CAUTION

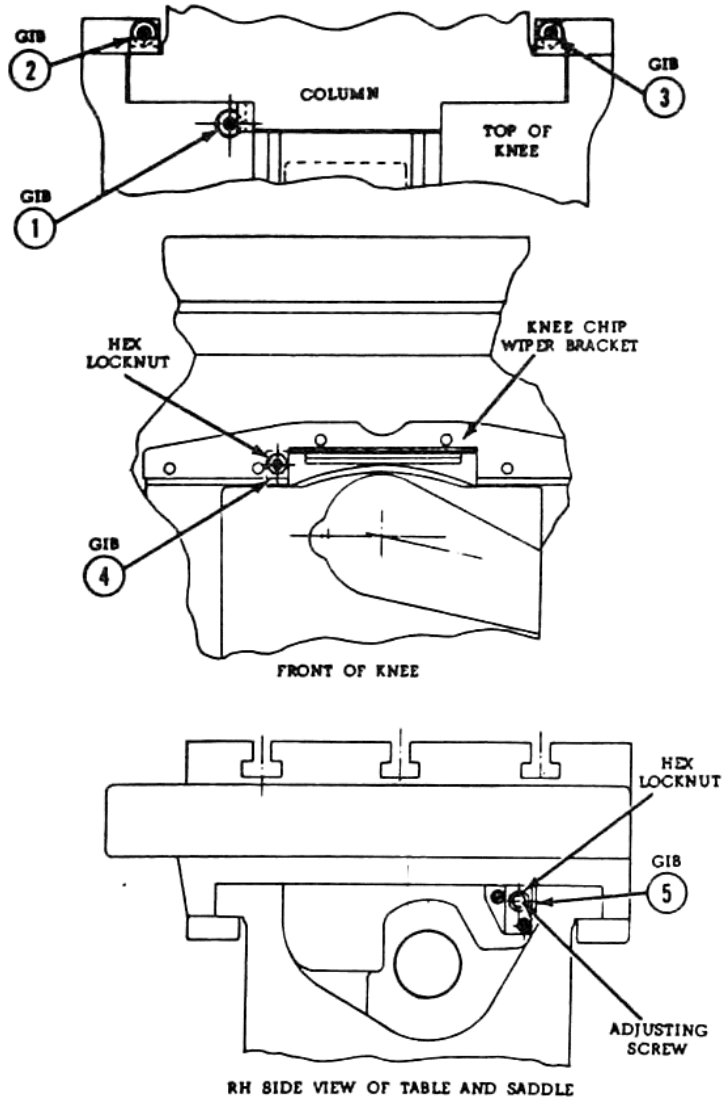
Too tight a gib setting may stall the Y axis in any position and may also increase the lost motion in the machine.

To set the X axis gib:

1. Set the table and saddle at approximately mid-travel.
2. Access to the gib adjustment is as shown in Figure 8-11.
3. Mount a dial indicator on top of the knee and in front of saddle with ball approximately 11" from knee center line as shown in Figure 8-11.
4. Manually rock the table back and forth noting that the indicator will show the spring effect and the deadband.
5. Maximum deadband is .001" TIR (not including spring). Another way of stating this tolerance is .0005" TIR plus whatever is recorded in the Y axis on the particular machine. (Normally also .0005" TIR.)

CAUTION

Too tight a gib setting may stall the X axis in any position and may also increase the lost motion in the machine.



Remove LH and RH chip wipers from top of knee to gain access to the 3 gibs—each is a screwdriver adjustment labelled (1), (2), and (3).

Remove knee chip wiper and wiper bracket to gain access to Y-axis gib. Loosen hex locknut and use socket wrench to adjust one gib (4).

Remove RH way cover on saddle to gain access to X-axis gib ajdustment. Loosen hex locknut and use socket wrench to adjust one gib—item (5).

Figure 8-9 Gib Locations.

