SECTION V

BASE ASSEMBLY ADJUSTMENT AND MAINTENANCE

(refer to Drawing 77-0002 included as Figure 5-6 at the end of this section)

5.1 X and Y Axis Counters

5.1.1 X-axis Counter Belt Replacement -

1. Remove the table; refer to section 5.5.1.

2. Remove two screws (1-01-1194) and lift the X-axis counter cover (77-0261) off the saddle.

3. Loosen two screws (1-01-1034) to relieve the tension on the counter pulley belt and lift the belt off the counter pulley (1-77-0057).

NOTE

One of the screws may need removal.

4. Lift the counter belt (1-77-0277) off the counter drive pulley (77-0042) and over the inside of the ball screw.

NOTE

Due to casting tolerances, the belt may not be easily removed. If this occurs, remove the X-axis ball screw assembly; refer to section 5.3.1.

5. Install a new belt by reversing the disassembly procedure.

6. Set belt tension; refer to section 5.1.2.

7. Adjust the X-axis counter; refer to section 5.1.3.

5.1.2 X-Axis Counter Belt Adjustment -

1. Remove two screws (1-01-1194) and lift the X-axis counter cover (77-0261) off the saddle.

2. Loosen two screws (1-01-1034) to relieve the tension on the counter pulley belt (1-77-0277).
3. Pull or push on bracket (77-0263) until desired tension is obtained.
4. Hold bracket firmly in place and tighten the two securing screws (1-01-1034).
5. Replace the counter cover (77-0261).
6. Check the X-axis counter adjustment; refer to section 5.1.3.

5.1.3 X-Axis Counter Adjustment –

NOTE

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

1. Remove two screws (1-01-1194) and remove the counter cover (77-0261).
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 set screws on coupling (77-0087) and adjust the counter to read 9.000 inches.
4. Tighten the two set screws and install cover (77-0261).

5.1.4 Y-Axis Counter Replacement –

The Y-axis counter is driven by two miniature spur gears and requires only minimal maintenance. To remove the counter (1-65-3746) proceed as follows:

1. Remove four screws securing the plexiglass cover (77-0027) to the housing cover (77-0019).
2. Remove four screws securing the counter mounting bracket (77-0068) to the housing cover. Lift the bracket with the counter attached out of the housing cover.
3. Remove four screws (1-01-1001) and separate the counter (1-56-3746) from the counting bracket (77-0068).
4. To replace the counter reverse the above procedure.

Installation Note

The small split gear (1-65-2240) on the counter shaft is spring loaded to eliminate backlash. When installing the counter, wind half of the split gear to apply tension to the springs (1 or 2 teeth), line up the teeth on the two halves, and mesh with the large gear on the end of the ball screw. Refer to section 5.1.5 for proper adjustment of the Y-axis counter.

5.1.5 Y-Axis Counter Adjustment

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. Remove four screws (1-65-1201) and remove cover (77-0027).

4. Loosen clamp (1-65-2320), zero the counter and tighten the clamp.

5. Install cover (77-0027).

5.2 X and Y Axis Drive Motors

5.2.1 X-Axis Drive Belt Replacement

1. Position the table fully to the left side of the machine.

2. Disconnect power to the machine by throwing the main
circuit breaker to the OFF position.

3. Remove the nut (1-01-1715) and washer (1-77-0151) from the end of the ball screw.

4. Slide the table by hand, to the right, approximately 3 1/2 inches or until the table end bracket clears the end of the lead screw (77-0014).

5. Compress the ball screw cover (1-77-0064) and tie it in the compressed position with a piece of wire.

6. Remove the cover from the ball screw.

WARNING

Do not release the cover from its compressed position! If the cover is released, it will spring open and may cause personal injury.

7. Remove key (1-01-3078) and washer (77-0758 V-Ram or 77-0047 R-Ram) from the end of the ball screw.

8. Remove two screws (1-65-1199) securing the cover (77-0022) to the mounting bracket (77-0016).

9. Support the drive motor, remove four screws (two 1-63-1061 and two 1-01-1055) and remove the drive motor, with the drive pulley attached, from the mounting bracket (77-0016).

