

# TRAK® TRL LATHES ProtoTRAK® SLX CNC

## Safety, Installation, Maintenance, Service and Parts List

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Version: 012412

### Covers Models:

- **1540SX**
- **1630SX**
- **1630HSSX**
- **1840SX**
- **1845SX**
- **2460SX**



**Southwestern Industries, Inc.**

2615 Homestead Place

Rancho Dominguez, CA 90220-5610 USA

T | 310.608.4422 | F | 310.764.2668

Service Department: 800.367.3165

e-mail: [sales@southwesternindustries.com](mailto:sales@southwesternindustries.com) | [service@southwesternindustries.com](mailto:service@southwesternindustries.com) | web: [southwesternindustries.com](http://southwesternindustries.com)

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Southwestern Industries, Inc.  
2615 Homestead Place  
Rancho Dominguez, CA 90220  
Phn 310/608-4422 ◆ Fax 310/764-2668  
Service Department  
Phn 800/367-3165 ◆ Fax 310/886-8029

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# 1.0 Safety Specifications

The safe operation of the TRAK TRL Lathe & ProtoTRAK SLX CNC depends on its proper use and the precautions taken by each operator.

- Read and study the TRAK TRL Lathe & ProtoTRAK SLX CNC Safety, Programming, Operating, and Care Manual. Be certain that every operator understands the operation and safety requirements of this machine **before** its use.
- Read and study the TRAK TRL Lathe Safety, Installation, Maintenance, Service & Parts List Manual. Be certain that every operator understands the operation and safety requirements of this machine **before** servicing.
- Always wear safety glasses and safety shoes.
- Always stop the spindle and check to ensure the CNC control is in the stop mode before changing or adjusting the tool or workpiece.
- Never wear gloves, rings, watches, long sleeves, neckties, jewelry, or other loose items when operating, or around the machine.
- Use adequate point of operation safeguarding. It is the responsibility of the employer to provide and ensure point of operation safeguarding per ANSI B11.6-2001.

## 1.1 Safety Publications

Refer to and study the following publications for assistance in enhancing the safe use of this machine:

**Safety Requirements for Manual Turning Machines with or without Automatic Control (ANSI B11.6-2001).** Available from the American National Standards Institute, 1819 L Street N. W., Washington, D.C. 20036.

**Concepts And Techniques Of Machine Safeguarding (OSHA Publication Number 3067).** Available from The Publication Office - O.S.H.A., U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210.

All other regulations are specific to the State in which the machine is installed.

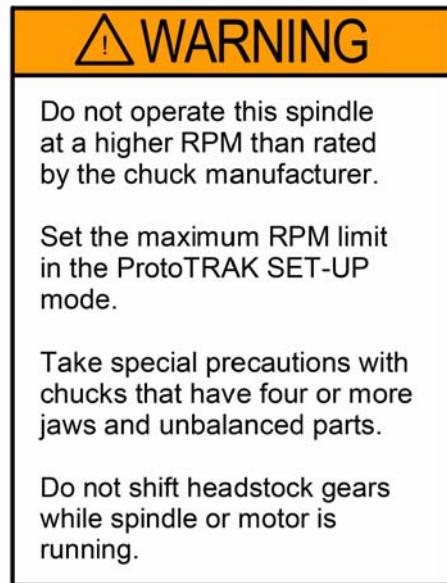
## 1.2 Danger, Warning, Caution, and Note Labels and Notices as Used In This Manual

**DANGER** - Immediate hazards that **will** result in severe personal injury or death. Danger labels on the machine are red in color.

**WARNING** - Hazards or unsafe practices that **could** result in severe personal injury and/or damage to the equipment. Warning labels on the machine are gold in color.

**CAUTION** - Hazards or unsafe practices that **could** result in minor personal injury or equipment/product damage. Caution labels on the machine are gold in color.

**NOTE** - Call attention to specific issues requiring special attention or understanding.



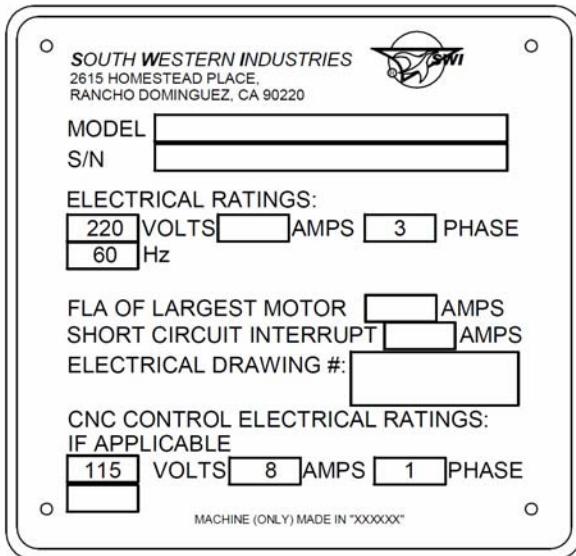
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## Safety & Information Labels Used On The TRAK TRL Lathe

*It is forbidden by OSHA regulations and by law to deface, destroy or remove any of these labels*



i00774

Power Requirements at 220 Volts, 3-phase 60 HZ		
Model	Full-load Amp of Machine	Full-load Amp of Largest Motor
1540SX	33	33
1630SX	25	25
1630HSSX	25	25
1840SX	35	33
1845SX	33	33
2460SX	45	45

### 1.3 Safety Precautions

**WARNING!**

Use only chucks which are rated to the maximum RPM of the lathe.

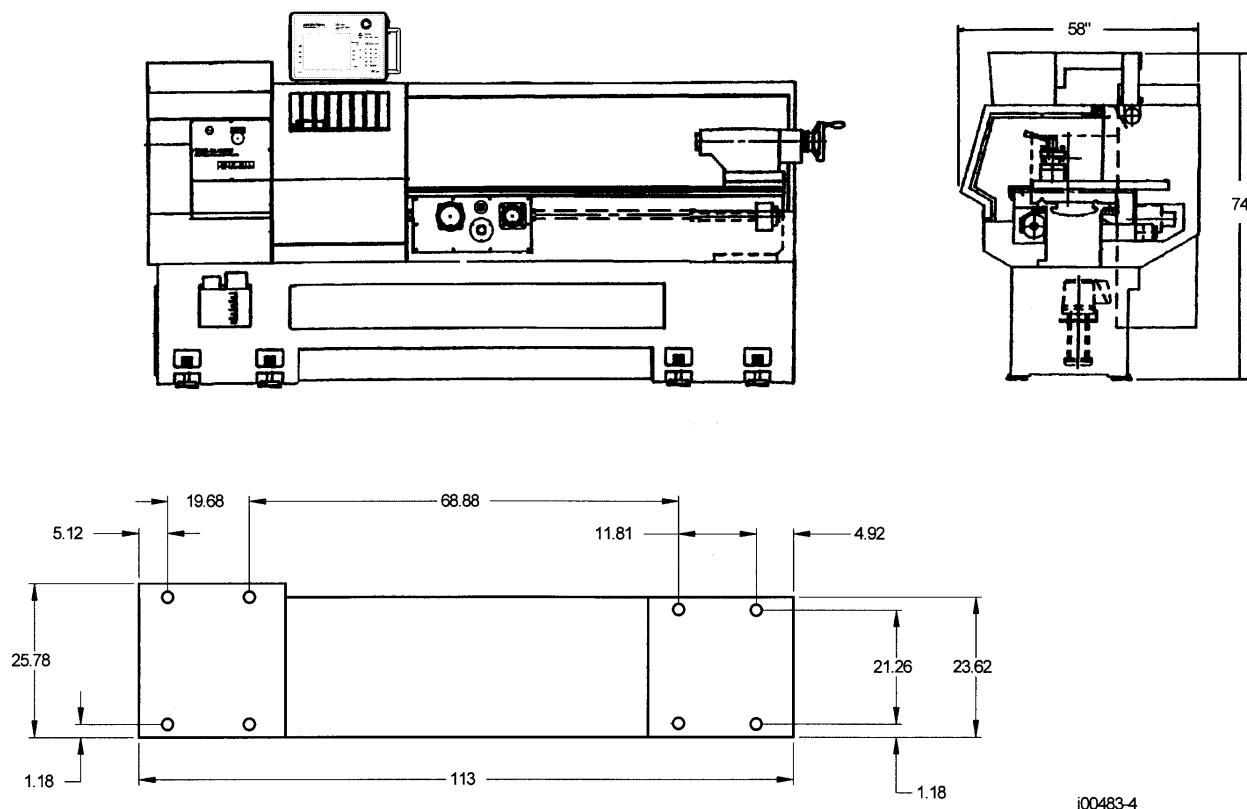
1. Do not operate this machine before the TRAK TRL Lathe and ProtoTRAK SLX CNC Programming, Operating and Care Manual has been studied and understood.
2. Read and study this TRAK TRL Lathe Safety, Installation, Maintenance, Service & Parts List Manual. Be certain that every operator understands the operation and safety requirements of this machine **before** servicing.
3. Do not run this machine without knowing the function of every control key, button, knob, or handle. Ask your supervisor or a qualified instructor for help when needed.
4. Protect your eyes. Wear approved safety glasses (with side shields) at all times.
5. Don't get caught in moving parts. Before operating this machine, remove all jewelry, including watches and rings, neckties, and any loose-fitting clothing.
6. Keep your hair away from moving parts. Wear adequate safety headgear.
7. Protect your feet. Wear safety shoes with oil-resistant, anti-skid soles, and steel toes.

