Like most manufacturers, we go to great lengths to make our products as safe as possible—but operators can still get hurt.

In virtually every case, injury is the result of:

- Not knowing how to properly operate the machine;
- Not following proper operating and safety procedures;
- Carelessness or inattention;
- Trying to "take a short cut;"
- Poor maintenance.

For your personal safety, and to get the maximum efficiency out of this precision machine; read and follow operation instructions carefully.

Standard Safety Precautions for operating the AUTOSTEP/AUTOMATIC Surface Grinder:

- Not knowing how to properly operate the machine;
- Not following proper operating and safety procedures;
- Carelessness or inattention;
- Trying to "take a short cut;"
- Poor maintenance.
- NEVER operate machine without safety glasses.
- NEVER operate machine without wheel guard in place.
- DO NOT wear tie, scarf, ID bracelet, neck chain or other object that could become entangled in the machine or work piece.
- ALWAYS wait for wheel to stop before bringing your hands to table or work piece.
- MAKE CERTAIN work piece is SECURELY held in place.
- NEVER attempt to hand hold or hand feed a work piece.
- NEVER exceed machine's capacity.
- Use proper grade grinding wheels and keep them dressed.
- Stop the machine and correct any malfunction immediately (see Maintenance manual or contact your supervisor).
- Inspect and maintain machine by schedule—not by chance.
- Keep hands and clothing away from table when operating.
- If you're not a qualified electrician, do NOT tamper with electrical connections or wiring. Report any suspected electrical malfunction immediately.
- Lock table when not grinding.

IMPORTANT NOTICE

Although reasonable care has been exercised in the preparation of this AUTOMATIC/AUTOSTEP Operator's Manual to make them complete and accurate, they do not purport to cover all conceivable problems or applications pertaining to this machine.

CAUTION

The following VIOLATIONS will VOID your WARRANTY

USING anything other than Harig® Way Lube Oil™ (P/N 16211245)
ALTERATIONS to the following parts: CASTINGS, ELECTRICAL, LUBRICATION, COOLANT, and HYDRAULICS

INSTRUCTIONS ON GRINDING THE BOTTOM OF THE CHUCK

1 Place the chuck, top down, on a surface plate. The object of this is to determine if the center of the chuck is high. With an indicator press at different areas to determine if the chuck rocks in the center you have determined the chuck is high, the center you will need to shim one end, so the chuck will be stable and not rock while grinding. A chuck with a warped bottom when installed and tightened, will permanently warp the table, this will affect the performance of the machine for life.

2 Block each end of the chuck to prevent from moving while being ground. DO NOT HOLD IN PLACE BY ENERGIZING THE CHUCK, OR CLAMPING DOWN ON THE ENDS.

3 Using a general-purpose medium hardness 46 grit type-grinding wheel. WET GRIND using any ion-nitrate or inhibited-nitrate coolant.

4 Depth of cut can vary depending what grit wheel and how much cross feed.

5 Table speed 20 to 40 surface feet.

6 When total surface is flat you are ready to turn over and grind the top surface. Refer to the owner’s manual for instructions (Grinding in Chucks) ALSO REFER TO Fig. 16 for Chuck Torque.

If you have any questions regarding these procedures please contact your dealer.
Harig Grinder Preventative Maintenance Check List
PREFORMED BY THE OPERATOR DAILY

Customers Name ___________________________________________________________________

Machine Type ______________________ S/N __________________________

☐ Check way lube level. Fill as needed.
☐ Check ways for proper oiling. If more oil is needed turn oil adjustment control a 1/8 of a turn, observe performance and increase if needed.
☐ Clean machine with vacuum and /or treated dust cloth (Caution do not use air blast.)
☐ Check lube lines for leaks.
☐ Check table for smooth operation; make sure there is oil on ways.
☐ Check operation of coolant pump. Clean tank, change coolant if needed.
☐ Check spindle for noisy operation.
☐ Make maintenance recommendations for any potential problems found.

____________________________________________________________________________________
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____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Checked by ________________________________________________ Date _____________________
Customers Name ________________________________________________________________

Machine Type ___________________________ S/N ___________________________

☐ Every 1000 hrs: Clean oil pump filter, clean reservoir and change oil.
☐ Check lube lines for leaks.
☐ Every 1000 hrs: Check hydraulic pump pressure, fluid level and filter. Clean filter if needed.
   To add hydraulic oil use a good grade of (150 SUS) hydraulic oil.
☐ Every 5000 hrs: replace hydraulic oil with a good grade. (150 SUS)
☐ Every 6 months: check level of machine.
☐ Check coolant pump. Clean tank, change coolant, when dirty.
☐ Every 1000 hrs: check axis belts. (Autostep, CNC, Ez Surf)
☐ Every 1000 hrs: Check axis motors for noise or excessive heat. (Automatics, Autosteps, CNC and Ez Surf)
☐ Make maintenance recommendations for any potential problems found.

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Checked by ________________________________________________ Date _____________________
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NOMENCLATURE

AUTOMATIC

ELEVATING SCREW GUARD
SIGHT GLASS
ELEVATING HANDWHEEL
SPINDLE POWER
CROSS FEED MOTOR
LONGITUDINAL HANDWHEEL
CROSS FEED HANDWHEEL
EMERGENCY STOP
POWER INDICATION LIGHT
COOLANT OFF/ON
SPINDLE START
HYDRAULIC OFF/ON
CROSS FEED OFF/ON
CROSS FEED CONTROL

Front View
Fig. 4

SPINDLE MOTOR
LONGITUDINAL HANDWHEEL
CROSS FEED MOTOR
CROSS FEED HANDWHEEL
EMERGENCY STOP
POWER INDICATION LIGHT
COOLANT OFF/ON
SPINDLE START
HYDRAULIC OFF/ON
CROSS FEED OFF/ON
CROSS FEED CONTROL

Side View
Fig. 5

SPARK GUARD
OIL CUP
DRAIN HOLE
HYDRAULIC TANK AND PUMP COMPARTMENT
HYDRAULIC TANK AND PUMP COMPARTMENT
WORK LIGHT RECEPTACLE
WET COOLANT RECEPTACLE
WET COOLANT TANK & PUMP COMPARTMENT

Fig. 6
Step 1. Do Not Remove Skid.
Do not remove skid until the machine has been moved adjacent to its installation site.

Step 2. Lift Grinder From Skid and Position.
Before moving the elevating hand wheel to remove the wood brace between the table and spindle housing, remove the plastic temporary dust cover from the top of the column and slowly pour 2 ounces (1/4 cup) of way oil (the gallon container in the “standard accessory box” found on the left rear corner of the machine skid) over the bevel gear.

2.1 Place ¾” steel bar through holes near bottom of grinder base (Fig. 7)

2.2 Attach 1800 lb. Lifting strap to ends of bar and join near top of column. Strap to top of column. Pad machine adequately to prevent damage to finish (Fig. 7)

2.3 Remove the four ½-20 head bolts holding the base cabinet to the skid. Caution: do not lift by motor, spindle, table or saddle.

2.4 Lift slightly from skid. Loosen locking thumbscrew. (A, Fig. 11, page 7) balance machine by turning feed hand wheel. For safety, support the machine on two 4ft. pieces of 4 X 4 while installing leveling legs.

2.5 Screw 4 leveling legs (located in “standard accessory box”) into the holes in the base cabinet to project 5/8” below the bottom.

Step 3. Position Machine
Position machine where desire. No special pad, floor reinforcement or drip pans are required.

Remove grease from table hand wheels and exterior surfaces with clean rag. It is not necessary to disassemble anything, as all interior surfaces are factory prepared. Do not solvents or abrasive that may damage machine’s finish.

Step 5. Level Machine
5.1 Crank table all the way to the right and all the way toward the column

5.2 Raise left front leveling leg ¼” off the floor.

5.3 Place level on table platen and adjust the three remaining legs to level the table in both direction.

5.4 Lower left front leg to floor and give it an additional 1/8 turn.

Step 6. Assembly
Use three round head screws (furnished) to fasten Elevating screw Guard to Column Cap (Fig. 8)

Step 7. Wet Coolant
If wet coolant attachment has been purchased with this machine, remove it from coolant component (loosen three ¼ turn screws) and assemble as per instruction packed with the system. (Fig. 9)

Step 8. Lubrication.
8.1 Fill lube oil reservoir (Cup at rear of machine). If needed. Add way oil from the gallon furnished to bring level to up to nearly full. (Fig. 10)

8.2 Ways and feed screws are automatically lubricated.
8.3 Spindle and motor bearings are permanently lubricated.
8.4 The rack and pinion longitudinal table drive was greased at the factory. Add small amount of grease to the rack each month.

Step 9. Down Feed Control.
Unit is in carbon strapped to the crate or in the base cabinet of machine. The gasket and four button head screws for mounting the control box are located in the standard accessory package.

