- NOTICE -
Damage resulting from misuse, negligence, or accident is not covered by the Hardinge machine warranty.

Information in this manual is subject to change without notice.

This manual covers the maintenance of Hardinge ELITE® series lathes equipped with a GE Fanuc 18i-TB or 21i-TB control.

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.

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CONVENTIONS USED IN THIS MANUAL

- WARNINGS -
Warnings must be followed carefully to avoid the possibility of personal injury and 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.

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READ THIS INFORMATION CAREFULLY BEFORE STARTING OPERATION, MAINTENANCE, OR REPAIR OF THE MACHINE

The technicians who use this manual should have a general knowledge of machine maintenance and repair. This general knowledge coupled with the following manual will greatly reduce or eliminate downtime of the Cobra machine.

When machine maintenance is performed by persons not familiar with the operation of this equipment, the most recent version of the operator’s manual (M-429) must be consulted when instructions require that the machine be run.

- WARNING -

Occupational Safety and Health 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

READ THESE SAFETY RECOMMENDATIONS BEFORE PROCEEDING ANY FURTHER.

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 machine tools. The safety recommendations are described below.

READ THE APPROPRIATE MANUAL 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 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.

REDUCE SPINDLE SPEED if vibration occurs. Bar stock straightness will have an effect on vibration and balance of the spindle system.
NEVER OPERATE THE MACHINE SPINDLE without a work-holding device if the draw tube is in the spindle.

TIGHTEN ALL DRAW TUBE SCREWS before beginning spindle operation.

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

DISCONNECT MAIN ELECTRICAL POWER before attempting 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 CHEMICAL AND FLAMMABLE MATERIAL 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 and that all doors are closed and secured.

TO REMOVE OR REPLACE the collet closer it is necessary to remove the guard door at the left end of the machine. Make certain that the guard door is in place before starting the machine.

DON’T OPEN GUARD DOORS while any machine component is in motion.

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 tool top plate before pressing the Cycle Start push button.

CHECK THE POSITION of any load/unload automation before pressing the Cycle Start push button.

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 point” 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.

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.

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

DON’T LEAVE tools, workpieces 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 threads 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 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 a high-pressure air hose. The hand-held air nozzle supplied with the machine limits the air pressure to 30 psi [2.1 bar].

COMPLY with any tags indicating limited or no direct air use.

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

DON'T LET STOCK project past the back end of the collet closer or machine spindle without being adequately covered and properly supported.

FOLLOW each bar feed manufacturer’s guidelines. For performance and safe application, size and use feed tube bushings, pushers, and spindle liners according to bar feed information.

MAKE CERTAIN that any bar feed mechanism is properly aligned with the spindle. If the bar feed is a floor-mounted type, it must be securely bolted to the floor.

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 when opening or closing the coolant guard door and any access covers.

FOR YOUR PROTECTION - WORK SAFELY
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- CAUTION -

The recommended operating temperature range for the machine is 50° to 95° F [7° to 35° C] ambient.

POWER-UP PROCEDURE

- NOTE -

It is important that the power-up procedure is followed as described to ensure safe, accurate, and repeatable machine operation.

1. Turn main disconnect switch “A”, Figure 1.1, ON.

2. Turn the air supply to regulator "B", Figure 1.2 or 1.3, ON.

- NOTE -

Refer to Chapter 6 for information on draining the air filter bowl(s).

3. On ELITE® 42 and ELITE 51 series lathes, drain air filter bowl “C”, Figure 1.2.

   On ELITE 27 MS lathes, drain air filter bowls “C” and “D”, Figure 1.3.

4. Check lubricant and coolant levels. If necessary, add lubricant and coolant.
- CAUTION -

When turning the Machine Power switch to ON, DO NOT press any other push buttons or keys until the position or alarm screen is displayed. Some push buttons and keys are used for control maintenance or special operation commands.

5. Turn Machine Power switch “E”, Figure 1.4, to ON and wait until the CNC display screen is ON.

6. Pull Emergency Stop push button “F” out to the first detent, wait two seconds; then, pull the push button out to the end of travel and release.

7. Open and close the coolant guard door to perform the guard door switch verification and clear the verification alarm.
POWER-DOWN PROCEDURE
1. Be sure “Cycle Start” is not active. The Cycle Start push button light will be OFF.
2. Be sure the program has been completed and that the spindle and slides are stationary.
3. Press Emergency Stop push button “F”, Figure 1.4.
4. Turn Machine Power switch “E” to the OFF position (0).
5. Turn the air supply to regulator "B", Figure 1.2 or 1.3, OFF.
6. Turn main disconnect switch “A”, Figure 1.1, OFF.
7. If necessary, proceed to the lock-out procedures.

LOCK-OUT PROCEDURES

AIR LOCKOUT
Turn OFF and lock put the main air supply. The actual procedure will be determined by the hardware installed by the customer.

ELECTRICAL LOCKOUT
1. Turn main disconnect “G”, Figure 1.5, to the RESET / LOCKOUT position.
2. Press tab “H” to extend lock-out lever “I”, Figure 1.6.
3. Lock out the main disconnect handle through lever “I”.

Figure 1.5 - Main Disconnect Switch at the RESET/LOCKOUT Position
Figure 1.6 - Main Disconnect Switch Lock-Out Lever
CLEARING AN EMERGENCY STOP

- NOTE -

The operator must wait approximately ten seconds from the time the Emergency Stop push button is pressed before attempting to clear the Emergency Stop.

The Emergency Stop push button is located on the operator control panel.

1. Correct the condition that prompted the Emergency Stop (E-Stop) condition.

2. Pull the Emergency Stop push button out to the first detent, wait two seconds; then, pull the push button out to the end of travel and release.
CHAPTER 2 - COOLANT SYSTEM

INTRODUCTION

- WARNING -
When the coolant system requires maintenance, the machine must be powered down. Refer to Chapter 1 for the power-down procedure.

- CAUTION -
Do not use a high pressure coolant system with ELITE® series lathes.

The machine is equipped with a coolant recirculating system capable of using either oil-based or water-based coolant. The standard system consists of a tank with screen, an electric coolant pump, turret top plate/turret body, and a coolant catcher at the rear of the spindle. Coolant is fed to the work area through the hoses. All of the coolant drains back into the tank through the chip pan.

Clean most of the chips from the coolant tank chip screen and pour the coolant directly into the pan until the coolant level is at the screen.

COOLANT TANK FLUID CAPACITIES

The coolant tank fluid capacity is listed below in gallons [liters]:

<table>
<thead>
<tr>
<th>Machine with Chip Conveyor</th>
<th>59 [223]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine without Chip Conveyor</td>
<td>44 [166]</td>
</tr>
</tbody>
</table>

COOLANT CONTROL

Coolant flow can be controlled with M codes through the part program or with the Coolant push button on the operator control panel.

Refer to the programmer’s manual (M-428) or operator’s manual (M-429) for information on operating the coolant system.
CUTTING FLUID (COOLANT)

- CAUTION -

Whenever cutting fluids are used, it is essential to follow the manufacturer’s recommendations on the selection and maintenance for that particular fluid.

The chemical consistency of any cutting fluid must be accurately checked frequently.

Hardinge machine tools are designed using the latest technology and highest quality materials available. However, due to the ever increasing number of cutting fluid (coolant) selections available, it is impossible to test material compatibility with each and every coolant. The two most popular types of cutting fluids are cutting oils and water-based coolants.

WATER-BASED COOLANTS

Water-based coolants are a cutting fluid which, when improperly specified or maintained, can affect the life of a machine and the quality of the parts made on it. Water-based coolants are designed to suppress rusting, enhance cutting, increase tool life, promote heat dissipation, and be economical to use.

Some water-based coolants may cause machine corrosion problems and be incompatible with machine components, especially if the fluid is not maintained correctly. Poorly maintained coolants may result in rancidity, poor tool life, staining, rusting, and foaming. These conditions effect machine performance and may cause health problems such as dermatitis. Water-based coolants must be correctly specified according to the machined materials and ensure compatibility with the machine’s components.

It is important to follow the coolant manufacturer’s recommendations when using a water-based coolant. Maintaining coolants per the manufacture’s recommendations will provide the following benefits:

- Extend the useful life of the machine
- Minimize corrosion, rusting, staining, and health problems such as dermatitis

At a minimum, the coolant maintenance should include the following:

- Daily checks and correction of coolant concentration
- A measure of the coolant pH
CARE AND MAINTENANCE

A daily check of the concentration and pH will help keep the coolant at the optimum performance level.

Cutting fluid should be added to the coolant system when needed and according to the manufacturer’s recommendation. This is necessary to provide additional fresh coolant which contains the essential additives required to keep the coolant performing properly.

Proper cleaning of the machine is very important before refilling the tank with fresh coolant. Dispose of the used coolant properly. Bacteria live and cling to all wetted surfaces in the machine. Special cleaners, usually available from your coolant supplier, are recommended to flush the system before refilling. These cleaners will kill the bacteria left after draining the machine. It also is recommended that a thorough cleaning, which includes scraping and removing any sludge found on the bottom and hidden in the top panels of the coolant tank, be completed before circulating cleaner through the system.

Concentration

Proper concentration control is essential for optimal tool life, corrosion control, and inhibiting bacterial growth. Water soluble coolants lose water by evaporation during normal operating conditions which tends to increase the coolant concentration over a normal work shift. The coolant concentration must be checked each day.

The coolant concentration must be kept within the specified range determined by the coolant manufacturer. Failure to maintain the coolant concentration within this range may result in poor performance from that fluid. Lean concentrations can lead to rust, rancidity, short tool life, and other problems. Rich concentrations can result in foam, residues, health problems such as dermatitis, and increased coolant costs.

pH

pH is a measure of a solution’s alkalinity or acidity. There are two common methods used to determine pH. One method is the use of special pH test paper and the other is a pH meter.

Water based coolants are designed to run within the pH range determined by the manufacturer. The pH of water based coolants typically runs on the alkaline side of the pH scale. A drop in pH indicates a growth of microbiological organisms (bacteria), which live on the additives found in the coolants. Typically, the pH range is between 8.5 and 9.2.

Water Quality

The water quality is also an important factor toward achieving optimum coolant performance. Water that contains dissolved minerals, bacteria, and other impurities (hard water) can sometimes adversely affect the coolant selected. An indication of water related problems is the formation of a soap like scum which adheres to sumps and filters. It is best to consult with your coolant representative to determine your requirements.
CHIP REMOVAL

- WARNING -

Use a rake and suitable container to remove metal chips and shavings from the chip pan. Injury may result from attempting to remove chips without a rake. Dispose of the chips and shavings in an environmentally safe manner.

- NOTE -

The chip shields must be raised before the coolant tank can be moved from the machine.

The coolant tank is mounted on wheels and has a coolant hose that can be disconnected from the tank to allow the tank to be moved from the machine in several directions, as shown in Figure 2.1.

Figure 2.1 - Removing the Coolant Tank (Top View)
CHIP REMOVAL PROCEDURE

1. Wait for the cycle to stop, open the main coolant door and power down the machine. Wait a minute to allow most of the coolant to drain back into the tank.

2. Grasp chip deflector shield “A”, Figure 2.2, near the headwall and slowly lift the shields until they snap up and stay in a fixed position. Do NOT use force to lift the shields.

3. Disconnect the coolant supply hose from the coolant tank.

4. Move the tank into an area that is convenient to remove the metal chips and shavings.

   - NOTE -
   The coolant tank has a basket or baskets that can be removed and cleaned without fully removing the tank.

5. Rake the chips into a suitable container and dispose of them properly. The screen can be removed from the tank and cleaned. Lift out the basket and clean it. Install the basket and screen in the tank.

6. Return the tank to the opening under the front of the machine. Support the corner of the headwall chip shield “C” along with the corner of “B”, the back wall shield; lift both corners until the headwall shield can drop below the back wall shield and take the front wall shield down with it.

7. Connect the coolant supply hose to the coolant tank.

8. Check inside the work area to verify that coolant will drain into the chip pan. Make any adjustments before powering up the machine and turning coolant on.
CLEANING OR REPLACING THE IN-LINE COOLANT FILTER ELEMENT

Clean or replace the in-line filter element when any of the following occur:

- In-line filter gauge “G”, Figure 2.3, indicates between 4 to 6 in. Hg
- The coolant flow appears to be restricted
- Changing the type or brand of coolant

1. Power down the machine.
2. Wipe filter housing “D”, and filter head “F”, Figure 2.3, clean with a lint-free cloth.
   - CAUTION -
   Use care not to spill the coolant contained in the filter housing.
   Dispose of coolant in the filter housing in accordance with all applicable government guidelines. DO NOT introduce the coolant back into the coolant system.
3. Remove four screws “E” to release the filter housing from the filter head.
4. Allow the coolant in filter element “H”, Figure 2.4, to drain into the filter housing.
5. Properly dispose of the coolant in the filter housing.

Figure 2.3 - In-Line Coolant Filter

Figure 2.4 - Filter Element Mounted on the Filter Head
6. Remove the filter element from the filter head.
7. Clean or replace the filter element.
8. Clean the inside of the filter housing.
9. Verify that O-ring “I”, Figure 2.5, is in good condition and is properly installed in the top of the filter housing.
10. Install the filter element on the filter head.
11. Mount the filter housing on the filter head.
12. Power up the machine.
13. Check for coolant leaks around the filter housing. Tighten components as necessary.

Figure 2.5 - O-Ring Installed in the Top of the Filter Housing
CLEANING THE COOLANT TANK AND SCREEN FILTERS

- NOTE -

The coolant catcher and return hose should also be cleaned when the coolant tank is cleaned. Refer to page 2-12.

Clean the coolant tank:

- Every six months or more frequently if the coolant becomes contaminated by materials being cut.
- When changing the type or brand of coolant.

1. Wait for the cycle to stop, open the main coolant door and power down the machine. Wait a minute to allow the coolant to drain into the tank.

2. Grasp chip deflector shield “A”, Figure 2.2, near the headwall and slowly lift the shields until they “snap” up and stay in a fixed position. Do NOT use force to lift the shields.

3. Disconnect the coolant supply hose from the coolant tank.

4. Move the tank into an area that is convenient to remove the metal chips and shavings. Refer to Figure 2.1.

- WARNING -

Use a rake and suitable container to remove metal chips and shavings from the chip pan. Injury may result from attempting to remove chips without a rake. Dispose of the chips and shavings in an environmentally safe manner.

5. Rake the chips into a suitable container and dispose of them properly.

- WARNING -

Wear protection and be careful when removing coolant, metal chips, and shavings from the tank.

6. Lift off the cover plate.

7. Lift the screen from the tank; shake out the metal chips and wipe the screen clean.

8. Remove the basket from the tank and clean it.

9. Pump the coolant from the tank.

10. Remove any coolant still in the tank and wipe it clean.

11. Wash the tank, screen and basket with a cleaner recommended by the coolant manufacturer to remove any bacterial contamination.

12. Flush the cleaner from the tank and clean as recommended.

13. Install the basket and screen in the tank.

14. Install the cover plate.
15. Return the tank to the opening under the front of the machine.

16. Support the corner of the headwall chip shield “C”, Figure 2.2, along with the corner of the back wall shield “B”; lift both corners until the headwall shield can drop below the back wall shield and take the front wall shield down with it.

17. Connect the coolant supply hose to the coolant tank.

18. Check inside the work area to verify that coolant will drain into the chip pan.

19. Pour the coolant directly into the chip pan. Fill the tank with the selected coolant until the coolant level is at the screen. Refer to page 2-1 for the coolant tank fluid capacity

20. Make adjustments to the coolant and tank as necessary before powering up the machine and turning the coolant ON.
REPLACING THE COOLANT PUMP

The coolant pump is located on a platform at the rear of the machine. The pump draws coolant from the tank and pushes it to the work area.

1. Power down the machine. Wait a minute to allow the coolant to drain into the tank.
2. At the rear of the machine, locate the coolant pump on the platform.
3. Remove the cover from the electrical junction box on the pump to gain entrance to the wires.
4. Record all wire connections. This information will be important when connecting the replacement pump.
5. Disconnect the wires. Remove the cord grip and cable from the junction box.
6. Remove suppressor “J”, Figure 2.6 or 2.7, from the junction box.