8. Take off gloves before you start the machine. Gloves are easily caught in moving parts.
9. Remove all tools (wrenches, chuck keys, etc.) from the machine before you start. Loose items can become dangerous flying projectiles.
10. Never operate any machine tool after consuming alcoholic beverages, or taking strong medications, or while using non-prescription drugs.
11. Protect your hands. Stop the machine spindle and ensure that the CNC control is in the STOP mode:
  - Before changing tools
  - Before changing parts
  - Before you clear away the chips, oil or coolant. Always use a chip scraper or brush
  - Before you make an adjustment to the part, chuck, coolant nozzle or take measurements
  - Before you open safeguards (protective shields, etc.). Never reach for the part, tool, or fixture around a safeguard.
12. Protect your eyes and the machine as well. Don't use a compressed air hose to remove the chips or clean the machine (oil, coolant, etc.).
13. Stop and disconnect the power to the machine before you change belts, pulley, gears, etc.
14. Keep work area well lighted. Ask for additional light if needed.
15. Do not lean on the machine while it is running.
16. Prevent slippage. Keep the work area dry and clean. Remove the chips, oil, coolant and obstacles of any kind around the machine.
17. Avoid getting pinched in places where the spindle, carriage, cross slide or sliding door create "pinch points" while in motion.
18. Securely clamp and properly locate the workpiece in the chuck or in the fixture. Use proper tool holding equipment.
  
19. Use correct cutting parameters (speed, feed, and depth of cut) in order to prevent tool breakage.
20. Use proper cutting tools for the job.
21. Prevent damage to the workpiece or the cutting tool. Never start the machine (including the rotation of the spindle) if the tool is in contact with the part.
22. Don't use dull or damaged cutting tools. They break easily and may become airborne. Inspect the sharpness of the edges, and the integrity of cutting tools and their holders.
23. Large overhangs on cutting tools when not required result in accidents and damaged parts.
24. Prevent fires. When machining certain materials (magnesium, etc.) the chips and dust are highly flammable. Obtain special instruction from your supervisor before machining these materials.
25. Prevent fires. Keep flammable materials and fluids away from the machine and hot, flying chips.
26. Never change gears when the spindle is rotating.
27. Do not rotate the spindle by hand unless the Red Emergency Stop button is pressed.

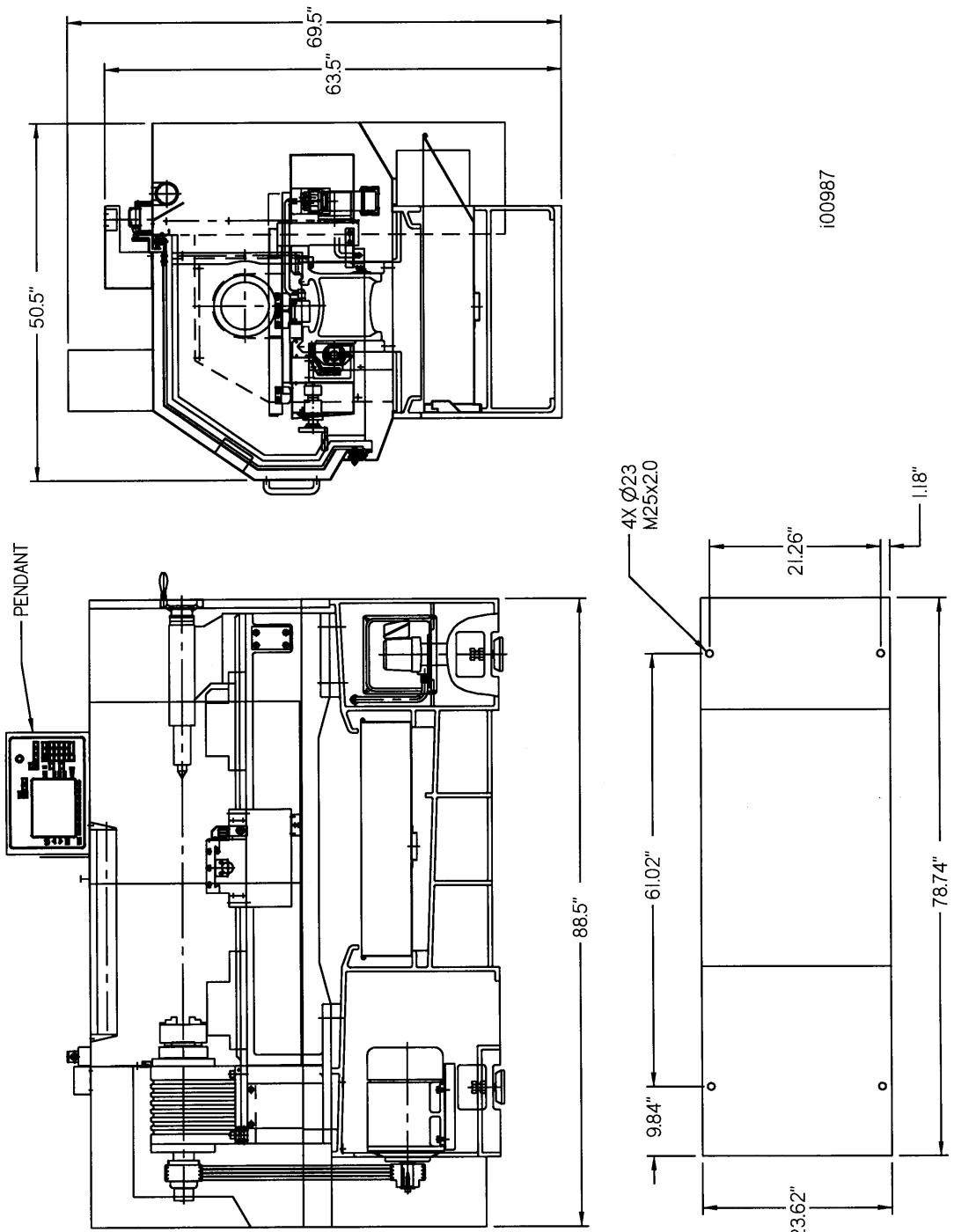
## 2.0 Installation

Read and understand this entire installation section before beginning the installation procedure.

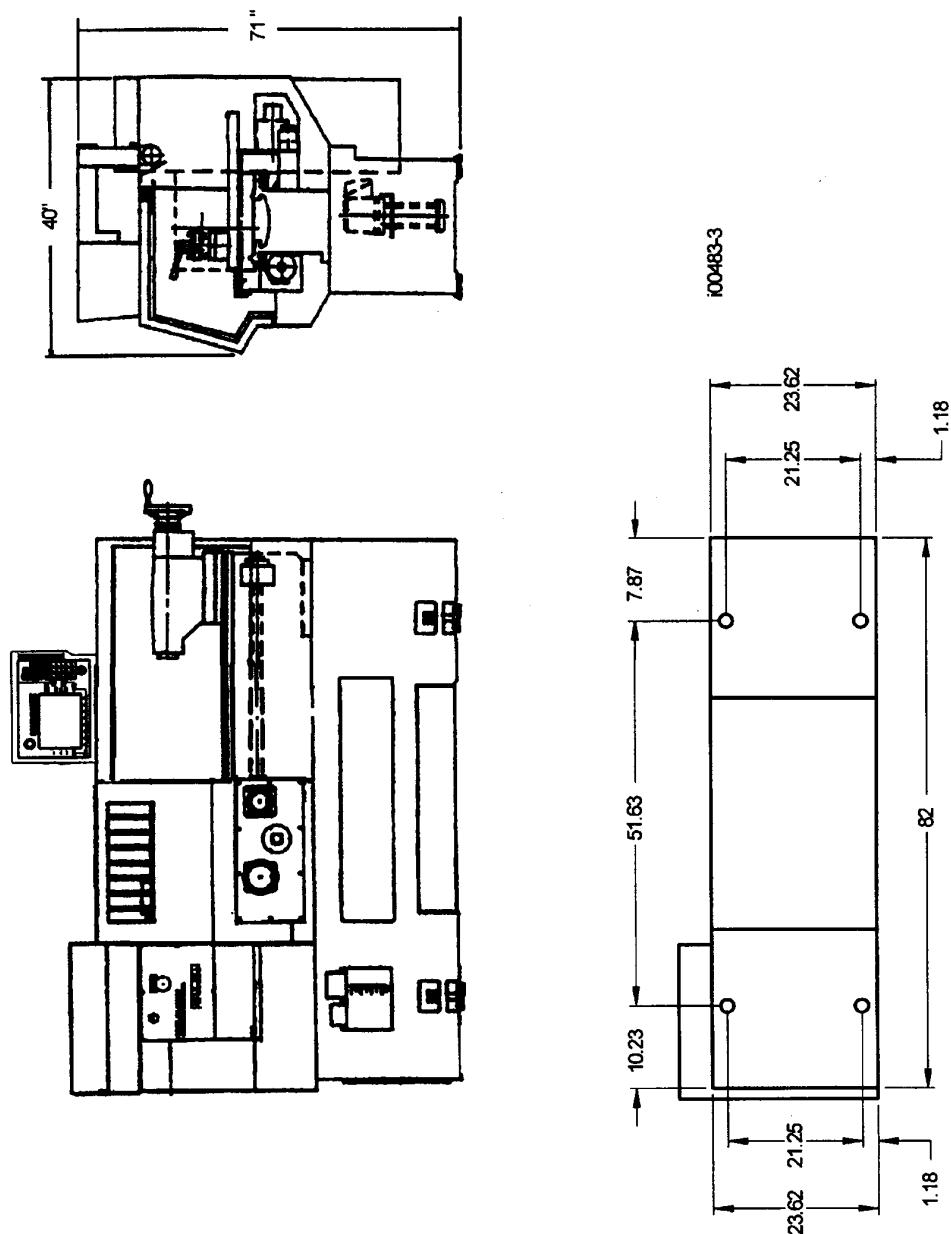
## 2.1 Floor Plan, Layout & Space Requirements