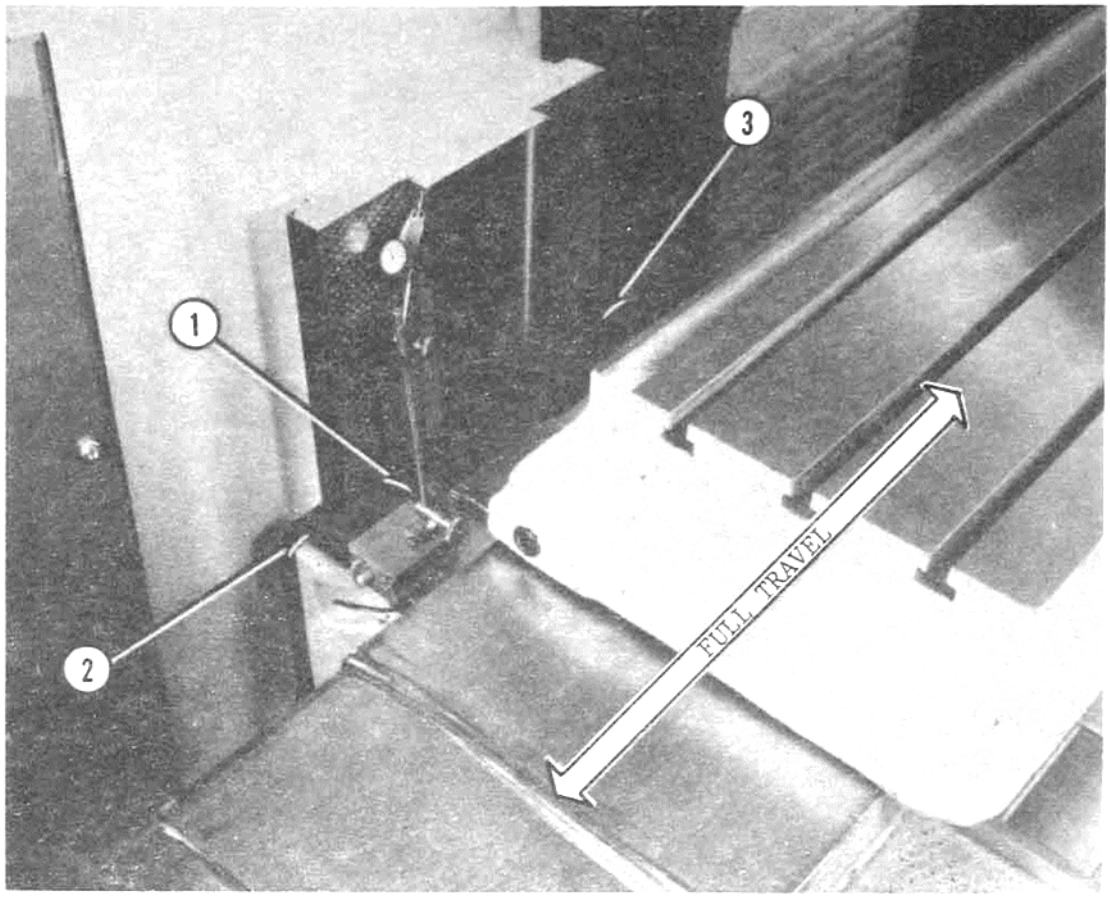


Figure 8-10 Knee Guiding Gib Adjustment

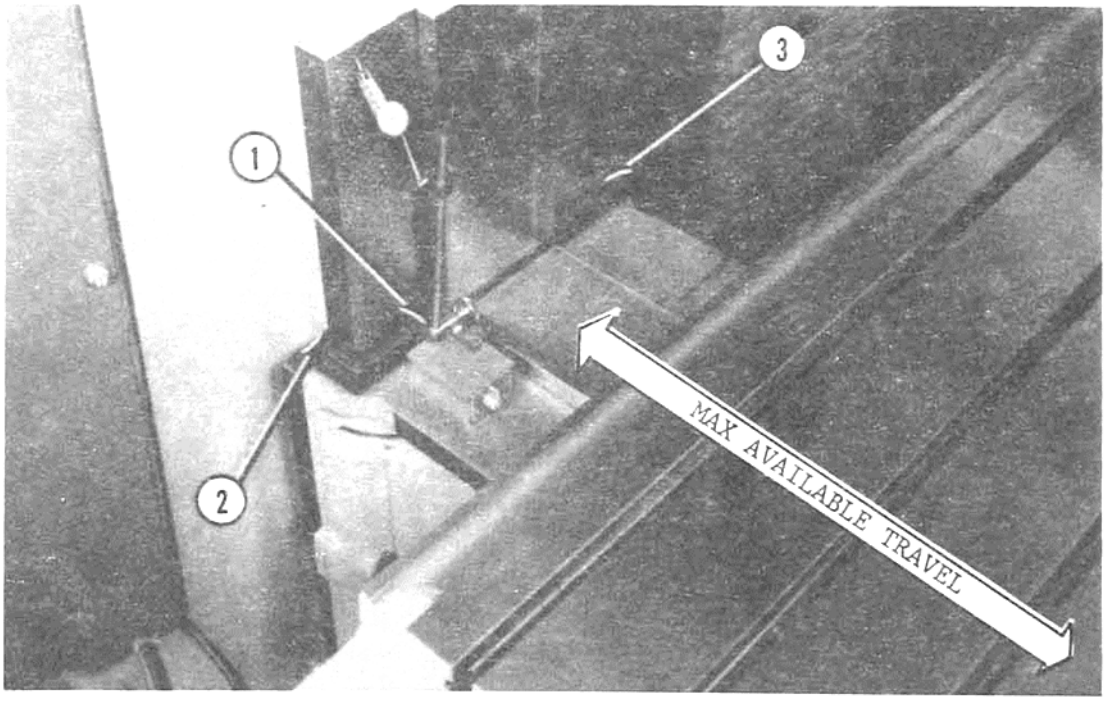


Figure 8-11 Knee to Column Gib Adjustment

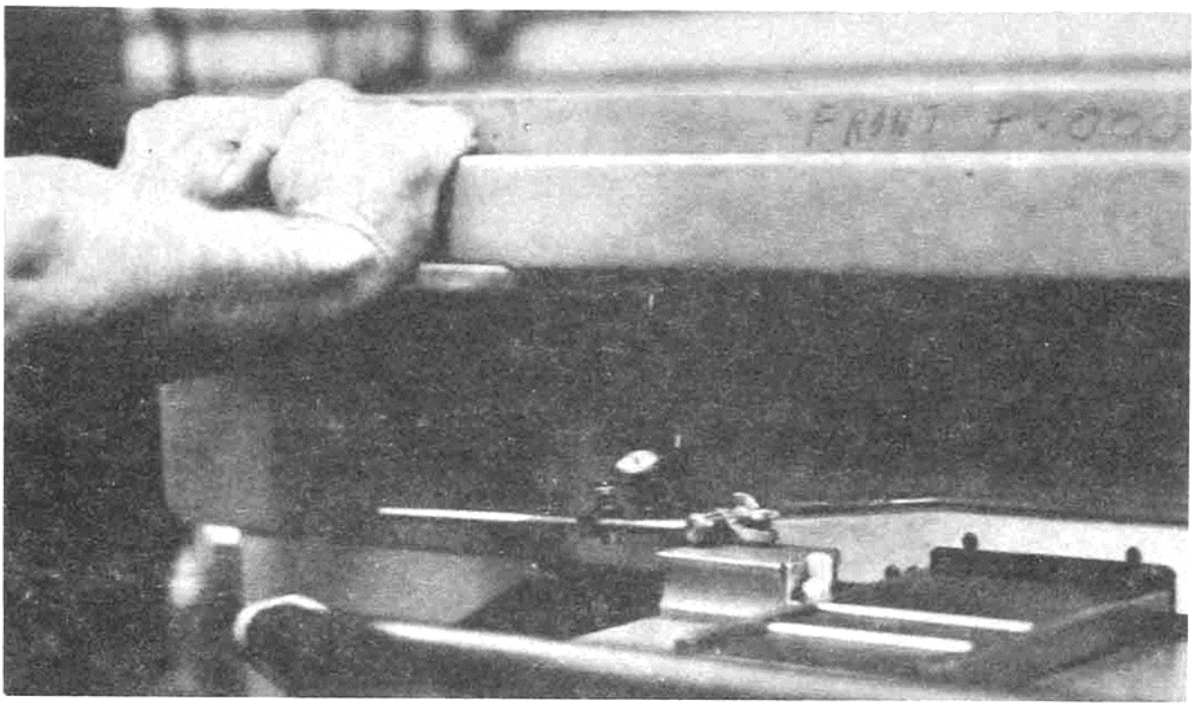


Figure 8-12 Y-Axis Gib Setting

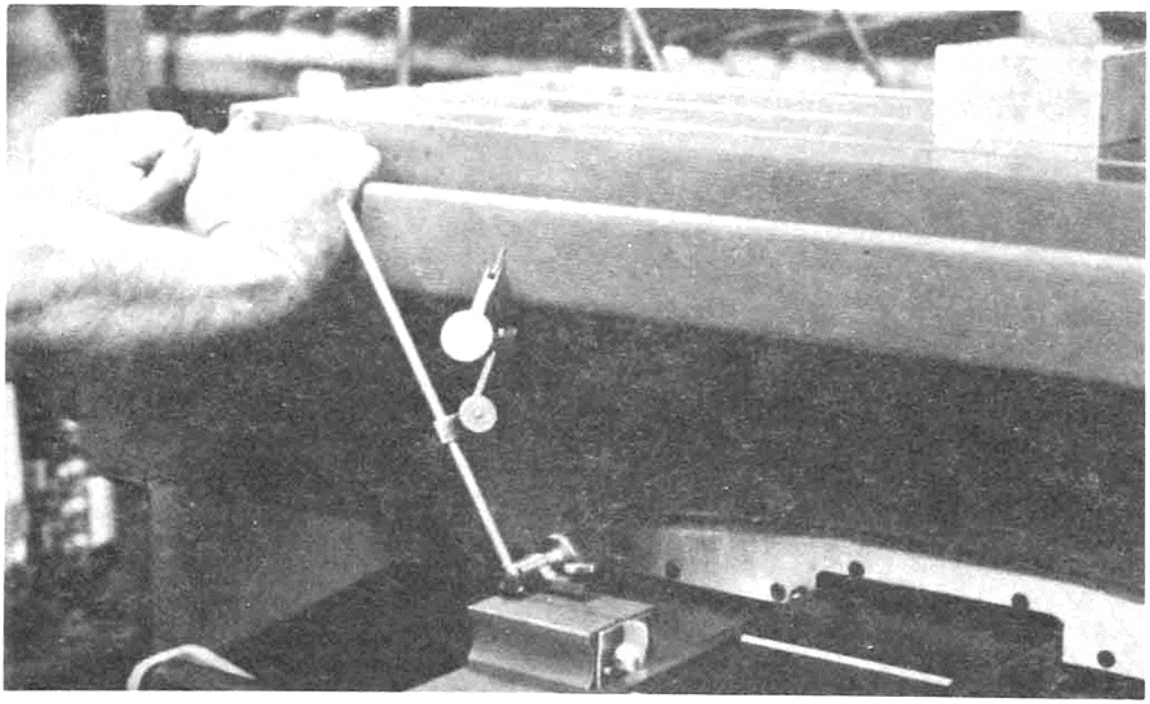


Figure 8-13 X-Axis Gib Setting

8.8 PNEUMATIC SYSTEM

The entire pneumatic system is self-contained and required no special start up procedures other than the need for 85-125 PSIG service along with adequately sized lines and plant equipment capacity.

The system consists of air hose, a lubrication bowl, manual pressure relief valve and a regulating valve set at 75 psi (482.5 kilo pascals). Average air consumption is 4 cfm. Instantaneous flow is 12 cfm requiring lines and external equipment to be sized for 12 cfm.

Pneumatic system contains a filter/regulator with a drain and a lubricator. There is also a manifold that controls air flow to the pneumatic motor and spindle brake. There are two kinds of valves used.

4 way, 2 position, part no. 504882
4 way, 3 position, part no. 504883

The air is lubricated with a small amount of oil. The flow of oil is controlled by a knob on the top of the filter/lubricator. To set the air flow, turn the knob clockwise to OFF then back clockwise to ON approximately 1/2 turn (3/4 turn is full flow).

CAUTION

Do not operate the system with the air system lubricator valve OFF. This will cause the hoses to deteriorate over a period of time.

If the pressure drops too low, approximately 55 psig (379 kilo pascals), the entire system shuts down to prevent possible damage to the spindle shaft. The red limit light will come on.

There is only one lubricant approved for use in the pneumatic system of machines so equipped: Texaco Capella A.

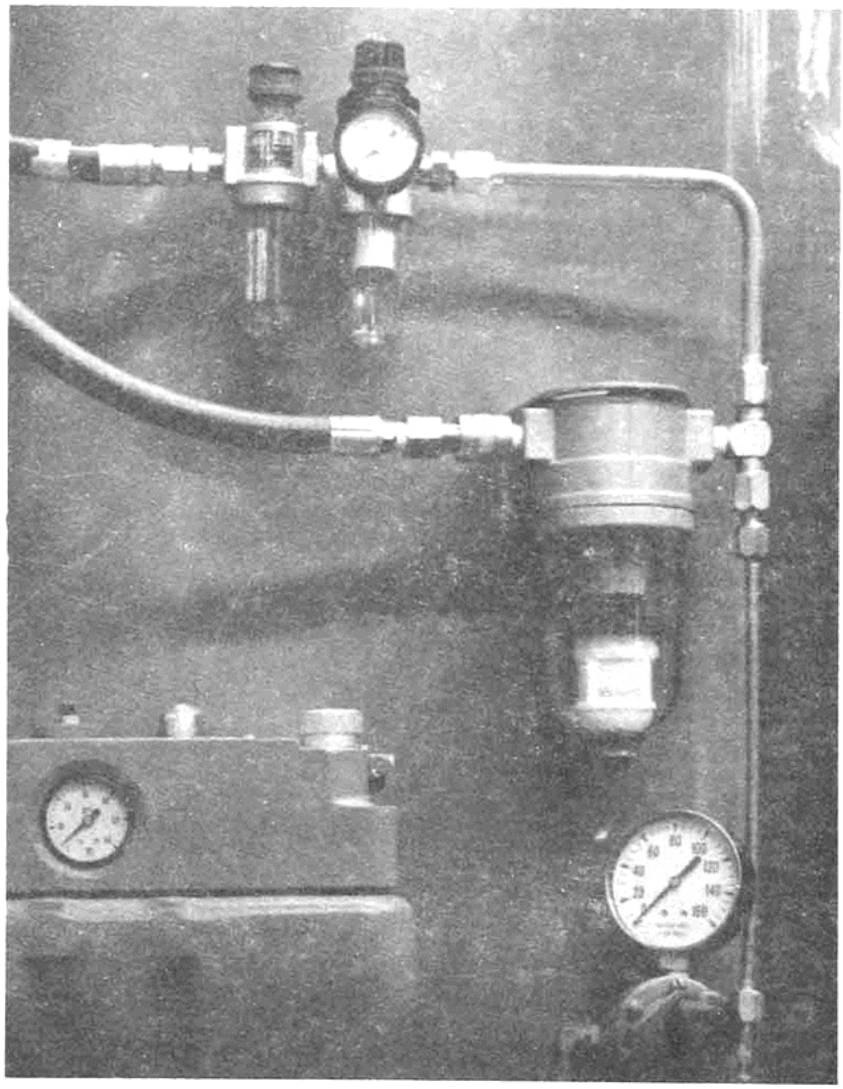


Figure 8-14. Pneumatic System

SECTION 9
PREVENTIVE MAINTENANCE

9.1 INTRODUCTION

To keep the machine in good order, it is important that you follow these procedures. All are Level 1 maintenance procedures with the exception of Board Cleaning and the six month procedure, which are Level 2 maintenance procedures. For information on how to clean the PC boards refer to Section 6.2, Troubleshooting.

We reprint the Bridgeport warranty as follows:

"Bridgeport warrants to the original purchaser only that all products manufactured by it will be free from defects in materials or workmanship for a period of twelve (12) months from date of shipment to such purchaser, such **warranty to remain in effect if and only if such products are used in accordance with all instructions as to maintenance and operation set forth in manuals and instruction sheets furnished by Bridgeport."**

9.2 LUBRICATING SYSTEM

9.2.1 Starting a New Machine

1. Fill the reservoir.
2. Pull and release the "Instant Feed Button" at the top of the reservoir several times until the oil shows freely on all bearing surfaces.

9.2.2 Maintenance

1. Check the oil level daily and refill the reservoir when required.
2. Check the system periodically for loose or broken tubing, worn hoses, loose fittings and connections.

9.2.3 Parts Replacement

Order all parts by part number and name. You must specify the complete lubricator part number and serial letters shown on the name plate on the top of the reservoir.

9.2.4 Motor Replacement

1. Remove the motor cover and the two screens that hold the motor to the top of the reservoir.
2. Replace with motor (1417850).
3. On reassembly, make sure the slot in the motor shaft is engaged with the pin in the drive shaft before replacing the screens.

9.2.5 Service

If there is too little oil at all bearing surfaces, check for low oil level, broken or cracked tubing, loose connections, flattened lubricator outlet tube or clogged filter.

9.3 ROUTINE MAINTENANCE

9.3.1 Daily Checks

1. Check the automatic lubricating system oil level and fill as necessary.
2. Clean the dirt and chips from ways.
3. Clean the Tape Reader Head. Use Miller Stephenson MS-200 Tape Head Cleaner. If not available, isopropyl alcohol may be substituted.
4. Check the tape for wear, tears, etc. Replace with a new tape if the present tape is damaged or worn.

9.3.2 Weekly Checks

1. Clean the chips and dirt from the outside of the control, the entire machine and the machine ways.
2. Make sure that the air intakes and exhausts are not obstructed.
3. Clean and apply a light coat of oil to the way covers.
4. Check the air filters. Replace them if necessary.

We recommend that you keep a close watch on the air filters for the first few months of operation in order to get an idea of how often they should be replaced. The time between filter changes cannot be predicted because it depends on many things, including the hours of operation per day, the nature of materials being machined in the vicinity, and most importantly, on the cleanliness of the air in the shop. KEEP THE FILTERS CLEAN.

Check the operation of nearby machines to ensure that they are not affecting the cleanliness or the operation of this machine.

If mist coolant is used on this or on nearby machines, it will be necessary to change the filters more often.

9.3.3 Checks Every Six Months

1. Drain the filter bowls of the pneumatic system.
2. Purge the filter-water separator unit.
3. Clean the bowls only with warm water.
4. Fill the lubricator bowl with Texaco Copella "A".

WARNING

Do not install where bowl may be exposed to materials incompatible with polycarbonate. Certain oils, solvents and chemicals or their fumes can weaken this bowl and possibly cause the bowl to burst, which could result in injury.

In addition to the above preventive maintenance procedures, the following checklist can prevent considerable downtime if carried out throughly. Since most customers do not have a preventive maintenance program, these simple checks are recommended during service calls. They will save time in the future.

The following are maintenance Level 2 procedures.

1. Check proper operation of all fans.
2. Clean tape reader head (MS 200 Miller-Stephenson).
3. Remove, inspect and clean logic cards. Check for shorted pins on w/w boards and reseat plug-in ICs if necessary. Do not use abrasives on edge connectors (MS 170 Miller-Stephenson-Trichlorethane).
4. Check all K-connectors. The tabs on the female pins should be closed.
5. Check all terminal connections for tightness. This includes bridge connections and axis drive motor leads.
6. Check all wire terminations on fuse holders, switches, contactors and relays. Inspect physical connections. A burnt or charred terminal indicates a loose connection (power supplies).
7. Check all ground connectors!
8. Make sure all fuse holders are tight, especially the thread-in type.
9. Check for bent pins and/or foreign matter between pins on X, Y, Z SMD and ACC connectors.
10. Verify that all AC voltages are within specs. (Refer to Troubleshooting, Section 6).
11. Verify that all DC voltages and Ripple are within specs. (Refer to Troubleshooting, Section 6).
12. Calibrate regulated supply (Refer to Troubleshooting, Section 6).
13. Calibrate static current on the ACC card (Refer to Troubleshooting, Section 6).
14. Inspect the wire harness for chafed wires, especially around the corners and sharp bends.
15. Compare the fuse values to those on the fuse chart.

9.3.4 Multiple Shift Operations and Hostile Environments

Bridgeport defines a multiple shift operation as a three shift operation, five or more days per week. Hostile environments are considered to be those in which the workpiece is cut dry or when magnesium or carbon is being cut.

If the workpiece is cut dry (cast iron or carbon) you must take extraordinary precautions. We recommend the following guidelines:

1. The (2J) head has a patented cooling system to minimize spindle growth. The spindle motor draws air from behind the speed indicator plate over the equipment in the belt housing and exhausts around the motor shroud. THE AIR INLET SHOULD BE FILTERED FOR HOSTILE ENVIRONMENTS.
2. Use specially designed vacuum systems at the cutting tool.
3. Do not use a compressed air hose to clean the machine. Use an industrial vacuum cleaner.
4. Use Electrostatic filters if clean air cannot be ducted to the head and the control cabinet inlets.

9.3.5 24-Hour Preventive Maintenance

1. Clean the dirt and chips from way surfaces and aprons. Use an industrial vacuum cleaner.
2. Check the automatic lubricating system oil level and fill. Use Sunoco Waylube 1180 or equivalent.
3. Clean the tape reader head. Use Miller Stephenson MS 200 tape cleaner or isopropyl alcohol.
4. Check the tape for wear, tears, etc.
5. Clean and apply a light coat of oil to the way surfaces.

9.3.6 48-Hour Preventive Maintenance

1. Follow the procedures in 9.3.4 above. Use an industrial vacuum cleaner over the entire machine and outside the control cabinet.
2. Check and replace the air filters.
3. Clean the dirt and chips from inside the controls and around the card frame.

9.3.7 144-Hours Preventive Maintenance (weekly)

1. Follow the procedures in 9.3.5 above. Wipe down the entire machine and the outside of the control cabinet.
2. Remove the spindle motor hood and clean it.
3. Remove the top cover of the spindle drive belt housing and inspect it for dirt.
4. Remove the front cover over quill switches and inspect it for dirt.

9.3.8 One-Month Preventive Maintenance

This is a Level 3 procedure.

1. Remove and inspect the logic boards.
2. Clean them only in accordance with the procedures listed in Section 6.2.
3. Clean the contact fingers.

Failure to follow the proper cleaning procedure may cause damage to the board.

9.3.9 Six-Month Preventive Maintenance

This is a Level 2 maintenance procedure.