10. Remove the X-axis ball screw drive belt (1-77-0063) from the lead screw.

11. Install a new belt by reversing the disassembly procedure.

12. Set the proper belt tension; refer to section 5.2.2.

5.2.2 X-Axis Drive Belt Adjustment

1. Position the table fully to the right side of the machine.

2. Shut down the machine per normal procedure. Compress the lead screw cover (1-77-0064) and tie it in the compressed position with a piece of wire. Move to the right side of the ball screw.
WARNING

Do not release the cover from its compressed position! If the cover is released, it will spring open and may cause personal injury.

3. Remove two screws (1-65-1199) securing the cover to the mounting bracket (77-0016). Move the cover to the right side of the ball screw. The belt will now be exposed.

4. Loosen, but do not remove, the four screws (two 1-63-1061 and two 1-01-0155) securing the drive motors to the mounting bracket (77-0016).

5. Set the belt tension. Pulling the motor downward will increase the tension, lifting the motor upward will decrease the tension.

6. The belt should have a tension of 93 pounds or should deflect, in the middle on one side, 3/32 inch with 7 pounds force applied.

7. Tighten the four motor mounting screws when the proper tension is obtained.

5.2.3 X-Axis Drive Motor Replacement -

WARNING

Disconnect power to the machine by throwing the main circuit breaker to the OFF position before beginning this procedure.

1. Remove four screws and remove the plate on the back of the stepping motor.

2. Disconnect the electrical wiring and remove the cable from the motor.

3. Support the motor, remove four screws (two 1-63-1061 and two 1-01-1055) and remove the drive motor, with the drive pulley attached, from the mounting bracket (77-0016).

4. Remove drive pulley (1-77-0260) and drive pulley bushing (1-65-5068) from the motor shaft.

5. Install replacement motor.
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CAUTION

1. The motor, complete with heat sink, should remain in one piece, since the annular gap between the motor outside diameter and the heat sink inside diameter between O-rings is filled with silicone grease.

2. The magnetic characteristics of the motor are destroyed if the armature is removed.

6. After the motor is installed set the proper to belt tension; refer to section 5.2.2.

5.2.4 Y-Axis Drive Belt Replacement -

WARNING

Disconnect all power to the machine before beginning this procedure.

1. Remove Y-axis counter; refer to section 5.1.4.

2. Support the housing cover (77-0019), remove three screws (1-01-1030) and lift the housing cover from the housing (77-0018).

3. Loosen, but do not remove, the four screws (1-01-1143) securing the drive motor to the housing (77-0018).

4. Remove the belt (1-65-2117) from the drive and driven pulleys.

5. Install the new belt.

6. Set the belt tension. Per steps 4-6 of 5.2.5 below.

7. Tighten the four motor mounting screws when the proper tension is obtained.
5.2.5 Y-Axis Drive Belt Adjustment -

**WARNING**

Disconnect all power to the machine before beginning this procedure.

1. Remove Y-axis counter, per section 5.1.4.

2. Support the housing cover (77-0019), remove three screws (1-01-1030) and lift the housing cover from the housing (77-0018).

3. Loosen, but do not remove, the four screws (1-01-1143) securing the drive motor to the housing (77-0018).

4. Set the belt tension. Pulling the motor downward will increase the tension; lifting the motor upward will decrease the tension.

5. The belt should have a tension of 93 pounds or should deflect, in the middle, on one side, 1/8 inch with 7 pound force applied.

6. Tighten the four motor mounting screws when the proper tension is obtained.

5.2.6 Y-Axis Drive Motor Replacement -

1. Disconnect power to the machine by throwing the main circuit breaker to the OFF position.

2. Remove Y-axis counter; refer to section 5.1.4.

3. Support the housing cover (77-0019), remove three screws (1-01-1030) and lift the housing cover from the housing (77-0018).