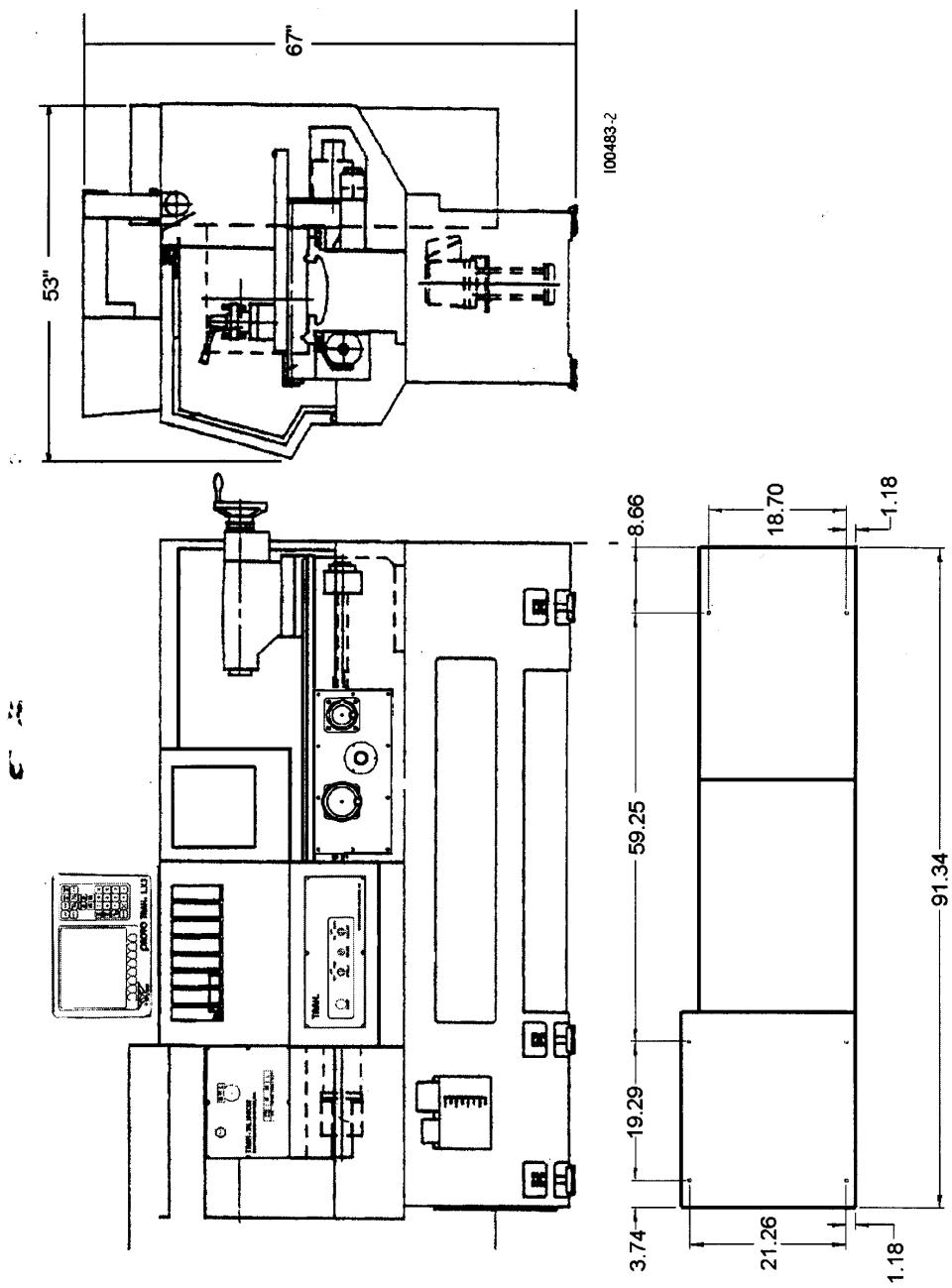
## Figure 1 2460SX Lathe



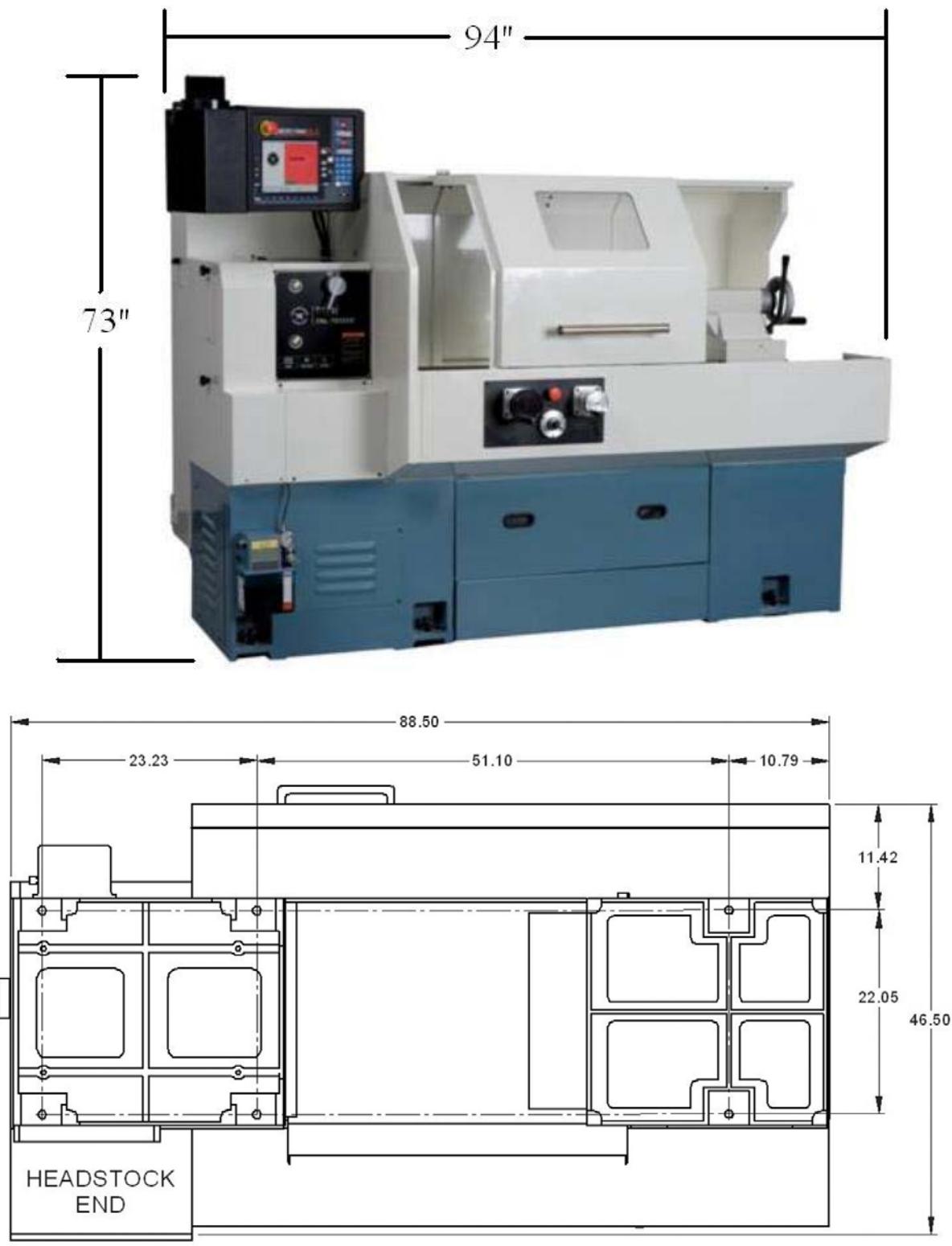
**Figure 2**  
**1540SX Lathe**



**Figure 3**  
**1630SX and 1630HSSX Lathe**



**Figure 4**  
**1840SX Lathe**



**Figure 4.1**  
**1845SX Lathe**

## 2.2 Lathe Specifications

Capacity	1540SX	1630SX	1630HSSX	1840SX	1845SX	2460SX
Height of Centers	8"	8"	8"	9"	9"	12"
Distance Between Centers	40"	30"	30"	40 1/4"	45"	60"
Swing Over Bed	15"	16"	16"	18 1/2"	18.1"	24"
Swing Over Saddle Wings	15"	16"	16"	17"	17"	24"
Swing Over Cross Slide	6 5/8"	8.6"	8.6"	9"	9.13"	14.5"
Cross Slide Travel	11 1/2"	8.5"	8.5"	13"	10.6"	12.5"
Tool Section Max.	3/4"	3/4"	3/4"	1"	1"	1"
Coolant	12 gal.	8 gal.	8 gal.	13 gal.	10 gal.	15 gal.
Oil Pump – Way Lubrication	2 liter	2 liter	2 liter	2 liter	2 liter	2 liter
Oil Reservoir – Headstock	None	1.5 gal.	1.5 gal.	3.5 gal.	1.85 gal.	3 gal.
<b>Bed</b>						
Width	12 5/8"	12.6"	12.6"	14 1/2"	13.4"	15.75"
Height	12 5/8"	12.6"	12.6"	13 3/8"	12.4"	12 5/8"
<b>Headstock</b>						
Spindle Nose	A2-5	D1-6	A2-4	D1-6	D1-6	D1-8
Spindle Through Hole	2 1/8"	2.12"	1.57"	2.36"	2.36"	4.09"
Spindle Taper	MT #6	MT#6	MT#5	MT #6	MT #6	MT #8
Taper in Reduction Sleeve	MT #4	n/a	n/a	MT #4	MT #4	MT #5
Spindle Diameter Front Bearing	3.15"	3.15"	2.56"	3.35"	3.35"	5.51"
Number of Bearings	5	2	5	3	2	2
Number of Spindle Speed Ranges	1	1	1	2	2	2
Spindle Speed Range (RPM)	150 – 4000	150-2500	150-4000	80 – 850 250 - 2500	80 – 850 250 - 2500	40-670, 100-1800
Spindle ID Thread on end of Spindle	N/A	M56 X 2 MM Pitch	M56 X 2 MM Pitch	M62 X 2 MM Pitch	N/A	M106.5 X 1.5 MM Pitch
<b>Tailstock</b>						
Quill Travel	5.75"	5.75"	5.75"	7.125"	6"	6.88" 2 speed
Quill Diameter	2.36"	2.36"	2.36"	2.96"	2.56"	3"
Quill Taper Hole	MT #4	MT#4	MT#4	MT #5	MT#4	MT #5
<b>Spindle Motor</b>						
H.P.	10	7.5	7.5	10	10	15
Voltage	220	220	220	220	220	220
Amps, Full Load	33	25	25	35	33	45
Phase, Hz	3/60	3/60	3/60	3/60	3/60	3/60
<b>Dimensions</b>						
Net Inches L x W x H lbs.	89 x 53 x 70, 4100	82 x 40 x 71, 2750	82 x 40 x 71, 2750	91 x 53 x 70, 4500	94 x 52 x 73, 3285	112 x 52 x 62, 5700 lbs
Ship Inches L x W x H lbs.	90 x 55 x 73, 4650	87 x 45 x 67, 3420	87 x 45 x 67, 3420	97 x 58 x 72, 5170	91 x 52 x 84, 3800	117 x 59 x 77, 6200 lbs
<b>Other</b>						
Coolant Pump Motor, H.P.	1/8	1/8	1/8	1/8	1/8	1/8
Spindle Motor Brake				Dynamic Braking		
Way Surface Hardness				400 – 450 HB	480-560 HB	400 – 450 HB
Headstock Lubrication	*Grease	Oil Bath	Grease	Oil Bath	Oil Bath	Oil Bath
<b>Options</b>						
Tooling Kit	3/4"	3/4"	3/4"	3/4" or 1"	3/4" or 1"	1"
Chuck	6", A2-5	8", D1-6	6", A2-4	8", D1-6	8", D1-6	12", D1-8
5C Collet Closer	A2-5	D1-6	A2-4	D1-6	D1-6	n/a
Indexer Option	3/4", 8-Position 3/4", 4-position	3/4", 8-Position 3/4", 4-position	3/4", 8-Position 3/4", 4-position	3/4 or 1" 8-position 3/4 or 1" 4-position	3/4 or 1" 8-position 3/4 or 1" 4-position	1", 4-position 1", 8-position
Gang Tooling	3/4"	n/a	n/a	3/4"	3/4"	n/a