1. Take the milling head out of service and inspect for wear if items 4 and 5 (the spindle drive belt housing and the quill switches) under the section above, have been deteriorating.

SECTION 10
BASE ASSEMBLY

10.1 INTRODUCTION

The procedures that follow are Level 1 maintenance procedures unless otherwise noted. Refer to Drawing 77-0002 for a drawing of the Series II CNC Base Assembly.

10.2 X- AND Y-AXIS COUNTERS

10.2.1 X-Axis Counter Belt Adjustment—Figure 10-1

1. Turn OFF the power.
2. Loosen but do not remove the screws that secure the counter housing.
3. To increase the tension on the belt, lower the housing. To decrease the tension, move the housing upward.
4. Holding the housing where it produces the right tension, tighten the screws again.

10.2.2 X-Axis Counter Belt Replacement—Figures 10-1, 10-2

NOTE

Replace the belt with a Bridgeport Timing Belt only.

1. Move the table to the far left position.
2. Turn OFF the power.
3. Slide the RH way cover (2) on top of the saddle to the right, exposing the timing belt.
4. Loosen but do not remove the screws that secure the counter housing.
5. Loosen two setscrews (5) that secure the pulley (6) to the end of the leadscrew (7).
6. Pull the pulley and belt (4) off the leadscrew.
7. Loosen the screws that hold the rubber cover and Plexiglas shield to the top of the counter housing and remove them.
8. Remove the bearing holder (18) and bearing (21) from the end of the counter housing.
9. Disengage the timing belt from the pulley (19) and work it around the end of the pulley shaft (20) and out through the hole vacated by the bearing holder.
10. Thread the new belt through the bearing holder area (18) and around the counter pulley.
11. Replace the bearing holder (18) so that the shaft (20) engages properly with the bearing (21).
12. Place the belt (4) through the hole in the side of the saddle.
13. If a new ballscrew has been installed, mount the pulley (6) in the end of the shaft without the setscrews and set the belt alignment.
14. Install the belt over the pulley (6) by raising the counter housing to obtain a slack in the belt (4).
15. Push the housing downward, increasing the tension in the belt (4). Secure the screws (3). Figure 10-2 shows the proper tension setting for the timing belt.
16. Drive the axis in both directions a few times ensuring that belt alignment is satisfactory. Dimple the shaft or drill cone depth only to provide a seat for the setscrews. Clean the chips out and install setscrews to secure the pulley (6).
17. Reinstall the Plexiglas and rubber cover.
18. Slide the way cover (2) back in place.

10.2.3 X-Axis Counter and Counter Coupling Replacement—Figure 10-1

1. Turn OFF the power.
2. Loosen and remove the screws (26) that secure the counter shield. Remove the shield (25) and the Plexiglas window.
3. Loosen the setscrews on the counter side of the coupling (19).
4. Remove the screws that secure the counter. Remove the counter (28).

NOTE

Keep all the shims that you find on the mounting surface.

5. Reassemble the counter (28) with screws loose (27) and engage the coupling (19).
6. Turn ON the power.
7. Move the axis drive in both directions while setting the alignment of the counter (28) with its drive shaft (20).
8. Secure the mounting screws (27).
9. Secure the driving setscrews in the coupling (19) with the counter set to read 00.000 in the fully minus position of the tool (table fully to the right) but approximately 0.050" clear of the limit switch. Check full travel of 30.000". Adjust the counter to split the full travel distance between limit switches.
10. Proceed to 10.2.4, and follow Steps 2-4.

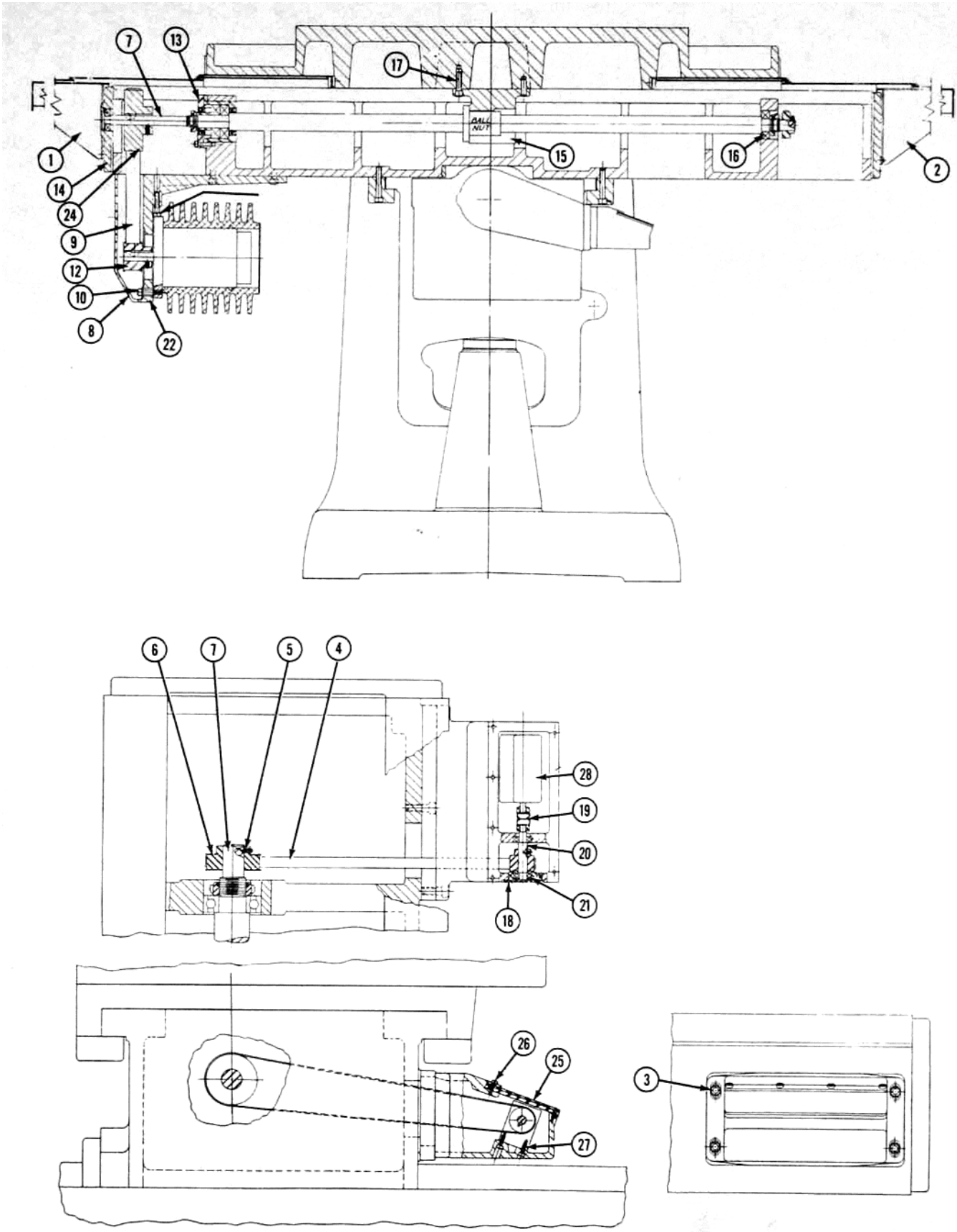


Figure 10-1 X-Axis Drive and Counter Assembly

10.2.4 X-Axis Counter Adjustment—Figure 10-1

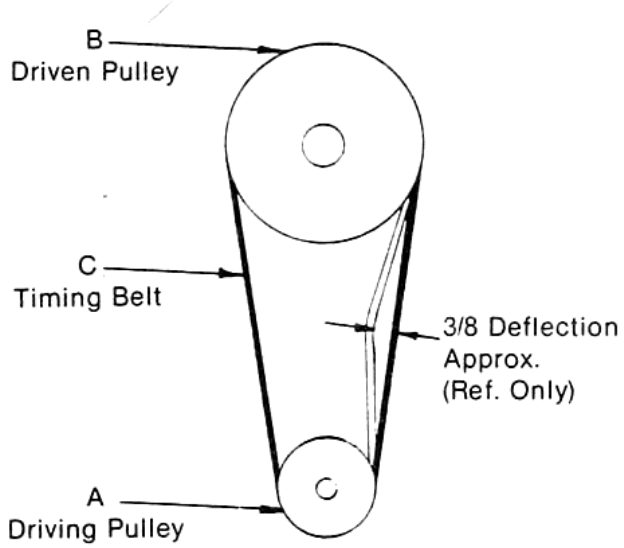
NOTE

The X-Axis counter should be adjusted after any adjustment that changes the spindle to table relationship.

1. Remove two screws and remove the counter cover.
2. Align the spindle center line with the table center slot. Use a dial gauge mounted to the spindle for an accurate alignment.
3. Loosen two setscrews on the coupling and adjust the counter to read 15.000 inches.
4. Tighten the two setscrews and install the cover.

10.2.5 Y-Axis Counter Belt Adjustment—Figure 10-3

1. Turn OFF the power.
2. Loosen but do not remove the screws that secure the counter housing (3).
3. To increase the tension on the belt, lower the housing. To decrease the tension, lift the housing.
4. Holding the housing at the position where it produces the right tension, tighten the screws again. Refer to Figure 10-2.



NOTE

Use belt tension gauge & set belt tension between 70-80 lbs.

Figure 10-2 Timing Belt Tensioning

10.2.6 Y-Axis Counter Belt Replacement—Figure 10-3

NOTE

Replace this belt with a Bridgeport Timing Belt only.

1. Turn OFF the power.
2. Remove the four screws (37) that secure the rubber guard and Plexiglas cover.
3. Remove the guard and cover.
4. Remove the bearing holder and bearing (30).
5. Work the belt off the pulley (31) and over the end of the shaft (32) and remove it through the hole in the side of the housing.
6. Thread the new belt through the bearing holder area (18) and around the counter pulley.
7. Adjust for proper tension. Refer to Figure 10-2.
8. Replace the bearing holder and bearing (30).
9. Replace the guard and cover by securing the four screws (37).

10.2.7 Y-Axis Counter Housing Removal—Figure 10-3

1. Turn OFF the Power.
2. Remove the belt cover (2).
3. Remove the screws that secure the counter housing (3).
4. Remove the housing.

10.2.8 Y-Axis Counter Housing Replacement—Figure 10-3

1. Turn OFF the power.
2. Engage the belt with the pulley (9).
3. Test for the proper belt tension by raising and lowering the counter housing. Hold the housing in place.
4. Screw in the screws that secure the counter to the housing.
5. Replace the belt cover (2).
6. Turn ON the power.
7. Drive the axis in both directions a few times ensuring that the belt alignment is satisfactory.
8. Reinstall the Plexiglas and rubber cover (36).
9. Replace the cover (2).

10.2.9 Y-Axis Counter and Counter Coupling Replacement—Figure 10-3

1. Turn OFF the power.
2. Loosen and remove the screws (37) that secure the counter shield. Remove the shield and the Plexiglas window (37).
3. Loosen the setscrews on the counter side of the coupling (19).
4. Remove the screws that secure the counter. Remove the counter (28).

NOTE

Keep all the shims that you find on the mounting surface.