9.1 Release and uncoil control wires from autostep box from the electrical compartment. Feed the wires from the autostep box down through the mounting tube and connect them to the mating halves I the electrical compartment. Make certain each fiber optic cable is plugged into its corresponding numbered fiber optic receiver.
9.2 Mount down feed control to top flange so front face is on same angle as elevating handwheel shaft (Fig. 11).

Step 10. Electrical connections.

Caution: electrical connections or Services. To preclude personal injury, or extensive Machine damage, all electrical services must be performed by an authorized Bridgeport/Harig distributor. Violation will void the warranty

10.1 Ground machine by connecting the green wire to a satisfactory ground. Neither the building structure nor a hot water pipe is a satisfactory ground.

If a satisfactory ground is not available, drive an 8-foot copper ground rod into the ground and securely clamp the ground wire to it.

10.2 Compare rating label on the back of the spindle motor with house current to make certain they correspond.

10.3 Turn the disconnect handle to the OFF position and loosen the ¼ turn screws. Open the control compartment.

Caution: Make sure the machine disconnect is turned OFF before plugging or unplugging any connectors to electronic logic units. Failure to observe this precaution may result in permanent damage to the unit.

10.4 Check that the plug-in relays and printed circuit cards are seated firmly in their respective sockets and have not vibrated loose during shipment.

10.5 Bring main line through knockout on back of cabinet. Connect to top of fused disconnect block.

10.6 Remove wheel from spindle.

10.7 Stand in front of the machine and turn spindle motor ON. It should ROTATE CLOCKWISE. If not, switch any two line wires to fused disconnect block. (DO NOT switch motor leads, as this will damage hydraulic system by making it run backward.)

POWER ON GRINDER SPINDLE MOTOR-OIL PUMP

The spindle motor is turned on by momentarily depressing the start button next to the spindle-on light. (Fig. 1,4)

This also starts the oil pump of the lubricating system. After ½ minute the oil level should rise to the mid-point of the sight glass in the column cap of the machine. The spindle and oil pump are stopped by pushing the “emergency stop” button. (This will also stop the hydraulic and cross feed system motors if they are running.)

LONGITUDINAL FEED

Warning: When first starting table to run automatically, make certain proximity sensors are between trip dogs. To connect powered longitudinal feed, crank table to right as far as it will go. Bring locking lever (A, Fig. 12) forward and down into slot in bracket to engage groove in the pilot nut on the end of the cylinder rod. Be sure lever is seated all the way into the groove adjust the two dogs (A, Fig. 13) to within a few inches less than the desired table travel. Press “hydraulic start” button. Disengage handwheel by loosening thumb screw (B, Fig. 12) on the left side of cross travel addle and pull longitudinal feed handwheel out about 1-1/4 inches. (Fig. 12) Momentarily rotate the “table” switch on the push button panel to the “start” position. (The handwheel electrically locks out the hydraulic feed when engaged)

Once the table is started, the control will keep track of directions and reversals until the main disconnect is turned off, even if the proximity switch is tripped while moving the table manually. The table will now power feed (back and forth) at a speed determined by the speed control knob. (B, Fig. 13)
The maximum feed rate will be 70 feet per minute. Turning the knob clockwise reduces the feed rate. When grinding a piece at the full length of the chuck it may be necessary to readjust table reversing dogs (Compensating for heat expansion) to prevent table from hitting the internal table stop. To convert grinder back to hand feed, stop table by momentarily rotating the table switch to the “stop” position while table is feeding to right. Turn off hydraulic system by pushing red “ Hydraulic Off” button. Re-engage handwheel. Crank table to right until table hits internal stop. Lift up locking lever (A, Fig. 12) to clear the pin and flip it to its back disengage position.

Note: The speed control valve should be rotated fully counterclockwise in order to permit manual movement of the table via the longitudinal feed handwheel. It is a good practice to distribute oil evenly over entire length of ways before using grinder. Simply turn on spindle and run table back and forth a few times. (Spindle switch activates oil pump.)

CROSS FEED

The cross feed may be operated either manually or automatically. For manual operation loosen the cross feed lock screw (A, Fig. 14) and move the cross feed dogs (E) as far apart as possible. Manual operation is now available using the cross feed handwheel.

For automatic operation, first set the cross feed increment with the thumbwheels. © [Warning: Never change the thumbwheel setting when the automatic cross feed is turned “on”, or erratic cross feed may occur] then set the cross feed travel with the cross feed dogs. (E). The cross feed may now be operated automatically by pressing the cross feed start button (B). During automatic operation, the cross feed will feed the desired increment at each table reversal when the hydraulic table feed is in use.

Caution: make certain when setting cross feed travel that the limit switch rollers are not behind a cross feed setting dog, as damage to the machine could result.

The cross feed can be set to the desired feed in .0005” increments from .0005” to .9995”. to reset cross feed increments, turn cross feed “off”, reset thumbwheel, and then turn cross feedback “on”.

Caution: A cross feed may occur if the table is cranked manually, causing a table dog to trip a proximity switch.

ELEVATING MECHANISM (AUTOSTEP ONLY)

To change zero setting, loosen two knurled screws (B, Fig. 17) projecting from face of wheel, slide calibrated slip ring to desired position, and retighten screws.

ELEVATING MECHANISM (AUTOMATIC ONLY)

-To raise or lower grinding head assembly turn handwheel (A, Fig. 15) on the right side of the column.
-To change zero setting, loosen two knurled screws (B, Fig. 15) projecting from face of wheel, slide calibrated slip ring to desired position, and retighten screws.
-To engage “fine feed” (optional equipment), tighten one large knurled screw. (A, Fig. 16) One revolution of the “fine feed” knob changes elevating screw setting by .001 inches. To disengage “fine feed”, loosen knurled screw ½ turn.

AUTOSTEP DOWN FEED

Electric down feed control on the Harig Autostep Surface Grinder is controlled from the ye-level console you mount to the machine. The panel is color coded and provides thumbwheels for preprogramming total depth from .001” to 9.9999”, in down feed increments of from .0001” to .0099” and from 1 to 8 spark out passes with an infinity (4) position to allow the machine to remain at total depth until released by the operator. A manual jog button moves the wheel head in .0001” increments.
OPERATION
Grinding Wheel Mounting
Grinding Magnetic Chucks

See Fig. 18 for the location of various Autostep switches and controls.

Power On-Off
The power to the Autostep control and the stepping motor is turned on or off by the toggle switch at the lower left of the control.

When this switch is flipped to the up or “on” position, the amber Power On light will go on to show the grinder is ready for power operation. The elevating handwheel may move a few tenths as the stepping motor holding current is turned on by the power switch. The jog button (Fig. 18) can be used to reposition the wheel.

The power On-Off can be used to disconnect an automatic cycle. To do so, turn the switch off for a few seconds and then back on. The feed mechanism can then be returned to the starting point if a new cycle from the original starting point were desired.

Up-Down Switch.
The direction that the elevating mechanism will be moved, by either “jog button” or “traverse switch” is controlled by position of toggle switch located in the green field on the control panel below the thumbwheels.

Elevating jog button.
Pushing and releasing the “Elevating Jog Button, located in the green field on the control panel, will cause the elevating mechanism to move .0001” in the direction indicated by the position of the Up-Down switch. This button is not active during the cycle unless the cycle has been interrupted by pressing the “Cycle Interrupt” button.

Traverse.
The traverse switch is a center-off 3-position toggle switch to the left of the jog button. Actuating the switch in the left direction causes the elevating mechanism to move continuously in the direction specified by the up-down switch at a rate of 10 inches per minute. Actuation in the right direction causes continuous movement at a rate of 1 inch per minute. This allows rapid movement yet still provides for easy positioning of the head without overshoot.

Rapid Approach.
This group of thumbwheels is used to program a high-speed approach to the work piece from zero position at the start of a cycle. The thumbwheel in the ten-thousandths’ position is frozen and serves as a placeholder only.

Total Depth.
The setting on these five thumbwheels determines the total depth to which the grinding head will descend relative to its position at the start of a cycle. The setting may range from 0.0001” to 9.9999” (far more than could ever be used) with a resolution of 0.0001”.

Left and Right Feed Setting.
The left and right feed thumbwheels control the increment for left and right table reversal, respectively. Only the last two of the four thumbwheels to the right of the decimal point are operable. The first two are stationary and are in place only to assist reading the feed step, which can be set between 0.0000” and 0.0099” in increments of 0.0001”. to achieve a feed on one side only, set thumbwheels on the other side to 0.0000”.

Note: Use of the “fast” mode requires allowance for positioning over shoot of the elevating positioning mechanism. Overshoot varies with the duration of the manual move depending on the length of the move up to the time maximum speed is reached. The “fast” mode is provided as a mean of rough positioning only. For precise positioning, use the “slow” mode and the jog button.
Spark-Out.
This thumbwheel, to the right of the Total Depth Thumbwheels, allows the operator to select up to eight additional spark-out or idling passes of the longitudinal feed, if the grinder is operating in the plunge mode, or up to eight cross feed reversals if the grinder is operating in cross feed mode. These extra passes occur after the total depth has been reached during an automatic down feed cycle.