\* no maintenance grease cartridge

## 2.3 Uncrating

Carefully remove the wood crate and protective packaging, paying attention not to scratch, damage, or mar any parts of the machine.

Remove the cardboard boxes with the PENDANT DISPLAY (handle carefully). The leveling pads and screws for the machine can be found in the toolbox.

Loosen and remove the screws and nuts holding the machine to the wood pallet.

### **ATTENTION!**

Immediately report, in writing, any damages observed at this time that can be attributed to the transportation or improper handling/moving of the machine.

## 2.4 Shortages: Inventory Checklist

- Machine (check model and serial number)
- Leveling pads and screws (4 each for 1540SX, 1630 SX, and 1630HSSX, 8 each for 2460SX, and 6 each for 1840 SX and 1845 SX)
- Pendant Display – 24000-3
- Pendant Cable Cover (24324), n/a to 1845SX
- Toolbox with various tools
- TRAK Lathe Safety, Operation & Programming Manual (P/N 24494)
- TRAK Lathe Safety, Installation, Maintenance, Service & Parts List Manual (P/N 25061)

In case of shortages, contact the representative from whom you purchased the machine.

## 2.5 Installation Instructions & Checklist

Installer: Use this checklist to assure a complete set-up of the SX Lathes.

<input type="checkbox"/>	1.	Shut off power to the machine.
<input type="checkbox"/>	2.	Visually inspect the 220-wiring going into the electrical panel. Visually verify the wiring is correct per our wiring diagram. Make sure a strain relief is being used where the wiring enters the cabinet. Have the customer repair any wiring discrepancies.
<input type="checkbox"/>	3.	Clean the machine if needed and remove any remaining grease.
<input type="checkbox"/>	4.	Mount the pendant on top of the sliding door or on the pendant arm. Make sure the pendant swivels and slides easily.
<input type="checkbox"/>	5.	Make and check all the proper electrical connections from the pendant to the electric box. See the pendant and electric box wiring diagrams. Be sure to mount the cable cover to the left side of the pendant along with the servo cable bracket to ensure the cables stay in place. Note: the servo drive cables plug into the top and bottom connector, the middle connector is not used on the lathe.
<input type="checkbox"/>	6.	Slide the door or doors back and forth to make sure it slides smoothly.
<input type="checkbox"/>	7.	Remove the protective plastic covers from the headstock and the windows on the sliding doors.
<input type="checkbox"/>	8.	Turn on the power to the machine and to the pendant. Ensure that the 220V and 110V lines are plugged in.
<input type="checkbox"/>	9.	Check that oil is flowing when the spindle is on. Ensure that the oil and coolant pumps are rotating in the correct direction.
<input type="checkbox"/>	10.	Lubricate all the way surfaces and the ball screws. Under service codes press code 300 to operate the lube pump.
<input type="checkbox"/>	11.	Jog the saddle and cross slide back and forth until the way surfaces are well lubricated. Oil should be visible on all the way surfaces.
<input type="checkbox"/>	12.	Position the saddle and tailstock to the center of the bed for leveling.
<input type="checkbox"/>	13.	Check the level of the machine. The machine should be level to within 0.0008" longitudinally and 0.0005" transversely. Even though it is the responsibility of the customer, make any adjustments if necessary.
<input type="checkbox"/>	14.	Check the tailstock and the tailstock barrel locks by locking and unlocking. Run the tailstock barrel in and out to ensure proper function.
<input type="checkbox"/>	15.	For 1840SX, 1845SX and 2460SX, shift the headstock in low and high gear and verify that the control recognizes each gear. To run the spindle, a maximum RPM must be set in SETUP mode.
<input type="checkbox"/>	16.	Open and close the door and verify the door switch is functional. The control should display a message of "DOOR OPEN" in DRO mode when the door is open and it should disappear when the door is closed.
<input type="checkbox"/>	17.	Make sure the X and Z electronic handwheels and jogstick are functional.
<input type="checkbox"/>	18.	Check to make sure that both E-Stop buttons are functioning correctly.
<input type="checkbox"/>	19.	Perform Service Code 12, Feed Forward Constant.
<input type="checkbox"/>	20.	Perform Service Code 123 to calibrate the X and Z-axis using a 150mm standard.
<input type="checkbox"/>	21.	Perform Service Code 127 and 128 to manually calculate the backlash for the X and Z-axis.
<input type="checkbox"/>	22.	Check for positional accuracy and repeatability on the X and Z-axis using programs X LATHE REPEAT.PT4 and Z LATHE REPEAT.PT4 respectively. Positioning and repeatability values should be less than or = to 0.0005". Programs can be found on hard drive under the PT4 folder followed by the SWI TEST PROGRAMS folder. Note: the door must be closed to run these programs.
<input type="checkbox"/>	23.	Perform Service Code 100 in both directions for the X and Z-axis to verify that the feed rate shown on the display is at least 300 ipm.
<input type="checkbox"/>	24.	Run the spindle throughout each gear range at various speeds.
<input type="checkbox"/>	25.	Use accessory key on pendant and make sure the coolant pump turns on. The accessory key should be in the ON position in DRO to test.
<input type="checkbox"/>	26.	Check to make sure the limit switches are functioning properly where applicable.
<input type="checkbox"/>	27.	Cut the test part to check for taper. Measure the test bar and make any machine adjustments.

		If unacceptable taper is found, re-check the level before attempting to adjust the headstock.
<input type="checkbox"/>	28.	Wipe down the machine prior to leaving.

### **CAUTION!**

If the TRAK Lathe has a chuck mounted to the spindle, make sure the chuck is mounted properly to the spindle and also make sure the chuck jaws are engaged onto themselves or a piece of material before running the machine.

If the chuck was not purchased from SWI, check to make sure the chuck is rated for the maximum rpm of the machine. If it is not, do not run the machine above the chuck's maximum rated rpm.

If the chuck's rpm rate is unknown, do not run the chuck over 1000 rpm.

The chucks purchased from SWI are rated for the machine's maximum rpm.

## 2.6 ProtoTRAK SLX Control Hardware

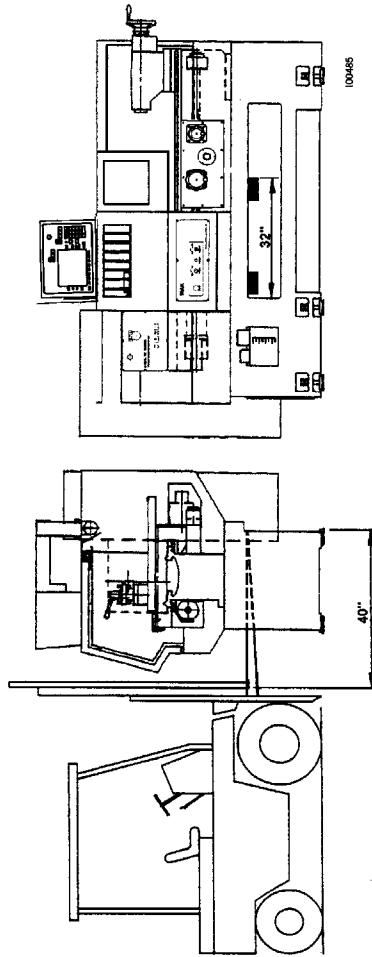
- 2-axis CNC, 2-axis DRO
- 400 mhz or faster PC-based processor
- 256 MB of RAM
- D.C. Servo Motors rated at 280 in-oz continuous torque for X axis and 560 in-oz for the Z-axis
- Precision ground ballscrews in the carriage and cross slide to ensure smooth accurate contours without backlash
- Feedrate override of programmed feedrate and rapid
- Programmable Spindle Speed
- Speed override of programmed spindle speed
- Polycarbonate sealed membrane and gasket sealed control enclosure to lock out contamination
- 10 ½" color LCD for clear presentation of prompts, status information and part graphics
- Modular design simplifies service and maximizes uptime
- 256 MB or larger compact flash drive
- Single floppy disk drive for additional part program storage
- Limit switches for the X and Z-axes that are installed to prevent crashes.
- Electronic handwheels on the X and Z-axes.
- 2 USB ports

## 2.7 Lifting and/or Moving the Machine

### CAUTION!

Proper equipment of sufficient capacity must be used when lifting and/or moving the machine.