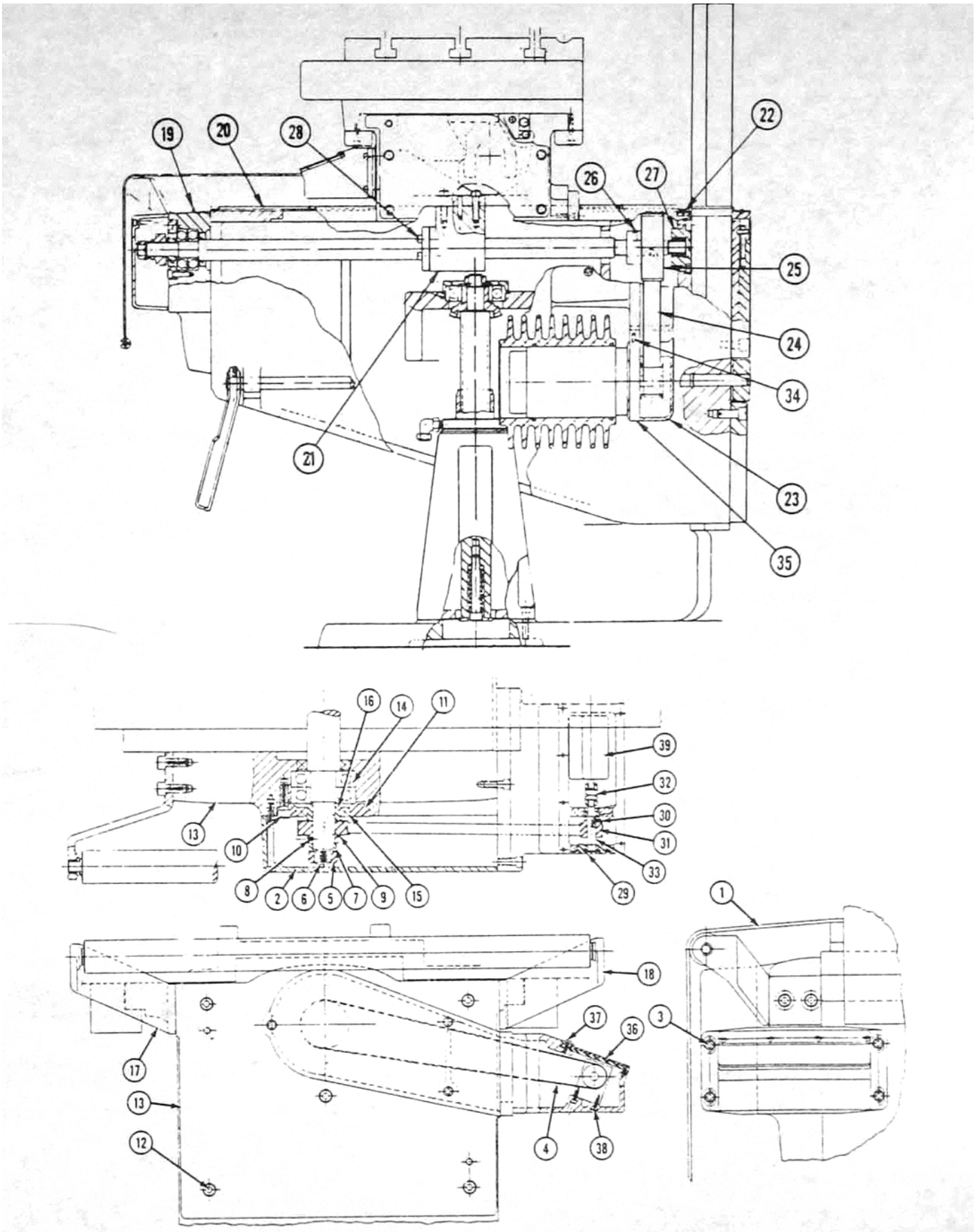


Figure 10-3 Y-Axis Drive and Counter Assembly

5. Reassemble the counter (39) with the loose screws (38) and engage the coupling (32).
6. Turn ON the power.
7. Move the axis drive in both directions while setting the alignment of the counter (28) with its drive shaft (20).
8. Secure the mounting screws (27).
9. Secure the driving setscrews in the coupling (19) with it set to read 00.000 in the fully minus position of the tool (saddle toward the column) but approximately 0.050" clear of the limit switch. Check full travel of 15.000". Adjust the counter to split the full travel between limit switches.
10. Proceed to 10.2.10 to adjust the counter.

10.2.10 Y-Axis Counter Adjustment—Figure 10-3

NOTE

The counters are to be used for indicators of position and not for measuring off distances. They may, therefore, be set at any position that is convenient. We recommend setting the Y-axis counter .010 out from the limit switch trip-dog position. This provides 12 inches to show at full travel.

1. Move the saddle back toward the column until the trip-dog just trips the limit switch.
2. Move the saddle away from the column .010 inches.
3. Turn OFF the power.
4. Remove four screws and remove the cover.
5. Loosen the clamp, zero the counter and tighten the clamp.
6. Install the cover.
7. Close the enclosure with window, shield and screws (37).

10.3 X- AND Y-AXIS DRIVE MOTORS

10.3.1. X-Axis Drive Belt Adjustment—Figure 10-2

1. Turn OFF the power.
2. Loosen the screws that secure the cover and remove the cover (8) to expose the motor timing belt.
3. Loosen but do not remove the screws (10) that secure the motor to the mounting bracket (22).
4. Turn the setscrew (11) to increase or decrease tension in the belt.
5. Tighten the motor mounting screws when the belt has the right tension. Refer to Figure 10.2.

CAUTION

Make sure that the motor pulley does not rub on the casting or there will be damage to the motor.

10.3.2 X-Axis Drive Belt Replacement—Figure 10-2

NOTE

Replace this belt with a Bridgeport timing belt only.

1. Move the table to the extreme right position.
2. Turn OFF the power.
3. Remove the LH way cover (1).
4. Loosen the screws that secure the cover and remove the cover (8) to expose the motor timing belt.
5. Loosen but do not remove the screws (10) that secure the motor to the mounting bracket (22).
6. Remove the belt from the pulley (12) on the motor shaft.
7. Loosen the LH end bracket (14) that is dowelled to the saddle and remove it.

CAUTION

This end bracket contains a bearing for the ballscrew extension. Be careful to hold the end bracket (14) parallel to the axis of the screw when you remove it to prevent damage to bearing.

8. Remove the belt (9).
9. Slide the new Bridgeport belt (9) over the ballscrew extension and over the pulley (24).
10. Clean and install the end bracket (14).
11. If a new ballscrew has been installed, align the pulley (24) along the shaft on its key to get the best belt alignment with the motor pulley (12).
12. Set the belt tension. Refer to section 10.2.1 and Figure 10-2.

CAUTION

Make sure that the motor pulley does not rub on the casting or there will be damage to the motor.

13. Turn ON power.
14. Run the axis drive in both directions to check the belt alignment. Adjust it if necessary.
15. Remove the setscrews from the pulley (24) and dimple the shaft in the new setscrew location by drilling a cone depth only enough to provide a seat for the setscrew. Clean out the chips.

NOTE

If the pulley does not have a hub, it will be a taper lock type. In this case, follow the steps shown in Figure 10-4.

16. Install the setscrews and secure the pulley (24) to the shaft (7).
17. Reassemble the covers.

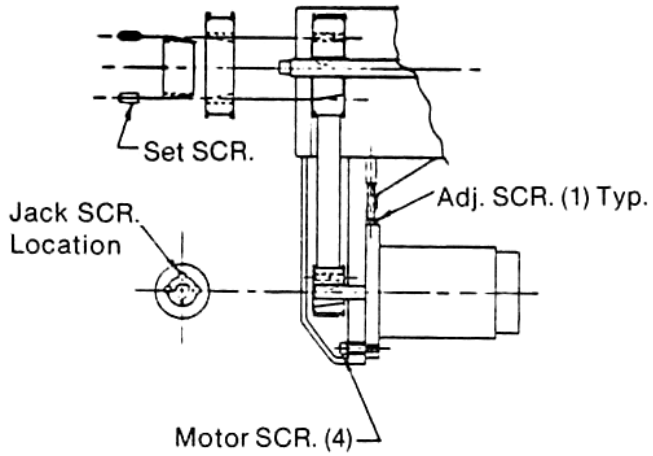


Figure 10-4 Taper Lock Bushing Installation

10.3.3 X-Axis Drive Motor Replacement—Figure 10-1

Turn OFF the power before beginning this procedure. Failure to follow this procedure could result in serious or fatal injury.

1. Loosen the screws that secure the cover (8) to expose the motor.
2. Loosen the screws that secure the motor to the mounting bracket (22).
3. Decrease the tension in the belt by turning the setscrew (11).
4. Support the motor and remove the mounting screws.

NOTE

Leave the motor in its heat sink. The annular gap between the motor OD and the heat sink ID between O-rings is filled with silicone grease.

Do not remove the armature from the motor. Removal will destroy the magnetic characteristics of the motor.

5. Install the replacement motor.
6. After the motor is installed, set the drive belt tension. Refer to X-Axis Drive Belt Adjustment, Section 10.2.1.

10.3.4 Y-Axis Drive Belt Adjustment—Figures 10-2, 10-3

1. Turn OFF the power.
2. Loosen the screws that secure the timing belt cover and
3. Loosen but do not remove the screws that secure the motor to the mounting bracket (35).
4. To increase the tension on the belt, lower the motor. To decrease the tension, raise the motor. Use the setscrew (34) to adjust the tension.
5. Holding the motor where it produces the right tension, tighten the mounting screws again. Refer to Figure 10-2.

10.3.5 Y-Axis Drive Belt Replacement—Figure 10-3

This section has two parts: Removal and Installation.

NOTE

Replace this belt with a Bridgeport timing belt only.

Removal

1. Center the saddle on the knee and roll up the apron (1).
2. Turn OFF the power.
3. Remove the belt cover (2).
4. Remove the counter housing. Refer to section 10.2.7.
5. With the housing in one hand, loop the belt (4) from engagement with the pulley.
6. Remove the hex nut (5) at the end of the leadscrew (6).
7. Slide the spacer (7) off the leadscrew.
8. Loosen the setscrew (8) on the pulley (9) and slide the pulley from the shaft.
9. Remove the Woodruff key from the shaft.
10. Loosen the screws (10) that secure the motor to the mounting bracket. Remove the bearing retainer (11), but leave the seal (15), spacer (16) and bearing (14) in place.
11. Loosen the pulley screws (12) and remove the knee bracket (13). The seal, spacer and bearing will remain with the bracket.

NOTE

The roller brackets (17) and (18) and the front knee way apron (1) will be attached to the knee bracket.

12. Move the saddle to the front of the knee.
13. Remove the rear knee way apron.
14. Remove the setscrew (19) in front of the saddle knee way and slide the chip guard (20) forward to expose the leadscrew.
15. Remove the three screws and lift out the plate (22) over the rear end of the leadscrew.

16. Remove the securing screws and the cover (23) over the Y-axis drive motor and pulley.
17. Loosen, but do not remove, the motor mounting screws and loosen the setscrews (34).
18. Lift the motor as high as possible to obtain slack in the belt (24). Tighten the mounting screws.
19. Reach through the top of the knee and disengage the belt from the pulley (25) on the leadscrew.
20. Manually turn the leadscrew enough to free the shaft from the bearing housing (27) and to allow removal of the belt over the end of the shaft.

Installation

1. With the ballscrew supported in the ballnut bracket (21), thread the new belt over the end of the screw and rotate the screw until it engages fully in the bearing housing (27).
2. Reassemble the bearings (14) in the knee bracket (13) with seal.

The duplex bearing pair must be assembled correctly for proper operation and the seals must be protected against stretching and tearing. Align witness marks on the outer races of the bearing.

3. Mount the knee bracket (13) subassembly over the projecting ballscrew shaft and support with screws (12). The ballscrew alignment is controlled by engaging the two dowels in the knee bracket (13) and the knee casting.

NOTE

Put the replacement screw into the same alignment as the original ballscrew.

4. Install the bearing retainer (11) with the securing screws (10). Torque to 25 ft.lb. to achieve even loading on the bearings. Install the seal (15) and spacer (16).
5. Install the pulley (9), spacer (7) and hexnut (5).
6. Draw the hexnut (5) up tight to preload the bearings.
7. Turn ON the power.
8. Drive axis in both directions to make sure that the belt alignment is satisfactory.
9. Reinstall the counter housing. Refer to Section 10.2.8.
10. Reset the drive belt tension. Refer to Section 10.3.4.
11. Reinstall the Plexiglas, rubber cover (36) and cover (2).

10.3.6 Y-Axis Drive Motor Replacement—Figure 10-3

This section has two parts: Removal and Installation.

Turn OFF the power before beginning this procedure. Failure to follow this procedure could result in serious or fatal injury.

Removal

1. Loosen the screws that secure the cover (8) to expose the motor.
2. Loosen the screws that secure the motor to the mounting bracket (22).
3. Turn the setscrew to decrease the tension in the belt.
4. Support the motor and remove the mounting screws.

NOTE

Leave the motor in its heat sink. The annular gap between the motor OD and the heat sink ID between the O-Rings is filled with silicone grease.

Do not remove the armature from the motor or the magnetic characteristics of the motor will be destroyed.

Installation

1. Install the replacement motor.
2. After the motor is installed, set the drive belt tension. Refer to Section 10.3.4.

10.4 X- AND Y-AXIS BALLSCREWS

10.4.1 X-Axis Ballscrew Assembly Replacement—Figure 10-2

This section has four parts: Removal, Stripping the Ballscrew Assembly, Reassembly of Bearings and Reassembly of X-Axis Ballscrew.

Removal

1. Move the table to the extreme right.
2. Turn OFF the power.
3. Follow steps 1-5 in Section 10.2.2 (Counter Belt Replacement) then remove the way cover (2).
4. Remove the X-Axis Drive Motor belt. Refer to Section 10.3.2 (Drive Belt Replacement).
5. Remove the cover (23).
6. Reach up under the saddle and remove the oil line from the flange in the ballscrew nut.
7. Remove the four screws that secure the ballscrew nut.

Before continuing, support the ballscrew assembly under the pulley (24) because the bearing cap (13) has radial clearance in its housing in the saddle.

8. Remove the locknut that secures the bearing (16) at the right hand end of the screw.

NOTE

This bearing will not pass through the nut bracket (15) when the screw is removed from the LH side of the saddle.

9. Remove the five socket head cap screws and the lock works that secure the bearing cap (13) to the saddle.

NOTE

This action destroys the alignment and the preload in the duplex bearing pair in the bearing cap.

10. Tap the ballscrew assembly with a soft mallet at the extreme right hand end until it is free from the bearing (16).
11. Remove the ballscrew assembly from the left side of the saddle complete with the pulley (24) and the bearing cap (13).

Stripping the Ballscrew Assembly

1. Grip the screw in the area of the pulley (24) and with a special spanner wrench, loosen the ball bearing locknut.
2. Loosen the setscrew in the pulley (24) and remove the pulley and key.
3. Remove the locknut that holds the duplex bearing inner races.
4. Remove the bearing cap (13) complete with the stationary and rotating spacers. Do not disassemble further.

CAUTION

Dispose of the two bearing locknuts you removed in steps 1 and 3. Do not reuse them. The ballscrew nut is never removed from the screw.