4. Support the motor, remove four screws (1-01-1143) and remove the drive motor from housing (77-0018).

5. Remove the drive pulley (1-65-5086) and drive pulley bushing (1-65-5071) from the motor shaft.

6. Remove four screws and remove the plate on the back of the stepping motor.

7. Disconnect the electrical wiring and remove the cable from the motor.
8. Install replacement motor.

CAUTION

1. The motor, complete with heat sink, should remain in one piece since the annular gap between the motor outside diameter and the heat sink inside diameter between O-rings is filled with silicone grease.

2. The magnetic characteristics of the motor are destroyed if the armature is removed.

9. After the motor is installed set the proper belt tension, per section 5.2.5.

5.3 X and Y Axis Ball Screws

5.3.1 X-Axis Ball Screw Assembly Replacement -

1. Remove the table, per section 5.5.1.

2. Remove two screws (1-01-1194) and lift the X-axis counter cover (77-0261) off the saddle.

3. Loosen two screws (1-01-1034) to relieve the tension on the counter pulley belt and lift the belt off the counter pulley (1-77-0057).

NOTE

One of the screws may need removal.

4. Remove two screws (1-65-1199) securing cover (77-0022) to mounting bracket (77-0016) and remove the cover.

5. Support the drive motor, remove four screws (two 1-65-1063 and two 1-01-1055) and remove the drive motor, with the drive pulley attached, from mounting bracket (77-0016).

6. Remove the X-axis ball screw drive belt (1-77-0063) from the ball screw.

7. Remove four screws (1-01-1033) securing the bearing re-
tainer plate (77-0079) to the bracket (77-0016). Lift the bearing retainer plate (77-0079) off the ball screw.

NOTE
Do not disconnect the lube line attached to the bearing retainer plate. There is sufficient line outside of bracket (77-0016) to allow for its removal.

8. Remove ball screw cover (77-0046) from the left side of the saddle. This will expose the end of the ball screw.

9. Remove counter belt (1-77-0277) from drive pulley assembly (77-0042).

10. Tap with a plastic mallet on the end of the ball screw to remove the ball screw assembly from mounting bracket (77-0016).

11. To disassemble the ball screw assembly see section 5.3.2.

12. Install the ball screw by reversing the disassembly procedure.

NOTES

1. The two bearings (1-77-0060) are angular contact bearings and must be assembled in the same orientation as their disassembly. To do this line up the "V" marks on the outside diameter of the bearings.

2. The counter timing belt (1-77-0277) should be installed when the ball screw assembly is assembled to mounting bracket (77-0016).

13. Adjust the X-axis drive belt. See section 5.2.2.

14. Adjust the X-axis counter belt. See section 5.1.2.

15. Set the X-axis counter. See section 5.1.3.
5.3.2 X-Axis Ball Screw Disassembly -

1. Remove four screws (1-01-1189) on the outside flange of the counter pulley assembly. Lift the pulley flange (77-0041) off the pulley (77-0040) and ball screw. Slide the pulley off the ball screw nut. Note: Do not damage the locking "0" ring (1-98-0531) attached to the pulley.

2. Grip the screw lightly in the area of the pulley (77-0028) and, with a 2 inch to 4 3/4 inch adjustable hook spanner wrench, loosen and remove the locknut (1-77-0062).

3. Remove the drive pulley (77-0028), key (H-56), spacer (77-0080), bearing set (1-77-0060), and bearing seal (1-77-0078), from the ball screw.

4. To reassemble the lead screw assembly reverse the disassembly procedure.

NOTE

When installing the bearing set (1-77-0060) clean the diameters and orient to match the witness lines. This will provide the bearings with the proper direction of preload.