To lift the machine, remove the chip pan. Place the forks of the forklift at least 32" apart as shown in the figure below. Be certain to lift the lathe toward the headstock.



**Figure 5 - Lifting the Lathe**

Lathe Model	Machine Weight	Approximate Machine Shipping Weight	Minimum Forklift Capacity
1540SX	4,100 Lbs	4,650 Lbs	10,000 Lbs
1630SX	2,875 Lbs	3,420 Lbs	6,000 Lbs
1630HSSX	2,875 Lbs	3,420 Lbs	6,000 Lbs
1840SX	4,500 Lbs	5,170 Lbs	10,000 Lbs
1845SX	3,285 Lbs	3,800 Lbs	8,000 Lbs
2460SX	5,700 Lbs	6,200 Lbs	10,000 Lbs

Do not attempt to lift this machine with a forklift having less than 10000 lb capacity for the 1540, 1840 and 2460, 6000 lb capacity for the 1630 and 8000 lb capacity for the 1845.

Do not remove the skid from the machine until it is brought to its final position, especially if the machine is to be moved on rollers.

Once the skid has been removed, place the machine in position on top of the eight (8) rest pads for the 2460SX, six (6) for the 1840SX and 1845SX and four (4) for the 1540SX and 1630SX.

For proper operation, the machine should be set on a substantial floor capable of supporting the weight safely. For the location of the bolt holes, size and recommended mounting, see Figures 1 - 4.

## 2.8 Cleaning

1. Remove rust protective coating from the machine before moving any slideways.
2. The coating is best removed with clean, dry rags. Do not use a cleaning solution that may damage the rubber way scrapers, plastic parts, or paint.

**WARNING!**

Do not use gasoline or other flammable cleaning agents for cleaning the machine.

3. It may be necessary to move back and forward and left and right the carriage and cross slide.

**CAUTION!**

Never move any of the above parts over ways that were not previously cleaned. Serious damage to the TURCITE surface of slideways can occur.

4. Be certain the carriage, cross slide and spindle move freely and smoothly over their entire length.

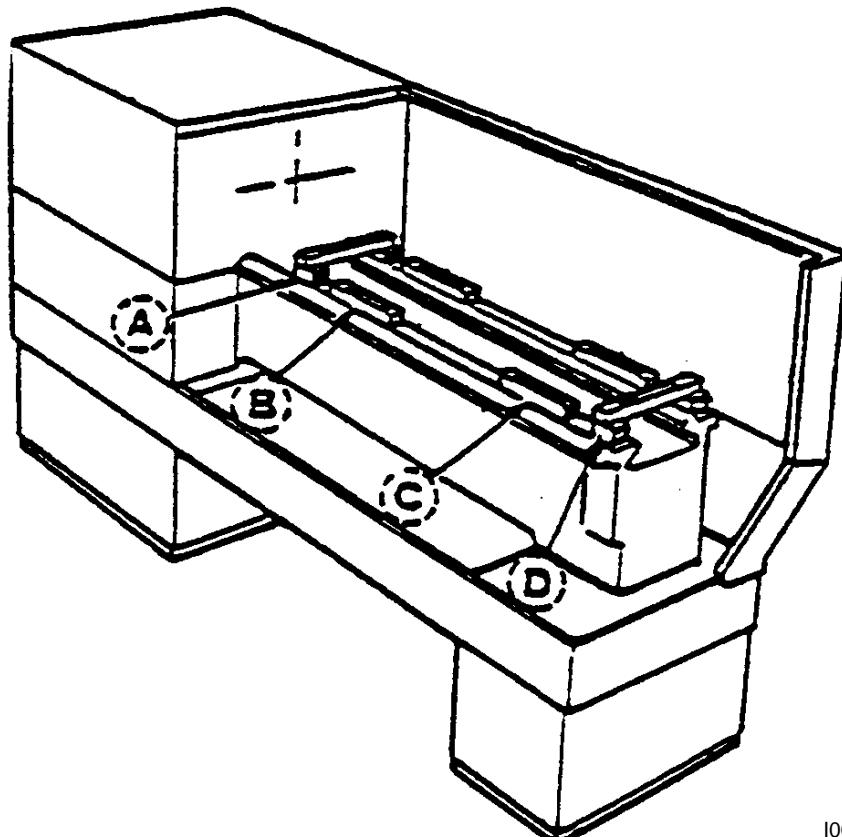
## 2.9 Leveling

The precision and durability of the lathe depends on it being leveled properly. Final inspection can be done only when the machine has been correctly leveled.

After the machine is in position on top of the 8/6/4 rest pads, it must be leveled by the use of the 8/6/4 leveling bolts. It is important that the lathe be level in order to produce accurate work. It may be necessary to lag bolt the machine in order to eliminate a small amount of twist.

*NOTE: The use of a precision level having a minimum accuracy of .0005" over 10.0" will be required.*

Move the saddle and tailstock to the center of the bed. To take a reading off the level longitudinally, place the level at each of the four (4) corners of the bedways (Figure 4, Positions B & C). To take a reading off the level transversely, place it on top of .7500" parallels at each end of the bedways (Figure 6 Positions A & D).



**Figure 6**  
**Leveling**

Using the four (4) interior leveling screws (see Figure 6) on the lathe base, level the bedways longitudinally within .0008" over the total length and transversely within .0005" inches. After leveling with the four (4) interior leveling screws, bring the exterior leveling screws on the lathe (see Figures 1 through 4) into contact with the leveling pads using care not to disturb the level. The 1540SX, 1630SX, and 1630HSSX lathes only have 4 leveling screws.

For a newly installed machine, check the level once every week. Once the foundation is rigid enough, then check it once per month.

## 2.10 Electrical Connection

The TRAK Lathe can only be configured for 208-240 volt 3 phase electricity. To run at 440V, you will need a step down transformer from 440V to 220V.

**DANGER!**

Be certain that 200-volt electricity (typical range 208 – 240V) is used only with a machine labeled 220 volts at the motor and at the electrics box on the back of the column.

**WARNING!**

440 Volts will damage expensive electrical components if machine is wired by mistake as 440 volts. These components are not covered under warranty.

**DANGER!**

The 208-240 volt line must originate from a dedicated and independent fused box with a manual shut-off lever. It is the responsibility of the purchaser to supply a wired box that meets all local codes and regulations.

The 208-240 volts wires to the machine through the electrical box located on the back of the column. The wire enters the main on/off switch through a hole on the top of the box. The ground wire should be connected at the top or bottom of the breaker bracket.

**DANGER!**

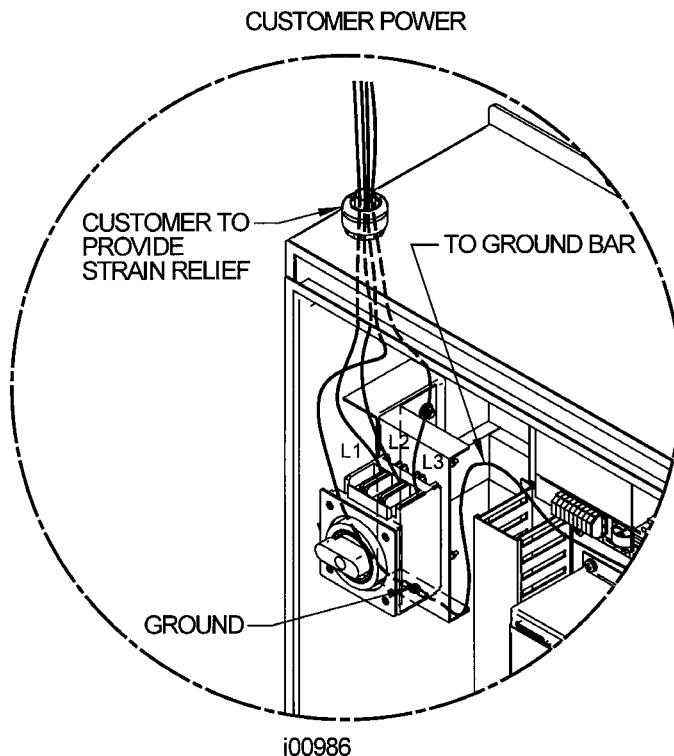
Only a qualified electrician should wire the 208-240 volt 3-phase electricity.

Southwestern Industries recommends the machine be earth grounded by driving a copper rod into the ground. It is the responsibility of the customer to install this rod.

### 2.10.1 Phase Converters

For those machines that will be run with a phase converter it must be a CNC rated rotary type rather than a static phase converters. CNC rated rotary phase converters allow for varying loads in the system. A CNC rated phase converter also regulates the new leg created so it does not end up being too high or low of a voltage. The electrical load on the machine will vary based on the type of cut taken and the speed of the motor. Static phase converters can only be used on machines with a non-varying load. Please contact your local phase converter distributor for precise sizing.

Model	Recommended Size of Phase Converter	Full-load Amp of Machine
1540SX	13 KVA	33
1630SX	9.5 KVA	25
1630HSSX	9.5 KVA	25
1840SX	13.5 KVA	35
1845SX	13 KVA	33
2460SX	17 KVA	45



**Figure 7**  
**Wiring the TRAK Lathe**

*NOTE: Please connect the incoming ground wire to copper ground bar on left side of cabinet*

## 2.11 Air Connection

The TRAK machines have an air hookup in the rear of the machine only if they come with a Dorian indexer option.

The air regulator is set to 90 psi at the factory for the indexer unit.

## 2.12 Mounting the Display Pendant

The ProtoTRAK SLX display pendant mounts a little bit different depending on which lathe you are installing it. The pendant is held with 4 socket head cap screws.

Make sure the pendant rotates freely from side to side (n/a to 1630).

Make all of the cable connections to the left side of the pendant and cover these cables with the cable cover provided with the machine.

