HARDINGE®

Bridgeport®

INSTALLATION, MAINTENANCE, AND PARTS LIST

EZ Vision™ Automated Milling Machines

TP7441

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Manual No. M-477A
Part No. M A-0009500-0477

Litho in U.S.A.
May, 2007

Information in this manual is subject to change without notice.

This manual covers the installation, maintenance, and parts list for *EZ Vision*™ automated milling machines equipped with the DC150 motion control system.

In no event will Hardinge Inc. be responsible for indirect or consequential damage resulting from the use or application of the information in this manual.

CONVENTIONS USED IN THIS MANUAL

- WARNINGS -

Warnings must be followed carefully to avoid the possibility of personal injury or damage to the machine, tooling, or workpiece.

- CAUTIONS -

Cautions must be followed carefully to avoid the possibility of damage to the machine, tooling, or workpiece.

- NOTES -

Notes contain supplemental information.

- NOTICE -

Bridgeport is a registered trademark of Hardinge Inc.

READ COMPLETE INSTRUCTIONS CAREFULLY BEFORE OPERATING MACHINE

When this instruction book was printed, the information given was current. However, since we are constantly improving the design of our machine tools, it is possible that the illustrations and descriptions may vary from the machine you received.

- WARNING -

Occupational Health and Safety Administration (OSHA) Hazard Communication Standard 1910.1200, effective May 25, 1986, and various state "employee right-to-know" laws require that information regarding chemicals used with this equipment be supplied to you. Refer to the applicable section of the Material Safety Data Sheets supplied with your machine when handling, storing, or disposing of chemicals.

HARDINGE SAFETY RECOMMENDATIONS

Your Hardinge machine is designed and built for maximum ease and safety of operation. However, some previously accepted shop practices may not reflect current safety regulations and procedures, and should be re-examined to insure compliance with the current safety and health standards.

Hardinge Inc. recommends that all shop supervisors, maintenance personnel, and machine tool operators be advised of the importance of safe maintenance, setup, and operation of Hardinge-built equipment. Our recommendations are described below. BE SURE TO READ THESE SAFETY RECOMMENDATIONS BEFORE PROCEEDING ANY FURTHER.

READ THE APPROPRIATE MANUAL AND/OR INSTRUCTIONS before attempting operation or maintenance of the machine. Make certain that you understand all instructions.

DON'T ALLOW the operation or repair of equipment by untrained personnel.

CONSULT YOUR SUPERVISOR when in doubt as to the correct way to do a job.

WEAR SAFETY GLASSES AND PROPER FOOT PROTECTION at all times. When necessary, wear a respirator, helmet, gloves, and ear muffs or plugs.

DON'T OPERATE EQUIPMENT unless proper maintenance has been regularly performed and the equipment is known to be in good working order.

WARNING OR INSTRUCTION TAGS are mounted on the machine for your safety and information. Do not remove them.

DON'T ALTER THE MACHINE to bypass any interlock, overload, disconnect, or other safety device.

DON'T OPERATE EQUIPMENT if unusual or excessive heat, noise, smoke, or vibration occurs. Report any excessive or unusual vibration, sounds, smoke or heat as well as any damaged parts.

MAKE CERTAIN that the equipment is properly grounded. Consult National Electric Code and all local codes.

DISCONNECT MAIN ELECTRICAL POWER before attempting any repair or maintenance.

ALLOW ONLY AUTHORIZED PERSONNEL to have access to enclosures containing electrical equipment.

DON'T REACH into any control or power case area unless electrical power is OFF.

DON'T TOUCH ELECTRICAL EQUIPMENT when hands are wet or when standing on a wet surface.

REPLACE BLOWN FUSES with fuses of the same size and type as originally furnished.

ASCERTAIN AND CORRECT the cause of a shutdown caused by overload heaters before restarting the machine.

KEEP THE AREA AROUND THE MACHINE well lighted and dry.

KEEP CHEMICALS AND FLAMMABLE MATERIALS away from electrical or operating equipment.

HAVE THE CORRECT TYPE OF FIRE EXTINGUISHER handy when machining combustible material and keep chips clear of the work area.

DON'T USE a toxic or flammable substance as a solvent cleaner or coolant.

MAKE CERTAIN THAT PROPER GUARDING is in place.

MAKE SURE chucks, closers, fixture plates, and all other spindle-mounted work-holding devices are properly mounted and secured before starting the machine.

MAKE CERTAIN all tools are securely clamped in position before starting the machine.

REMOVE ANY LOOSE PARTS OR TOOLS left on machine or in the work area before operating the machine. Always check the machine and work area for loose tools and parts especially after work has been completed by maintenance personnel.

REMOVE CHUCK WRENCHES before starting the machine.

BEFORE PRESSING THE CYCLE START PUSH BUTTON, make certain that proper functions are programmed and that all controls are set in the desired modes.

KNOW WHERE ALL STOP push buttons are located in case of an emergency.

CHECK THE LUBRICATION OIL LEVEL and the status of the indicator lights before operating the machine.

MAKE CERTAIN that all guards are in good condition and are functioning properly before operating the machine.

INSPECT ALL SAFETY DEVICES AND GUARDS to make certain that they are in good condition and are functioning properly before the cycle is started.

CHECK THE POSITION of the tooling before pressing the Cycle Start push button.

USE PROPER Point-of-Operation safeguarding.

CHECK SETUP, TOOLING, AND SECURITY OF THE WORKPIECE if the machine has been OFF for any length of time.

DRY CYCLE a new setup to check for programming errors.

MAKE CERTAIN that you are clear of any “pinch points” created by moving slides before starting the machine.

DON’T OPERATE any equipment while any part of the body is in the proximity of a potentially hazardous area.

KEEP ALL PARTS OF YOUR BODY AWAY from moving parts (belts, cutters, gears, and others).

DON’T REMOVE CHIPS with hands. Use a hook or similar device and make certain that all machine movements have ceased.

BE CAREFUL of sharp edges when handling a newly machined workpiece.

DON’T REMOVE OR LOAD a workpiece while any part of the machine is in motion.

DON’T OPERATE ANY MACHINE while wearing rings, watches, jewelry, loose clothing, neckties, or long hair not contained by a net or shop cap.

NEVER OPERATE A MACHINE after taking strong medication, using non-prescription drugs, or consuming alcoholic beverages.

DON’T ADJUST tooling or coolant hoses while the machine is running.

DON’T LEAVE tools, work pieces, or other loose items where they can come in contact with a moving component of the machine.

DON’T CHECK finishes or dimensions of workpiece near running spindle or moving slides.

DON’T JOG SPINDLE in either direction when checking thread with a thread gage.

DON’T ATTEMPT to brake or slow the machine with hands or any makeshift device.

ANY ATTACHMENT, TOOL, OR MACHINE MODIFICATION not obtained from Hardinge Inc. must be reviewed by a qualified safety engineer before installation.

USE CAUTION around exposed mechanisms and tooling, especially when setting up. Be CAREFUL of sharp edges on tools.

DON’T USE worn or defective hand tools. Use the proper size and type for the job being performed.

USE ONLY a soft-faced hammer on tooling and fixtures.

DON’T USE worn or broken tooling on machine.

MAKE CERTAIN that all tool or workpiece mounting surfaces are clean before mounting tools.

INSPECT ALL CHUCKING DEVICES daily to make certain that they are in good operating condition. Replace any defective chuck before operating the machine.

USE MAXIMUM ALLOWABLE gripping pressure on the chuck. Consider weight, shape, and balance of the workpiece.

USE LIGHTER THAN NORMAL feedrates and depth of cut when machining a workpiece diameter that is larger than the gripping diameter.

DON’T EXCEED the rated capacity of the machine.

DON’T LEAVE the machine unattended while it is operating.

DON'T CLEAN the machine with an air hose.

KEEP TOTE PANS a safe distance from the machine. Don't overfill the tote pans.

UNLESS OTHERWISE NOTED, all operating and maintenance procedures are to be performed by one person. To avoid injury to yourself and others, be sure that all personnel are clear of the machine before beginning operation.

FOR YOUR PROTECTION - WORK SAFELY.

Some of these precautions and other safety precautions are discussed in the American National Standards Institute Standard entitled Safety Requirements for the Construction, Care, and Use of Drilling, Milling, and Boring Machines (ANSI B11.8-1983).

This publication is available from:

American National Standards Institute
25 West 43rd Street, 4th floor
New York, NY 10036

Safeguarding for protection at the point of operation can only be designed and constructed when the parameters of the particular operation have been determined. As a result, ANSI B11.8-1983, Section 5.1, states that "it shall be the responsibility of the employer to provide, and ensure the use of, a guard, guarding device, awareness barrier, awareness device, or shield..."

To assist machine users in designing point of operation safeguarding for their specific machine applications the Occupational Safety and Health Administration has published a booklet entitled Concepts and Techniques of Machine Safeguarding (O.S.H.A. Publication Number 3067).

This publication is available from:

The Publication Office – O.S.H.A.
U.S. Department of Labor
200 Constitution Avenue, NW
Washington, D.C. 20210

The general purpose point of operation shield provided with this machine and shown in certain illustrations throughout this manual may not be appropriate and cannot be utilized for all possible applications of the machine. Use additional or alternate safeguarding where this shield is not appropriate or cannot be utilized. Note that for purposes of display, the shield has been removed in certain other illustrations in this manual.

- NOTE -

Any unauthorized changing of control parameters is not permitted. Hardinge Inc. will not accept any liability whatsoever for the alteration of any set parameters to those programmed at installation.

-NOTE -

DO NOT attempt disassembly or removal of major components without first contacting the Hardinge Inc. service department for proper procedures.

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CHAPTER 7 - PARTS LISTINGS

- NOTES -

CHAPTER 1 - MACHINE SPECIFICATIONS

BASIC COMPONENTS

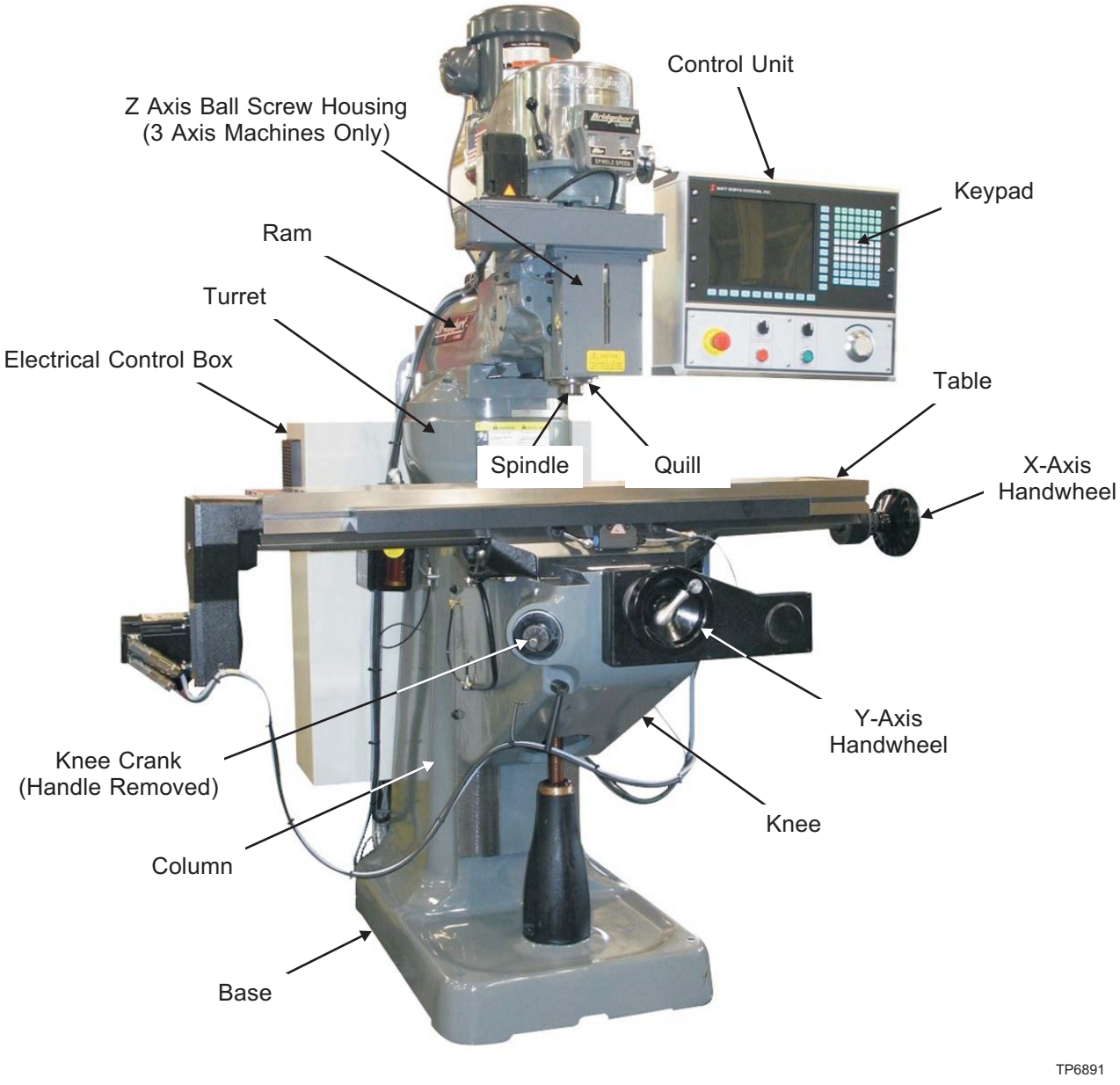


Figure 1.1 - 3 Axis Milling Machine

PHYSICAL SPECIFICATIONS

TRAVEL

Table travel (X axis)	30 in.	762 mm
Saddle travel (Y axis)	12 in.	305 mm
Quill travel	5 in.	127 mm
Quill travel w/3rd axis	4.5 in.	114 mm
Knee travel* (Z axis)	16 in.	406 mm
Ram travel	12 in.	305 mm
Throat distance (min.)	6.75 in.	171 mm
Throat distance (max.)	18.75 in.	476 mm
Table to spindle nose gage line (min.)	2.5 in.	64 mm
Table to spindle nose gage line (max.)	18.25 in.	463 mm

TABLE

Overall size	48 x 9 in.	1219 x 229 mm
Working surface	48 x 9 in.	1219 x 229 mm
Height above floor (max.)	47.4 in.	1204 mm
Maximum uniform load	300 lbs.	136 kg
T-slots	3 @ 2.5 in. Cntr	64 mm
T-slot size	.625 in.	16 mm

SPACE AND WEIGHT

Floor area (door open)	8.2 x 7.3 ft.	2.5 x 2.2 m
Floor area (door closed)	8.2 x 5.3 ft.	2.5 x 1.6 m
Height	6.8 ft.	2.1 m
Net weight	2340 lbs.	1061 kg
Shipping weight	2900 lbs.	1315 kg

SPINDLE

AC spindle motor rating (continuous)	2 hp	1.5 kw
Power rating	3 hp	2.2 kw
Duty cycle	30 min. duty rated	
Spindle speed Hi	500 – 4200 rpm	
Spindle speed Low	60 – 500 rpm	
Spindle diameter	1.875 in.	48 mm
Quill diameter	3.375 in.	86 mm
Standard Spindle Taper		
Spindle taper	R-8	
Tooling	R-8 collets	
Optional Spindle Taper		
Spindle Taper	#30 ISO	
Tool Holder	Erickson Quickchange #30 ISO	
Spindle Taper	#200 Universal	
Tool Holder	Universal #200 Kwik switch	

BALLSCREWS

Diameter	1.25 in.	32 mm
Pitch	0.200 in.	5.08 mm

POSITIONING

Auto (X,Y)	100 ipm	2540 mm/min.
Manual (X,Y)	100 ipm	2540 mm/min.
Feedrate range (X,Y)	0.1 - 100 ipm	2 - 2540 mm/min.
Minimum increment	0.0001 in.	0.003 mm

MACHINE AND CONTROL PERFORMANCE

Positioning accuracy over saddle	± 0.001 in.	0.025 mm
Positioning repeatability over saddle	± 0.0008 in.	0.02 mm
Input resolution	0.0001 in.	0.003 mm
Servo resolution	0.0001 in.	0.003 mm
Display resolution	0.0001 in.	0.003 mm

BPC2M PC Control system
Full 3-axis Digital Readout
Simultaneous 2 axis linear or 2 axis circular interpolation
10.5-inch color conversational display
Absolute and incremental programming
Automatic corner rounding
Mathematical help modes
Powerful canned cycles for machining arcs, diagonals, circles, bolt hole patterns, pocket milling and more
Cutter diameter compensation
English/metric conversion
1000 block program storage
Disk storage: (standard) 3.5 in. diskette, HD 1.44 Mb (12,000 ft.)
8MB PC Flashdisk
Maintenance, diagnostic and program error message display
Part program loading: RS-232 bi-directional communication link
Input/Output: 1 RS-232 serial port
Maintenance: Diagnostic routines embedded in system

POWER

Input power: 208/230/460 volts 3 phase, 50/60 cycles
Power capacity: 4kVA

PRINCIPAL DIMENSIONS

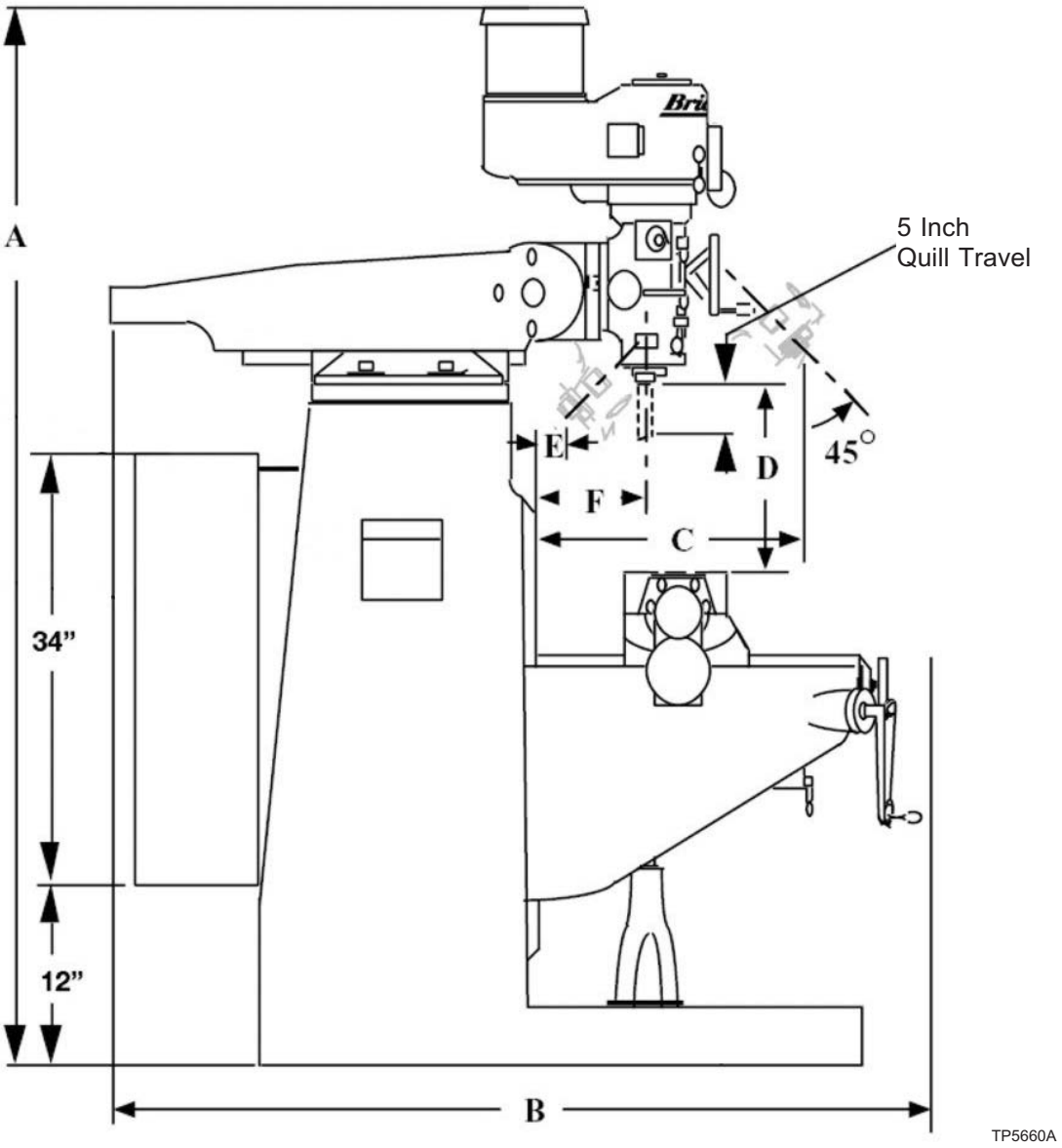


Figure 1.2 - Principal Dimensions

TABLE TRAVEL	30.0 in.	762 mm
TABLE LENGTH	48 in.	1219 mm

Dimension	A	B	C	D	E	F
Minimum	82 [2083]	51 [1295]	8.75 [222]	2.5 [64)]	0	6.75 [171]
Maximum	84 [2140]	63 [1600]	20.75 [527]	18.25 [470]	12 [305]	18.75 [476]

All dimensions shown in inches [millimeters].

MACHINE DIMENSIONS

FRONT VIEW

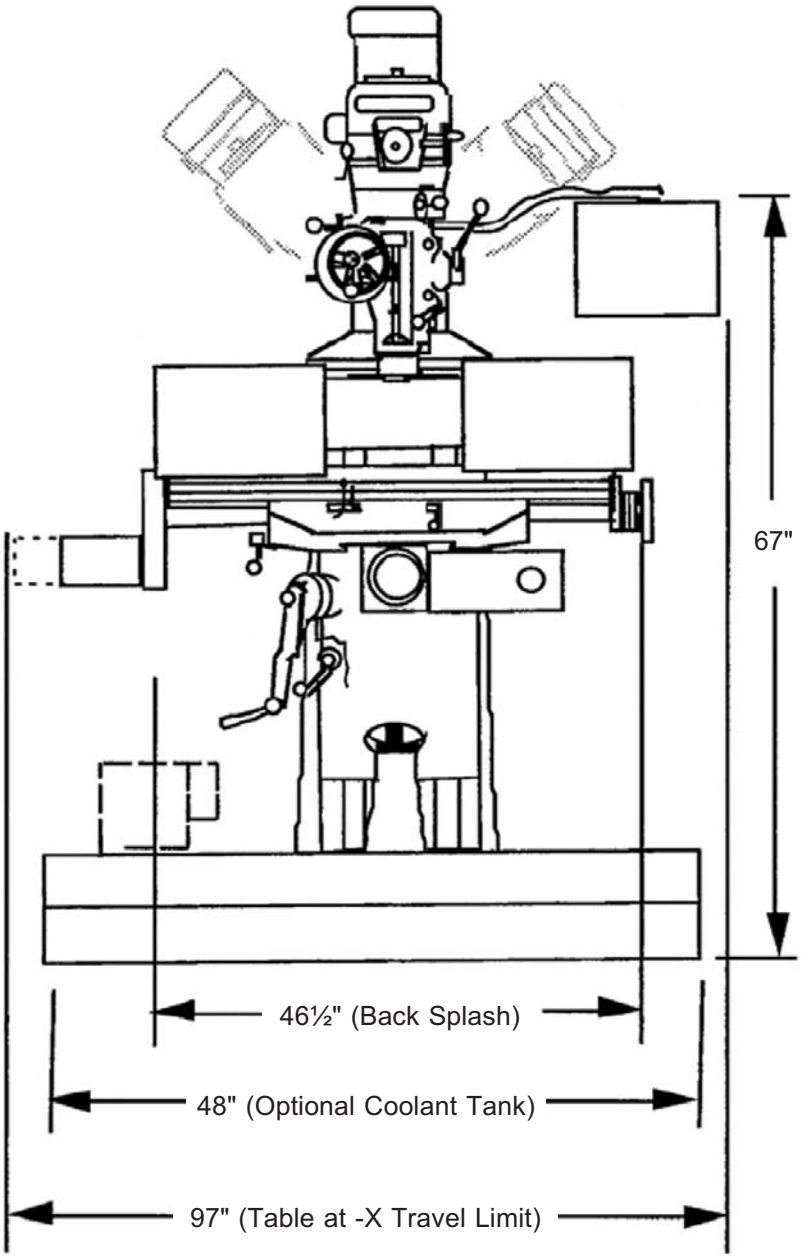


Figure 1.3 - Machine Dimensions
(Front View)

SIDE VIEW

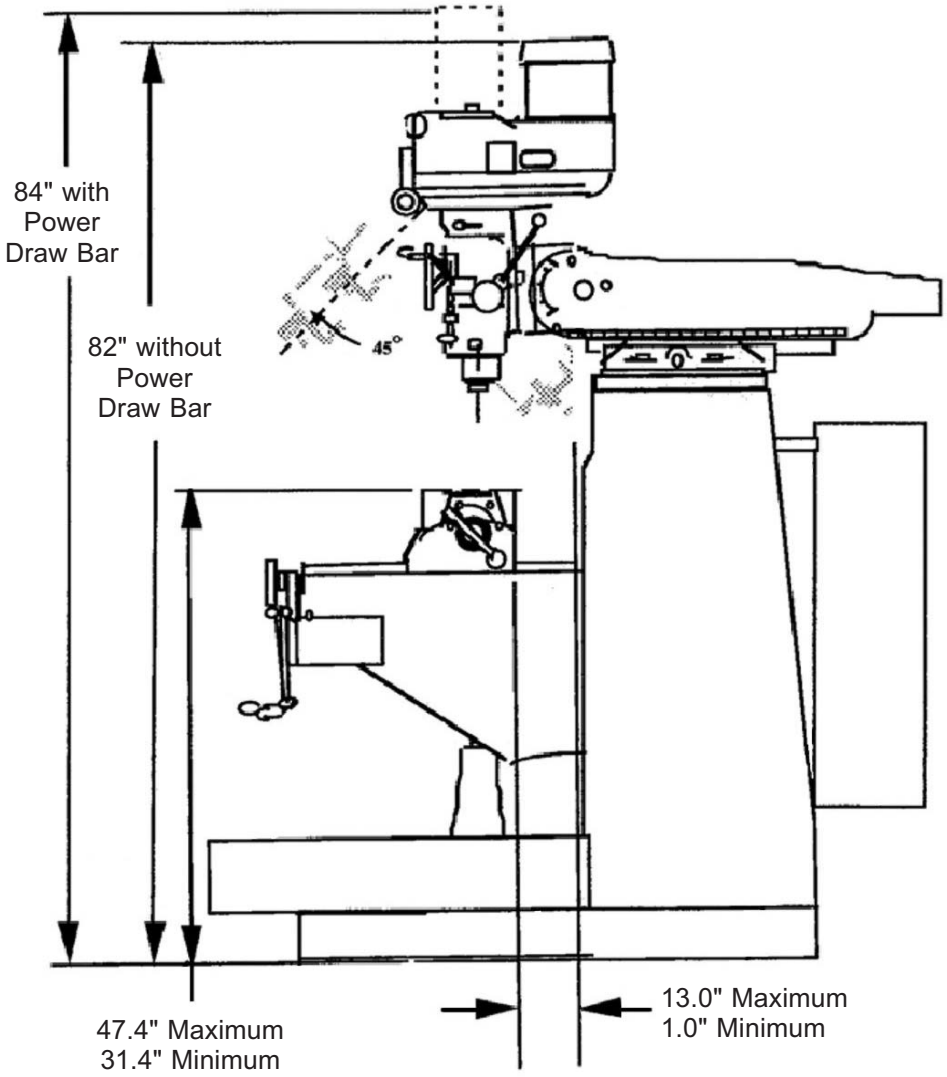


Figure 1.4 - Machine Dimensions
(Side View)

HEAD SPECIFICATIONS

Power	2.0 HP	
Motor RPM	1800 RPM	
Speed Ranges - RPM	Stepless	
LOW	60 - 500	
HIGH	500 - 4200	
Quill Travel	5.0 in.	127 mm
Quill Diameter	3.375 in.	86 mm
Spindle Tapers	R-8	
	#30 Q.C.	
Spindle Diameter	1.875 in.	48 mm
Spindle Feed Rate	0.0015/Rev	0.038 mm
	0.003/Rev	0.076 mm
	0.006/Rev	0.152 mm
Drilling Capacity - Manual	0.87 in.	22 mm dia.
Drilling Capacity - Power	0.37 in.	9.4 mm dia.
Boring Capacity	6.75 in.	152.4 mm dia.
Milling Capacity	2.0 cu. In./min.	32 cc/min.
Spindle to Column - Minimum	6.75 in.	171 mm
Maximum	18.75 in.	476 mm

RECOMMENDATIONS:

1. Use 2, 3, or 4 flute end mills. Eight flute end mills are usually not satisfactory for general milling. When using shell mills, face mills, or any other tooling, proper machining practice should be observed.
2. Power Feed can be used for drills up to 0.375 in. diameter. Use manual feed for drills larger than 0.375 in.