5.3.3 Y-Axis Ball Screw Removal -

1. Move the saddle fully to the out position (maximum distance from column).

2. Remove the table from the machine. See section 5.5.1.

3. Remove the Y-axis counter. See section 5.1.4.

4. Remove Y-axis drive belt. Refer to section 5.2.4, steps 1 through 4.

5. Support the Y-axis motor, remove four screws (1-01-1143) and remove the drive motor from housing (77-0018).

6. Loosen socket set screw (1-01-1207) and remove counter gear shaft (4H-2132), counter gear (1-77-0066) and clamp (1-65-2320) from the ball screw.

7. Remove drive pulley (1-65-5086) and bushing (1-77-0065) from the ball screw.

8. Remove the ball screw bearing locknut (1-20-1780) from
the ball screw.

9. Support housing (77-0018) and remove four screws (1-01-1077) securing the housing to the knee.

10. Remove the side cover plate (H-422) located on the rear left hand side of the knee.

11. Cut the lube line going to the Y-axis ball nut where it goes through the saddle. This line will have to be replaced on reassembly. Do not forget to use new ferrules in the fittings.

12. Loosen four screws (two 1-01-1074, and two 1-77-0252) an equal amount and tap on the head of each screw in an effort to lower the ball nut bracket (77-0020). The two pins (1-01-0727) will either remain with the saddle or the ball nut bracket. Continue the procedure until the pinned connection is loose.

13. Remove four screws (two 1-01-1074, and two 1-77-0252).

14. Lower the ball screw. See that the cut lube line does not hang up the ball screw.

15. Slide chip guards (1-77-1347, 1-77-1348) out from under the saddle.

16. Remove the Y-axis ball screw and ball nut bracket by lifting it out of the knee from behind the saddle.

17. Remove the two pins (1-01-0727) from the ball nut bracket and hold for reassembly.

NOTE
Do not remove nut bracket (77-0020) from the ball nut. Do not loosen four screws (1-01-1055) that secure the nut bracket to the ball nut, or necessary alignment will be lost. If a new ball screw is to be purchased, a new nut bracket will also be needed and will be supplied as part of the Y-axis ball screw assembly.

5.3.4 Y-Axis Ball Screw Installation -
NOTE

Due to the precise nature of the ball screw assembly, it should be handled with extra care so as not to destroy its alignment. Small nicks may result in major alignment problems. Never remove the nut bracket (77-0020) from the ball nut or misalignment will result.

1. Examine lead screw nut flange for a nylon ball which must plug a radial hole in the flange. There are two holes; the one to be plugged is on the right hand side viewed along the Y-axis from the front, with the ball return tubes on the bottom.

2. With the saddle in the full forward position, put the Y-axis ball screw assembly in the knee. The ball screw should enter the knee from the top behind the saddle.

3. Move the ball nut to the approximate center of the ball screw.

4. Position the saddle over the ball nut.

5. Lift the ball nut bracket up to the saddle mounting holes and install four screws (two 1-77-0252 and two 1-01-1074).

6. Tighten the four screws to a loose fit. The screws must be tight enough to accurately align the ball screw and loose enough to allow adjustment.

    NOTE

    Refer to section 5.5.2 for saddle removal.

7. Place a dial indicator on the way of the knee. Refer to Figure 5-1. Check for parallelism of the ball screw in the vertical plane relative to the ways of the knee. To bring this parallel adjustment into the required tolerance, remove the saddle from the knee and scrape the lower surface of the saddle which mates with the ball nut bracket.

    NOTE

    The saddle to knee gib must be temporarily set before measurements of parallelism may continue.
Figure 5-1. Y-Axis Ball Screw Alignment
8. With a .750 diameter gauge pin placed against the knee dovetail, place a dial indicator against the gauge pin and check for parallelism of the ball screw in the horizontal plane. The adjustment is provided for by the clearance holes in the saddle for the four mounting screws (two 1-77-0252, and two 1-01-1074). Adjust the ball screw until the tolerances are brought within the specifications given.

9. Tighten the four mounting screws and check for parallelism of the ball screw in both the vertical and horizontal plane. Correct any misalignment.