Reassembly of Bearings

1. Clean the bearing diameters and orient them to the witness lines on the outer races. Install the bearings with the bearing cap (13) complete with the stationary and rotating spacers on to the ballscrew. Snug them up with the new bearing locknut.
2. Check the bearing (16) and the new bearing locknut but do not install them yet.
3. Install the key and pulley (24) with the setscrew.
4. Grip the shaft in the area of the pulley (24) and with a special spanner wrench tighten the two bearing locknuts. There is no torque figure for this operation, but the nuts should be as tight as the wrench will allow without applying extraordinary force to it.
5. Look on the ballnut flange for an attached nylon ball. Use this ball to plug a radial hole in the flange. There are two holes in the flange, one for the oil line to be installed later, and one to be plugged with the nylon ball. Orient the nut to the position it had when installed. The return tube is at the bottom. The hole at the top, near the column is the one you plug with the ball.

Reassembly of X-Axis Ballscrew

1. Turn ON the power.
2. Move the table to its extreme RH position.
3. Turn OFF the power.
4. Feed the ballscrew assembly through the bearing brackets that are cast into the saddle.

CAUTION

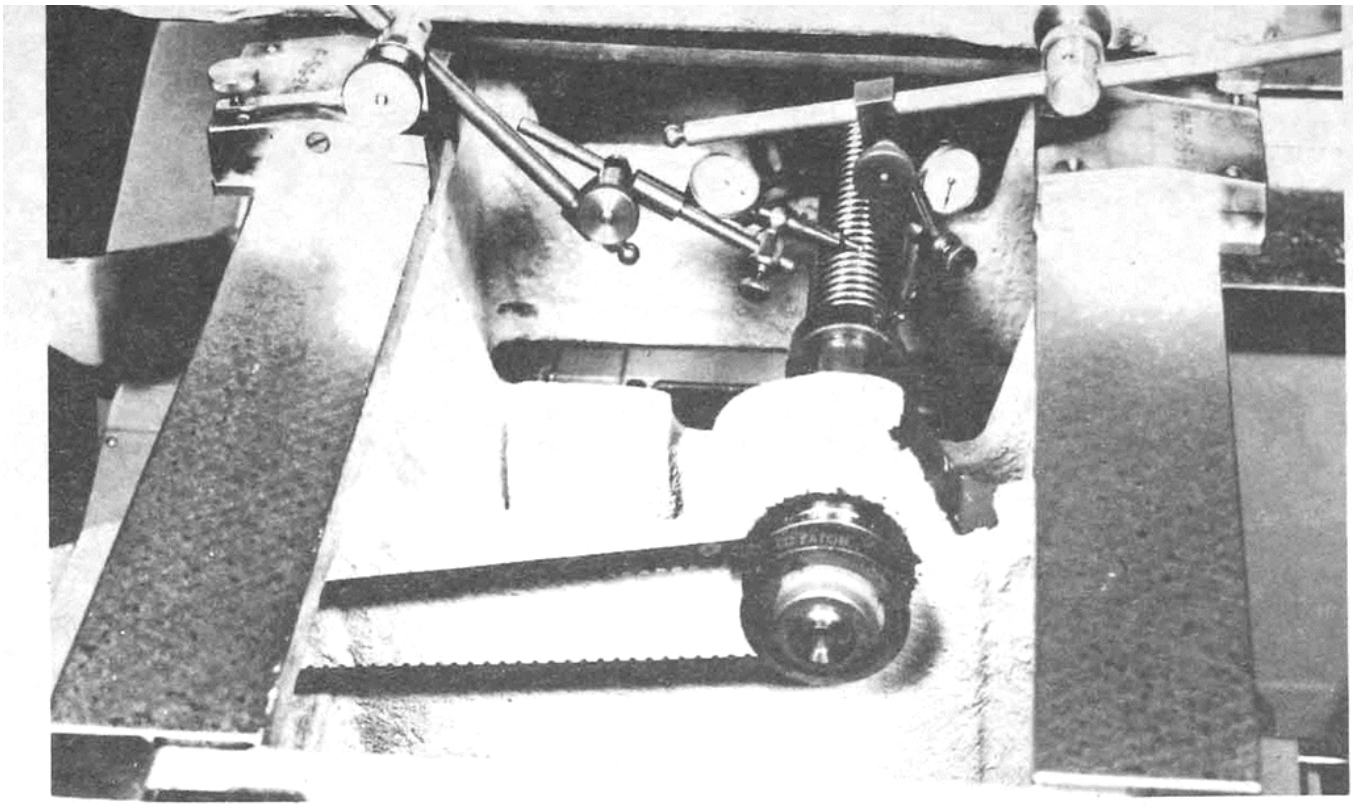
To avoid collision with casting make sure the ball return tubes in the ballscrew nut are in the lowest position during this operation.

5. Engage the ballscrew with the bearing (16) in its housing using a light tap if necessary. Install and tighten the new locknut.
6. Install the five socket head cap screws and lockwashers to secure the bearing cap (13) with a light friction grip only between the cup flange and the saddle casting face.
7. Install the four socket head cap screws (17) finger tight. This mounts the ballscrew nut to the nut bracket.
8. Install the end bracket (14) complete with its bearings on the existing dowels and secure it with its screws.

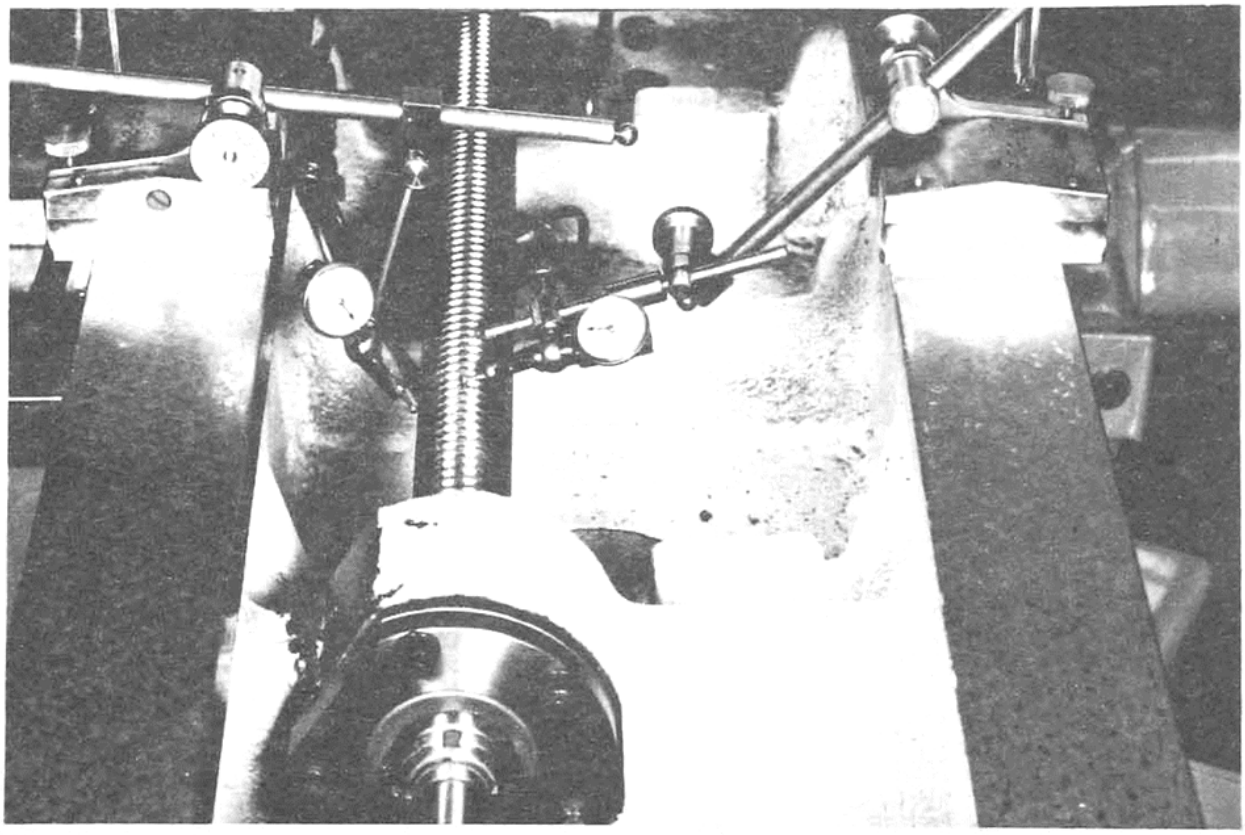
NOTE

Installing the dowels will force the bearing cap (13) into the alignment associated with the original ballscrew that was mounted in the machine. This alignment will also be correct for the replacement ballscrew.

9. With a dial indicator base containing two pins, mount the assembly on the rear way of the saddle and bank the pins against the grinding edge nearest to the column. Install the two dial indicators mutually perpendicular (top and side) and set these on the OD of the ballscrew ath the right hand end. Set them to zero. Refer to Figure 10-5.
10. Remove the indicator assembly, shift the table to the right hand end and mount the indicator assembly at the left hand end of the saddle.



Right End (As Viewed by Operator)



Left End (As Viewed by Operator)

Figure 10-5 Field Alignment of Z-Axis Ballscrew

11. It will be necessary to remove the sag in the screw by placing the bearing cup in such a position that the indicator readings are within .001" TIR. Snug up the five capscrews.

NOTE

There will be a gap between the spacer plate and the cup.

12. Secure the four socket head capscrews (17) to draw the ballscrew nut against its mounting bracket.
13. Install the lubricating line for the nut.
14. Secure the cover (23).
15. Reinstall the X-axis counter belt, pulling the belt through the hole in the side of the saddle.
16. Reinstall the X-axis drive belt. Make sure to align the pulley (24) along the shaft on its key, then adjust and reassemble. Refer to Section 10.2.2, steps 13-17 (X-Axis Motor Drive Belt Replacement).

NOTE

For accurate readings, the dial indicators must be placed as shown.

10.4.2 Y-Axis Ballscrew Replacement—Figure 10-3

This section has two parts: Removal and Installation.

Removal

1. Follow steps 1-19, Section 10.2.5 (for Y-Axis Drive Belt Replacement). Turn OFF the power.
2. Loosen the pulley setscrews (26) to free the pulley from the shaft.
3. Rotate the leadscrew enough to remove the pulley and its Woodruff key entirely.

CAUTION

To prevent distortion in the ballscrew make sure the shaft is supported by the ballnut bracket (21) during this operation.

4. Remove the lubrication tube from the left hand side of the ballnut flange.
5. Support the leadscrew and remove the screws (28) that secure the ballnut.
6. Remove the leadscrew through the 3-5/8" diameter opening in the front face of the knee.

Installation

1. Turn ON the power.
2. Move the saddle forward.
3. Look on the ballnut flange for the attached nylon ball. Use this ball to plug a radial hole in the flange. There are two holes in the flange, one for the oil line to be installed later and one to be plugged with the nylon ball. Orient the nut to the position it had when installed. The return tubes are at the bottom. The hole at the top near the column is the one you plug with the ball.
4. Feed the ballscrew through the 3-5/8" diameter hole in the front face of the knee casting. The ball return tubes should be down.
5. Support the screw in the ballnut bracket (27) by making the four socket head capscrews (28) finger tight.
6. Install the belt, following the procedure in Section 3.3.5 (Y-Axis Drive Belt Replacement). In addition to step 1, install the pulley (25) and key into the ballscrew when you thread the belt over the shaft.
7. After step 6, preloading the bearings, on page 10-7, tighten the four socket head capscrews to secure the ballscrew nut to the bracket (21).
8. Install the lubrication feed tube into the hole provided in the nut flange on the left hand side facing the machine.
9. Reinstall the counter housing. Refer to Section 10.2.8.
10. Reset the drive belt tension. Refer to Section 10.3.5 (Y-Axis Drive Belt Replacement).
11. Turn ON the power.
12. Drive the axis in both directions to check the belt alignment. Adjust it if necessary. Remove the setscrews from the pulley (24) and dimple the shaft in the new setscrew location by drilling a cone depth only enough to provide a seat for the setscrew. Clean out the chips.
13. Install the setscrews and secure the pulley (25) to the shaft (6).
14. Reassemble the covers.

10.5 LIMIT SWITCHES

10.5.1 X-Axis Limit Switch Replacement—Figure 10-6

The X-Axis Limit Switches are located under the table on the rear of the saddle.

1. Turn OFF the power.
2. Unscrew the knurled nut (1, Figure 10-6) on the electrical cable and disconnect the cable from the microswitch.
3. Loosen the socket head cap screws (2) that secure the microswitch to the mounting plate (3). Remove the switch.
4. The mounting plate can be removed by removing the screws (4) and washers (5) that hold it to the saddle.

10.5.2 Y-Axis Limit Switch Replacement—Figure 10-7

The Y-axis limit switch is located under the table on the right saddle hold-down strap to the saddle-knee way.

1. Turn OFF the power.
2. Unscrew the knurled nut (1, Figure 10-7) on the electrical cable and disconnect the cable from the microswitch.

