounted either in or out of the mower frame.

The ATI version of the Jupiter grinding machine allows automatic cylinder relief grinding. It is used primarily to control the operation of the indexing motor in conjunction with traversing the grinding head. When set up, the machine will traverse the grinding head along the cylinder, grinding the blade, then index the cylinder to the next blade and resume the grinding process, repeating for all blades and feeding the grinding wheel towards the cylinder as required.

The base of the unit houses a one-piece cast iron bed to give strength and durability, and reduce the effects of shock and vibration. All bearing surfaces are precision machined to give exceptional accuracy.

Quick change mounting brackets positioned on the machine bed allow fast and simple transfer of cylinders and are easily adjustable for varying mower sizes and formats.

The unit is supplied with a tank mounted coolant pump to supply coolant to the cutting area, preventing localised heating and distortion of the blade. The coolant also minimises the release of grinding dust into the atmosphere.

A fully tested electric hoist, with a 200 kilogram safe working load, is mounted over the unit for ease of lifting heavy components. The design of the hoist support frame allows it to be swung out over the area in front of the grinder. Twin halogen lights mounted on the hoist frame illuminate the work area.

The Jupiter comes complete with fully interlocked guarding for the safety of the operator.

All Hunter grinding machines are installed by fully qualified engineers from Hunter Grinders

All purchasers of our machines are trained for the safe and correct use of our grinding machines.

A full set of comprehensive instructions are provided with each machine on delivery and installation.

Handling of grinding machines: Normally carried out by Hunter Grinders. If you wish to re-site your grinding machine, contact Hunter Grinders for help or advice.

Correct use of the machine as outlined in the comprehensive instructions. In the case of any misuse of grinding machines, Hunter Grinders will NOT BE LIABLE should any accident occur.

The maintenance of the grinding machine is detailed in this document, but regular maintenance can be carried out by one of Hunter Grinders qualified service engineers.

Training: The grinding machine must only be operated by trained personnel. Retraining of operatives can be arranged with Hunter Grinders If unsure of any procedures outlined in these instructions, please contact Hunter Grinders who are able to offer advice, help and training in all aspects of the equipment.

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For any further information or spare parts contact, Hunter Grinders

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Identification of Machine

Customer:

Project Number: Jupiter ATI Series 5

Name of Machine: Jupiter Cylinder & Bottom Blade Grinding Machine

Serial Number:

The machine information for this can be identified by the serial number plate attached to the machine.

Machine Installation Requirements

Electrical Supply:	240VAC Single Phase, Neutral and Earth 13amp 50/60Hertz 13 amp fuses required
Compressed air supply:	Not required
Positioning:	On a firm level floor, sited indoors

Machine Specification

The machines is designed to relief and spin grind lawn mower cylinders, either in or out of the mower frame, and also grind front and top edges of bottom blades.

Grinding wheel size:
Rotational speed:
Grinding motor rating:
Traversing motor rating:
Spin motor rating:

Please note that the details and specifications contained herein are correct at the time of going to print. Hunter Grinders reserves the right to change specifications at any time without prior notice.

SECTION 4 - OPERATING INSTRUCTIONS

Cylinder preparation and mounting - without frame

⚠ Ensure that the grinding machine power is switched off to prevent accidental start-up

Before grinding an unmounted cylinder (not mounted in a mower frame), check the overall condition. Bent spirals must be straightened. Spirals that have been repaired by welding should have any projecting welds ground back away from the cutting edge.

Check that the spirals have not been badly worn or previously ground close to the mounting webs.

Check that the cylinder shafts are in good condition, particularly the bearing mounting areas. Clean off any burrs, scores or corrosion using a fine abrasive tape.

Lightly oil the shafts and fit the appropriate bearing adaptor. These can be identified using the tables in section 7. Contact Hunter Grinders for additional adaptors or for help in identification. The bearing sides of the adaptors should face inwards, fully on the shaft and flush with the shoulder. Do not use a hammer or other hard object to drive the adaptors onto the shafts as this will cause damage resulting in the incorrect fit within the machine tailstocks and inaccurate grinding. Use a soft faced mallet or tubular drift.

Mount the cylinder with the bearing adaptors between the tailstocks. Check that the rotation of the cylinder is in the correct direction. When viewing the cylinder from the operator's side of the machine, the "mowing" rotational direction is downwards. See figure 1 below. The cutting edge should be on the lower spiral face.

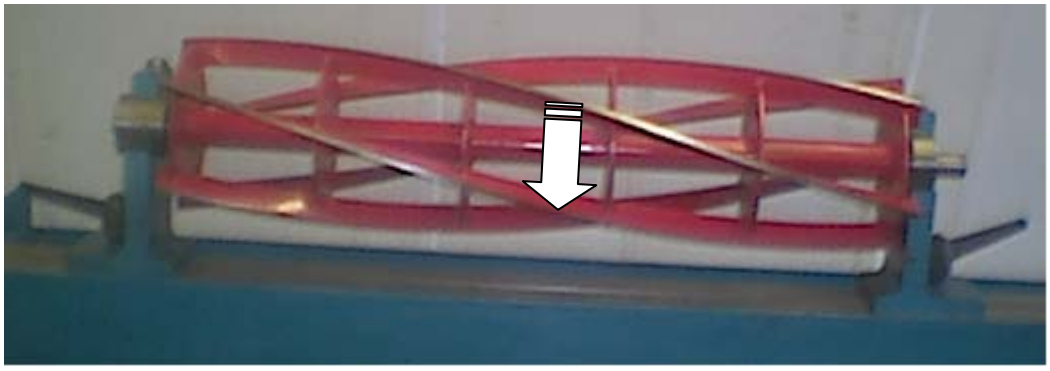


Figure 1 – Direction of cylinder rotation viewed from the front of the grinding machine

Secure the bearing adaptors in the tailstocks by tightening the top nut and fix the tailstocks to the machine bed so that the cylinder is roughly central within the machine. Check that the cylinder is free to rotate.

In figure 1, the cylinder spiral has the leading edge and the cylinder drive point on the right hand side. This will dictate that the spin motor is fitted to the right of the cylinder.

Fit the appropriate spin driver to the cylinder drive shaft and secure it in position. This will allow attachment of the spin driver motor to the cylinder. Various options are

available to do this. The two pin spin driving system is shown below. The two halves engage when brought together.

Figure 2 - Spin drive coupling cylinder side

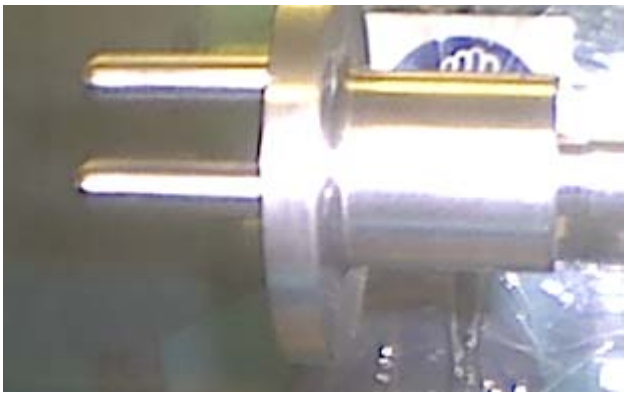


Figure 3 - Spin drive coupling spin motor side

Alternatively, a flexible coupling is available with adaptors for clamping to the cylinder drive shaft. See figure 4.

Figure 4 – Flexible coupling

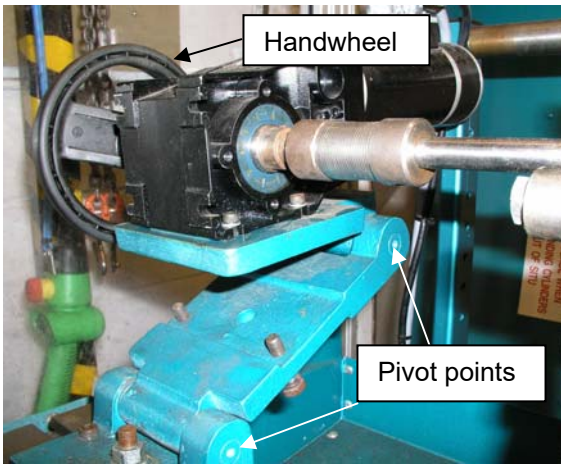


Figure 5 – Spin motor adjustment

Contact Hunter Grinders for advice on connecting the spin driver to the cylinder and for details of other drive options.

A drive shaft extends from both sides of the spin motor so that it can be used at either the right or left of the cylinder. Mount the motorised spin driver adjacent to the drive end of the cylinder. For larger cylinders it may be necessary to position the mounted cylinder closer to one end of the grinding machine to give sufficient space for the spin motor to be mounted.

The motor is mounted on a pivoting system so that the shaft can be aligned with the cylinder. Figure 5 shows the motor arranged for left hand mounting and indicates the pivot points. Support the motor and slacked the pivot clamps. Move the centre of the motor shaft to line up with the centre of the cylinder shaft. Tighten the motor in position.

Fit the appropriate drive mechanism between the motor and cylinder and engage the two shafts. Tighten all clamps.

Mount the spin motor hand wheel to the other side of the motor. This will allow easy unpowered rotation of the cylinder.

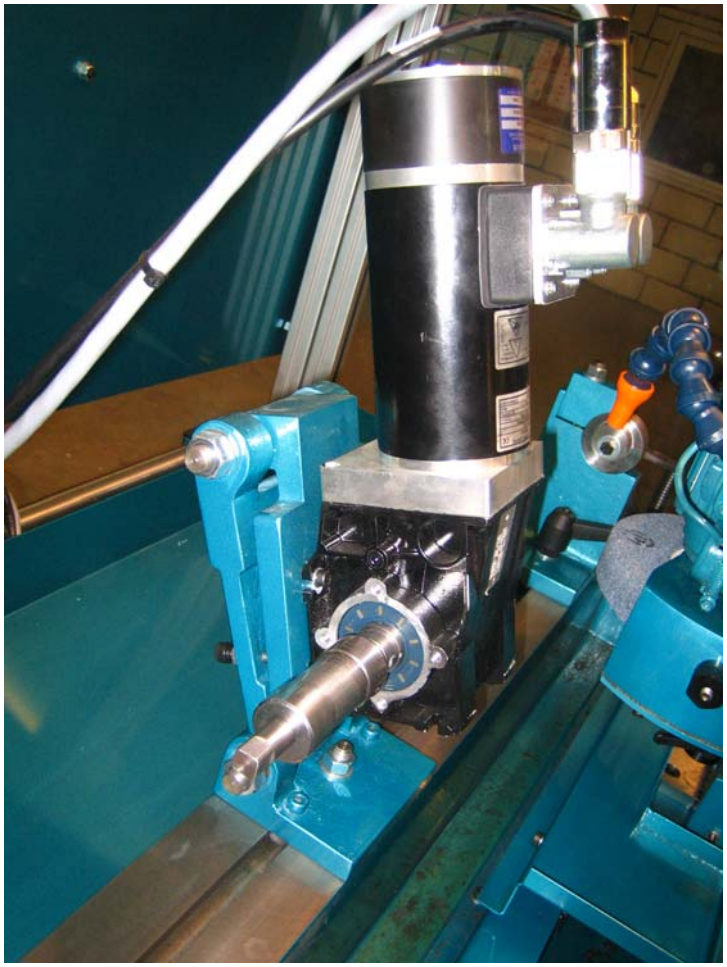


Figure 6 – Spin motor with flexible coupling fitted to the left hand side

Cylinder preparation and mounting - in-situ in frame

⚠ Ensure that the grinding machine power is switched off to prevent accidental start-up

Before grinding a cylinder mounted in a mower frame, check the overall condition. Bent spirals must be straightened. Spirals that have been repaired by welding should have any projecting welds ground back away from the cutting edge.

Check that the spirals have not been badly worn or previously ground close to the mounting webs.

Remove the bottom blade and any rollers or groomers which will impede the grinder's access.

Wind the cylinder adjusters to reposition the cylinder in the mower frame so that the blades are more easily accessed by the grinding wheel.

Identify suitable mounting points on the sides of the mower frame. Typically these will be two in-line bedknife mounting holes and these will be used to mount the frame between centres fitted to the tailstocks – see figures 7 and 8 below. The correct mounting brackets for each mower model are listed in section 7. Contact Hunter Grinders for further information and guidance on frame mounting equipment.

One of the two mounting brackets has front-to-rear adjustment so that the cylinder can be set parallel to the grinding machine. This is shown in figure 7 and the required plane of adjustment is indicated by the arrow.

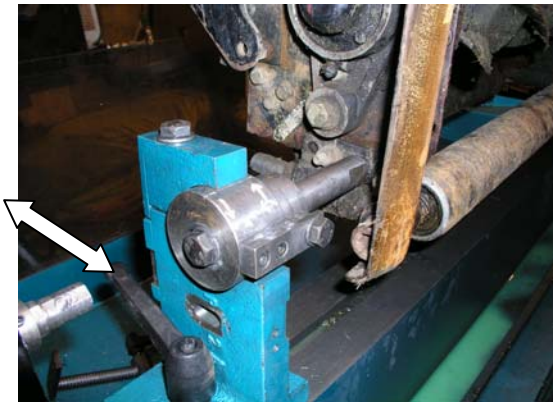


Figure 7 – Adjustable mounting bracket located in the side of the mower frame

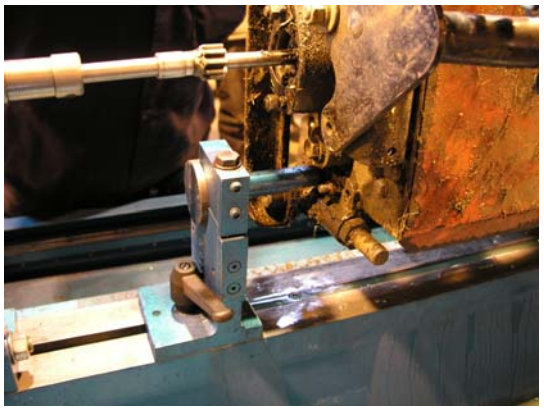


Figure 8 – Fixed mounting bracket viewed from the rear of the machine

Using the hoist and suitable lifting chains or straps, lift the mower frame over the grinding machine so that the rear of the frame is lowest and the lower face of the frame is towards the operator.

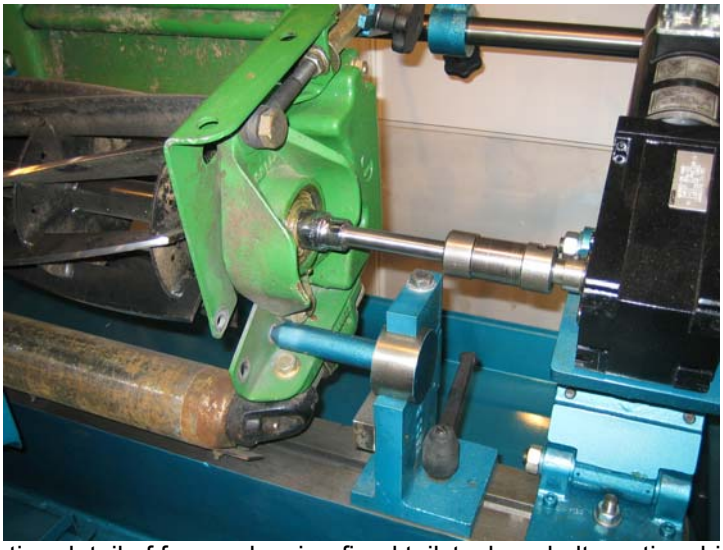


Figure 9 – Mounting detail of frame showing fixed tailstock and alternative drive arrangement

Locate and fix the frame between the tailstocks and secure the frame in an upright position using the grab arms attached to the rear rail of the machine. When secure, remove the lifting chains or straps and move the hoist out of the working area.