10. Drill and ream the two dowel pin holes to provide a light press fit for the next larger dowel pin size.

11. Install two temporary dowel pins. These dowel pins must be long enough to allow for easy removal. The temporary pins will be pulled out later.

12. Assemble the housing (77-0018) (with the ball screw bearings attached) onto the ball screw and fasten to the knee using four screws (01-1077). Tighten the four screws lightly. Do not lock the screws.

13. Assemble and tighten the bearing locknut (1-20-1780) onto the ball screw.

14. Float the housing (77-0018) on the face of the knee. To obtain the required alignment specifications, see Figure 5-2. Use the same alignment procedure as indicated in steps 7 and 8.

15. Tighten the four screws securing the housing (77-0018) to the knee and recheck the alignment.

16. Remove the two temporary pins and four screws securing the nut bracket to the saddle.

17. Slide the chip guards (1-77-1347, 1-77-1348) into the knee slot and under the saddle.

NOTE

The shorter guard (1-77-1347) is placed on top of the other guard (1-77-1348).
Figure 5-2. Y-Axis Ball Screw Alignment
18. Fasten the nut bracket (77-0020) to the saddle using four screws (two 1-77-0252, and two 1-01-1074) and two new pins. The new dowel pins should have a loose press fit to the saddle and ball nut bracket. The two pins must be flush or slightly below the top of the holes in the saddle. Lock the four screws (two 1-77-0252, and two 1-01-1074).

NOTE

Buy a new correctly shaped lubrication line from a Bridgeport Machines Distributor. Any effort to bend your own lubrication line will be frustrated by lack of space.

19. Install the ball screw nut lube line, from the lube manifold, located in the saddle cavity, through the saddle and into the ball screw nut flange hole.

20. Assemble the knee side cover plate (H-422).

21. To complete the assembly reverse steps 1 to 8 of the disassembly procedure. See section 5.3.3.

22. Set the saddle to knee gib. See section 5.8.3.

23. Set the saddle to table gib. See section 5.8.2.

24. Set the X and Y axes drive belt tension. See sections 5.2.2 and 5.2.5.

25. Set the X and Y axes trip dogs. See sections 5.4.1 and 5.4.3.

26. Set the X axis counter belt tension. See section 5.1.2.

27. Set the X and Y axes counters. See sections 5.1.3 and 5.1.5.

5.4 Limit Switch Replacement

5.4.1 X-Axis Trip-Dog Adjustment, (See Figure 5-3) -

NOTE

Perform the following operations before the trip-dog adjustment is made. The turret must
Figure 5-3. X-Axis Trip-Dog Adjustment

- Set table limit switch trip brackets to this travel
- MIN. TABLE OVER TRAVEL PAST TABLE LIMIT SWITCH TRIP BRACKET
- SPINDLE
- TABLE CENTER SLOT
- TABLE
- 9.010 TABLE TRAVEL LEFT
- 9.010 TABLE TRAVEL RIGHT
- .150 MIN.
be set square to the column. Check to see that the pointer on the turret lines up with the groove in the column. On the Rigid Ram machine there is no turret and the pointer is on the ram. The spindle should be properly trammed. Instructions are given in the Installation Manual, section 5.5.

1. Align the spindle center line with the table center slot.

2. Move the table (X-axis) in one direction a distance of 9.010 inches.

3. Set the table limit switch trip bracket to engage at this point.

4. Move the table in the same direction, overriding the limit switch a distance of .150 inches. This is done to insure that the lead screw positive stop is not within that distance.

5. Repeat steps 1 through 4 moving the table in the opposite direction.

NOTE

If the lead screw positive stop was hit when overriding the table limit switch .150 in either direction, then the spacer between the end of the table ball screw and the table end bracket must be changed. The V-Ram machine requires spacer number (77-0758), and the Rigid Ram machine requires spacer number (77-0047). The spacer thickness should be decreased if the lead screw positive stop was hit when the table was travelling to the left. A thicker spacer should be used if the lead screw positive stop was hit when table was travelling to the right.