## 2.13 Cable Interconnections

All cable interconnections are made at the factory except for those connecting to the pendant display. There are a total of 6 cables that need to be connected to the pendant.

With the main power to the machine turned off plug in the connectors that are bundled on the pendant arm. Each cable mates to only one connector on the pendant display back panel. Each cable is labeled with a sticker. Use the key on the pendant to match up the connectors with the correct port. The parallel port will have a key plugged into this port.

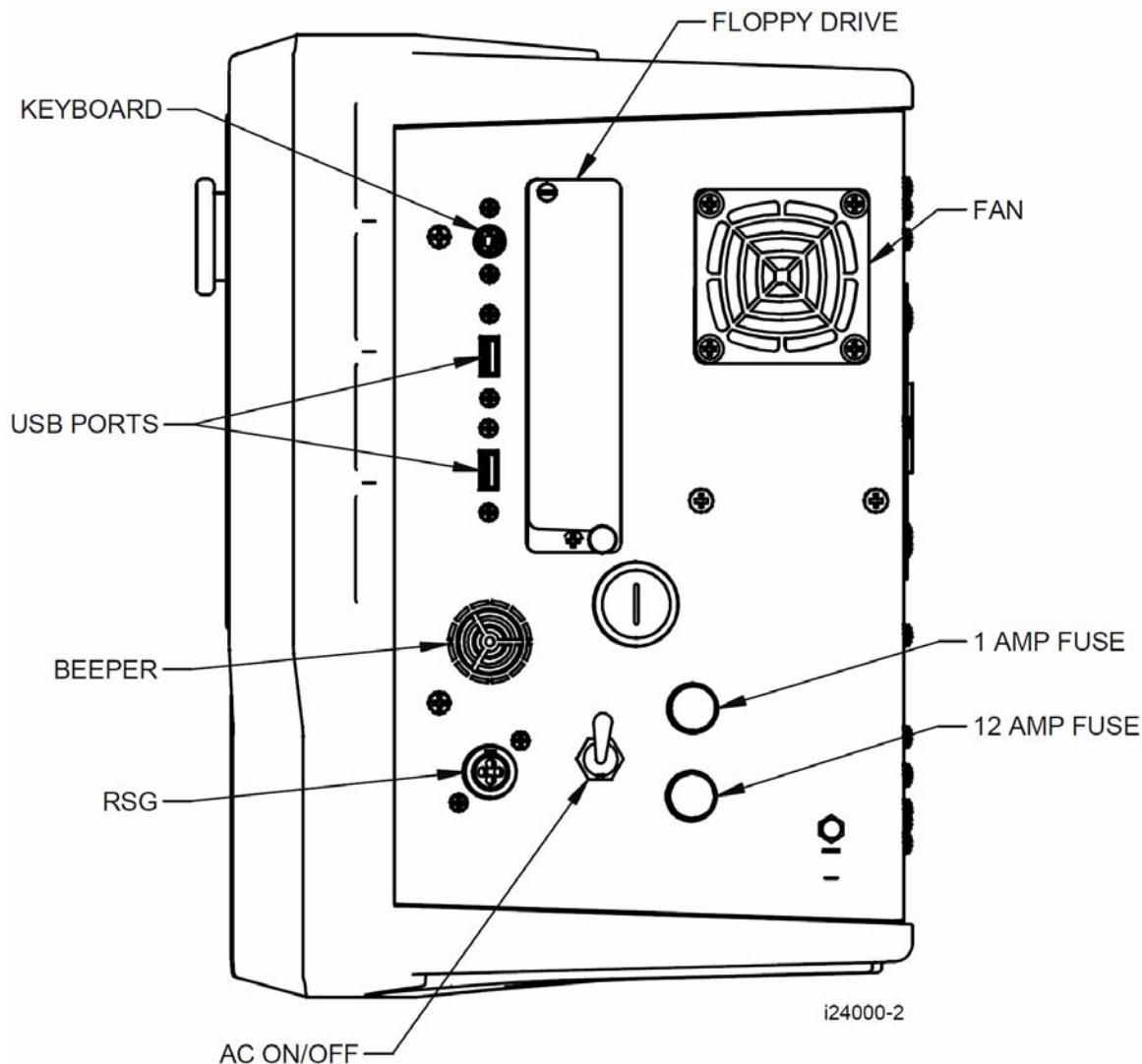
Make sure there is sufficient slack in the cables for when the pendant is rotated about the pendant arm. The following drawing describes all of the cable connections to the

pendant. Make sure to plug the servo cables into the X and Z ports on the pendant. The Y-axis port is left empty. These cables also have a bracket that is used to fasten the cable securely to the pendant. Failure to install this bracket could cause intermittent problems.

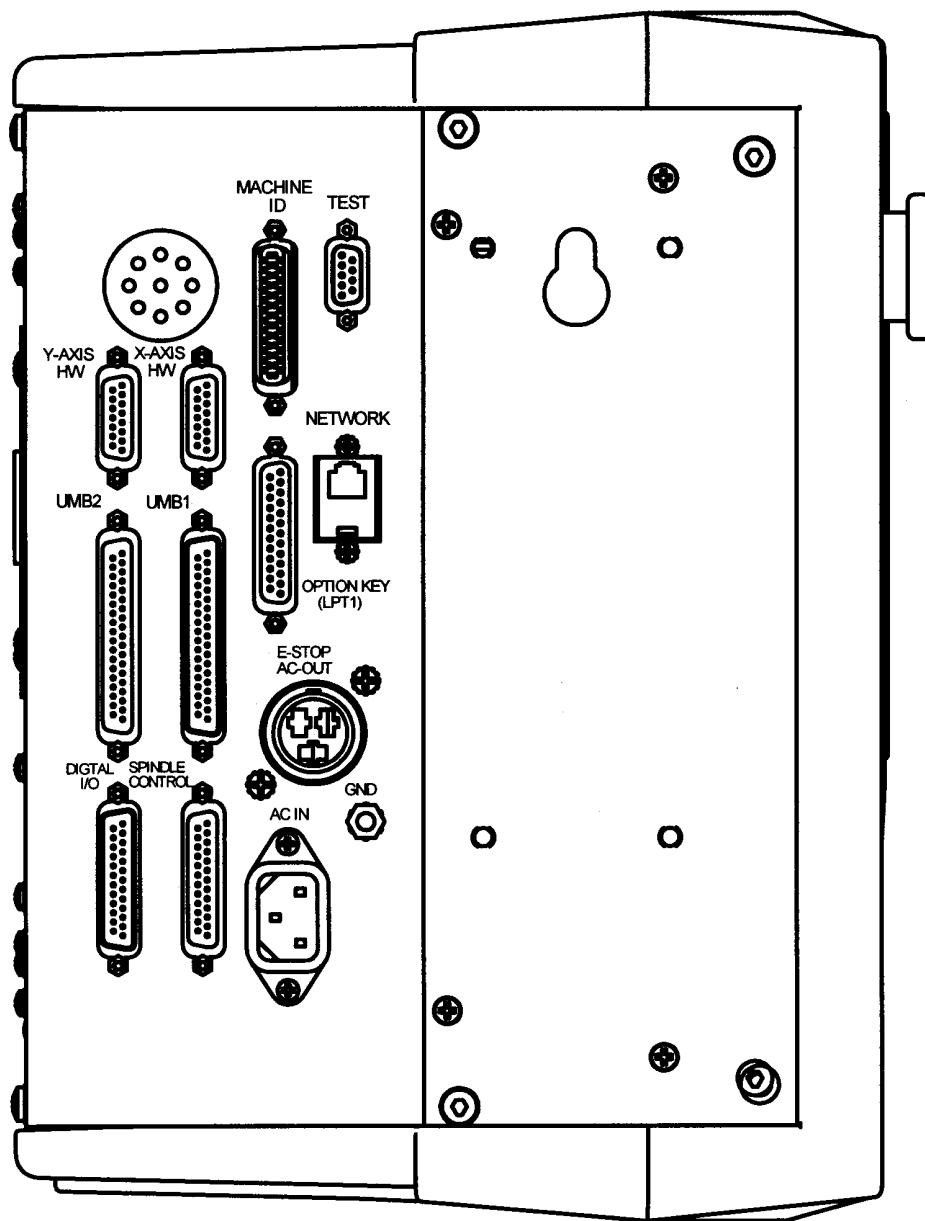
Make sure there is a hardware (option) key plugged into the parallel port of the pendant. This key activates any converters or options ordered. The part number for this key is 22648. The key must be programmed according to the type of machine it is on and the options ordered.

**CAUTION!**

Make sure the main power switch is turned off on the back of the electrical cabinet before plugging in the cables.