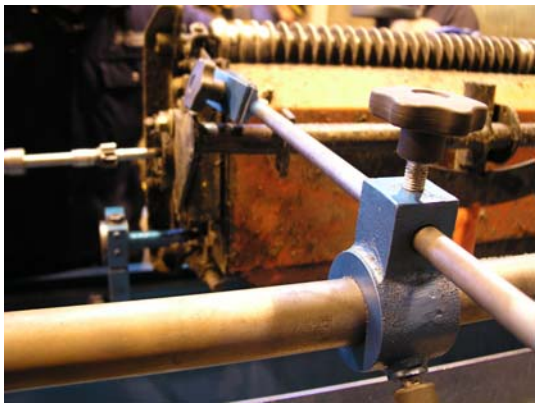


Figure 10 – Grab arm securing frame viewed from the rear of the machine

Figure 11 – Grab arm attached to the mower height adjuster

The cylinder must now be set parallel to the grinding machine bed. This is done using a depth stop located at the side of the grinding head. Push the depth bar through the mounting pillar until it touches the cylinder centre rod at one end of the cylinder. The grinding head should be adjusted up or down to suit, using the hand wheel on the top. Point the depth bar as close to the centre of the cylinder as possible – see figure 12. Lock the collar on the depth bar and withdraw from the cylinder blades.

Move the grinding head to the other end of the cylinder – the traverse must be disengaged to allow free movement – see figure 13 for the correct traverse lever position. Push the depth bar towards the cylinder centre and assess how far out of parallel the cylinder is. Using the mowers own adjusters, or the adjustable mounting bracket (figure 7) set the cylinder parallel to the grinder. Continue to check each end of the cylinder and adjust until parallel. Check also that the height of the cylinder centre from the machine bed is equal at each end by judging the vertical alignment of the depth bar.

Figure 12 – Depth stop in position touching the cylinder centre

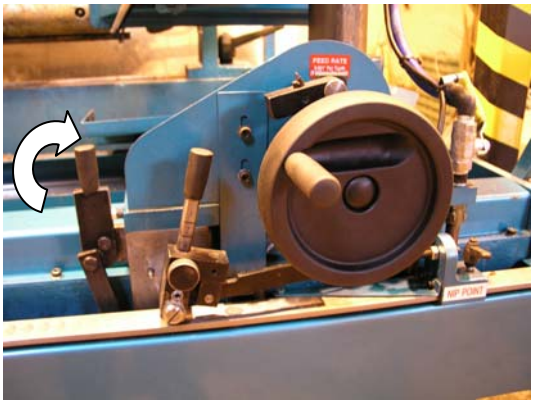


Figure 13 – Traverse lever in disengaged position

Remove the depth stop. If not already done disconnect or release any drive to the cylinder so that it can revolve freely in its own bearings.

Fine tune the parallelism of the cylinder and check for any high spirals by bringing the stationary grinding wheel up to the blades. Rock the cylinder gently past the grinding wheel with the wheel barely touching. If a high spiral is detected identify it clearly with correction fluid (Tippex) or a quality waterproof marker pen or other similar marker. Connect the drive end of the cylinder to the spin motor using the instructions set out in the earlier section ‘Instructions for mounting cylinders into grinding machine’

If access can not be gained to the cylinder blades with the 8” (203mm) head then the 3” (51mm) grinding head should be fitted. Contact Hunter Grinders for details of this option.

ATI Programming

The ATI version of the Jupiter grinding machine allows automatic cylinder relief grinding. It is used primarily to control the operation of the indexing motor in conjunction with traversing the grinding head. When set up, the machine will traverse the grinding head along the cylinder, grinding the blade, then index the cylinder to the next blade and resume the grinding process, repeating for all blades and feeding the grinding wheel towards the cylinder as required.

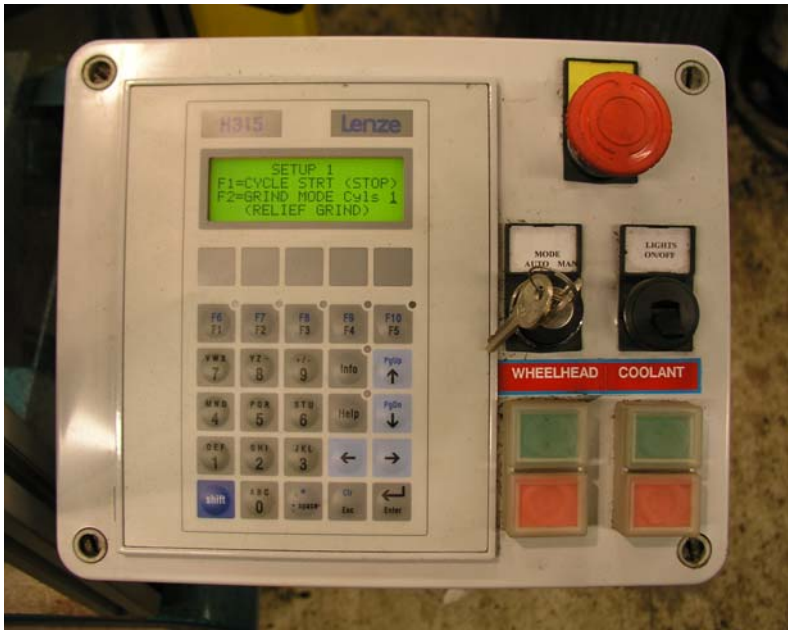


Figure 14 – Layout of ATI control panel

The ATI control panel, situated at the right hand side of the machine, houses a keypad to allow parameter programming.

Also on this panel are start and stop buttons for the grinding wheel motor and the coolant pump. Gantry lights are controlled using the push button.

A keyswitch is used to select between auto and manual modes. The manual mode is used during machine maintenance and will over-ride all guarding interlocks allowing operation of the machine without the guarding in place. The keyswitch should be set to auto mode during normal use and the key removed to prevent unauthorised operation of the machine in the manual mode.

The control panel also has an emergency stop button, in addition to the emergency stop button to the left hand end of the machine.

When the machine is powered up, the controller display shows the ‘Setup 1’ page, as shown in figure 15. Pressing button F1 starts the cycle, pressing again will stop the cycle.

SETUP 1
F1 = CYCLE STRT (STOP)
F2 = GRIND MODE Cyls 1
(RELIEF GRIND)

Figure 15

In figure15, pressing button F2 will change the grinding mode from relief grinding to spin grinding and vice versa. The display will state the currently selected mode on the bottom line.

When in relief grinding mode, pressing the page down button (PgDn ↓) will change the display to show the ‘Setup 2’ page, shown in figure 16. Pressing the page up button (PgUp ↑) will return the display to the ‘Setup 1’ page.

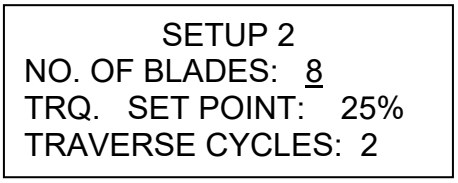


Figure 16

On this page, parameters for relief grinding can be set. Setting the number of blades lets the control system calculate how much to rotate the cylinder when indexing from blade to blade. To adjust this value, use the left ← and right → arrows on the keypad to move the curser (_) to the number. This is as shown in figure 2 below the value 8. Type the desired number on the keypad and press the enter key to confirm the change.

The ‘traverse cycles’ setting refers to the number of full traverses of the grinding head past each of the cylinder blades. To adjust this value, use the left ← and right → arrows on the keypad to move the curser (_) to the number. Type the desired number on the keypad and press the enter key to confirm the change.

The torque set point value should be left at 25% unless otherwise advised by Hunter Grinders. This setting may be changed by the same method outlined for the other two values.

Pressing the page down button move the display to the ‘Setup 3’ page as shown in figure 17.

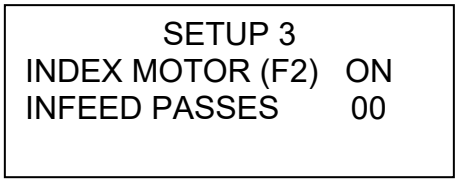


Figure 17

Pressing the F2 button turns the indexing motor on and off.

The grinding head can be set to feed towards the cylinder a set number of times before stopping. This value can be altered, as before, by moving the curser to the value, typing in a revised value and pressing the enter button to confirm.

For example, with the number of blades set to 8 and the traverse cycles set to 2 in the ‘Setup 2’ page, and the infeed passes value set to 3 in the ‘Setup 3’ page the following sequence would be performed.

- Two full traverse cycles on blade 1 (each cycle starts and ends in the same position).
- Index to blade 2 and make two full traverses.
- Repeat for blades 3 to 8.
- Grinding head infeeds by the amount set on the feed rate adjuster block.
- Index to blade 1 and make two full traverses.
- Repeat for blades 2 to 8.
- Grinding head infeeds for second time.
- Index to blade 1 and make two full traverses.
- Repeat for blades 2 to 8.
- Grinding head infeeds for third time.
- Index to blade 1 and make two full traverses.
- Repeat for blades 2 to 8.
- Grinding head parks at one end of the machine.

To adjust the rotational speed of the indexing motor, press the page down button to move from the ‘Setup 3’ page to the ‘Spin Speed’ page – see figure 18. Pressing F1 or F2 will increase or decrease the speed. The value of the current set speed will be shown in the bottom line of the display.

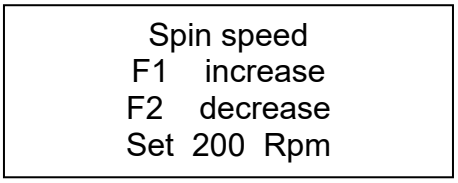


Figure 18

Relief angle grinding preparation

Note: These guidelines must be adhered to or accuracy cannot be guaranteed.

Number the spirals using correction fluid, or some suitable marker pen. If any high spirals were found during preparation of the cylinder use this as your starting spiral and mark it number 1.

Figure 19 – numbering the spirals

The finger guide must be fitted in front of the grinding wheel. This serves to guide the cylinder blade at precisely the right height when grinding. Two formats exist depending on the direction of the spiral and whether the leading edge of the spiral is to the left or right.

Note: The two views in figures 20 and 21 are from front of the grinder - as seen from the operator's position.

Figure 20 - Leading edge on left

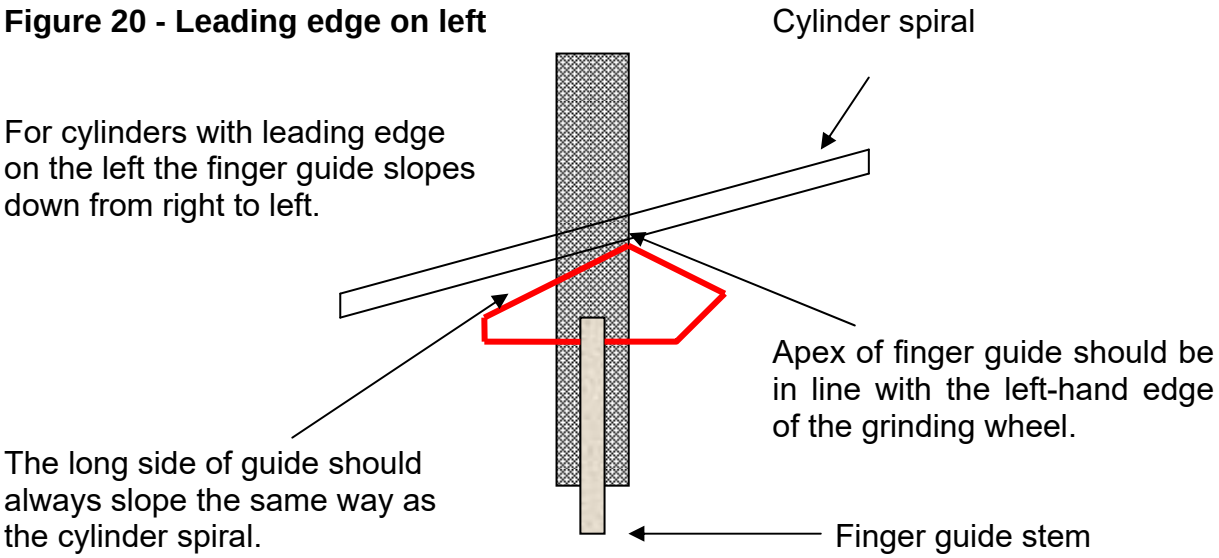
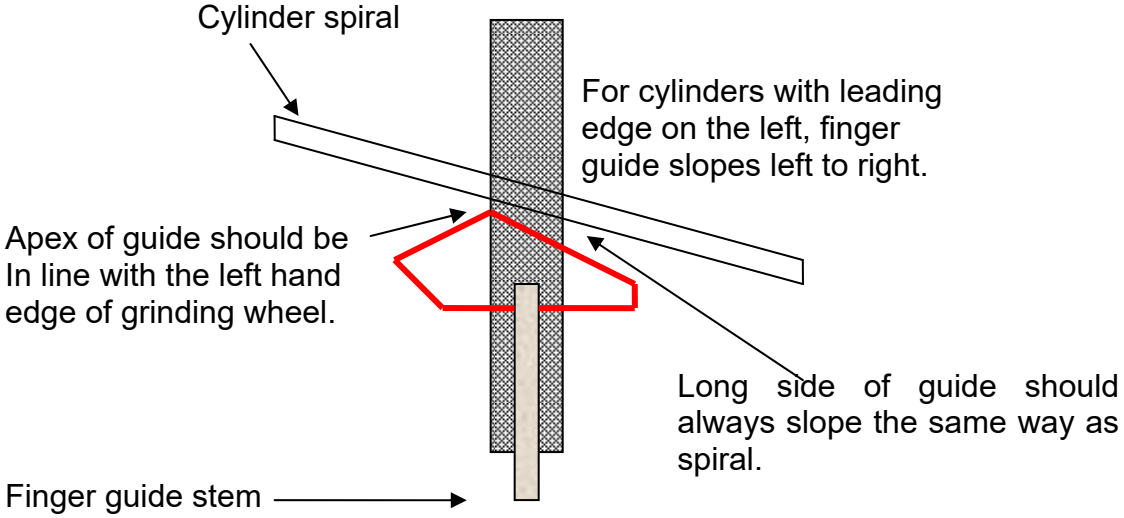


Figure 21 - Leading edge on right



Orient the finger guide according to the spiral of the cylinder. The guide should be positioned approximately 1.5 to 2mm (1/16”) away from the face of the grinding wheel. Check that the guide will not contact the mounting webs within the cylinder.

Set the height of the guide according to figures 22 and 23. There are two marks on the finger guide to enable the relief angle to be set. Consult the mower manufacturer’s handbook to determine the correct angle or contact Hunter Grinders for advice. Details of setting the height of the finger guide to give a generally acceptable relief angle are contained in section 6. Using a standard relief angle and finger setting for all cylinders will result in subsequent regrinds being quicker with the minimum amount of material being removed.