- NOTE -

Do not cut the coolant hose unless the fitting does not turn when the hose clamp is loosened. There is enough hose if it is necessary to cut it.

Use a container large enough to accept some coolant from the coolant hoses.

7. Loosen the clamp on the hose from the check valve to be removed from the old pump and mounted on the new pump.
8. Disconnect the coolant hoses from the pump.
9. Check the flow directional arrow on the coolant pump for replacement pump position.
10. Remove the coolant pump from the platform.
11. Remove the check valve and fittings from the coolant pump.
12. Install the check valve and fittings on the replacement pump.

Figure 2.6 - Coolant Pump Motor Suppressor (ELITE® 27 MS Lathe)

Figure 2.7 - Coolant Pump and Motor Suppressor (ELITE 42 and ELITE 51 Series Lathes)
13. Drill an opening and install suppressor “J” on the motor junction box.
14. Connect the suppressor wires according to the information recorded in step 4.
15. Mount the cord grip on the junction box.
16. Verify the flow directional arrow and mount the replacement pump on the platform.
17. Feed the cable into the junction box and connect the wires according to the information recorded in step 4.
18. Make certain that the gasket is fitted and install the junction box cover.
19. Connect the coolant hoses to the pump.
20. Set the coolant pressure as follows:

   **NOTE**

   Pipe plug “K” has a 1/8 NPT thread. Prepare a 300 or 500 psi pressure gauge and fitting to be installed at this opening.

   The coolant pressure must be set at 200 psi.

   A) Remove pipe plug “K”, Figure 2.7 or 2.8, and install a pressure gauge.
   B) Power up the machine according to the procedure in Chapter 1.
   C) Remove cap “L”, Figure 2.8 or 2.9, and loosen the lock nut to release the stem.
   D) Read the coolant pressure on the gauge. If necessary, adjust the stem to change the coolant pressure to 200 psi.
   E) Secure the lock nut to secure the stem. Check the coolant pressure reading again.
   F) When the pressure is satisfactory, install cap “L”.
   G) Power down the machine and wait a minute to allow a relief in the coolant pressure system.
   H) Remove the pressure gauge and install the pipe plug.
COOLANT CATCHER

The coolant catcher (shown in Figure 2.11) is accessed through spindle draw tube access cover “M”, Figure 2.10. A hose attached to the coolant catcher drain returns coolant to the tank through an opening in the base. If the rest of the coolant system is being cleaned, the catcher and return hose should also be cleaned.

CLEANING THE COOLANT CATCHER

1. Power down the machine.
2. Remove access cover “M”, Figure 2.10.
3. Wipe out any coolant that remains in the coolant catcher.
4. Wash the catcher with a cleaner recommended by the coolant manufacturer.
5. Flush and then check the tank to verify that the cleaner flows into the tank.
6. Clean again and/or remove the hose at the connector to clean it if necessary.
7. Replace access cover “M”.
8. Do what is necessary to clean and then ready the coolant tank as described earlier in this chapter.
9. Fill the tank with coolant to the screen.
10. Power up the machine and test the coolant flow.
THRU-SPINDLE COOLANT - MAIN SPINDLE [Option]

This thru-spindle coolant option directs coolant through the main spindle to clean chips from the spindle and gripping surface(s).

- NOTE -

The thru-spindle coolant tube does not require lubrication.

The spindle coolant carrier tube is sized for the inside diameter of the spindle. It is mounted and sealed within the spindle shaft but can be removed when necessary. The thru-spindle coolant line is equipped with an in-line quick-disconnect coupling. The ½-20 threaded coolant tube tip makes it possible to create and mount specialized nozzles.

REMOVING THE THRU-SPINDLE COOLANT SHAFT FROM THE SPINDLE

1. Power down the machine.

- CAUTION -

Support the cover while removing the left screw, then; the right screw. Pull the cover straight off.

2. Remove access cover "M", Figure 2.10, to gain access to the thru-spindle coolant tube and the quick-disconnect coupling, shown in Figure 2.12.

3. Pull back on the knurled ring and unfasten the quick-disconnect coupling in the coolant line.

4. Secure the thru-spindle bearing housing and unthread the three screws.

5. Carefully pull on the bearing housing to pull the coolant tube from the spindle. Continue to pull on the bearing housing while supporting the coolant shaft (tube) as it is removed.

Figure 2.12 - Thru-Spindle Coolant Coupling
MOUNTING THE THRU-SPINDLE COOLANT SHAFT IN THE SPINDLE

1. Put a light coat of grease on the coolant shaft O-rings.
2. Align the nose of the coolant shaft in the spindle opening and push the tube into the spindle.
3. Turn the coolant shaft until the open port on the bearing housing is in the bottom (down) position.
4. Continue to carefully push on the bearing housing until the coolant tube is all the way into the spindle.
5. Rotate the bearing housing to align the screws on the threaded holes.
6. Thread the screws in and tighten them to 120 lb-in. [14 N•m] torque to secure the coolant tube in the spindle.
7. Connect the coolant line.
8. Install access cover "M".
CHAPTER 3 - LUBRICATION

INTRODUCTION

- WARNING -

When the lubrication system requires maintenance, the machine must be powered down. Refer to page 1-3 for the power-down procedure.

The lubrication system supplies grease to the ball screws and truck bearings on the linear guideways for each axis.

IMPORTANCE OF LUBRICATION

Running conditions of this machine depend heavily upon the lubrication management. Make certain that the lubrication system is checked frequently under severe operating conditions to keep the machine in proper working condition.

AXIS LUBRICATION

INTRODUCTION

Grease is used to lubricate the following:

• X axis linear guides and ballscrews (Cross Slide)
• Z axis linear guides and ballscrews (Carriage)
• E axis linear guides (Tailstock)
• E axis linear guides and ballscrews (Sub-Spindle)

- NOTE -

The tailstock is equipped with four lubrication ports. The E axis ball screw lubrication port (labeled "BS") is only present on machines equipped with a sub-spindle.

The center port (labeled "BS") on each grease block supplies grease to the associated ball screw. The remaining four ports on each grease block supply grease to the trucks on the linear guides.

Refer to the next page for axis grease specifications.

Fresh grease should be added every six months or 1000 hours of machine operation or more frequently under severe operating conditions.
AXIS GREASE SPECIFICATIONS

Hardinge Inc. recommends KLÜBER® Isoflex NCA 15 or NBU 15 grease for axes lubrication. Other greases may not contain certain additive packages needed for proper lubrication and performance. The additive packages may include compounds which have been blended specifically for that application. Although many companies offer similar greases, these may not contain the needed additives to ensure maximum performance and protection of Hardinge machines.

The machine control displays a message every 1000 hours of operation. The control does not stop the machine when the lubrication alarm is displayed; however, Cycle Start is inhibited. After the machine has been properly lubricated, press the Rapid Traverse and Cycle Start push buttons at the same time to clear the lubrication message.

- NOTE -
The grease volume delivered is dependent upon the grease gun being used. Carefully measure the amount of grease or count the grease gun strokes necessary to lubricate the guides and ball screws. Be certain that all air is purged from any grease gun before use.

Check the grease lubrication system every six months (approximately 1000 hours of operation) and add grease according to the following tables:

<table>
<thead>
<tr>
<th>Location</th>
<th>“BS” Ball Screw Lube (center grease port)</th>
<th>Linear Guides (grease ports each side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Axis</td>
<td>4 cc</td>
<td>7 cc</td>
</tr>
<tr>
<td>Z Axis</td>
<td>10 cc</td>
<td>7 cc</td>
</tr>
<tr>
<td>E Axis (Tailstock)</td>
<td>-</td>
<td>7 cc</td>
</tr>
<tr>
<td>E Axis (Sub-Spindle)</td>
<td>10 cc</td>
<td>7 cc</td>
</tr>
</tbody>
</table>

When a LINCOLN #1147 grease gun (available from Hardinge; part number TT 0010994-01) is used, the following number of strokes supplies the correct amount of grease:

<table>
<thead>
<tr>
<th>Location</th>
<th>“BS” Ball Screw Lube (center grease port)</th>
<th>Linear Guides (grease ports each side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Axis</td>
<td>4.5 strokes</td>
<td>8 strokes</td>
</tr>
<tr>
<td>Z Axis</td>
<td>11.5 strokes</td>
<td>8 strokes</td>
</tr>
<tr>
<td>E Axis (Tailstock)</td>
<td>-</td>
<td>8 strokes</td>
</tr>
<tr>
<td>E Axis (Sub-Spindle)</td>
<td>11.5 strokes</td>
<td>8 strokes</td>
</tr>
</tbody>
</table>

Make certain that all the sliding surfaces are lubricated well by jogging the axes at 50% of the maximum rapid traverse for a full 30 minutes before resuming machine operation.
**GREASING THE MACHINE AXES**

**X and Z Axes**

- **NOTE** -
  Grease should be added when the linear guides are still warm from operation.

Grease block "A", Figure 3.1, supplies grease to the X axis linear guides and ballscrew.

Grease block "B" supplies grease to the Z axis linear guides and ballscrew.

1. Wait for the cycle to end and that the spindles and slides are stationary.
2. Jog the Z axis until the grease fittings on the block are accessible.
3. Power down the machine.
4. At the rear of the machine, remove the access cover to expose the grease block. Refer to Figure 3.1.
5. Wipe each grease fitting clean.

- **NOTE** -
  Only use a manually operated grease gun.

The ballscrew lubrication line connects to the middle fitting (marked BS) on the grease block.

6. Attach the grease gun nozzle to the grease fitting; slowly and evenly pump in the specified amount of grease. Repeat the process for each grease fitting on the grease block.
7. Wipe the fittings clean of excess grease.
8. Install the access cover.
9. Power up the machine.
10. Press the Reset and Feed Hold push buttons at the same time to clear the lubrication message.
11. Jog the axes at 50% of the maximum rapid traverse for a full 30 minutes before machining workpieces.

*Figure 3.1 - X and Z Axis Grease Blocks*
E Axis

- NOTE -
Grease should be added when the linear guides are still warm from operation.

1. Wait for the cycle to end and that the spindles and slides are stationary.
2. Jog the tailstock or sub-spindle toward the main spindle until cover "C", Figure 3.2, is accessible.
3. Power down the machine.
4. Remove cover "C" to gain access to the E axis grease block.
5. Clean the grease fittings.

- NOTE -
Only use a manually operated grease gun.

The ball screw lubrication line connects to the middle fitting (marked BS) on the grease block. The ball screw lubrication line is only present on machines equipped with a sub-spindle.

6. Attach the grease gun nozzle to the grease fitting; slowly and evenly pump in the specified amount of grease. Repeat the process for each grease fitting on the grease block.
7. Wipe the fittings clean of excess grease.
8. Install the cover "C".
9. Power up the machine.
10. Press the Reset and Feed Hold push buttons at the same time to clear the lubrication message.
11. Jog the axes at 50% of the maximum rapid traverse for a full 30 minutes before machining workpieces.

Figure 3.2 - Access Cover for E Axis Lubrication Block
REPLACING A GREASE LUBRICATION LINE

- NOTE -

The Hardinge part number for the grease line is TT -0007007.

1. Wait for the cycle to end and make certain that the spindle is stopped.
2. Jog each axis until the grease lubrication lines are accessible.
3. Power down the machine.
4. If servicing the X or Z axis, remove the access cover at the rear of the machine to gain access to the grease blocks and grease lines. Refer to Figure 3.1.

   If servicing the E axis, remove cover "C", Figure 3.2, to gain access to the grease block and grease lines.

   - NOTE -

   Replace the grease lubrication lines one line at a time.

   The ballscrew lubrication line connects to the middle fitting (marked BS) on the grease block.

5. Check each grease lubrication line for damage. Measure the length of each line being replaced and check the route to either linear guide or ball screw.
6. Disconnect the grease lubrication line and verify the new line is the same length as the line being replaced.
7. Before installing the replacement line, fill the line with KLÜBER® Isoflex NCA 15 or NBU 15 grease.
8. Connect one end of the replacement line at the grease manifold and add the specified grease through the fitting until grease appears at the other end of the truck or ball screw line; then, connect that end of the line.
9. Repeat the process for each grease lubrication line being replaced.
10. Wipe the fittings clean of excess grease.
11. Install the access cover.
12. Power up the machine.
13. Jog the axes at 50% of the maximum rapid traverse for a full 30 minutes before machining workpieces.
HARDINGE TURRET LUBRICATION

- NOTE -

Grease is used to lubricate the live tooling drive shaft.

The live tooling drive shaft must be lubricated every 2000 hours of operation.

Use KLÜBER® Isoflex NCA 15 or NBU 15 grease (Hardinge grease cartridge part number TT 0010994NCA or HS 0010994SL).

1. Move the turret to a convenient position to access top plate cover “D”, Figure 3.3.
2. Open the main coolant guard door.
3. Press the Emergency Stop push button.
4. Power down the machine.
5. Wipe coolant, chips, and other contaminants from the turret top plate.
6. Remove six screws “E” and the associated lock washers to remove turret cover “D”.

- NOTE -

Use a manually operated grease gun.

7. Attach the grease gun nozzle to grease fitting “F”, Figure 3.4.
8. Slowly and evenly pump in approximately 2.0 cc (2 strokes) of the specified grease.
9. Wipe any excess grease from the fitting.
10. Install top plate cover “D”, Figure 3.3, using six screws “E” and the associated lock washers. Torque the screws to 120 lb-in [13.6 N•m].
LIVE TOOLING ATTACHMENT LUBRICATION

- NOTE -

Do not disassemble the live tool attachment. Return the entire assembly to Hardinge Inc. if repairs are necessary.

The live tooling attachment must be removed from the turret top plate each 160 hours to be inspected and lubricated.

Apply a light coat of Molylube Anti-Seize grease on spline “G”, Figure 3.5, when mounting a live tooling attachment on the turret top plate.

1. Move the turret and index the turret top plate to a convenient position where the live tooling attachment can be removed.

2. Open the main coolant guard door.

3. Wipe coolant, chips, and other contaminants from the live tool attachment and turret top plate.

4. Unthread the clamp screw just enough to be able to remove the live tool holding attachment. Pull the attachment straight out from the turret top plate.

5. Inspect the live tool attachment for wear and the amount of grease on spline “G”, Figure 3.5.

6. Check O-ring “H” to be sure that it is in good condition.

7. Mount the live tooling attachment and tighten the clamp screw to 11 - 18 lb-ft [15 - 24 N•m] torque.

8. Close the main coolant guard door and power up the machine.

Figure 3.5 - Live Tool Holding Attachment
CHAPTER 4 - HYDRAULIC SYSTEM

INTRODUCTION

The hydraulic unit is located at the rear of the machine. The following maintenance procedures have the greatest effect on hydraulic system performance, efficiency, and life:

- Maintaining a clean sufficient quantity of hydraulic fluid of the proper type and viscosity.
- Changing the hydraulic filter on a regular schedule and keeping the strainers clean. (ELITE® 42 and ELITE 51 series lathes only)
- Keeping air contamination out of the system and keeping all connections leak free.

ELITE 42 AND ELITE 51 SERIES LATHES

The hydraulic unit primarily consists of a 3 horsepower motor, pump, filter, and manifold mounted on the hydraulic tank. The pump provides a maximum of 750 psi [52 bar] operating pressure to the collet closer, turret, and tailstock carriage. The 3-micron filter cleans the hydraulic fluid before it enters the distribution manifold. The hydraulic pressure is controlled, as required by each function, at the main system manifold.

All hydraulic system gauges are mounted on manifold “A”, Figure 4.1.

Heat exchanger “B” is a radiator and fan unit that reduces and stabilizes the temperature of the hydraulic fluid.

ELITE 27 MS LATHE

The hydraulic unit, shown in Figure 4.2, primarily consists of a 2 horsepower motor, pump, and manifold mounted on the hydraulic tank. The pump provides hydraulic pressure to the turret.

Heat exchanger “B” is a radiator and fan unit that reduces and stabilizes the temperature of the hydraulic fluid.

The hydraulic system pressure is preset at the factory.
HYDRAULIC TANK

The oil level should be maintained at full or near full to ensure good system cooling, good air dissipation, and overall system performance. Read sight gauge “C”, Figure 4.1 or 4.2.