3. Loosen the two socket head capscrews (2) and remove the microswitch from the down strap (3).

4. Install new switch and follow the above steps in reverse order.

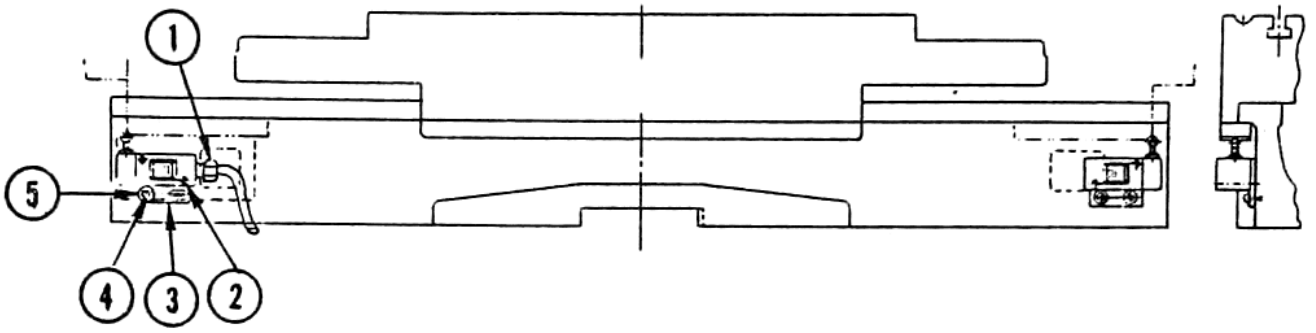


Figure 10-6 X-Axis Limit Switch Assembly

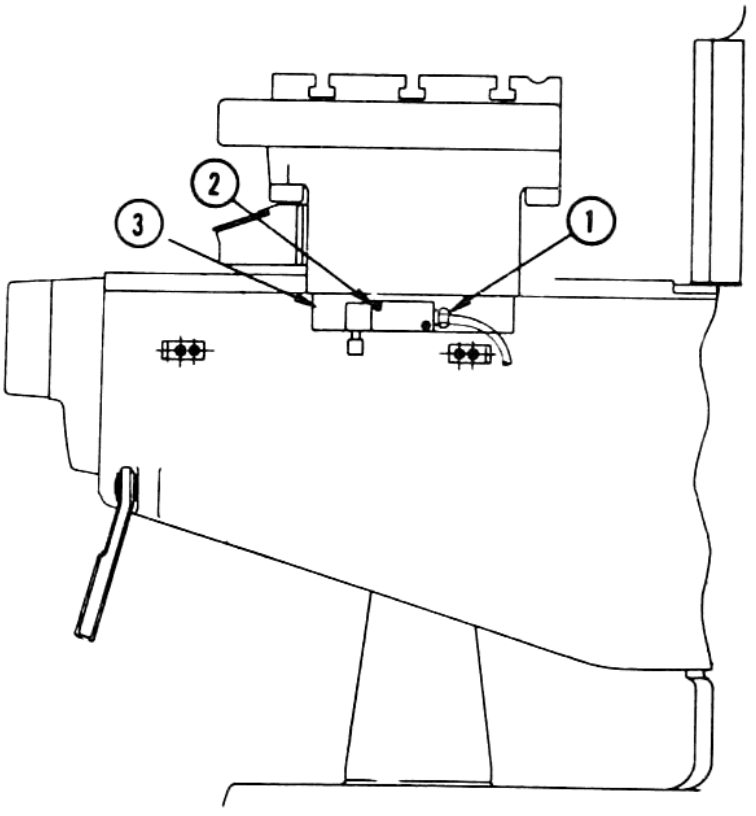


Figure 10-7 Y-Axis Limit Switch Installation

10.6 TABLE AND SADDLE

10.6.1 Removal of the Table—Figure 10-8

1. Move the table to the extreme right position.
2. Turn OFF the power.
3. Remove the left hand and right hand way guards (1) (2).
4. From underneath the left end of the table, remove the four screws that secure the ballnut. After removing the lubrication tube from the ballnut flange, back the nut off to clear the mounting bracket by rotating the screw.
5. Remove the LH end bracket.
6. Loosen the table gib mounting screws and remove the gib (3, Figure 3-9).
7. Remove the front and rear hold-down straps (4) by removing the securing screws.

NOTE

Set the torque to 120 in. lb. on reassembly.

8. Disconnect the lube system hose from the left rear side of the table.
9. Disconnect the flood coolant system return hoses, if this option is incorporated in the system.
10. Support the table with a sling and lift it off the saddle.

CAUTION

Lift the table slowly to avoid damaging the ballscrew shaft. The shaft must pass through an opening at the bottom of the ballscrew nut bracket. The table will come clear with the ballnut bracket still attached.

10.6.2 Removal of the Saddle—Figure 10-9

Remove the table by following the instructions in Section 10.6.1, then proceed as follows.

1. Move the saddle as far forward on the knee as possible.
2. Turn OFF the power.
3. Loosen the screws and free the rear knee way apron from the saddle.
4. Unscrew the knurled nuts and disconnect the power lines to the two limit switches (1 and 2, Figure 10-9) on the rear of the saddle. Remove the clips and free the lines.
5. Disconnect and remove power line (3) to the X-axis drive motor under the left side of the saddle.
6. Disconnect and remove the lube lines (4) from the left rear of saddle.
7. Remove the setscrew (19, Figure 10-10) in front of the saddle-knee way and slide the chip guard (20) forward to expose the ballnut bracket (21).
8. Remove the screws (28) that secure the ballnut.
9. Loosen the securing screws and remove the left and right saddle hold down straps (5 and 6, Figure 10-9).

NOTE

Torque on reassembly to 33 ft. lb.

10. Attach a sling to the saddle and lift it carefully off the knee ways.

NOTE

The Y-axis lead screw will remain in the knee.

10.7 MANUALLY OPERATED KNEE DRIVE

10.7.1 Dial Replacement—Figure 10-10

1. Turn OFF the power.
2. Loosen the screw (1), that holds the knee elevating crank (2) to its shaft.
3. Remove the crank and washer (3).
4. Loosen the setscrew (4) in the knee elevating clutch (5) and remove the clutch, clutch cover (6) and key (7) from the shaft.
5. Slide the dial (8) off the shaft.
6. Install the new dial and follow the above steps in reverse order.

10.7.2 Elevating Crank Shaft Removal—Figure 10-10

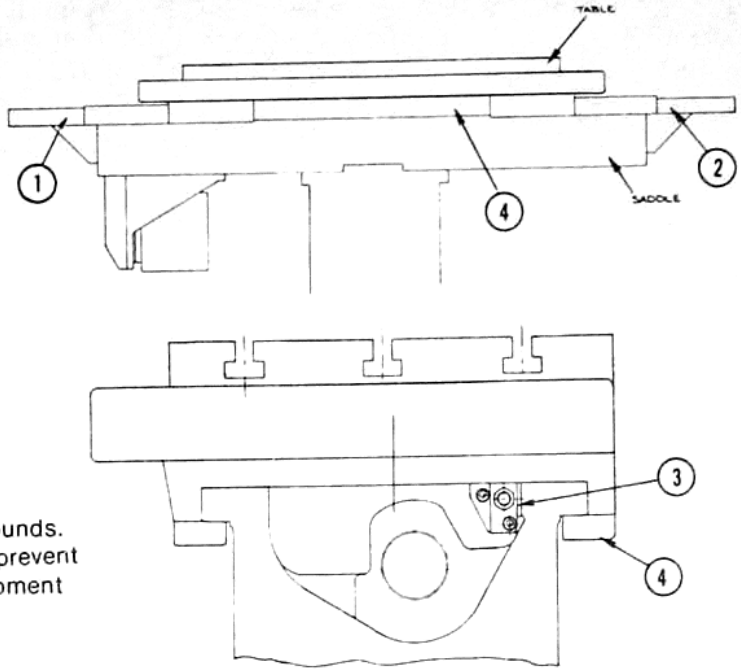
1. Follow the above procedure to remove the dial.
2. Remove the three screws (9) to release the knee elevating shaft bracket (10).
3. Withdraw the knee elevating crank shaft from the knee.

10.7.3 Knee Elevating Screw Replacement—Figure 10-11

1. Support the knee with a chain hoist or floor jack. A bearing rib is provided inside of the knee for the use of a jack.
2. Remove the knee lock shaft cover from the left side of the knee.
3. Through the opening provided, remove the hex head jam nut (1) and the bearing washer (2) from the top of the elevating screw.
4. Lift the knee up slowly to its maximum travel.
5. Lock the knee in place.

NOTE

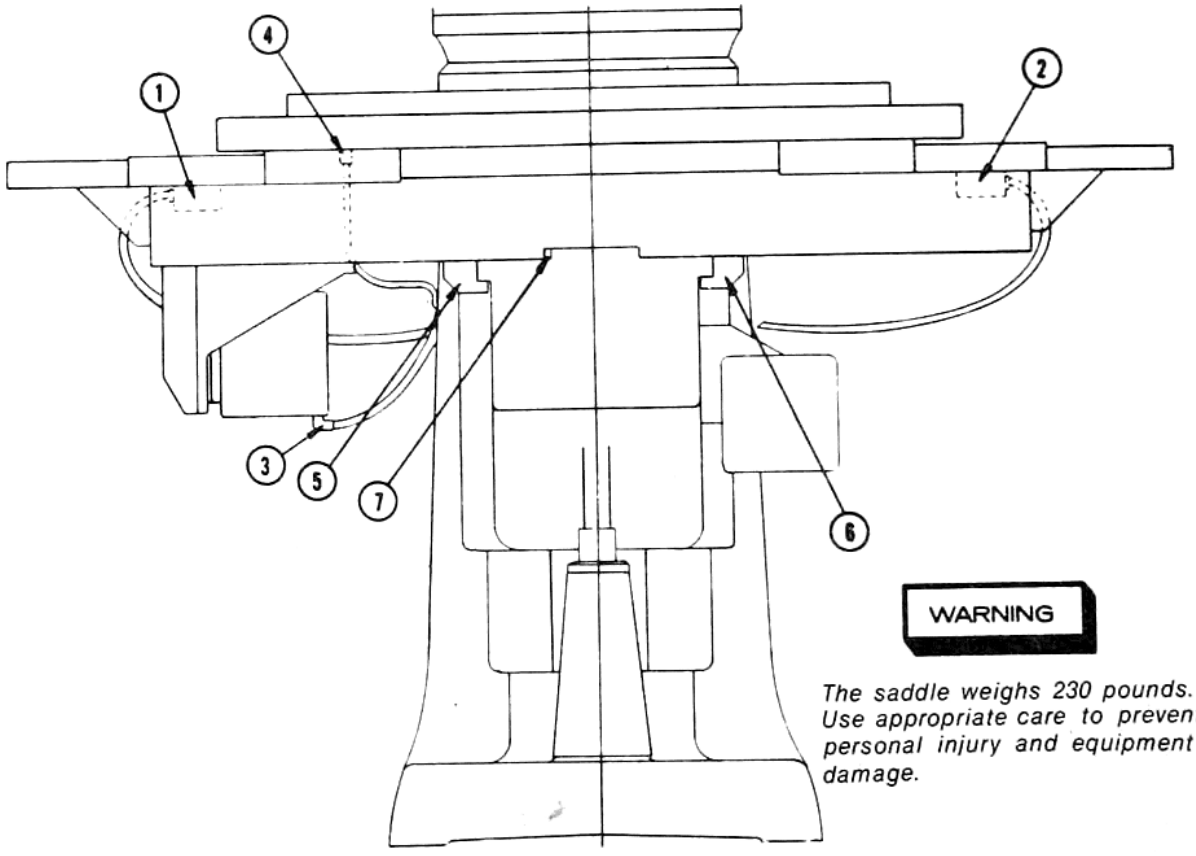
In lifting the knee, the knee elevating screw will slide out of the bearing and bevel gear assembly. The bearing cap (10), bearing (11) and bevel (12) should remain intact in the knee.



WARNING

The table weighs 432 pounds. Use appropriate care to prevent personal injury and equipment damage.

Figure 10-8 Table Removal and Installation



WARNING

The saddle weighs 230 pounds. Use appropriate care to prevent personal injury and equipment damage.

Figure 10-9 Saddle Installation

6. Loosen the securing screws (13) and remove the knee elevating lead screw nut (14).
7. Remove the lube line from the knee elevating lead screw nut.
8. Lift the elevating screw out of the pedestal, pulling it upward and forward.

NOTE

Once the elevating screw is mounted on the pedestal, you can replace the bearing assembly manually by either raising the screw or lowering the knee.

10.7.4 Cylinder and Pedestal Replacement—Figure 10-11

NOTE

Since the cylinder is required to be air tight, the cylinder sleeve (1) is considered an integral part of the pedestal assembly which is removed as a unit.

1. Turn OFF the power.
2. Raise the knee to a sufficient height (not total travel) to allow access to the pedestal and leadscrew.
3. Hold the knee in place with a chain hoist or other suitable means to prevent it from dropping when air is discharged from the cylinder.
4. Disconnect the air hose (2) to the cylinder and lube lines at the top of the pedestal.
5. Loosen and remove the screws that secure the nut (3).
6. Remove the screws (4) to free the nut mount (5).
7. Hoist the knee to full travel height and pull the assembly (6) out of the pedestal along with the packing cup (7), packing retainer (8), bumper (9) thrust bearing (10) and bearing retainer (11).
8. Loosen and remove the two pedestal mounting screws (12).
9. Remove the pedestal and cylinder unit (13) from the column base.