Accuracy: In the interests of accuracy under no circumstances allow the apex of the finger guide to be external or in the middle of the grinding wheel. This will tend to grind the corners low or to leave the ends of the blades high. The apex must be in line with the side face of the wheel.

Figure 22 - Grinding at low relief mark

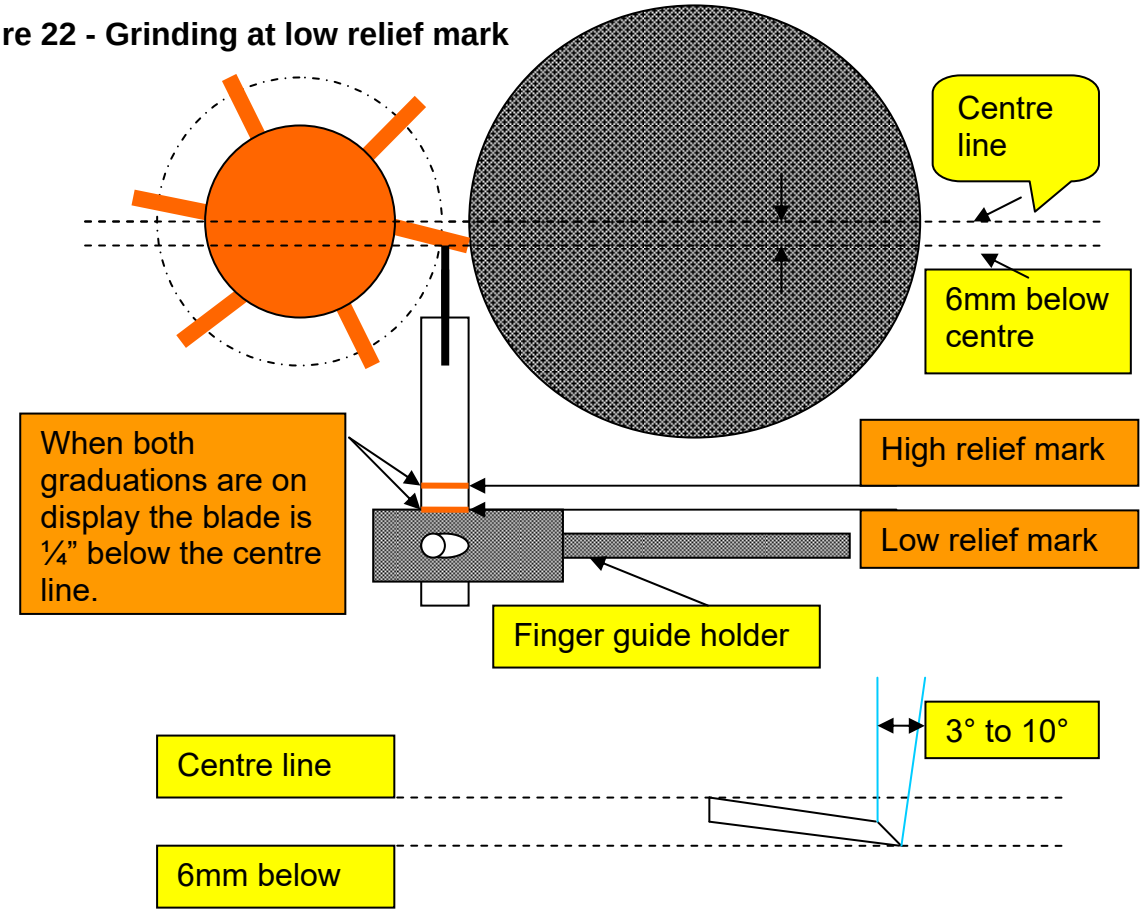
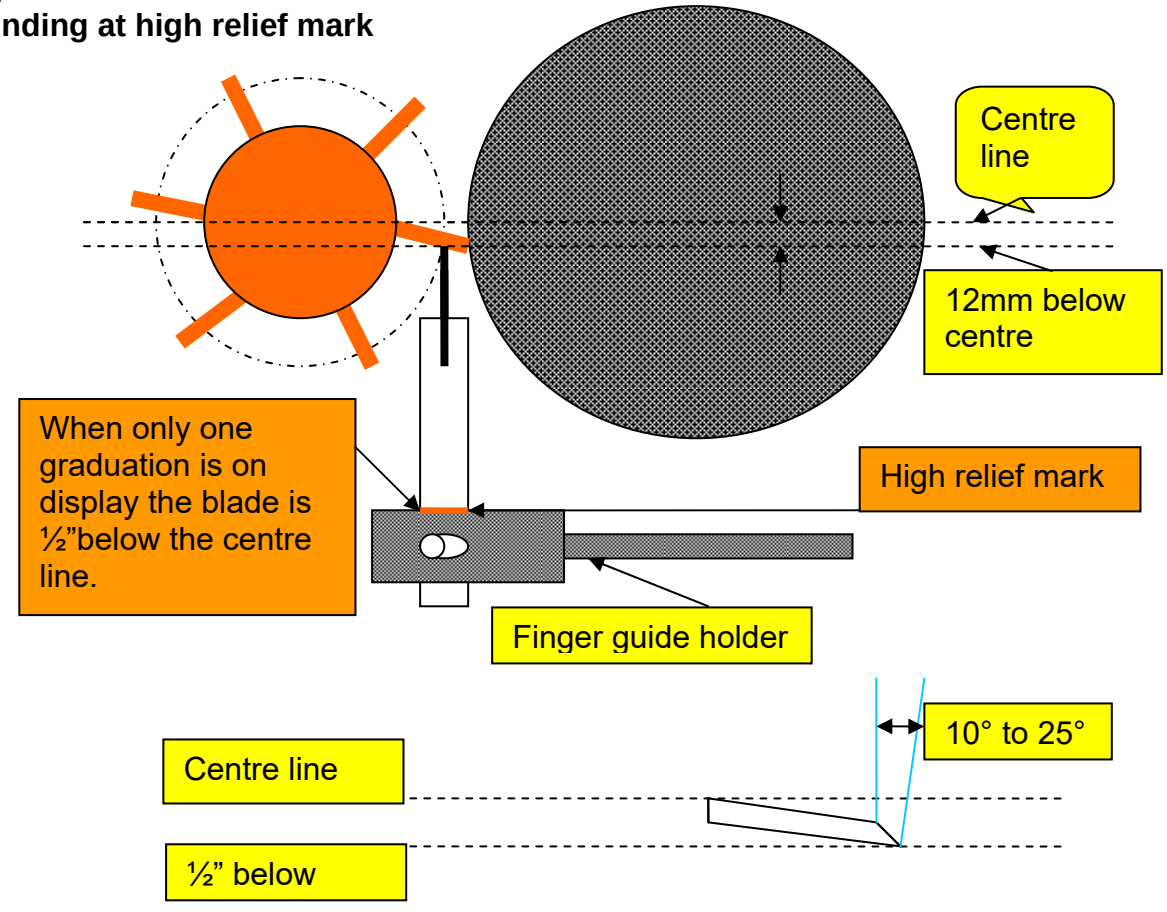


Figure 23
Grinding at high relief mark



Setting the traverse limit switch end stops

During automatic operation, the grinding head traverses back and forth along the machine. To prevent excessively long movements, and to avoid potential contact between the grinding wheel and the mower frame, the traverse end stops must be set.

With the finger guide correctly set, as detailed in the previous section, and the grinding wheel close to, but not contacting the blade, position the grinding head at the left hand end of the cylinder so that the finger guide is clear of the end of the blade and the cylinder is free to rotate.

Bring the left hand traverse stop along its rail until the sensor LED attached to a bracket below the grinding head lights up. The sensor is energised by a small magnet on the end stop. Lock the end stop in position using the small locking handle as shown below in figure 24. Check again that the cylinder is free to rotate and that there is no possibility of the grinding wheel coming into contact with the mower frame.

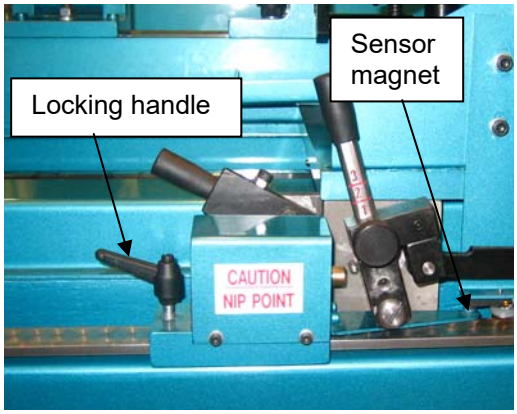


Figure 24 – left hand end stop

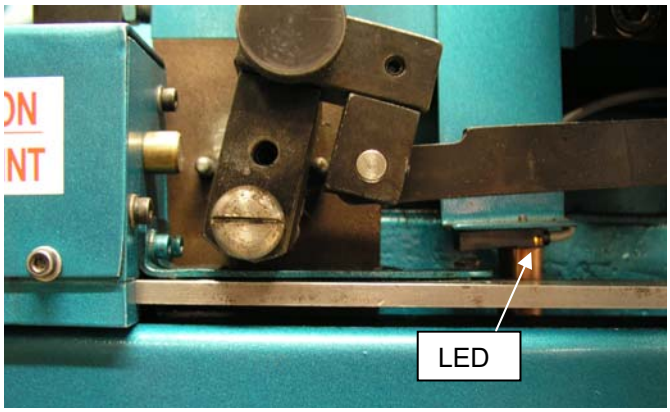


Figure 25 – position of illuminated sensor LED

Repeat the procedure for the right hand traverse stop at the other end of the machine as shown in figure 26.

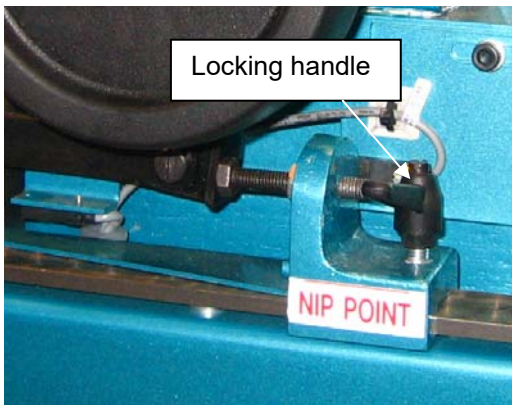


Figure 26 – right hand end stop

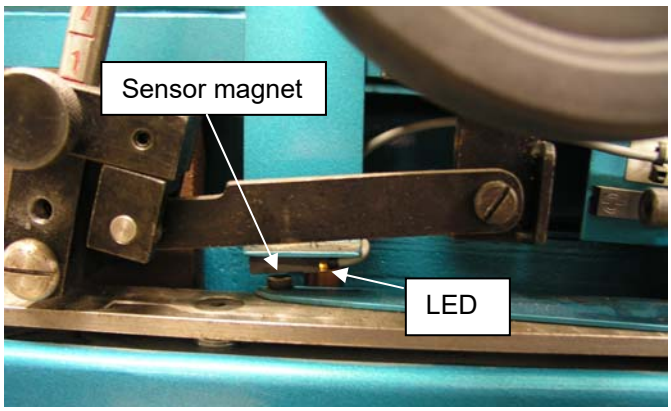


Figure 27 – position of illuminated sensor LED

Setting the grinding head infeed rate (depth of cut)

The ATI control system can be programmed to feed the grinding wheel towards the cylinder. This can be set to feed in after one or more full traverses of the machine.

To achieve this, a solenoid contained in the right hand end stop energises and pushes the infeed lever causing the infeed pawl to rotate the head feed screw.

The infeed lever has an adjustable block which varies the degree of infeed.

Set the grinding head infeed rate to a depth of cut of 0.001”, 0.002” or 0.003” by loosening the thumbwheel and sliding the feed rate adjuster block to the required position. Lock the block in place. See figure 28.

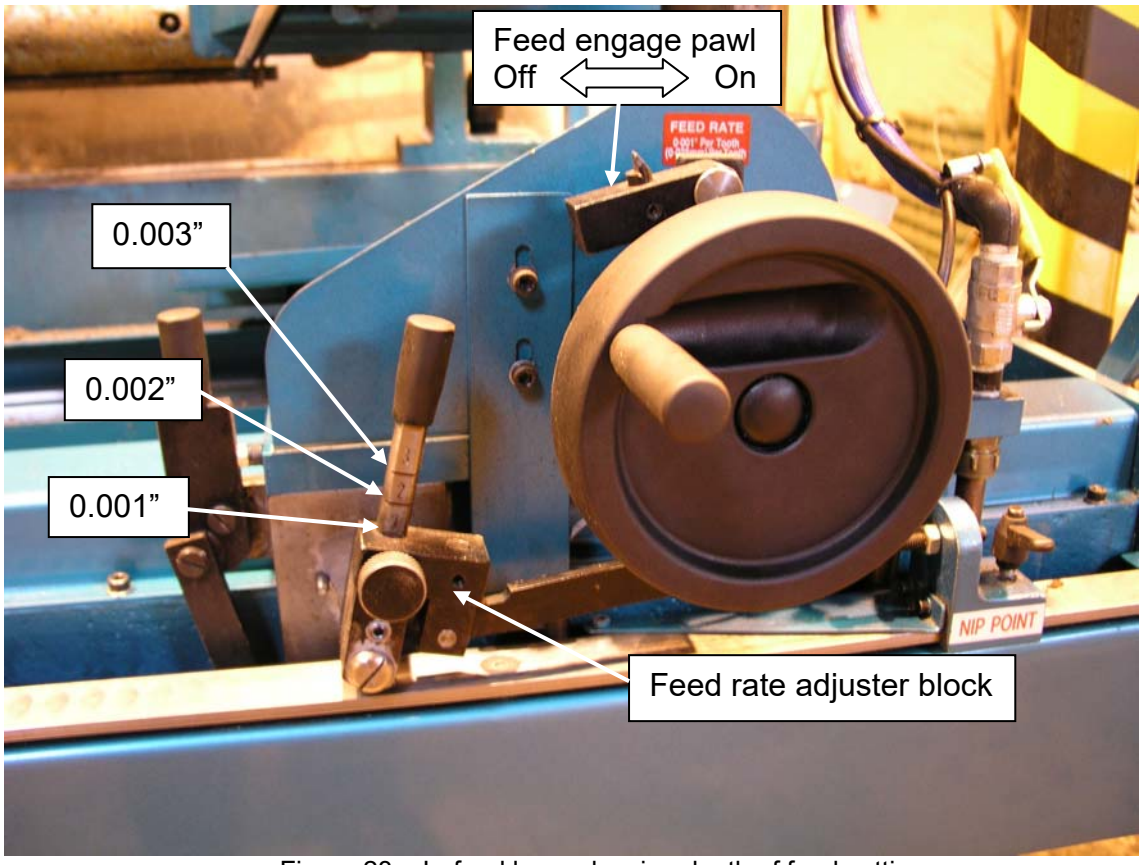


Figure 28 – In-feed lever showing depth of feed settings
Feed engage pawl shown on the off position

Relief angle grinding

Back the grinding wheel away from the cylinder blade and switch on the power to the machine. Switch on the coolant pump and adjust the nozzle so that coolant flow touches the face of the wheel. Switch on the grinding wheel and allow full speed to be achieved.

Identify the spiral with the number 1 marked on it. Wind the grinding head slowly towards the blade until spiral number 1 can be rested upon the finger guide.