FILLING THE HYDRAULIC TANK

1. Power down the machine.
2. Wipe filler cap “D”, Figure 4.1 or 4.2, and the area around the cap clean with a lint-free cloth.
3. Remove the filler cap and slowly fill the tank with Mobil DTE-13M hydraulic fluid.
4. Replace the filler cap.
5. Wait 10 minutes to allow any air in the oil to escape before powering up the machine.
HYDRAULIC FILTER

-NOTE-

ELITE® 27 MS lathes are not equipped with a hydraulic filter.

The hydraulic system filter is located to the right of the hydraulic manifold. Check the filter pressure daily by viewing red indicator “E”, Figure 4.3. If the red indicator is extended, try to reset it by gently pressing down on the dome.

Replace the filter element after 1000 hours of operation or if the red indicator does not reset.

REPLACING THE FILTER ELEMENT

1. Power down the machine.
2. Check the red indicator to determine the condition of the filter or check the number of hours the machine has been run.
3. Unthread filter bowl “G”, Figure 4.3, from filter head “F”, until it drops from the head.
4. Pour the oil from the filter bowl. Wipe the bowl clean with a lint free cloth.
5. Clean the bowl with solvent recommended by the hydraulic oil manufacturer. Wipe it dry with a lint free cloth.
6. Wrap the filter element in a rag and pull it straight down to release it from the nipple in the filter head.
7. Install a new filter element by gently pressing it onto the nipple.
8. Fill half the filter bowl with fresh Mobil DTE-13M® hydraulic fluid and thread it on the filter head hand tight.
9. Reset the indicator by pressing down on the clear dome.
10. If necessary, fill the tank with hydraulic fluid.
11. Wait 10 minutes for air in the oil to dissipate; then, power up the machine.
12. Check for hydraulic fluid leaks around the filter bowl. Tighten the bowl if necessary.

Figure 4.3 - Hydraulic System Filter (Tailstock Machine Shown)
HYDRAULIC MANIFOLD COMPONENT IDENTIFICATION

ELITE® 42 AND ELITE 51 SERIES LATHES

Refer to Figures 4.4 or 4.5 for component identification.

Figure 4.4 - Hydraulic Manifold Components
(ELITE 42 and ELITE 51 Series Lathes Equipped with Tailstock)

Figure 4.5 - Hydraulic Manifold Components
(ELITE 42 and ELITE 51 Series Lathes Equipped with Sub-Spindle)
ELITE® 27 MS LATHE

Refer to Figures 4.6 and 4.7 for component identification.

Figure 4.6 - Hydraulic Unit: Front
(ELITE 27 MS Lathe)

Figure 4.7 - Hydraulic Unit: Left Side
(ELITE 27 MS Lathe)
INTRODUCTION

- NOTE -

Refer to Chapter 9 for information on the sub-spindle for ELITE® 42 and ELITE 51 series lathes.

The ELITE 27 MS is not available with a tailstock.

The standard configuration for ELITE 42 and ELITE 51 series lathes is to be equipped with a hy-
draulically operated, programmable tailstock. The tailstock provides additional support and reduces
part deflection when machining long parts. This allows for closer tolerances and better surface fin-
ishes at higher speeds and feeds than would otherwise be possible.

A hydraulic cylinder extends and retracts the tailstock assembly. The hydraulic system is located at
the rear of the machine. Tailstock movement can be controlled automatically from the part program or
manually by using the Z/E push buttons on the machine control panel.

There are two rates of motion:

- The rapid traverse rate is approximately 300 in/min [7620 mm/min].
- The adjustable rate of feed.

The tailstock has a bushing which will accept a live center with a #3 Morse taper.

- CAUTION -

The tailstock pressure must be above 150 psi [10.3 bar] for maximum operating
safety and to ensure that the hydraulic components function correctly.

Refer to the operator’s manual (M-429) for information on setting the tailstock hy-
draulic pressure.

The force applied to the workpiece is controlled by
hydraulic oil pressure which is regulated by valve “A”,
Figure 5.1. Gauge “B” indicates the pressure in psi
and bar.

Always make certain that the turret is in a safe in-
dex position before moving the tailstock toward the
spindle.

The tailstock design incorporates a safety shear
feature to limit the damage if there is contact between
the tailstock and the turret or turret tooling. If contact
is made, the safety shear feature allows the tailstock
to pivot. Refer to page 5-6 for instructions on aligning
the tailstock.

Figure 5.1 - Hydraulic System Manifold
TRAVEL SPECIFICATIONS

The tailstock travel specifications are shown in Figure 5.2. The Home (Retract) position is fixed from the spindle face at 18.106 inches [459.89 mm]. However, the forward (extend) position can be adjusted to suit the workpiece length. Refer to “Tailstock Set-Up” in the Operator’s manual (M-429) for information on setting the rapid-to-feed position. The maximum part length for tailstock operation is shown in Table 5.1.

<table>
<thead>
<tr>
<th>Work-Holding Device</th>
<th>Maximum Part Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches [Millimeters]</td>
</tr>
<tr>
<td>Collet</td>
<td>14.00 [355.6]</td>
</tr>
<tr>
<td>Hardinge Chuck with Hard Top Jaws</td>
<td>9.41 [239.0]</td>
</tr>
</tbody>
</table>

Table 5.1 - Maximum Part lengths

![Figure 5.2 - Tailstock Travel Specifications](image)

NOTE: All dimensions shown in inches [millimeters].
TAILSTOCK POSITIONS

There are three tailstock positions recognized by the control:

- Fixed Home Position
- Rapid-To-Feed Position
- Over-Travel Position

FIXED HOME POSITION

The home position is at the maximum tailstock travel away from the machine spindle. This position is NOT adjustable.

RAPID-TO-FEED POSITION

The rapid-to-feed position is automatically established when the tailstock is moved from the forward position to the fixed Home position.

Assuming the tailstock has been against the face of the workpiece and, then, moved to the Home position, the rapid-to-feed position will automatically be set approximately one inch before the tailstock will contact the face of the workpiece.

The velocity reduction at the rapid-to-feed position will provide acceptable tailstock contact with the workpiece.

During programmed operation, the tailstock will RAPID forward (toward the machine spindle) until the rapid-to-feed position is reached. At that point, the tailstock will slow to the preset feedrate and feed onto the workpiece.

OVER-TRAVEL POSITION

The over-travel position is automatically established when the tailstock is moved from the forward position to the fixed Home position.

Assuming the tailstock has been against the face of the workpiece and, then, moved to the Home position, the over-travel position is automatically set approximately one inch beyond where the tailstock should contact the face of the workpiece.

An alarm message will be generated and the machine will be put into a feed hold condition if the tailstock reaches the over-travel position.

Clearing the Overtravel Alarm

1. Press the control Reset key.
2. Activate Jog mode.
3. Set the Manual Axis Movement switch to “E” to select the tailstock.
4. Press the right-hand Z/E push button to move the tailstock to the Home position at the rapid traverse rate.
LIVE CENTER AND BUSHING

REMOVING OR REPLACING THE TAILSTOCK LIVE CENTER OR BUSHING

- NOTE -
Refer to the operator's manual (M-429) for information on moving the machine axes to reference position.

1. Move the turret to the X and Z axis reference positions.
2. Move the tailstock to a convenient work space in front of the main access door.
3. Power down the machine.
4. Carefully press a brass or soft metal rod through the bore in the rear of the tailstock casting to push the live center out of the bushing.
5. If the bushing and live center are to be removed together, loosen both binding nuts “C”, Figure 5.3, and push the bushing and center out with the brass or soft metal rod. The binding nuts and bolts remain in place.

- NOTE -
To lubricate the live center, follow the manufacturer’s directions. If no directions are available; unthread the screw, put a few drops of Mobil 43-DTE Lite oil in the opening and re-insert the screw.

6. Make certain that the bushing and live center are free of burrs before assembly.
   - If the bushing was NOT removed, proceed to step 7.
   - If the bushing was removed, proceed to step 8.
7. Install the live center in the bushing.
8. Place the bushing and center in the tailstock bore, but do not tighten the binding nuts.

Figure 5.3 - Live Center Alignment
9. Power up the machine.
10. Activate Jog mode.
11. Set the Manual Axis Movement switch to “E” to select the tailstock.
12. Press the right-hand Z/E push button to move the tailstock to the Home position.

   **NOTE**
   Align the tailstock within ±.001 inch [0.025 mm] of the center with the hydraulic pressure set at 350 psi [24.1 bar].

   Once the forward position of the tailstock is set, the rapid-to-feed is automatically set at one inch (1” [25.4mm]) before the expected part contact.

13. Chuck a test arbor in the machine spindle.
14. Press the left-hand Z/E push button to feed the tailstock toward the machine spindle and gently bring the tailstock live center into contact with the tip of the test arbor.
15. Press the right-hand Z/E push button to move the tailstock to the Home position.
16. If the machine has the hard stop option, check the stop position.
17. Press the left-hand Z/E push button to move the tailstock to position the live center against the end of the test arbor.
18. Check to be sure that the tailstock hydraulic pressure is set at 350 psi [24.1 bar].
19. Check the alignment between the live center and the test arbor. If the center is out of alignment, reposition the bushing to bring the center closer into alignment.

20. Tighten binding nuts “C”, Figure 5.3.
TAILSTOCK ALIGNMENT

The tailstock is bored in place for accuracy. It rides on linear guideways and is protected by the safety shear design of the tailstock base. The tailstock pivots on the tailstock base if the turret or tools make contact with it.

Alignment stop block “D”, Figure 5.4, limits the pivot rotation of the tailstock when it is being repositioned. After the tailstock is positioned, set the tailstock pressure gauge at 350 psi [24.1 bar] and align the bushing to within ±.001 inch [.025 mm] as in the previous directions.

- WARNING -

DO NOT program tailstock motion until the tailstock alignment has been completed.

1. Make certain that the control is in an Emergency Stop condition. The program should have stopped and the Emergency Stop light should be flashing.
2. Press the upper X/Y push button to jog the turret and turret tooling clear of the tailstock.
3. Remove the workpiece.
4. Power down the machine.
5. Open the main coolant guard door to the turret and tailstock.
6. Remove the access cover on the right end of the machine.
7. Remove the alignment stop block cover from the tailstock to gain access to stop block “D” Figure 5.4.
8. Have a work partner put a 6 feet [2 meters] long brass or soft metal bar into the back of the live center opening in the tailstock.
9. Carefully tap the bar to loosen the live center and, then, remove the center from the bushing.
10. Keep the brass or soft metal bar in the opening and apply downward pressure on it to hold the tailstock in place while loosening mounting screws “E” and “G”, Figure 5.5.
11. Loosen pivot screw “H”, Figure 5.6, if the tailstock doesn’t align when the mounting screws are loosened.
12. Carefully pivot the tailstock near alignment by applying more downward pressure on the brass or soft metal bar and some pressure on the tailstock nose until adjustment stop block “D”, Figure 5.4, stops upward movement.

13. Hold the tailstock in place and tighten pivot screw “H”, Figure 5.6, to 15 lb-ft [20 N•m] torque.

14. Tighten mounting screws “E” and “G”, Figure 5.5, to 15 lb-ft [20 N•m] torque.

15. Remove the brass or soft metal bar from the tailstock opening.

   - NOTE -
   Align the tailstock within ±.001 inch [.025 mm] of the spindle centerline with the hydraulic pressure set at 350 psi [24.1 bar].

16. Align the tailstock as follows:

A) Install a dead center in the eccentric bushing in the tailstock.

B) If the machine has the hard stop option, make certain that the tailstock solid stop block is set to the far left.

C) Power up the machine.

   - NOTE -
   All doors may have to be closed to activate Jog mode.

D) Activate Jog mode.

E) Press the right-hand Z/E push button to move the tailstock to the Home position.

F) Chuck a test arbor in the machine spindle.

   - NOTE -
   Align the tailstock within ±.001 inch [.025 mm] of the center with the hydraulic pressure set at 350 psi [24.1 bar].

Once the forward position of the tailstock is set, the rapid-to-feed is automatically set at one inch (1" [25.4mm]) before the expected part contact.

G) Press the left-hand Z/E push button to gently bring the tailstock center into contact with the test arbor.

H) Press the right-hand Z/E push button to move the tailstock to the Home position.

I) Press the left-hand Z/E push button to move the tailstock to position the center against the end of the test arbor.

J) Check to be sure that the tailstock hydraulic pressure is set at 350 psi [24.1 bar].

Figure 5.6 - Tailstock Pivot Screw and Eccentric Bushing
K) Check the alignment between the live center and the test arbor. If the center is out of alignment, rotate the eccentric bushing to bring the center into alignment.

L) Tighten binding nuts “C”, Figure 5.3.

M) If the tailstock needs to be further aligned, use the following directions:
   1. Power down the machine.
   2. Loosen mounting screws “E” and “G”, Figure 5.5.
   3. Loosen the adjustment screw in the stop block “D”, Figure 5.4.
   4. Adjust the tailstock and align the tailstock dead center to the arbor.
   5. Tighten the three mounting screws to 15 lb-ft [20 N•m] torque to hold the tailstock in place.
   6. Tighten the adjustment screw flush against the relief in the tailstock carriage.

N) Tighten mounting screws “E” and “G”, to 40 lb-ft [54 N•m] torque.

O) Tighten pivot screw “H”, Figure 5.6, to 40 lb-ft [54 N•m] torque.

P) Power up the machine.

Q) Test the alignment of the tailstock dead center again. Rotate the eccentric bushing to bring the dead center into alignment specification, if necessary.

R) Home the tailstock. Replace the dead center with a live center.

S) Check the alignment between the live center and the test arbor. If the center is out of alignment, rotate the eccentric bushing to bring the center into alignment.

17. Power down the machine.
18. Tighten binding nuts “C”, Figure 5.3.
19. Install the alignment stop block cover.
20. Mount the side access cover.
21. Close the main coolant guard door.
22. Power up the machine.
TAILSTOCK HYDRAULIC CYLINDER REPLACEMENT

One end of hydraulic cylinder “I”, Figure 5.7, is mounted to the tailstock carriage and the other end has a flange which is fastened to a bracket in the guideway casting. The cylinder pushes the tailstock toward and pulls it away from the spindle. It is either controlled from programmed commands or manually from push buttons on the control panel.

- NOTE -

Refer to the operator's manual (M-429) for information on moving the machine axes to reference position.

1. Move the turret to the X and Z axis reference positions. If the tailstock cylinder functions, move the tailstock toward the spindle.

2. Power down the machine.

3. Wipe the chips and excess coolant from the tailstock rear waycover.

4. Remove the rear waycover.

5. Record where each hydraulic line (hydraulic cylinder extend and retract) fastens to the hydraulic cylinder.

6. Disconnect the hydraulic lines.

7. Remove nut “F”, Figure 5.5, from the hydraulic cylinder shaft mounted under the front of the tailstock carriage.

8. Note the location and direction of the hydraulic fittings in relation to the casting for re-assembly.

9. Pull the “e” clip from the clevis pin “J”, Figure 5.7, and lift the pin from the mounting block.

10. Lift the hydraulic cylinder from the guideway casting.

11. Verify the new cylinder is the correct replacement.

12. Remove the fittings from the old hydraulic cylinder and mount them on the new cylinder.

13. Put the new hydraulic cylinder in the guideway casting with the hydraulic fittings oriented as noted in step 8.

Figure 5.7 - Tailstock Hydraulic Cylinder
14. Put the hydraulic cylinder shaft into the hole under the tailstock carriage.
15. Place a drop of Loctite #242 thread locker on the threads and tighten nut “F”, Figure 5.5, to 30 lb-ft [41 N•m] torque.
16. Align the hydraulic cylinder flange in the mounting block.
17. Slip the clevis pin into the mounting block and through the cylinder flange.
18. Install the “e” clip.
19. Fasten the hydraulic lines to the hydraulic cylinder as recorded in step 5.
20. Put each of the waycovers in place and install the screws.
21. Power up the machine.
22. Activate Jog mode.
23. Set the Manual Axis Movement switch to “E” to select the tailstock.
24. Use the Z/E push buttons several times allowing the tailstock to fully extend and retract five or six times to bleed the hydraulic lines.
CHAPTER 6 - AIR SYSTEM

INTRODUCTION

ELITE® lathes require an air line connected to fitting "A", Figure 6.1 or Figure 6.2.