An infinity (4) position is also provided to allow the grinder to remain at total depth for an indefinite period of time. The infinity setting causes the grinder to interrupt itself after reaching total depth; just as an operator had depressed the interrupt button himself. At this point the operator is free to manually manipulate the position of the grinding head or allow the machine to spark-out for an undetermined length of time.

To complete the cycle, depress the restart button. The Autostep control will immediately return the grinding head to zero and determine the cycle.

Interrupt and Restart.
During an automatic cycle there may be times when you wish to stop the cycle for some reason. Depressing the interrupt button will accomplish this. After interrupting the cycle, thumbwheel values may be changed and the grinding head may be manually moved by means of the jog and Rapid buttons. To restart the cycle, depress the Restart button. The cycle will resume with the new settings.

During interrupt, the red LED under the Interrupt button illuminates to show that the Autostep control is in interrupt status.

Digital Display.
The digital display will show, in sequence:
1) HP
2) A five-digit number.
3) 0.0000 when the Autostep control box is first turned on.

The five-digit number identifies the software in use. As the grinding head is manually moved via the Rapid Traverse and Jog switches, the display will keep track of the head’s relative position in relation to the original zero point. As you move the head up from 0.0000”, the display will take the grinding head’s position as the new “relative zero” position and reset to zero when a cycle is started.

Cycle Start.
To start a cycle, depress the cycle Start button to the right of the power switch on the Autostep control box. The green cycle light will illuminate and the display will reset to zero, then the automatic cycle will begin.

Plunge or Cross Down Feed.
The Autostep control can operate in two modes: cross feed mode or plunge mode. In the plunge mode automatic cycle, the Autostep will follow this sequence:

1.) Execute rapid approach, if any
2.) At the first table reversal after rapid approach, the Autostep will index the grinding head in the amount shown on the appropriate thumbwheel. (Left or right feed)
3.) This continues until total depth is reached. At this point the Autostep control will execute the set number of spark out passes according to the spark out thumbwheel setting.
4.) The Autostep control then returns to zero. The cycle ends.

Cross feed mode is selected by means of the cross feed pushbutton on the push button panel. (Fig. 14 B)

Note: the state of the cross feed (on or off) is locked in at the start of an Autostep cycle and cannot be altered until the completion of the cycle. Therefore, select cross feed or plunge mode before activating the cycle start button on the Autostep.

Error Code Indications.
E-01 Not used.
E-02 Zero value set on total depth thumbwheel.
E-03 Rapid thumbwheel setting exceeds total depth setting.
E-04 Zero set on both left and right feed thumbwheels

Grinding Wheel Mounting.
Use only balanced wheels to ensure getting the maximum quality this precision machine is capable of producing. When specific problems regarding wheels selection are encountered, contact a grinding wheel manufacturer or its local representative for recommendations.

The spanner wrenches (furnished) fit the wheel nut, which holds the grinding wheel on the adaptor, and the two holes in the back of the adaptor. Unless a right-hand thread has been specifically ordered, the wheel nut has a left-hand thread (letters LH stamped on face of nut) so that the wheel will tend to tighten under starting torque. When changing wheel, be sure adaptor is retightened. If left loosed, wheel may shift and cause chatter marks.

The socket on one spanner wrench fits the nut holding the adaptor on the spindle. To remove adaptor, unscrew nut completely (left-hand thread) and screw in the “puller” (furnished) until the center screw hits the spindle end. Tighten center screw until adaptor is free. (Fig. 20)
Grinding Magnetic Chucks.

A magnetic chuck with an untrue bottom can distort a surface grinder table to which it is clamped. For this reason, the bottom should be wiped dry, placed on a surface plate and checked for bow. If the chuck rocks or pivots rather than having an even drag, place it face down on the platen and grind the bottom flat. If a surface plate is not available, use the grinder’s platen.

Caution: Never grind the platen, as this can impair accuracy.

Grinding the chuck surface requires special technique and great care. The “lead” filling between the magnetic poles tends to load the wheel and will cause the unsupported areas of the chuck over the magnet to move with any temperature difference created by grinding. Follow these instructions carefully:

1. Use a relatively coarse grit wheel of medium grade and open structure with a vitrified bond. The 9A-46-H8-V52 wheel furnished with the machine works well if used with a mist or wet coolant and can be used dry if care is used to prevent heat buildup. If difficulty is experienced, use a still softer and more open wheel such as a 32A46-G12BEP.

2. Dress wheel rather coarsely with a sharp diamond. Cross feed the diamond at a fairly rapid rate (15 in./min.) and do not pass under wheel unless down feed at least .0005 inches. Tighten screws holding chuck to table with minimum force needed to keep chuck in place. Over tightening may cause warping.

3. Chuck must be in “on” position while being grinded.

4. It is best to grind chuck with hand feeding so any increase of cut caused by heating can be detected. If power feeding, use ¼ of maximum speed. (52 ft./min.)

5. Take a cross feed cut of at least .060 inch for each pass, and set depth of cut to .0002 inch.

6. Dress wheel after each cut across chuck to remove any “lead”

7. A loaded wheel, whether caused by heavy cuts, improper dressing or the wrong type of wheel, can create heat building sufficient to warp center of chuck up into the wheel and seriously affect chuck flatness.

PROPER TORQUE FOR CHUCK MOUNTING

MAXIMUM TABLE WEIGHT WITH MAGNETIC CHUCK

| 1- 612 Steel Turkite or Plain Way: | 160 Lbs |
| 2- 618 Steel Turcite or Plain Way: | 200 Lbs |
| Left, 15 to 20 ft.lbs | Right, 10 to 15 Ft.lbs |

MAGNETIC CHUCK

Figure 19
MAINTENANCE

This precision surface grinder is equipped with an automatic “Flo-Clean” oil system. Unlike other grinder, this completely separate system circulates, filters and re-circulates the cleaning/lubricating oil. All moving mechanical and wear surfaces are automatically and continuously flushed with filtered oil whenever the spindle is running.

Cleaning.

This machine requires only surface cleaning. All internal parts are cleaned automatically by the built-in system mentioned above. When cleaning the external surfaces:

1. Center table to prevent dirt and grit from being brushed onto ways.

2. Never use an air blast to clean machine. Use a vacuum and/or treated dusting cloth. Remove dirt-don’t just move it.

3. Make certain that exhaust from vacuum or dust collector is not directed toward grinder and particularly not at underside of table.

4. If solvents must be used to clean surfaces, use caution not to drip on ways. Do not use a lacquer base or other solvent, which may damage machine’s enamel finish.

Lubrication.

Since the motor and drive are permanently lubricated and sealed, the only lubrication maintenance required are the following periodic checks:

Every 100 hours of operation:

Check the large oil cup in the rear of the machine. If less than half full, add enough Harig Way Oil (No. 16211245, furnished with machine) To bring level nearly full (Fig. 10)

Caution
Using anything other than Harig oil will Void the Warranty
Harig oil part number 16211245

Every 1000 hours of operation:

Clean the oil pump filter. Unscrew dust guard retaining screw and remove guard. (Fig. 21) Remove pump from sump. With pump up side down remove the retaining clip (Fig. 22) from filter cup (be careful not to puncture screen) and remove screen. Clean pump, screen and sump, and reassemble and refill with new way oil.

LONGITUDINAL FEED HYDRAULIC SYSTEM MAINTENANCE

Every 100 hours of operation:

Check hydraulic tank oil level. Remove back center plate of base cabinet by loosening four ¼ turn screws. Sight gauge (Fig. 19) should indicate at least above the halfway point. If not, add any good grade of hydraulic oil (150 SUS) to bring level to full.

Every 1000 hours of operation:

Check hydraulic pump filter (Fig. 23). Remove back center panel. While the pump is running, examine filter restrictor gauge (left side of manifold assembly). During normal operation the gauge should indicate in the green zone. A red zone reading indicates the filter is clogged; remove it and clean with a solvent by flushing from the outside in. replace filter and change the hydraulic oil (approximately 4 gal.)

Every 5000 hours or two years of operation (which ever comes first):

Replace hydraulic oil and clean filter.

Caution: to protect system pressure gauge, close valve except when taking pressure reading!
Your Harig® surface grinder has been designed and manufactured to give a long life of accurate finish surface grinding. It has been thoroughly checked during manufacturing and final assembly, has been run in, and has been given a performance test. A final inspection report showing the actual deviations found in six of the many checks performed on this machine is included with this manual.

The following section is set to assist you in getting maximum performance from the machine. Each trouble or malfunction is listed, followed by possible causes, together with suggested adjustments or changes you can make.

Caution: Electrical connection or services to preclude personal injury or extensive machine damage. All electrical service must be performed by an authorized Bridgeport/Harig distributor. Violation will Void the Warranty.

Ordering Replacement Parts. When repair parts are ordered, be sure to include the serial number of the machine as well as the part number shown in the following drawings. The machine serial number is stamped into the column cap casting next to the elevating handwheel.