HEAD DIMENSIONS

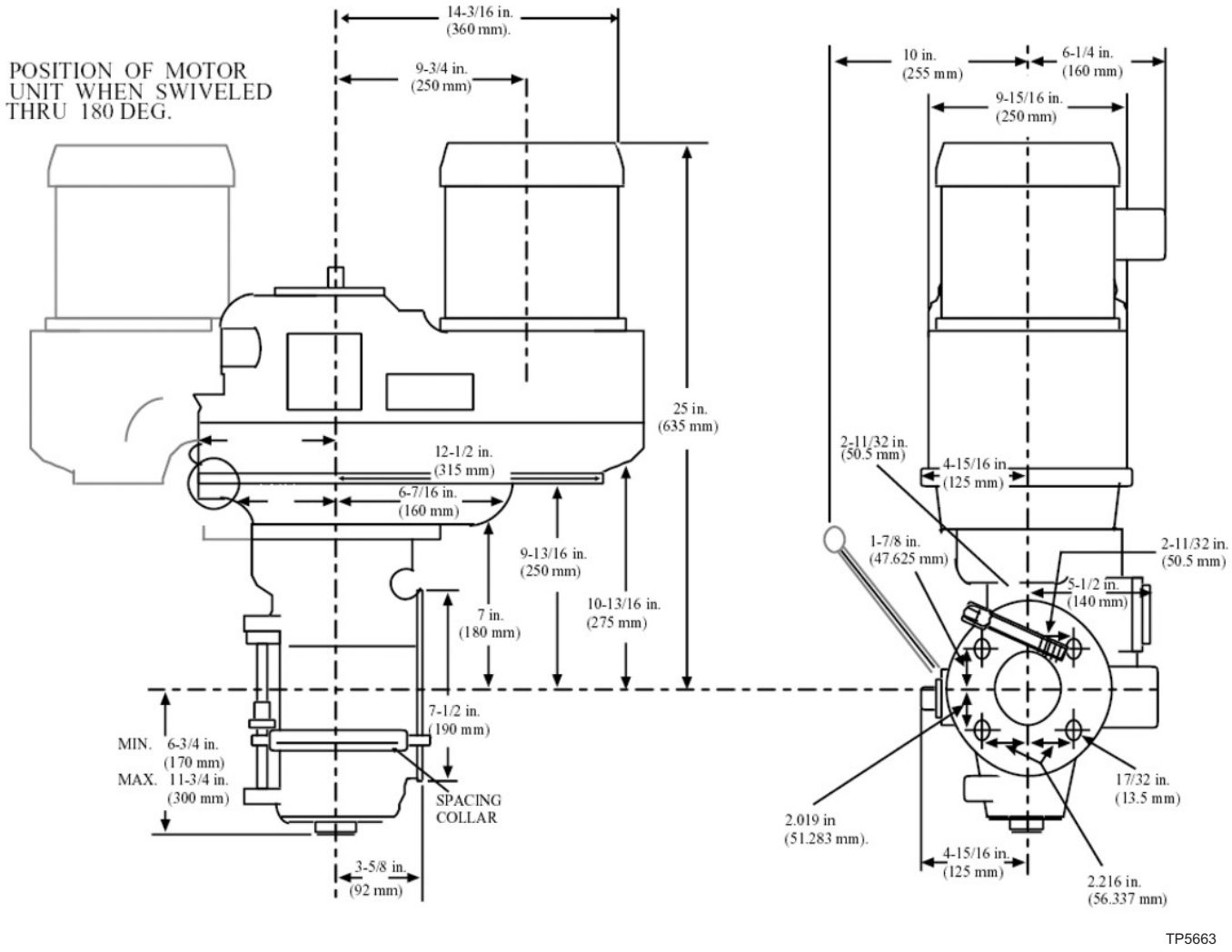


Figure 1.5 - Head Dimensions

SPINDLE SPECIFICATIONS

Spindle Taper	R8	
Spindle speeds - RPM	60-4200	
Motor	*2 HP	1.5 kw
Quill travel	5 in	127 mm
Power feed of Quill	0.0015 in.	0.04 mm
per rev of Spindle (3 rates)	0.003 in.	0.08 mm
	0.006 in.	0.15 mm
Collet capacity	1/8 - ¾ in x 1/16 in.	3-9 mm x 1.5 mm
Weight	196 lb.	89 kg

*2 HP Continuous - 3 HP Intermittent

- NOTES -

CHAPTER 2 - INSTALLATION

UNCRATING

Carefully remove crating and skids so that the machine and parts are not marred, scratched or impaired. In the event of damage in transit, communicate IMMEDIATELY with our representative and the transportation company making delivery.

Retain the lag bolts used to secure the machine to the skid. The lag bolts will be used in the event the machine is to be secured to the floor during installation.

SHORTAGES

Check the shipment carefully against the itemized packing list which is included in the parts box. In the case of shortages, report them IMMEDIATELY to the representative from whom the machine was purchased, indicating parts not received that have been checked on the packing list.

CLEANING AND LUBRICATING

- WARNING -

DO NOT use gasoline or any other flammable cleaning agent for cleaning machine.

- CAUTION -

DO NOT attempt to operate the machine until all ways have been well cleaned and lubricated.

1. Thoroughly clean the protective coating from machine with a suitable cleaning solution.
2. Move the table, saddle, and knee by hand to a limit stop in one direction.
3. Clean and lubricate the exposed ways.
4. Move each unit to the opposite limit stop and clean and lubricate the exposed ways.
5. Loosen bolts to unlock the ram and move it forward and backward to the full length to allow cleaning and lubrication.
6. Check lubricator reservoir "A", Figure 2.1, and fill if necessary. Refer to Chapter 5 for a list of approved lubricants.
7. Pull and release Manual Feed knob "B" several times until oil flows freely on the way surfaces and lead screws.

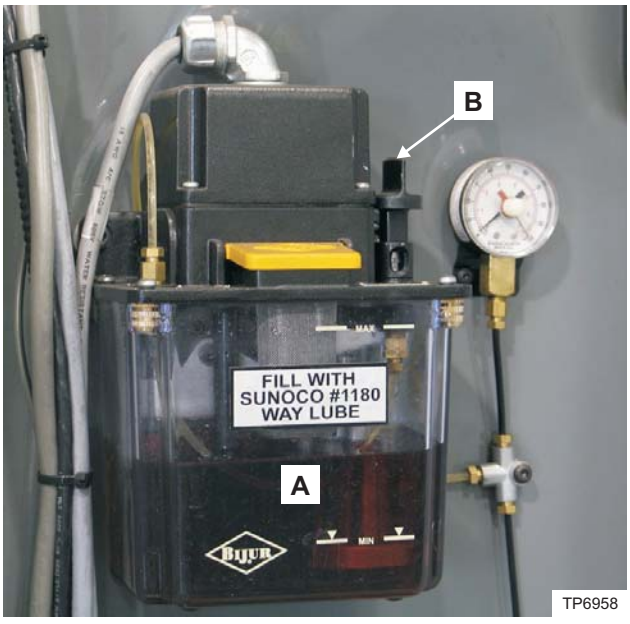
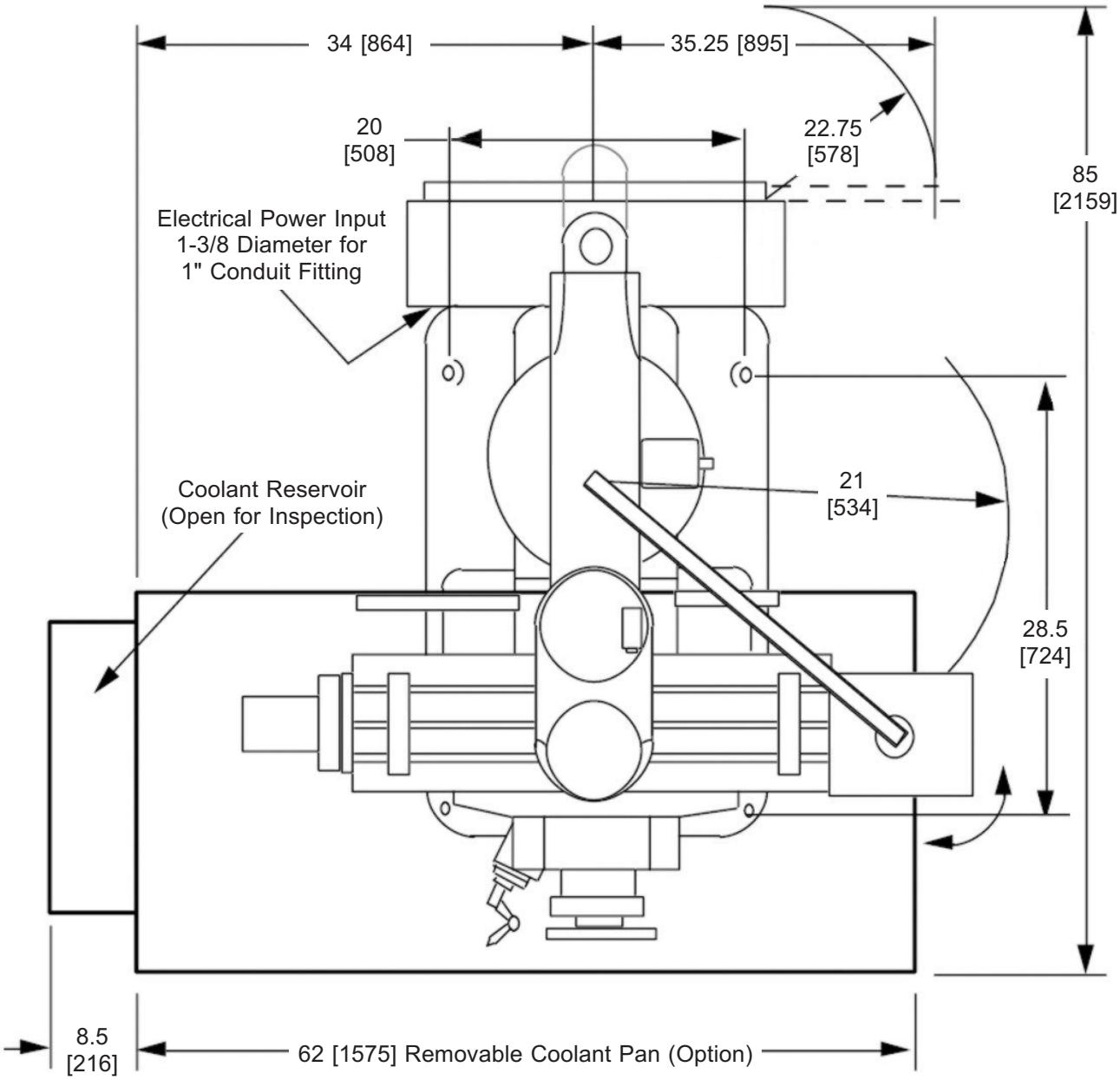


Figure 2.1 - Lubricator Assembly
(Mounted on Left Side of Machine)

MACHINE FLOOR PLAN

The machine floor plan, shown in Figure 2.2, can be used to determine floor space requirements.



NOTE: All dimensions shown in inches [millimeters].

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Figure 2.2 - Machine Floor Plan (Top View)

LIFTING THE MACHINE

- WARNING -

Observe all instructions given in Figure 2.3. Improper lifting could cause serious injury or damage to the machine.

Refer to Chapter 1 for the machine weight.

Check the position of the ram and table before lifting with a sling. The machine should be lifted by placing a sling under the ram as shown in Figure 2.3. Be sure to use the proper sling when lifting the machine.

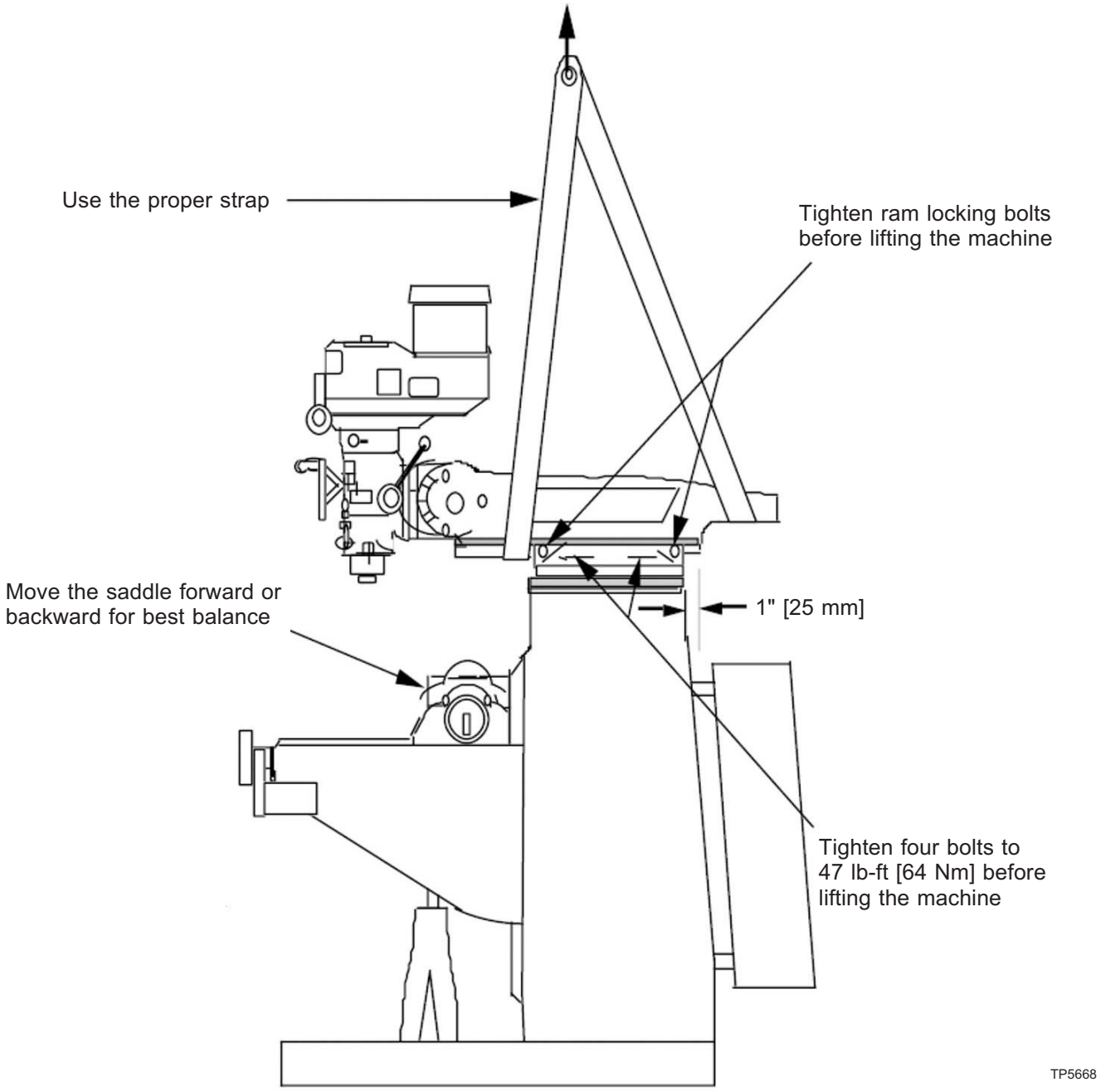


Figure 2.3 - Proper Method of Lifting the Machine

PLACING MACHINE ON A SOLID FOUNDATION

- WARNING -

The machine should be placed on a solid level floor with shims or anti-vibration pads to insure machine base is positioned evenly to prevent rocking. Refer to Figure 2.4.

1. When setting machine on a concrete foundation, use grout (thin mortar) to compensate for any unevenness in the concrete, as well as to provide a solid foundation at all contact points.
2. When setting machine on a floor that has any surface irregularities, use shims to correct this condition to the greatest extent possible. Refer to Figure 2.4.
3. Level the machine by checking the work table lengthwise and crosswise with a precision instrument, as shown in Figure 2.5.
4. Verify that all four corners are making contact with the floor after the machine is leveled. If all four corners are not making contact with the floor, it is possible to twist the column and put a bind into the ways.

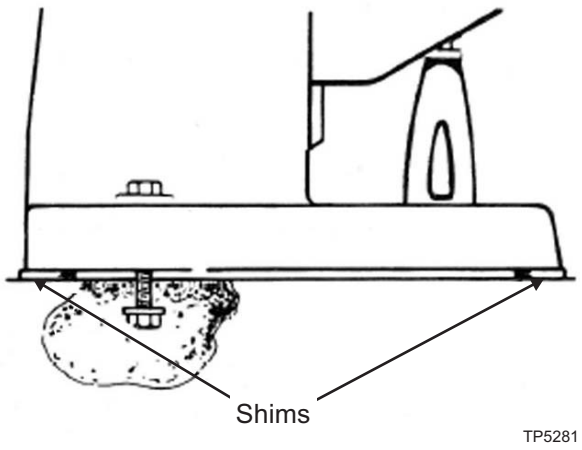


Figure 2.4 - Shim Installation Under the Machine

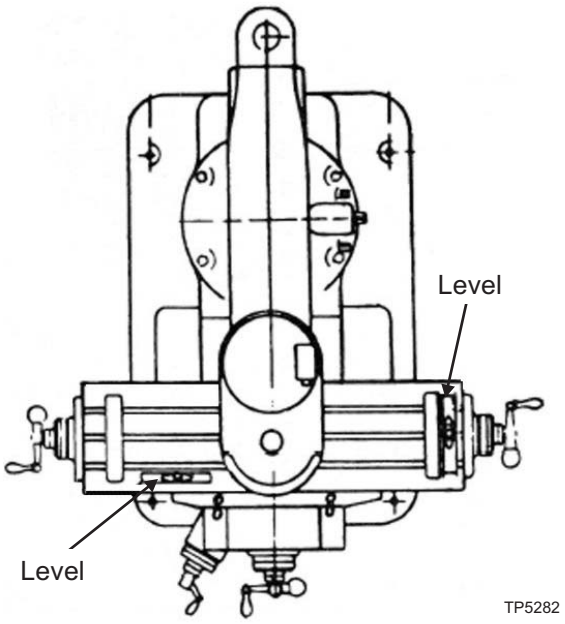


Figure 2.5 - Leveling the Machine

- NOTE -

It is recommended the machine be secured to the floor to prevent movement or tipping due to off-center loading.

The lag bolts used to secure the machine to the skid during shipment can be used to secure the machine to the floor.

5. Install and tighten the hold-down bolts to secure machine to floor. Refer to Figure 2.6.
6. Recheck the machine for level. Adjust as needed.

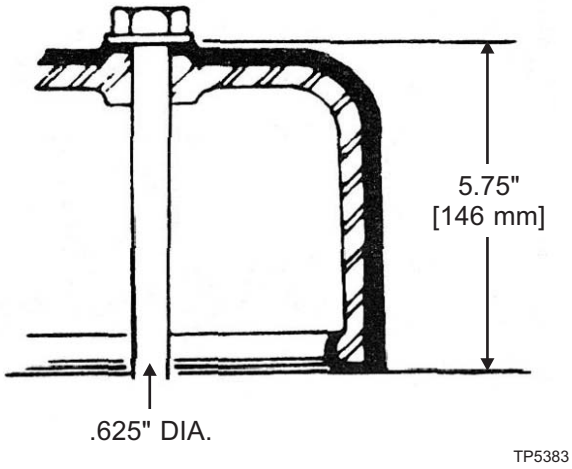


Figure 2.6 - Hold-Down Bolt
Machine Dimension

CONTROL PENDANT INSTALLATION

- WARNING -

Two people are required to perform the control pendant installation.

1. Check all contents for damage.
2. Remove lower mounting bracket "C", Figure 2.7, from the back of the control pendant.
3. Slide upper mounting bracket "D" over the end of rod "E".
4. Install the lower mounting bracket, as shown in Figure 2.7.
5. Connect cable "F" to the back of the control pendant.
6. Route wire carrier "G", Figure 2.8, to the bottom of the power case.
7. Secure the cable and wire carrier to the pendant arm with straps "H".

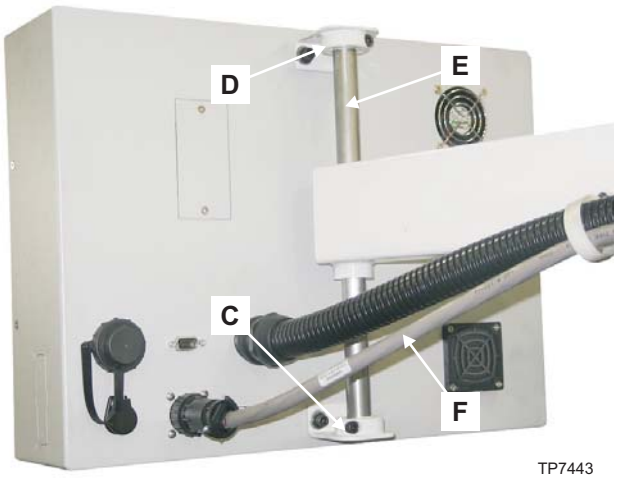


Figure 2.7 - Pendant Mounted on Arm

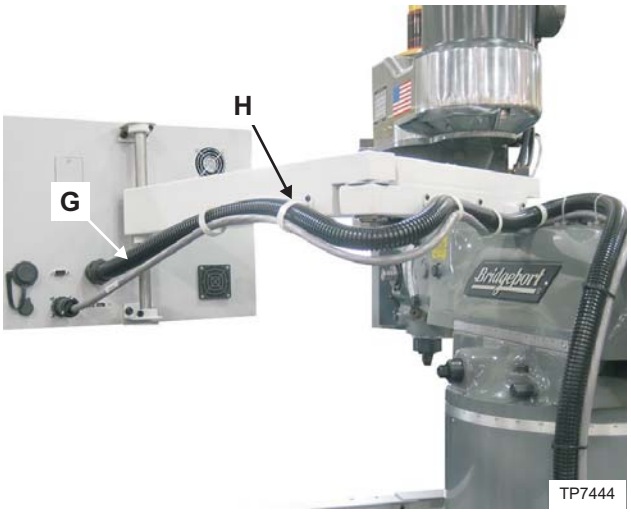


Figure 2.8 - Pendant Arm

8. Turn main disconnect switch handle “I”, Figure 2.9, to the OFF position.
9. Release two latches "J" and open the power case door.
10. Remove a hole plug from the bottom of the power case.
11. Feed the fiber optic cable in the wire carrier through cord grip "K", Figure 2.10, and into the power case.
12. Connect the wire carrier to the bottom of the power case.
13. Remove wireway cover "L".
14. Route the fiber optic cable to the motion control unit and connect as shown in Figure 2.11.
15. Install wireway cover "L", Figure 2.10.
16. Tighten cord grip "K".

Leave the power case door open for additional procedures.

Figure 2.9 - Power Case Door

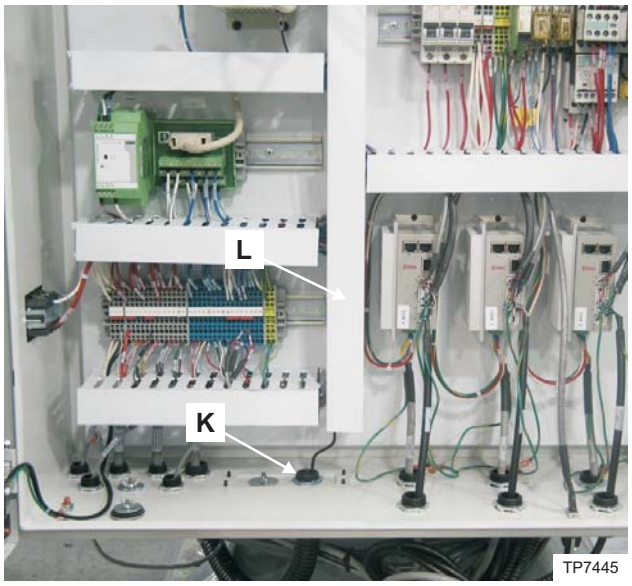


Figure 2.10 - Internal View of Power Case

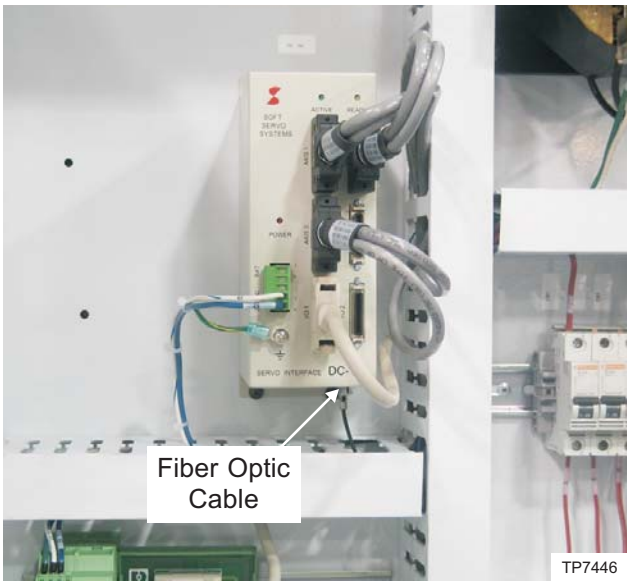


Figure 2.11 - DC150 Motion Control Unit

POWER CASE INSPECTION

1. Check all electrical connections in the power case to be sure they are secure.
2. Check the spindle overload setting:

   A) Verify the spindle overload is properly set for the machine voltage. The table shown below reflects the data shown on the spindle Full Load Amp tag, located on the front of the machine head.

50 Hz Electrical Service		60 Hz Electrical Service	
Voltage	**Full Load Amps**	**Voltage**	**Full Load Amps**
200 V	6.5	200 V	6.2
220 V	6.6	208 V	6.1
380 V	3.3	220 V	5.8
415 V	3.2	230 V	5.8
440 V	3.3	460 V	2.9

   B) Locate the appropriate Full Load Amp value for the machine, based on the frequency and voltage of the electrical service to be used.

   C) Multiply the Full Load Amp value by "1.1". The result will be a realistic setting for the spindle overload.

   D) Check the adjustable dial on spindle overload "M", Figure 2.12, to be sure the setting matches the value calculated in the previous step. Adjust if necessary.

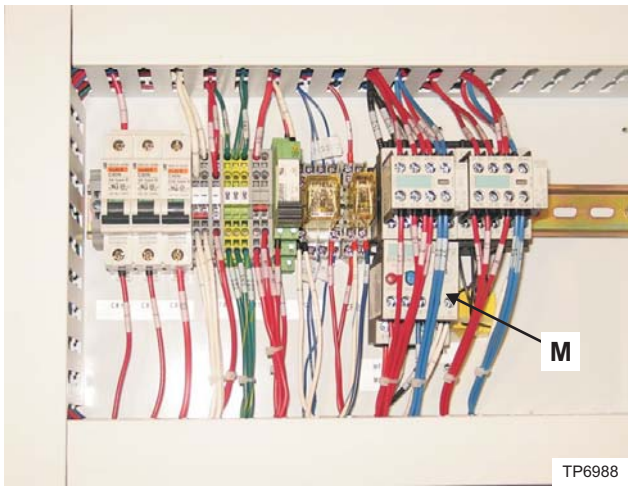


Figure 2.12 - Spindle Overload Relay and Ground Connection

CONNECT THE ELECTRICAL POWER

- NOTE -

Due to the variation of local electrical codes, Hardinge recommends the local utility supply company be consulted to determine exact service and wiring requirements.

Maximum impedance of the protective ground connection must not exceed 1.0 Ohm. Refer to Protective Ground, on page 2-10.