The air control assembly is located at the back of the machine.

Supply an air line with proper fittings to the fittings on the machine with an air lock-out valve or a quick disconnect coupling to control the ON-OFF air flow. Factory air goes through a filter/regulator to set the air pressure and remove contaminants before they get into the machine air supply. Refer to page 6-4 for information on adjusting the machine air pressure.

An air dryer may need to be added to the air line if the factory air has excessive moisture.

Figure 6.1 - Machine Air Connection (ELITE 42 and ELITE 51 Series Lathes)

Figure 6.2 - Machine Air Connection (ELITE 27 MS Lathe)
AIR SYSTEM COMPONENT IDENTIFICATION

ELITE® 42 AND ELITE 51 SERIES LATHES

- NOTE -

Sub-spindle air control components are only present on machines equipped with a sub-spindle.

Sub-spindle draw tube valve "B", Figure 6.3, supplies air to disengage the sub-spindle draw tube lock pin.

Air blast valve "C" supplies air for the headwall air blast. (Air blast is an option)

Main air pressure switch "D" will put the machine in Emergency Stop in the event the machine air pressure drops below 20 psi [1.38 bar] on the fall.

Air filter/regulator "E" removes contaminants from the air supply and controls the air pressure delivered to the machine.

Figure 6.3 - Air System Components
(ELITE 42 and ELITE 51 Series Lathes)
ELITE® 27 MS LATHE

Gauge "F", Figure 6.4, indicates the air pressure delivered to the sub-spindle collet closer.
Regulator "G" is used to control the air pressure delivered to the sub-spindle collet closer.
Gauge "H" indicates the air pressure delivered to the main spindle collet closer.
Regulator "I" is used to control the air pressure delivered to the main spindle collet closer.
Air filter/regulator "J" removes contaminants from the air supply and controls the air pressure delivered to the machine.
Coalescing air filter "K" provides additional air filtration.
Flow control "L" sets the air volume for the sub-spindle air purge. **This control is set at the factory and is not to be adjusted.**
Main air pressure switch "M" will put the machine in Emergency Stop in the event the machine air pressure drops below 45 psi [3.10 bar] on the fall.
Sub-spindle air pressure switch "N" will put the machine in Emergency Stop in the event the air pressure to the sub-spindle drops below 20 psi [1.38 bar] on the rise.

Figure 6.4 - Air System Components
(ELITE 27 MS Lathe)
HAND-HELD AIR NOZZLE
- NOTE -
Comply with any tags indicating limited or no direct air use.

The machine’s hand-held air line is fitted with an OSHA approved nozzle that limits the air pressure to 30 psi. The use for this air nozzle should be directed at the workpiece.

ADJUSTING THE AIR PRESSURE
The recommended range for machine air pressure is between 70 psi and 90 psi [4.9 to 6.2 bar].
1. Turn the main air valve ON.
2. Lift the adjustment knob on the top of filter/regulator “E”, Figure 6.3 or "J", Figure 6.4.
3. Rotate the adjustment knob to set the air pressure at the desired level.
4. Press the adjustment knob down to lock the setting.

DRAINING THE FILTER BOWL(S)
- CAUTION -
The air filter bowl must be drained once a day. If more frequent draining is required, it may be necessary to install an air dryer in the air line.
1. Make certain that the air source is connected and turned ON.
- NOTE -
The drain on the bottom of the filter/regulator has standard right-hand threads.
2. Open the drain valve on the bottom of filter/regulator "E", Figure 6.3, or "J", Figure 6.4, only enough to drain the bowl.
3. After the bowl empties the contaminants, close the drain valve.
4. On ELITE® 27 MS lathes, repeat steps 2 and 3 to drain coalescing filter "K" Figure 6.4.
CLEANING THE FILTER BOWL(S)

1. Power down the machine.

   - NOTE -

   The drain on the bottom of the filter/regulator has standard right-hand threads.

2. Open the drain valve on the bottom of filter/regulator "E", Figure 6.3, or "J", Figure 6.4, to relieve the pressure in the machine air system.

3. Close the drain valve after air pressure has been relieved.

4. Rotate the bowl sleeve counterclockwise just enough to release the sleeve and bowl to pour out contaminants.

5. Wipe the bowl clean with a lint-free cloth and change the filter if necessary.

6. Insert the bowl under the filter head and rotate the sleeve clockwise to seat the bowl O-ring.
AIR FILTER REPLACEMENT

- NOTE -

ELITE® 42 and ELITE 51 series lathes are equipped with a filter/regulator.

ELITE 27 MS lathes are equipped with a filter/regulator and a coalescing filter.

Drain the air filter(s) and check daily for contaminates. Change the filter(s) once a month.

1. Power down the machine.

2. Make certain that the air lock-out valve is OFF or disconnect the air supply. If the machine has an air lock-out valve, lock the valve in the OFF position.

3. Open the drain valve on the bottom of filter/regulator "E", Figure 6.3, or "J", Figure 6.4, to relieve the pressure in the machine air system.

4. Close the drain valve after air pressure has been relieved.

5. Replace the filter/regulator filter (Hardinge part number LC-0011614-K) and coalescing filter (LC -0011614) as follows:
   A) Grasp the bowl and turn it counterclockwise about one eighth of a turn to release it from the filter/regulator filter head. Do not use excessive force to remove the bowl.
   B) Wipe the bowl clean with a lint-free cloth and check the O-ring for damage. Replace the O-ring and/or bowl if necessary.
   C) To release the filter, unscrew the nylon fixture on the bottom of the filter from the stem. Align the replacement filter on the nylon fixture and thread the fixture on the stem until it is tight.
   D) Mount the bowl by aligning the bowl and sleeve on the head and turning it clockwise about one eighth of a turn to tighten it in place. Pull down on the sleeve to confirm that the bowl is secure.

6. Remove the lock from the lock-out tab or connect the air source; power up the machine, and turn the air lock-out valve ON.

7. Set the regulator to 85 psi [5.9 bar] and check for air leaks. Correct any air leaks as necessary.

8. Set the regulator to an operating pressure between 70 psi to 90 psi [4.9 to 6.2 bar].

9. Check the air system bowl for contamination, moisture, or air leaks and correct any problems as necessary.
PARTS CATCHER FLOW CONTROL VALVES

The extend and retract air valves, shown in Figure 6.6, are located in the spindle compartment near the front of the machine under the operator’s control panel. They are set at the factory and should not be adjusted with unless the air cylinder is replaced. The flow valves control the air speed to extend or retract the piston in the air cylinder.

SETTING THE PARTS CATCHER EXTEND OR RETRACT SPEED

1. Power down the machine.
2. Open the petcock to release air from the air receiver.
3. Remove cover "O", Figure 6.5.
4. Locate the parts catcher air cylinder, air manifold and air valves, shown in Figure 6.6.

   - CAUTION -

   The flow control valves are set at the factory and should not be adjusted unless absolutely necessary. They should only be adjusted for smooth operation.

5. Adjust the flow control valves as follows:
6. Thread the flow control valve screw clockwise to slow the travel speed of the parts catcher travel.
7. Unthread the flow control valve screw counterclockwise to increase the parts catcher travel speed. DO NOT allow the parts catcher to slam out or back or come to an abrupt stop.
8. Install cover "O", Figure 6.5.
9. Power up the machine and test the parts catcher travel.
CHAPTER 7 - MAIN SPINDLE

- WARNING -
When the spindle drive requires maintenance, the machine must be powered down. Refer to Chapter 1 for the power-down procedure.

INTRODUCTION
The headstock and spindle assembly is mounted toward the left end of the machine. The headstock has a solid, cast-iron housing that dissipates heat and supports the spindle assembly. The headstock assembly cannot be disassembled.

The spindle motor requires minimal maintenance due to the fan-cooled, brushless, and permanently sealed and lubricated design. Drive vibration is minimized through the use of multiple belts.

SPINDLE DRIVE BELT TENSION ADJUSTMENT
Spindle drive belt tension is adjusted by moving the drive motor mounting plate away from the spindle centerline for more belt tension or toward the spindle centerline for less belt tension.

1. Power down the machine.
2. Remove lower spindle compartment access cover "A", Figure 7.1.
3. Remove front spindle compartment cover “B”, Figure 7.2, located behind the operator's control panel.
4. If necessary, cover "C" can also be removed.
- NOTE -
If coolant catcher “D”, Figure 7.2, is removed, anti-rotation bracket “E”, Figure 7.3, must be removed.

There is enough cable from the interlock switch to set coolant catcher “D” aside.

5. If necessary, disconnect the coolant return hose from the coolant catcher drain and remove coolant catcher “D”.

6. Loosen, but do not remove, four bolts “F” that fasten drive motor mounting plate “G”, Figure 7.4, to the base. These bolts secure the plate once the belt tension has been adjusted.

- NOTE -
Check the belt tension by applying force across all drive belt ribs simultaneously at a point midway between the pulleys.

7. Adjust the drive belt tension by moving the motor mounting plate toward or away from the spindle centerline. Refer to the following table:

<table>
<thead>
<tr>
<th>Machine Model</th>
<th>New Belt Specification</th>
<th>Used Belt Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELITE® 42 Series Lathe</td>
<td>.24 Inch deflection at 13 to 14 lb [6.1 mm deflection at 5.9 to 6.4 Kg]</td>
<td>.24 Inch deflection at 12 to 13 lb [6.1 mm deflection at 5.4 to 5.9 Kg]</td>
</tr>
<tr>
<td>ELITE 51 Series Lathe</td>
<td>.24 Inch deflection at 18 to 19 lb [6.1 mm deflection at 8.2 to 8.6 Kg]</td>
<td>.24 Inch deflection at 16 to 17 lb [6.1 mm deflection at 7.3 to 7.7 Kg]</td>
</tr>
<tr>
<td>ELITE 27 MS Lathe</td>
<td>.25 Inch deflection at 15 to 16 lb [6.4 mm deflection at 6.8 to 7.3 Kg]</td>
<td>.25 Inch deflection at 13 to 14 lb [6.4 mm deflection at 5.9 to 6.4 Kg]</td>
</tr>
</tbody>
</table>

Figure 7.3 - Anti-Rotation Bracket
Figure 7.4 - Spindle Motor and Mounting Plate
8. Torque four bolts “F” to 100 lb-ft [136 N•m].
9. Torque four bolts “F” to 230 lb-ft [312 N•m].
10. If removed, install cover “C”.

- NOTE -
If coolant catcher “D” was removed, anti-rotation bracket “E”, Figure 7.3, must be installed after the coolant catcher is installed.

11. If removed, install coolant catcher “D” and connect the coolant return hose to the coolant catcher drain.

12. Install front spindle compartment cover “B”.
13. Install the lower spindle compartment cover “A”, Figure 7.1.
SPINDLE DRIVE BELT REPLACEMENT

- NOTE -

This procedure covers the replacement of the spindle drive belt and the spindle encoder belt.

1. Power down the machine.
2. Remove lower spindle compartment access cover "A", Figure 7.1.
3. Remove front spindle compartment cover “B”, Figure 7.2, located behind the operator’s control panel.
4. If necessary, cover “C” can be removed.
5. Disconnect the coolant return hose from the drain on coolant catcher “D”.

- NOTE -

When coolant catcher “D”, Figure 7.2, is removed, anti-rotation bracket “E”, Figure 7.3, must be removed.

There is enough cable from the interlock switch to set coolant catcher “D” aside.
6. Remove coolant catcher “D”.
7. Cut the cable ties that fasten the collet closer hoses to spindle motor eye bolt “I”, Figure 7.5.
8. Position a floor-based lifting device under the spindle drive motor. The weight of the motor is approximately 80 to 90 pounds [36 to 41 kilograms]. Engage the drive motor with the lifting device to support the weight of the motor.
9. Remove bolts “F”, and move the motor and mounting plate “G”, Figure 7.4, away from the base. It is not necessary to disconnect the cable from the electrical junction box.

Figure 7.5 - Collet Closer Hoses
Fastened to Spindle Motor Eye Bolt
10. Label and disconnect the collet closer hoses. Seal or cap the hoses and fittings to prevent contamination.

11. Remove the drive belts from the spindle pulley.

12. Mount the replacement belts on the spindle pulley.

   - NOTE -
   It might be easier to connect the collet closer hoses before installing the spindle drive motor.

13. Connect the collet closer hoses according to the labels attached in step 10.

14. Move the spindle motor and mounting plate assembly into position while aligning the belt on the motor pulley.

15. Lightly tighten bolts “F”, Figure 7.4, until the plate is flush with the base. Remove the lifting device.

   - NOTE -
   Refer to page 7-2 for the spindle drive belt tension specifications.
   Check the belt tension by applying force across all drive belt ribs simultaneously at a point midway between the pulleys.

16. Adjust the drive belt tension by moving the motor mounting plate toward or away from the spindle centerline.

17. Torque four bolts “F” to 100 lb-ft [136 N•m].

18. Torque four bolts “F” to 230 lb-ft [312 N•m].

19. Use cable ties to fasten the collet closer hoses to spindle motor eye bolt “I”, Figure 7.5.

20. If removed, install cover “C”, Figure 7.2.

   - NOTE -
   When coolant catcher “D”, Figure 7.2 is installed, anti-rotation bracket “E”, Figure 7.3, must be installed.

21. Install coolant catcher “D”, Figure 7.2.

22. Connect the coolant return hose to the coolant catcher drain

23. Install front spindle compartment cover “B”.

24. Install lower spindle compartment access cover "A", Figure 7.1.
SPINDLE DRIVE MOTOR REPLACEMENT

- NOTE -

When replacing the spindle drive motor, check the spindle drive motor model and not just the machine model.

1. Power down the machine.
2. Remove lower spindle compartment access cover "A", Figure 7.1.
3. Remove front spindle compartment cover “B”, Figure 7.2, located behind the operator’s control panel.
4. Cut the ties that fasten the collet closer hoses to spindle motor eye bolt “I”, Figure 7.5.
5. Disconnect the cables from the drive motor as follows:
   A) Remove cover “H”, Figure 7.4, from spindle motor junction box.
   B) Record the wire connections.
   - NOTE -
     Observe how plug “J”, Figure 7.6, is installed in the plug bracket.
   C) Lift plug “J”, Figure 7.6, from the plug bracket and press tabs “K”, Figure 7.7, to disconnect.
   D) Disconnect the wires in the junction box.
   E) Release the nut from the 90° conduit connector.
   F) Carefully pull the 90° conduit connector and cables from the junction box.
6. Loosen, but do not remove, four bolts “F”, Figure 7.4, that mount the drive motor mounting plate to the base. These bolts secure the mounting plate once the belt has been adjusted.

7. Position a floor-based lifting device under the spindle drive motor. The weight of the motor is approximately 80 to 90 pounds [36 to 41 kilograms]. Engage the drive motor with the lifting device to support the weight of the motor.

8. Loosen and remove the drive belts from the motor pulley.

9. Remove bolts “F”, and move the motor and mounting plate away from the base.

10. Loosen the 12 bolts and remove pulley “L” and clamping sleeve “M”, Figure 7.8, from the shaft of the old motor.

   - NOTE -

   Observe the orientation on the bolts that secure the mounting plate to the motor.

11. Remove four bolts “N”, nuts, and lock washers to release the motor mounting plate from the motor.

12. Use four bolts “N” nuts, and lock washers to mount the motor mounting plate to the new spindle motor. Alternately torque all four bolts through the mounting plate to the motor to 30 lb-ft [41 N·m]; then, torque to 65 lb-ft [88 N·m].

13. Slide pulley “L” and clamping sleeve “M”, Figure 7.8, on the replacement motor shaft and position as shown in Figure 7.9.

14. Using a face spanner wrench, progressively torque the 12 bolts in clamping sleeve “M”, Figure 7.8, in a diametrically opposing pattern to 50 lb-in [5.6 N·m].

15. Progressively torque the 12 bolts in clamping sleeve “M” a second time in a diametrically opposing pattern to 110 lb-in [12.4 N·m].