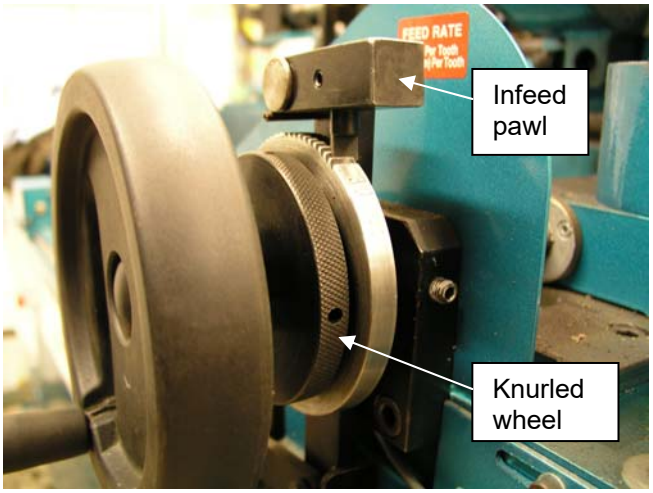


Figure 29 – Infeed ratchet wheel adjustment

Wind the grinding head slowly forward towards the blade until a very light cut is being made. Taking great care not to infeed the head any further, set the infeed ratchet wheel as shown in figure 29. Position the infeed engage pawl to rest on the ratchet wheel. Loosen the knurled wheel and rotate the ratchet wheel so that the pawl rests on the end tooth as shown. Tighten the knurled wheel.

Slowly traverse the grinding head, by hand, towards the opposite end if the spiral, using the hands free indexing wheel to keep the blade in light contact with the finger guide. The traverse should start from the trailing end of the spiral and the finger guide should have the effect of raising the spiral as it travels along the underside of the blade. Do not force the grinding wheel and either slow down the traverse feed or back off the grinding wheel if a high spot is met.

Stop traversing as soon as the wheel passes the end of the spiral and sparking stops. Traverse the head back to the start position, keeping the finger guide in contact with the spiral. Take the finger guide out beyond the start of the spiral and rotate the cylinder so that the spiral marked number 2 can be rested on the finger guide and grind back and forth along the length of the blade. Repeat this for all of the spirals.

The above process ensures that all high spots have been found and it is safe to proceed to the ATI automatic cycle.

Program the ATI controller for the following variables:

- Grind mode set to relief grinding
- Number of cylinder blades
- Number of traverse cycles

- Number of infeed passes
- Index motor switched on

Set the ATI controller so that the ‘Setup 1’ page is visible. Switch on the grinding head and coolant pump. Check that the coolant is flowing onto the cutting face of the wheel.

Position the underside of the first cylinder blade is resting on the finger guide.

Push the F1 button on the controller to start the cycle (at setup page 1) and engage the traverse lever (figure 31)

Figure 30
Traverse disengaged

Figure 31
Traverse engaged

Allow the cycle to complete, disengage the traverse lever and switch off the grinding head and coolant pump. Inspect the ground face of the blades. A slight ‘rag’ or ‘burr’ should be detectable on the cutting edge – take care as this will be sharp. A fully ground cylinder will show a newly machined surface across the full width of all of the blades.

Continue to cycle the process until the cylinder has been completed, varying the ATI parameters as appropriate.

Once a good full-face cutting edge has been achieved, two ‘polishing’ cuts are made no further adjustment to the grinding wheel. With the infeed pawl in the disengaged position, grind each blade for one full rotation of the cylinder. Then repeat the cut in reverse starting at the highest blade number to the lowest. This allows for the wear of the grinding wheel to be cancelled out.

Note: If in the event that contact is lost on any of the polishing cuts this means that the grinding wheel may have been eroded slightly. In this case continue to the end of that revolution and apply a small cut of 0.001" (0.0254mm) to 0.002" (0.0508mm). Take one more polishing cut on all of the spirals.

Spin grinding.

Spin grinding is carried out under two circumstances.

1. After relief grinding, to cut a small land on the face of each blade
2. Over the full face of the blade if required by the manufacturer's specification.

The process is virtually the same in both of these circumstances.

If spin grinding is being carried out relief grinding, then the cylinder should not have been removed from the grinding machine. Otherwise the cylinder, either in or out of its mower frame, must be checked and mounted parallel in the grinding machine as detailed in earlier sections. The spin motor must be connected to the drive end of the cylinder.

The finger guide must be removed from the grinding head, otherwise the cylinder will be prevented from rotating, and damage may result.

Check and set the position of the traverse end stops as detailed in an earlier section. This may not be necessary of the cylinder has been previously relief ground and was not removed from the grinding machine.

Set the grinding head infeed rate to a depth of cut of 0.001", 0.002" or 0.003" as detailed in the earlier section.

Programme suitable parameters into the ATI controller, as detailed in the earlier section. In particular, at the 'Setup 1' page, press button F2 to set the grinding mode to spin grinding.

Wind the wheel head in until the face of the wheel almost touches the cylinder spiral. Bring the grinding head carriage to the left of the machine until the stone is just past the end of the cylinder.

Traverse the wheel head to the right of the machine and turn on the grinding wheel motor and allow it to reach full speed.

Turn on the spin motor to rotate the cylinder and allow it to reach full speed (approx 5 seconds).

Press the F1 button at the 'Setup 1' page to begin the cycle. Engage the feed engage pawl by rotating it over to the right (see figure 29) and turn on the traverse (see figure 33). The wheel head will now start to traverse and feed inwards to contact with the spinning cylinder.

Figure 32
Traverse disengaged

Figure 33
Traverse engaged

The machine will continue to traverse, grinding the cylinder and feeding in the number of traverse cycles programmed into the ATI controller has been reached. At no point should the operator leave the machine. Monitor the movement of the grinding head and disengage the traverse if the grinding wheel becomes stressed (see figure 32).

After 2 or 3 complete traverses of the cylinder, disengage the traverse when the grinding head is at its right hand limit. Disengage the feed engage pawl. Stop the spin motor and allow the cylinder to come to a complete stop (press F1 at the ‘Setup 1’ page). Inspect the ground surface of the cylinder.

If the cylinder has previously been relief ground, and the spin grinding process is being used to create a small land on the ground face, stop grinding when the width of the land across the blade has reached 25% of the blade width.

If the cylinder is being fully spun ground, stop grinding when a sharp edge has been achieved over the full length of all of the blades.

If required, continue grinding by starting the spin motor and engage the feed engage pawl and traverse lever. Inspect at regular intervals.

When the cylinder has been ground to the required extent allow several full polishing traverses of the grinding head. This is carried out with the grinding wheel and spin motors switched on, the traverse engaged, but the feed engage pawl in the disengaged position, i.e., the infeed switched off.

At this point the wheel head will continue to traverse but the infeed will no longer apply any further cut. The wheel head will continue to traverse until switched off. Some operators prefer to let the cylinder spark out before switching off the traverse.

Note: If in the event that contact is lost on any of the polishing cuts this means that the grinding wheel may have been eroded slightly. In this case continue to the end of that revolution and apply a small cut of 0.001" (0.0254mm) to 0.002" (0.0508mm). Take one more polishing cut on all of the spirals.

Bottom blade preparation and mounting

⚠ Ensure that the grinding machine power is switched off to prevent accidental start-up

Fit the bottom blade brackets to the inboard sides of the tailstocks. These are identified left (L) and right (R). The part of the bracket fitted to the tailstock has a red line scored into it to indicate the uppermost point and this should line up with the jaw face at the top of the tailstock.

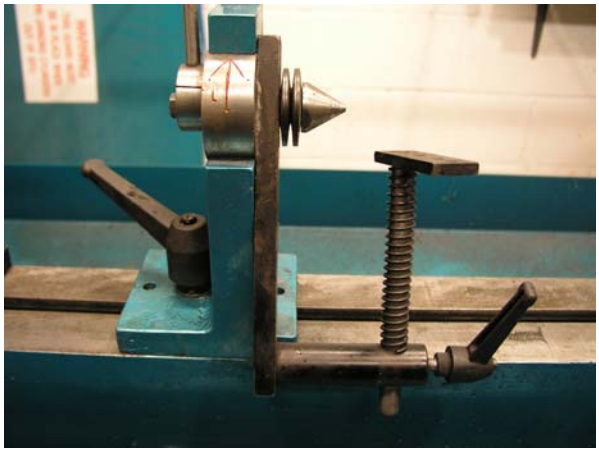


Figure 34 – Left hand bracket

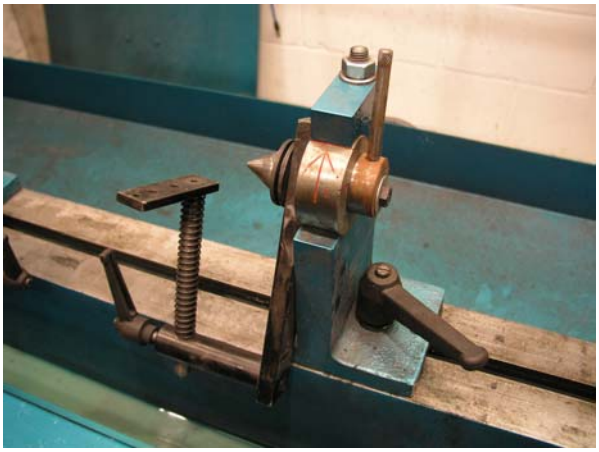


Figure 35 – Right hand bracket

The bottom blade should remain attached to the sole plate used to fix it to the mower. Clean any accumulated dirt and grass from the blade, and inspect to ensure that it is not bowed or twisted.

Depending on the manufacturer, the sole plate usually has a number of mounting holes at each end, typically one to three. Normally the lower rear bolt holes are used. Check that the chosen mounting holes are not worn out of shape and are free from burrs. Mount the bottom blade between the centre points of the bottom blade brackets. The tailstocks should be brought together and tightened sufficiently to prevent any free play or float, but not excessively tightened which would cause blade distortion. The blade should be able to pivot up and down between the tailstock centres

Pivot the blade up and towards the rear of the machine, depress the spring loaded jack plates (which will support the blade) fully down and lock in position. Swing the bottom blade forward to rest on the jacking plates.

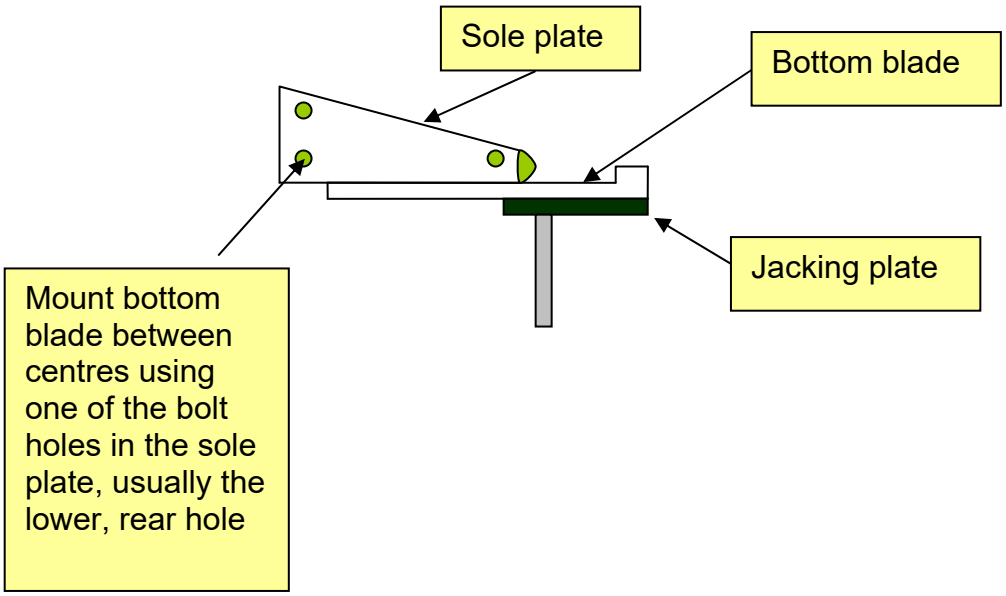


Figure 36 – Bottom blade mounting

The grinding head must be turned so that the side face of the wheel is horizontal, i.e. the wheel axis is vertical. To do this, wind the grinding head out away from the bottom blade and slacken the downward friction locking screw on the front of the wheel-head column. Wind up the wheel-head column, by using the hand-wheel situated on the top of the column, to a reasonable height. Slacken the wheelhead rotation lock, next to the handle used to traverse the wheel-head from side to side, take hold of the motor and swing it through 90 degrees anti-clockwise until it comes to a stop. Retighten the rotation lock and now take out any slack in, but do not tighten, the downward friction knob. Figure 37 shows the grinding head in the cylinder grinding position. For bottom blade grinding the head is pivoted to the left.

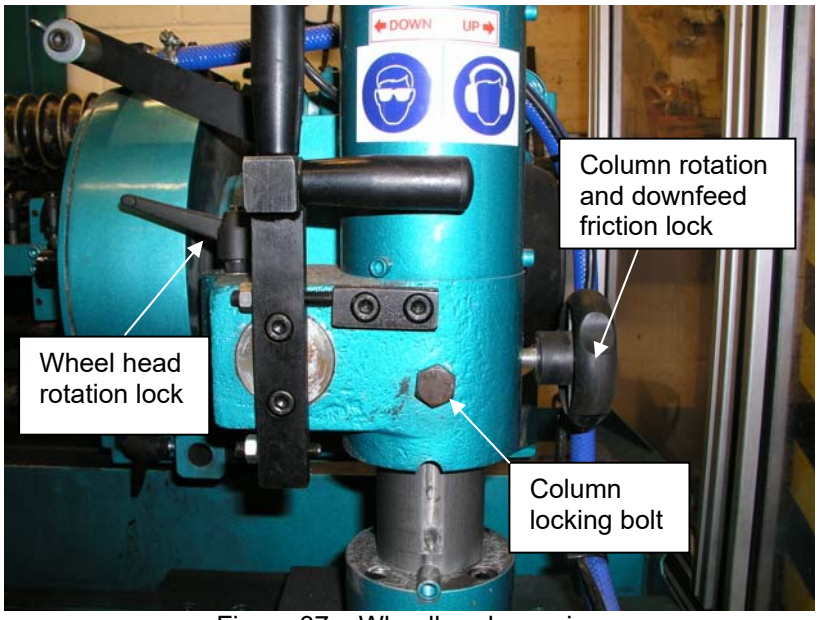


Figure 37 – Wheelhead securing

The column rotation lock holds a key into a keyway on the column. Slackening this knob causes the key to be withdrawn from the keyway allowing the grinding head to be rotated around the column.

Adjustments to the position of the bottom blade are made using the levers mounted at the outer sides of the mounting brackets. These control eccentrics within the brackets. The lever on the left hand bracket controls up and down movement, and the right hand lever controls back to front movement. Slacken the screw in the eccentric to make adjustments.

Loosen the jacking plates and allow them to come upwards to the bottom blade. Set the blade approximately horizontal with the jacking plates in contact and relock the plates. Check that both jacking are making equal contact with the blade underside.

Bring the grinding wheel over one end of the blade and then adjust the wheel downwards to make light contact. Slide the grinding head along the blade to assess how level it is, taking care not to stress the wheel. Adjust the eccentric on the left hand bracket to bring the blade towards the level position and reset the jacking plates for good contact. Re-assess the blade using the face of the grinding wheel. Continue to adjust until the blade is level and the grinding wheel is making constant light contact for the full length of the blade.