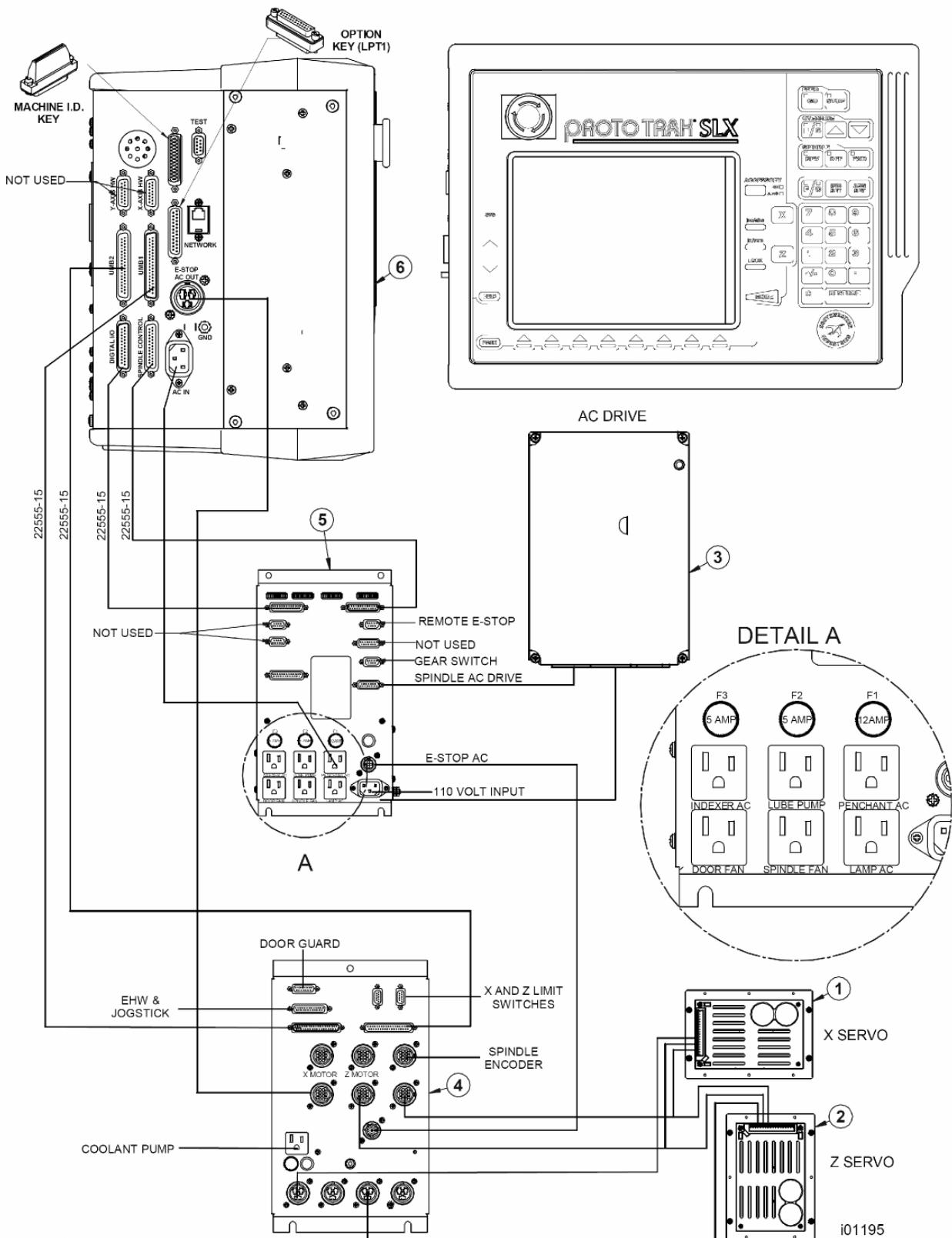


**Figure 8 - Pendant Right Side – P/N: 24000-3**



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**Figure 9 - Pendant Left Side**  
**P/N: 24000-3**



**Figure 10 - Pendant Cable Connections**

## Figure 10 Parts List

Item	1540SX	1630SX	1630HSSX	1840SX	1845SX	2460SX	Description
1	20201	20201	20201	20201	20201	20201	X Servo Amplifier
2	24101-7	20327-3	24101-7	20327-3	24101-7	24101-7	Z Servo Amplifier
3	25108-1540SX	25107-1630SX	25107-1630HS-SX	25108-1840SX	25108-2460SX	25111-2460SX	AC Drive
4	24999-2	24999-2	24999-2	24999-2	24999-2	24999-2	Cable Breakout Box
5	24042	24042	24042	24042	24042	24042	Spindle Control Module
6	24000-3	24000-3	24000-3	24000-3	24000-3	24000-3	Pendant

## 2.14 Lubrication

The TRAK Lathe auto lube system provides centralized automatic lubrication for the carriage, cross slide and ballscrews. The lube pump has a 2-liter reservoir filled with Mobil Vactra Oil No. 2.

### CAUTION!

Oil that is too heavy and viscous such as 50W or 90W oil can clog oil line tubing. Do not mix detergent type automotive or multi-purpose oils with the Mobil Vactra Oil No.2 used in this application.

The lube pump has electronic memory, which acts as an internal clock to keep track of the running time of the axis motor. Even when the spindle is turned off, the lube pump's internal clock will not reset. The interval between pump cycles is based on axis motor movement time.

### 2.14.1 Lube Pump Operation

The pumping output can be regulated electronically to control the Interval Time between pumping cycles, and the Discharge Time of each pumping cycle. The pump can also be run manually through a key found under service codes. The following describes the steps used to program the lube pump's Interval and Discharge times.

- **Setting Interval Time:** Service Code 301  
Press "Mode", "Set up", "Service Codes", "C" (Machine Setup), Code 301, and then enter the desired Interval time in minutes.
- **Setting Discharge Time:** Service Code 302  
Press "Mode", "Set up", "Service Codes", "C" (Machine Setup), Code 302, and then enter the desired Discharge time in seconds.
- **To manually Pump Oil:** Service Code 300  
Press "Mode", "Set up", "Service Codes", press "E", and then press Code 300 (Lubrication Pump Switch). The pump will pump oil for the amount of time programmed in Code 302. The spindle does not need to be turned on.

### 2.14.2 Factory Default Values

Interval Time - 60 min

Discharge Time - 15 sec

Discharge Pressure - Approximately 100 - 150psi

To adjust the amount of Discharge Pressure displayed on the lube pump gauge, loosen the jam nut and turn the adjustment screw located on the top right side of the lube pump while the lube pump is activated. To activate the lube pump use Service Code 300.

**CAUTION!**

Failure to properly lubricate the lathe will result in the premature failure of ball screws and sliding surfaces.

**CAUTION!**

Failure to manually activate the pump at the beginning of each day, or allowing the Auto Lube to run dry may cause severe damage to the lathe way surfaces and ballscrews.

The settings for the lube pump can be viewed by doing the following: press Service Codes, press "A" (software), press Code 313. This screen lists the values programmed for the cycle time and discharge time.

### **2.14.3 1840SX Headstock Oil Reservoir**

Before turning on the spindle, check to make sure the headstock oil reservoir is full. A site glass is located under the spindle cover. The reservoir holds approximately 3 gallons. If low, fill the site level with Mobil DTE 24 or equivalent oil through the plug located on the headstock cover.

### **2.14.4 1630 SX, 1845SX and 2460SX Headstock Oil Reservoir**

Oil will only be visible on the headstock site glass when the spindle is running. If oil is not flowing to the site glass when the spindle is on for either machine, stop running the spindle immediately and call for service. Failure to do so may ruin the spindle bearings. The 1840 and 2460 have an oil level site glass on the under the gear shift lever.

## **2.15 Cutting the Test Part (See Figure 11)**

### **Tools Required**

- Chuck
- Tool Post
- Tool Block
- Tool Holder, right-hand face and turn type

In order to accurately machine the test part, the gears and bearings in the headstock must be properly warmed and preloaded. This is accomplished by running the spindle for 15 to 25 minutes prior to cutting the test bar at 500 RPM.

Load an approximately 2" dia. aluminum bar into the spindle chuck. Load a standard right hand face and turning tool into a tool block. Align and lock the tool block onto the tool post. Set the depth of cut to a maximum of .002.

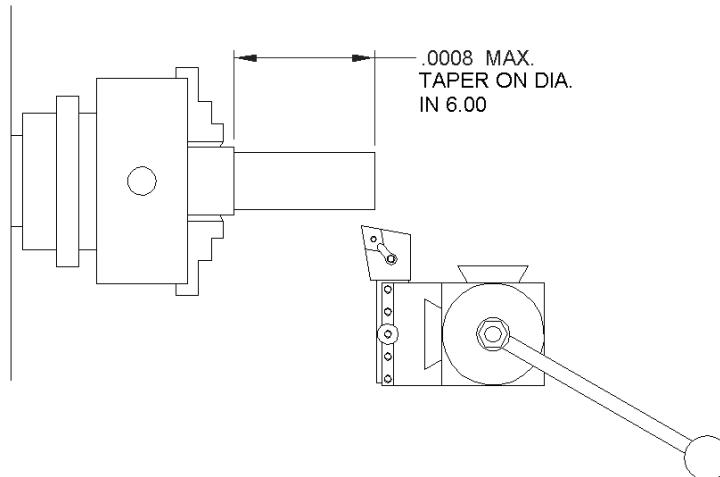
Set the spindle to an acceptable speed for turning the test piece. A speed range from 650 to 950 RPM is recommended.

## **2.16 Measurement of the Test Part**

### **Tools Required:**

- O.D. Micrometers with .0001" graduations

Using a calibrated O.D. micrometer with .0001" graduations, measure and record the generated dimension at a 6.00 spacing. The acceptable measurement of parallelism of spindle axis to carriage movement (taper of test piece) is .0008" in 6". If the taper measured is not acceptable, re-machine the test part and/or check and adjust the level of the machine, or adjust the headstock.



**Figure 11 – Test Part**

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## 2.17 Mounting of A2-4 and A2-5 Chucks

The 1540SX and 1630HSSX lathes have A2-5 and A2-4 spindles respectively and require chucks of this type. Use the following procedure to mount this style chuck.

Bolt the chuck adapter plate to the spindle with (4) M10 X 50 SHCS. The key on the spindle orients the adaptor.

Then bolt the chuck to the adaptor plate with (3) M8 x 70 SHCS. The chucks SWI provides are self-aligning and need no adjustment.

**WARNING!**

Use only chucks which are rated to the maximum RPM of the lathe.

## 3.0 Troubleshooting by Symptom

Use this section to begin the process of resolving a service problem. Each problem type is described in a few words and then more fully described in an explanatory paragraph. Following this is a chart that directs in the most logical steps.

### 3.1 Problems Relating to Machining Results

#### 3.1.1 Poor Finish

Poor finish can be caused by a number of variables including: speeds, feeds, tooling, machine setup and chatter.

Perform the following Service Codes:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 12** Feed Forward Constant.
- **Code 127** Measures backlash in the system.
- **Code 128** Enter backlash compensation.