16. Use a floor-based lifting device to position the new motor near the spindle compartment.

Figure 7.8 - Spindle Drive Motor Pulley and Clamping Sleeve

Figure 7.9 - Pulley Location on Spindle Motor Shaft
- NOTE -

All contact surfaces, including bolt threads and bolt head bearing surfaces, must be cleaned and lightly greased. Do not use greases containing molybdenum disulfide.

17. Move the spindle motor and mounting plate assembly into position while aligning the belts on the motor pulley.

18. Install bolts “F”, Figure 7.4, hand tight.

19. Remove the lifting device.

20. Connect the cables to the drive motor as follows:

   A) Insert the 90° conduit connector and cables into the junction box.
   B) Slide the nut for the 90° conduit connector over the cables and secure the conduit connector.
   C) Connect plug “J”, Figure 7.6, and insert into the plug bracket.
   D) Connect the wires as recorded in step 5.
   E) Make certain that the gasket is in place to seal the junction box and install the junction box cover.

- NOTE -

Refer to the table on page 7-2 for the spindle drive belt tension.

Check the belt tension by applying force across all drive belt ribs simultaneously at a point midway between the pulleys.

21. Adjust the drive belt tension by moving the motor mounting plate toward or away from the spindle centerline.

22. Torque four bolts “F”, Figure 7.4, to 100 lb-ft [136 N•m].

23. Torque four bolts “F” to 230 lb-ft [312 N•m].

24. Use cable ties to fasten the collet closer hoses to spindle motor eye bolt "I", Figure 7.5.

25. Install front spindle compartment cover “B”, Figure 7.2.

26. Mount lower spindle compartment access cover "A", Figure 7.1.
CLEANING THE MAIN SPINDLE AND DRAW TUBE

As a general rule, the spindle and spindle draw tube should be cleaned between setups or monthly if a long-run job is on the machine. However, when the machine is run more than one shift per day or certain types of materials are being machined, it may be necessary to clean the spindle and spindle draw tube more often.

Refer to Chapter 6 in the operator's manual (M-429) for information on cleaning and lubricating the main spindle and draw tube.
CHAPTER 8 - CARRIAGE AND CROSS SLIDE

- WARNING -
When the carriage or cross slide requires maintenance, the machine must be powered down. Refer to Chapter 1 for the power-down procedure.

INTRODUCTION

The carriage (Z axis) supports the cross slide and turret. The carriage rides on linear guideways and travels toward the spindle (-Z direction) and away from the spindle (+Z direction). The Z-axis drive motor and ball screw is located at the rear of the machine on the machine tray.

The cross slide (X axis) supports the turret. The cross slide rides on linear guideways and travels toward the spindle centerline (-X direction) or away from the spindle centerline (+X direction). The X-axis drive motor and ball screw is located on the carriage at the rear of the machine.

Information relating to the machine carriage begins below.
Information relating to the machine cross slide begins on page 8-5.

CARRIAGE DRIVE BELT ADJUSTMENT OR REPLACEMENT

1. Power down the machine.
2. Remove two screws “A” and lift rear guard “B”, Figure 8.1, from the machine.
3. Loosen mounting screws “C”, Figure 8.2, just enough to allow the motor to slide toward the ball screw and relieve the belt tension.

4. If belt replacement is necessary, remove the old belt and mount the new belt on the pulleys.

5. Verify the drive belt is properly aligned on the pulleys.

<table>
<thead>
<tr>
<th>Gates Sonic Tension Gauge Data</th>
<th>Deflection / Force Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass: .41 gf/cm Width: 25 mm Span: 160 mm Tension: 175 to 185 N</td>
<td>English Metric</td>
</tr>
<tr>
<td>0.10” Deflection at 5.7 to 6.1 lb</td>
<td>2.54 mm deflection at 25.35 to 27.13 N</td>
</tr>
</tbody>
</table>

6. Adjust the drive belt tension by moving the motor toward or away from the ball screw.

7. Alternately torque screws “C” to 15 lb-ft [20 N•m].

8. Alternately torque screws “C” to 25 lb-ft [34 N•m].

9. Install rear guard “B”, Figure 8.1.

10. Install two screws “A”.

Figure 8.2 - Carriage Drive Motor and Belt
CARRIAGE DRIVE MOTOR REPLACEMENT

The carriage drive motor/encoder assembly is located at the rear of the machine behind the power case. The motor and encoder form an integral unit and cannot be replaced separately.

1. Power down the machine.

2. Remove two screws “A” and lift rear guard “B”, Figure 8.1, from the machine.
   - NOTE -
   Observe the orientation of the motor connections.

3. Disconnect plugs “D” and “E”, Figure 8.3, from the motor and encoder connections.

4. Loosen mounting screws “C”, Figure 8.2, just enough to allow the motor mounting bracket to slide toward the ball screw and relieve the belt tension.

5. Slip the drive belt from the motor drive pulley.
   - NOTE -
   Observe the orientation of the pulley and bushing.

   Bushing “G”, Figure 8.4, has three clearance holes and three tapped holes. The clearance holes are for securing the pulley and bushing on the motor shaft. The tapped holes are for removing the pulley and bushing from the motor shaft.

6. Remove three screws “F” from bushing “G”, Figure 8.4.

7. Thread screws “F” into the tapped holes in the bushing to separate the pulley and bushing.
   - NOTE -
   It may be necessary to insert a screwdriver into the slot on the bushing to flex the bushing for removal.

8. Slide the pulley and bushing off the drive motor shaft.
   - WARNING -
   Be prepared to accept the weight of the drive motor.

9. Remove four screws “C”, nuts, and lock washers to release the drive motor from the ball screw support.

10. Mount the replacement motor on the ball screw support and torque mounting screws “C”, Figure 8.2, to 15 lb-ft [20 N•m].
- NOTE -
Orient the slot in the bushing approximately 180° from the key slot in the motor shaft.

11. Mount the pulley and bushing on the motor drive shaft. The clearance holes in the bushing must be aligned with the tapped holes in the pulley.

- NOTE -
Be sure there is a minimum of 0.062 inch [1.6 mm] clearance between the back of the pulley and the face of the ball screw support, as shown in Figure 8.5.

12. Insert screws “F” through the clearance holes in bushing “G”, Figure 8.4, and engage the tapped holes in the pulley.

13. Torque screws “F” to 40 lb-in [4.5 N•m].

14. Progressively torque screws “F” to 95 lb-in [10.7 N•m].

- NOTE -
Refer to the chart on page 8-2 for the carriage drive belt tensioning specifications.

15. Loosen mounting screws “C”, Figure 8.2, and adjust the drive belt tension by moving the motor toward or away from the ball screw.

16. Alternately torque mounting screws “C”, Figure 8.2, to 15 lb-ft [20 N•m].

17. Alternately torque mounting screws “C” to 25 lb-ft [34 N•m].

18. Connect plugs “D” and “E”, Figure 8.3, to the motor and encoder connections.

19. Install rear guard “B”, Figure 8.1.

20. Install two screws “A”.

Figure 8.5 - Carriage Drive Motor Pulley Position
CROSS SLIDE DRIVE BELT ADJUSTMENT OR REPLACEMENT

1. Power down the machine.

2. Remove two screws “A” and lift rear guard “B”, Figure 8.1, from the machine.

3. Loosen mounting screws “L”, Figure 8.6, just enough to allow the motor mounting plate to slide toward the ball screw and relieve the belt tension.

4. If belt replacement is necessary:
   A) Disconnect spindle brake electrical plugs “H”.
   B) Release cable clamps “K”.
   C) Remove the old belt and mount the new belt on the pulleys.
   D) Secure the brake cable to the motor mounting plate using clamps “K”.
   E) Connect spindle brake electrical plugs “H”.

5. Verify the drive belt is properly aligned on the pulleys.

6. Adjust the drive belt tension by moving the motor mounting plate toward or away from the ball screw.

7. Alternately torque screws “L” to 15 lb-ft [20 N·m].

8. Alternately torque screws “L” to 25 lb-ft [34 N·m].

9. Install rear guard “B”, Figure 8.1.

10. Install two screws “A”.

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### Gates Sonic Tension Gauge Data

<table>
<thead>
<tr>
<th>Mass: .41 gf/cm</th>
<th>Width: 25 mm</th>
<th>Span: 185 mm</th>
<th>Tension: 146 to 156 N</th>
</tr>
</thead>
</table>

### Deflection / Force Data

<table>
<thead>
<tr>
<th>English</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11” Deflection at 2.79 to 2.93 lb</td>
<td>2.79 mm deflection at 12.4 to 13.0 N</td>
</tr>
</tbody>
</table>

---

Figure 8.6 - Cross Slide Motor Pulley and Belt
CROSS SLIDE DRIVE MOTOR REPLACEMENT

1. Power down the machine.
2. Remove two screws “A” and lift rear guard “B”, Figure 8.1, from the machine.
3. Disconnect plugs “N” and “O”, Figure 8.7, from the motor and encoder connections.
4. Loosen mounting screws “L”, Figure 8.6, just enough to allow the motor mounting plate to slide toward the ball screw and relieve the belt tension.
5. Slip the drive belt from the motor drive pulley.

- NOTE -
Observe the orientation of the pulley and bushing.

Bushing “J” has three clearance holes and three tapped holes. The clearance holes are for securing the pulley and bushing on the motor shaft. The tapped holes are for removing the pulley and bushing from the motor shaft.

6. Remove three screws “I” from bushing “J”.
7. Thread screws “I” into the tapped holes in the bushing to separate the pulley and bushing.

- NOTE -
It may be necessary to insert a screwdriver into the slot on the bushing to flex the bushing for removal.

8. Slide the pulley and bushing off the drive motor shaft.

- WARNING -
Be prepared to accept the weight of the drive motor.

9. Remove four screws “M”, Figure 8.7, and lock washers to release the drive motor from the mounting plate.

10. Mount the replacement motor on the mounting plate and torque screws “M” to 15 lb-ft [20 N•m].

- NOTE -
Orient the slot in the bushing approximately 180° from the key slot in the motor shaft.

11. Mount the pulley and bushing on the motor drive shaft. The clearance holes in the bushing must be aligned with the tapped holes in the pulley.

Figure 8.7 - Cross Slide Drive Motor (Viewed from Below)
12. Insert screws ‘I’ through the clearance holes in bushing ‘J’, Figure 8.6, and engage the tapped holes in the pulley.

13. Torque screws “I” to 45 lb-in. [5.1 N•m].

14. Progressively torque screws “I” to 95 lb-in [10.7 N•m].

- NOTE -
Refer to the chart on page 8-5 for the cross slide drive belt tensioning specifications.

15. Adjust the drive belt tension by moving the motor mounting plate toward or away from the ball screw.

16. Alternately torque mounting screws “L” to 15 lb-ft [20 N•m].

17. Alternately torque mounting screws “L” to 25 lb-ft [34 N•m].

18. Connect plugs “N” and “O”, Figure 8.7, to the motor and encoder connections.

19. Install rear guard “B”, Figure 8.1.

20. Install two screws “A”.

Figure 8.8 - X Axis Drive
Motor Pulley Position

- NOTE -
Be sure there is a minimum of 0.062 inch [1.6 mm] clearance between the back of the pulley and the motor mounting plate, as shown in Figure 8.8.
CROSS SLIDE BRAKE REPLACEMENT

- WARNING -
The carriage must be supported while the cross slide brake is replaced.

- NOTE -
The brake mounting bracket has been aligned with the cross slide ball screw. DO NOT loosen bracket mounting screws “P”, Figure 8.9.

1. Move the coolant tank.

2. Safely wedge a 2 X 6 or 4 X4 inch [50 X 152 or 102 X 102 mm] block of wood between the bottom of the carriage and the floor to support the cross slide.

3. Power down the machine.

4. Remove two screws “A” and lift rear guard “B”, Figure 8.1, from the machine.

5. Disconnect spindle brake electrical plugs “H”, Figure 8.6.

6. Release cable clamps “K”.

7. Remove screws “Q”, Figure 8.9, and lift the cross slide brake assembly straight off the end of the ball screw coupling and brake mounting bracket.

8. Check the condition of the drive belt and replace it as necessary. Refer to “Cross Slide Drive Belt Adjustment or Replacement”, on page 8-5.

9. Mount the replacement brake on the ball screw coupling and torque screws “Q” to 60 lb-in [7 N•m].

10. Secure the brake cable to the motor mounting plate using clamps “K”, Figure 8.6.

11. Connect spindle brake electrical plugs “H”.

12. Install rear guard “B”, Figure 8.1.

13. Install two screws “A”.

14. Power up the machine.

15. Remove the wood support.
CHAPTER 9 - SUB-SPINDLE
(ELITE® 42 and ELITE 51 Series Lathes)

INTRODUCTION

The sub-spindle is available as original equipment only. The spindle has the standard 16C spindle and will accept a center head (Hardinge part number AK-0000296-16 C), which will allow the sub-spindle to act as a tailstock.

Sub-spindle travel toward or away from the main spindle is controlled either by programmed commands or manually from the control panel. The E word is used to program sub-spindle positioning.

The sub-spindle rides on linear guide ways. A safety shear feature in the design minimizes damage to tooling and linear ways if there is contact between the turret and sub-spindle.

The sub-spindle is shimmed in place on the sub-spindle base for proper alignment with the main spindle in the Y direction. An eccentric bushing assembly is adjusted to align the sub-spindle with the main spindle in the X direction.

Refer to the programmer's manual (M-428) and operator's manual (M-429) for information on the following:

- programming the sub-spindle
- operating the sub-spindle
- sub-spindle tooling
- sub-spindle travel specifications
**SUB-SPINDLE COLLET CLOSER**

The sub-spindle is equipped with a .50 inch [12.7 mm] stroke, hydraulically-actuated collet closer. If repairs to the collet closer assembly are required, the ENTIRE ASSEMBLY must be removed and returned to the factory. Refer to page 9-8 for information on removing the sub-spindle collet closer.

- **CAUTION** -

  DO NOT exceed the maximum pressure setting, as shown in the table below.

- **NOTE** -

  The sub-spindle collet closer has an operational pressure range of 50 to 500 psi [3.45 to 34.5 bar].

  It is the responsibility of the machine operator or set-up person to properly adjust the collet closer hydraulic pressure, based on the type of material being machined and the configuration of the workpiece.

  The sub-spindle collet closer chucking force is controlled by hydraulic pressure. The sub-spindle collet closer holding force is set by adjusting knob “A” while reading gauge “B”, Figure 9.1, on the hydraulic manifold. Gauge “B” registers the collet closer hydraulic pressure in psi and bar.

  Refer to the table shown below to determine the approximate gripping force that will be applied to the workpiece for a given pressure. A check valve system positively holds the closer open or closed, whichever is active, in the event of hydraulic pressure failure.

<table>
<thead>
<tr>
<th>English</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure (psi)</td>
<td>Chucking Force (lb-f)</td>
</tr>
<tr>
<td>100</td>
<td>1206</td>
</tr>
<tr>
<td>200</td>
<td>2412</td>
</tr>
<tr>
<td>300</td>
<td>3619</td>
</tr>
<tr>
<td>400</td>
<td>4826</td>
</tr>
<tr>
<td>500</td>
<td>6000</td>
</tr>
</tbody>
</table>

Figure 9.1 - Hydraulic System
CLEANING THE SUB-SPINDLE DRAW TUBE

- NOTE -

Refer to the operator's manual (M-429) for information on:

• removing / installing spindle tooling
• moving the sub-spindle.

1. Remove any spindle tooling present in the spindle.
2. Move the sub-spindle to a position easily accessible from the right end of the machine.
3. Power down the machine.
4. Remove access door "C", Figure 9.2.
5. Remove cover "D", Figure 9.3.
6. Remove cap "E", Figure 9.4, from the right end of the collet closer.
7. Cover the main spindle to protect it while the sub-spindle is being cleaned.
8. Close the main coolant guard door.
9. From the right end of the collet closer, use an air line to blow chips and coolant out of the spindle.
10. Thoroughly clean the cap and the right end of the collet closer.
11. Install the cap on the collet closer.
12. Install cover "D", Figure 9.3.
13. Install access door "C", Figure 9.2.
14. Power up the machine.
15. If necessary, install spindle tooling.
The sub-spindle alignment procedure requires that covers and doors be removed or open while the machine is powered up. Be extremely careful when working with covers removed and doors open.