5.4.2 X-Axis Limit Switch Replacement -

To remove the X-axis limit switch located at the front left hand surface of the saddle, turn off power and proceed as follows.

1. Unscrew the knurled nut on the electrical cable connector and disconnect the cable from the limit switch.
2. Remove two screws (1-01-1016), located on the left side of the saddle, which secure the limit switch mounting bracket to the saddle.

3. Remove two screws (1-01-1454) securing the mounting bracket (77-0050) to the limit switch (1-65-2653).

NOTE

After installation of the limit switch the table stop dogs must be reset. See section 5.4.1.

5.4.3 Y-Axis Trip-Dog Adjustment -

NOTE

Total travel between the limit switch trip dogs is a minimum of 12.000 inches. Total travel between the lead screw dog stops is a nominal 12.250 inches.

1. Move the saddle to the full back position (toward the column), override the limit switch and stop at the lead screw dog stop.

CAUTION

Do not feed in rapid traverse when stopping on the lead screw dog stop.

2. To determine the actual travel between the lead screw dog stops, indicate present saddle position. Move the saddle to its full forward position, stopping at the front lead screw dog stop. Measure the total travel of the saddle.

3. Take the total travel measured, and subtract 12.000 inches to get the total overtravel.

4. Divide the total overtravel by two and then subtract 0.010 inch to get the trip-dog overtravel.

5. From either lead screw dog stop position move the saddle the trip-dog overtravel distance.

6. Loosen two screws (1-01-1030) on the trip-dog (77-0052) located under the right side of the saddle.

7. Move the trip-dog against the limit switch roller until the switch just trips.
8. Hold this position and tighten the two screws (1-01-1030) securing the trip-dog to the saddle.

9. Move the saddle in the other direction 12.020 inches and set the second trip-dog to actuate the limit switch.

10. Check to see that the adjustment was done correctly by measuring the trip-dog overtravel and comparing it to the calculated value of the trip-dog overtravel.

11. Set the Y-axis counter adjustment. Refer to section 5.1.5.

5.4.4 Y-Axis Limit Switch Replacement -

To remove the Y-axis switch located on the upper right hand side of the knee, turn off power and proceed as follows.

1. Unscrew knurled nut on the electrical cable connector and disconnect the cable from the limit switch.

2. Remove the two screws (1-01-1463) which secure the limit switch to the knee.

NOTE

After installation of the limit switch reset the saddle (Y-axis) stop-dogs. See section 5.4.3.

5.5 Table and Saddle Removal

5.5.1 Table Removal -

1. Move the table to the left side of the machine.

2. Disconnect power to the machine by throwing the main circuit breaker to the OFF position.

3. Remove the nut (1-01-1715) and washer (1-77-0151) from the end of the ball screw.

4. Slide the table by hand to the right until the table end bracket clears the end of the ball screw (77-0014), or approximately 3 1/3 inches.
5. Compress the ball screw cover (1-77-0064) and tie the cover in the compressed position.

WARNING
Do not release the cover from its compressed position! If the cover is released, it will spring open and may cause personal injury.

6. Remove the cover from the ball screw.

7. Remove key (1-01-3078) and washer (77-0758 V-Ram, 77-0047 Rigid Ram) from the end of the ball screw.

8. Remove the table gib adjusting screw (H-88) and remove the gib (77-0049) from the table.

WARNING
The table weighs 330 pounds. Use appropriate care to prevent equipment damage and possible personal injury.

9. Support the table (77-0167) with an overhead hoist and slide it to the right until it clears the saddle.

10. After the table has been installed reset the table saddle gib. See section 5.8.1.

5.5.2 Saddle Removal —

1. Move the saddle to the full out position, (maximum distance from the column).

2. Remove the table from the machine. See section 5.5.1.

3. Remove the X axis ball screw assembly. See section 5.3.1.

4. Remove the Y axis drive belt. See section 5.2.4, steps 1 through 4.

5. Remove the Y axis ball screw assembly. See section 5.3.3.

6. Disconnect the lubrication line where it enters the saddle. Its location is on the left underside of the saddle.
7. Remove the X axis limit switch. Refer to section 5.4.2.