1. CHATTER OR VIBRATION MARKS IN FINISH.

A. Wheel loose on sleeve. Put additional tension on wheel adaptor nut. Even if nut is not loose, motor starting torque may be causing wheel to shift slightly. Redress after adding tension to wheel nut.

B. Wheel out-of-balance. All grinding wheels are out-of-balance. It is only a question of how much. (One can verify this by holding the projecting part of the spindle housing while the grinder is running with the wheel, wheel nut and washer removed, and by comparing the vibration with the wheel mounted in place) Balance the wheel with a Harig Wheel Balancer (No. 17794350) or comparable unit.

If the wheel has not been balanced, the chatter can be minimized by dressing the wheel at the grind point and taking a finishing cut that puts the same drag on the wheel as the dressing operation. The wheel is dressed out-of-round to compensate the amount of vibration. If a heavier cut is taken, however, the chatter will occur because of the “hammering” of the out-of-round wheel at a different vibration rate.

C. Wheel not dressed on sides.

If the wheel has not been dressed on the sides, a chatter or vibration pattern can result because of the side-to-side movement of the edge of the wheel, and because of the surfaces of a wheel next to the mold are harder than the rest of the wheel.

D. Wheel in need of dressing.

If the wheel appears after the wheel has been used for a time, it is probably due to the fact that most grinding wheels vary in hardness around the periphery. Since this chatter appearance is usually only a few millionths of an inch high, weigh the economics of more frequent wheel dressing against the slight loss of appearance.

E. Loss of preload.

Occasionally, due to a phenomenon called fretting corrosion (usually caused by out-of-balance wheels), the rear bearing outer race will freeze in the spindle sleeve and the wave springs no longer hold the spindle shaft tightly back against the front bearings. To check for loss of preload, place an indicator against the spindle nose as shown in Figure 24. Push against wheel guard with thumbs, pulling wheel forward while watching indicator. When release, needle should instantly return to original position. If the needle returns to original position only by rotating wheel by hand, return spindle to factory for repair. Be sure to state that there was loss of preload on this test.

F. Grade of wheel too hard.

Loading up or glazing of the wheel, particularly if grinding without coolant can cause chatter. Replace wheel with one of a softer grade.
G. Taper of adaptor sleeve in error.
If the taper in the wheel adaptor sleeve is not the same as that on the spindle nose, or if a piece of dirt or grit has been assembled on the taper, chatter can appear on the work. To check the adaptor sleeve, put a thin film of Prussian Blue inside the sleeve and press it on the spindle. The spindle taper should show contact all around the circumference on two separate rings.

H. Ball bearing failure.
The super precision bearing used in the Harig Spindle is sized to give an average life of many years of service. If a failure of either the spindle or motor bearing does occur, a chatter will appear on the work being ground, and a noise will be heard when the spindle is running. (Wheel, wheel nut and washer should be removed to make certain an unbalanced wheel is not causing the noise.) Replacement of all bearings on the spindle assembly, or a new motor required. It is recommended that the spindle assembly be returned to the factory for repair so that dynamic balance of the unit can be checked.

I. Unbalanced electric supply.
If the three-phase current supplied to the machine is not reasonably uniform, a poor finish will result.

J. Use of phase converter.
A phase converter used to run a three-phase motor on a single-phase supply will also affect finish and motor sound because of the unbalance current a converter delivers. The type of converter that switches out of the circuit after starting the motor will cause a poorer finish than a single-phase motor. The type of converter that stays connected and is rated to run the spindle motor, will give a better finish than a single-phase motor.

2. LONGITUDINAL LINES – SCRATCHY FINISH

A. Wheel too soft for material being ground.
The grains in too soft wheel will pull out before they have really dulled. The dressed surface will be lost too quickly and the few remaining pointing grain will give a scratchy appearance. Replace with a harder wheel.

B. Wheel dressed too finely, or wheel too hard.
If wheel if not cutting freely, longitudinal lines in the finish, sometimes discolored or burnt will result. Replace with a softer grade wheel or pass a diamond across the wheel at a faster speed when dressing. Do not dress the wheel without a down feed before each pass.

C. “Hard-Shell” sides on wheel.
Break the corners of the grinding wheel with an abrasive stick.

D. Grinding swarf in coolant.
Clean out coolant tank.

3. INACCURATE GRINDING.

A. Magnetic chuck clamped too tightly or too loosely
A chuck or fixture clamped too tightly may warp the table, causing it to rock in the saddle ways rather than tracking smoothly. If chuck is not clamped tight enough, it could shift position and lift up and over dirt. Tighten one of the clamps firmly to hold the chuck in position when the table reverses. Then tighten the other clamp only enough to keep the chuck down on the table. See Fig. 19

B. Wheel glazed; not cutting freely.
Redress wheel, or replace wheel with a softer grade.

C. Machine out-of-level
Be sure that cabinet was leveled according to installation instructions. Thickness of the four vibration isolation pads that support grinder on the base cabinet has been adjusted to support the grinder base so that the V-ways are exactly parallel with the plane of the flat ways. If grinder base is located on anything other than its own base cabinet and vibration isolation pads, check base ways for twist by laying a small surface plate on two 1.000 inch rolls in the V-ways and two .582 inch parallels on the flat ways of the base. If the two rolls are placed at the ends of the V-ways and one of the parallel put in the center of the flat way, the height of the pad should be adjusted until you get the same “feel” at either end of the way with the other parallel.

D. Magnetic chuck in need of dressing.
See “grinding magnetic chuck” in the operating instructions in this manual.

E. Grinding wheel shifted adaptor.
If the wheel is not tight enough on the adaptor, it can shift when grinder is turned on and off, or when a heavy cut is taken. This could cause grinder to cut an additional few thousandths, as well as giving a chatter appearance on the surface.

F. Down feed inaccurate.
See section “uneven Down Feeding Response”

G. Gouge in work piece.
If the power longitudinal feed is being used, and the grinder is set to reverse near one end of the stroke, grinder table may be occasionally hitting the internal stop. Adjust table reversing “dog” to shorten stroke slightly.
TROUBLESHOOTING

Inaccurate Grinding

Motor Do Not Run, Oil Dripping

Uneven Down Feeding Response

**H. Work piece not parallel.**
If machine does not grind parallel front-to-back, be sure cross feed lock screw is loosened enough so the pressure pin is not rubbing on the locking strap 16213042 (See Fig. 31).

**I. Long spark out time.**
If the grinder does not “spark out” after a reasonable number of passes, make sure that Harig way oil is being used. The pressure oiling system floods the ways with so much oil that a higher viscosity lubricant can lift the table a few tenths when light cuts are taken.

**J. Side grinding not square.**
If cartridge spindle has been replaced in the machine, it may be necessary to realign the spindle in its housing by adjusting tension on the five set screws that hold it in place. (The 5/16” diameter by 5/16” long set screws shown in Fig. 27) To check squareness of the spindle to the longitudinal travel, an angle plate can be indicated parallel to the table travel as shown in Fig 27 of our Final Inspection Report, and an indicator fastened to the nose of the table can be swung as shown. If indicator has a higher reading for the right hand position shown in (Fig. 27), slightly tighten the upper right and lower left setscrews on top of the spindle housing to shift the spindle slightly.

The angle plate can also be used to check the spindle axis parallelism to work the table as shown in Fig. 3 of the Final Inspection Report. Varying the tension applied by the bottom set screw, against the tension of the top set screws, can change this indicator reading slightly.

**4. MOTORS DO NOT RUN.**

**A. Disconnect switch not turned on.**
If “power-on” panel light is not lit, be sure disconnect switch on control compartment door is turned on.

**Caution:**
Electrical connection or services to preclude personal injury or extensive machine damage. All electrical service must be performed by an authorized Bridgeport/Harig distributor. Violation will Void the Warranty.

**B. Fuse blown out.**
If more than one motor will not run, if a motor runs slowly, or if “power-on” light will not turn on, one or more fuses may be blown. There are three (3) main fuses mounted on the disconnect, plus one or two circuit fuses mounted on or next to the transformer. First check lines leading to the machine to make sure plant circuit fuses are not blown. Replace fuses with delay type of equal, or not more than 10% higher amperage. If a single element fuse is used for replacement, be sure it is rated at 3 times the amperage of the dual element fuse.

On rare occasion a fuse will blow under normal machine usage. If a fuse bows repeatedly, however, the cause must be found and corrected.

*(A stalled motor can blow a fuse before the overload heaters of the motor starters kick out.)*
Inspect control compartment and motor wiring for loose connections (particularly in the motor connection box) and for worn through insulation, causing grounding out to the machine frame. If machine is equipped with a coolant system, excess coolant may have overflowed or splashed onto the cabinet and dripped into the hydraulic motor or sockets on the back of the machine.

**C. Overload relay tripped.**
The spindle, hydraulic pump, oil pump, and coolant (optional) motors are protected with overload relays or fuses in the control cabinet. If any motor is overloaded for a period of time, its overload relay or fuses will shut it off. (If either the spindle relay or the lube pump fuses trips, it will shut off the hydraulic pump, the spindle and the lube pump)

The overload relays are mounted on the motor starters (1M, 2M, etc.) Fuses are separately mounted and identified 6-FU. See wiring diagram (inside door of control compartment) for identification of various motors.