Special arbors are required to properly align the sub-spindle to the main spindle. Contact the Hardinge Sales Department to purchase an alignment kit.

The sub-spindle assembly rotates around an eccentric sleeve on the carriage when the turret or turret tooling make contact with the sub-spindle. The In-Position switch puts the control into an Emergency Stop condition when the sub-spindle is moved out of alignment.

The alignment of the sub-spindle must be checked if the X-axis torque limiter has been tripped or if the parts being run are out of specification. Align the sub-spindle to within ±.0003 inch [±.0076mm] with the main spindle.

The sub-spindle alignment is measured by sweeping the edges of arbors mounted in the main spindle and sub-spindle with an indicator. Refer to Figure 9.5.

Figure 9.5 - Arbors Installed in Both Spindles
ALIGNING THE SUB-SPINDLE

1. Move the sub-spindle to a convenient work position near the main spindle and the main access door opening.

2. Remove access door "C", Figure 9.2.

3. Remove cover "D", Figure 9.3, to gain access to screw "F" and eccentric bushing "G", Figure 9.4.

4. Remove cover "H", Figure 9.6, to gain access to alignment block mounting holes "I", Figure 9.7.

   - NOTE -
   
The alignment block and screws are supplied in the alignment kit.

   The alignment block helps adjust and hold the sub-spindle until the mounting bolts are tightened.

5. Use two M8 x 1.25 x 30 screws to mount alignment block "K", Figure 9.8, to the carriage.

6. Position a metal shim plate between jack screw "L" and sub-spindle mounting block "M", as shown in Figure 9.8.

7. Thread jack screw "L" into contact with the shim plate.
Once the mounting screws are loosened, the jack screw in the alignment block and the pivot assembly can position the sub-spindle.

8. Mount the arbors from the alignment kit in both the main spindle and sub-spindle collets.
9. Position the sub-spindle near the arbor in the main spindle. Refer to Figure 9.5.
10. Mount an indicator on the turret top plate.
11. Move the turret into position to sweep the arbor in the main spindle along the Z axis.
12. Set the indicator to zero and sweep the arbor in the main spindle.
13. Loosen mounting screws "J".
14. Use wrench "N", Figure 9.9, to loosen eccentric screw "F", Figure 9.4.

The sub-spindle must be aligned within ±.0003 inch [±.076 mm] alignment of the main spindle.

15. Align the sub-spindle as follows:

A) Jog the turret so that the indicator sweeps the arbor in the sub-spindle along the Z axis.
B) When the indicator is positioned as shown in View A, Figure 9.10, use wrench "O", Figure 9.9, to rotate eccentric sleeve "G", Figure 9.4, to adjust the sub-spindle alignment.
C) When the indicator is positioned as shown in View B, Figure 9.10, use jack screw "L", Figure 9.8, to adjust the sub-spindle alignment.
D) Sweep the full length of the arbor in the sub-spindle along the Z axis to check the alignment.
E) Repeat steps A through D until alignment is within specification.
16. Tighten mounting screws "J", Figure 9.8, to 50 lb-ft [68 N•m].
17. Use wrench "N", Figure 9.9, to tighten eccentric screw "F", Figure 9.4, to 50 lb-ft [68 N•m] torque.
18. Sweep the full length of the arbor in the sub-spindle again to verify that the sub-spindle alignment is within specification. If the sub-spindle alignment is not within specification, repeat steps 13 through 17 until the sub-spindle is properly aligned.

- CAUTION -
Do not operate the machine until all covers and access doors are in place.

19. Remove the alignment block from the carriage.
20. Replace the sheet metal covers.
21. Install access door "C", Figure 9.2.
22. Remove the arbors from the main spindle and sub-spindle.
23. Close the main coolant guard door.
24. Move the turret and sub-spindle to the reference positions.
COLLET CLOSER AND ROTARY UNION REPAIR

The entire collet closer and rotary union assembly must be returned to the factory if repairs to the collet closer or rotary union are required.

The collet closer and rotary union assembly is balanced on the machine at the factory and a mark is scribed on the side of the collet closer and collet closer mounting plate. The mark on the side of the collet closer MUST be aligned with the mark on the collet closer mounting plate during reassembly.

COLLET CLOSER AND ROTARY UNION REMOVAL

1. Move the sub-spindle to a convenient work position near the main spindle and the main access door opening.
2. Power down the machine.
3. Remove access door "C", Figure 9.2.
4. Remove cover "D", Figure 9.3.
5. Label the hoses for re-connection. Refer to Table 9.1 and Figure 9.11 for hose identification.

<table>
<thead>
<tr>
<th>Connection Number</th>
<th>Hose Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Collet Open</td>
</tr>
<tr>
<td>2</td>
<td>Hydraulic Oil Drain</td>
</tr>
<tr>
<td>3</td>
<td>Collet Close</td>
</tr>
<tr>
<td>4</td>
<td>Spindle Draw Tube Lock Pin Air Supply</td>
</tr>
<tr>
<td>5</td>
<td>Coolant Drain</td>
</tr>
<tr>
<td>6</td>
<td>Hydraulic Oil Drain</td>
</tr>
</tbody>
</table>

Table 9.1 - Rotary Union Hose Identification

![Figure 9.11 - Rotary Union Hose Identification](TP6221A)
6. Disconnect the hoses from the rotary union on the end of the collet closer and the spindle lock pin.

7. Seal or cap the hoses and fittings to prevent contamination.

8. Label all electrical cables for reconnection.

9. Disconnect all electrical cables.

- CAUTION -

Use care not to damage the gaskets when removing sub-spindle covers.

10. Remove rear cover "P", Figure 9.12.

11. Remove top cover "Q", Figure 9.13.

12. Remove main cover "R", Figure 9.14.
13. Remove anti-rotation bracket "S", Figure 9.15.
14. Remove two screws "W" and spindle draw tube lock pin "T", Figure 9.16.
15. Remove two screws "U" and brake caliper "V".
16. Remove eight screws "Y", Figure 9.17, and lock washers.
17. Carefully remove collet closer assembly "X".
COLLET CLOSER AND ROTARY UNION INSTALLATION

- NOTE -
Collet closer mounting plate "Z", Figure 9.18, and the mating surface on the collet closer assembly MUST be completely clean and free of oil and grease.

1. Clean collet closer mounting plate "Z", Figure 9.18, and the mating surface on the collet closer assembly with a petroleum-based solvent.

2. Lightly stone collet closer mounting plate "Z" and the mating surface on the collet closer assembly.

3. Clean collet closer mounting plate "Z" and the mating surface on the collet closer assembly a second time with a petroleum-based solvent.

- NOTE -
Lightly tighten mounting screws "Y", Figure 9.17. The screws will be tightened to specification after the run-out specification has been achieved.

4. Mount collet closer and rotary union assembly "X" to the mounting plate with eight collet closer mounting screws "Y", Figure 9.17, and lock washers.

5. Mount a dial indicator to check collet closer run-out. Check the collet closer on the high-lighted diameter indicated in Figure 9.19.

- NOTE -
When checking the collet closer, total indicator run-out must not exceed .0005 inches [.012 mm].

6. Manually rotate the collet closer and observe the run-out.

Figure 9.18 - Collet Closer Mounting Plate

Figure 9.19 - Indicator Position for Checking Collet Closer Run-Out
7. If the run-out is within specification, proceed to step 8.
   If the run-out is not within specification:
   A) Move the indicator off the collet closer.
   B) Slightly loosen eight collet closer mounting screws "Y", Figure 9.17.
   C) Using a soft-faced hammer, gently tap the collet closer in the proper direction to reduce run-out.
   D) Lightly tighten the collet closer mounting screws.
   E) Re-position the indicator and check the collet closer run-out.
   F) Repeat as needed until run-out is within specification.
8. Tighten the collet closer mounting screws to 120 lb-in [13.6 N\(\cdot\)m].
9. Install brake caliper "V" and two screws "U", Figure 9.16.
10. Install spindle draw tube lock pin "T" and two screws "W".
    
    - CAUTION -
    The coolant drain fitting must oriented downward before the anti-rotation bracket is installed. Refer to Table 9.1 and Figure 9.11 to identify the coolant drain fitting.
11. Install anti-rotation bracket "S", Figure 9.15.
12. Install main cover "R", Figure 9.14.
13. Install top cover "Q", Figure 9.13.
14. Install rear cover "P", Figure 9.12.
15. Connect all electrical cables as recorded during collet closer removal.
16. Connect the hoses to the rotary union on the end of the collet closer and the spindle draw tube lock pin. Refer to Table 9.1 and Figure 9.11 for hose identification.
17. Install cover "D", Figure 9.3.
18. Install access door "C", Figure 9.2.
CHAPTER 10 - SUB-SPINDLE
(ELITE® 27 MS Lathe)

CHECKING AND ADJUSTING SPINDLE DRIVE BELT TENSION

1. Press the Reset key.
2. Activate Jog mode.
3. Move the sub-spindle to a position near the main spindle.
4. Power down the machine.
5. Remove cover “A”, Figure 10.1.

- NOTE -
Use a Gates sonic tension gauge to check the spindle drive belt tension.

6. Check belt tension through access hole "E", Figure 10.2. Proper belt tension is as follows:

<table>
<thead>
<tr>
<th>New Belt Specification</th>
<th>Used Belt Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>143 - 148 Hz</td>
<td>132 - 138 Hz</td>
</tr>
</tbody>
</table>

If belt tension is correct, proceed to step 16.
If belt tension is not correct, proceed to step 7.
7. Remove cover “D”, Figure 10.1.
8. Remove cover “B”.
9. Remove cover “C”.
10. Loosen four motor mounting plate screws “G”, Figure 10.3.
11. Rotate tension adjustment screw “F” to move the motor mounting plate as needed to obtain the proper drive belt tension.
12. Torque four motor mounting plate screws “G” to 25 lb-ft [33.9 N•m].
13. Replace cover “C”, Figure 10.1.
14. Replace cover “B”.
15. Replace Cover "D".
16. Replace cover “A”.

---

Figure 10.2 - Sub-Spindle with Top Cover Removed

Figure 10.3 - Motor Plate Screws
SPINDLE DRIVE BELT REPLACEMENT

1. Press the Reset key.
2. Activate Jog mode.
3. Move the sub-spindle to a position near the main spindle.
4. Power down the machine.
5. Remove cover “A”, Figure 10.1.
6. Remove cover “D”.
7. Remove cover “B”.
8. Remove cover “C”.
9. Remove collet closer anti-rotation bracket “I”, Figure 10.4.
10. Tag both air lines (collet open and collet close) for reconnection; then, disconnect them from the collet closer. Refer to Figure 10.4 for collet closer air connections.
11. Cap the air lines and the fittings on the collet closer to prevent contamination.
12. Remove the mounting screws from sub-spindle brake "H" and move the brake to allow for drive belt removal.
13. Loosen four motor mounting plate screws “G”, Figure 10.3.
14. Remove tension adjustment screw “F”.
15. Remove four motor mounting plate screws “G” and move the motor and mounting plate to allow for drive belt removal.

Figure 10.4 - Collet Closer Anti-Rotation Bracket and Sub-Spindle Brake
16. If the machine is equipped with the thru-spindle coolant option:
   A) Rotate the sub-spindle to orient one of the blind holes in the front of the sub-spindle upward.
   - NOTE -
   The spanner wrench is designed to engage the blind hole in the sub-spindle.
   B) Mount spanner wrench “L”, Figure 10.5, on the sub-spindle.
   C) Disconnect fitting “N” from the end of collet closer “M”, Figure 10.6.
17. Remove two screws "K" and sensor assembly "J", Figure 10.5.
18. Remove the drive belt from the sub-spindle pulley.
19. Mount the replacement drive belt on the sub-spindle pulley and feed it into the motor mounting location.
20. If the machine is equipped with the thru-spindle coolant option:
    A) Rotate the sub-spindle to orient one of the blind holes in the front of the sub-spindle upward.
    B) Mount the spanner wrench on the sub-spindle.
    C) Connect fitting “N” to the end of collet closer “M”, Figure 10.6.
21. Positioning the drive belt on the drive motor pulley, set the motor and mounting plate into position on the machine.
22. Install four motor mounting plate screws “G”, Figure 10.3, finger tight. Do not fully tighten.
23. Install tension adjustment screw “F”.
24. Rotate adjustment screw "F" to position the motor mounting plate as needed to obtain the proper drive belt tension. Refer to page 10-1 for information on setting the drive belt tension.
25. Torque four motor mounting plate screws “G” to 25 lb-ft [33.9 N•m].
26. Install sensor assembly "J", Figure 10.5.
27. Check the sensor gap as shown in Figure 10.7.
   If the gap is correct, go to step 28.
   If the gap is not correct:
      A) Loosen screw "P" only enough to allow the position of sensor "O" to be adjusted.
      B) Adjust the sensor gap as needed.
      C) Carefully tighten screw "P" to secure the sensor.
28. Install sub-spindle brake "H", Figure 10.4.
29. Connect the air lines to the collet closer.
30. Install collet closer anti-rotation bracket “I”.
31. Install cover “C”, Figure 10.1.
32. Install cover “B”.
33. Install cover “D”.
34. Install cover “A”.

NOTE: Inches [Millimeters]

Figure 10.7 - Sub-Spindle Sensor Assembly Gap Adjustment
(Section View of Sub-Spindle Assembly)
SPINDLE DRIVE MOTOR REPLACEMENT

1. Press the Reset key.
2. Activate Jog mode.
3. Move the sub-spindle to a position near the main spindle.
4. Power down the machine.
5. Remove cover "A", Figure 10.1.
6. Remove cover “D”.
7. Remove cover “B”.
8. Remove cover “C”.
9. Disconnect the two cables from the spindle drive motor.
10. Loosen four motor mounting plate screws “G”, Figure 10.3.
11. Remove tension adjustment screw “F”.

- WARNING -

Be prepared to accept the weight of the drive motor and mounting plate, which is approximately 45 lb [20.5 Kg].

12. Remove four motor mounting plate screws “G”.
13. Remove the motor and mounting plate from the machine and place on a clean level surface.
14. Loosen six screws “Q”, Figure 10.8, and slide the pulley and clamping sleeve from the motor shaft.

Figure 10.8 - Motor Pulley and Clamping Sleeve
15. Remove four screws “R”, Figure 10.9, to release the motor from the mounting plate.
16. Use four screws “R” to mount the new motor on the mounting plate.

- NOTE -
Do not use an oil that contains Molybdenum Disulfide.

17. Remove, lightly oil, and replace each of the screws in the clamping sleeve.
18. Lightly oil all bearing surfaces on the pulley and clamping sleeve.
19. Slide the pulley and clamping sleeve onto the shaft of the new motor and position according to Figure 10.10.

Figure 10.9 - Motor Mounting Screws

Figure 10.10 - Drive Motor Pulley Location
20. Check the clamping sleeve to be sure it is completely seated in the pulley.

21. Tighten six screws “Q”, Figure 10.8, in a diametrically opposing pattern as follows:
   A) Tighten all screws finger tight.
   B) Verify the position of the pulley as shown in Figure 10.10.
   C) Torque all screws to 75 lb-in [8.5 N•m].
   D) Torque all screws to 150 lb-in [17 N•m].

   - NOTE -
   Maximum pulley run-out is .005 inches [0.125 millimeters].

22. Position an indicator on the surface of a pulley groove and rotate the pulley to check for run-out.
    If the pulley run-out is within specification, proceed to step 23.
    If the pulley run-out is not within specification, loosen six screws “Q”, Figure 10.8, and re-
    peat steps 20 and 21.

23. Positioning the drive belt on the drive motor pulley, set the motor and mounting plate into
    position on the machine.

24. Install four motor mounting plate screws “G”, Figure 10.3, finger tight. Do not fully tighten.

25. Install tension adjustment screw "F".

26. Rotate adjustment screw “F” to move the motor mounting plate as needed to obtain the proper
    drive belt tension. Refer to page 10-1 for information on setting the drive belt tension.