To connect the electrical supply, have a qualified electrician proceed as follows:

1. Verify the electrical service is compatible with the machine voltage, which is stamped on a plate mounted on the outside of the power case door.
2. Turn OFF the power source to be connected to the machine.
3. Verify the incoming power is properly grounded.

- NOTE -

Use a cable clamp to secure the cable at the entrance to the power case.

4. Route the power cable into the top of the power case far enough to easily reach the top of disconnect switch "N" and ground stud "O", Figure 2.13.
5. Connect the incoming power to the top of disconnect switch "N".
6. Connect the ground wire to ground stud "O".
7. Close and latch the power case door.

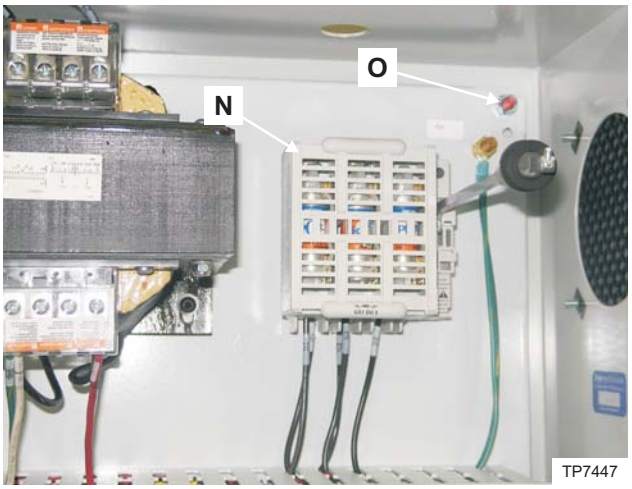


Figure 2.13 - Disconnect Switch and Ground Stud

PROTECTIVE GROUND

- DANGER -

PROTECTIVE GROUND IS REQUIRED. It minimizes the exposure to personal shocks in the event of circuit shorts or other malfunctions. Failure to ensure protective ground may create electrical shock hazard, causing serious personal injury or death.

Protective Ground (Chassis or Safety Ground) establishes a low impedance path from the equipment enclosure and other mechanical parts of the system to earth ground. Protective Ground assures that all conductive parts of the enclosure are safe. If any circuit inadvertently touches the chassis, the voltage will be reduced to zero and the enclosure will be safe to touch.

Since safety requirements vary with locality, consult local codes that will take precedence over the following guidelines.

The four methods listed below are commonly used to establish earth ground:

CONTINUOUS METAL WATER PIPE

When properly buried, length is installed below the permanent moisture level, impedance is typically 3 ohms.

COPPER STAKE (¾ IN. DIA, 6-8 FT. LG)

When properly driven into the ground below permanent moisture level, the impedance of this type is typically below 5 ohms.

FOURTH WIRE GROUND

Although a copper ground stake is preferred, an alternative is a fourth wire for ground included with the power wires from the enclosure ground stud to the power company service panel ground bus. (See Note below.)

OTHER METAL ELECTRODES (WELL CASTINGS OR THE LIKE)

Must be well chosen, since they generally exceed an impedance of 5 ohms but are well below 25 ohms.

- NOTE -

The resistance of the earth ground connection is measured from the enclosure ground stud, through the ground wire, to the earth ground connection; then through the earth ground to another earth ground connection (at least 20 feet away), and through its associated wire to another ground stud. The resistance should not exceed 5 ohms. The wire used between the ground stud and the earth ground should be AWG10 or larger and should be braided cable to minimize resistance at high frequencies (cable resistance less than 0.075 ohm). The ground wire should be inspected for mechanical abuse periodically.

PRESTART CHECKS

Make a careful check of the following conditions before applying power.

1. The floor is of sufficient quality to support the machine and maintain machine level.
2. The incoming power is within +/- 10% of voltage specified on the machine data plate.
3. The machine is properly grounded (1 ohm between ground rod and reference point.)
4. The electrical cabinet components are inspected for loose connections.
5. Check the oil level in the automatic lubricator, shown in Figure 2.1. Refill the oil reservoir if necessary. Refer to Chapter 5 for additional information on the automatic lubrication system.
6. The air pressure level must be adjusted to nominal 80 psi (5.5 bar). This air pressure requirement is applicable only if the power drawbar is installed.
7. The machine way areas are cleared, cleaned, and lubricated.

- CAUTION -

DO NOT use coolant containing the following chemicals: Mono-ethanolamide, Di-ethanolamide, or Triethanolamide. These chemicals may degrade the polycarbonate spindle guard.

- NOTE -

The optional coolant tank capacity is approximately 15 gallons [56 liters].

8. Fill the coolant tank.

START-UP CHECKLIST

- NOTE -

Refer to the programmer's and operator's manual (M-476) for information on powering up the machine and homing the machine axes.

1. Power up the machine and home the machine axes.

- CAUTION -

DO NOT shift the HI-NEUTRAL-LO lever when the spindle is motion.

2. Check spindle rotation:

   A) Set Spindle Direction switch "P", Figure 2.14, to FORWARD.

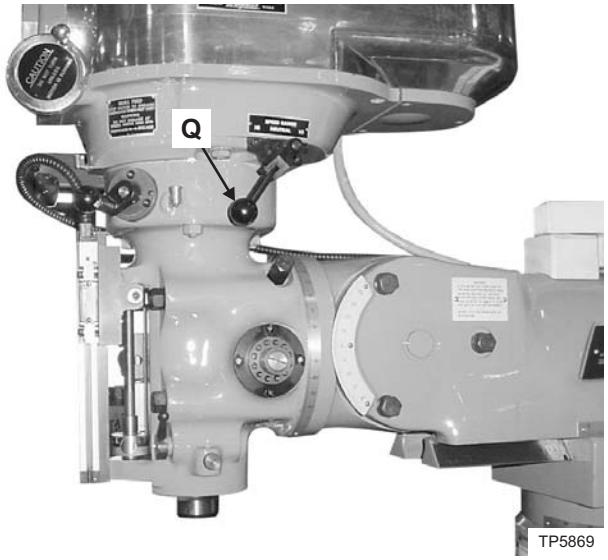
   B) Set HI-NEUTRAL-LO lever "Q", Figure 2.15, to HI.

3. Check spindle rotation. The spindle should rotate clockwise when viewed from the top of the machine.

4. Verify the door fan is blowing air into the power case.

TP7442

Figure 2.14 - Operator Control Panel



TP5869

Figure 2.15 - Machine Head (Side View)

HEAD TRAM

The head tram was properly set at the factory, but it is recommended the head tram be checked to ensure that it has not moved during shipment.

Specification: ±.0005" in 9 inches

1. Install an indicator in the spindle
2. Sweep the indicator around the spindle centerline to check the X axis tram, as shown in Figures 2.16 and 2.17.
3. Sweep the indicator around the spindle centerline to check the Y axis tram, as shown in Figures 2.18 and 2.19.

If the axes are within specification, not adjustment is required.

If the axes are **not** within specification, leave the indicator in the spindle and use the appropriate procedure to adjust tram.

Figure 2.16 - X Tram Check
(Indicator to the Left)

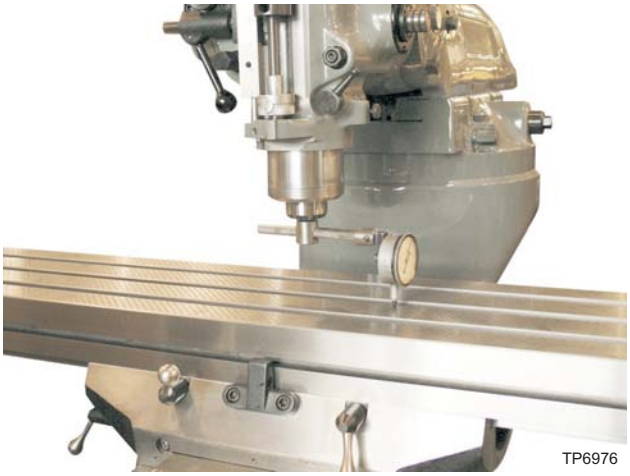


Figure 2.17 - X Tram Check
(Indicator to the Right)

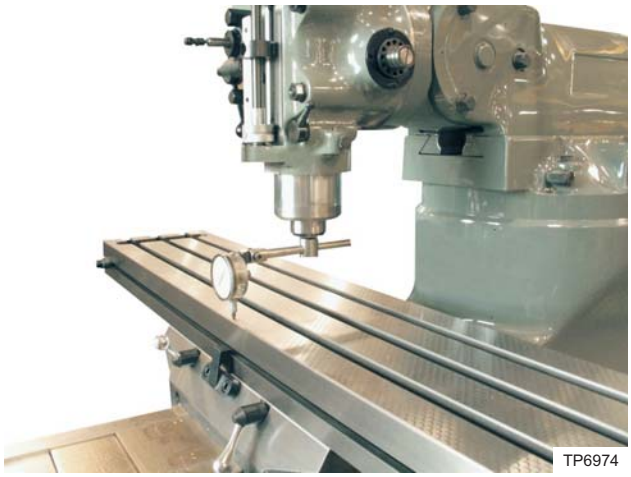


Figure 2.18 - Y Tram Check
(Indicator toward the Front)

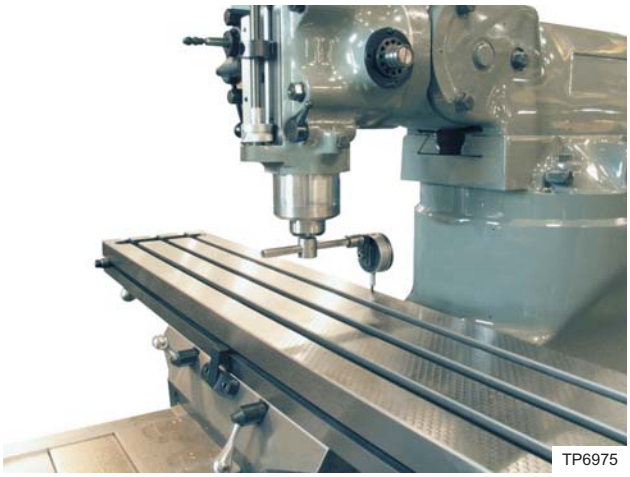


Figure 2.19 - Y Tram Check
(Indicator toward the Back)

X Axis Tram Adjustment

1. Loosen four locknuts "R", Figure 2.20, but leave some drag for fine adjustment.
2. Sweep the indicator around the spindle centerline as shown in Figures 2.16 and 2.17.
3. Compare the indicator run-out with the specification on page 2-13.
4. Rotate swivel bolt "S", Figure 2.21, to adjust the X axis tram as needed.
5. Tighten the four locknuts in the sequence shown in Figure 2.22:

   A) Torque to 25 lb-ft [33.9 N•m].

   B) Torque to 50 lb-ft [67.8 N•m].
6. Sweep the indicator around the spindle centerline to verify the adjustment.
7. Remove the indicator from the spindle if tram adjustments are complete.

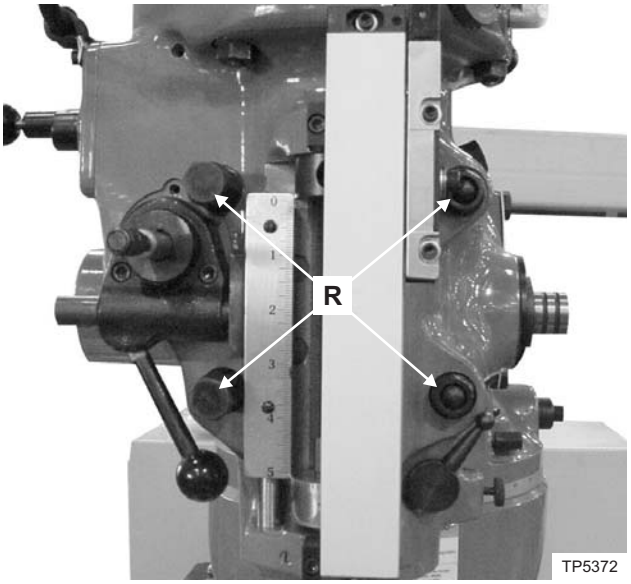


Figure 2.20 - Positioning the Head (Front View)

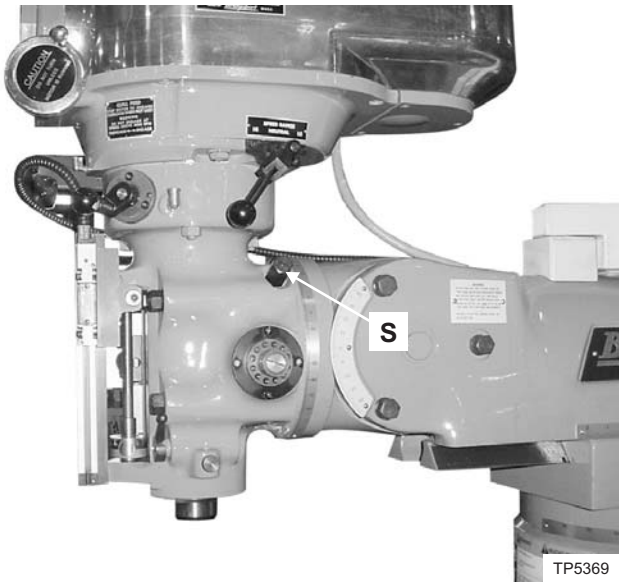


Figure 2.21 - Positioning the Head (Right Side View)

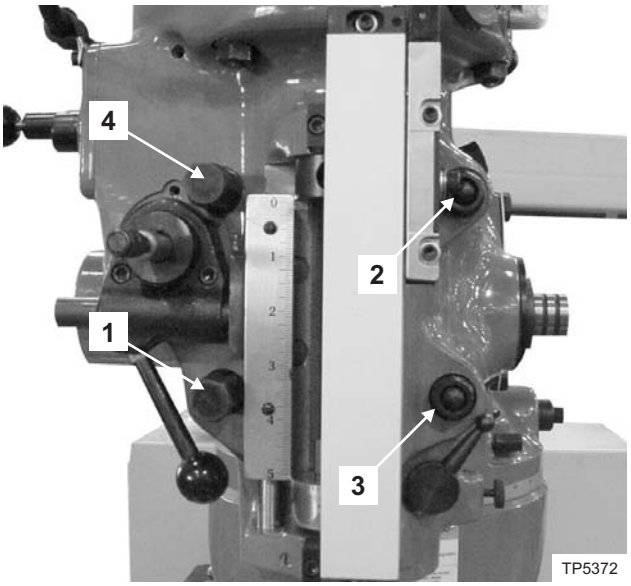


Figure 2.22 - Locknut Torque Sequence

Y Axis Tram Adjustment

1. Loose three ram locking bolts "T", Figure 2.23.
2. Sweep the indicator around the spindle centerline as shown in Figures 2.18 and 2.19
3. Compare the indicator run-out with the specification on page 2-13.
4. Use vertical adjustment worm shaft "U", Figure 2.23, to adjust the Y axis tram as needed.
5. Tighten the three ram locking bolts to 75 lb-ft [102 N•m].
6. Sweep the indicator around the spindle centerline to verify the adjustment.
7. Remove the indicator from the spindle if tram adjustments are complete.

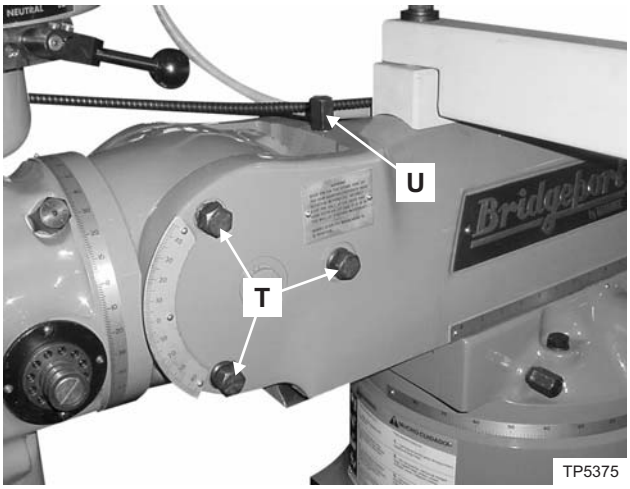


Figure 2.23 - Head Tilt Bolts

- NOTES -

CHAPTER 3 - PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE SCHEDULE

The following maintenance schedule is approximate and components may need attention more frequently if excessive environmental pollution is present. Preventive maintenance frequency is for single shifts and should be increased proportionally when work is for two or three shifts per day.

Refer also to "Dry Cutting", page 3-2, for additional considerations.

DAILY

Check the automatic lubrication system oil level.
Refer to Chapter 5 for additional information on the automatic lubrication system.

Clean dirt and chips from ways.

WEEKLY

Clean way covers and lightly oil.

Check coolant level.

Check flood coolant.

Apply oil to drawbar.

Apply oil to spindle.

MONTHLY

Clean machine exterior. Clear air intakes and exhausts.

Check air filters. Replace if necessary. Use electrostatic filters if dry cutting.

SEMI-ANNUALLY

Check pneumatic lubricator bowl. Fill if necessary.

Drain, clean, and refill pneumatic filter bowl.

Check spindle motor for dirt. Wipe clean if necessary.

Check spindle drive belt for wear. Notify Dealer Service to replace belt if necessary.

Clean inside of power case.

AS SPECIFIED ON LUBRICATION TAG

Oil quill downfeed twice weekly.

AS REQUIRED

Clean automatic lubrication system pump filter.

DRY CUTTING

A additional consideration for preventive maintenance is dry cutting. In this case, the machine is used to cut materials such as cast iron, magnesium or carbon that produce unusually large amounts of dust in the air. This is considered to be a Hostile environment which requires more than the average amount of care.

- CAUTION -

Extra precautions must be taken If the workpiece is cut dry, both while cutting and in cleanup, to prevent dust and contaminated air from entering the system. Follow the maintenance procedures recommended for your shift conditions. In addition, use the following guidelines:

- Check the cooling system for proper operation. The air inlet should be filtered. This filtering system is not standard equipment supplied by the machine manufacturer and must be provided by the machine owner.
- Use an industrial vacuum cleaner and clean the exterior of the machine frequently. Do not use compressed air to clean the machines.
- Use specially designed vacuum systems at the cutting tool.
- Use electrostatic filters if clean air cannot be directed to the head or the control cabinet inlets.

EQUIPMENT AND SUPPLIES

The following items will be required to conduct a satisfactory maintenance check of the machine:

- Dry rags or paper cleaning cloths.
- Brush to sweep chips from the tables and ways.
- Industrial vacuum cleaner.
- Mobil® DTE Light oil.
- Mobil Vactra® Oil No. 4.
- Lubriplate No. 107 grease.
- Coolant. The recommendation is for Trim Sol or comparable antibacterial emulsified cutting oil.
- Lubricant for the way lubrication system. The following way lubricants are approved for use in this system:
  - Gulfway 68
  - Sunoco Waylube No. 1180
  - Mobil Vactra Oil No. 2
  - Way Lubricant 68 (Texaco)
  - Tonna 68 (Shell)

MAINTENANCE PROCEDURES

DAILY

Check the Automatic Lubrication System Oil Level

The most convenient course of action is to keep the level of oil to the top of the tank. Check the oil level daily. If the reservoir is allowed to empty, a liquid level switch at its base will not allow the spindle to start. Refer to Chapter 5 for additional information on the automatic lubrication system.

Clean the Machine Ways

- WARNING -

DO NOT use compressed air to clean the ways or around the cabinets. Using compressed air could blow chips and other foreign material into the interlocking parts, control system, or at the operator, resulting in machine damage or personal injury.

Clear dirt and chips from the ways at the end of the day. Use a brush and/or an industrial wet or dry vacuum cleaner, then wipe carefully to remove damage-causing abrasive material.

WEEKLY

Clean the Way Covers and Lightly Oil

Clean and apply a light coat of oil to the way covers to keep them pliable.

Check the Coolant Level

Check the coolant level. Fill if necessary.

Check the Flood Coolant

Check the Flood Coolant. Keep hose joint areas free of chips and dirt. The coolant will come out of the nozzle in spurts when the coolant level is low. Fill with Trim Sol or a comparable antibacterial emulsified cutting oil.

Apply Oil to the Drawbar

Move the quill downward approximately 2 inches and apply five drops of Mobil® Vactra® Oil No. 4 to the top of the drawbar.

Refer to the lubrication plate on the right side of the machine head.

Apply Oil to the Spindle

Add five drops of Mobil DTE Light oil to spindle oil cup "B", Figure 3.1.

Refer to the lubrication plate on the right side of the machine head.

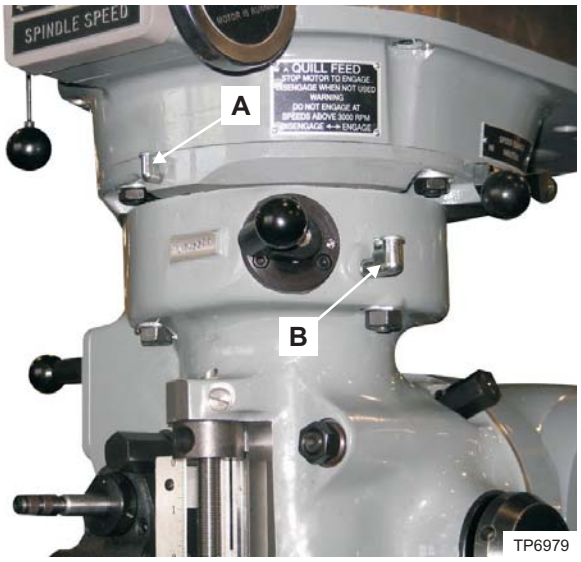


Figure 3.1 - Oil Cups on the Machine Head

MONTHLY

Clean the Machine Exterior, Clear Air Intakes, and Exhausts

Clear dirt and chips from machine at the end of the day Use an industrial wet or dry vacuum cleaner; then, wipe carefully to remove damage-causing abrasive material. Do not use compressed air to clean the machine.

Clean the Air Filters

- NOTE -

Keep the air filters clean to help prevent problems. Watch 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 and the nature of materials being machined in the vicinity.

Clean the air filters. Replace the air filters when you can no longer see light through them. Dirty shop air can cause damage to the control system if not filtered properly.

Clean the Interior of the Power Case

- WARNING -

Turn OFF the power case main disconnect switch and the power connected to the machine BEFORE opening the power case.

Close and secure the power case door before turning machine power ON.

Clean all contaminants from the interior of the machine power case.

SEMI-ANNUALLY

Check the Pneumatic Regulator System Bowl

Check the pneumatic regulator system bowl. Fill the lubricator bowl if necessary.

When the level drops below the EMPTY line, fill to FULL with Mobil® DTE Light oil.

1. Shut OFF the air pressure.
2. Remove the screw from the fill hole at the left rear of the lubricator.
3. Fill the bowl to the FULL line. Do not overfill.
4. Replace the fill hole screw.

Drain and Clean the Pneumatic Filter Bowls

The bowls should be cleaned a minimum of twice a year. Clean the bowls more frequently if contaminant build-up is severe.

- WARNING -

DO NOT use soap. Use only warm water to clean the filter bowls. Using soap, solvent, or chemicals may weaken the bowl and cause it to burst, resulting in serious personal injury.

To drain and clean the bowls:

1. Put a dry rag under the regulator to catch the drips.
2. Drain the filter bowls by pressing up on the drain valves.
3. Turn the air supply to the machine OFF.
4. Gently unscrew both bowls.
5. Rinse the filter bowls with WARM WATER only.
6. Replace the bowls.
7. Fill the lubricator with Mobil DTE Light oil.
8. Turn the air supply to the machine ON.

Check the Spindle Motor for Dirt

The spindle motor can become overheated if excessive grease and dirt are allowed to build up.

1. Remove spindle motor hood.
2. Inspect the motor for dirt.
3. Wipe the motor with a rag and remove as much of the build-up as possible.
4. Replace the hood.

Check the Spindle Drive Belt for Dirt and Wear

If the housing itself is excessively dirty, the belt may be worn or weak.

1. Remove the spindle drive belt cover.
2. Inspect the belt for wear, cracks, or damage.
3. If the belt looks worn, call Dealer Service to replace it.
4. Replace the cover.

Grease the Vari-Drive

1. Remove screw "C", Figure 3.2, from the Vari-Drive grease port.
2. Introduce .08 fluid ounces [2.5 milliliters] of Lubriplate No. 107 grease into the Vari-Drive grease port.
3. Replace screw "C".

AS SPECIFIED ON LUBRICATION TAG

OIL THE QUILL DOWNFEED TWICE WEEKLY

Add five drops of Mobil® Vactra® Oil No. 4 to downfeed oil cup "A", Figure 3.1.

Refer to the lubrication plate on the right side of the machine head.

AS REQUIRED

Remove and clean the automatic oil system pump filter.

Figure 3.2 - Vari-Drive Grease Port

- NOTES -

CHAPTER 4 - MAINTENANCE

SPINDLE DRIVE MOTOR REMOVAL

1. Run head to adjust to lowest speed.
2. Disconnect power.
3. Remove three screws “A” and cover “B”, Figure 4.1.
4. Use two of three screws “A” to compress spring “C”.
5. Rotate the speed changer to the highest speed.
6. Remove the reversing switch from the belt housing.
7. Remove two securing screws “D”.
8. Pull back on the motor; then, push the motor forward.
9. Reach up inside and pull the drive belt back.
10. Lift the motor and rest the case on stud “E”, Figure 4.2.
11. Ease the belt over the lower drive disc and remove the motor.

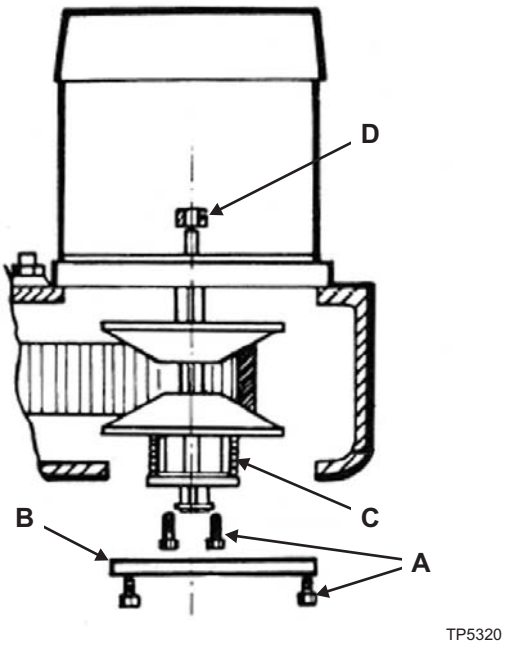


Figure 4.1 - Motor Removal: Front View

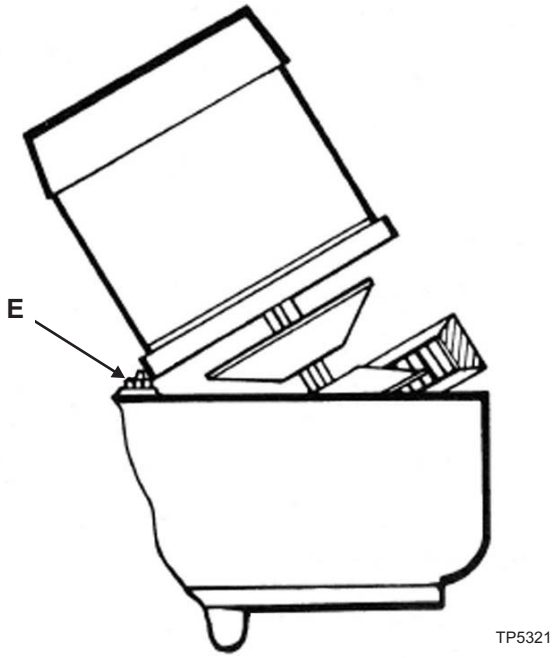


Figure 4.2 - Motor Removal: Side View

DRIVE BELT REPLACEMENT

1. Remove the spindle drive motor as described on page 4-1.
2. Remove three screws “F”, Figure 4.3. Insert them into the adjacent tapped holes and withdraw bearing housing “G”.
3. Remove the two screws and bushings “H”.
4. Remove four screws “I” and one screw “J”.
5. Remove the four screws securing speed changer “K”.
6. Remove top housing “L”. Tap to clear the dowels.
7. Replace the belt.