If only the spindle motor overload is tripping, chances are the grinding wheel is taking too heavy a cut is, or that the wheel is loading up, putting extra strain on the motor. A 1.5 HP motor will have enough power to take as heavy a cut as the operator normally wishes if table is cross feeding and coolant is not being used. If cross feeding with coolant, or plunge grinding, it is easy to take a cut that requires more power. Under these conditions, check spindle motor current consumption to make sure it is not exceeding full load motor current shown on nameplate before adjusting the overload relays.

Overload relays are installed set for automatic reset. If overload trips, it will reset after it cools. To change to manual reset, depress and turn the blue button until the slot aligns with the letter “H”. If nuisance tripping is occurring due to a higher ambient temperature, the trip point may be raised slightly by turning the black dial on the overload relay to slightly higher number. (Do this only after determining that the motor is not drawing higher than nameplate current. If current draw is excessive the problem is in the motor, not the overload.)
D. Motor burnt out.
All motor used on your grinder have a design life of many years. The motor most likely to fail is the oil pump motor because it depends on the oil level being maintained to keep it from overheating. A burnt out motor will usually draw an excess of current and trip the motor overloads, blow fuses, or overheat in one spot. It may, however, overheat an internal connection and cause a wire to break loose. Checking motor circuit with an ohmmeter should locate any internal breaks. An ammeter check on motor current on each of the three legs of a three phases motor will show a shortened out section of winding by drawing more that the rated full load current.

A maximum temperature at which a motor can be safely operated depends on the class of insulation of its windings.

A motor stamped class A can reach a temperature of 203°F on its shell; Class B can reach a temperature of 239°F, and still be within the manufacturer specifications.

E. Electrical Discontinuity.
If all above checks have been made and one or more motors still do not run, check motor starters and control panel wiring. Open control compartment and visually check for loose wires or connections. Check motor power circuits by visually turning current on and pushing in the motor starter solenoid with a fully insulated screwdriver.

Caution:
Electrical connection or services to preclude personal injury or extensive machine damage. All electrical service must be performed by an authorized Bridgeport/Harig distributor
Violation will void the warranty

If motors run, check control circuit by turning off current and using an ohmmeter to check control-wiring continuity against the electrical diagram. (The most likely cause of an open circuit would be the starter solenoid coil or a faulty overload relay.)

If the motor does not run with the starter solenoid held in, turn off current and check power circuit continuity.

5. OIL DRIPPING.
A. Machine not level.
Oil dripping from underside of the table ways can be caused by machine improperly leveled. Recheck leveling and follow installation instructions if machine is not leveled.

B. Restricting valve opened too wide. Check setting of restricting valve (17778007 in Fig. 24). Remove dust guard (Part No. 16211072) by loosening the two screws and sliding guard up so screw heads will pass through the key hole slot in the guard. Reset valve by closing it down completely and then reopening ½ turn. If dripping from ways continues, close valve back to the point where it is opened approximately 1/3 of a turn.

C. Oil level too low.
If the oil level in the pump of the lubrication system is allowed to get below the level of the oil fill cap, add oil as shown in Fig. 7, page 3

D. Hydraulic system leaking.
A leak in the hydraulic system can be recognized by the lighter color of the oil. If the saddle is cranked all the way forward (toward the operator) hydraulic lines can be inspected to determine where the leak is occurring.

Tighten all loose fitting. Replace any defective hose or tubing. If it is necessary to remove the saddle in order to get at the hydraulic fittings, lift table off the saddle.

The hydraulic hoses may be removed from fittings on the carriage, or the hydraulic unit taken out of the compartment and placed in a position to allow the saddle to be handled within a range that the hose will flex. If hoses are removed, tag them so that they can be reconnected to their proper fittings. Then crank the saddle all the way up to the column. Remove the screw in the end of the cross feed hand wheel, loosen setscrews in the side of the hand wheel and pull the hand wheel off its shaft. Now pull the saddle forward until it hits the cross feed stop, which pulls the bearing off the cross feed screw shaft. Remove the tubing connector that fastens the lubricating oil line between the base and the saddle from the saddle fitting. The saddle can now be lifted off the machine.

The entire underside of the table, saddle and the ways in the base and saddle should be carefully cleaned before reassembling the machine to be sure that grit cannot fall into the way when table and saddle are being put back into place

6. UNEVEN DOWN FEEDING RESPONSE.
A. Wheel too loose.
If grinder has been stopped and restarted, with the wheel insufficiently tight, the wheel may have shifted slightly when the motor was restarted, cutting an additional amount because of being off center. Retighten grinding wheel.
B. No oil on column ways.
Check oil level in sight glass at the top of the column shortly after motor is turned on. If oil does not appear, make sure that oil cup on the back of machine base is nearly filled. Add oil if necessary.

If oil is at the proper level, see that pump is running and that filter screen is clean. (See Lubrication under Maintenance.) Check that oil line are intact and on their proper fittings as shown in Fig. 24

C. Spindle housing assembly sticking in column ways.
The exceptional rigidity of the Harig grinder is obtained by an extremely close fit on the column ways. Since there is only a few tenths clearance between the spindle housing and column, any dirt or grit, or every small warping of the back plate, could cause spindle housing to “hang up” in the ways. Check for this condition by mounting an indicator in the wheel guard or spindle housing to touch a block on the grinder table. Turn down feed hand wheel and note response on the indicator.

The 100 lb. combined weight of the motor. Spindle and housing, and guard assembly should keep the bevel gear carrying the elevating screw firmly seated in the thrust ball bearing in the column cap. (See Fig. 27) The only slack that should be seen as column is raised and lowered with the hand wheel should be the small amount between the bevel gear and pinion on the hand wheel shaft.

If the response between hand wheel readings and the indicator show a slack of several thousandths rather than the normal half thousandths slack between the pinion and the bevel gear, the spindle housing assembly is probably “hanging up” in the column ways until the bevel gear is backed up to the pinion and forces the elevating screw down.

To inspect column ways, first remove the grinding wheel from the spindle. Then remove the wheel guard by loosening its clamping screw and sliding it off the end of the spindle. Loosen the five 5/16 set screws holding the spindle cartridge in the housing approximately 1/8”. The spindle cartridge and motor assembly can now be removed from the back of the machine. Take out the six Phillips head screws holding the back dust guard retainer in place and remove the dust slides and retainer. Crank the saddle away from the column and remove the six Phillips head screws holding the front dust guard retainer. Move the dust guard retainer away from the column.

Note: The front dust guard retainer has been sealed at the bottom with silicone rubber sealant. Take care while removing the retainer to avoid bending it. If the retainer is removed, reseal it along the bottom edge with silicone sealant when reinstalling.

The front dust slides can now be removed. Then alternately crank the spindle housing to the top and then to the bottom of the travel, wipe off the ways with a clean cloth and inspect. Clean any dirt or grit. Check to see is a piece of grit has scored the ways. If so they should be dresses with a fine stone to remove any ridges.

If the column way surfaces are clean and smooth and the spindle assembly is still sticking, either the spindle slide back plate has warped or the column uprights have moved closer together by a few tenths. If the spindle is tight in only a small area, scrape the back ways of the column to remove the high spot. The high areas of the way can be found by applying a thin layer of red lead to the ways and running the housing assembly up and down.

If the assembly is tight over the entire column, remove back plate from the spindle housing by taking out the six 5/16 screws holding it in place. Crank the spindle assembly to the bottom position and push the housing just far enough away from the column to inspect the 45° ways. If there is no evidence of scoring or a piece of grit lodged in the casting, grind .0003” off the two surfaces of the back column ways. Accurately check the step between the way surfaces of the back plate and the center part that is screwed to the spindle housing before grinding the way surface, so the entire back plate can be reground if found to be warped. Reassemble the back plate to the spindle housing. If still too tight, remove an additional .0003” from the way surface. If the 45° way of the spindle housing is scored, remove housing from the column as follows:

- Mark elevating screw (Fig. 27) at the point where it enters the spindle housing so that it can be turned to the same point when the grinder is reassembled.
- Loosen the 1/4-20 by 1” screw that holds the elevating screw in place. (See Fig. 27)
- Unscrew elevating screw from the housing and run it up to clear by holding screw with one hand and turning elevating handwheel with the other.
- Spindle housing can then be removed from the column and any score marks stoned off smooth.

D. Spindle housing too loose.
If error in down feed response is less than .001", spindle-housing assembly may be too loose in the column ways. Remove motor spindle assembly and dust guards as outlined in previous paragraph. Determine amount of looseness by placing an indicator on grinder table to read against the part of the spindle projecting to the front of the grinder. With the column way wiped clean of oil, alternately twist the spindle housing from one side to the other.