10.7.5 Cylinder Gasket Replacement—Figure 10-11

1. Turn OFF the power.
2. Raise the knee to a height sufficient to allow working area underneath. Support the knee with the hoist or blocks.
3. Remove the pedestal mounting screws (4).
4. Lift the pedestal assembly to maximum height to clear the column and support it in that position.
5. Remove the securing screws (1) and the cylinder bottom cover (2).
6. Remove and replace the cylinder cover gasket (3).

10.7.6 Packing Cup Replacement—Figure 10-11

Follow the instructions for cylinder and pedestal replacement (Section 10.7.4, steps 1 through 6 only) then proceed as follows.

1. Turn OFF the power.
2. Loosen and remove the packing retainer securing screws (5).
3. Remove the packing retainer (6).
4. Remove the packing cup (7). Replace with Bridgeport Code No. 2-65-7121 only.

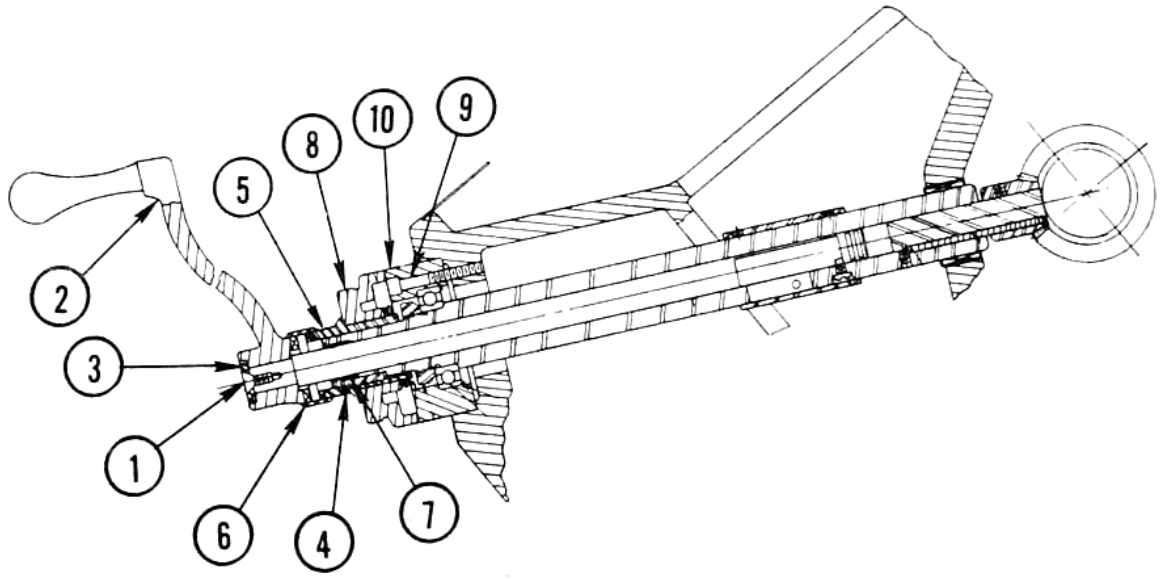


Figure 10-10 Knee Elevating Crank Assembly

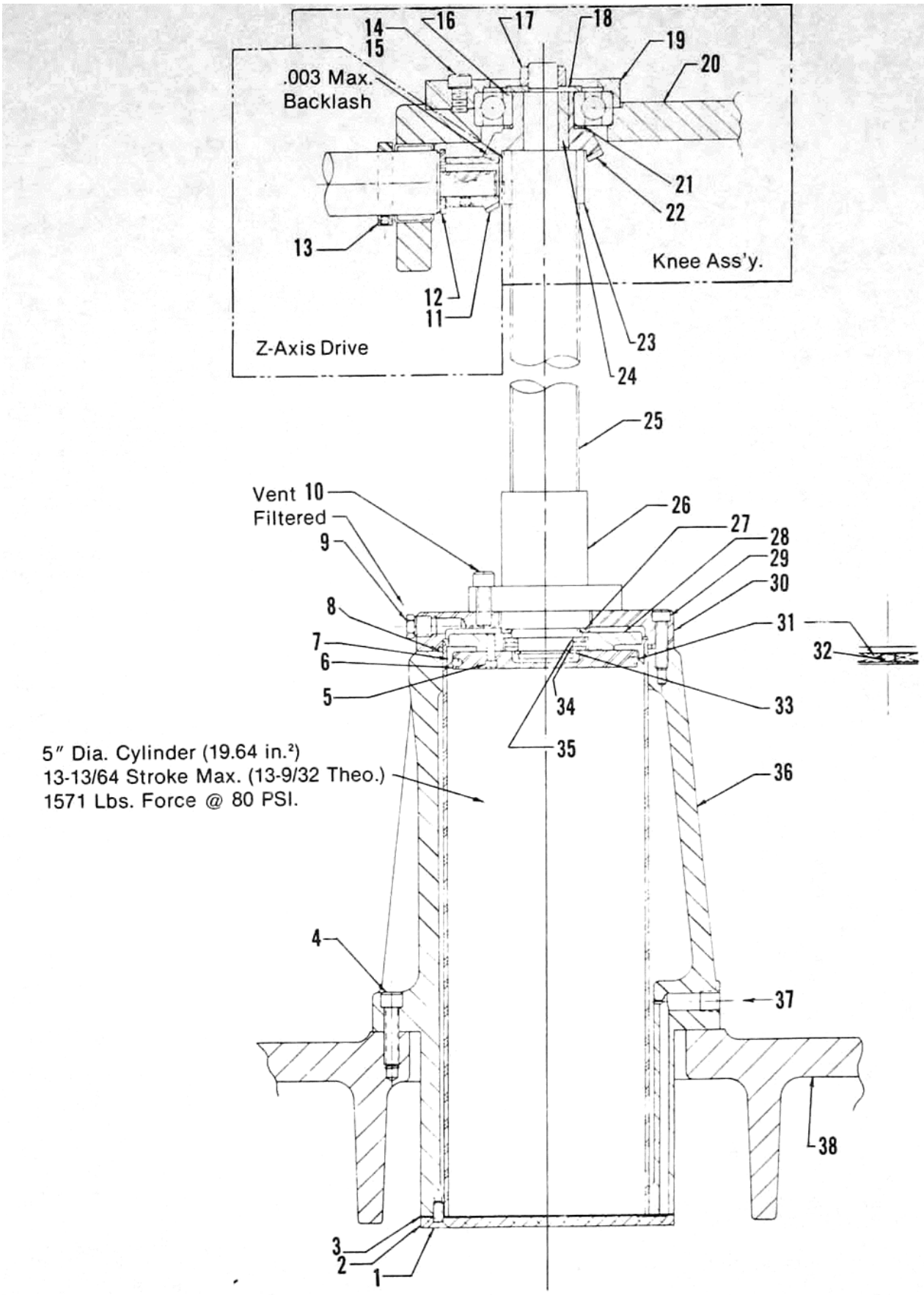


Figure 10-11 Z-Axis Pedestal and Cylinder

10.7.7 Leadscrew Bearing (Cylinder End) Replacement—Figure 10-11

Complete steps 1 through 6, Section 10.7.4, (Cylinder and Pedestal Replacement), then proceed as follows:

1. Turn OFF the power.
2. Loosen and remove the packing retainer screws (5) but do not remove the packing cup (7).
3. Remove the snap ring (33).
4. Using the bearings retainer as a lever, pull the bearing (16) and thrust washers (19) off the leadscrew assembly.

10.7.8 Leadscrew and Nut Replacement—Figure 10-11

1. Turn OFF the power.
2. Raise the knee to a sufficient height to provide working space underneath.
3. Support the knee with a chain hoist or blocking to prevent it from falling when the air in the cylinder is released.
4. Loosen and remove the hex jam nut (17) at the top of the leadscrew. Also remove the washer (18) from the knee elevating screw bearing.

NOTE

The knee elevating screw bevel gear (22) and pinion gear (11) will remain in the knee.

5. Loosen and remove the screws (30) that secure the nut mount.
6. Raise the knee to full travel height, pulling the upper portion of the leadscrew assembly down through bevel gear.
7. When the leadscrew assembly is free of the knee and bevel gear at upper end, turn it a few times manually until about two inches of screw have entered the cylinder.
8. Pull the leadscrew assembly upward and tilt it forward to clear the pedestal.

NOTE

At this point, the leadscrew assembly still has parts attached which must be removed.

9. Loosen and remove the screws (5) that secure the retainer.
10. Release the leadscrew from subassemblies and replace it. Do not remove the screw nut (26) from the screw.

NOTE

While replacing the screw and air cylinder, take care to avoid damage to the edges of the packing cup.

10.7.9 Vertical Greaser Retainer Replacement—Figure 10-11

Raise the knee to its full height with the hoist. Apply knee-to-column binders to lock the knee in position. Place blocks under the knee as a precaution. Turn OFF the power and proceed as follows.

1. Remove the hex jam nut (17) along with the elevating screw bearing washer (18).
2. Remove the bearing cap screws (14) and washers (15).
3. Remove the bearing (16) and knee elevating screw bevel gear (22) and bevel gear spacer (21).
4. Remove the bevel gear key (24) from the shaft.
5. Manually turn the screw (25), lowering it into the pedestal assembly.

NOTE

At this point, the knee elevating screw is free of the knee. The knee elevating screw (29) must also be removed to allow replacement of grease retainer.

10.7.10 Knee Removal—Figure 10-12

After removing the table and saddle (Sections 10.6.1 and 10.6.2) remove the knee using the following procedure:

CAUTION

The knee must be supported by a hoist during the removal procedure. This will prevent damage to the column ways and personal injury.

1. Turn OFF the power.
2. Remove the rear knee chip guard to expose the elevating screw bearing locknut which secures the knee to the elevating screw and pedestal.
3. Disconnect the lubrication line from the left side of the knee.
4. Disconnect the electrical cables to the drive motors and the limit switches.
5. Remove the lube line from elevating screw nut at the top of the pedestal.
6. Remove the hex nut (1) from the top of the knee elevating shaft.
7. Remove the knee binders (2), gibs (3) and clamps (4) from knee-to-column ways.

NOTE

The knee is now free and ready to be removed. Lifting the knee upward will leave the pedestal and elevating screw on the column pad.

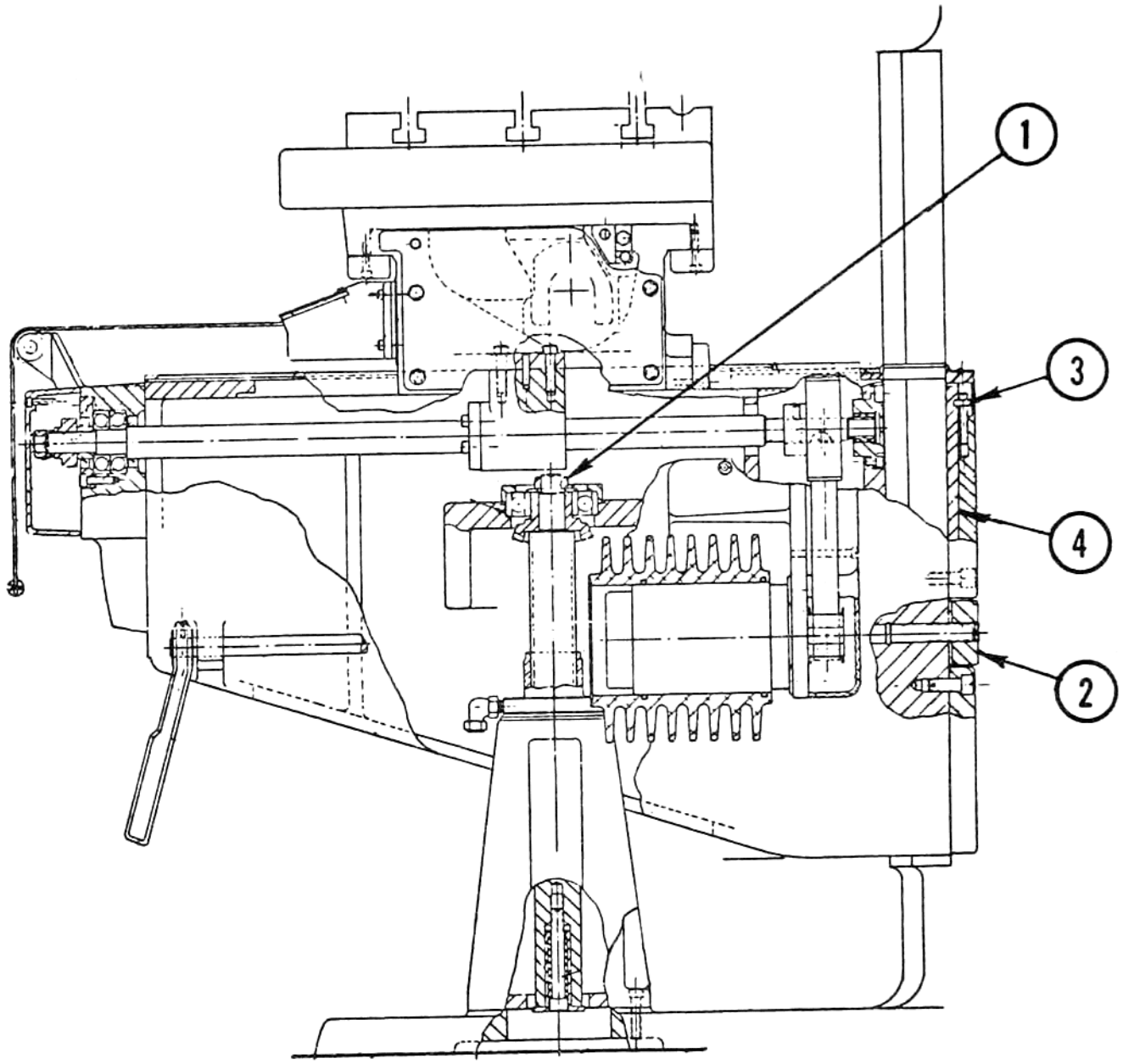


Figure 10-12 Removal of Knee

SECTION 11
HEAD ASSEMBLY

11.1 INTRODUCTION

The procedures that follow are Level 1 maintenance procedures unless otherwise noted. Refer to Figure 80-0011 for a drawing of the complete assembly and referenced parts in Section 14.