8. Remove the front way wiper cover 77-0037 from the saddle.

9. Remove the saddle to knee gib screw (H-88) and gib (H-131).

WARNING

The saddle weighs 135 pounds. Use appropriate care to prevent equipment damage and possible personal injury.

10. Support the saddle with an overhead hoist and slide it to the front until it clears the knee.

5.5.3 Saddle Installation -

1. Slide the rear way wiper cover (77-0037) over the knee to saddle ways.

2. Slide the saddle onto the knee.

3. Install and temporarily set the saddle to knee gib.

4. Slide the front way wiper cover (77-0208) over the knee to saddle ways.

5. Install the X axis limit switch. Refer to section 5.4.2.

6. Connect the lubrication line where it enters the saddle.

7. Install the Y axis ball screw. See section 5.3.4.

5.6 Knee Drive (Manual)

5.6.1 Dial Replacement -

1. Slide the knee crank handle (H-28) off its shaft (77-0031).

2. Pry the clutch (H-70) out from the knurled locknut
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(H-69) and remove it from the shaft.

3. Unscrew the locknut (H-69) and remove it.

4. Slide the dial (H-67) off the end of the shaft.

5.6.2 Crank Shaft Removal -

1. Remove the elevating dial. See section 5.6.1.

2. Remove three screws (1-01-1038) to release the bearing retainer (77-0036), thereby allowing the knee elevating crank shaft and bearing to be withdrawn from the knee.

5.6.3 Knee Removal -

CAUTION

The knee must be blocked up from underneath or supported by a hoist throughout this operation.

1. Remove the saddle. See section 5.5.3.

2. Remove the knee elevating crank. See section 5.6.2.

3. Remove the Y-axis limit switch. See section 5.4.4.

4. Remove the lube pump reservoir lines from the left side of the knee.

5. Reach in through the top of the knee and remove the hex head jam nut (1-01-1755), washer (2-06-0072), and gear (H-59) from top of the knee elevating screw (H-51).

NOTE

For the V-Ram machine proceed as indicated. For the Rigid Ram machine the head will have to be removed. The procedure is described in section 6.2.2. When the head has been removed, support the knee with an overhead hoist. Complete the procedure starting with step 6.

6. Loosen the four screws securing the turret to the top of the column. Do not remove these screws. Turn the ram
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and head to clear the area above the knee and attach a suitable sling and hoise to support and raise the knee.

7. Remove the way wiper covers (H-96, H-97) and wipers (H-99) to expose the knee-column gib.

CAUTION

Use care to avoid damage to the upper end of the knee elevating screw which remains on the column pad.

8. Remove the gib (H-87) by removing the adjusting screw (H-88).

9. Lift the knee upward off the knee-column ways.

5.6.4 Knee Elevating Screw Replacement -

1. Support the knee with a chain hoist or floor jack.

2. Remove the knee elevating crank shaft. See section 5.6.2.

3. Remove the cover plate (H-422) located on the left side of the knee.

4. Through this side opening, remove the hex head jam nut (1-01-1755), washer (2-06-0072) and gear (H-59) from the top of the elevating screw (H-51).

NOTE

In lifting the knee, the knee elevating screw will slide out of the bearing assembly. The bearing cover (H-53) and bearing (1-06-0205) should remain intact in the knee.

5. Lift the knee up slowly to its maximum travel.

6. Lock the knee in place.

7. Remove three screws (1-01-1033) securing the knee elevating lead screw nut (H-3) to the pedestal (06-0207).

8. Lift the elevating screw out of the pedestal, pulling it upward and forward.

5-24
5.7 Lubrication

5.7.1 X, Y, and Z Axes -

The table, saddle, and head quill are lubricated by an automatic system that operates whenever the spindle motor is running.