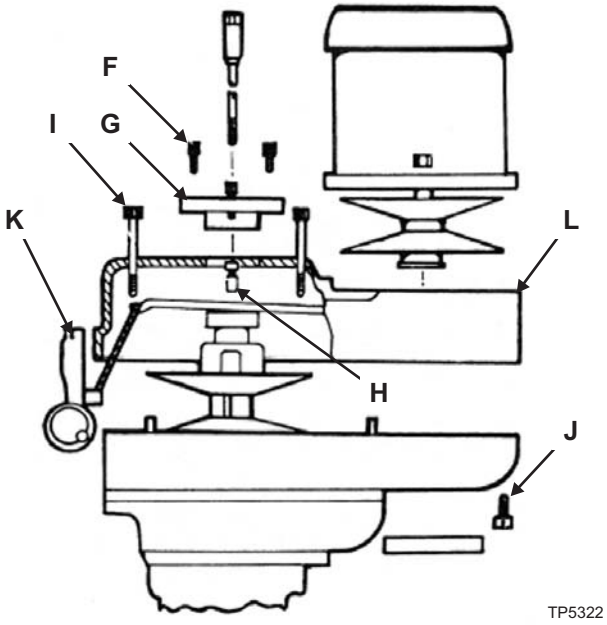


Figure 4.3 - Drive Belt Replacement

TIMING BELT REPLACEMENT

1. Remove the motor.
2. Lower the quill to full extent.
3. Remove two lower cap screws “M”, Figure 4.4, from the speed changer housing.
4. Remove four cap screws “N”.
5. Remove top assembly “O” and tap to clear dowels.
6. Replace the belt.

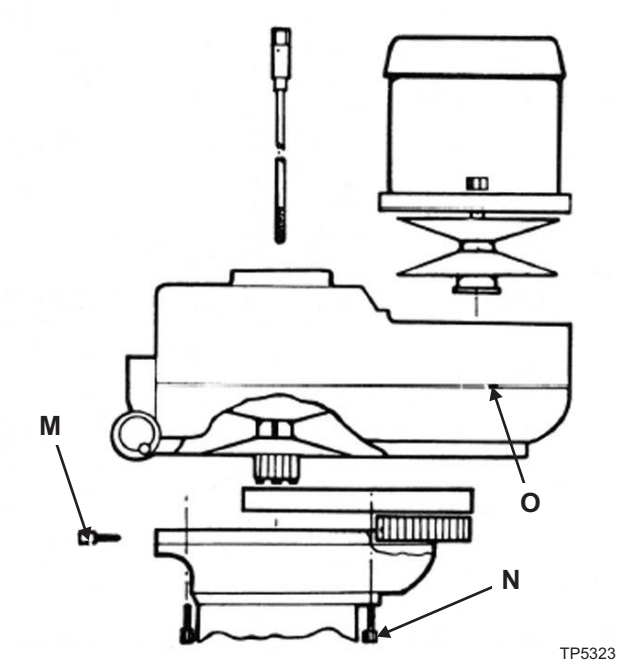


Figure 4.4 - Timing Belt Replacement

BRAKE SHOE REPLACEMENT

1. Remove the top housing. Refer to:
   - Spindle Drive Motor Removal, on page 4-1
   - Timing Belt Replacement, on page 4-3
2. Remove two screws “P”, Figure 4.5.
3. Remove clutch hub assembly “Q”.
4. Replace brake shoes “R”.
5. Remove the bearing, drive discs and circlips from hub assembly “Q”.
6. Replace the bearing and housing “S”.
7. Thread the hub through the bearing and reassemble the discs. Replace top housing and motor.

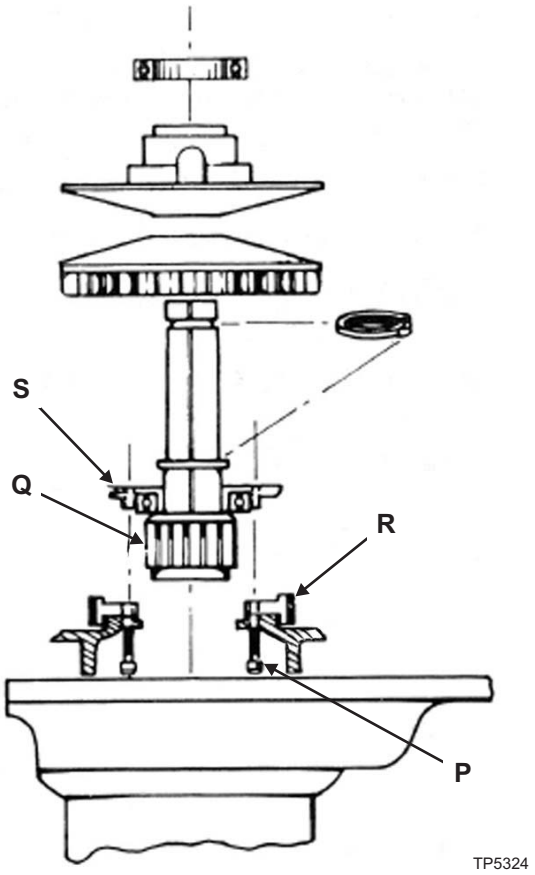


Figure 4.5 - Brake Shoe Replacement

MICRO FEED TRIP ASSEMBLY AND QUILL REMOVAL

1. Remove screw “A”, Figure 4.6.
2. Remove ball reverse lever “B”:
   A) Thread a #4-40 screw into the ball reverse lever.
   B) Use the #4-40 screw to remove the ball reverse lever.
3. Remove retaining ring “C”, screw “D”, and arm “E”.
4. Thread shaft “F” through the micro nuts and remove.
5. Remove screw “G” and stop “H”.
6. Remove the quill.
7. Clean all areas, oil liberally, and reassemble.
8. Check correct operation of micro feed trip assembly together with feed trip linkage as per the Feed Trip Adjustment on page 4-7.

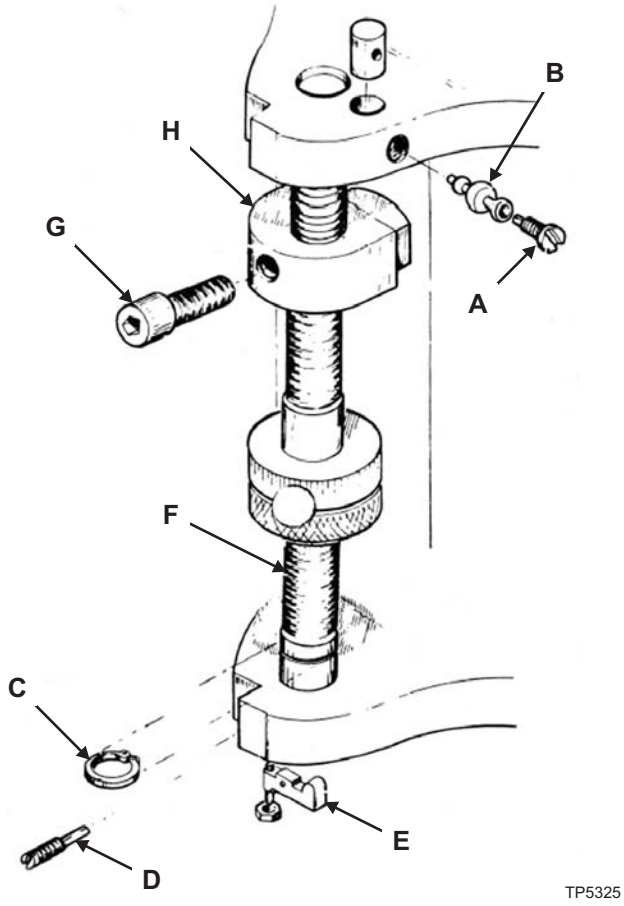


Figure 4.6 - Micro Feed Trip Assembly and Quill Removal

BALANCE SPRING REPLACEMENT

1. With the quill at the maximum UP position, apply the quill lock.
2. Remove screw “I”, hub “J”, and key “K”, Figure 4.7.
3. Remove screws “L”, allowing the housing to rotate slowly, releasing spring tension.
4. Lift the end of the spring from the pin on the pinion shaft.
5. Rotate housing “M” counterclockwise from the head casting.
6. Remove the spring from the housing and replace.
7. Refit the spring to the main housing casting. Turn the housing clockwise until the spring locates on the pin in the pinion shaft.

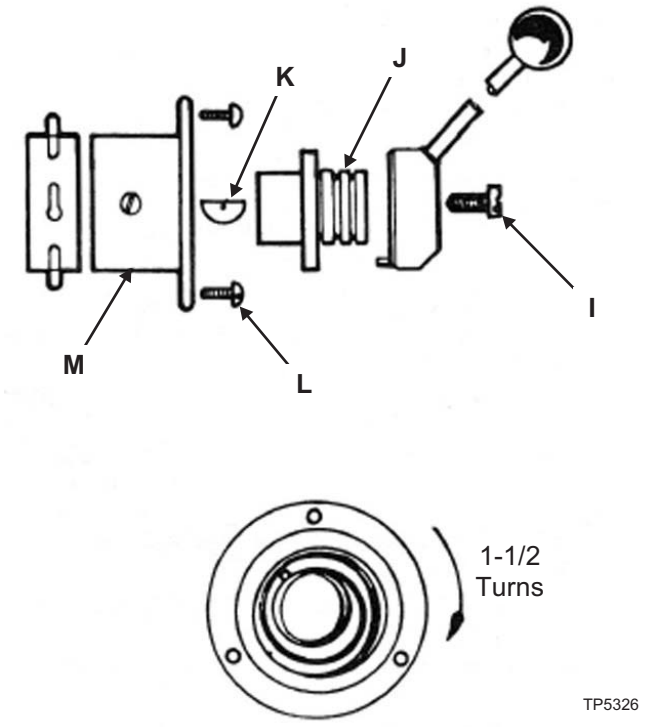


Figure 4.7 - Balance Spring Replacement

FEED TRIP ADJUSTMENT

1. Release locknut “N”, Figure 4.8.
2. Engage trip handle “P”.
3. Adjust the micro nuts against quill stop “O”.

- NOTE -

The machine will not be able to drill if adjusting screw “Q” is set too light.

4. Slowly turn adjusting screw “Q” until lever “P” trips.
5. Secure locknut “N”.
6. Check for quick action response.

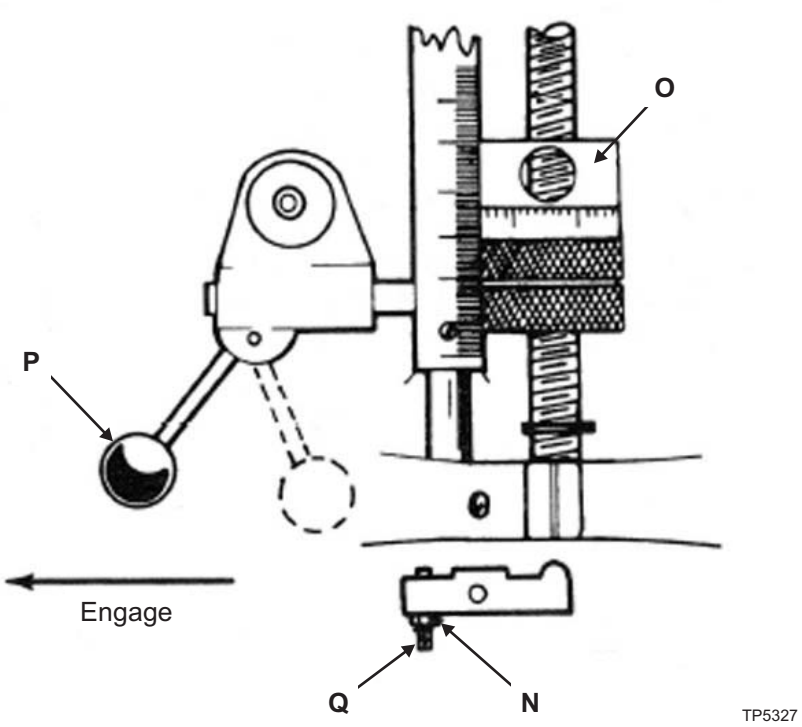


Figure 4.8 - Feed Trip Adjustment

COLLET ALIGNING SCREW REPLACEMENT

- CAUTION -

DO NOT attempt to remove nose cap before removing set screw "R". Doing so will cause serious damage.

1. Use a felt pen to mark a reference line on the quill and nose cap "S", Figure 4.9.
2. Remove set screw "R".
3. Unscrew nose cap "S".
4. Remove lock screw "T" and collet aligning screw "U".
5. Replace collet aligning screw "U".
6. Insert a collet and check that the dog on the end of the screw does not interfere with the bottom of the guide slot.
7. Replace lock screw "T".
8. Replace nose cap "S". Check felt pen markings for correct alignment.
9. Replace set screw "R".

- CAUTION -

DO NOT over-tighten as this will cause distortion.

10. Verify gap "V" is 0.003 in. (0.08 mm).

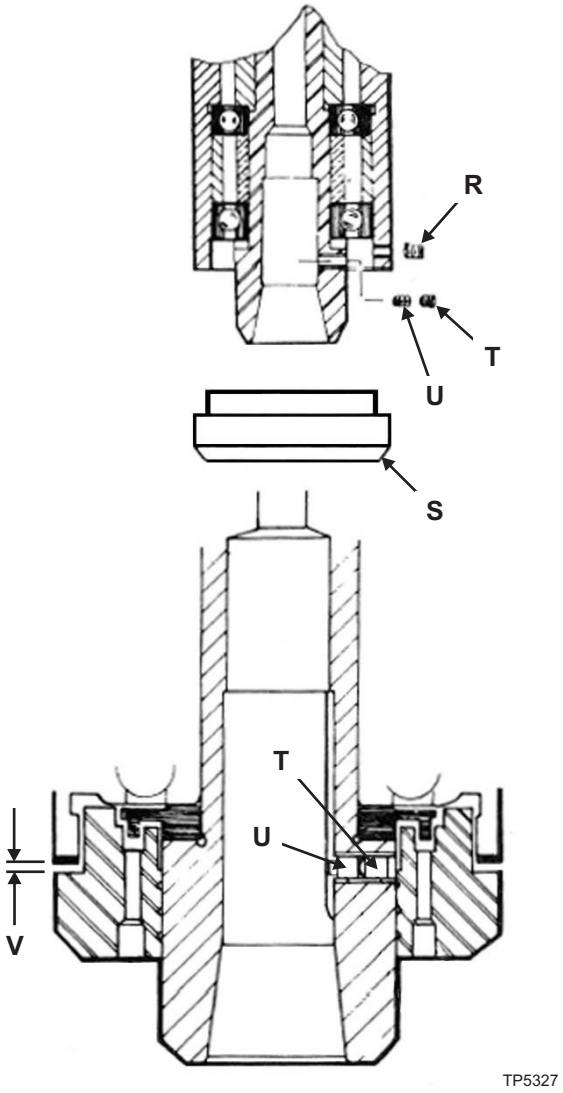


Figure 4.9 - Collet Aligning Screw Replacement

TABLE GIB ADJUSTMENT

The table gib is used for adjusting the table bearing on the saddle. The gib serves as a guide for the table travel.

1. Clean the front angular face of the saddle.

- NOTE -

Figure 4.10 shows how the left side indicator is mounted. Mount the right side indicator facing toward the right end of the machine in the same manner. Refer also to Figure 4.11.

2. Mount two magnetic-based indicators on the front angular face of the saddle.
3. Push the right end of the table by applying 50 lb_f [222 N] and pull the left end of the table by applying 50 lb_f [222 N], as shown in Figure 4.11.
4. Zero the indicators.

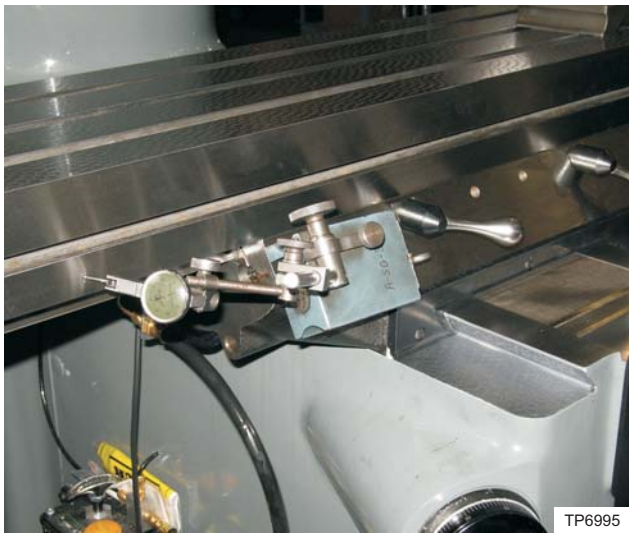


Figure 4.10 -Left Indicator Position for Table Gib Adjustment

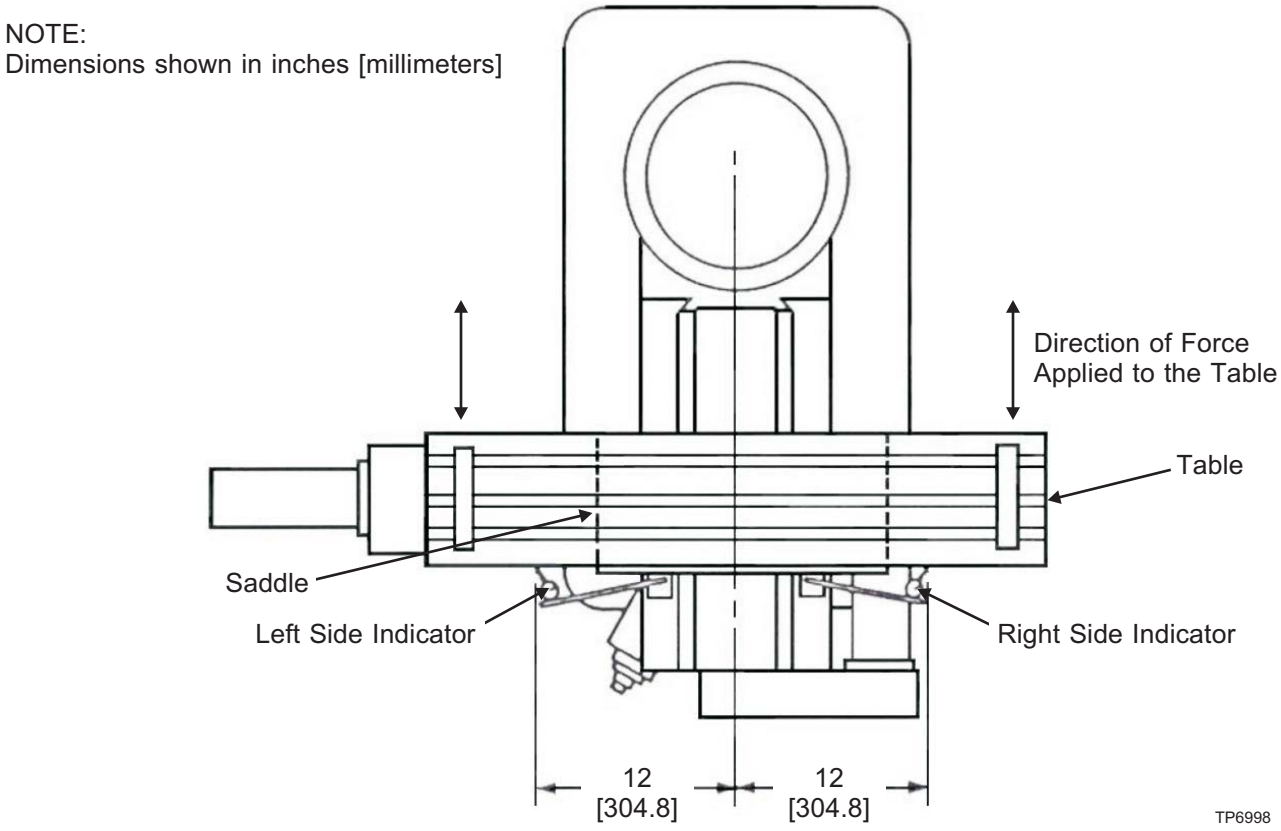


Figure 4.11 - Indicator Positions for Table Gib Adjustment

5. Pull the right end of the table by applying 50 lb_f [222 N] and push the left end of the table by applying 50 lb_f [222 N].
6. Record both indicator readings. Ignore + or - signs.

   Refer to Table 4.1 for the optimum indicator readings.

Indicator Readings	Values, Inch [Millimeter]
Minimum Indicator Readings	.0002" [.005]
Maximum Indicator Readings	.0004" [.010]
Maximum Difference Between Indicator Readings	.0002" [.005]
Springback (at 50 lb_f Force)	.0002" [.005]

Table 4.1 - Optimum Indicator Readings

7. If the readings do not exceed .0004 inches [.010 mm], gib adjustment is not required.

   If the readings exceed .0004 inches [.010 mm]:

   A) Adjust the gib by tightening gib screw "A", Figure 4.12, slightly until a slight drag is felt when moving the table by hand.

   B) Repeat steps 3 through 6 to check the gib adjustment. Repeat as needed.
8. Remove the indicators from the machine.

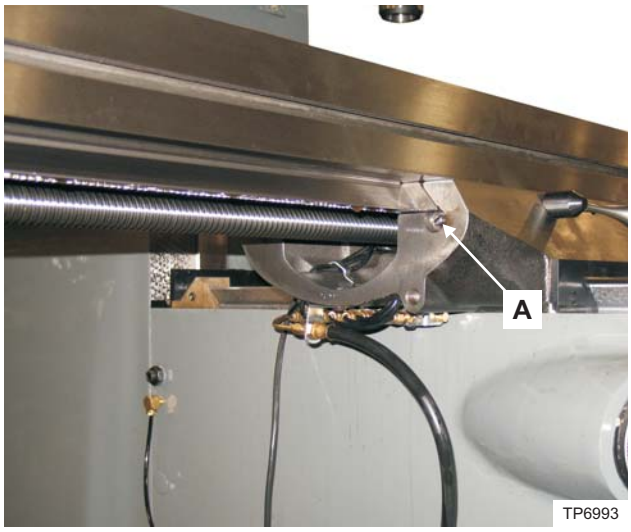


Figure 4.12 - Table Gib Adjustment Screw

SADDLE GIB ADJUSTMENT

The saddle gib is used for adjusting the saddle bearing on the knee. The gib serves as a guide for the saddle travel.

- NOTE -

Observe the orientation of the front saddle wiper before removing.

1. Remove three screws and slide front saddle wiper "B", Figure 4.13, off the machine.
2. Move the Y axis to position the saddle at the approximately midpoint of travel.

- NOTE -

Figure 4.14 shows how the front indicator is mounted. Mount the rear indicator facing toward the front of the machine in the same manner. Refer also to Figure 4.15.

3. Clean the dovetail surfaces to be used to mount the magnetic-based indicators.
4. Mount two magnetic-based indicators on the left dovetail surface on the top of the knee.
5. Push the right end of the table by applying 50 lb_f [222 N] and pull the left end of the table by applying 50 lb_f [222 N], as shown in Figure 4.15.
6. Zero the indicators.
7. Pull the right end of the table by applying 50 lb_f [222 N] and push the left end of the table by applying 50 lb_f [222 N].
8. Record both indicator readings. Ignore + or - signs.

   Refer to Table 4.1 for the optimum indicator readings.

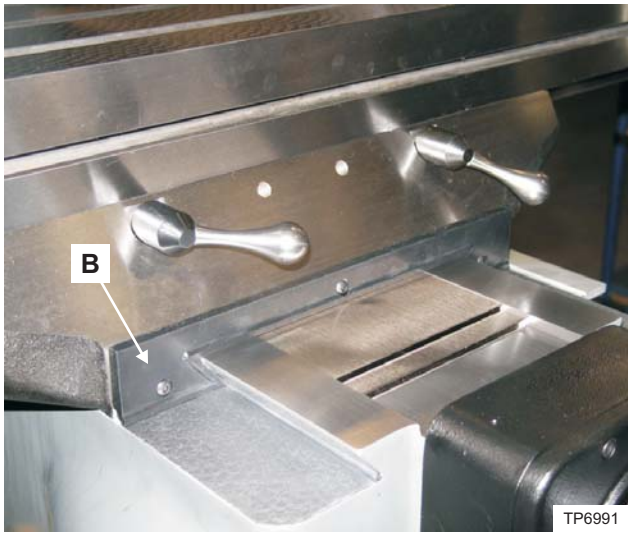


Figure 4.13 - Front Wiper on Saddle

Figure 4.14 - Front Indicator Position for Saddle Gib Adjustment

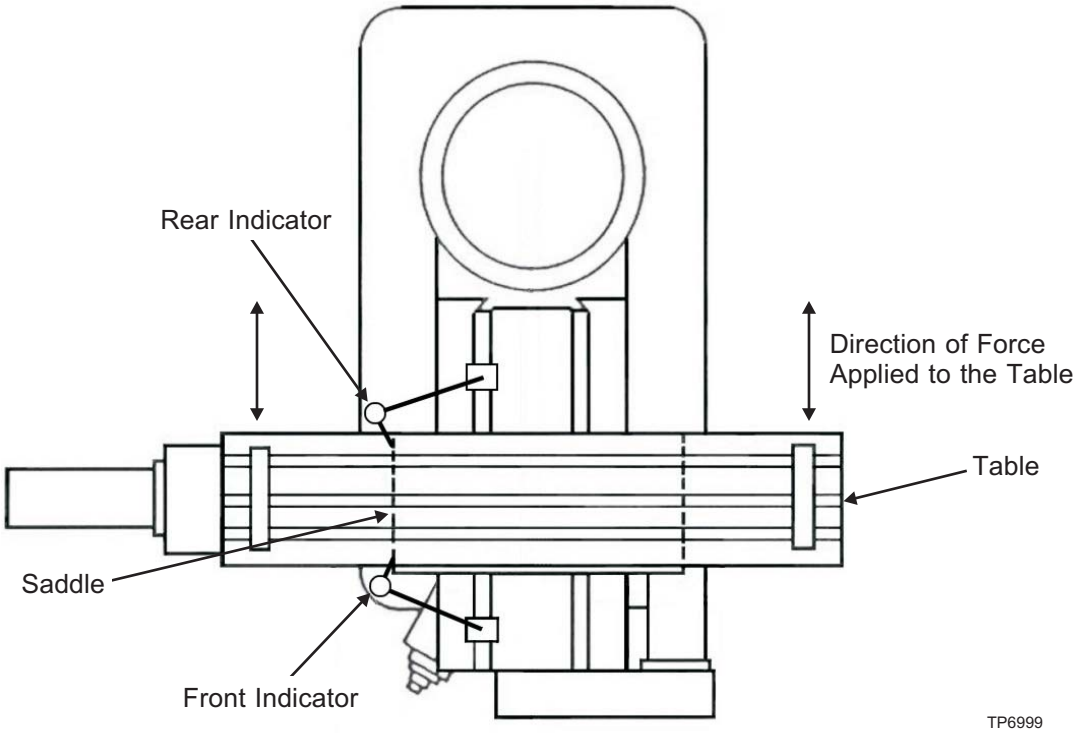


Figure 4.15 - Indicator Positions for Saddle Gib Adjustment

9. If the readings do not exceed .0004 inches [.010 mm], gib adjustment is not required.

   If the readings exceed .0004 inches [.010 mm]:

   A) Adjust the gib by tightening gib screw "C", Figure 4.16, slightly until a slight drag is felt when moving the saddle by hand.

   B) Repeat steps 5 through 8 to check the gib adjustment. Repeat as needed.