Bring the grinding head out away from the blade and lower the wheel to be in line with the front face of the blade. Wind the head until the wheel makes light contact with one end of the blade. Slide the grinding head along the blade to assess how parallel it is with the machine slideways, taking care not to stress the wheel. Adjust the eccentric on the right hand bracket to bring the blade towards the parallel position and reset the jacking plates for good contact. Re-assess the blade using the face of the grinding wheel. Continue to adjust until the blade is parallel and the grinding wheel is making constant light contact for the full length of the blade.

Return the grinding wheel to its former position over the blade and recheck that it is still level. If further adjustments are made, recheck that the blade is still parallel. Continue to check the front and top of the blade until correctly position. Take care at each adjustment to check that the jacking plates maintain an equal contact with each end of the blade.

If there is a significant variation along the blade which adjustments cannot remove, investigate the blade’s condition for any warps or twists. Badly distorted blades cannot be ground.

Setting the top face of the bottom blade

Push the jacking plates down and lock them in position. Pivot the blade up and hold in an approximately horizontal position. Bring the grinding head to the mid point of the bottom blade and, using the front hand wheel, bring the grinding wheel over the top of the bottom blade, so that the blade is still approximately horizontal and the grinding wheel is about ¼" (6mm) past the lip or surface of the blade which is to be ground – see figure 38.

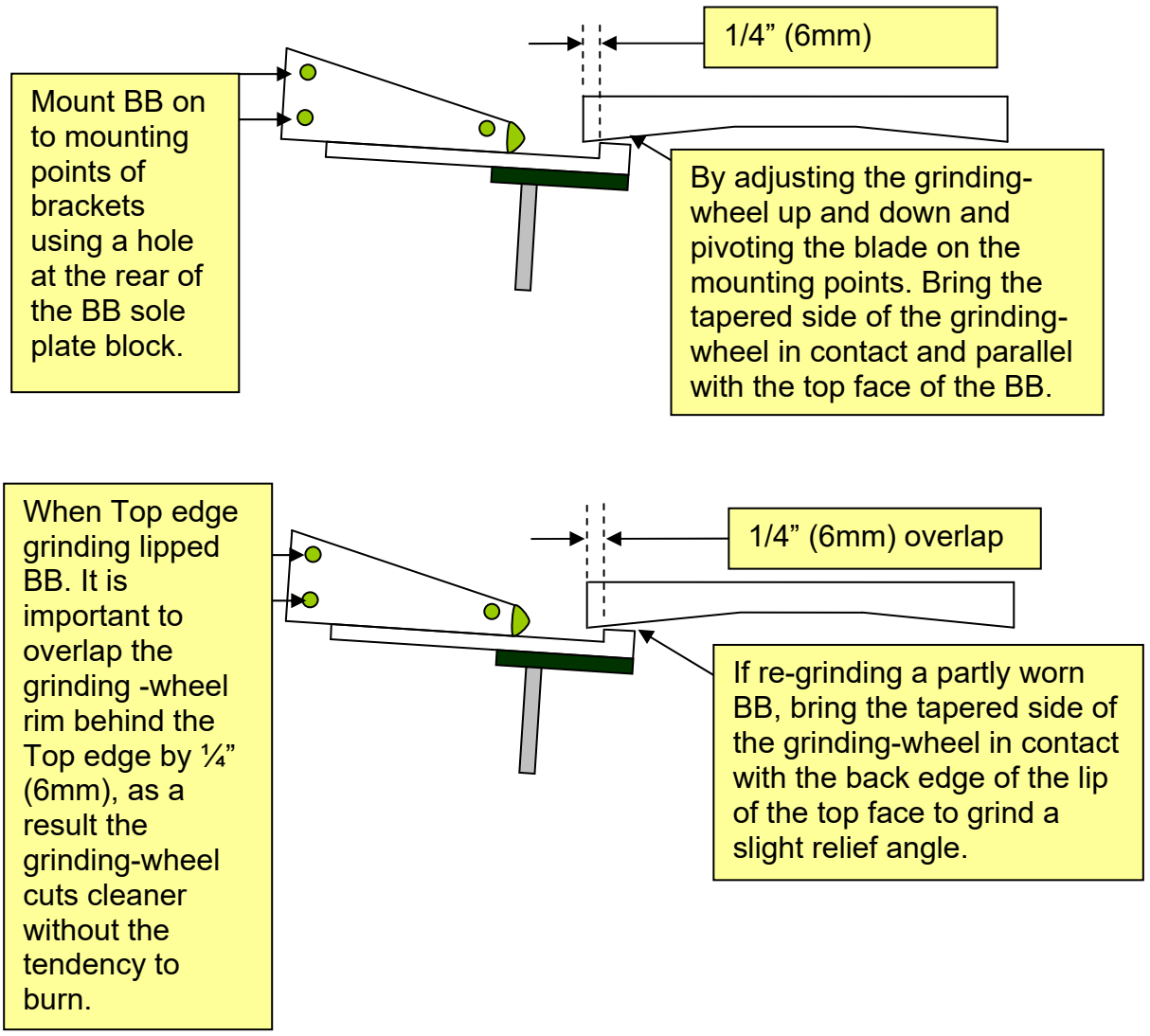


Figure 38 – position of the grinding wheel over the blade

To set the top angle of the blade, place the magnetic angle finder on the underside of the bottom blade – see figure 39.

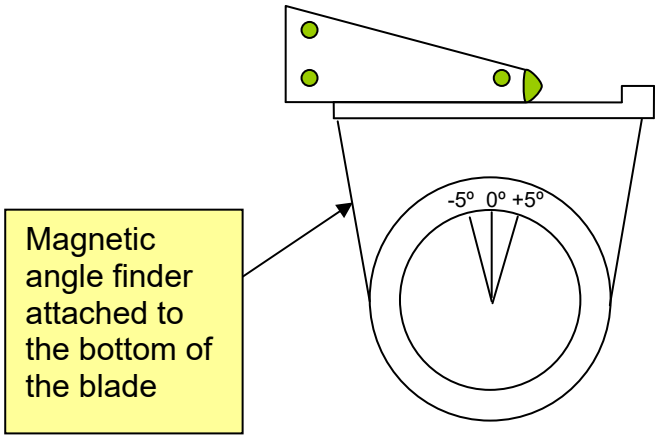


Figure 39 – Angle setting

Adjust the grinding wheel up and down pivoting the blade in contact with the surface of the wheel until the required position achieved. Typically, a 5 degree negative relief angle is required

A selection of suggested top angles can be found later in this section. Consult the mower manufacturer or Hunter Grinders for equipment not listed.

Check that the ¼" (6mm) dimension shown in figure 38 has not altered, and adjust as necessary.

Support and release the spring loaded jacking plates so that they gently contact the underside of the bottom blade. This will hold the blade up, applying a light contact with the side face of the grinding wheel. Lock the jacking plates in position.

Check that the bottom blade has good, full face contact with both jacking plates. This can be done by tapping the front corners of the blades above the jacks with a non-metallic object. A hollow sound indicates poor contact, and a solid sound indicates good contact. Re-adjust as necessary

Ideally, the jacking plates should support the blade under the front corners. Avoid supporting the blade under any screws securing the bottom blade to the sole plates. Fix capscrews to the holes in the jacking plates to give clearance around sole plate screws if necessary. See the diagrams in figure 40 below.

It must be ensured that there is no movement of the bottom blade over the jack posts, otherwise an accurate grind will not be achieved.

Raise the grinding wheel a short distance away from the surface of the blade. Take the grinding head to one end of the blade and lower the side face of the wheel until it has a light contact with blade surface above the jacking plate. Slide the grinding head to the other end of the blade, taken care not to stress the wheel checking that the blade has not moved out of alignment. Ideally the degree of contact between the wheel and the blade should be constant. Adjust if necessary as detailed in the earlier section.

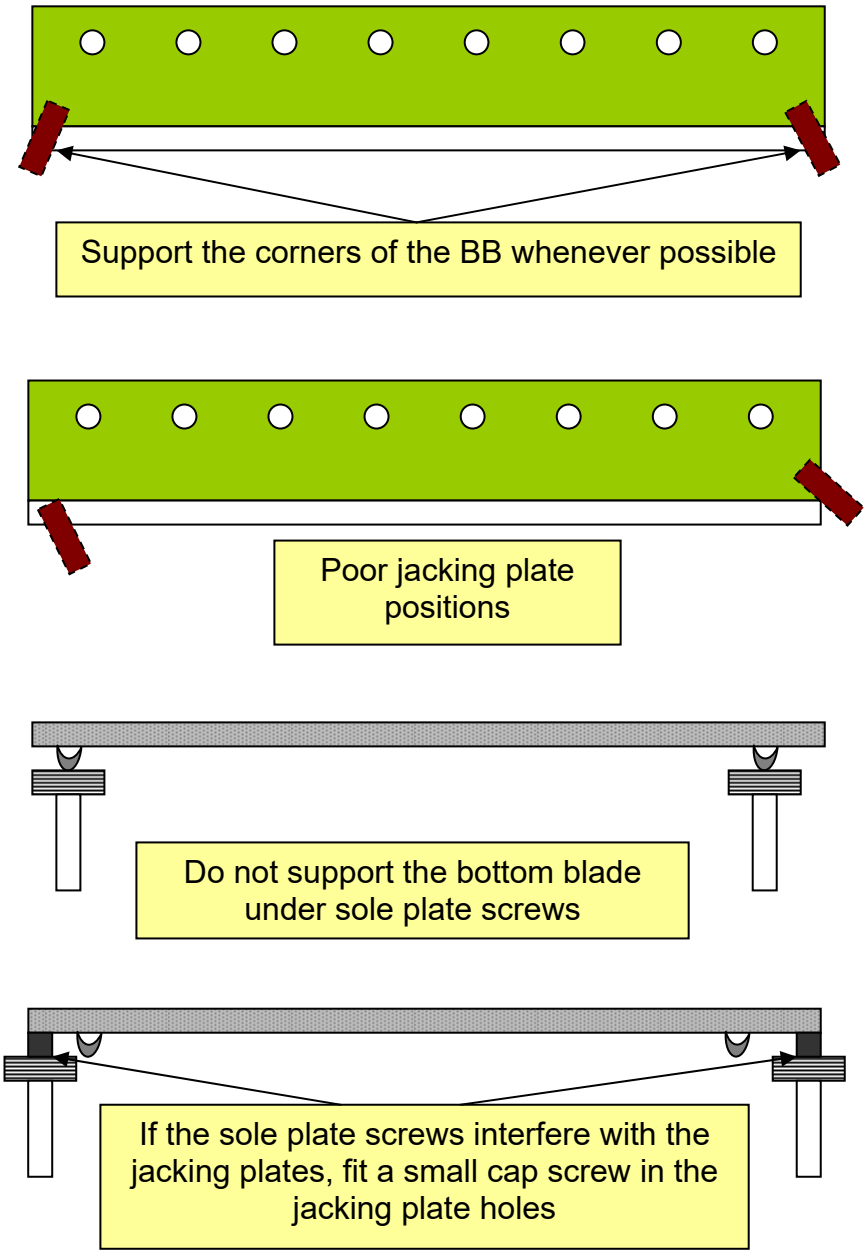


Figure 40 – Guidance on jacking plate positioning

Grinding the top face of the bottom blade

⚠ Ensure that the grinding machine power is switched off to prevent accidental start-up

Raise the grinding wheel away from the surface a short distance. Switch on the coolant pump and adjust the nozzle so that an adequate flow is directed to the grinding area.

Switch on the grinding wheel motor and allow the wheel to reach its full speed. Slowly lower the wheel to make a light contact with the top face of the bottom blade and traverse the grinding head along the full length of the blade. Take great care not to stress the grinding wheel. Stop traversing if the grinding process becomes laboured.

Grind the top face, traversing left and right, adding small cuts until all irregularities have been ground out and the full cutting face of the blade has been machined. Apply several polishing cuts, traversing the grinding head without feeding the grinding wheel down.

When complete, park the grinding head to one side and switch off the grinding wheel motor and the coolant pump.

Remember to regularly dress the side of the wheel with the 'star wheel' dresser tool – see section 5. Doing this will remove any rust or other materials clogging the surface and speed up the operation of grinding the top face and also prevent any burn marks. If burn marks persist, speed up the traverse of the grinding head from side to side, or reduce the downward feed.

Setting-up front face of bottom blade

The grinding head must be turned so that the side face of the wheel is vertical, i.e., the wheel axis is horizontal. To do this, slacken the downward friction locking screw on the front of the wheel head column (see figure 37), wind up the wheel-head column, by using the hand-wheel situated on the top of the column, to a reasonable height. Slacken the wheel head rotation lock, adjacent to the handle used to traverse the wheel-head from side to side, take hold of the motor and swing it upwards through 90 degrees clockwise until it comes to a stop. Retighten the rotation lock and now take out any slack in the downward friction screw, but do not tighten.

Swing the bottom blade upwards and over towards the back of the machine. Unlock the jacking plates and depress them on their springs fully downwards and relock in position. Swing back the bottom blade so that it can be swung easily between the mounting bracket points.

Position the grinding head at the midpoint of the blade. Pivot the blade up and bring the grinding wheel towards the blade so that contact between the two is just achieved. At this point, the face of the bottom blade will be aligned with the centreline of the grinding wheel.

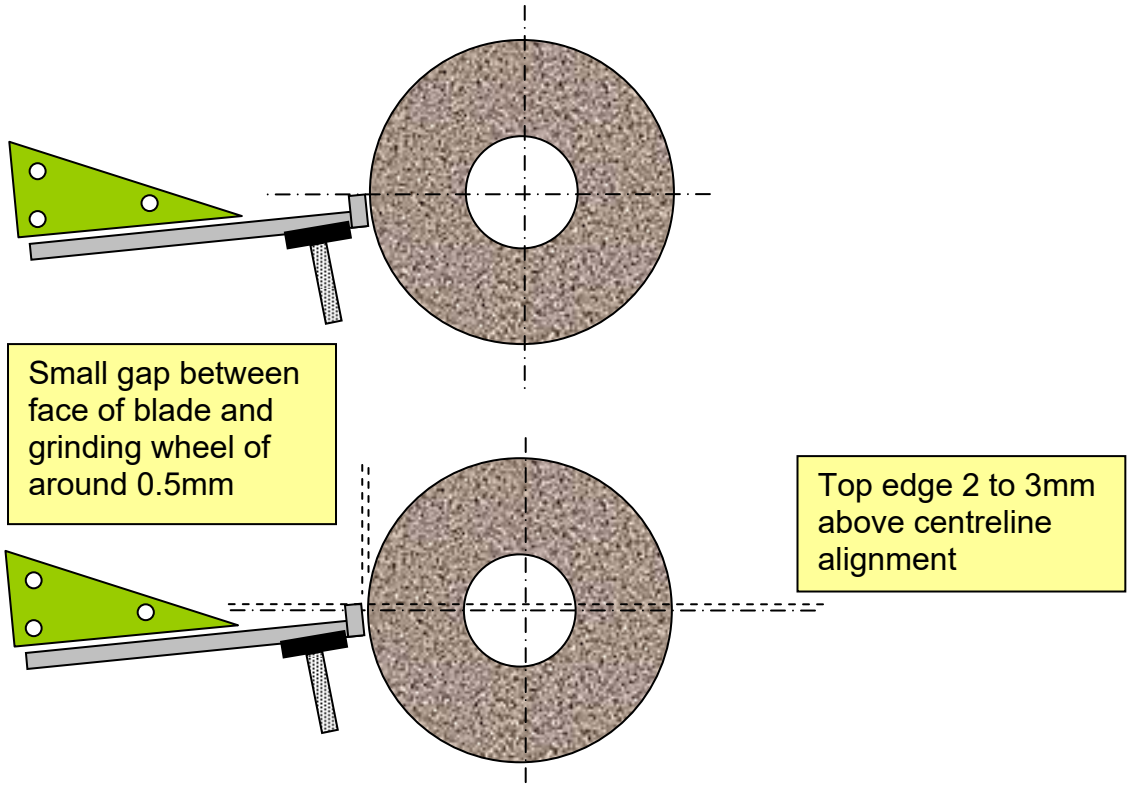


Figure 41 – Setting the grinding wheel height

Raise the top edge of the blade approximately 2 to 3mm above that centreline and release one of the jacking plate so that it contacts the bottom of the blade. Lock it in position. Move the grinding wheel head to one side and bring the remaining jacking plate up to the blade, locking it in position.