27. Torque four motor mounting plate screws “G” to 25 lb-ft [33.9 N•m].

28. Connect the two cables to the spindle drive motor.

29. Install cover "C”, Figure 10.1.

30. Install cover “B”.

31. Install cover “D”.

32. Install cover “A”.
CLEANING THE SUB-SPINDLE DRAW TUBE

- NOTE -

Refer to the operator's manual (M-429) for information on:

- removing / installing spindle tooling
- moving the sub-spindle.

1. Remove any spindle tooling present in the spindle.
2. Move the sub-spindle to a position easily accessible from the right end of the machine.
3. Power down the machine.
4. Remove access door "S", Figure 10.11.
5. Remove cover "D", Figure 10.1.
6. Cover the main spindle to protect it while the sub-spindle is being cleaned.
7. Close the main coolant guard door.
8. From the right end of the sub-spindle, use an air line to blow chips and coolant out of the spindle.
9. Install cover "D".
10. Install access door "S", Figure 10.11.
11. Power up the machine.
12. If necessary, install spindle tooling.
CHAPTER 11 - FANS

- WARNING -
When the fans replacement is necessary, the machine must be powered down. Refer to Chapter 1 for the power-down procedure.

INTRODUCTION

ELITE® lathes are equipped with the following fans:

- Main power supply, axis drive, and spindle drive fans on the rear of the power case
- One fan on the hydraulic heat exchanger
- One fan built into the spindle drive motor

The fan openings MUST NEVER BE BLOCKED. The fans are active as soon as the machine's electric power is turned on.

POWER CASE FANS

Fans “A”, Figure 11.1 or 11.2, are located at the rear of the power case. These fans move air around the heat sinks on the back of the main power supply and axis drive units while sealing out potentially contaminated, external air from the power case. They provide the cooling and environmental protection necessary for proper operation of the printed circuit boards.

Figure 11.1 - Power Case Exterior Fans (ELITE 42 & ELITE 51 Series Lathes)

Figure 11.2 - Power Case Exterior Fans (ELITE 27 MS Lathes)
REPLACING A POWER CASE FAN

1. Power down the machine.

   - NOTE -
   The axes drive fans are mounted to the axes drives inside the power case.

2. Open the power case door.

3. Unthread nuts “B”, Figure 11.3, and loosen drives “C” from the rear of the power case.

4. Use the air flow arrow scribed on the side of the fan as a reference and mark the direction of the air flow on the bracket.

5. Follow the fan cable to the terminal strip and record the wire connection at the terminal strip.

6. Disconnect the wires from the terminal strip and remove the ground wire from the screw.

7. Connect the wires from the new fan to the terminal strip as recorded in step 5 and connect the ground wire.

8. Point the air flow arrow in the same direction as noted in step 4 and mount the new fan to the bracket.

9. Mount the drive in the power case.

10. Close the power case door.

11. Power up the machine and verify proper fan operation.

Figure 11.3 - Rear of the Power Case and Fan Location
HYDRAULIC HEAT EXCHANGER FAN

- NOTE -

This information relates to ELITE® 42 & ELITE 51 series lathes only.

The hydraulic heat exchanger fan on ELITE 27 MS lathes is incorporated into the hydraulic pump motor.

Hydraulic system heat exchanger "D", Figure 11.4, is mounted at the rear of the machine. Refer to Chapter 4 for additional information regarding the hydraulic heat exchanger and hydraulic system.

The heat exchanger is composed of a radiator and fan unit that reduces and stabilizes the temperature of the hydraulic oil. It can be checked each time the machine is powered up by feeling the air being vented.

REPLACING THE HYDRAULIC HEAT EXCHANGER FAN

1. Power down the machine.
2. Remove two screws and lift the rear cover off to gain access to the mounting screws through the tray.
3. Remove the screws and loosen the heat exchanger from the tray.
4. Remove the fan junction box cover or open the power case doors and follow the cable from the fan to the terminal block.
5. Record the wire connections.
6. Disconnect the wires from the terminals in the fan junction box or from the terminal block.
7. Remove the fan from the heat exchanger bracket.
8. Mount the new fan in the bracket.
9. Feed the electric cable into the fan junction box or to the terminal block in the power case.
10. Connect the wires as recorded in step 5.
11. Make certain that the gasket is in place and mount the fan junction box cover if necessary.
12. Power up the machine and ensure that the fan rotation is in the correct direction.
13. Power down the machine and mount the heat exchanger on the tray.
14. Mount the rear access cover.

Figure 11.4 - Hydraulic Heat Exchanger
SPINDLE MOTOR FAN

Spindle motor fan "E", Figure 11.5, is mounted on the end of the spindle motor.

REPLACING THE SPINDLE MOTOR FAN

1. Power down the machine.
2. Remove the screws and lift off the spindle wraparound compartment cover at the left end of the machine.
3. Remove the cover from junction box “F”, Figure 11.5.
4. Follow the power cable from fan “E” to the junction box and record the cable wire connections.
5. Disconnect the power cable wires.
6. Remove the fan from the motor.
7. Use the arrow on the fan for reference and mark the air flow direction on the cover.
8. Remove the fan from the cover.
9. Point the air flow arrow on the new fan in the same direction as it is on the fan cover and install the fan.
10. Mount the fan on the motor.
11. Connect the power cable wires to the fan as recorded in step 4.
12. Mount the cover onto junction box “F”.
13. Mount the spindle compartment cover.
14. Power up the machine and ensure that the new fan moves air over the spindle motor. The fan is turned on as soon as the machine is powered up.

Figure 11.5 - Spindle Drive Motor Fan
- WARNING -
Power down the machine before performing any work on electrical components. Refer to Chapter 1 for the power-down procedure.

CONTROL AND AXIS DRIVE BATTERY MAINTENANCE

- CAUTION -
A fresh battery must be installed at least once a year. Failure to perform this maintenance will result in the loss of control information.

The recommended replacement interval for the control and axis drive batteries is once a year. Check the age of the control and axis drive batteries.

Battery units are located in two places on the machine:

- The control battery is behind the control display panel and on top of the control unit
- The drive unit battery is on the X/Z axis servo drive unit in the power case

- NOTES -
Make certain that the replacement battery is like the battery being removed. Check the battery voltage and receptacle.

CONTROL BATTERY

- CAUTION -
Control battery replacement can be done with the control turned ON or OFF. If the power is OFF, the change MUST be done within 30 minutes of when the power was turned OFF.

The control can temporarily maintain memory for approximately 30 minutes without the battery backup.

Battery Specifications
- Manufacturer: Sanyo Electric Corp.
- Battery Number: CR17450SE-R
- Voltage Rating: 3 volt
- Battery Type: Lithium

Use the following procedure to check or replace the control battery.

1. Power up the machine.
2. After approximately 30 seconds, power down and lock out the machine.
- CAUTION -

Use care not to damage the gasket for the access cover.

3. Remove access cover “A”, Figure 12.1.
4. Press the battery latch down and remove control battery “C”, Figure 12.2, from the holder.
5. Verify the new battery matches the battery being replaced.
6. Pull plug “B” straight off the battery connection.
7. Install the new battery.
8. Push the plug from the new battery onto the battery connection.
9. Replace access cover “A”, Figure 12.1.
10. Dispose of the old battery properly.

Figure 12.1 - Rear Access Cover on Operator Pendant

Figure 12.2 - Control Battery Unit
AXIS DRIVE BATTERY

Battery Pack Specifications

Manufacturer: Panasonic Corp.
Battery Number: BR-CCF2TH
Voltage Rating: 6 volt

Use the following procedure to check or replace the axis drive battery.

1. Power up the machine.
2. Press the Emergency Stop push button.
3. Release two power case door locks “D”, Figure 12.3.
4. Use a screwdriver to rotate door interlock bypass “E”, Figure 12.4.

- WARNING -
High voltage AC will be present in the power case when the main disconnect switch is ON.

5. Open the power case door.

- WARNING -
Hold the battery cover by the top and bottom and squeeze the cover while pulling it off.

6. Remove battery cover “F”, Figure 12.5.
7. Verify the new battery pack matches the battery pack being replaced.
8. Disconnect the old battery.
9. Connect the new battery.
10. Install the new battery and cover “F”.
11. Close and lock the power case door.
12. Pull the Emergency Stop push button out to the first detent, wait two seconds; then, pull the push button out to the end of travel and release.
TURRET
- NOTE -

The information in this section relates to machines equipped with a Hardinge turret. Refer to the Sauter documentation for information relating to Sauter turrets.

TURRET TOP PLATE ZERO RETURN PROCEDURE

The turret top plate must be zero returned (synchronized with the machine control) if the turret top plate is interrupted while indexing. Top plate indexing can be interrupted by the following:

- Electrical outage
- Pressing the Reset key while the top plate is in motion
- Pressing the Emergency Stop push button while the top plate is in motion
- Faulty turret proximity switch

When zero returning the turret, the top plate will continue to the original station during interruption or to the selected station.

The following procedure is used when the turret top plate fails to seat properly and the control is put into an alarm condition:

1. Clear the Emergency Stop condition or power down the machine and replace the turret proximity switch as necessary.
2. Power up the machine. Set the Machine Modes selector switch to Jog.
3. Turn the Turret Station selector switch to 1 or any other selected top plate station.
4. Press the Index push button to reference the turret. The turret will index to the station selected in step 3 and seat (clamp down). The alarm will clear.
5. Reset the program to the beginning of the current tool operation.
LIVE TOOL TORQUE LIMITER RESET PROCEDURE

The turret is equipped with a torque limiter to protect live tooling. When resistance is great enough in the event of a collision or excessively aggressive machining, the torque limiter will disengage the live tooling drive motor to protect tooling from further damage and alarm “1066 Live Tool Torque Limiter” is displayed.

1. Open the coolant guard door.
2. Wipe coolant, chips, and other contaminants from the live tool attachment in the active position.
4. Press the System key.
5. Press the PMC soft key.
6. Press the PMCPRM soft key.
7. Press the KEEPRL soft key.
8. Change K00, bit 7, to “1”:
   A) Position the cursor on K00, bit 7.
   B) Key in 1 and press the Input key. The Live Tool Setup Mode alarm will be displayed.
10. Press the Main Spindle Collet Open/Close push button ONCE. The live tool drive motor will be engaged.
11. Press the Reset key.
   If the live tool torque limit alarm is NOT cleared from the display, proceed to step 12.
   If the live tool torque limit alarm is cleared from the display, proceed to step 15.
12. Position an adjustable wrench on the flats of the live tool attachment nut.
13. Rotate the live tool attachment until the torque limiter resets.
14. Press the Reset key. The live tool torque limit alarm will be cleared from the display.
15. Press the System key.
16. Press the PMC soft key.
17. Press the PMCPRM soft key.
18. Press the KEEPRL soft key.
19. Change K00, bit 7, to “0”. The Live Tool Setup Mode alarm will be cleared from the display.
WORK LIGHT

The work light is mounted on the ceiling of the coolant guard. It is a 23 Watt fluorescent standard screw type lamp. It is replaced or installed from the rear and top of the machine.

REPLACING THE LAMP

1. Power down the machine.
2. Remove two screws and lift the rear cover off to be able to reach the work light.
3. Use a safe platform or ladder to access work light housing “G”, Figure 12.6, located at the on top rear of the machine.

- NOTE -

It may be easier to remove the screws and remove the sheet metal around the work light on the canopy.

4. Loosen the work light mounting screws a few turns.
5. Lift up and spread the sheet metal to lift off the work light housing.

- NOTE -

The original light is a Sylvania 23 Watt, Compact Fluorescent light; Hardinge part number LC 0008915B. Use only on 120V 60Hz circuits.

6. Remove the lamp from the fixture by grasping the plastic base.
7. Install a new lamp.
8. Mount the work light housing and, if the rear cover has been removed, install the cover.
9. Power up the machine and check the work light.

Figure 12.6- Work Light Housing (Top Rear of the Machine)
APPENDIX ONE - PREVENTIVE MAINTENANCE SCHEDULE

INTRODUCTION

Hardinge lathes are designed to provide minimal downtime and insure long machine life when the following schedule of preventive maintenance is applied. Modular construction and easy access to components facilitate machine maintenance. Sensors have been built into the machine’s turret, lubrication, and control system for ease in troubleshooting problems. Pressure sensors and control alarms alert the operator through the control display when systems malfunction. Circuit breakers provide visual confirmation of the electrical status of each circuit. The plug-in I/O modules have LED’s for verification of circuit status.

The access covers and doors, along with the sheet metal safety housings, have been designed to be removed easily when service is required. Open access covers and doors or remove panels to gain access to machine components. Components can be easily removed from the machine when extensive service or replacement is necessary.

- CAUTION -
Do not use caustic or abrasive cleaners on this machine.

Maintaining a clean machine is part of any good maintenance program. Machines should be periodically wiped with lint-free cloths soaked with the appropriate solvent. If the machine is operated in an atmosphere that causes surfaces to rust quickly, wipe these surfaces with a lint-free cloth soaked in mineral oil.

DO NOT USE HIGH-PRESSURE COMPRESSED AIR TO CLEAN THE MACHINE. The hand-held air nozzle supplied with the machine limits the air force to an OSHA compliance maximum of 30 psi. High air pressure could force dirt particles and other foreign material past seals and wipers.

STANDARD MAINTENANCE SCHEDULE

The following maintenance times are 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.

8 HOURS

Check coolant level ........................................ Chapter 2
Check coolant concentration and measure coolant pH ........................................ Chapter 2
Check chips in coolant tank; remove as necessary ........................................ Chapter 2
Check hydraulic heat exchanger fan ........................................ Chapter 4
Check hydraulic pressure gauges ........................................ Chapter 4
Check fluid level in the hydraulic tank; check hydraulic fluid leaks ........................................ Chapter 4
Check red “pop up” indicator; hydraulic system filter ........................................ Chapter 4
40 HOURS
Remove chips from coolant tank ..................................... Chapter 2
Clean fan air filter ......................................................... Chapter 11
Check circulating fans for dirt and proper operation ................ Chapter 11
Wash machine and wipe clean ........................................ Appendix One

160 HOURS
Clean and lubricate main spindle and draw tube ...................... Chapter 7
Clean the sub-spindle draw tube
   ELITE® 42 and ELITE 51 series lathes ............................... Chapter 9
   ELITE 27 MS lathe .................................................... Chapter 10

500 HOURS
Check spindle drive belt for wear and tension ........................ Chapter 7
Inspect Z-axis drive belt tension ...................................... Chapter 8
Inspect X-axis drive belt tension ...................................... Chapter 8

1000 HOURS
Clean and flush coolant system and change coolant ................ Chapter 2
Lubricate the machine axes ............................................. Chapter 3

2000 HOURS
(Harding Inc. recommends installing fresh batteries every 2000 hours)
Lubricate the live tooling drive shaft ................................ Chapter 3
Install a fresh control battery .......................................... Chapter 12
Install fresh axis drive battery ........................................ Chapter 12
MAINTENANCE SCHEDULE FOR OPTIONS

8 HOURS
- Drain air filter/regulator bowl ................................................. Chapter 6
- Check barfeed oil level
- Grease chuck master jaws

40 HOURS
- Clean chip conveyor

160 HOURS
- Clean chuck jaws
- Check and replace air line filter ............................................. Chapter 6
- Lubricate tailstock live center .................................................. Chapter 5

1000 HOURS
- Check warning lights
- Check barfeed in-position switch
- Tighten plug connections
- Check and fill chip conveyor gearbox oil
- Check and adjust chip conveyor drive belt tension
APPENDIX TWO - ALARM AND OPERATOR MESSAGES

ALARM MESSAGES

1002 VERIFY OPERATOR DOOR SWITCH
   Machine Power-Up Message. Open and close the main guard door to verify interlock switch operation.

1006 TOOL GROUP LIFE END
   All of the tools in one or more tool groups have reached the tool life specified in the Tool Life Management program and an M30 “End of Program” has been read by the control.
   Refer to the operator’s manual (M-429) for instructions on resetting the tool group counter(s).

1026 HYD. PRESSURE TOO LOW
   The hydraulic pressure switch indicated that the pressure was too low for machine operation. To restart, press the Emergency Stop push button to put the machine in emergency stop state. After a few seconds, clear the Emergency Stop. If the pump starts and stays ON, press Reset to clear the alarm.