The oil reservoir and pump are located on the lower left side of the machine column.

A float switch in the oil reservoir prevents restart of the spindle if the oil level is too low.

NOTE

The float switch will not stop the spindle while it is running but will protect it against restarting without sufficient lubrication.

Oil distributors for the table and saddle are located inside the saddle and can be exposed by removing the table. For instructions on table removal see section 5.5.1. Oil distributors for the head quill are located on the left side of the column.

CAUTION

Use only Sunoco Waylube 80 or equivalent to ensure maximum effectiveness of the lubrication system.

All other moving parts such as bearings, gears, etc., are pre-packed with lifetime grease at the factory and should not require further servicing for their full service life.

5.7.2 Knee Lubrication -

The Knee ways are lubricated by automatic system from a distributor located inside the knee. External feeder hoses are attached to the left side of the knee. All bearings are greased for life.

5.8 X and Y Axis Gibs
5.8.1 Adjustment of Table and Saddle Gibs -

At the factory, all gibs are given an initial setting, the machine is cycled for approximately 50 hours and then the gibs are given a final setting. Therefore, they should not require readjusting if proper maintenance of the automatic lube system is provided. In the event that gib adjustment is required, however, proceed as follows.

5.8.2 Saddle to Table Gib Setting (See Figure 5-4) -

1. Set up indicators in position No. 1.

2. Push end of table and release. Pull end of table and release. Note the total indicator reading less the springback.

3. Adjust the gib, by turning the adjusting screw, to obtain a maximum indicator reading (less springback) of .0005 inch.

4. After the gib is set, move the indicator to position No. 2.

5. Push and pull on end of the table and note the total indicator reading (less springback).

6. Total indicator reading in position No. 1 (after gib is set) should equal the total indicator reading in position No. 2 within +/- .0002 inch. If not, remove and scrape the gib and repeat setting.

5.8.3 Saddle to Knee Gib Setting (Figure 5-5) -

1. Move the saddle to position No. 1 and set up indicator.

2. Push the end of the table and release. Pull the end of the table and release. Note the total indicator reading, less springback.

3. Adjust the gib, by turning the adjusting screw, to obtain a maximum indicator reading (less springback) of .0005 inch.

4. After the gib is set, move the saddle to position No. 2 and set up the indicator.
Figure 5-4. Saddle-To-Table Gib Setting
Figure 5-5. Saddle-To-Knee Gib Setting
5. Push and pull on the end of the table and note the total indicator reading (less springback).

6. The total indicator reading in position No. 1 (after the gib is set) should equal the total indicator reading in position No. 2 within +/- .0002 inch. If not, remove and scrape the gib and repeat the setting.

5.8.4 Knee to Column Gib Setting -

1. Remove the way wiper cover (H-96) and wiper (H-99) to expose the knee to column gib.

2. Using the crank handle, raise and lower the knee and turn the adjusting screw (H-88) until a smooth movement is attained.
Figure 5-6. Series I CNC Base Assembly
VIEW C-C

H-905 STRAP

77-031 COVER

SADDLE TO TUBE PIPE LENGTH — 18'-32'
SADDLE TO PIPE RIFS. WIDTH — 18'-19'1/2
SADDLE TO PIPE RIFS. LENGTH — 18'-22'

NOTE:
FOR TABLE TRAVEL SETTINGS
SEE DRAWING 77-025 C.

SPECIFICATIONS:
TABLE TRAVEL — 10' X 15'
HORIZONTAL TRAVEL — 18'
CROSS TRAVEL — 12'
VERTICAL TRAVEL OF KNEE — 44'4" (46" LESS THAN 59" DUE TO MOUNTING IN SADDLE HEIGHT)

TABLE TRAVEL SETTINGS:
SEE DRAWING 77-025 C.