10. Remove the indicators from the machine.

11. Install front saddle wiper "B", Figure 4.13, and secure with three screws.

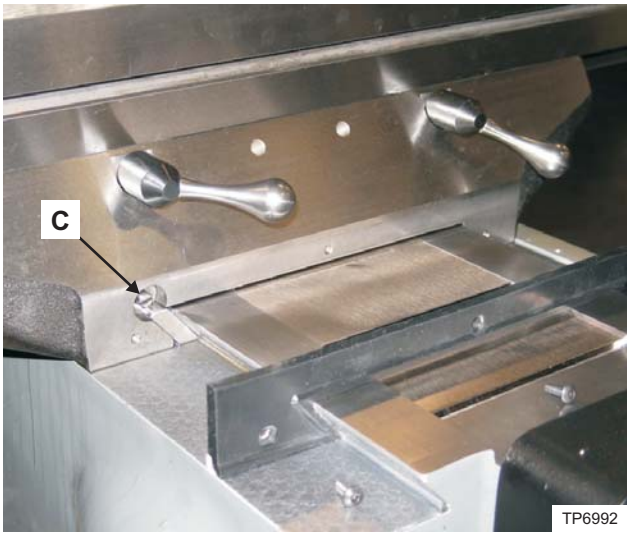


Figure 4.16 - Saddle Gib Adjustment Screw

KNEE GIB ADJUSTMENT

1. Move the X axis to position the table at the approximate midpoint of travel.
2. Move the Y axis to position rear saddle surface "D", Figure 4.17, approximately four inches [100 millimeters] from column dovetail surface "E", Figure 4.18.
3. Loosen the jam nuts on gib adjustment screws "F", Figure 4.19.
4. Use a hex wrench to loosen the gib adjustment screws approximately ¼ turn.
5. Alternately and evenly, torque the gib adjustment screws to 40 lb-in [4.5 N•m].

- NOTE -

DO NOT allow the gib adjustment screws to turn while tightening the jam nuts.

6. Hold the gib adjustment screws in place with the hex wrench while tightening the jam nuts.

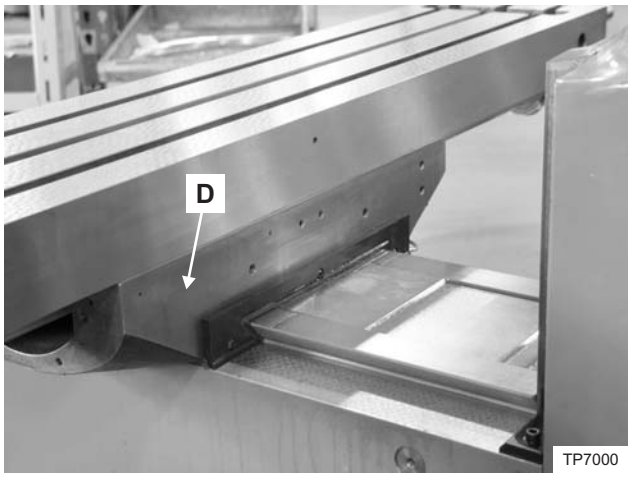


Figure 4.17 - Rear View of the Saddle

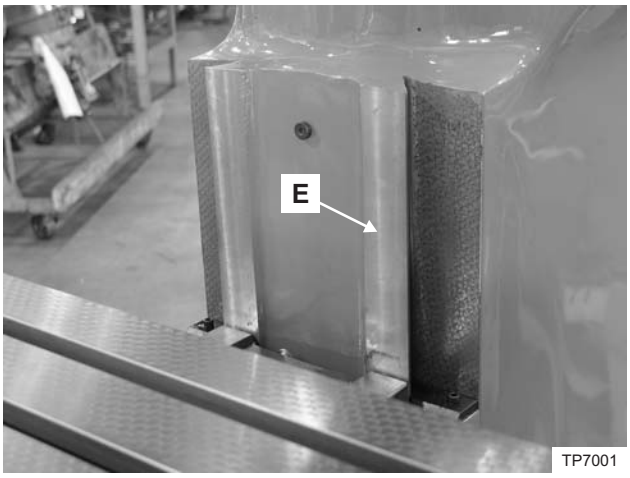


Figure 4.18 - Vertical Dovetail on the Column

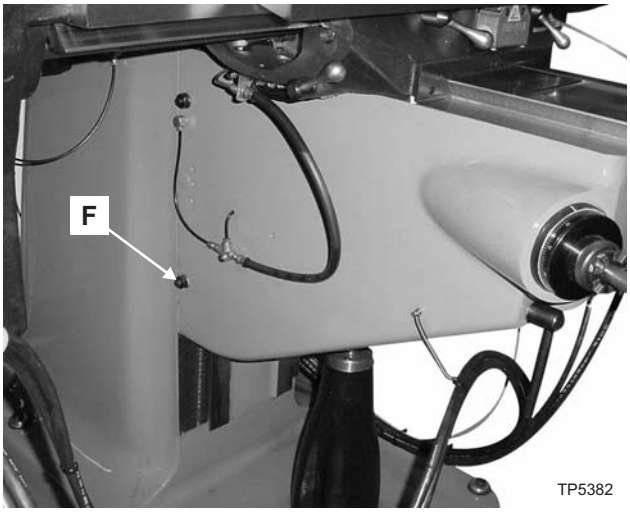


Figure 4.19 - Knee Gib Adjustment Screws

- NOTES -

CHAPTER 5 - AUTOMATIC LUBRICATION SYSTEM

INTRODUCTION

The first section of this chapter supplies general information concerning the machine automatic lubrication system. The following pages provide adjustment procedures and parts replacement information.

OVERVIEW

The bearings in the spindle, the spindle drive transmission, and the ballscrew mountings have antifriction angular contact bearings greased for life.

The moving components are all fed from a central lubricating reservoir, which contains a filter and motorized timed plunger pump.

The lubricator is located on the left side of the machine column. Refer to Figure 5.1.

OIL VISCOSITY RANGE

The viscosity range is 150 to 8000 SUS at operating temperature.

APPROVED LUBRICANTS

The following lubricants or equivalents are approved for use in the automatic lubrication system:

Gulf Oil Corp.	Gulfway 52 and subsidiaries
Mobil Oil Corp.	Mobil® Vactra® Oil No. 2
Shell Oil Company	Tonna 68
Sun Oil Corp.	Sunoco Way Lubricant 1180
Texaco Inc.	Way Lubricant D

Figure 5.1 - Lubricator Assembly
(Mounted on Left Side of Machine)

LUBRICATOR UNIT

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, and loose fittings and connections.
3. Check the bearing surfaces daily. If there is too little oil, check the following and repair as necessary:
    - Low oil level
    - Broken or cracked tubing
    - Loose connections
    - Flattened lubricator outlet tube
    - Clogged filter

MOTOR REPLACEMENT

- NOTE -

During reassembly, ensure the slot in the motor shaft is engaged with the pin in the drive shaft before replacing the screens.

Remove the motor cover and the two screens holding the motor to the top of the reservoir.

Install the new motor, screens, and cover.

OPERATION

Lubricator Pump

- NOTE -

The lubricator can also be actuated manually by raising and releasing the Manual Feed knob.

The lubricator is a motor-driven piston pump, spring-discharge type. Pump cycle time is controlled by an integral gear reduction in the motor.

Adjusting the Oil Discharge Volume Per Cycle

The stem on the Manual Feed knob has numbered graduations, ranging from 1 to 5. The number indicates the approximate discharge volume in cubic centimeters.

1. Lift collar "A" to allow Manual Feed knob "B", Figure 5.2, to be rotated.
2. Rotate the Manual Feed knob as follows:

   Clockwise to decrease the discharge volume

   Counterclockwise to increase the discharge volume
3. Release collar "A".

Discharge Pressure

The discharge pressure is 60 PSI maximum. Peak system pressure will decrease when the discharge volume decreases or the oil viscosity decreases.

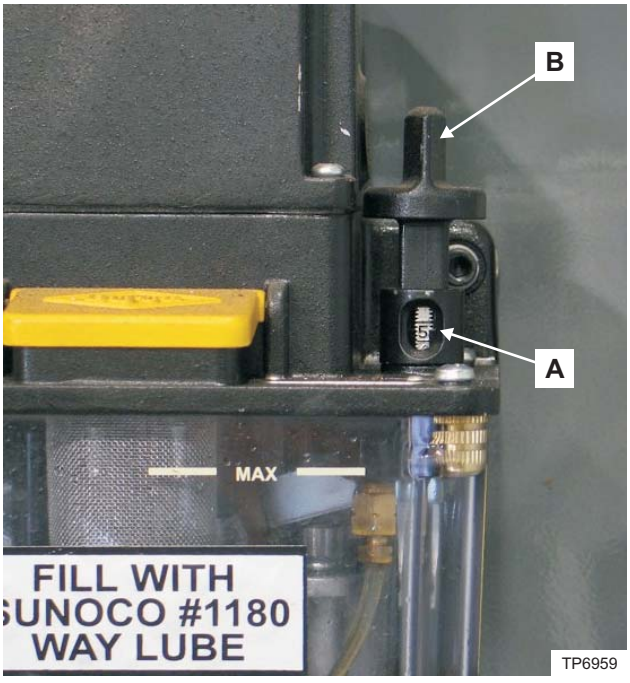


Figure 5.2 - Manual Feed Knob and Locking Collar

LUBRICATOR FILTER

- NOTE -

The lubricator filter should be replaced a minimum of once a year.

The lubricator filter is rated at 40 micron particle separation. It should be inspected periodically and replaced as required.

Remove the filter as follows:

Slide the spring clip OFF.

Remove the filter disc and spring.

LIQUID LEVEL SENSOR

The oil reservoir is equipped with an oil level sensor. The following conditions exist if the lubrication oil level falls below the minimum level:

- Automatic machine operation is inhibited.
- Manual spindle operation is inhibited.

Add lubrication oil to the Maximum mark on the reservoir.

LUBRICATION OIL SPECIFICATION

GENERAL DESCRIPTION

The way lubrication must contain tackiness additives.

The way lubrication must **not** contain lead or chlorine compound additives

USES

Machine tool way, heavy loaded journals, and screws.

SPECIFICATION TABLE

Lubricant specifications listed below are minimum standards which must be met by all lubricants recommended for use on the machine.

LUBRICATION SPECIFICATIONS			
			WAYLUBE
ASTM OR ABLE LUBE NUMBER			315
VISCOSITY S.U.S.		100° F	283 / 347
		210° F	-
V.I. - MINIMUM			-
FLASH POINT - ° F MINIMUM			350
POUR POINT - ° F MAXIMUM			0
MAXIMUM OP. TEMPERATURE - ° F			150
ADDITIVES OR INHIBITORS			R.F.S.
TEST REQUIREMENTS			
TIMKIN O.K. LD. - MINIMUM			
OXIDATION	ASTM D-943	MINIMUM HOURS	-
		NEUTRAL NUMBER CHG.	-
	ASTM D-943 MODIFIED		-
CU. CORROSION - ASTM - D-130 STAIN			-
ABLE ACCELERATED BREAKDOWN TEST			5
FOAM - ASTM D-892			2
EMULSION - ASTM - D-1401			-
BIJUR DIFFERENTIAL FILTRATION TEST			PASS
EVAPORATION ROCKWELL TEST			6
STICK SLIP RATIO - CMM TEST - MAXIMUM			.85
RUST - ASTM D-665A			PASS

- NOTES -

CHAPTER 6 - SAFETY GUARD INSTALLATION

INTRODUCTION

- NOTE -

American National Standard B11.8 and O.S.H.A. Section 1910.212 assign responsibility for point of operation safeguarding of milling machines to the employer/user. Point of operation safeguarding should be used on milling machines to the greatest extent possible to prevent injury resulting from the cutter, chips, or coolant.

This chapter provides basic information for the installation and use of the general purpose safeguard. A safety guard is supplied with each machine. The safety guard is designed to provide protection from chips and coolant.

Point of operation safeguarding is the responsibility of the employer or user. They are in the best position to evaluate the safety requirements and ensure that the proper safeguards are employed.

There is no single safety guard that can match the versatility of the *EZ Vision*™ automated milling machine. As a result, you will find that the general purpose safeguard, like all safeguards, will be suitable for some operations, but not for others. Carefully analyze the operation to be performed before deciding whether this safeguard is suitable. Adjust the safeguard to suit your special requirements. If you find that it is not suitable for a particular application, you should use an alternate form of protection.

- WARNING -

Some coolants and cutting oils contain chemicals harmful to the safety guard. These chemicals are: Mono-ethanolamine, Di-ethanolamine, Tri-ethanolamine and the combination thereof. These chemicals may significantly reduce the impact strength of the safety guard within days and could destroy the safety guard within weeks.

Use of coolants or cutting oils containing any of these chemicals will void the warranty on your safety guard and could expose the machine operator to injury.

A safeguard DOES NOT take the place of any other safety practice or safety equipment.

YOU MUST ALWAYS wear safety glasses and safety shoes.

YOU MUST ALWAYS stop the spindle of the machine completely before changing or adjusting the workpiece, fixture, or tool.

YOU MUST NEVER wear gloves, long sleeves, long hair, rings, watches, neckties, jewelry, or other loose items.

INSTALLATION PROCEDURES

MACHINES WITH R-8 SPINDLE

The manufacturer has drilled and tapped two holes in the nose cap of the spindle to be used for mounting the guard (the two untapped holes serve to remove the nose cap with a spanner wrench).

1. Place mounting ring “B” underneath top of guard “D”, Figure 6.1.
2. Place two socket head cap screws “A” through the holes in ring, and hand-start them into the threaded holes in the nose cap until hand tight.
3. Align guard to be square with the table of the machine, unless angular mounting is desired.
4. Tighten screws with a 3/16” Allen wrench.

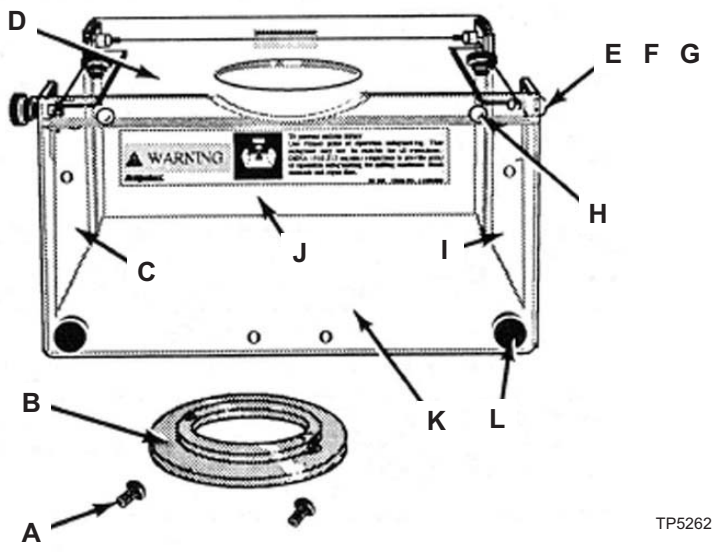


Figure 6.1 - Safety Guard for Machines with an R-8 Spindle

MACHINES WITH ERICKSON #30 OR UNIVERSAL #200 QUICK-CHANGE SPINDLE

If the machine has either an Erickson #30 or a Universal #200 quick-change spindle, the manufacturer has drilled and tapped four #8-32 holes in the nose cap of the spindle for mounting the guard.

Erickson #30 Quick-Change Spindle

If the nose cap mounting ring has been installed, omit steps 1, 2, and 6.

If the nose cap mounting ring has not been installed, the following procedure will apply:

1. Remove the knurled spindle locknut. This is done by removing the long button head black finish screw, which is normally left of the cadmium-finished button head screw on the locknut of the spindle. This will allow you to unscrew the locknut by turning it counterclockwise.
2. Place the nose cap mounting ring “O” up against the quill nose cap and install the four button head cap screws “M”, Figure 6.2.

- NOTE -

The counterbored side of the nose cap mounting ring fits against the nose cap.

3. Lower the quill. Place the clamping ring “P” underneath the top of the guard “Q” and position the guard under the spindle.
4. Install the four socket head cap screws “N” through the nose cap mounting ring and thread them into the clamping ring.
5. Align the front of the guard parallel to the front of the table. Tighten the screws clamping the guard in position.
6. Install the knurled spindle locknut.

Universal #200 Quick-Change Spindle

The quick change locknut is not to be removed. To install the spindle safeguard, follow the preceding steps listed above: 2, 3, 4, and 5.

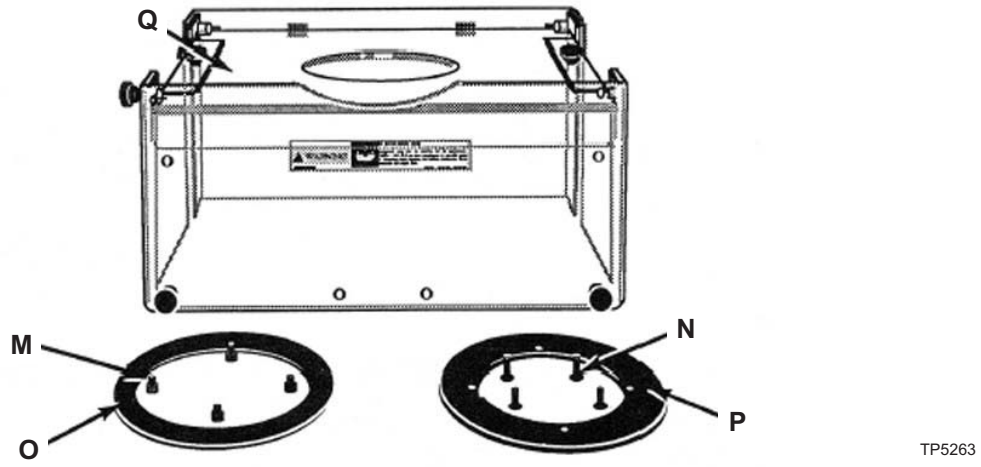


Figure 6.2 - Safety Guard for Machines with a Quick-Change Spindle

COMPONENT LISTS

R-8 SAFETY GUARD ASSEMBLY

(Part Number BP 11191200)

Refer to Figure 6.1 for component identification.

Item	Part Number	Description	Quantity
A	BP 11011031	Screw, Socket Hd Cap, .250”-20 x .625”	2
B	BP 12191201	Ring, Guard	1
C	BP 11191204	Shield, Left Side	1
D	BP 11191206	Shield Assy, Top	1
E	BP 11665810	Screw, Button Hd Cap, #10-32x.750”	3
F	BP 11010065	Washer, Plastic, #10-32	8
G	BP 11010055	Nut, Stop, Plastic, #10-32	3
H	BP 11010063	Screw, Drive, Type U, #12 x .625”	2
I	BP 11191205	Shield, Right Side	1
J	BP 11191203	Assembly, Rear Shield	1
K	BP 11121202	Assembly, Front Shield	1
L	BP 11010056	Screw, Hand, #10-32 x .750”	4

QUICK-CHANGE SAFETY GUARD ASSEMBLY

(Part Number BP 11190341)

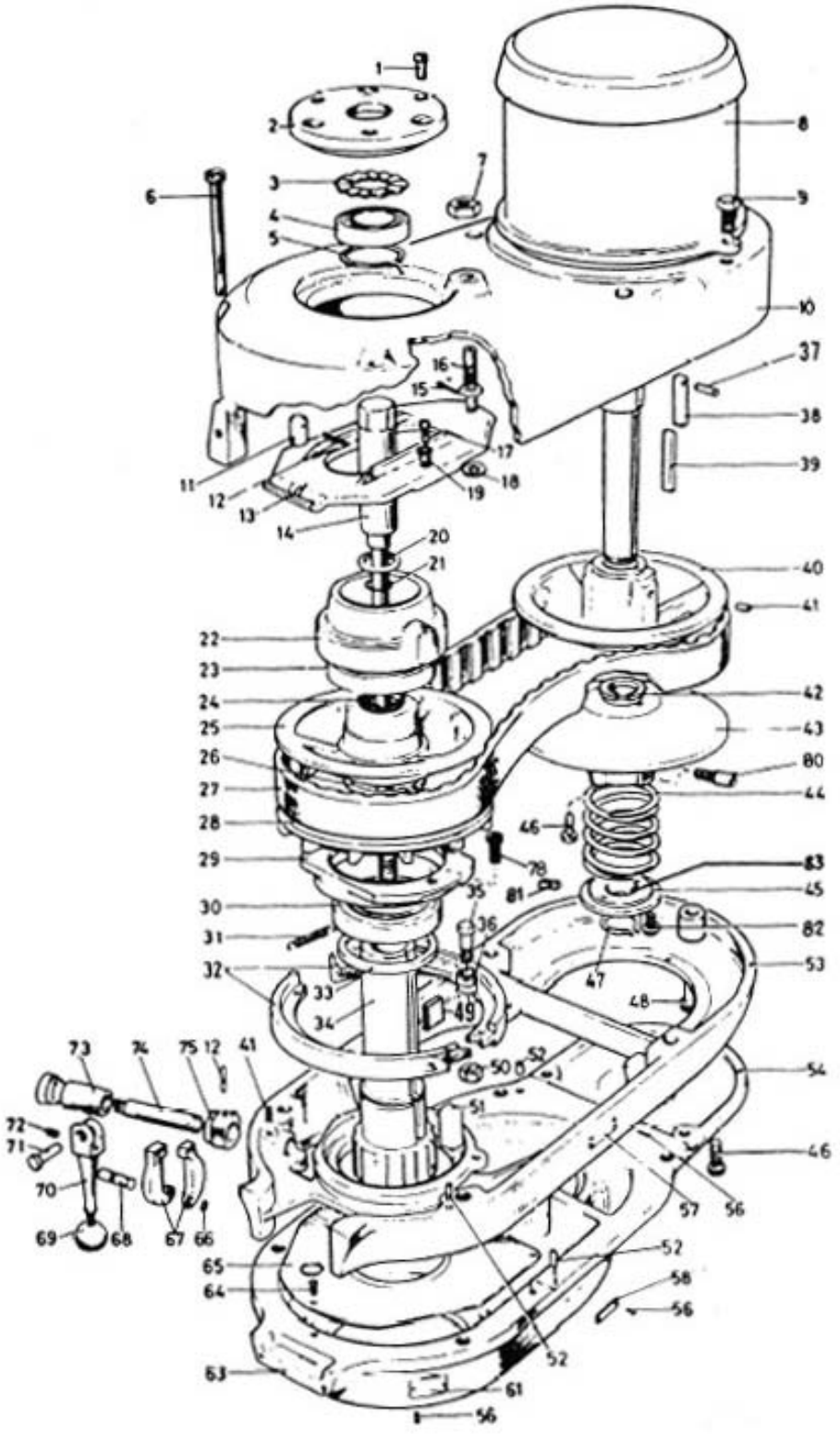
Refer to Figures 6.1 and 6.2 for component identification.

Item	Part Number	Description	Quantity
A	BP 11011031	Screw, Socket Hd Cap, .250”-20 x .625”	2
C	BP 11191204	Shield, Left Side	1
E	BP 11665810	Screw, Button Hd Cap, #10-32x.750”	3
F	BP 11010065	Washer, Plastic, #10-32	8
G	BP 11010055	Nut, Stop, Plastic, #10-32	3
H	BP 11010063	Screw, Drive, Type U, #12 x .625”	2
I	BP 11191205	Shield, Right Side	1
J	BP 11191203	Assembly, Rear Shield	1
K	BP 11121202	Assembly, Front Shield	1
L	BP 11010056	Screw, Hand, #10-32 x .750”	4
M	BP 11651199	Screw, Button Hd Cap, #10-32 x .500”	4
N	BP 11980224	Screw, Socket Hd Cap, #8-32 x .625”	4
O	BP 12190330	Ring, Guard	1
P	BP 12190331	Ring, Guard	1
Q	BP 11191207	Shield Assy, Top	1

- NOTES -

CHAPTER 7 - PARTS LISTINGS

HEAD TOP HOUSING



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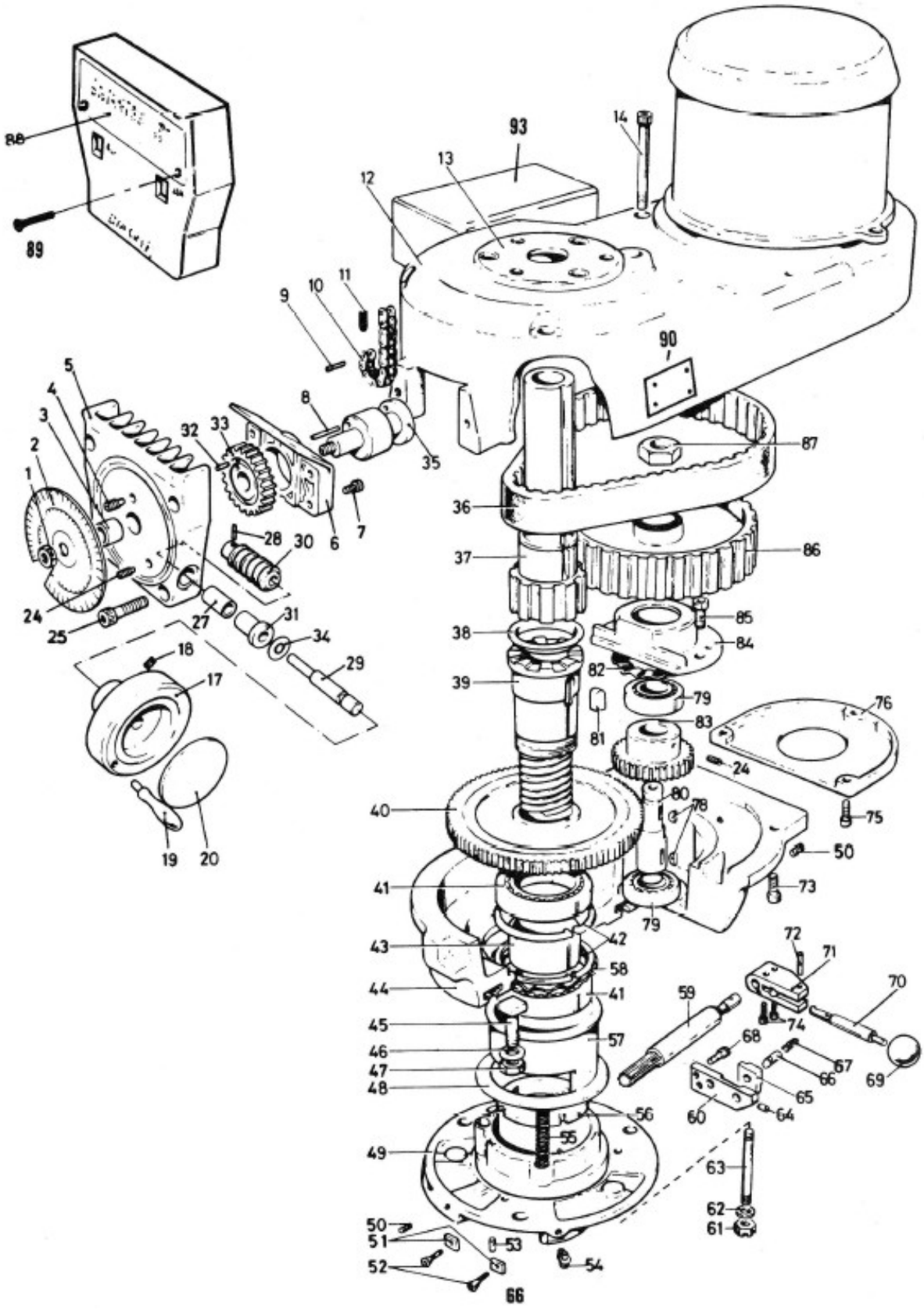
HEAD TOP HOUSING

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 11011033	Screw, Socket Hd Cap, ¼”-20 x ¾” Lg	3
2	BP 12180094	Cap, Top Bearing	1
3	BP 11181977	Washer, Wave Spring	1
4	BP 11180252	Bearing, Ball, Fafnir #9107 NNP	1
5	BP 11180848	Ring, Snap, #5100-137	1
6	BP 11011069	Screw, Socket Hd Cap, 5/16”-18 x 6”	2
7	BP 11011745	Nut, UNC Hex Jam, 3/8”-16	1
8	BP 11550001	Motor, 2 HP, Multi-Volt, 50/60	1
9	BP 11011148	Screw, Hex Hd Cap, 3/8”-16 x 1"	2
10*	BP 12180051	Housing, Upper Belt	1
11	BP 12180066	Stud, Speed Change Chain	1
12	BP 11010535	Pin, Roll, 5/32" Dia. x 1.00" Lg	2
13	BP 11180058	Plate, Speed Change	1
14	BP 12184920	Assembly, Drawbar	1
15	BP 11010606	Pin, Cotter, 3/32" Dia. x ¾"	1
16	BP 12180074	Stud, Speed Change Plate Pivot	1
17	BP 11011020	Screw, Socket Hd Cap, #10-32 x ¾”	2
18	BP 11180095	Washer	1
19	BP 12180089	Sleeve, Pivot	2
20	BP 12180093	Washer, Drawbar	1
21	BP 11180915	“O” Ring, Parker #2-14	1
22	BP 12180056	Housing, Spindle Pulley Bearing Sliding	1
23	BP 11170262	Bearing, Ball, Fafnir #RM9110NPP	1
24	BP 11182124	Insert, Plastic	2
25	BP 12183934	Varidisc, Adjustable Drive A	1
26	BP 11180855	Ring, Retaining, #5102-156	1
27	BP 11182120	Belt, Varispeed	1
28	BP 12180082	Varidisc, Stationary Drive	1
29	BP 12180043	Cap, Brake and Bearing	1
30	BP 11170262	Bearing, Ball Fafnir #RM9110NPP	1
31	BP 11182081	Spring, Brake	2
32	BP 12180073	Shoes, Brake	2
33	BP 12180078	Spacer, Spindle Pulley	1
34	BP 12180042	Assembly, Spindle Pulley Hub	1
35	BP 11011138	Screw, Hex Hd Cap, ¼”-20 x ¾"	1
36	BP 12180071	Sleeve, Brake Shoe Pivot	1
37	BP 11010513	Pin, Roll, .125” x .437”	1
38	BP 12550007	Key, Drive, Fixed Varidisc	1
39	BP 12550004	Assembly, Key, Drive, Varidisc	1
40	BP 12550006	Varidisc, Stationary Motor	1