The difference of the indicator reading when the twisting pressure is released should be less than a half a thousandth. Make this check at both the top and bottom positions of the spindle housing, as well as in the middle, and use the lowest reading. Remove the back plate from the spindle housing. Then remove ¾ of the difference between the at-rest indicator reading from the center area of the back plate that is clamped against the spindle housing. For example, if .0012” slack is found, remove .0009” from the center area of the place.

E. Spindle assembly creeps down.
Because of the exceptionally smooth action of the down feed mechanism, it would be possible for the spindle assembly to creep down or “unwind” itself if a frictional drag were not used. This creep is most likely to occur is a vibration caused by an off balance wheel is occurring.

The wave spring No. 17748702 adds a drag to the system by pressing the nylon washer which in turn press against the bridge of the column casting and the inner race of the elevating screw bearing. (See Fig. 27)
If it is necessary to increase drag, order a ‘C’ spring No. 16213088 and install it between the outer bearing race and the bevel gear in position shown in Fig 27.

To install this, remove the elevating screw guard from the machine. Drop the open end of the C under the bevel gear and push the back of the spring with a screwdriver until the spring is horizontal. Then move the spring sideways to snap across the high point of the gear and fit in the angular space between the bearing race and the bevel gear.

7. IMPROPER LONGITUDINAL FEED

A. Table runs slow or stop.
See that the hydraulic pump is running in the direction indicated by the arrow on the motor. (If motor is not running, see heading number 4, page 12, Motor Do Not Run.) If the motor is turning in the wrong direction, check to make sure the spindle motor is turning in the proper direction. If not, reverse any two of the wire connections to the machine. If the spindle motor is running correctly, reverse any two of the electrical connections to the hydraulic motor to change its direction of rotation.

If the pump motor is turning in the correct direction, make certain the speed control valve is open and the table drive handwheel is pulled all the way out. If the table still will not start, the following checks may be used to determine the problem.

If the machine has just been set up, check the hose connections to the pump and to the machine to make sure they are connected properly.

Check the hydraulic pressure by opening the back valve next to the gauge while the pump is running. The pressure should be between 240 and 250 psi. (Note: gauge should be turned off when not in use.) If the pressure is too low, adjust according to directions listed under “Table Too Slow”

First check transformer supplying current to the hydraulic unit and associated fuse (refer to electrical schematic). If voltage is not present, replace transformer or fuse as necessary. If voltage is present (approximately 24 VAC at the input to the hydraulic control card terminals 1 and 2) turn the table selector switch to “start” Check the voltage at terminal 5 and 6 or 5 and 4. one set of terminals should show a potential of approximately 24 VDC. If 24 VDC is present at the terminals and at the associated solenoid valve, the associated solenoid valve is bad and should be replaced. ) Note: due to the nature of the solenoid drive system, no voltage can be measure on the output with the solenoid disconnected.

If 24 VDC is not present at the aforementioned terminals, check the proximity switches. Check the handwheel interlock proximity switch across terminals 15 and 18. a meter should read approximately 6 VDC with the handwheel pushed in and 11 VDC with the handwheel pulled out. If voltage at these terminals does not agree with these readings, replace the handwheel proximity switch. If the table still will not start, replace the hydraulic control card.
If the machine has been operating properly for a period of time and then starts to run slow, check the level of the hydraulic oil in the tank. Be sure the speed control knobs are rotated fully counterclockwise.

If the grinder is still running a little slow, its speed can be increased by adjusting the relief valve on the hydraulic pump unit to allow higher pressure in the system. To adjust relief valve, remove the sealing cap from the adjusting screw. (See Fig. 25) Turn the adjusting screw one-half turn. Turn on the grinder and check the speed. If additional speed is desired, make another half turn adjustment. When the grinder is running the proper speed, replace the seal cap. The pressure of the hydraulic system is normally operating at 200 lbs. per square inch when the table is feeding at the rate of 70 feet per minute. The grinder should require less than 225 psi to operate at this speed. If more pressure is required, check that the oil level is proper, that there is no mechanical obstruction in the hydraulic lines.

B. Table will not reverse
If the table will not reverse, first check the clearance from the proximity switches to the table reversing dogs. The clearance should be between 0.010” and 0.070”. If the clearance is incorrect, loosen the locknut on the threaded proximity switch (es) and adjust the clearance by turning the switch. If the clearance is correct, check the proximity switches at terminals 15 and 15 (right switch) or terminals 15 and 16 (left switch). When not activated by the reversing dogs, switches should read about 11 VDC. When a dog is positioned over a switch, the voltage reading should be approximately 6 VDC.

If the machine has been operating properly for a period of time and then starts to run slow, check the level of the hydraulic oil in the tank. Be sure the speed control knobs are rotated fully counterclockwise.

If the grinder is still running a little slow, its speed can be increased by adjusting the relief valve on the hydraulic pump unit to allow higher pressure in the system. To adjust relief valve, remove the sealing cap from the adjusting screw. (See Fig. 25) Turn the adjusting screw one-half turn. Turn on the grinder and check the speed. If additional speed is desired, make another half turn adjustment. When the grinder is running the proper speed, replace the seal cap. The pressure of the hydraulic system is normally operating at 200 lbs. per square inch when the table is feeding at the rate of 70 feet per minute. The grinder should require less than 225 psi to operate at this speed. If more pressure is required, check that the oil level is proper, that there is no mechanical obstruction in the hydraulic lines.

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If the readings are not correct, replace the proximity switch (es) in question. If the readings are correct, replace the hydraulic control card.

C. Jerky table reversal
The hydraulic direction valve design has been optimized to give the smoothest table reversal under all conditions. Because the grinder base is mounted on flexible vibration pads, some movement of the grinder during table reversal is normal. Since this occurs when the grinding wheel is full and the filter is clean, adjust the relief valve while the noise is occurring as outlined in last paragraph 7A “Table Runs Slow or Stops” on page 15.

D. Jumpy table movement.
If the grinder is being operated at a very slow speed (speed control valve turned way down), an irregular movement or “jump” may be seen. If the grinder has not been operated for a long period of time, this may be due to air in the cylinder. The air is removed from the cylinder by setting the table travel for almost maximum stroke and operating the grinder at full speed for a short period of time. Insufficient lubrication of the longitudinal ways can also cause this problem. More oil can be fed to the ways by opening the restricting valve an additional 1/3 turn. (See paragraph B under N0. 5, pg. 11, Oil Dripping) Running the table back and forth a few times before taking a cut will help distribute the oil evenly over the ways to minimize this condition. A grinder with Teflon ways will not have this problem, which is caused by the “stick-slip” effect, since Teflon has the same friction for starting to move as it has when running with an oil film.

E. Noisy or Vibrating Pump.
A noise or vibration in the hydraulic pump unit can be caused by resonance of the relief valve. If the noise changes as the machine warms up, or as the feed speed control setting is changed, first check that the oil level is proper and that the filter is clean. If the level is full and the filter is clean, adjust the relief valve while the noise is occurring as outlined last paragraph 7A “Table Runs Slow or Stops” on page 15.

8. CROSS FEED MALFUNCTION

A. Normal Operation.
Automatic cross feed occurs when the electric module turns on the stepping motor. The feed cycle is started when the hydraulic control output relay changes states as the table changes direction. Cross feed continues until the electronic module has moved the stepping motor the correct number of steps; each step equal .0005” The feed distance can be set from .0005” to .9995” in .0005” increments.

Note: If the table reverses before completing a cross feed, the electronic module will reset and give a complete feed from that point. The force to turn the cross feed screw is transmitted from the motor through the coupling to drive sleeve which has a square hole broached in its end. The slip fit between this hole and the square shaft that is pinned to the end of the cross feed screw allows the screw to travel back and forth with the saddle and still be driven by the stationary motor. The direction of feed is control by the direction of rotation of the motor. Motor rotation is changed by tripping the Y-shaped limit switch mounted on the right-hand side of the machine base directly below the carriage.
Improper Longitudinal Feed
Cross Feed Malfunction

B. Hand feed wheel turns hard.
Be sure cross lock thumbscrew has been loosened (A, Fig. 14, page 4)

C. Cross feed does not work.
Be sure that both the cross feed system and the hydraulic system has been turned “on”, and grinder power longitudinal feed is being used. If the “cross feed” light goes on only while the cross feed start button is depressed, check the pushbutton contact blocks and wiring for proper operation and loose wires. If this does not help, check the upper of two relays on the cross feed module’s base. The two relays may be interchanged to determine if the relay is causing the problem.

If the cross feed turns “on” correctly, but still does not feed, check the hydraulic output relay inputs on the cross feed module terminal strip terminals 11, 12 and 13. With the cross feed unit turned “on” use a high impedance meter with grater than one mega-ohm (standard digital volt meter) to measure between pin 13x and pin 11. When table is traveling to the right, the meter should read at least 10 volts. When the table is traveling to the left, the meter should read 1 volt or less. Measure between pin 13 and pin 12. when the table is traveling to the left, the meter should read at least 10 volts, when the table is traveling to the right, the meter should read 1 volt or less. If these reading are not correct, check the hydraulic output relay and associated wiring.