11.2 LUBRICATION

All the bearings and gears in the head are lubricated for life. The bearings and quill feed pinion are lubricated with BRB lifetime grease and the back gears with Sunoco No. 741 E.P. grease or Mobil Lux No. 1 E.P.

The automatic lubrication system that lubricates the table, saddle and knee also lubricates the ball quill extension. Fill the reservoir, located on the left side of the column, periodically with Sunoco Waylube No. 1180 or equivalent.

11.3 HEAD REMOVAL

1. Turn OFF the power to the machine and remove the electrical cable from the motor. Do this at the motor by removing the cover of the electrical connection box and disconnecting the wires. Be sure to label the wires properly to insure correct reassembly.
2. Remove the four bolts (77-0216) that secure the control box (77-0191) to the head. Place the control box (11-0191), still connected to its cable, out of the way.
3. Remove four screws (1-01-1035) and remove the front cover (77-0160).

NOTE

Oil is likely to drop out from under the cover (77-0160). This oil should be discarded and need not be replaced upon reassembly.

4. Disconnect the wires from the microswitches.

NOTE

Refer to the wiring diagram for reassembly.

5. Remove two screws (1-01-1044) and (1-01-1040) and put the cover (77-0166) out of the way.
6. Locate the nylon tubing that comes out of the back of the ram and disconnect it from the Bijur lubricator and its hose clamp.
7. From under the previously removed cover (77-0166), pull the nylon tubing through the ram, coil and tie.

NOTE

To rethread the nylon tubing, remove the name plate on each side of the ram.

8. Remove the quill feed motor. Refer to section 11.4.2, steps 1 through 10.

NOTE

The head should now be clear of all electrical connections.

9. Attach the head lifting tool (Figure 11-1) to the belt housing bearing cap (2-18-0094) using three 1/4-20 X .750 screws. The loop in the lifting tool should be over the center of gravity of the head.

NOTE

Figure 11-1 provides instructions for field fabrication of the head lifting tool.

10. Support the head by an overhead hoist through the loop of the lifting tool.
11. Remove the remaining four bolts that secure the head to the ram.
12. After reassembly, set or adjust the following:
    1. Home switch. Refer to Section 11.6.1.
    2. Deceleration switch. Refer to Section 11.6.2.
    3. Bottom position switch. Refer to Section 11.6.3.
    4. Quill drive belt. Refer to Section 11.5.3.
    5. Quill feed counter. Refer to Section 11.5.1.

11.4 POWER TRANSMISSION

11.4.1 Resetting the Speed Control

Excess wear on the Vari-Drive belt will cause a slight increase in actual speed as compared to that shown on the dial. The speed control can be reset by the following procedure.

1. With the spindle rotating, turn the variable speed control snugly against the high speed stop (4200 reading on the dial). Loosen the jam nut (1-01-1745) and turn the adjusting screw (2-18) at the top of the head. Using a tachometer, set the spindle speed at 4200 R.P.M. Tighten the jam nut.
2. Loosen the acorn nut (1-01-1765) in the center of the speed dial (1-18-2890) and reposition the dial to match the tachometer reading. Tighten the acorn nut.

NOTE

When the belt is worn to the extent that accurate speed adjustment is no longer possible, the belt must be replaced. Refer to section 11.4.3.

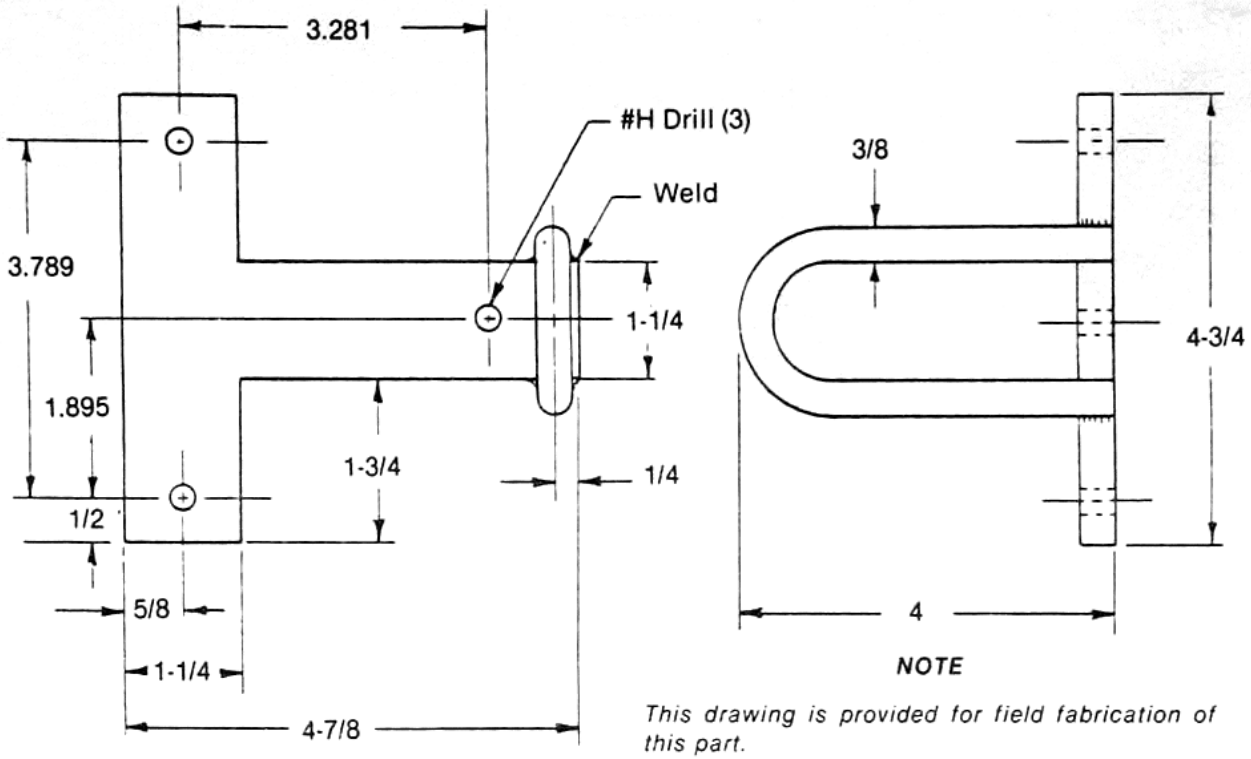


Figure 11-1 Special Tool ST-6921 Head Lift Bracket

11.4.2 Motor Removal

1. With the motor running, adjust the variable speed control to the top of the speed range. Adjust the speed changer into the red zone until the mechanical stop in the speed changer is reached. This adjustment may be made in either the high or low speed range. The variable speed belt is now in the proper position for motor removal.

NOTE

It is essential to adjust the speed range before proceeding to step 2.

2. Shut down the motor.
3. Turn OFF the power to the machine and remove the electrical cable from the motor.
4. Remove the head. Refer to section 11.3.
5. Remove the motor pulley cover (77-0195).
6. Refer to section 11.3 for the remaining motor removal procedure. Start with the note in step 5 and proceed through the end of the section.

NOTE

If step (1) was done correctly the drive belt (1-18-2120) will ride towards the outside edge of pulleys (2-77-0182 and 2-55-0005). If this condition does not exist, reassemble the head and correctly perform step No. 1.

7. Remove the retaining ring (1-01-0880).
8. Loosen the socket setscrew (1-01-1222) and remove the pulley (2-77-0182). Be prepared for the pulley to spring up approximately one half inch when the socket setscrew is loosened.
9. Compress the lower pulley (2-77-0182) on the motor shaft until the pressure is relieved from the retaining ring (77-0084) and remove the ring. Lift the lower pulley (2-55-0005), compression spring (1-18-2083) and the collar (2-55-0003) off the motor shaft.

WARNING

The motor weighs approximately sixty pounds. Take appropriate precautions to prevent equipment damage and possible personal injury.

10. Support the motor and remove the two screws (1-01-1150) that secure the motor to the variable speed housing. Remove the motor from the housing.
11. Reassemble by reversing the disassembly procedure. The retaining ring (77-0084) is easily damaged on removal and may need replacement. You may have difficulty assembling the pulley (2-77-0182). First work the belts as far toward the center of the driven pulleys (2-18-0081 and 2-18-0082) as possible. Next, work the belt as far as possible toward the periphery of the drive pulleys (2-77-0182 and

2-55-0005). With hand pressure and a small plastic mallet, lower the pulley (2-77-0182) until the retaining ring (1-01-0880) can be assembled. Trammel the spindle after reassembly. Refer to Installation Manual.

11.4.3 Vari-Drive Belt Replacement

1. With the motor running, adjust the variable speed control to the top of the speed range. Adjust the speed changer into the red zone and until the mechanical stop in the speed changer is reached. This adjustment may be made in either the high or low speed range.
2. Shut down the motor.
3. Disconnect power to the machine.
4. Remove the motor pulley cover (77-0195).
5. Remove the retaining ring (1-01-0880).
6. Loosen the socket setscrew (1-01-1222) and remove the pulley (2-77-0182). Be prepared for the pulley to spring up approximately one half inch when the socket setscrew is loosened.
7. Remove the top bearing cap (2-18-0094), two screws (1-01-1125) and two bushings that secure the speed changer plate (2-18-0058) to the bearing housing (2-18-0056).
8. Remove the two screws (1-01-1037) under the speed changer dial (1-18-0033) that secure the speed changer housing (77-0170) to the belt housing base (77-0163).
9. Remove the screws (two 1-01-1069, three 1-01-1065) securing the belt housing (77-0164) to the belt housing base (77-0163). The belt housing is now held in place by two taper pins (1-18-0107).
10. Lift the belt housing, with the speed changer bracket attached, off the taper pins and separate it from the belt housing base. To facilitate this step, tap upward on the speed changer housing (77-0170) with a plastic mallet. Several blows may be necessary to loosen the two housings.
11. Remove the old belt and replace it with a new one.

Only replace with a belt purchased from a Bridgeport dealer. A wrong belt may cause vibration and overheating.

12. Reassemble by reversing the disassembly procedure. You may have difficulty when assembling the pulley (2-77-0182). First work the belt as far toward the center of the driven pulleys (2-18-0081 and 2-18-0082) as possible. Next, work the belt as far as possible toward the periphery of the drive pulleys (2-77-0182 and 2-55-0005). With hand pressure and a small plastic mallet, lower the pulley (2-77-0182) until the retaining ring (1-01-0880) can be assembled.

11.4.4 Timing Belt Replacement

1. With the motor running, adjust the variable speed control to the top of the speed range. Adjust the speed changer into the red zone until the mechanical stop in the speed changer is reached. This adjustment may be made in either the high or low speed range.
2. Shut down the motor.
3. Lower the quill.
4. Disconnect power to the machine.
5. Remove the motor pulley cover (77-0195).
6. Remove the retaining ring (1-01-0880).
7. Loosen the socket setscrew (1-01-1222) and remove the pulley (2-77-0182). Be prepared for the pulley to spring up approximately one half inch when the socket setscrew is loosened.
8. Compress the lower pulley (2-55-0005) and remove the retaining ring (77-0084).

NOTE

This retaining ring is easily damaged and may need to be replaced.

9. Lift the lower pulley compression spring (1-18-2083) and the collar (2-55-0003) off the motor shaft.
10. Put the HI-NEUTRAL-LO lever on the right side of the head in the LO position.
11. Remove the two lower screws (1-01-1037) in the speed changer housing (77-0170).
12. Remove the two screws (1-01-1056) and three screws (1-72-1060) holding the belt housing base (77-0163) to the gear housing (77-0162). There are two taper pins still holding these parts together. To facilitate this step, tap upward on the speed changer housing (77-0170) with a plastic mallet. Several blows may be necessary to loosen the two housings.
13. The two upper screws (1-01-1037) on the speed changer housing should be loosened after the belt housing has been loosened from the gear housing.
14. Gently disengage the timing belt (1-55-2106) from the pulley (1-55-0012) as the belt housing is being raised.
15. Remove the old belt and replace it with a new one.
16. Reassemble by reversing the disassembly procedure. You may have difficulty assembling the pulley (2-77-0182). First work the belt as far toward the center of the driven pulleys (2-18-0081 and 2-18-0082) as possible. Next, work the belt as far as possible toward the periphery of the drive pulley (2-77-0182 and 2-55-0005). With hand pressure and a small plastic mallet, lower the pulley (2-77-0182) until the retaining ring (1-01-0880) can be assembled.