ITEM	PART NUMBER	DESCRIPTION	QTY
41	BP 11011287	Screw, Stainless Steel, ¼”-20 x ¼”	2
42	BP 11182126	Insert, Plastic Replaceable Type	2
43	BP 12550046	Assembly, Adjustable Motor Varidisc	1
44	BP 11182083	Spring, Varidisc Motor Shaft	1
45	BP 11550003	Collar, Adjustable Varidisc Spring	1
46	BP 11011022	Screw, Socket Hd Cap, #10-24 x 1.00” Lg	3
47	BP 11150843	Ring, Snap	1
48	BP 11011052	Screw, Socket Hd Cap, 5/16”-18 x ¾”	1
49	BP 11182122	Key, Plastic	1
50	BP 11011707	Nut, Hex Jam, .250”-20	1
51	BP 12180084	Key	1
52	BP 12180107	Pin, Taper, #4 x 1.00"	4
53*	BP 12180052	Base, Belt Housing	1
54	BP 12180088	Cover, Motor Pulley	1
56	BP 11011552	Screw, Drive, Type U, #0 x ¼"	8
58	BP 11182893	Nameplate, Hi-Low Range	1
61	BP 11182894	Nameplate, Quill Feed	1
63	BP 12180053	Housing, Gear	1
64	BP 11011443	Screw, Round Hd Machine, #10-24 x 3/8"	3
65	BP 11185030	Plate, Gear Housing	1
66	BP 11180818	Ring, Snap, #5100-25	1
67	BP 11182306	Finger, Brake Operating	2
68	BP 12180083	Stud, Brake Finger Pivot	1
69	BP 11192151	Knob, Bakelite, ¼” x 20"	1
70	BP 12190133	Handle, Brake	1
71	BP 12190134	Pin, Brake Lock	1
72	BP 11011260	Screw, Stainless Steel, #10-32 UNF x ¼"	1
73	BP 12180104	Sleeve for Brake Lock Shaft	1
74	BP 28025521	Shaft, Brake Lock	1
75	BP 12180069	Cam, Brake Lock	1
78	BP 11011031	Screw, Socket Hd Cap, ¼”-20 x 5/8"	1
80	BP 11011016	Screw, Flat Hd Cap, #10-32 x 0.500"	1
82	BP 11011006	Screw, Socket Hd Cap, #8-32 x 0.250"	1
83	BP 12550008	Key	1

* Item 10 and 53 sold as assembly only

HEAD BACK GEAR



HEAD BACK GEAR

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 11011710	Nut, Hex, 5/16"	1
2	BP 11180133	Dial, Spindle Speed	1
3	BP 11183646	Bushing, Bronze, Boston #B810-4	1
4	BP 11011380	Screw, Full Dog Socket Hd Set, ¼”-20 x ½” Set	1
5	BP 12180055	Housing, Speed Changer	1
6	BP 12182003	Block, Plastic Bearing	1
7	BP 11011031	Screw, Socket Hd Cap, ¼”-20 x 5/8"	4
8	BP 11010516	Pin, Roll, 1/8" Dia. x 5/8" Lg	1
9	BP 11010520	Pin, Roll, 1/8" Dia. x 1.00" Lg	1
10	BP 11183720	Chain, Speed Changer, Morse #35	1
11	BP 12180066	Stud, Speed Change Chain	1
12	BP 12180051	Housing, Belt	1
13	BP 12180094	Cap, Top Bearing	1
14	BP 11011065	Screw, Socket Hd Cap, 5/16”-18 x 4"	1
17	BP 12182001	Hub, Speed Change	1
18	BP 11181233	Screw, Socket Hd Set, 1/4”-UNC x 3/8"	1
19	BP 11182178	Handle, Machine, #3302	1
20	BP 11182892	Plate, Caution	1
24	BP 11011287	Screw, Stainless Steel, ¼”-20 x ¼"	2
25	BP 11011037	Screw, Socket Hd Cap, ¼”-20 x 1-1/4"	4
27	BP 11183645	Bushing, Oilite	1
28	BP 28300619	Pin, Roll, 2.5mm x 12mm Lg	1
29	BP 28025716	Shaft, Speed Changer	1
30	BP 28007307	Gear, Boston Worm	1
31	BP 11180214	Bushing, Oilite Flanged, FB	1
32	BP 11010539	Pin, Roll, 3/16" Dia. x 3/8" Lg	1
33	BP 12180090	Gear, Speed Change Spur	1
34	BP 11181923	Washer, Wavy Spring	1
35	BP 12180065	Drum, Speed Change Chain	1
36	BP 11552106	Belt, Timing	1
37*	BP 12180042	Hub, Spindle Pulley	1
38*	BP 12180064	Sleeve, Timing Pulley Clutch	1
39	BP 12180059	Hub, Splined Gear	1
40**	BP 12180062	Gear, Spindle Bull	
41	BP 11180254	Bearing, Ball, Fafnir #RM9308NPP	2
42	BP 11180803	Ring, Snap, #5000-244	2

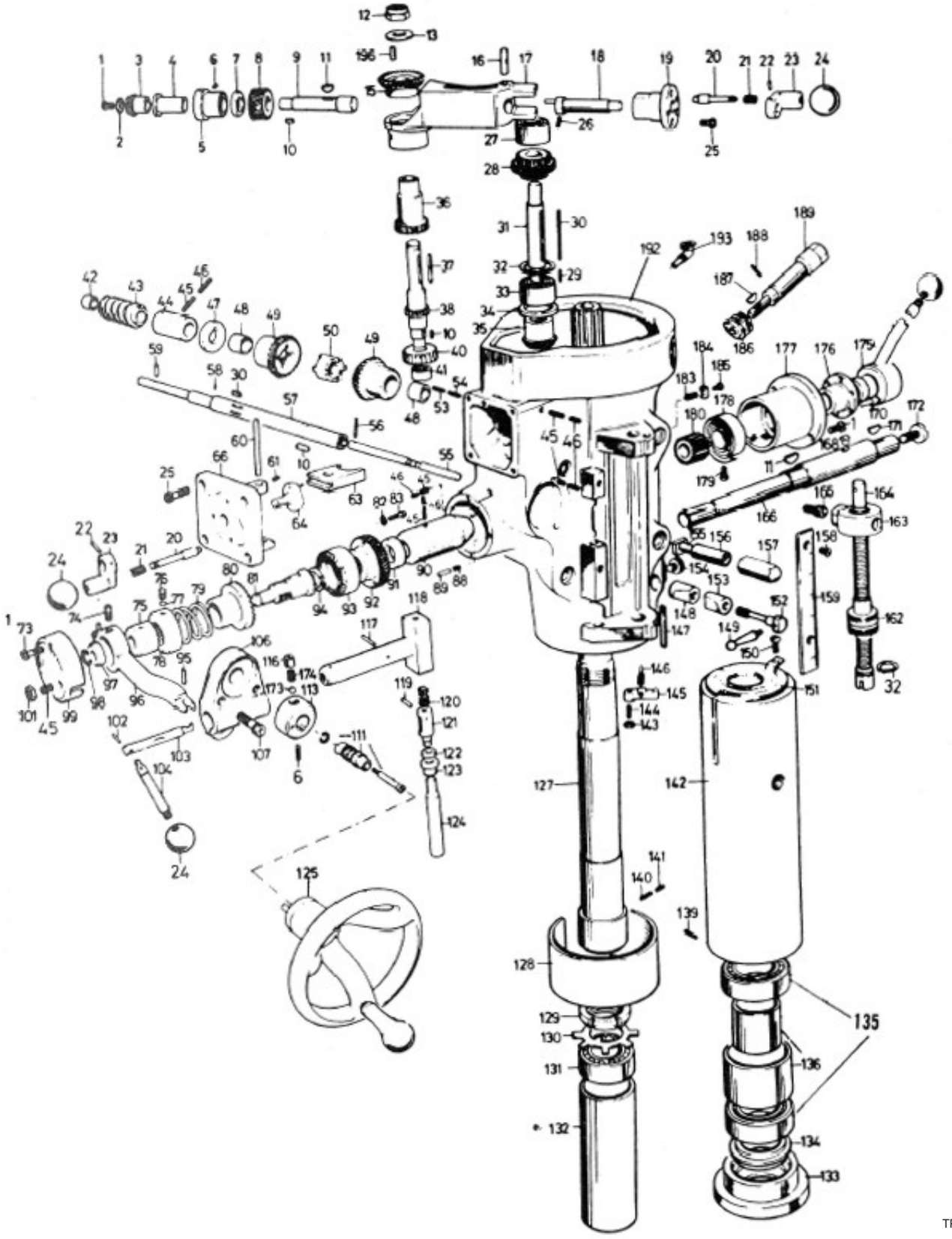
ITEM	PART NUMBER	DESCRIPTION	QTY
43	BP 12180063	Spacer, Bull Gear Bearing	1
44	BP 12180052	Housing, Gear	1
45	BP 11181650	Bolt, Tee	3
46	BP 11181906	Washer, Flat, 15/32" ID x 15/16" OD x 1/16"	3
47	BP 11011750	Nut, HDN Finished Hex Jam, 7/16”-14	3
48	BP 11181986	Washer, Ball Bearing Gear Sleeve	3
49	BP 12180054	Bracket, Fixed Clutch Bracket	1
50	BP 11011246	Screw, Socket Hd Set, 5/16”-18 x 5/16"	2
51	BP 28025615	Guide	2
52	BP 28025671	Screw, Flat Socket Hd Cap, #10-32 x 3/8"	2
53	BP 11010511	Pin, Roll, 1/8” x ¼" Lg	1
54	BP 11183104	Cup, Oil, Gits #1202 Style L	1
55	BP 11182071	Spring, Compression, 3/8" OD x 3.00" Lg	3
56	BP 11181794	Locknut, Bearing, #–08	1
57	BP 12180061	Sleeve, Bearing	1
58	BP 11181977	Washer, Wave Spring	1
59	BP 12180067	Bull Gear Shift Pinion	1
60	BP 12180161	Plate, Hi-Low Detent	1
61	BP 11181732	Nut, Hex, 3/8”-16"	3
62	BP 11151913	Lockwasher, 3/8"	3
63	BP 12180085	Studs	3
66	BP 12180100	Plunger, Hi-Low Detent	1
67	BP 11182072	Spring, ¾” x 0.032 x 9/16"	1
68	BP 11011017	Screw, Socket Hd Cap, #10-32 x ½" Lg	2
69	BP 11192151	Knob, Bakelite, ¼”-20	1
70	BP 12180099	Crank, Hi-Low Shift	1
71	BP 12180096	Block, Hi-Low Pinion	1
72	BP 11010516	Pin, Roll, 1/8" Dia. x 5/8" Lg	1
73	BP 11011052	Screw, Socket Hd Cap, 5/16” x ¾” Lg	4
74	BP 11181007	Screw, Socket Hd Cap, #8/32 x 0.625"	2
75	BP 11011022	Screw, Socket Hd Cap, #10-24 x 1.00"	1
76	BP 12180088	Cover, Motor Pulley	1
78	BP 11013079	Key, Woodruff #9	2
79	BP 11180235	Bearing, Fafnir #203NPP-C8	2
80	BP 12180075	Shaft, Bull Gear Pinion Counter	1
81	BP 12180103	Key, Sq, .312” x .540”	1
82	BP 11181975	Washer, Wave Spring	1
83**	BP 12180077	Pinion, Bull Gear	

ITEM	PART NUMBER	DESCRIPTION	QTY
84	BP 12180076	Cap, Bull Gear Pinion Bearing	1
85	BP 11011011	Screw, Socket Hd Cap, #10-24 x 5/8" Lg	2
86	BP 12550016	Pulley, Timing Belt	1
87	BP 11191738	Nut, Hex Jam, 5/8-18"	1
88	BP 11182912	Nameplate, Speed Change	1
89	BP 11011139	Screw, Flat Hd Machine, #8-32 x 0.750"	2
90	BP 11182897	Plate, Lubrication	1
93	BP 11182655	Drum, Switch	1

* Items 37 and 38 sold as assembly only

** Items 40 and 83 sold as assembly only

HEAD LOWER HOUSING



HEAD LOWER HOUSING

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 11011445	Screw, Round Hd Cap, #10-24 x 3/8" Lg	3
2	BP 12190163	Washer, Bevel Pinion	1
3	BP 12190203	Gear, Feed Bevel Pinion	1
4	BP 12190164	Sleeve, Feed Worm Gear Shaft	1
5	BP 11192303	Bushing, Worm Cradle	1
6	BP 11011287	Set Screw, ¼”-20 x 5/16"	2
7	BP 12190165	Spacer, Worm Gear	1
8	BP 12190266	Gear, Feed Drive Worm	1
9	BP 12190167	Shaft, Feed Drive Worm Gear	1
*	BP 12193440	Assembly, Gear Drive Shaft	
10*	BP 12190162	Key, Worm Shaft, 1/8" Sq. x 5/16"	3
11	BP 11013078	Key, Woodruff #7	3
12	BP 11191796	Locknut, Flexloc, 3/8”-24"	1
13	BP 12190199	Washer, 3/8"	1
15	BP 11192209	Gear, Feed Reverse Bevel	1
16	BP 12190168	Pin, Feed Engage	1
17	BP 12190059	Cradle, Word Gear	1
18	BP 12190169	Throw-out, Worm Gear Cradle	1
19	BP 12190170	Sleeve, Shift	1
20	BP 12190138	Pin, Shift	2
21	BP 11192052	Spring, Compression	2
22	BP 11010517	Pin, Roll, 1/8” x ¾"	2
23	BP 12190064	Crank, Shift Crank	2
24	BP 11192151	Ball, Black Plastic, 1" Dia.	4
25	BP 11011010	Screw, Socket Hd Cap, #10-24 x ½" Lg	7
26	BP 11011258	Setscrew, #10-24 x 3/8"	1
27	BP 12190181	Bushing, Cluster Gear Shaft Upper	1
28	BP 28007099	Assembly, Cluster Gear (Supplied as One Unit)	1 unit
29	BP 12190148	Key, 1/8" Sq. x ¾"	1
**	BP 12193544	Assembly, Bevel Feed Pinion	
30*	BP 12190175	Assembly, Key, 1/8" Sq. x 9/16"	2
31	BP 28007106	Shaft, Cluster Gear Shaft	1
32**	BP 11190836	Ring, External Retaining, #5100-62	2
33**	BP 12190149	Bearing, Bevel Gear	1
34**	BP 12190150	Spacer, Bevel Gear Thrust	1
35**	BP 12190180	Pinion, Feed Reverse Bevel	1

ITEM	PART NUMBER	DESCRIPTION	QTY
36*	BP 12190146	Gear, Feed Driving	1
37*	BP 12190176	Key, Round End, 1/8" Sq. x ¾"	1
38*	BP 12190145	Shaft, Cluster Gear Input	1
40*	BP 12190144	Gear, Feed Drive	1
41	BP 1110-310	Bearing, Torrington Needle, B-66	1
42	BP 11193637	Bushing	1
43	BP 28007307	Gear, Worm Speed Control	1
44	BP 12190155	Bushing, Feed Worm Shaft	1
45	BP 11011268	Setscrew, Socket Hd, ¼”-20 x ½" Lg	6
46	BP 11011542	Setscrew, 5/16”-18 x 15/16" Lg	5
47	BP 11190152	Washer, Feed Worm Shaft Thrust	1
***	BP 12193432	Assembly, Bevel Feed	
48***	BP 11183646	Bearing, Oilite	2
49***	BP 12190151	Gear, Feed Reverse Bevel	2
50	BP 12190153	Clutch, Feed Reverse	1
53	BP 11011547	Screw, Stainless Steel, 0.312”-18 x 0.156"	1
54	BP 11011375	Setscrew, Dog Point, 0.312-18 x 0.250"	1
55	BP 12190157	Rod, Reverse Clutch	1
56	BP 11010509	Pin, Roll, 3/32” x ¾" Lg	1
57	BP 12190198	Shaft, Feed Worm	1
58	BP 12190200	Pin, 3/32” x 5/16" Lg	1
59	BP 28007308	Pin, 0.110” x 7/16" Lg	1
60	BP 12190179	Rod, Feed Shift	1
61	BP 11011260	Setscrew, #10-32 x ¼" Lg	1
63	BP 11190061	Fork, Feed Gear Shift	1
64	BP 12193446	Assembly, Cluster Gear Shift Crank	1
66	BP 12190065	Cover, Cluster Gear	1
73	BP 11011014	Screw, Socket Hd Cap, #10-32 x 1-1/2"	2
74	BP 12190188	Pin, Clutch Ring	2
75	BP 12190098	Ring, Clutch	1
76	BP 11011265	Setscrew, 1/4”-UNC x ¼"	1
77	BP 12190073	Plug, Brass, 3/16" Dia. x 3/32"	1
78	BP 12190105	Locknut, Overload Clutch	1
79	BP 11192055	Spring, Safety Clutch	1
80	BP 28007058	Clutch, Overload	1
81	BP 28007054	Sleeve, Overload Clutch	1
82	BP 11191920	Washer, Single Spring	3
83	BP 11011431	Screw, Round Hd, #8-32 x 5/8"	3

ITEM	PART NUMBER	DESCRIPTION	QTY
88	BP 11192032	Spring, Compression, ¼" Dia. x 1-1/4"	1
89	BP 12190096	Brass, Overload Clutch Lever Spring Plunger	1
90	BP 12190106	Bushing, Quill Pinion Shaft	1
91	BP 12190104	Spacer, Pinion Shaft Worm Gear	1
92	BP 11190103	Gear, Overload Clutch Worm	1
93	BP 28007059	Ring, Overload Clutch	1
94	BP 11190870	Ring, External Retaining	1
95	BP 11010717	Pin, Dowel, 3/16” x 5/8"	1
96	BP 12193427	Assembly, Overload Clutch Trip Lever	1
97	BP 12190097	Washer, Overload Clutch	1
98	BP 11190822	Ring, External Retaining, #5100-37	1
99	BP 12190068	Cover, Clutch Arm	1
101	BP 11011740	Locknut, Chemically Blacked, ¼” x 20 UNC	1
102	BP 11010717	Pin, Dowel, 3/16 x ¾"	1
103	BP 12190094	Rod, Cam	1
104	BP 12190095	Handle, Trip	1
106	BP 12190067	Bracket, Feed Trip	1
107	BP 11011035	Screw, Socket Hd Cap, ¼”-20 x 1" Lg	2
111	BP 12193433	Assembly, Reverse Knob	1
113	BP 12190159	Assembly, Handwheel Clutch	1
116	BP 12190154	Screw, Handwheel Clutch Spring	1
117	BP 11010515	Pin, Roll, 1/8” x 9/16" Lg	1
118	BP 12190093	Assembly, Cam Rod Sleeve	1
119	BP 11010513	Pin, Roll, 1/8” x 7/16" Lg	1
120	BP 11192053	Spring, Compression Spring	1
121	BP 12190091	Plunger, Trip	1
122	BP 12190092	Bushing, Feed Trip Plunger	1
123	BP 12190090	Bushing, Trip Plunger	1
124	BP 12190089	Plunger, Feed Trip	1
125	BP 28007120	Assembly, Handwheel	1
127	BP 12190191	Spindle	1
128	BP 11190081	Skirt, Quill	1
129	BP 11191790	Locknut, #06	
130	BP 11191942	Lockwasher, W-06	1
131	BP 11190237	Bearing, Fafnir #M206K	1
132	BP 12190197	Sleeve, Bearing	1
133	BP 12190196	Nosepiece	1
134	BP 12780915	Shield, Spindle Dirt	1

ITEM	PART NUMBER	DESCRIPTION	QTY
135	BP 11190238	Bearing, Spindle	1
136	BP 12193513	Spacer, Bearing	1
139	BP 11011265	Setscrew, 1/4”-UNC x ¼"	1
140	BP 12193540	Screw, Collet Alignment, ¼-32"	1
141	BP 11011545	Setscrew, Special Locking, ¼”-32 x 1/8"	1
142#	BP 12190192	Quill	1
143	BP 28300336	Nut, Steel, #6-32 NC	1
144	BP 28300609	Setscrew, #6-32 x ¾"	1
145	BP 28007042	Lever, Feed Trip	1
146	BP 12190185	Pin, Trip Lever	1
147	BP 12200103	Rod, Indicator	1
148	BP 12190109	Sleeve, Quill Lock, Tapped	1
149	BP 12200098	Lock Handle	1
150	BP 11011595	Screw, Round Hd, #10-32 x 3/8" Lg	2
151	BP 11192403	Strainer, Felt Oil	1
152	BP 12190111	Bolt, Quill Lock	1
153	BP 12190110	Sleeve, Quill Lock, Untapped	1
154	BP 12200102	Screw, Rod Indicator Thumb	1
155	BP 12191620	Bolt, Tee, ½"	4
156	BP 12190135	Spacer, Lower Clamping Bolt	2
157	BP 12191736	Nut, Hex, ½” x 1-1/2"	2
158	BP 11011411	Screw, Round Hd, Chem. Blacked, #6-32 x ¼"	2
159	BP 11195306	Scale, Quill, Micrometer Inch	1
162	BP 12190344	Assembly, Quick Nut	1
163	BP 12190082	Stop Nut, Quill	1
164	BP 12190083	Stop, Quill, Micro-Screw	1
165	BP 11011090	Screw, Socket Hd Cap, 3/8”-UNF x 5/8"	1
166	BP 28007063	Shaft, Quill Pinion	1
168	BP 12200111	Pin, Spring	1
170	BP 11010541	Pin, Dowel, 3/16” x ¾" Lg	1
171	BP 11013076	Key, Woodruff #3	1
172	BP 12190182	Screw, Pinion Shaft Hub	1
173	BP 11192165	Ball, Steel	1
174	BP 11192054	Spring, Compression	1
175	BP 12201031	Assembly, Quill Feed Handle	1
176	BP 28009053	Hub, Quill Pinion	1
177	BP 12190066	Cover, Spring	1
178	BP 11192020	Spring, Clock	1

ITEM	PART NUMBER	DESCRIPTION	QTY
179	BP 28007150	Pin, Outside Clock Spring	1
180	BP 28007064	Pinion, Quill	1
183	BP 12190085	Lever, Reverse Trip Ball	1
184	BP 12190086	Plunger, Feed Reverse Trip	1
185	BP 12190087	Screw, Reverse Trip Ball Lever	1
186	BP 11192207	Gear, Worm	1
187	BP 11013077	Key, Woodruff #5	1
188	BP 11011370	Setscrew, Socket Hd, 1/4”-UNC x 20 x 3/8"	1
189	BP 12190850	Shaft, Adjustable Worm	1
192#	BP 12190051	Housing, Quill	1
193	BP 11193111	Cup, Oil	1
196	BP 12190162	Key, Worm Shaft, 1/8" sq. x 5/16"	1

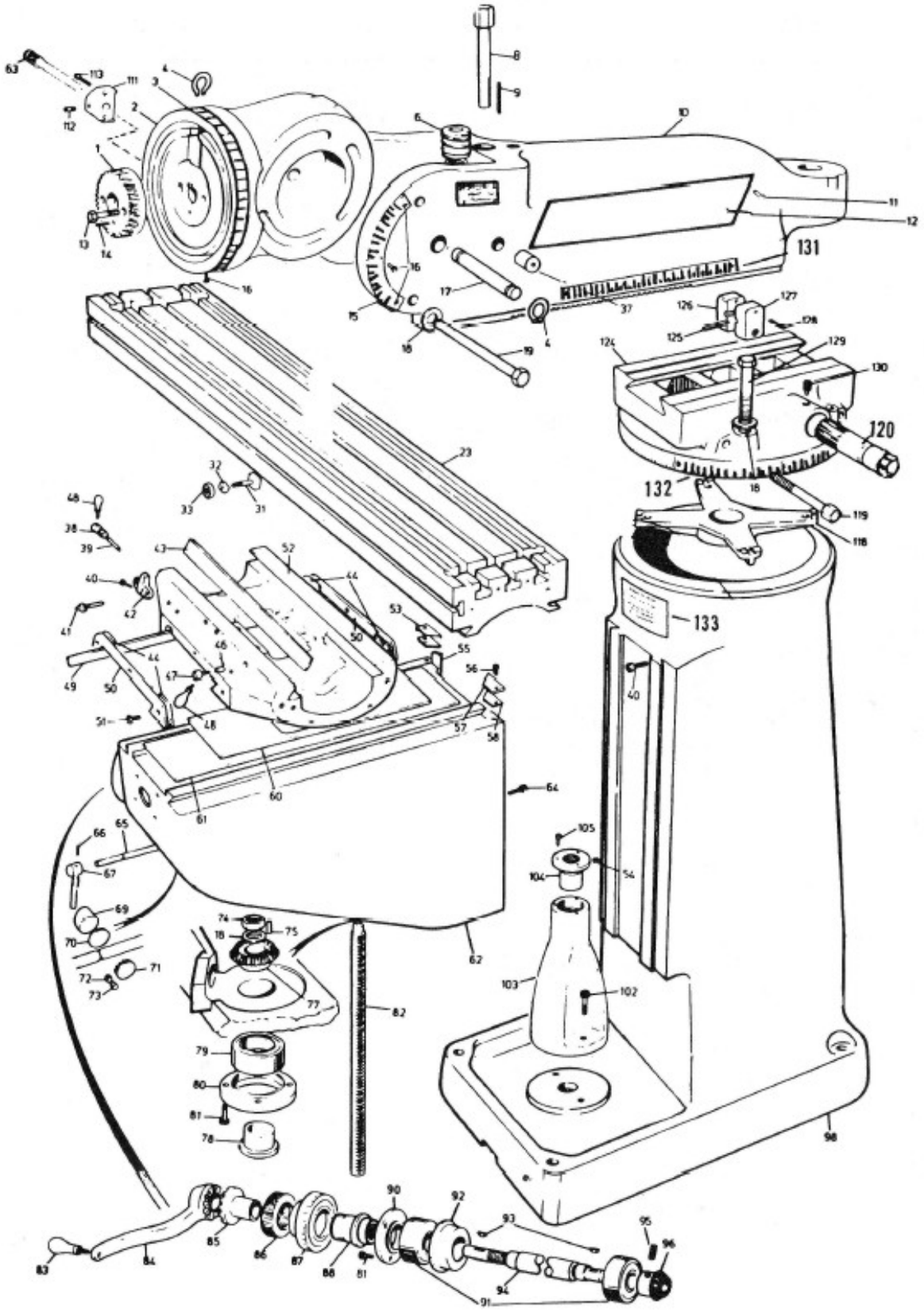
* Item Numbers 10, 36, 37, 38, and 40 sold as assembly BP 12193440