Check that the bottom blade has good contact with both jacking plates. This can be done by tapping the front corners of the blades above the jacks with a non-metallic object. A hollow sound indicates poor contact, and a solid sound indicates good contact.

Grinding the front face of the bottom blade

Move the grinding head to the right hand end of the machine

Switch on the coolant pump and adjust the nozzle so that an adequate flow is directed to the grinding area.

Switch on the grinding wheel motor and allow the wheel to reach its full speed. Slowly bring in the wheel to make a light contact with the front face of the bottom blade and traverse the grinding head along the full length of the blade. Take great care not to stress the grinding wheel. Stop traversing if the grinding process becomes laboured.

Grind the front face, traversing left and right, adding small cuts until all irregularities have been ground out and cutting edge has been achieved along the full length of the blade. Apply two polishing cuts, traversing the grinding head at a slow constant speed, without feeding the grinding wheel down.

When complete, park the grinding head to one side and switch off the grinding wheel motor and the coolant pump.

Remember to regularly dress the face of the wheel with the 'star wheel' dresser tool – see section 5. Doing this will remove any rust or other materials clogging the surface and speed up the operation of grinding the top face and also prevent any burn marks. If burn marks persist, speed up the traverse of the grinding head from side to side, or reduce the inward feed.

Removing the bottom blade from the machine

Take great care when handling the bottom blade as it will be extremely sharp. Wear suitable gloves.

Loosen the left hand tailstock lock. Hold the bottom blade in both hands, avoiding contact with the sharpened edge, and push the blade and left hand tailstock to the left releasing the blade.

Remove the blade to a safe place, ready for installation into the mowing machine.

Improved results can be obtained by hand grinding small chamfers at each end of the bottom blade after the edge grinding process is complete

Figure 42 – Chamfer each end of the blade

Suggested angles for bottom blades

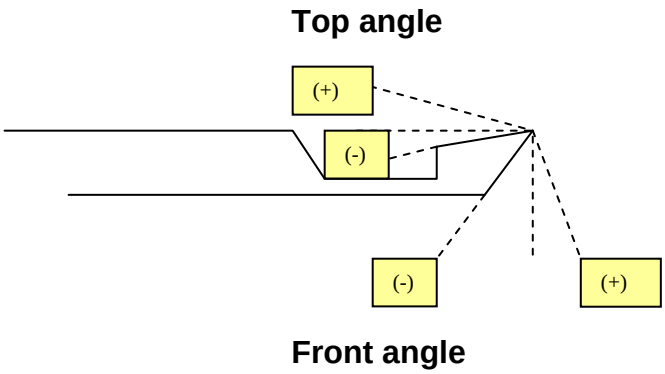


Figure 43 – Bottom blade angles

MAKE	MODEL	TOP ANGLE (Degrees)	FRONT ANGLE (Degrees)
Jacobsen	19” 22” Greens Mower Blitzer F133 Fairway Greens King 418,518,422,522. Greens King 426, 526. Greens King ii, iv, iv plus, v. HF5, HM11. LF 100, 123, 128, 3810. Ranger, ST5111. Tri King 1671, 1672, 1684, 1900. Trim King, Turf King ii, 76, 84.	-8 to -10 +4 to +6 -8 to -10 -8 to -10 -8 to -10 +4 to +6 -8 to-10 +4 to +6 -8 to -10 +4 to +6	0 to -5 0 to -5 0 to -5 0 to -5 0 to -5 0 to -5 0 to -5 0 to -5 0 to -5 0 to -5
John Deer	All Models	-6.5	-5
Lesco	All Models	-6	-5
National	All Models	-5	-5
Ransomes	G-Plex 160 Fairway 250, 305, 405. Motor 180, 350D, T-Plex 185	-8 to -10 -3 -3	0 to -5 0 0
Toro	GR500, 1000, 3000, HTM175 RM5100, 5300, 6500. RM108, 216, 2300, 3500, 4500. RM5, RM7, RM11, Spartan, Turf Pro.	-5 -5 -5 -5	-15* -15* -15* -15*
Sabo Roberine	All Models	-5	-5

* If height of cut is less than ½” (12.5mm), increase angle up to -30 degrees.

Note: The above table is for use as a guide only, consult the manufacturers specification for the exact angle.

SECTION 5 – GRINDING WHEEL MAINTENANCE

Dressing the side of the grinding wheel

⚠ Eye protection manufactured to the current European Safety Standards must be worn when operating this equipment. Everyday glasses do not have impact resistant lenses, and are not safety glasses.

⚠ Grinding wheel dressing, truing and replacement should only be carried out by operators correctly trained in the safe use of abrasive wheels as detailed in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98).

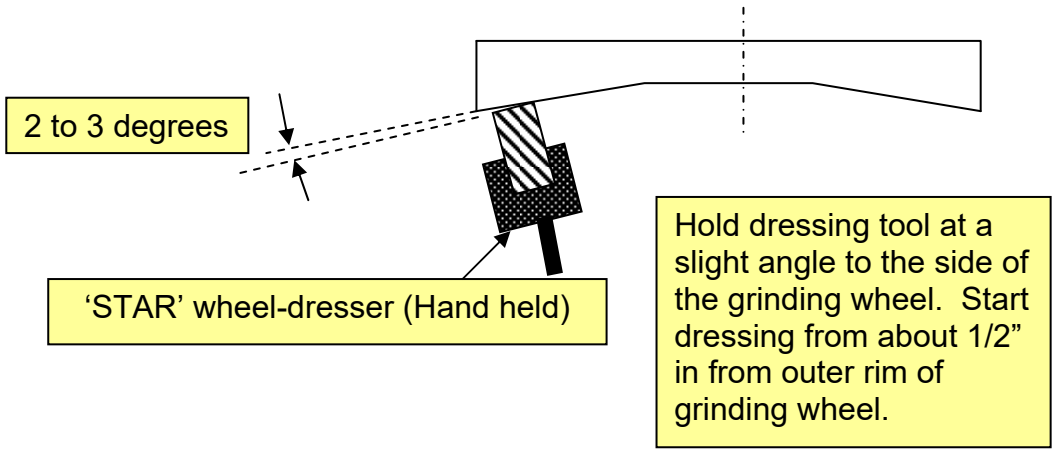


Figure 44 – Star wheel dressing

⚠ Dust is frequently generated when dressing wheels – use adequate dust protection.

⚠ Always dress the wheel above the centre of the wheel. Failure to do so will result in the cutters digging into the grinding wheel

⚠ Never wedge the feet of the dresser handle behind a tool rest or fixture in order to gain leverage. Rest the feet of the dresser handle on top of the tool rest and gently move the tool back and forth. Let the dresser do the work; do not apply excessive pressure

⚠ Always use the proper dresser for the size of grinding wheel you are dressing. Consult Hunter Grinders for guidance.

Diamond dressing the grinding wheel

The purpose of the diamond dressing tool is to keep the grinding wheel in shape. A Star-Wheel dresser should be used to open and roughen up the grinding wheel prior to doing any further grinding otherwise burning and reduced cutting rates will be observed.

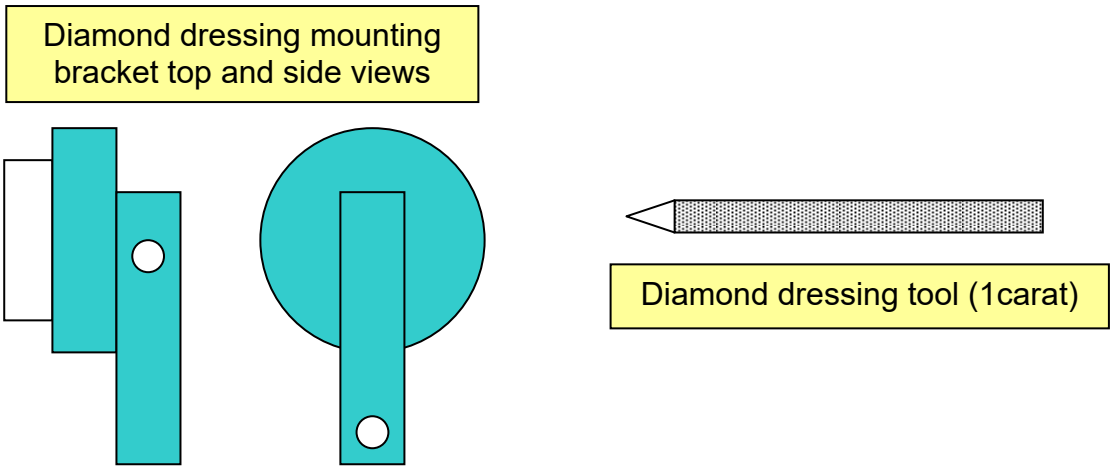


Figure 45 Diamond dressing equipment

Truing the front face of the grinding wheel

⚠ Grinding wheel dressing, truing and replacement should only be carried out by operators correctly trained in the safe use of abrasive wheels as detailed in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)

Secure the diamond dresser mounting bracket into the left hand tailstock as shown in the picture below. Fit the dressing tool into the mounting bracket and lock in place. The dressing tool must be horizontal.

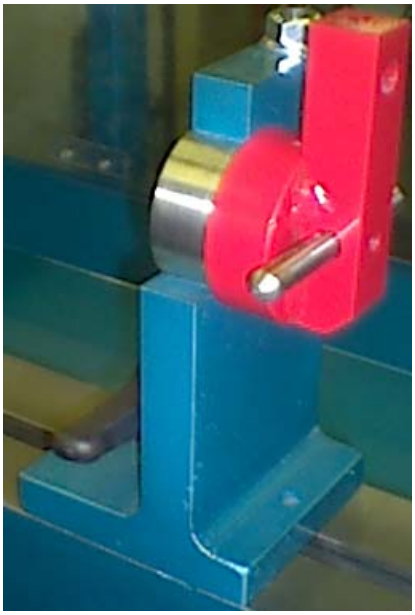


Figure 46 – Diamond dressing tool in position for face truing

Raise or lower the grinding head so that the dressing tool is slightly below the centreline of the wheel.

Bring the grinding head opposite the diamond dresser and wind the wheel in until the front face of the grinding wheel is just in contact with the dressing tool. Take the grinding head to one side before commencing the operation.

Switch on the grinding wheel motor, wait until it reaches full operating speed then gently traverse the wheel-head from side to side against the dressing tool.

Every two to four passes, lightly feed the wheel into the dressing tool. Keep repeating this until the full width of the grinding wheel face has been trued.

Move the grinding head away from the tool and switch off the grinding wheel motor.

Use the star wheel dresser to ‘open up’ the grinding wheel before any grinding commences.

Truing the side face of the grinding wheel

⚠ Grinding wheel dressing, truing and replacement should only be carried out by operators correctly trained in the safe use of abrasive wheels as detailed in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)

Secure the diamond dresser mounting bracket into the left hand tailstock as shown in the picture below so that the arm of the bracket is horizontal. Do not fit the dressing tool into the mounting bracket at this stage.

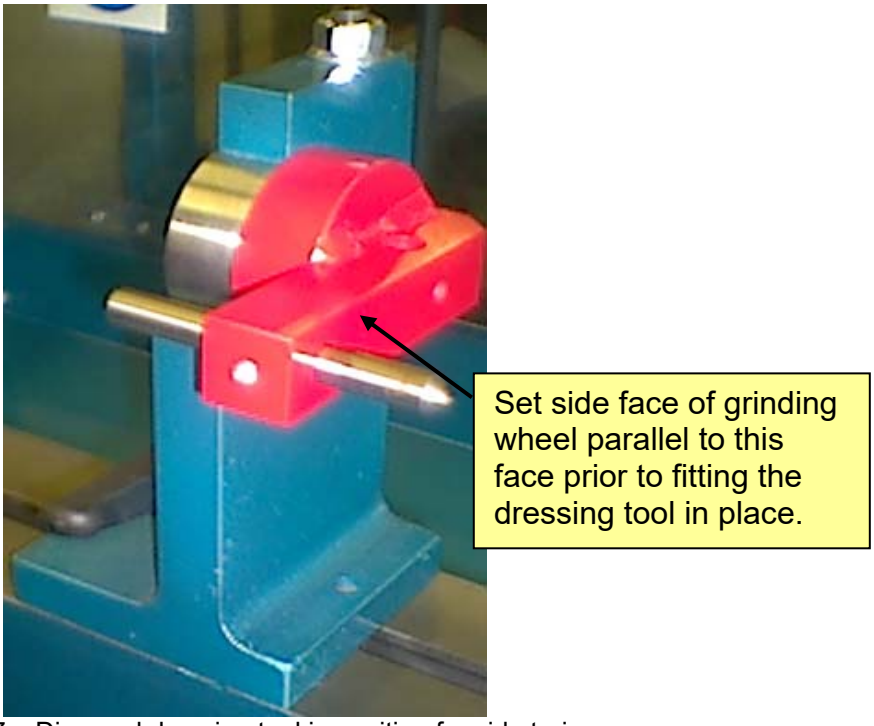


Figure 47 – Diamond dressing tool in position for side truing

Park the grinding head at the right hand of the machine and make sure it is firmly locked.

During the following operation of the dressing of the side face of the grinding wheel, the wheel-head must not move. This is of the utmost importance and must be adhered to, as any side movement will damage the stone, possible resulting in a wheel burst.

Remove the side guard from the grinding head.

Wind-up the wheel-head column, as shown below in figure 48.