1035 HYD. PUMP OL
   Hydraulic motor overload on contactor tripped. Reset the overload to restart the motor and clear this message.

1052 LIVE TOOL DISENGAGE FAULT
   The live tooling disengaged proximity switch does not give the expected signal. The live tooling spline may have failed to engage or the live tooling disengaged proximity switch may be faulty. Press Reset to clear the alarm.

1060 TURRET FAULT
   Turret index was interrupted by Reset or Emergency Stop.
   To clear the fault:
   1. Reset Emergency Stop.
   2. Select Jog mode.
   3. Select a station and press the Turret Index push button.
   4. The turret will index to the selected station.

1061 TURRET UNCLAMPED
   The turret top plate is not properly seated. Turret index time exceeds two seconds. Turret proximity switch may be faulty. The control is put in an alarm condition.
1062  PLEASE PRESS RESET
   Turret index is not allowed when the live tool drive is engaged. Press Reset to disengage the live tool drive. Try to index the turret.

1063  TURRET UNCLAMPED SWITCH
   The turret unclamp solenoid is energized but the turret unclamped switch has not been activated. Either the turret has failed to unclamp or the unclamped switch has failed.

1064  TURRET SWITCHES MAY BE SWAPPED
   The Turret Clamped and Turret Unclamped switches are wired incorrectly or have malfunctioned. Check the switches.

1065  Y AXIS TOO LOW TO INDEX
   The turret is positioned below Y0. Move the turret to Y0 before attempting to index the turret.

1066  LIVE TOOL TORQUE LIMITER
   The live tool torque limiter has tripped. The control is put into an alarm condition and the machine in Emergency Stop.
   Refer to the maintenance manual (M-430) for information on resetting the torque limiter.

1067  TURRET STATION SWITCH FAULT
   The turret station selector switch indicates an invalid station. The control is put into an alarm condition.

1072  PLEASE TURN OFF POWER
   Machine Lock mode has been canceled. When Machine Lock mode is active there is no machine motion during program execution, but the position registers indicate all motion dictated by the part program. The machine power must be cycled to return these registers to their correct values.

1075  BAR FEED FAULT
   Bar feed signals a fault. The control is put in an alarm condition.
   Adjust the bar feed and press Reset to clear the alarm.

1076  END OF BAR
   End of bar condition exists. The control is put in an alarm condition.
   Press Reset to clear the alarm.
1082 T CODE INVALID
   The T word exceeds the maximum number of turret stations on the top plate.
   T word format error.

1083 M CODE INVALID
   M word is programmed for an option not available/enabled on the machine.
   M word is not defined in the control.
   M word format error.
   Press Reset to clear the alarm.

1085 B CODE INVALID
   B word orient angle is invalid.
   B word is programmed for an option not available/enabled on the machine.
   B word format error.
   Press Reset to clear the alarm.

1102 PARAMETER WRITE FAULT
   The control has failed to write a parameter correctly. Restarting the machine may clear the problem. Contact the Hardinge Service Department if necessary.

1110 MAIN COLLET ACCESS DOOR
   The main spindle collet access door is open. Executing a program in Automatic mode is inhibited. Close the door and press Reset to allow machine operation.

1113 MAIN COLLET LIMIT SWITCH
   One or both of the main spindle collet Open/Close pressure switches are faulty. Both switches indicate the same state. The control is put into an alarm condition.

1114 MAIN SPINDLE ORIENT FAULT
   Spindle orient failed to complete in five seconds. Press Reset to clear the alarm.

1115 MAIN SPINDLE BRAKE FAULT
   Main spindle brake switch input contradicts the state of the solenoid valve.

1120 TAILSTOCK PAST LIMIT POSITION
   The tailstock has traveled past the anticipated contact point and reached the over-travel position. Refer to the operator’s manual (M-429) for information on the tailstock.
1121 MOVE TAILSTOCK TO HOME POSITION
The tailstock is out of position. Move the tailstock to the fixed Home position. Cycle Start is inhibited.

1122 TAILSTOCK HOME SWITCH FAULT
The tailstock was commanded to move forward, but the Tailstock Home switch indicates the tailstock is still at the Home position. Correct the cause of the problem. Press Reset to clear the alarm.

1123 PLEASE HOME TAILSTOCK
Power Up Message. Home the tailstock.
Refer to the operator's manual (M-429) for information on homing the tailstock.

1160 TURRET UNCLAMPED
The turret is allowed to index while the machine is making a positioning move (G00 active). This alarm indicates that the turret was unclamped when the machine was making another type of move.
Verify the turret index commands are programmed in separate blocks or in G00 blocks. Correct the part program as needed.
Press Reset to clear the alarm.

1161 TURRET STATION PROGRAM FAULT
The turret station number is too large. Correct the part program. Press Reset to clear the alarm.

1162 PARAMETER WRITE FAILED
When the turret is referenced, CNC parameter settings are automatically changed. This alarm indicates one of these operations has failed.
Press Reset to clear the alarm. Referencing the turret is required.

1163 TURRET FAULT, REFERENCE REQUIRED
A turret fault has occurred. Activate Jog mode, move the turret to a safe index position, and reference the turret to clear this fault.

1170 TURRET INCREMENT FAULT
An attempt to manually index the turret has failed. Press Reset to clear the alarm.

1172 TURRET GEAR SHIFT FAULT
The turret failed to shift gears in the time allowed. Press Reset to clear the alarm. Referencing the turret is required.
1173 TURRET ILLEGAL SWITCH STATES
   This message indicates the turret proximity switches have failed or are out of adjustment. DO NOT attempt to operate the turret when this alarm is displayed. Press Reset to clear the alarm.

1176 TORQUE LIMITER FAULT - SPINDLE
   Excessive torque was applied to the live tool drive mechanism. Refer to the Sauter Operating Instructions Manual for information on resetting the torque limiter and clearing the alarm.

1177 TORQUE LIMITER FAULT - TURRET
   Excessive torque was applied to the turret index drive mechanism. Refer to the Sauter Operating Instructions Manual for information on resetting the torque limiter and clearing the alarm.

1213 OPPOSITE COLLET LIMIT SWITCH
   One or both of the sub-spindle collet Open/Close pressure switches are faulty. Both switches indicate the same state. The control is put into an alarm condition.

1214 OPPOSITE SPINDLE ORIENT FAULT
   Spindle orient on sub-spindle failed to complete in five seconds. Press Reset to clear the alarm.

1215 OPPOSITE SPINDLE BRAKE FAULT
   Sub-spindle brake switch input contradicts the state of the solenoid valve.

1216 OPPOSITE SPINDLE BREAKAWAY FAULT
   - NOTE -
   This alarm message applies to ELITE® 42 and ELITE 51 series lathes only.
   The sub-spindle breakaway switch has been tripped. The control is put into an alarm condition and the machine into Emergency Stop
   Refer to Chapter 9 for information on resetting the sub-spindle.

1234 DOOR FAILED TO LOCK
   The door lock was turned ON, but the door failed to lock In the time allowed. The door lock may be broken or jammed.
OPERATOR MESSAGES

2001  1000 HOUR LUBE REQUIRED
     Machine lubrication is required every 1000 hours of machine ON time. Cycle Start is inhibited while this message is displayed.
     Refer to Chapter 3 for information on machine lubrication.
     After lubricating the machine, press the Rapid Traverse and Cycle Start push buttons at the same time to clear this message.

2005  NEW TOOL USED ON THIS PART
     A tool in the currently active tool group has reached the tool life specified in the Tool Life Management program. The next tool in the active tool group has been selected.
     Press Cycle Start or Reset to clear this message.

2017  TAILSTOCK LUBE TIMEOUT
     The tailstock lube pressure sensor failed to indicate pressure at least once in the time allowed. The lube pump or pressure switch may have failed. Repeat mode is canceled.
     Press the Rapid Traverse and X1 push buttons at the same time to clear this message.

2020  TAILSTOCK LUBE LEVEL LOW
     The level sensor in the tailstock lubrication reservoir indicates the lube level is low. Repeat mode is canceled. Refill the lube reservoir.
     Press the Rapid Traverse and X1 push buttons at the same time to clear this message.

2021  LAMP OUTPUT DISCONNECTED
     An output module driving the panel lamps is overloaded. Turn the machine OFF to clear this message.

2022  OPERATOR DOOR OPEN
     The coolant guard door is open. Cycle Start is inhibited until the guard door is closed.

2023  CONTROL BATTERY LOW
     Low voltage condition on control memory battery back-up. DO NOT POWER DOWN THE MACHINE!
     Refer to Chapter 12 for instructions to replace the battery.
2024  PART PROBE BATTERY LOW
The part probe battery is nearly discharged.
Refer to the operator’s manual (M-429) for instructions to replace the battery. After the battery is replaced, press Reset to clear this message.

2026  AIR PRESSURE TOO LOW
The air pressure switch indicates the air pressure is too low for machine operation. The recommended pressure range is 70 to 90 psi [4.9 to 6.2 bar]. Restore adequate air pressure and press Reset to clear this message.

2030  COOLANT PUMP MOTOR OL
The overload on the coolant pump motor contactor in the machine power case has tripped. Repeat mode is canceled.
Correct the cause of the overload. Locate the coolant pump contactor in the power case and reset the overload. When the overload is reset, press Reset to clear this message.

2032  MIST COLLECTOR MOTOR OL
The overload on the mist collector contactor in the machine power case has tripped. Repeat mode is canceled.
Correct the cause of the overload. Locate the mist collector contactor in the power case and reset the overload. When the overload is reset, press Reset to clear this message.

2033  AIR CONDITIONER FAULT

- NOTE -
Air conditioner maintenance should be referred to qualified service personnel.
The optional air conditioner on the power case has issued a fault signal to the CNC control. Possible causes are:
• Temperature limit has been exceeded.
• Air inlet or outlet may be blocked.
• Heat exchanger module may need to be cleaned.
• Air conditioner fan may be defective.
• Condenser may be defective.
• Coolant level may be low.
• Temperature sensor may be defective.
Correct the problem and press Reset to clear the alarm.
2055  TURRET THRUST LIMIT EXCEEDED, PLEASE ADJUST FEEDRATE
The Z axis thrust limit has been exceeded. The machine is put into a feed hold condition.
Turn the Feedrate Override switch down by 10% and press Cycle Start. Repeat until the message clears. Adjust the feedrate in the part program by the percentage that was required to clear the message.

2056  TURRET REFERENCE IN PROGRESS, PLEASE WAIT
Turret reference is in progress. Please wait for turret reference to complete.

2077  OPEN COLLET ONLY IN JOG MODE
For machines equipped with the bar feed option and the option is turned ON, the control must be in Jog mode to manually open the collet or chuck. Press Reset or select Jog mode to clear this message.

2086  PART COUNT SATISFIED
The part count specified has been completed. Repeat mode is canceled.
It may be desirable to reset the parts counter to zero. Refer to the operator’s manual (M-429) for information on resetting the parts counter.
Press Cycle Start or Reset to clear this message.

2090  TURRET MUST BE AT X AXIS HOME POSITION
The turret must be at the X axis reference position before a Z axis Rapid Reference can be performed.
When the tool probe is installed, the turret can only be indexed when it is positioned at the X axis reference position. Move the turret to the X axis reference position before attempting to index the turret.
Press Reset to clear this message.

2093  TOOL PROBE MUST BE STOWED
The tool probe must be removed and the cover must be in place before a part program can be executed.
Running the spindle manually, moving the tailstock, and referencing the turret are not allowed while the tool probe is installed.
Indexing the turret is allowed if the turret is at the X axis reference position.
Press Reset to clear this message.
2094 TOOL PROBE SWITCH FAULT
   The tool probe receiver cover must be properly installed unless the tool probe is in use. This alarm occurs when neither the probe or the cover are installed on the tool probe receiver.
   Install either the tool probe or the cover and press Reset to clear this message.

2133 COLLET OPEN
   Machine Equipped with Tailstock:
      Automatic machine operation was attempted with the collet closer in the Open position.
      Manual spindle operation was attempted with the collet closer in the Open position.
      Set the collet closer to the closed position before attempting automatic machine or manual spindle operation.
      Press Reset to clear this message.
   Machine Equipped with Sub-Spindle:
      Automatic machine operation was attempted with both collet closers in the Open position.
      Manual spindle operation was attempted with both collet closers in the Open position.
      Set the appropriate collet closer to the closed position before attempting automatic machine or manual spindle operation.
      Press Reset to clear this message.

2232 OPPOSITE SPINDLE LOCKPIN ENGAGED
   The sub-spindle lockpin is engaged. Automatic operation is inhibited. Select Jog mode and press the AUX (Auxiliary) push button to disengage the sub-spindle lockpin.

2240 DOOR CLOSED SWITCH FAULT — SHORTED
   One of the two door closed switch contacts is ON all the time or the two contacts are shorted together. Cycle Start is inhibited. Check the switch wiring.
   When the problem is corrected, press Reset to clear this message.

2241 DOOR CLOSED SWITCH FAULT — OPEN
   One of the two door closed switch contacts is disconnected. Cycle Start is inhibited. Check the switch wiring.
   When the problem is corrected, press Reset to clear this message.
2242 DOOR LOCKED SWITCH FAULT — SHORTED
   One of the two door locked switch contacts is ON all the time or the two contacts are shorted together. Cycle Start is inhibited. Check the switch wiring. When the problem is corrected, press Reset to clear this message.

2243 DOOR LOCKED SWITCH FAULT — OPEN
   One of the two door locked switch contacts is disconnected. Cycle Start is inhibited. Check the switch wiring. When the problem is corrected, press Reset to clear this message.

2246 PLEASE CONTACT HARDINGE AT 800/635-0192 EXTENSION 4227, OR AT TPC@HARDINGE.COM, AND PROVIDE THE KEY CODE SHOWN BELOW. YOU WILL BE GIVEN A FOUR DIGIT PASSWORD. YOU HAVE 45 DAYS TO OBTAIN YOUR PASSWORD. KEY CODE: [XXXX]
   Contact Hardinge Inc. as instructed.

2247 YOUR WARNING PERIOD HAS EXPIRED. PLEASE CONTACT HARDINGE AT 800/635-0192 EXTENSION 4227, OR AT TPC@HARDINGE.COM, AND PROVIDE THE KEY CODE SHOWN BELOW.
   KEY CODE: [XXXX]
   Contact Hardinge Inc. as instructed.
Figure A3.1 - Front View of Machine
Figure A3.2 - Hydraulic System: Machine Equipped with Tailstock (ELITE® 42 and ELITE 51 Series Lathes)

Figure A3.3 - Hydraulic System Manifold: Machine Equipped with Tailstock (ELITE 42 and ELITE 51 Series Lathes)
Figure A3.4 - Hydraulic System:
Machine Equipped with Sub-Spindle
(ELITE® 42 and ELITE 51 Series Lathes)

Figure A3.5 - Hydraulic System Manifold:
Machine Equipped with Sub-Spindle
(ELITE 42 and ELITE 51 Series Lathes)
Figure A3.6 - Hydraulic System
(ELITE® 27MS Lathe)

Figure 3.7 - Hydraulic Manifold:
Left Side View
(ELITE 27MS Lathe)

Figure 3.8 - Hydraulic Manifold:
Front View
(ELITE 27MS Lathe)
Figure A3.9 - Air Control System
(ELITE® 42 and ELITE 51 Series Lathes)
Figure A3.12 - Control Case Interior

This Page - Figure A3.12
A - MDI Panel
B - CPU
C - Operator Panel

Next Page - Figure A3.13
D - Incoming Power
E - Input/Output (I/O)
F - Main Power Distribution
G - 24vDC Power Supply
H - Spindle and Servo Drives
Figure A3.13 - Power Case Interior
Figure A3.14 - X-Axis Drive and Brake

Figure A3.15 - X-Axis Drive Motor and Grease Lubrication Blocks
Figure A3.16 - Z-Axis Drive
Figure A3.17 - Tailstock
(ELITE® 42 and ELITE 51 Series Lathes)
Figure A3.18 - Main Spindle, Spindle Brake, and Collet Closer