If the previous test shows correct values, check the DC power supply at terminals 1, 2 and 10 of the electronic module. There should be approximately 15 VDC between terminals 1 and 10 and approximately 17 VDC between terminals 1 and 2. if these values are not found, check the bridge rectifier, the transformer T-2 and capacitor C-1 as follows:

Remove leads from the bridge rectifier, and check between adjacent terminals by reversing the probe connecting at each pair of terminals. A high resistance reading should be found with one connection and a low resistance reading with the other. With the bridge rectifier still disconnected, check secondary windings of transformer T-1 for shorted or open winding wires numbered 57, 59, and 69. Reconnect the bridge rectifier, disconnect the capacitor C-1 and check as follows:

With an ohmmeter set on its highest resistance scale, measure the capacitor. A pulse of the needle toward 0 resistance with a return to infinity should be seen, or if the final value is not infinity, replace the capacitor. If the previous checks do not define the problem, replace one of the circuit cards. If motor is trying to run, but doesn’t complete the full feed, replace driver card. If the motor doesn’t try to run, replace logic card.

D. Cross feed runs continuously.
If the cross feed runs continuously on some but not all thumbwheels settings, replace the thumbwheel settings; check the thumbwheel plug at the electronic module. If this connection is correct, replace the logic card.

E. Cross feed does not reverse direction.
If the cross feed does not reverse direction automatically, move the reversing dogs out to their maximum width setting and operate the Y-shaped arm on the limit switch (D, Fig. 14) by hand. If reversal occurs with hand operation, the Y-shaped arm may have moved on the limit switch shaft. Reposition the Y so that the limit switch click occurs the same amount past center in either direction. Tap the lock pin lightly while tightening the lock nut on the other end of the pin top hold securely in position.

If cross feed reversal occurs before the Y-shaped arm has clicked into the return position, the switch is out of adjustment. Shut off power to the machine and remove the switch from the grinder base by removing the four screws holding it in position.

The limit between the electrical contact and the limit switch actuator can be changed on some switches.
If the cross feed does not reverse direction when the limit switch is operated by hand, open the control compartment, turn the cross feed back “on”, and see if the cross feed reversing relay (the lower relay on the electronic module) moves when the limit switch is reversed by hand. If it does not move, turn the power “off” and check the limit switch, terminals 3 and 8 on the electronic module with an ohmmeter. If the switch is not operating, check the wiring and replace the switch if necessary. If the switch is operating, replace the relay. If the relay does move and appears to be operating correctly, replace the logic card.

F. Cross feed feeds erratically.
A loose cross feed drive coupling may cause an erratic cross feed. Check the tightness of the cross feed drive-coupling setscrews and tighten if necessary. Erratic feed may result if the feed rate oscillator loses its factory-preset adjustment. If everything else is operating correctly, oscillator speed may need adjustment. Consult factory before attempting to adjust oscillator speed.
9. DOWN FEED MALFUNCTION

A. All down feed malfunctions.
A momentary shut-off of power, or a power surge that can occur if the utility line is struck by lightning, can cause the feed unit to malfunction. If the operator notices a flickering of lights while an automatic cycle is in progress, the machine should be carefully watched, or preferably the entire cycle restarted to be sure the power variation has not caused a change in the unit.

Check all plug-in connections as follows: Open main control compartment door on the side of the base cabinet and check the plug in relays to be sure they are all seated firmly in their respective sockets. If so, pull out each one approximately 1/16” and then reseat, to scrape off any oxide film that may have formed on the contact surfaces. Check the plug and connector leading from the Autostep control box the same way, for their connections to the plug and socket from the main control panel.

Caution:
Electrical connection or services to preclude personal injury or extensive machine damage. All electrical service must be performed by an authorized Bridgeport/Harig distributor Violation will void the warranty

Loosen the two screws holding the clamps on the right-hand side of the Autostep control box and swing the door open as shown in Fig. 18. Check that the ribbon cable plugs are properly seated. If they have worked themselves loose, they should be tightly reassembled.

If the malfunction occurs only occasionally, check the tightness of the connections on the grounding circuit (paragraph 9.1 in the installation section) If the ground wire from the machine is more than 10 feet in length, it should be at least 10 gauge or larger. Make sure it is connected to a satisfactory ground. (Some hot water heaters are insulated to help control corrosion and sediment. A hot water pipe to that kind of system is not a satisfactory ground.) A wire clamped to the building structure is not an adequate ground. For proper grounding drive an 8-foot ground rod into the ground and securely clamp the ground wire to it. If the occasional malfunction occurs at the time a piece of heavy equipment such as an air compressor is started, or if a spot welder is being used, it may be necessary to move the Autostep to another plant circuit, or a new circuit may have to be run to the plant service electrical connection.

Observe the indicating light (Fig. 20) Mounted on the logic board to check the operation of the hydraulic control assembly output relay. With the longitudinal table feed operating and the Autostep control turned on, the light should be on when the table is feeding to the right, and off when the table is feeding to the left. If the operation of this LED is not as described, there may be a fault with the hydraulic control assembly or the interconnection cable between the assembly and the box. Refer servicing to a qualified Bridgeport/Harig Service representative

B. Stepping Motor Feed Short.
A short feed can be caused by the timing belt between the stepping motor pulley and the pulley on the hand wheel being too tight. The timing belt serves as a flexible coupling between the stepping motor and the mass of the elevating mechanism. It must be loose enough to allow the stepping motor to start moving before it has to pick up the inertia of the hand wheel and screw, and should have much more slack than a V-belt

C. Down Feed Adjustment.
Proper belt tightness can be checked by removing the three screws that hold the side dust cover on the housing supporting the stepping motor. The side plate can then be rotated to permit observation of the belt. A light pressure on the top belts should cause it to move in at least 1/8” from a straight line between the two pulleys. Its tension can be adjusted by loosening the 3 screws holding the stepping motor in place and sliding the motor closer or further from the handwheel pulleys. If the jog button is first pushed to cause the feed to go up, the toggle switch reversed and then pushed to cause thee grinder to feed down, the belt should be only tight enough to barely cause a perceptible movement of the handwheel for this procedure. When the side cover has been rotated out of position to observe the belt, a line should be drawn across the end of the motor shaft and onto the motor pulley and the grinder traversed up and down to make sure the set screw holding the pulley has not loosened and is allowing a movement to occur between the pulley and the belt.

D. No Power To Don Feed Box
If the spindle motor will not turn on, make the checks outlined in section 4 “Motor Do Not Run” If the motor start properly but the power-on light of the box does not turn on, check the fuse in the control box and fuses FU-4&5 on the main control panel. If the fuses are good, check plug A, pins 13 and 14. If power is at these terminals, check the power switch in the control box.

Caution:
Electrical connection or services to preclude personal injury or extensive machine damage. All electrical service must be performed by an authorized Bridgeport/Harig distributor Violation will void the warranty
TROUBLESHOOTING

Improper Longitudinal Feed
Cross Feed Malfunction

It is normal for any transformer to have 40EC. temperature rise. A constant voltage transformer may be designed to operate with as much as 100EC. rise. This mean that the regular transformer in the enclosed controlled compartment might reach a normal operating temperature of up to 90EC. (190EF), and the constant voltage transformer could be well above the temperature of boiling water in normal operation.

If the voltage checks of plug A, terminal 13 and 14 are not correct, the constant voltage transformer may not be regulating correctly, if wires 60 and 61 give approximately 80 volts, or 0 volts, the transformer may be defective.

E. Lights Burn Out.
If the power-on/off or cycle-on light does not go on, but the Autostep is operating correctly, replace the burnt out bulb with a CM 330 bulb (Chicago miniature bulb or equivalent). Remove the bulb by unscrewing the amber or green lens from the front of the down feed box. Turn directly on the lens by hand or with a pliers cushioned with a rubber strip. Pull the bulb from the lens assembly by grasping the thin metal flange at the end of the screw shell with your fingernail, or carefully pry it apart with a knife blade.

F. Stepping Motor Will Not Run.
If the digital readout on the Autostep box shows the unit is operating correctly, but the stepping motor response is irregular, check 7A and 7B. if the down feed is still malfunctioning, perform the following tests.

Caution: Any continuity or resistance checks must be made with a volt/ohm meter that has a high resistance for any voltage check, and less than 5 volts for any resistance check. The integrated circuit chips in the Autostep unit can be destroyed if a higher voltage is applied. If the motor will not run and has no holding torque, make the following checks.

1.) With the Autostep turned on, check voltage at the power input of the driver assembly DR-1. The power terminals are at the opposite end of the driver from the signal and motor connections; one is marked “power” and another is marked “ground”. The voltage between these two terminals should be 49 VDC +/-10%. If this voltage is not present, or is incorrect:

2.) Check the output of transformer T-3, terminals 7 & 8. The voltage here should be 27.8 VDC +/-10%. If this voltage is not correct, or not present:

3.) Check for power at the transformer input. If not present, check input wiring and fuses. If input power is present, transformer is probably defective and should be replaced. If transformer is operating correctly:

4.) Check bridge rectifier, REC-2. replace if defective.