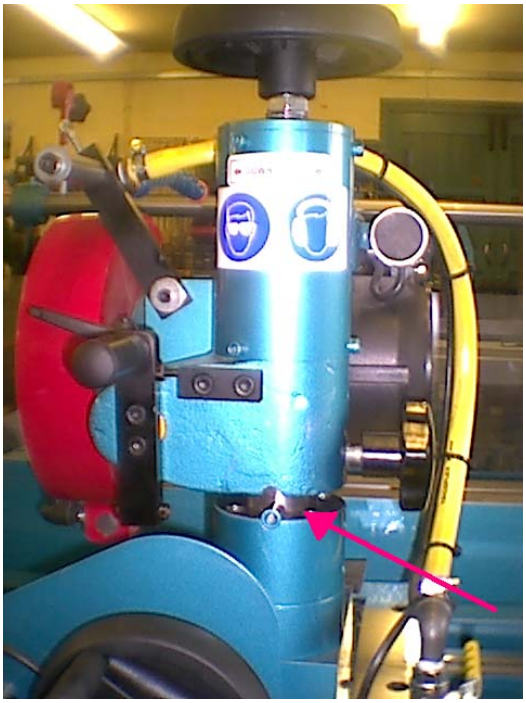


Figure 48 - Wind up-column

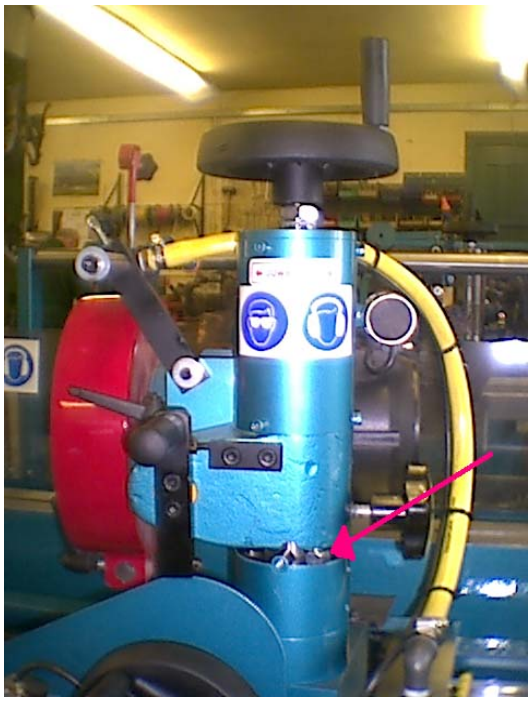


Figure 49 - Insert 8mm Nut

Take the Wheel-head column a short distance; slacken the knob on the side of the column sufficiently so that the column can be rotated clockwise.

Insert an 8mm nut as a spacing piece and then tighten the grinding head column so that the side of the grinding wheel is parallel to that flat face of the arm of the mounting bracket which is shown in figure 47.

Insert the diamond dresser tool into the hole in the mounting bracket, as shown in figure 47 and lock in place.

Bring the dressing tool up to the grinding wheel and lock the tailstock into place. Wind the wheel backwards away from the dressing tool

Start the motor and let it speed up to its operating speed. Slowly wind the wheel inwards past the tool until the diamond point almost reaches the inside rim of the grinding wheel mount. Wind the wheel backwards away from the dressing tool.

When the tool is safely away from the rotating wheel, lightly tap the tailstock, with the dressing tool in place to the right, using a soft faced mallet, or similar. This is done to give a small ‘infeed’ of the dressing tool – there is no mechanical means of winding the tailstock along the machine bed, and the grinding head has been locked in position to prevent any movement.

Slowly wind the grinding head past the diamond tip of the tool as before. Take care not to stress the wheel. If the tailstock has moved too far, wind the wheel out and use the hammer to tap the tailstock back to the left. Take extreme care not to strike the wheel.

Repeat the process of winding out the wheel, tapping in the tailstock, and winding in to true the wheel until all score marks and hollows have been removed and a flat surface has been generated.

Switch off the grinding wheel motor and allow the wheel to come to halt. Replace the grinding head side guard.

Use the star wheel dresser to ‘open up’ the grinding wheel before any grinding commences.

Grinding wheel replacement

Main reasons for changing:

- If the stone is worn out, the grinding process accuracy cannot be maintained.
- Peripheral speeds of the wheel will be reduced and the grinding process will take longer.
- There will be increase in risk to both the operator and the equipment.

⚠ Grinding wheel dressing, truing and replacement should only be carried out by operators correctly trained in the safe use of abrasive wheels as detailed in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98)

Ensure that the machine is disconnected from the mains supply to prevent accidental start-up

Remove the side guard from the left hand side of the grinding wheel. This is held by five socket capscrews (5mm).

Figure 50 – Side guard removal

Remove Finger Guide stem and the ‘L’ shaped splash guard. The grinding wheel is now exposed for removal.

There may be up to two balancing screws, possible with a number of washers, fitted to the outer wheel flange. These should be removed.

Remove the three socket countersunk screws which hold the securing flange and the grinding wheel in place. Place the flange to one side and safely dispose of the grinding wheel.

Figure 51 – Removing the wheel securing flange

Clean and remove any traces of old gasket from the inner and outer wheel flanges. Clean out the balancing holes (6 total) and re-grease the three countersunk securing screws with anti-seize grease.

Place the new grinding stone complete with gasket on to the inner wheel flange. If the wheel has a dished face, this should be on the opposite side from the motor. Place the outer wheel flange on the opposite side of the grinding stone, line-up the securing bolts holes and refit the three countersunk screws. Wind in the screws until all of the slack has been taken up, then further tighten the screws progressively and evenly. Do not over tighten the screws as undue stresses will be placed on the wheel, potentially damaging it. Spin the wheel by hand to check that it is aligned and does not run out of true.

Balancing the grinding stone

After fitting a new grinding stone, the new stone should be checked for rotational balance. This is done by switching on the grinding head – stand to one side, away from the grinding wheel in case of a failure of the new wheel.

Check for noise and vibration over and above the normal expected levels. If these are present, the wheel must be balanced.

The main reasons for balancing are:

- Reduced stresses in the wheel
- Reduced motor bearing wear
- Improved grinding surface finish
- Increased wheel life
- Reduced workshop noise

Using a felt-tipped pen or similar, place a mark adjacent to one of the six balancing holes in the wheel securing flange, as shown in figure 52.

Figure 52 – Mark one of the balancing holes

Fit one of the balancing screws into the marked hole and tighten in position.

Switch on the wheel motor and allow the wheel to reach full speed. Check the levels of noise and vibration. This should be compared with the earlier assessment. Switch off the motor and allow the wheel to come to rest.

If the vibration has been eliminated, the wheel is balanced. If not, remove the balancing screw and move it to the next hole around the flange. Check for vibration as before.

If necessary, continue repositioning the balancing screw around the flange. At this point, it should be possible to conclude that the screw positioned in one of the holes provided the most reduction in vibration.

To fully eliminate vibration, experiment by adding a small number of flat washers over the screw. It may be that the true balance point lies between two adjacent balancing holes, in which case two equal balancing screws could be used.

Important:

- Never fit more than two balancing screws
- Switch off the grinding motor immediately when increased vibration is noticed.

After changing and balancing the grinding wheel, it should be diamond trued and star wheel dressed

SECTION 6 - GENERAL MACHINE MAINTENANCE.

Routine Maintenance

Correct and regular maintenance of the Jupiter grinding machine prolong the unit's life and help provide consistently accurate grinding.

Daily

Check the general condition the machine for any damage, paying particular attention to the control panel and external wiring. Any damaged wiring must be reported immediately and the machine isolated to prevent use until repairs have been carried out.

Ensure that the emergency stop buttons are working correctly. Report any faults immediately and isolate the machine to prevent use until suitable repairs have been carried out.

L Electrical repairs must only be carried out by a suitably qualified person.

After each days use, clean the machine surfaces and channels using a soft paintbrush. Gather the debris together and deposit it in a waste bin. Once most of the dirt has been removed, use the machines coolant system to wash away residues. It is important to remove as much heavy soiling as possible before washing over with coolant as this will result in excessive contamination of the coolant system. Traversing the grinding head along the machine, direct the coolant at the slideways and coolant catchment trays to wash away the dirt. Use the paintbrush to direct the coolant and dirt towards the drainage holes in the centre of the trays where it will be carried to the coolant storage tank. Wipe down all surfaces using a lint-free cloth or workshop quality paper towelling.

Apply a light coating of lubricant to the T-Slot top machined face and wipe off any excess with clean cloth. The ideal lubricant is a light grade penetrating oil which contains PTFE (Teflon) such as Fin Lube TF. Use the cloth with the excess lubricant to wipe down and clean the traverse stop rail, rear grab arm rail, grab arms shafts and spin/index motor shaft. This will help prevent oxidation of their surfaces.

Weekly (in addition to the above)

Remove the tailstocks and the spin /indexing motor assembly from the machine bed, clean the contact faces on the undersides thoroughly and apply a little with the PTFE lubricant. Wipe off excess with a clean cloth.

Whilst tailstocks and spin/indexing motor are removed, clean any build up of dirt from the T-Slot.

Check coolant level and condition. Switch off the pump and allow coolant to settle in tank. Remove the tank lid and inspect the level. It should settle between 25-75mm from the top of the tank, across all three chambers. Top up as required using correctly diluted coolant only. Contact Hunter Grinders for information on approved coolants and their use. Discard coolant mix after 3 months and replace with a fresh mix. In heavy machine use, coolant may need to be replaced at shorter intervals due

to contamination. Thoroughly cleaning cylinders and cutting units before grinding will help prolong the life of your coolant mix. Dispose of used coolant according to the recommendations contained in the coolant manufacturer's COSHH sheet.

Check condition of linear bed-rails, clean any excess dirt accumulated at the end of their travel. Check there is no build up of dirt behind the rails, particularly the rail towards the rear of the machine. Lubricate the rails with Shell Tonna S oil. Note that this lubricant is specially designed for machine slideways, especially as it resists being washed off by the system coolant. It is important to use only this approved lubricant. Contact Hunter Grinders Technical Department for additional guidance.

Monthly (in addition to the above)

Raise the wheel-head up the support column, clean the shaft and apply a thin film of anti seize oil, such as Lok-Cease.

Wind the in-feed saddle forward, clean the now exposed dovetail and lubricate using light grade oil (SAE 30). Wind the in-feed saddle back and clean the other end of the dovetail. Lubricate as before.

Remove the locking handles from the tailstocks and clean the threads. Lubricate using an anti seize oil, such as Lok-Cease.

6-12 monthly (in addition to the above)

Grease the linear bed rail bearings blocks via their grease nipples using a lithium based grease, number 2. The recommended method is to apply the grease dynamically, whist slowly traversing the grinding wheel-head from side to side while injecting small amounts of grease. The bearings only hold a small amount of grease so it is important not to overload them with too much. Wipe off any old and contaminated grease which will have been ejected from the bearings.

Annual (in addition to the above)

It is recommended that all medium to heavy machine users have their machines serviced on an annual basis. Light to medium uses should at least look to having their machines serviced biannually. This comprehensive service includes travel to site, checking all grinder settings, stripping down the headstock, in-feed, down-feed, traverse bearings and rails, traverse, tailstocks, checking the coolant facility, hoist (where applicable) etc. Repair and/or replace as necessary, reassemble and test. Favourable rates are offered to those customers who sign up to annual / biannual maintenance schedules. Contact Hunter Grinders for more details.

Setting the finger guide height

Finger guides are factory set for optimum relief angle. However it is possible to vary this height for individual mowers in order to achieve the mower manufacturer's specification. It is important to make a record of the original factory set finger guide height.

When replacing a worn finger guide, the correct setting position must be established to enable resetting following removal and replacement.

⚠ Ensure that the grinding machine power is switched off to prevent accidental start-up

Mount a cylinder in the grinding machine and set the grinding wheel on the same centreline as the cylinder, as described in the earlier section.

Place the finger guide in the finger guide clamp, ensuring that the guide is correctly oriented relative to the direction of the spiral (see earlier section), and lightly clamp in a lower than normal position.

With the grinding wheel stationary, slowly wind in the grinding head towards the cylinder. Turn the cylinder back and forth until the point is found where the cylinder blade can just make contact with the wheel. This contact point marks the centreline between the cylinder and the grinding wheel.

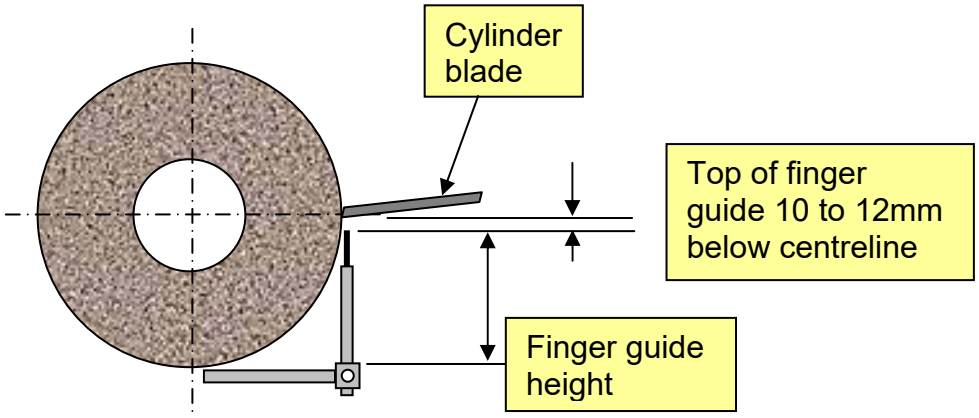


Figure 53 – setting finger guide height

Loosen and bring the finger guide into position 10 to 12mm below the cylinder spiral and wheel contact point. Reclamp the finger guide.

Reference chart
Approximate 'Relief Angle' when using the Finger Guide settings

Cylinder diameter (inches)	6mm below centre °(degrees)	12mm below centre ° (degrees)
3	10	25
4	9-10	22-24
5	8-9	20-22
6	7-8	18-20
7	6-7	16-18
8	5-6	14-16
9	4-5	12-14
10	3-4	10-12

SECTION 7 - MOUNTING INFORMATION

Bearing Adapters – cylinder out of frame

Make and model of mower	Bearing adaptor required
Allen National	K09194 Taper
Allen Ranger	K09194 Taper
Atco	6206
Allet Buffalo all models	6205 Standard
Allet Shaver & Tornement	6204 Standard
Allet 30” & 36”	RL9 Extended
Bunton hand mowers	30204 Standard
Brauer Gang	6205 Extended
Dennis cassette Mowers	RL6 Standard
Dennis 36” Drive end requires larger bearing	6206/6207
Huxley 358	44610 Taper
Hater 744 Mk3 Beaver	6205 Standard
Jacobson Triking	44610 Taper
Jacobson LF3810	44610 Taper
Jacobson Greensking	11910 Taper
Jacobson LF100	11910 Taper
Jacobson 22” hand mower	11910 Taper
Jacobson 422	11910 Taper
Jacobson Magna Gang	07204 Standard
Jacobson Blitzer Gang	07204 Standard
Jacobson Ranger Gang	07204 Standard
Jacobson Hydro Turf King	6204 Standard
Jacobson Hydro Ranger	6204 Standard
John Deere 180 Pedestrian	11910 Taper
John Deere 2243 Greens Mower	11910 Taper
John Deere 3235 Fairway	12610 Taper
John Deere 3235A Fairway	11910 Taper
John Deere 2500 Greens Mower	44610 Taper
John Deere 2653 Tees Mower	12610 Taper
John Deere 220 Hand Mower	30204 Taper
John Deere 365 Hydraulic Gang	67010 Taper
John Deere 3235B	12610 Taper
Lesco Machines	11910 Taper
Lloyds Paladin Drive end requires larger bearing	44610 / 03162

Lloyds Arial	09194 Taper
Lloyds Leda (Post 1993)	30207A Taper
Lloyds Leda (Pre 1993)	K14276 Taper
Lloyds Pentack Titan	LM67010 Taper
Lloyds Elite	4TK1922 Taper
Lloyds Gang	
Ransomes Sports cutter 220	44610 Taper
Ransomes Sports cutter 350D	44610 Taper
Ransomes Magna 250	44610 Taper
Ransomes Marquis (Pre1972)	RL5 Standard
Ransomes Marquis (Post1972)	6203 Standard
Ransomes 185	44610 Taper
Ransomes 300 Fairway	44610 Taper
Ransomes TG 4650	
Ransomes Triplex	11710 Taper
Ransomes Hahn	11710 Taper
Ransomes Classic	11710 Taper
Ransomes GT	11710 Taper
Ransomes Super Bowl (Post 1996)	11710 Taper
Ransomes Greens Super 50-55 & 60	11710 Taper
Ransomes Greens Plex 160	11910 Taper
Ransomes E-Plex 160	11910 Taper
Ransomes Auto Certees (Pre 1978)	RL5 Standard
Ransomes Auto Certees (Post 1978)	6203 Standard
Ransomes Super Certees (Pre 1978)	RL5 Standard
Ransomes Super Certees (Post 1978)	6203 Standard
Ransomes Super Bowl	6203 Standard
Ransomes 180D	6204 Standard
Ransomes 213D	6205 Standard
Ransomes 465	6205 Standard
Ransomes Teesplex	4TL45449 / 44610
Sabo Robarine Tail end all models	6205 Standard
Sabo Robarine Drive end all models	6206 Extended
Saxon all models	6204 Standard
Suffolk colt	Colt cups
Suffolk Punch	Colt cups
Suffolk Punch new models	6202 Standard
Toro GM3	44610 Taper
Toro GM3000	44610 Taper
Toro GM3100	44610 Taper
Toro GM3200	44610 Taper
Toro GM5100	44610 Taper
Toro GM3200D	6206 Extended
Toro GM6500	6206 Extended
Toro 1000	6205 Standard

Toro 70	RL6 / 6203
Toro 216	RL8 Standard
Toro 2300	RL8 Standard
Toro 450D	6205 Standard
Toro 335D	6205 Standard
Toro 6500D	
Toro 4500	6205 Standard
Toro Sidewinder	RL8 Extended
Webb Wizard	6201 / RL5
Webb 14”	1302

Consult Hunter Grinders Technical Department for information and guidance in mounting cylinders not listed above.