** Item Numbers 32, 33, 34, and 35 sold as assembly BP 12193544

*** Item Numbers 48 and 49 sold as assembly BP 12193432

Item Numbers 142 and 192 sold as assembly BP 12124541

BASIC MACHINE



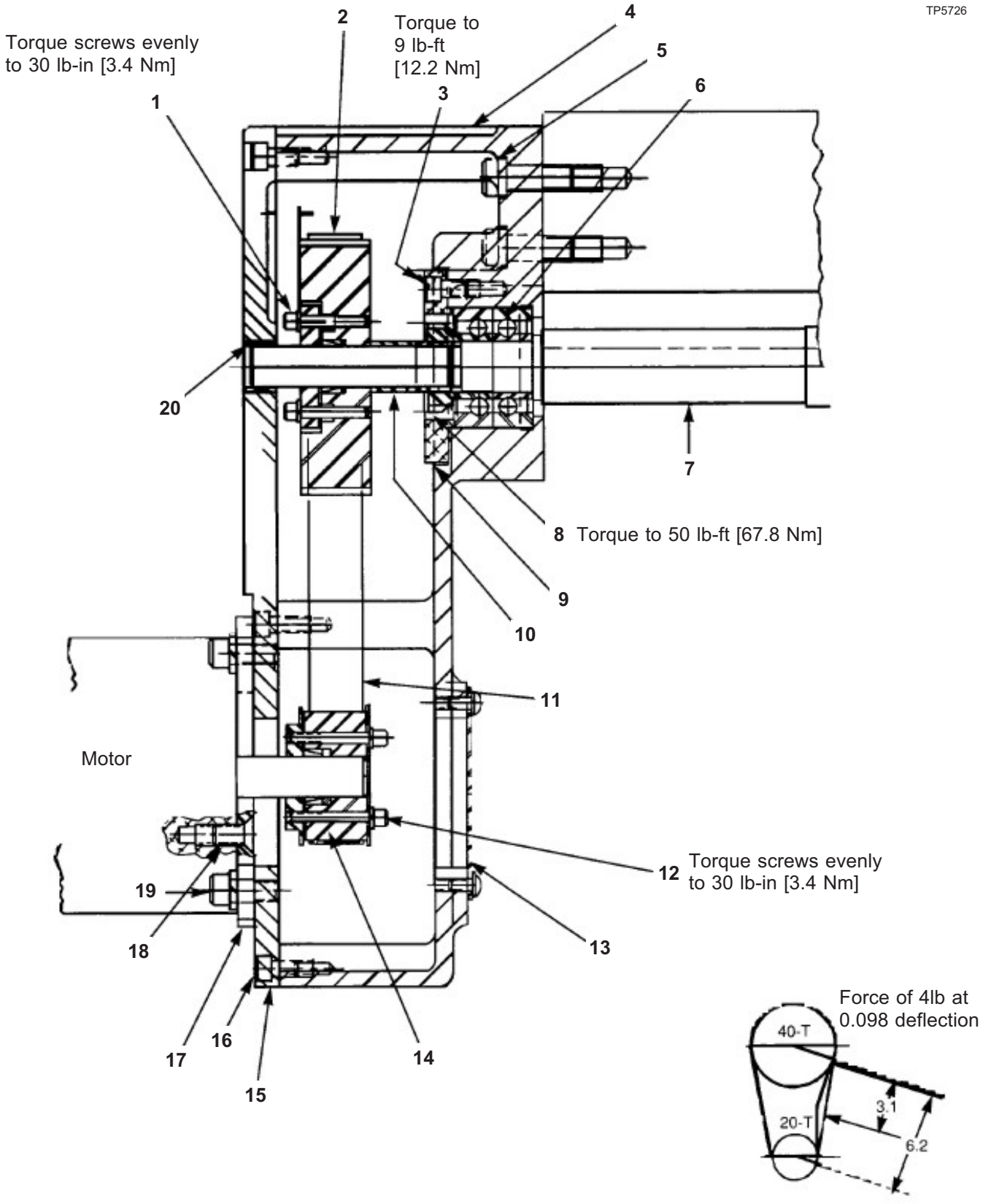
BASIC MACHINE

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 12190178	Housing, Adjustable Gear Tilting Quill	1
2	BP 12069013	Assembly, Ram Adapter	1
3	BP 11060603	Scale, Adapter	1
4	BP 11060892	Ring, External Retaining	2
6	BP 11062206	Worm, Vertical Adjusting	1
8	BP 12060130	Shaft, Vertical Adjusting Worm	1
9	BP 12060138	Key, Sq., 0.188” x 1.938"	1
10	BP 12060128	Ram	1
11	BP 11011556	Screw, Drive, Type 0, #6 x 0.375"	4
12	BP 11060502	Nameplate, Ram	2
13	BP 11011035	Screw, Socket Hd Cap, ¼”-20 x 1"	2
14	BP 11010590	Pin, Roll, 0.312 x 1.50"	1
15	BP 11062826	Plate, Angle, Graduated	1
16	BP 11011555	Screw, Round Hd Drive	5
17	BP 12061028	Pin, Adapter Pivot	1
18	BP 11200109	Washer, Chamfered and Hardened, ½” x 1/8 x 1"	2
19	BP 11061180	Bolt, Hex Hd, Adapter Locking, 0.500”-13 x 7.25"	3
23	BP 12060347	Table, 48" Lg	1
31	BP 11061602	T-Bolt, Stop Piece	2
32	BP 11062301	Piece, Table Stop	2
33	BP 11011720	Nut, 3/8”-16 Hexagon	3
34	BP 12060122	Washer	2
37	BP 12060328	Bushing, Clamping	1
38	BP 12746137	Bolt, Saddle Lock	1
39	BP 12060125	Plunger, Saddle Lock	1
40	BP 11770252	Screw, Low Hd	2
41	BP 11060088	Screw, Gib Adjusting	3
42	BP 12060300	Bracket, Table Stop	1
43	BP 12060482	Gib, Table with Chrome	1
44	BP 11062406	Wiper, Felt	4
46	BP 12060118	Plug, Table Lock, Table/Saddle Lock R.H.	2
47	BP 12060119	Bolt, Table Lock - R.H. (12060114 for L.H.)	1
48	BP 11062179	Handle, Table Lock	2
49	BP 12060124	Gib, Saddle/Knee	1
50	BP 12060123	Plate, Saddle/Knee Wiper	2
51	BP 11011580	Screw, Oval Hd, #10-32 x ½"	6

ITEM	PART NUMBER	DESCRIPTION	QTY
52	BP 12060487	Saddle, with Chrome	1
53	BP 12060093	Holder, Left Hand Column Wiper	1
55	BP 12060146	Gib, Knee/Column	1
56	BP 11011031	Screw, Socket Hd Cap, 0.250”-20 x 0.625"	2
57	BP 12060094	Holder, Right Hand Column Wiper	1
58	BP 11062405	Guard, Upper Chip, Kn 60 11060153	1
61	BP 11060152	Guard, Lower Chip	1
62	BP 11060493	Knee, with Chrome	1
63	BP 12069999	Pin, Head Rotation Stop	1
64	BP 11770252	Screw, Low HD	1
65	BP 12060148	Shaft, Knee Lock	1
66	BP 11010409	Pin, Taper, 1” x 1"	1
67	BP 12061230	Hub, Lock Shaft	1
69	BP 12060089	Plunger, Knee Lock	1
70	BP 12150131	Washer, Table Locking	1
71	BP 11010786	Plug, Knee Binder (Plastic)	1
72	BP 11011375	Setscrew, Dog Pt., 5/16”-18 x 5/16"	1
73	BP 11011270	Setscrew, 5/16”-18 x 5/16"	1
74	BP 11011755	Nut, Jam, ½”-20"	1
75	BP 12060071	Key, 3/16” x 3/16” x 7/8"	1
77	BP 11062204	Gear, Bevel	1
79	BP 11060205	Bearing, Fafnir #W306PP3	1
80	BP 12060070	Ring, Bearing Retaining	1
81	BP 11011031	Screw, Socket Hd Cap, ¼”-20 x 5/8"	6
82	BP 12060069	Inch, Elevating Screw	1
83	BP 12060060	Handle	1
84	BP 11060080	Crank, Elevating	1
85	BP 12060079	Clutch, Gearshaft	1
86	BP 12060078	Locknut, Dial	1
87	BP 12060213	Dial, 100 Graduation	1
88	BP 12060077	Holder, Dial	1
90	BP 12060210	Ring, Bearing Retaining	1
91	BP 11060204	Bearing, Fafnir H204KTT	2
92	BP 11011030	Screw, Socket Hd Cap, ¼”-20 x ½"	3
93	BP 11013078	Key, Woodruff #7	2
94	BP 12060147	Shaft, Elevating, Z Axis	1
95	BP 11011220	Setscrew, ¼”-20 x ¼" Lg	2
96	BP 11062205	Gear, Bevel Pinion	1

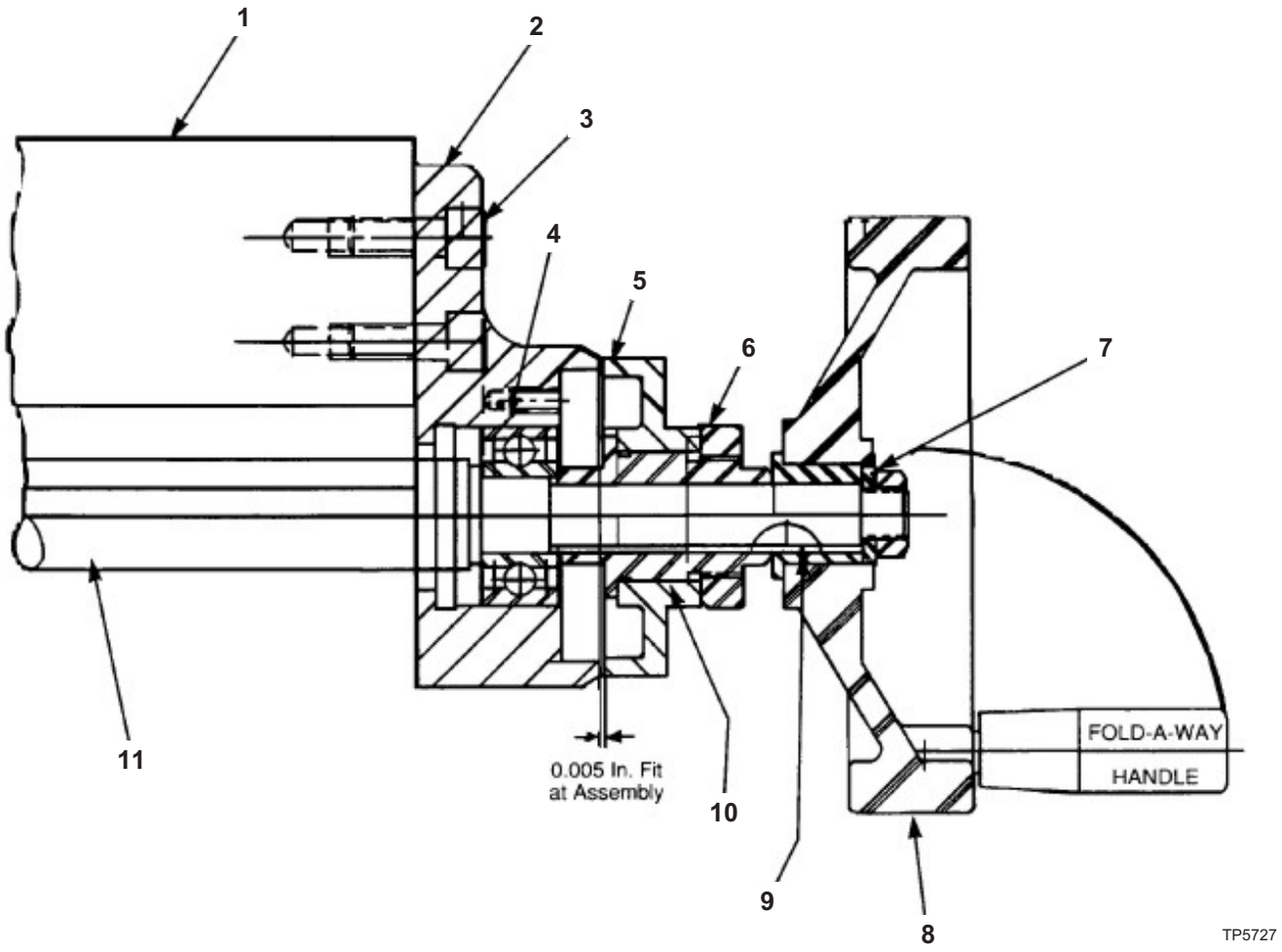
ITEM	PART NUMBER	DESCRIPTION	QTY
98	BP 12060209	Column	1
102	BP 11011074	Screw, Socket Hd Cap, 3/8”-16 x 1"	2
103	BP 12060207	Pedestal	1
104	BP 12060051	Nut, Elevating Screw	1
105	BP 11011195	Screw, Socket Hd Cap, ¼”-20 x 1"	3
111	BP 12650180	Block, Stop (Head Rotation)	1
112	BP 11152094	Plunger, Spring	1
113	BP 11011017	Screw, Socket Hd Cap, #10-32 x 0.500"	2
118	BP 12060144	Spider	1
119	BP 11060112	Stud, Ram Lock	2
120	BP 12060255	Pinion, Ram	1
124	BP 12060208	Turret	1
125	BP 12060137	Bar, Ram Clamp	2
126	BP 12060141	Clamp, Ram, Blank	2
127	BP 12060113	Clamp, Ram, Tapped	2
128	BP 11010619	Pin, Cotter	2
129	BP 11061178	Bolt, Hex, ½”-13 x 5"	4
130	BP 12060140	Screw, Ram Pinion	1
131	BP 11060602	Scale, Ram	1
	BP 11980426	Drive, Screw	2
132	BP 11060601	Turret, Scale	1
	BP 11989426	Screw, Drive	2
133	BP 11010200	Plate, Warning	1
	BP 11980426	Screw, Drive	4

LEFT END OF X AXIS BALLSCREW



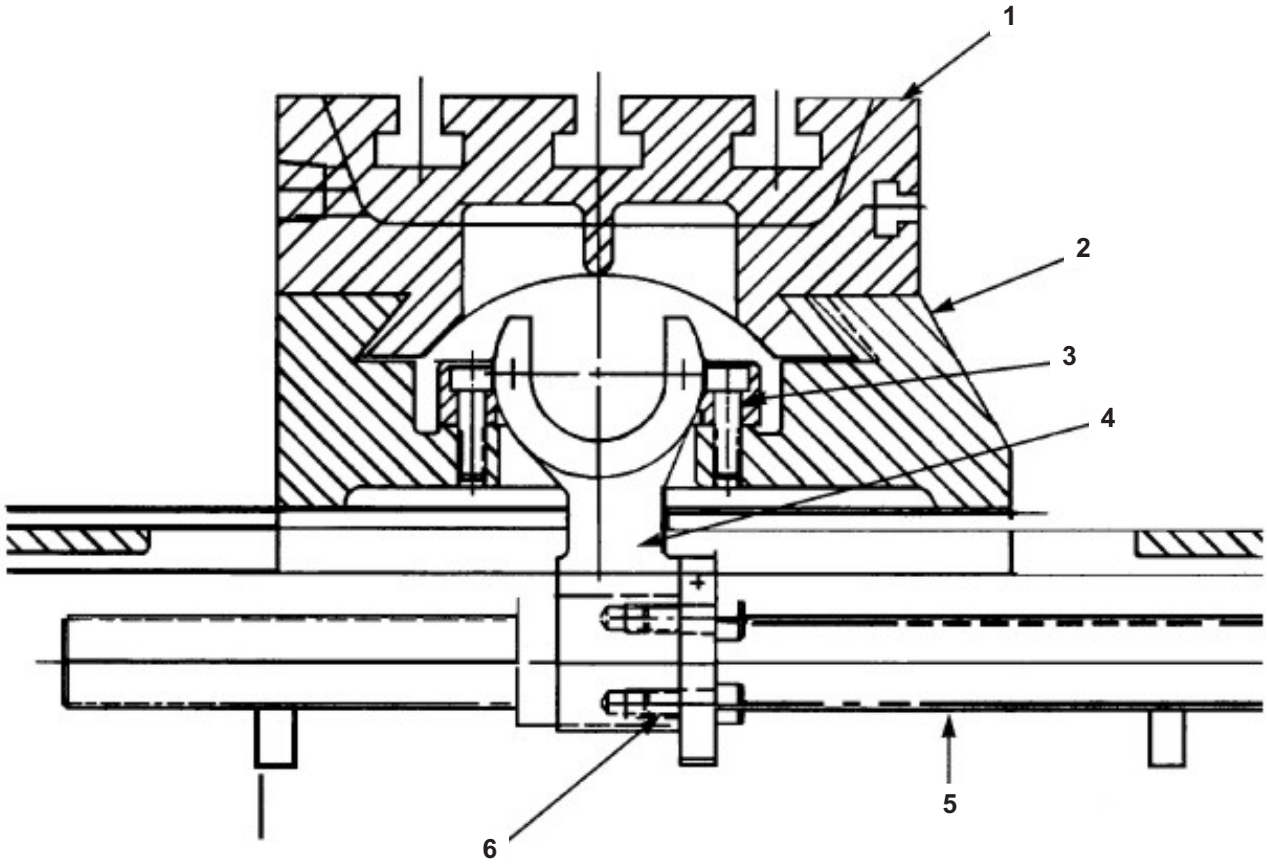
LEFT END OF X AXIS BALLSCREW

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 11010210	Screw, Socket Hd Cap, #8-32 x 1.000"	4
	BP 61705552	Washer, Plastic Nylite, 4 mm	4
2	BP 24649915	Pulley Assembly (40-T)	1
3	BP 11011030	Screw, Socket Hd Cap, ¼”-20 x 0.500"	3
4	BP 12749003	Bracket	1
5	BP 11011075	Screw, Socket Hd Cap, 3/8-16 x 1.250"	4
6	BP 11060203	Bearing, Fafnir RM 204-KT4	1
7	BP 12746209	Ballscrew, X Axis	1
	BP 11011075	Screw, Socket Hd Cap, 3/8”-16 x 1.250"	2
8	BP 11151779	Locknut	1
9	BP 12746126	Retainer, Bearing	1
10	BP 12746109	Spacer, Pulley	1
11	BP 21577911	Belt, HTD 560-8M-20	1
12	BP 11980227	Screw, Socket Hd Cap, #8-32 x 1.250"	4
	BP 11191920	Lockwasher, #8	4
13	BP 12780491	Cover	2
	BP 11665162	Screw, Button Hd Cap, #10-32 x 0.375"	1
14	BP 64649912	Assembly, Pulley (20-T)	1
15	BP 12746116	Cover, Bracket	1
	BP 11010543	Pin, Roll, 3/16” x 1"	2
16	BP 11011031	Screw, Socket Hd Cap, ¼”-20 x 0.625"	6
17	BP 12746122	Adapter, Motor Counting	1
18	BP 11010173	Screw, Flat Hd Cap, 5/16”-24 x 0.625"	4
19	BP 11665570	Screw, Socket Hd Cap, 5/16”-18 x 0.750"	4
	BP 11421984	Washer	4
20	BP 11746111	Bearing, Needle, Torrington M-1081	1



RIGHT END OF X AXIS BALLSCREW

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 12060347	Table, 48"	1
2	BP 1260115	Bracket	1
3	BP 11011074	Screw, Socket Hd Cap, 3/8”-16 x 1.000"	4
4	BP 11060204	Bearing, Fafnir H 204K	1
5	BP 12060214	Dial	1
6	BP 12060078	Locknut	1
7	BP 11011755	Nut, Jam, ½”-20 NF	1
	BP 12150164	Washer, Flat	1
8	BP 12746140	Handwheel	1
9	BP 11013078	Key, Woodruff	1
10	BP 12060084	Holder, Dial	1
11	BP 12746209	Ballscrew, X Axis	1
	BP 11011075	Screw, Socket Hd Cap, 3/8”-16 x 1.250"	2



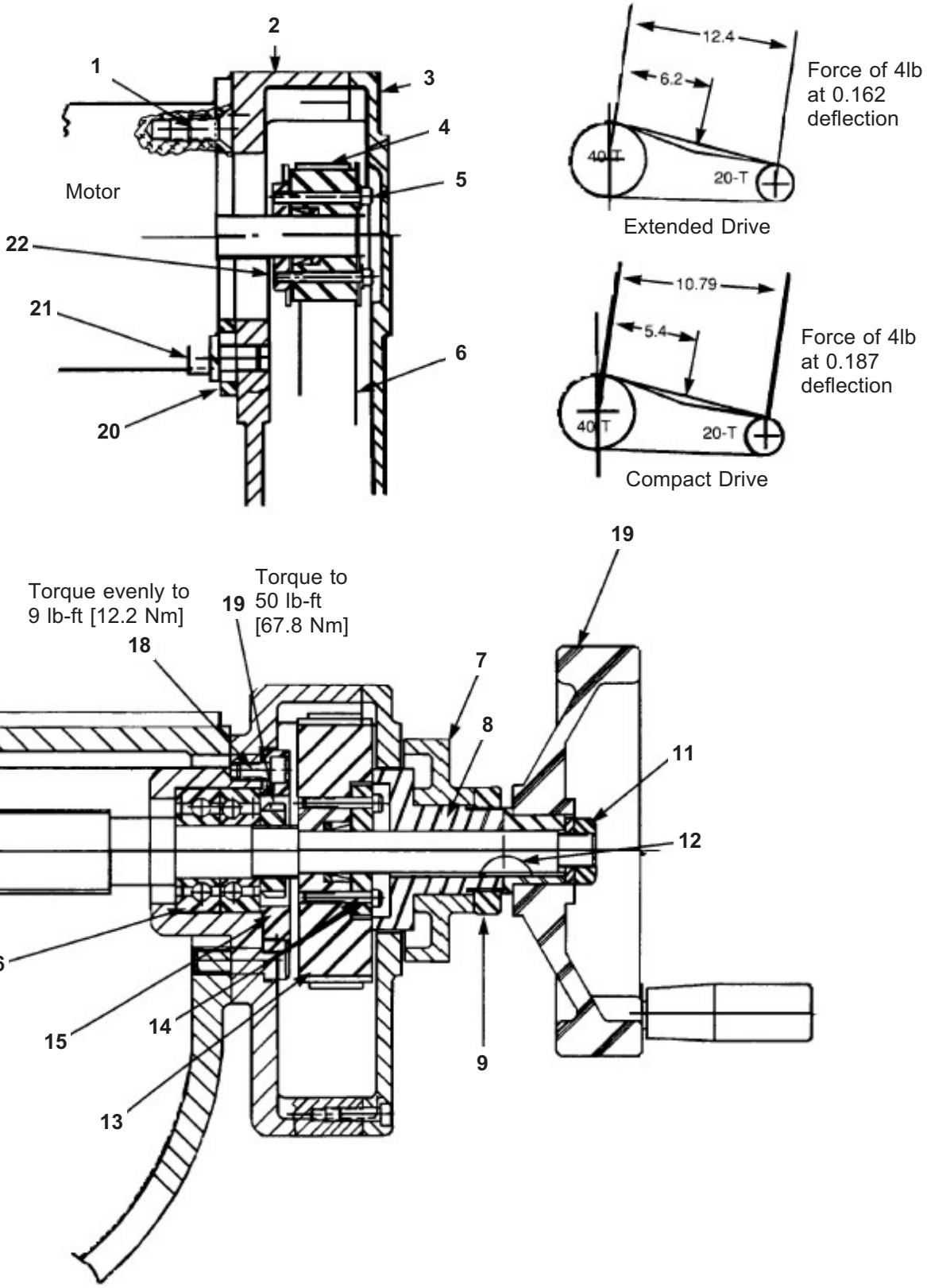
Torque to 35 lb-ft [47.5 Nm]

TP5728

BALLSCREW WITH NUT BLOCK

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 12060347	Table, 48"	1
2	BP 12060487	Saddle	1
3	BP 11011074	Screw, Socket Hd Cap, 3/8”-16 x 1"	4
4	BP 12749023	Nutblock	1
5	BP 11746208	Ballscrew	1
6	BP 11011074	Screw, Socket Hd Cap, 3/8”-16 x 1.000"	3

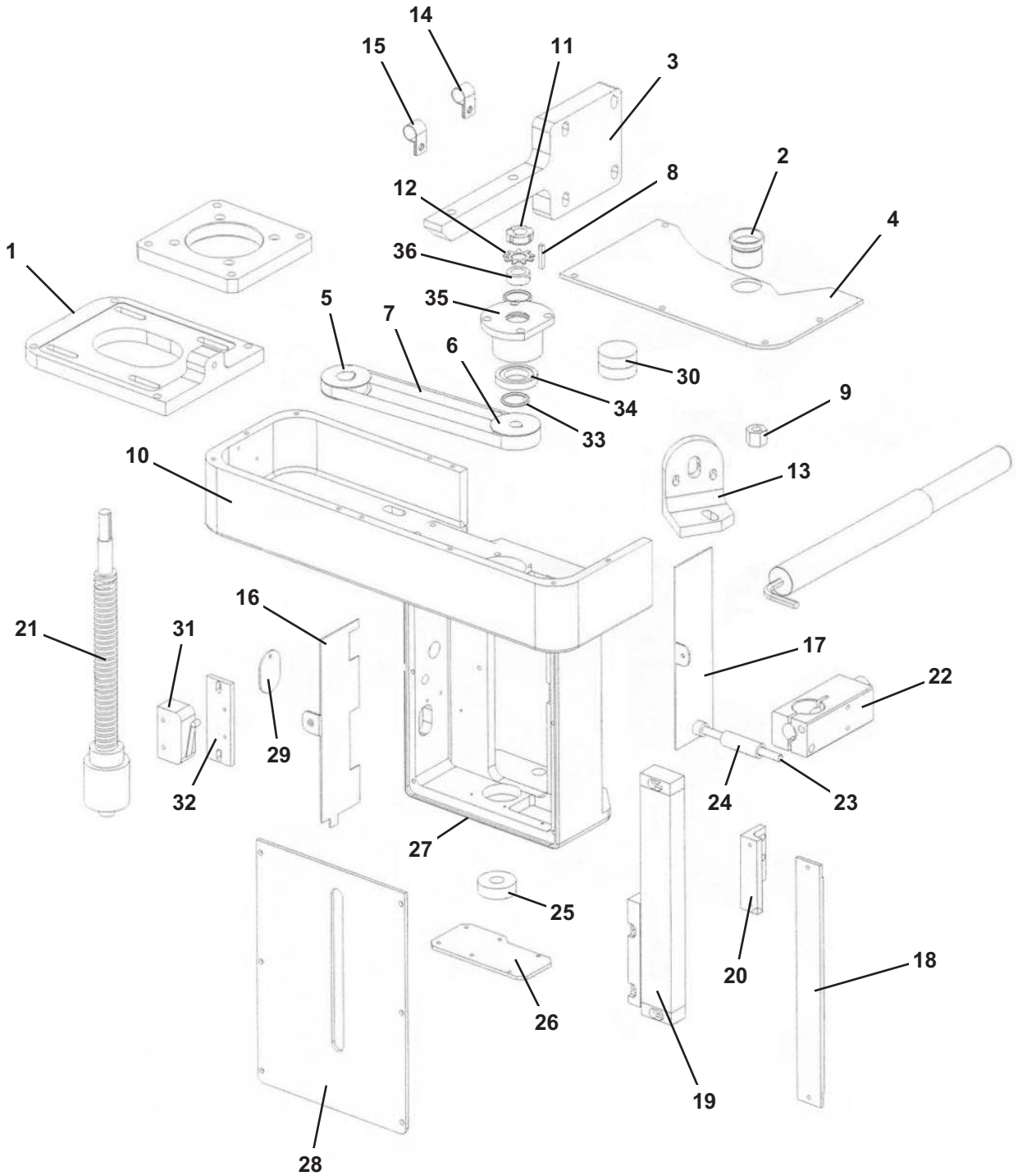
Y AXIS DRIVE WITH NUTBLOCK



Y AXIS DRIVE WITH NUTBLOCK

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 1101073	Screw, Flat Hd Cap, 5/16”-24 x 0.620"	4
2	BP 12746205	Housing (Compact Drive)	1
	BP 12746117	Housing (Extended Drive)	1
3	BP 12746214	Cover (Compact Drive)	1
	BP 12746118	Cover (Extended Drive)	1
4	BP 64649912	Assembly, Assembly (20-T)	1
5	BP 11980227	Screw, Socket Hd Cap, #8-32 x 1.250"	4
	BP 11191920	Lockwasher, #8	4
6	BP 21577910	Belt, (Extended Drive) HTD 880-8M-20	1
	BP 11601076	Belt, (Compact Drive) HTD 800-8M-20	1
7	BP 12060214	Dial	1
8	BP 12746143	Holder, Dial	1
9	BP 12060078	Locknut	1
10	BP 12746140	Handwheel	1
11	BP 11011755	Nut, Jam, ½”-20	1
12	BP 11011078	Washer, Flat	1
13	BP 11665570	Screw, Socket Hd Cap, 5/16”-18 x 0.750"	4
	BP 11421984	Washer	4
14	BP 11011011	Screw, Socket Hd Cap, #10-24 x 0.625"	6
15	BP 24649915	Assembly, Pulley (40-T)	1
16	BP 11010210	Screw, Socket Hd Cap, #8-32 x 1.000"	4
	BP 61705552	Washer, Plastic Nyltie, 4 mm	4
17	BP 12746126	Bearing Retainer	1
18	BP 11060203	Bearing	1
19	BP 11746208	Ball Screw	1
20	BP 11011030	Screw, Socket Hd Cap, ¼”-20 x 0.500"	4
21	BP 11151779	Locknut	1
22	BP 12746122	Adapter, Motor Mounting	1
	BP 11010543	Pin, Roll, 3/16” x 1.000"	2