5.) Check Capacitor C-2. replace if defective.

6.) If all above voltage checks are correct, check disable line level on the fiber optic interface card FO-1

7.) Check test point labeled TP-5 and TP-6. Voltage level should be approximately 3.5 VDC when the Autostep control is turned on. If this voltage is not correct:

8.) Check the two fiber optic links going to the Autostep control. Each must be firmly snapped into its socket at each end. There should be no breaks or kinks in these optic cables. If so, cable must be replaced. If cable are connected and not damaged, logic board assembly may be defective and need replacement. Before replacing logic assembly, problem.

9.) Check the Autostep box power supply level. Voltage between the terminals of the blue capacitor in the Autostep box should be 12.7 VDC +/-10%. If this voltage is incorrect or not present, check power supply components and replace if necessary. If power supply is correct, the logic assembly and/or stepper buffer assembly should be replaced. If the disable line on the fiber optic interface board FO-1 was at the correct level, the driver module may be defective and should be replaced.

G. Stepping Motor Response Irregular.
If the motor has holding current but will not move, make the following checks. With the unit trying to make a move in automatic cycle, or with the rapid button held in fast position, use an oscilloscope to measure the pulse train at test points TP-2 and TP-6 for down feed axis. Measuring at full speed (after about 1 sec.) the pulse train should appear like this.

If the pulse train is correct, check each phase current with a digital auto polarity ammeter. Caution: turn off power before attempting to insert the ammeter. Never disconnect or connect the motor, or make or break any connections with the power on. Insert the ammeter between the main panel barrier strip and each motor lead (refer to drawing found in door pocket on the inside of the magnetic panel compartment for wire number.). The current level should be 3.5 Amps with the motor stopped. Check the current at least four jog positions. The current level varies depending on which phases are energized. Look for a short in any lead that shows no current. A loose motor wire may also cause the
If the motor runs in the wrong direction, check the following:

1.) In manual mode, check the direction switch. For an automatic cycle, or if direction switch is correct,

2.) Check the direction signal on the fiber optic interface card FO-1 at test points TP-4 and TP-6. The voltage level should be approximately 5 VDC for up, and 0 VDC for down. If these levels are incorrect,

3.) Check for the correct condition of the fiber optic cable as in previous section. If the fiber optic cable is OK, check the ribbon cable and the Autostep control box as describe in the last section. Repair the power supply or replace the logic assembly and/or stepper buffer assembly as necessary. If the logic level measured on the fiber optic card was correct, the driver assembly may be defective. And need to be replaced. A defective fiber optic interface or a loose motor wire could also cause this condition.

4.) If the stepping motor misses counts, indicated by the fact that the digital readout gets ahead of the handwheel slip ring, make the following checks. Using the jog button, jog at least 8 steps in each direction. If the motor does not jog at any point, or jumps backward, the problem is in the motor wiring or in the driver card assembly. If motor wiring is OK, the driver card is probably defective and should be replaced. If the unit performs correctly for the jog test, check the pulse train as described in the previous section. If the wave shape of the pulse train does not match the drawing shown, the problem is probably on the logic assembly, and it should be replaced.

If the motor is running rough, there may be an intermittent short circuit. Examine the over current LED on the driver module.

It will flash on and off if an intermittent short circuit is present.

If the motor is making a grinding noise, the belt tension may be incorrect. Check and adjust the belt tension if necessary. Refer to section C for belt tension adjustment. Never attempt to disassemble a stepping motor. Because of the characteristics of this permanent magnet motor, the magnetic field will be considerably reduced if the motor is ever removed from the stator.

H. Non-existent or incorrect automatic cycle.
If the Autostep operates properly in manual jog traverse mode but will not correctly run an automatic cycle, use the following diagnostic routines to help pinpoint the area of trouble.

To place machine in diagnostic mode, first turn control module power switch S-2 to position 1. Now turn power switch “on”. The machine is now in its diagnostic mode; it is not necessary to turn the power off until it is desired to return to the run mode.

-Diagnostic position # 1 increments the down feed display through the following sequence of characters: 0,1,2,3,4,5,6,7,8,9,-,E,H,L,P, and blank. This tests the display, decoder drivers and associated wiring.

Note: When leaving this mode, the unit will finish current sequence.

-Diagnostic position # 2 reads and display “rapid” thumbwheel settings. In this mode, changing the “rapid” thumbwheels immediately causes the display to change to the new value.

-Diagnostic position # 3 reads and Display the “total” thumbwheel settings. Changing these will immediately cause the display to change to the new value.

-Diagnostic position # 4 reads and display the “feed left” thumbwheel settings changing the “feed” thumbwheels immediately causes the display to change to the new value.

-Diagnostic position # 5 reads and display the “spark-out” thumbwheel settings. Changing the “spark-out” thumbwheel immediately causes the display to change to the new value. Note: infinity (4) will be shown as a 9 on the display.

-Diagnostic position # 6 reads and display the “feed right” thumbwheel settings. Changing the “feed right” thumbwheel will immediately causes the display to change to the new value.

-Diagnostic position # 9 test the Autostep control toggle switches and push buttons. Each switch is given a corresponding number in its test description. To test each switch, set its number in the last two digits of the down feed ”feed” left thumbwheel. Each test description indicates the display code for each switch position.

Switch # 2: down feed traverse fast – slow switch in center position, display will show H’s; in “fast” or “slow” position, display will show L’s

Switch # 3: Down feed up-down switch in “up” position, display will show H’s “down” position display will show L’s

Switch # 4: Down feed jog push button in “released” position, display will show H’s; in “depressed” position, display will show L’s

Switch # 6: Interrupt push button in “released” position, display will show H’s; in “depressed” position, display will show L’s
Switch # 7: Restart push button in “released” position, display will show H’s; in “depressed” position, display will show L’s.

Switch # 8: cycle start push button in “released” position, display will show H’s; in the depressed position, display will show L’s.

To return control to run mode turn control power “off”, place switch S-2 in position “o”; turn power “on”.

If any problems are indicated by the diagnostic routines, change the indicated component (s). If the diagnostics indicate no problems, or if repairing the indicated component (s) does not correct the automatic cycle, replace the logic card.

To remove stepper buffer assembly, remove the three fiber optic cables from their respective numbered connectors. Remove the cable from the connector in the lower left corner of the assembly. Remove the four mounting screws and lift the stepper buffer assembly away from the logic assembly beneath it, being careful to detach the remaining connector that attaches directly to the bottom edge of the logic assembly. To reinstall, reverse above procedure.

To remove logic assembly, first complete the above procedure. Then remove the five cables from the logic assembly connectors. Lastly, remove the mounting screws and lift the assembly out of the box. To reinstall, reverse the above procedure.

If any problems persist or recur, consult factory.

I. No automatic Down Feed in Cross Feed Mode

If the grinder does not automatically down feed in either the cross feed nor plunge mode, see section 7G. If the automatic cross feed on the machine is not operating properly, see section 9. If the down feed operates properly in the plunge mode, but does not operate properly in the cross feed mode, make the following checks:

Open control compartment door on the base cabinet of the machine, turn power back on, and observe the plug-in relay CR-2 when the cross feed is turned by pushing its start button. (This is one of the plug-in relays on the control panel.) The relay should change position when the cross feed is turned on and off. If the relay does not work, check the voltage between wires #30 and #10 at the plug-in base to that socket. A reading of approximately 110 VAC should be found when the cross feed is turned on.

If relay CR-2 appears to be operating properly, and if the grinder is still cross feeding but not automatically down feeding when the carriage reverses direction, unplug relays CR-2 and CR-4 and exchange their positions in the socket.

If the machine now operates correctly and the cross feed is now operating, the relay that has just been transferred to the socket of CR-2 is making intermittent contact and should be replaced. After the relays have been reversed, the Y-shaped limit switch should be operated by hand and relay CR-4 observed to see if it changes position with the change of the limit switch position. If not, there is a break in the continuity of wire #24 from the terminal of relay CR-4 to the Y-shaped limit switch, or a break in the continuity of wire #10.

J. Other Down Feed Malfunctions

Checks in section 7A should be made if there is any occasional or irregular down feed malfunction. If this does not correct the problem, in most cases the Autostep box should be removed and returned to the factory for repair. It is important, particularly if the malfunction is intermittent, that a full description of the kind and frequency of malfunction be described in a letter with the returned box. For example, the kind of question that should be answered is, “Does the miss occur on certain feed numbers and not on others?”

If the digital readout shows that the unit is intermittently changing speed of travel to much different rate than the 10” per minute, the logic board could be at fault and should be replaced. If the unit goes past a rapid approach setting, or a total depth setting, the time of malfunction should be noted and reported to factory when the unit is returned.
Figure 25: Hydraulic System Schematic
CROSS FEED REVERSING MECHANISM

Figure 30