Cylinders mounted within frames

Make and model of mower	Mounting Brackets required
Allen National	
Allen Ranger	
Atco	
Allet Buffalo all models	Extended mounting points.
Allet Shaver & Tornement	Extended mounting points.
Allet 30” & 36”	Extended mounting points.
Bunton hand mowers	
Brauer Gang	
Dennis cassette Mowers	
Dennis 36” Drive end requires larger bearing	
Huxley 358	
Hater 744 Mk3 Beaver	
Jacobson Triking	
Jacobson LF3810	Extended mounting points.
Jacobson Greensking	
Jacobson LF100	Extended mounting points.
Jacobson 22” hand mower	Extended mounting points.
Jacobson 422	Extended mounting points.
Jacobson Magna Gang	Extended mounting points.
Jacobson Blitzer Gang	Extended mounting points.
Jacobson Ranger Gang	Extended mounting points.
Jacobson Hydro Turf King	Extended mounting points.
Jacobson Hydro Ranger	Extended mounting points.
John Deere 180 Pedestrian	Universal mounting brackets.
John Deere 2243 Greens Mower	Universal mounting brackets.
John Deere 3235 Fairway	Extended mounting points.
John Deere 3235A Fairway	Extended mounting points.
John Deere 2500 Greens Mower	Universal mounting brackets.
John Deere 2653 Tees Mower	Universal mounting brackets.
John Deere 220 Hand Mower	Universal mounting brackets.
John Deere 365 Hydraulic Gang	Extended mounting points.
John Deere 3235B	Extended mounting points.
Lesco Machines	
Lloyds Paladin Drive end requires larger bearing	Universal mounting brackets
Lloyds Arial	Universal mounting brackets
Lloyds Leda (Post 1993)	Universal mounting brackets

Lloyds Leda (Pre 1993)	
Lloyds Pentack Titan	
Lloyds Elite	Extended mounting points.
Lloyds Gang	
Ransomes Sports cutter 220	
Ransomes Sports cutter 350D	
Ransomes Magna 250	
Ransomes Marquis (Pre1972)	
Ransomes Marquis (Post1972)	
Ransomes 185	
Ransomes 300 Fairway	
Ransomes TG 4650	
Ransomes Triplex	
Ransomes Hahn	
Ransomes Classic	
Ransomes GT	
Ransomes Super Bowl (Post 1996)	
Ransomes Greens Super 50-55 & 60	
Ransomes Greens Plex 160	
Ransomes E-Plex 160	
Ransomes Auto Certees (Pre 1978)	
Ransomes Auto Certees (Post 1978)	
Ransomes Super Certees (Pre 1978)	
Ransomes Super Certees (Post 1978)	
Ransomes Super Bowl	
Ransomes 180D	
Ransomes 213D	
Ransomes 465	
Ransomes Teesplex	
Sabo Robarine Tail end all models	Extended mounting points.
Sabo Robarine Drive end all models	Extended mounting points.
Saxon all models	
Suffolk colt	
Suffolk Punch	
Suffolk Punch new models	
Toro GM3	GM3 Mounting blocks
Toro GM3000	Extended mounting points.
Toro GM3100	Extended mounting points.
Toro GM3200	Extended mounting points.
Toro GM5100	Extended mounting points.
Toro GM3200D	Extended mounting points.
Toro GM6500	Extended mounting points.
Toro 1000	Universal mounting brackets
Toro 70	Extended mounting points.
Toro 216	Extended mounting points.

Toro 2300	Extended mounting points.
Toro 450D	Extended mounting points.
Toro 335D	Extended mounting points.
Toro 6500D	Extended mounting points.
Toro 4500	Extended mounting points.
Toro Sidewinder	Extended mounting points.
Webb Wizard	
Webb 14”	

Consult Hunter Grinders Technical Department for information and guidance in mounting cylinders not listed above.

Drivers required for cylinder spinning

Make and model of mower	Spin Drivers Required.
Allen National	
Allen Ranger	
Atco	
Allet Buffalo all models	
Allet Shaver & Tornement	
Allet 30” & 36”	
Bunton hand mowers	
Brauer Gang	
Dennis cassette Mowers	
Dennis 36” Drive end requires larger bearing	
Huxley 358	
Hater 744 Mk3 Beaver	9/16 socket with drive pin
Jacobson Triking	
Jacobson LF3810	
Jacobson Greensking	
Jacobson LF100	
Jacobson 22” hand mower	
Jacobson 422	
Jacobson Magna Gang	
Jacobson Blitzer Gang	
Jacobson Ranger Gang	
Jacobson Hydro Turf King	
Jacobson Hydro Ranger	
John Deere 180 Pedestrian	Gaytor driver
John Deere 2243 Greens Mower	
John Deere 3235 Fairway	
John Deere 3235A Fairway	
John Deere 2500 Greens Mower	
John Deere 2653 Tees Mower	
John Deere 220 Hand Mower	
John Deere 365 Hydraulic Gang	
John Deere 3235B	
Lesco Machines	
Lloyds Paladin Drive end requires larger bearing	
Lloyds Arial	

Lloyds Leda (Post 1993)	Bent M 10 drive pin
Lloyds Leda (Pre 1993)	Bent 7/16 BSW drive pin
Lloyds Pentack Titan	
Lloyds Elite	3 pin cup driver
Lloyds Gang	
Ransomes Sports cutter 220	9/16 socket with drive pin
Ransomes Sports cutter 350D	9/16 socket with drive pin
Ransomes Magna 250	9/16 socket with drive pin
Ransomes Marquis (Pre1972)	
Ransomes Marquis (Post1972)	
Ransomes 185	
Ransomes 300 Fairway	
Ransomes TG 4650	Slotted driver RTD
Ransomes Triplex	
Ransomes Hahn	
Ransomes Classic	
Ransomes GT	
Ransomes Super Bowl (Post 1996)	
Ransomes Greens Super 50-55 & 60	
Ransomes Greens Plex 160	
Ransomes E-Plex 160	
Ransomes Auto Certees (Pre 1978)	
Ransomes Auto Certees (Post 1978)	
Ransomes Super Certees (Pre 1978)	
Ransomes Super Certees (Post 1978)	
Ransomes Super Bowl	
Ransomes 180D	2 pin cup driver
Ransomes 213D	
Ransomes 465	
Ransomes Teesplex	
Sabo Robarine Tail end all models	
Sabo Robarine Drive end all models	
Saxon all models	
Suffolk colt	
Suffolk Punch	
Suffolk Punch new models	
Toro GM3	
Toro GM3000	
Toro GM3100	
Toro GM3200	
Toro GM5100	
Toro GM3200D	
Toro GM6500	
Toro 1000	½” square driver
Toro 70	

Toro 216	
Toro 2300	
Toro 450D	
Toro 335D	
Toro 6500D	
Toro 4500	
Toro Sidewinder	
Webb Wizard	
Webb 14”	

Consult Hunter Grinders Technical Department for information and guidance in driving cylinders not listed above.

SECTION 8 - DRAWINGS AND MACHINE PARTS LISTS

SECTION 9 - ELECTRICAL DRAWINGS AND PARTS LISTS

SECTION 10 - SUPPLIERS/MANUFACTURERS DATA SHEETS

SECTION 11 - RISK ASSESSMENT

Risk categories for the design of fail safe control systems

The harmonised European Standard PR EN 954 - 1 for the design of fail-safe control circuits outlines 5 levels of risk. It is deemed the designer's responsibility to objectively identify a risk level for a particular machine and design all safety related systems to that level.

In general, the following block diagram, figure 40, gives guidelines to the identification of design risk level, which may be used to help determine the structure of the fail safe control circuit required on a particular facility.

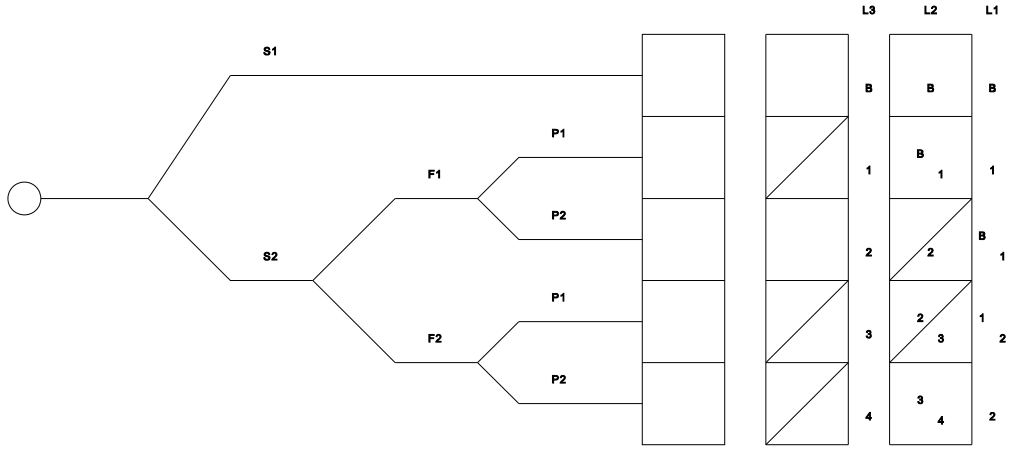


Figure: 40

S. <u>Severity of injury</u>
S1 - Slight injury (bruise)
S2 - Severe injury (amputation or death)

F. <u>Frequency of exposure to hazard</u>
F1 - Seldom
F2 - Frequent to continuous

P. <u>Possibility of avoiding the hazard</u>
P1 - Possible
P2 - Less possible

L. <u>Likelihood of occurrence (if an interlock fails)</u>
L1 - Very unlikely
L2 - Unlikely
L3 - Highly Likely

Requirements of the safety related control circuit to meet the various categories are listed in section 7 of PR EN 954 - 1, but in general their requirements are as follows :-

Category B. Safety devices and control systems as a minimum must be designed, selected and assembled to meet the operational requirements of the design limits and influence of the processed materials and other external influences. Most domestic appliances fall into this category, and providing the components are correctly specified (load, switching frequency etc), then no other special features are required.

Category 1. All conditions B apply, but the safety related system must use 'well tried' principles and components, (7.2.2 PR EN 954 - 1). Software or electronic logic is not considered adequate at this level.

Category 2. All conditions of B apply, but in addition the machine shall be prevented from starting if a fault is detected on power up. This suggests the use of an interface relay with redundancy and self-checking on energisation. Single channel operation is permitted providing that the input devices (Em/stop buttons, gate switches) are tested for operation on a regular basis. If regular testing cannot be guaranteed, then the designer has little choice but to opt for two channel control.

Category 3. All conditions of B apply, but the complete safety control system shall be designed so that any single fault shall not lead to the loss of the safety function and, where practical, the single fault shall be detected. This now calls for not only redundancy in the interface relay but also in the input devices pointing to dual channel systems.

Category 4. All of the conditions of B apply. In addition, any single fault must be detected at or before the next demand on the safety system, **or** an accumulation of three faults shall not lead to the loss of the safety functions. In this category single fault detection is essential, redundancy in both the input and output devices, self checking, cross monitoring and duel channel control. This level of safety is for dangerous machines where it is imperative that the safety circuit functions correctly at all times. Generally, if any input devices are connected to the safety circuit via flexible cables in vulnerable positions where damage could foresee-ably cause a number of faults, this level of two channel safety circuit should be used. Also this level of safety circuit is used where the inputs are vulnerable and are not necessarily being tested by operation of the safety circuit on a regular basis.

In general all of the above requirements can be met by applying various Pilz safety products (or equivalent safety relays) in the correct way.

Method of Stopping

When providing a risk assessment for a particular machine, it is also necessary to take into account the method of stopping required by all of the elements to be incorporated in its design. This process again allows the machine to be placed into a category indicating the method of stopping.

CENTER LINE

The following procedure is used when assessing the method of stopping required as defined in EN60204 paragraph 9.2.2:

Category 0

a) Immediate removal of power to machine actuators or
b) Mechanical disconnection (declutching) between the hazardous elements and their machine actuators and
c) If necessary braking (uncontrolled stop).

Category 1

Controlled stop with power to the machine actuators available to achieve the stop and then removal of power when the stop is achieved.

Category 2

Controlled stop with power Left available to the machine actuators.

Emergency Stop Safety Circuit

The Bottom Blade Grinding Machine has been designed to operate safely. When this machine is examined, it can be seen that all areas of movement on the machine will be protected, where possible, using fixed guards. There will be Emergency Stop push-buttons situated at various points around the machine such that the operator will be able to reach at least one Unit easily.

Using Figure: 1 shown previously, it is possible to provide a risk assessment for this machine and determine the level of safety control circuit required.

Firstly, the severity of injury on this machine will be regarded as severe (S2), because of the moving carriage and the wheel-head. Either of which could cause amputation. Secondly, the frequency of exposure as been taken as continuous (F2). This helps to increase the safety factor. Thirdly, the possibility of avoiding the hazard as been taken as possible (P1). We know the operators are skilled and trained to handle this equipment. Finally, the likelihood of occurrence if an interlock fails on this machine is being taken as unlikely (L2).

When all of the moving parts on this machine are examined for the required method of stopping, it can be seen that this machine may be classed as a category 0 machine. This is due to the fact that all the movement on the machine is via electric motors and if power is removed from the motors they will cease movement very quickly.

From the above risk assessment, it can be seen that a minimum of a category 2 safety control circuit will be required on this machine. We have elected to use a Pilz PNOZ safety relay to provide better than the required category for the Emergency Stop circuit on this machine. As the machine falls within category 0 for the method of stopping, it is not necessary to provide any powered stopping procedures and simply removing the power supply from the moving parts will be adequate.