3RD AXIS OPTION



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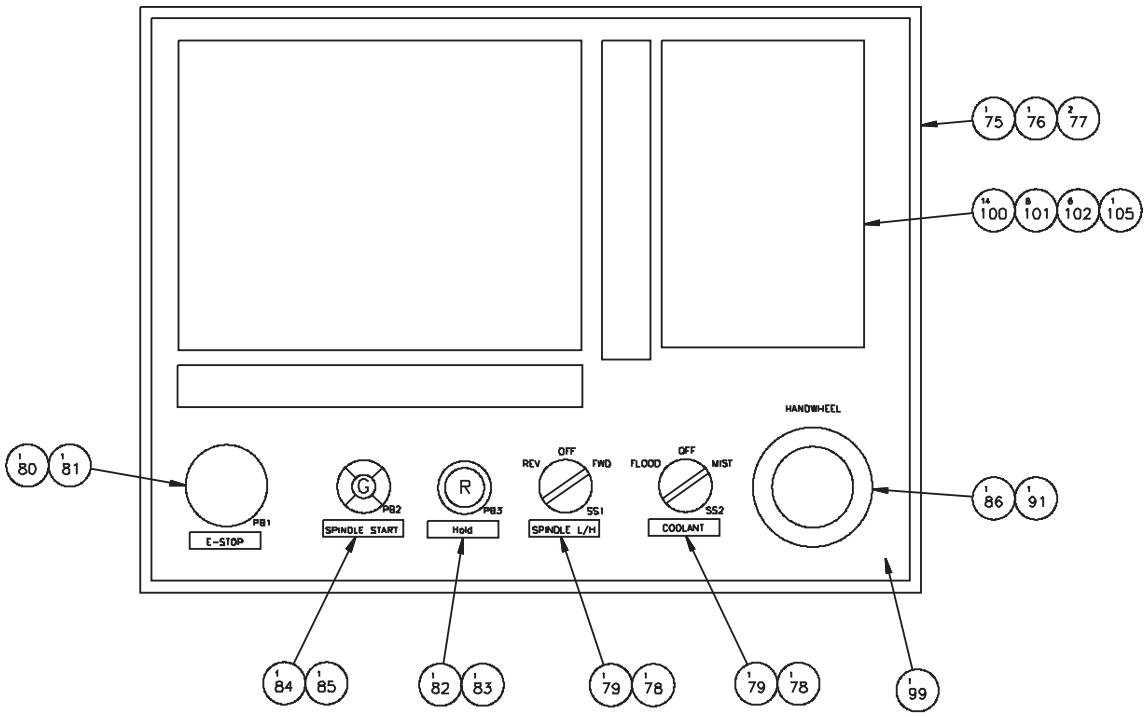
3RD AXIS OPTION

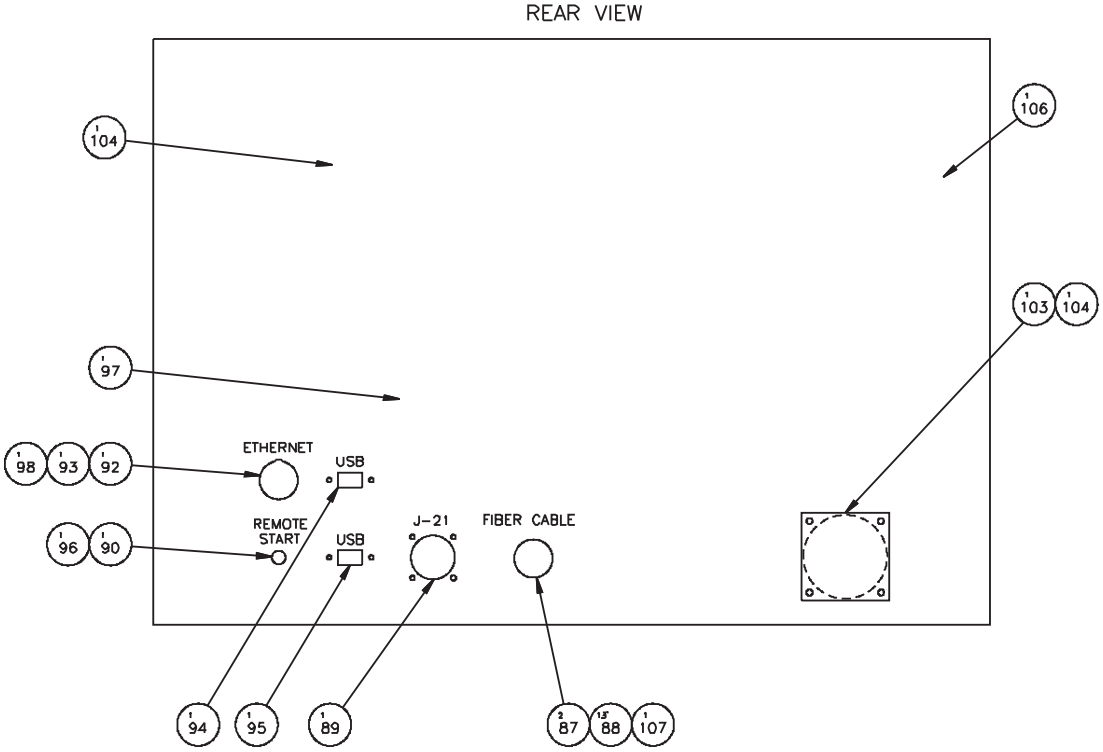
ITEM	PART NUMBER	DESCRIPTION	QUANTITY
1	BP 11749351	Motor Mount Plate Assembly	1
2	BP 11749352	Scale Cable Tube	1
3	BP 11749354	Left Mount Plate Assembly	1
4	BP 11749355	Top Cover Assembly	1
5	BP 11749325	Pulley, Motor	1
6	Bp 11749326	Pulley, Ballscrew	1
7	BP 11749420S8	Belt	1
8	BP 11749356	1/8" Sq. Key	1
9	BP 11749420S10	Front 3/8-16 ext. Nut for Top	1
10	BP 11749420S11	Top Casting Assembly	1
11	BP 11749359	Lock Nut	1
12	BP 11749360	Lock Washer	1
13	BP 11749420S14	Right Mount Angle Assembly	1
14	BP 11749420S15	Cable Clamp #1	1
15	BP 11749420S16	Cable Clamp #2	1
16	BP 11749420S17	Left Chip Cover Assembly	1
17	BP 11749420S18	Right Chip Cover Assembly	1
18	BP 11749420S19	Scale Spar Assembly	1
19	BP 11749420DS	Scale,12" Differential	1
20	BP 11749420S21	Reader Head Carrier Assembly	1
21	BP 11749323	Ballscrew Assembly ¾" X 200P	1
22	BP 11749372	Ball Nut Block, 3rd Axis	1
23	BP 11011834	SHCS with E-Clip	1
24	BP 11749373	Spacer Tube	1
25	BP 11749322	Bearing, Single Row	1
26	BP 11749375	Access Plate Assembly	1
27	BP 11749420S28	Lower Housing Assembly	1
28	BP 11749420S29	Front Cover Assembly	1
29	BP 11749378	QD Access Plate Assembly	1
30	BP 11749379	Bearing, Thrust (Set)	2
31	BP 11749381	Sensor, Z Axis	1
32	BP 11749382	Limit Switch Mount Plate Assembly	1
33	BP 11749420S35	O Ring 1/16” x .750 x .875	2
34	BP 11749420S36	Bearing Lock Ring	1
35	BP 11749420S37	Thrust Bearing Cartridge Body	1
36	BP 11749420S38	Seal Ring	1
37	BP 11749383	Plexi-glass Window, Front Cover (Not Shown)	1
38	BP 11749420S40	Grease, White Lithium 1.75 oz (Not Shown)	1

OPERATOR PENDANT
(DC150 Motion Control System)

FRONT VIEW

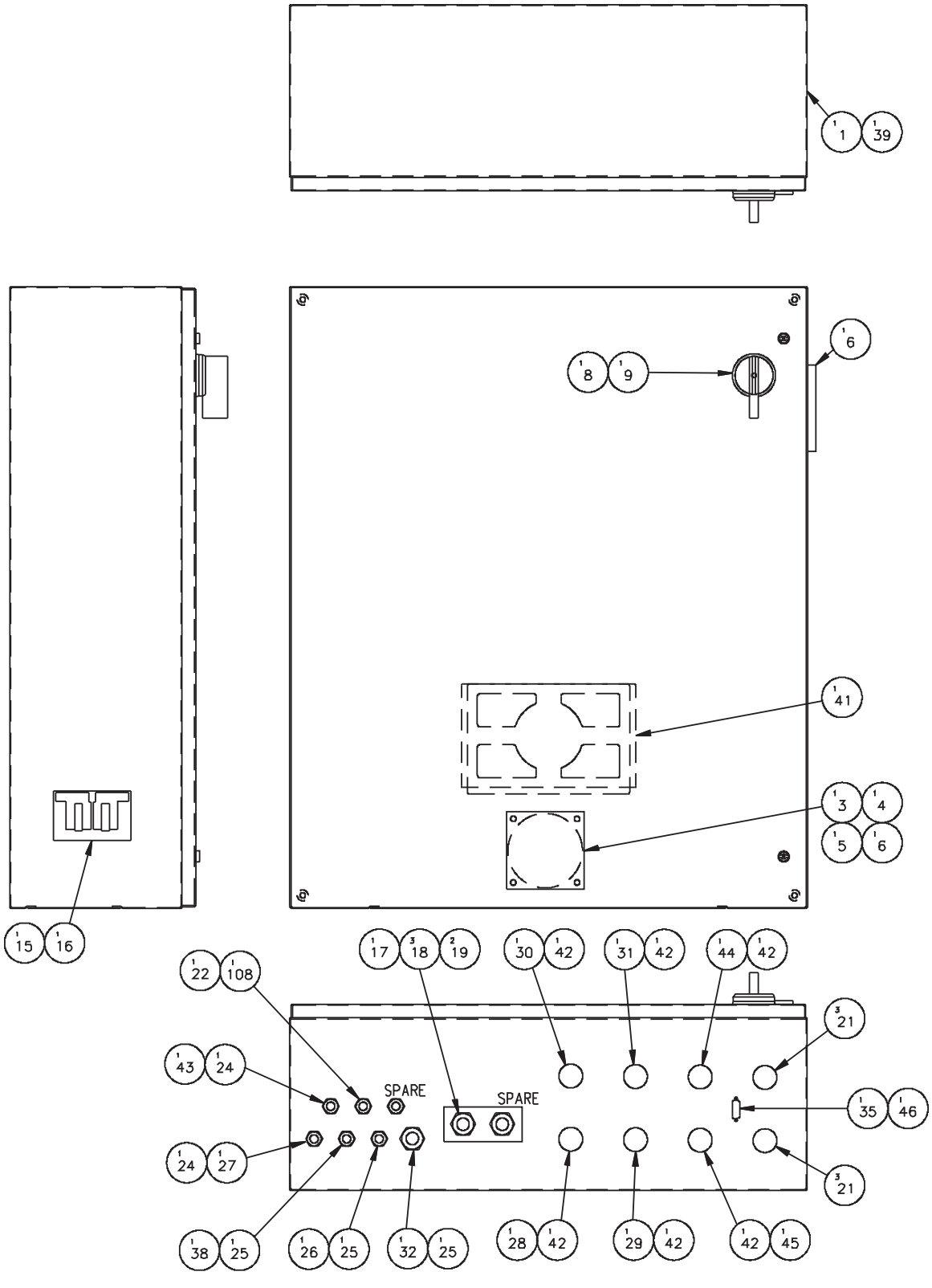


REAR VIEW



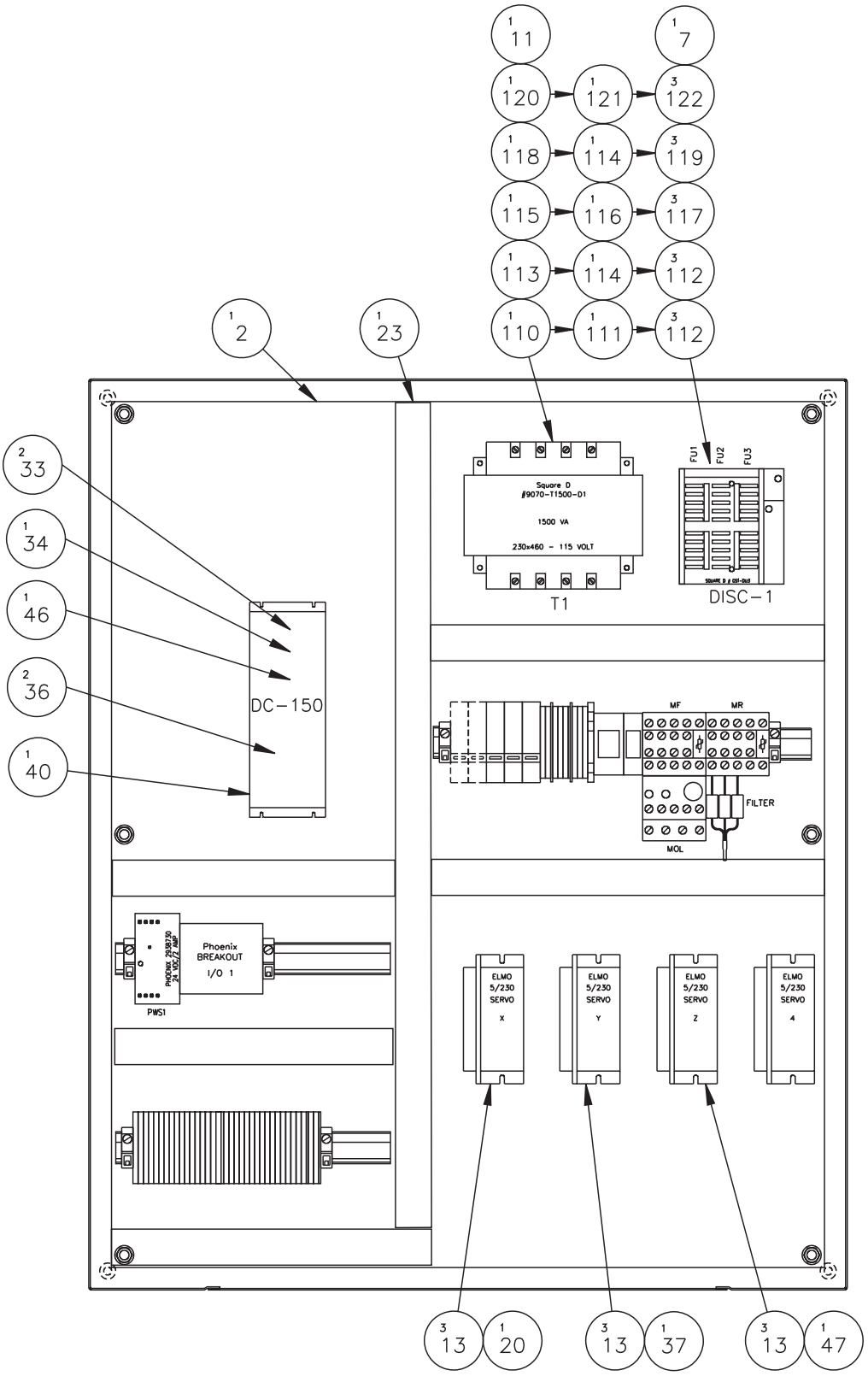
TI5563

POWER CASE, EXTERNAL VIEW
(DC150 Motion Control System)



TI5564

POWER CASE, INTERNAL VIEW
(DC150 Motion Control System)



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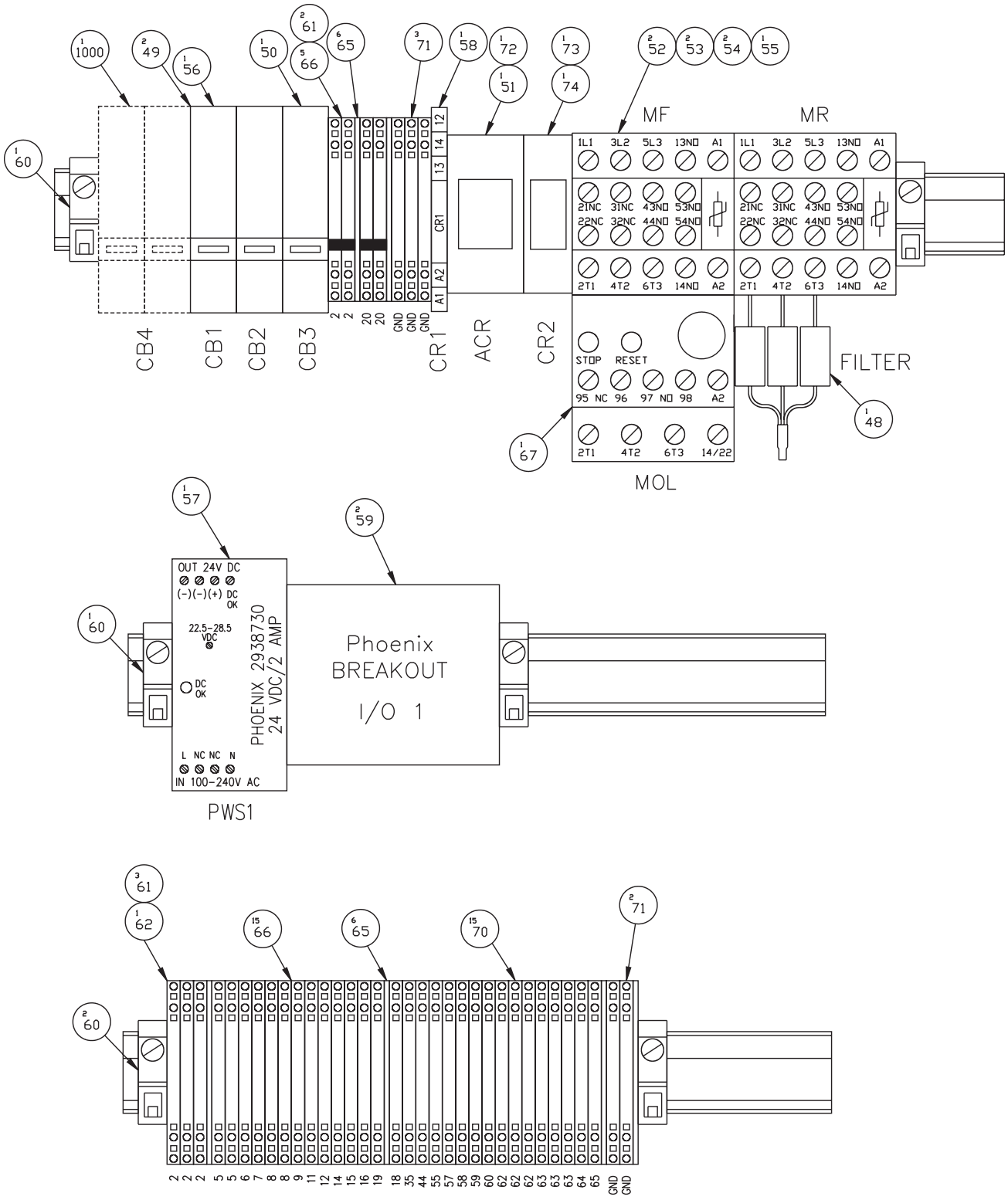
POWER CASE TERMINAL STRIPS
(DC150 Motion Control System)



TI5566A

OPERATOR PENDANT AND POWER CASE COMPONENT LIST
(DC150 Motion Control System)

ITEM	PART NUMBER	DESCRIPTION	QTY
1	BP 0004158SZ	Enclosure Control Electrical	1
2	BP 0001990SZ02	Panel, Rear	1
3	BP 0004158F	Fan	1
4	BP 0004158FG	Guard, Fan	1
5	BP 0004158FC	Cable, Fan	1
6	BP 0004158FFLT	Filter, Fan	2
7	BP 0010016DS	Switch, Disconnect	1
8	BP 0010016DH	Handle, Disconnect	1
9	BP 0010016SS	Shaft, Disconnect	1
11	BP 00005490063	CP8, Terminal Cover	1
13	BP 00005490158	Drive, ELMO BAS-5/230R-4	3
14	BP 00005490157	Motor/Resolver Assembly, SEM HJ116	1
15	BP 00005490075	Receptacle, 15a Duplex	1
16	BP 00005490076	Weatherproof Duplex Cover	1
17	BP 00005490065	Tubing Fitting 3/4"	1
18	BP 00005490066	Corrugated Tubing 3/4"	1
19	BP 00005490162	Fiber Optic Cable	13.5
20	BP 00005490170	24VDC X Axis Power Cable	1
21	BP 00005490052	3/4" Oil Tight Hole Plug	3
22	BP 00005490053	1/2" Oil Tight Hole Plug	1
23	BP 00005490107	SS Duct / DIN	1
24	BP 00092077	Cord Grip, 7MM Opening	3
25	BP 000920712	Cord Grip, 12MM Opening	2
26	BP 11598417	Cable, Spindle Motor	1
27	BP 11598415	Cable, Home Switch	1
28	BP 00005490163	X Axis Motor Cable	1
29	BP 00005490164	Y Axis Motor Cable	1
30	BP 00005490165	X Axis Resolver Cable	1
31	BP 00005490166	Y Axis Resolver Cable	1
32	BP 00005490090	Cable, Pendent to Control	1
33	BP 00005490167	Cable, DC150 to X Axis	1
34	BP 00005490168	Cable, DC150 to Y Axis	1
35	BP 00005490104	Screwlock Kit	1
36	BP 00005490093	Parallel Cable, IEEE1284 1 Meter Long	1
37	BP 00005490171	24VDC Y Axis Power Cable	1
38	BP 11598412	Cable, Lubricator Pump	1
39	BP 00005490064	Cap Plug	1
40	BP 00005490155	DC150 Interface Module	1
41	BP 00005490054	Print Pocket	1

42	BP 00005490110	Cord Grip, 3/4", 6.5-14MM	4
43	BP 11597846	Cable, Home Switch Z Axis	1
44	BP 00005490109	Z Axis Resolver Cable	1
45	BP 00005490108	Z Axis Motor Cable	1
46	BP 00005490169	Cable, DC150 to Z Axis	1
47	BP 00005490174	24VDC Z Axis Power Power Cable	1
48	BP 0003277MRS	Sub-Assembly, Mr Snubber	1
49	BP 11598898	Circuit Breaker, 3 Amp 1 Pole	2
50	BP 11598894	Circuit Breaker, 20 Amp 1 Pole (Non-CSA)	1
	BP 00101160099	Circuit Breaker, 15 Amp 1 Pole (CSA)	1
51	BP 00005490072	Relay, 4 Pole 120VAC	1
52	BP 001036SZ	Contactor, 3P-9A	2
53	BP 0008122SZ	Surge Suppressor	2
54	BP 0010019SZ	Contact Block, 2NO 2NC Auxiliary	2
55	BP 00005490068	Reversing Kit	1
56	ML 00081221P3	Busbar, 1 Pole X 3	1
57	BP 0008776SZ	Power Supply, 24VDC 2A	1
58	BP 0011791DPDT	Relay, DPDT 120VAC	1
59	BP 00005490070	Box, MDR Breakout	2
60	BP 000054940014	End Bracket, Gray	6
61	BP 00005490012	Bridge, 2-Position Plug In	5
62	BP 00005490003	FBS 3-5 Bridge	3
65	BP 0011032PP2	Block Terminal Partition Plate	5
66	BP 0008116TB1	Terminal Block ST 2,5 Gray	6
67	BP 00005490067	SPR, solid state (208 - 480V)	1
	BP 00005490188	SPR, solid state (575V)	1
70	ML 0011032BU	Block Terminal - Blue	8
71	BP 00005490013	Terminal, Ground ST2,5	6
72	BP 00005490071	Relay Base, 4 Pole	1
73	BP 00005490073	Relay Base, 2 Pole	1
74	BP 00005490074	Relay, 2 Pole 24VDC	1
75	BP 0001990PS02	Optipanel, Special Size	1
76	BP 0011280PS	Mounting Kit	1
77	BP 00005490055	M6 Spring Nut	2
78	BP 0003650SD01	Contact Block, 2NO-2NC	2
79	BP 0003650SD02	Switch, 3 Position	2
80	BP 0003650SD03	Head, Mushroom 60MM	1
81	BP 0003650SD04	Contact Block 1NO-1NC	1
82	BP 00005490081	I, Push Button	1
83	BP 00005490082	I, Block Assembly	1
84	BP 00005490148	Mounting Collar, 24VDC LED	1
85	BP 00005490149	I, Push Button	1
86	BP 0011796SZ	Manual Pulse Generator	1

87	BP 00005490065	3/4" Conduit Fittng	2
88	BP 00005490066	3/4" Conduit	13
89	BP 00005490094	Cable with Bulkhead Connector	1
90	BP 00005490095	Cable with Phone Jack	1
91	BP 00005490096	Cable with Jumper	1
92	BP 00005490097	RJ 45 Ethernet Jumper	1
93	BP 00005490098	RJ45 CAT5 2-PR-2’	1
94	BP 00005490099	USB Extension Cable	1
95	BP 00005490100	USB Extension Cable	1
96	BP 00005490101	Jack Cover, Black	1
97	BP 00005490102	AC Power Cable with 90 Degree Connector	1
98	BP 00005490103	RJ 45 Ethernet Port Cap	1
99	BP 00005490056	Switch Panel with Overlay	1
100	BP 00005490058	Flat Washer	14
101	BP 00005490059	Black Cap	8
102	BP 00005490060	Morning Gray Cap	6
103	BP 00005490061	60MM Tubeaxial Fan	1
104	BP 00005490062	Plastic Filter Assembly	2
105	BP 11598873SS	SSP 120 PC Workstation	1
106	BP 0001990PS01	Panel, 113MMX438MM BLK	1
107	BP 0000549FOC	Cable, Fiber Optic Communication	1
108	BP 11598413	Cable, Spray Mist	1
109	BP 11598888BH	Motor/Resolver Assembly	2
110	BP 00005490116	Kit, EzVision 208 Voltage	1
111	BP 11598487208	Transformer 1.5KVA 50/60HZ	1
112	BP 000961015	Fuse, 15A 600V Class J	6
113	BP 00005490117	Kit, EzVision 230-240 Voltage	1
114	BP 11598487	Transformer 1.5KVA 50/60HZ	2
115	BP 00005490118	Kit, EzVision 380-416 Voltage	1
116	BP 11598487380	Transformer 1.5KVA 50/60HZ	1
117	BP 000961009	Fuse, 9A 600V Class J	3
118	BP 00005490120	Kit, EzVision 460-480 Voltage	1
119	BP 000961007	Fuse, 7A 600V Class J	3
120	BP 00005490121	Kit, EzVision 575 Voltage	1
121	BP 11598487575	Transformer 1.5KVA 50/60HZ	1
122	BP 000961006	Fuse, 6A 600V Class J	3
1000	BP 001011682	Circuit Breaker, 8A, 2 Pole (208-230V, CSA Only)	1
	BP 001011652	Circuit Breaker, 5A, 2 Pole (380V, CSA Only)	1
	NV 00101160015	Circuit Breaker, 4A, 2 Pole (460-480V, CSA Only)	1
	NV 0000549CB	Circuit Breaker, 3A, 2 Pole (575V, CSA Only)	1

- NOTES -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