Possible Cause	Check This
Inadequate or no Lubrication to Ballscrews and Way surfaces	Make sure all the Way surfaces are getting proper lubrication. If not, check to make sure that the lube pump is functioning properly. Also check for any pinched or blocked oil lines.
X & Z-axis Drive Trains are loose	Check Repeatability using the Repeatability and Positional Accuracy procedure. Step by step, carefully inspect the Drive Train for any looseness. It may be necessary to disassemble and then reassemble the Drive Train. See Mechanical Drive Train (X, Z) Section 4.2
Way surfaces are pocked, scarred, or excessively worn	Visually check the condition of all the Way surfaces. For machines that may have excessively worn Way surfaces you may need to adjust the Gibs in this area. This will affect performance when using the machine outside of this area. Check lubrication to affected areas.
Machine set-up problem	Machine's feet are not equally supporting weight. See Leveling, Section 2.9
Tooling problem	Improper tooling, Work piece not properly supported speeds too fast, Feeds too slow. See Machine Tool & Setup, Section 4.1
X gib too tight or loose	See Gib Adjustment, Section 5.2.1
Loose bearing problem	Looseness in the spindle bearings. Adjust spindle preload. Ball screw misalignment, See Mechanical Drive Train (X, Z), Section 4.2. See Spindle Bearing Preload, Section 5.1.17

### 3.1.2 Turning Diameters Out of Round

Parts are not round within .0004" TIR for 2460, .0006" TIR for the 1630SX, 1840SX and 1845SX, and 0.0002" for the 1630HSSX. Runout for the spindle is best measured by using a .0001" dial indicator and mounting to the inside taper of the spindle. Rotate the spindle and measure the indicator movement.

*NOTE: The typical geared head engine lathe is not capable of more precise diameters. Careful adjustments to this turning machine will insure to maintain this accuracy. Better accuracy should not be expected from a lathe of this class.*

Perform the following service code and procedures:

Possible Cause	Check This
Tooling problem	Improper tooling, workpiece not properly supported. See Machine Tool & Setup, Section 4.1
Loose bearing problem	Looseness in the spindle bearings. See Mechanical Drive Train (X, Z), Section 4.2. Spindle bearing not preloaded correctly. Reseat bearing and preload. See Adjust Spindle Bearing Preload, Section 5.1.17

### 3.1.3 Cutting Taper

Parts are considered to be cutting on a taper if there is a difference in diameter of more than .0008" over 6 inches. This is best measured by using a .0001" micrometer.

Perform the following service code and procedure:

- Code 12     Determines the feed forward constant for the axis motors.

Possible Cause	Check This
Machine set-up problem	Machine not leveled properly See Leveling - Section 2.9
Tooling problem	Improper tooling; Work piece not properly supported. Use steady rest or follow rest, reduce overhang from chuck headstock or tailstock.
Looseness in the gib or misalignment of ball screw	Gib adjustment. See Gib Adjustment - Section 5.2.1 See Z Ball screw Alignment - Section 5.1.15
Loose bearing problem	Looseness in the spindle bearings. See Mechanical Drive Train (X, Z) - 4.2 See Spindle Bearing Preload - Section 5.1.17
Headstock and/or tailstock not aligned	See Adjust Headstock for Taper - Section 5.1.16 To adjust tailstock from side to side, adjust grub screw. See Section 5.1.18

### 3.1.4 Parts Have Incorrect Dimensions

Parts are being machined with dimensions that are different than those programmed.

Typical accuracy expectations should be:

- Parts should be round within .0004" TIR on 2460SX, .0006" TIR on 1630SX, 1840SX and 1845SX and 0.0002" on 1630HSSX.
- The acceptable measurement of parallelism of spindle axis to carriage movement is .0008" over 6 inches.

### 3.1.4.1 Every Part Has the Same Error

Possible Cause	Check This
Programming Error	Programmed dimensions not correct. Check absolute and incremental values.
Machine & Setup Related	See Machine Tool & Setup - 4.1

### 3.1.4.2 Errors are Random or Accumulate in Size over the Part Run

Possible Cause	Check This
Machining Setup	See Machine Tool & Setup - 4.1
Looseness in the Drive Train, ball nut loose in yoke, split nut loose, yoke loose	See Mechanical Drive Train (X, Z) - 4.2

## 3.1.5 Threading Problems

Threads can be cut with and an unlimited number of pitches and up to 10 leads.

To reduce the relief area when threading up to a shoulder the spindle speed should be reduced as much as possible. The slower the speed of the spindle, the closer the cutting tool can come to the end of the programmed thread before it pulls out and retracts. If a nut must be turned all the way up to a shoulder, machine a relief area behind the last thread.

*NOTE: No machine can thread up to a shoulder and instantaneously pull out.*

Perform the following service codes and procedures:

- Code 12 Determines the feed forward constant for the axis motors.
- Code 133 Spindle encoder test

### 3.1.5.1 Cross Threading

Threaded parts are cross-threaded after completion of the threading event.

Possible Cause	Check This
Looseness in the Gib	Gib adjustment See Gib Adjustment - Section 5.2.1
Looseness in the drive train	The drive train Diagnostics See Mechanical Drive Train (X, Z) - Section 4.2
Failure of the spindle encoder Run service code 133 to check if the encoder counts.	Replace spindle encoder See Spindle Encoder replacement - Section 5.1.9

### 3.1.5.2 Not Threading

The machine will not cut a thread at all.

Possible Cause	Check This
Spindle speed too fast	Slow down spindle speed.
Failure of the spindle encoder Run service code 133 to check if the encoder counts.	Replace spindle encoder See Spindle Encoder replacement - Section 5.1.9
Broken or slipping encoder coupling	Check and replace as necessary
Broken or loose belt on 1630HSSX lathe only	Check belt tension

## 3.2 Problems Regarding the Motion of the Machine

### 3.2.1 Run Away Axis

The axis makes an unwanted move at rapid speed in one direction and faults out. This is usually caused by an encoder signal being interrupted.

Perform the following Service Codes:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.

Possible Cause	Check This
The home position or tools are not set correctly	See the Controls Programming, Operations and Care manual.
Bad Motor Encoder	See Motor diagnostics Section 4.4

### 3.2.2 Slow Down Axis

The axis slows down and moves at a feedrate that is lower than rapid or than the programmed feedrate.

Perform the following Service Codes:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.
- **Code 129** Set's the maximum allowable arc accuracy error. This applies to arcs only.

Possible Cause	Check This
The maximum allowable Arc Accuracy is set too low.	This value will only slow down the machine during arc moves. The factory default is set at 0.005". Perform Code 129 to check or change this value. See Service Codes section. Values lower than 0.005" may reduce the feedrate.
Incoming AC voltage is inadequate	Perform Code 100. See Service Codes - Section 4.8 and Electrical Section 4.6
Inadequate or no Lubrication to Ballscrews and Way surfaces	Make sure all the Way surfaces are getting proper lubrication. If not, check to make sure that the lube pump is functioning properly. Also check for any pinched or blocked oil lines. See Lubrication Section 4.1.3
X and Z-axis Gibs are not adjusted properly	Check the adjustment of the X and Z-axis Gibs using the X and Z-axis Gib adjustment procedures.
Binding in the Drive Train	Check Repeatability using the Repeatability and Positional Accuracy procedure. Check the torque reading of the Drive Train. Step by step, carefully inspect the Drive Train for any binding. It may be necessary to disassemble and then reassemble the Drive Train. See Mechanical Drive Train (X, Z) Section 4.2
Servo Drive failure	See Servo Drive Section 4.5
Motor failure	See Motor Section 4.4

### 3.2.3 Axis Motor Motion Is Not Smooth

While under motor power, the motion is not smooth. The motion appears to be "rough" or jerky".

Perform the following Service Codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 12** Feed Forward Constant.
- **Code 127** Measure's the backlash in the system.
- **Code 128** Enter backlash compensation.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.

Possible Cause	Check This
X and Z-axis Gibs are not adjusted properly	Check the adjustment of the X and Z-axis Gibs using the X and Z-axis Gib adjustment procedures.
Calibration or Backlash problem	Recalibrate the machine. Reset the Backlash. Check Repeatability and Positional Accuracy. See Calibration & Backlash Constants section.
Binding in the Drive Train	Check Repeatability using the Repeatability and Positional Accuracy procedure. Check the torque reading of the Drive Train. Step by step, carefully inspect the Drive Train for any binding. It may be necessary to disassemble and then reassemble the Drive Train. See Mechanical Drive Train (X, Z) Section 4.2

### 3.2.4 Vibration in Motion

While axis is moving there is vibration or noise coming from the X or Z-axis.

Perform the following Service Codes and procedures:

- **Code 12** Feed Forward Constant.
- **Code 127** Measure's the backlash in the system.
- **Code 128** Enter backlash compensation.

Possible Cause	Check This
Too much backlash entered in Code 128.	Recheck the machines backlash.
Inadequate or no Lubrication to Ballscrews and Way surfaces	Make sure all the Way surfaces are getting proper lubrication. If not, check to make sure that the lube pump is functioning properly. Also check for any pinched or blocked oil lines. See Lubrication section
X Gib is not making good contact.	Pull gibbs out and mark with a blue die to check where the gibbs are making contact. It is recommended that the gibbs uniformly contact at least 80% of the surface.
Binding or looseness in the Drive Train	Check Repeatability using the Repeatability and Positional Accuracy procedure. Check the torque reading of the Drive Train. Step by step, carefully inspect the Drive Train for any binding or looseness. It may be necessary to disassemble and then reassemble the Drive Train. See Mechanical Drive Train (X, Z) Section 4.2
Axis Motor belt too tight.	Loosen belt.
Misalignment of ball screw	See Mechanical Drive Train (X, Z) Section 4.2

### 3.3 Problems Relating to the Operation of the Control

#### 3.3.1 Display Blanks

The display is completely blank.

Possible Cause	Check This
Screen saver has been activated	Press any key to turn back on. All LED keys on pendant will blink when the screen saver is on. Press any key to deactivate. Hitting this key will not activate any feature on the control.
The system has shut down	Turn off the power switch off; check the computer/pendant fuses and cable connections. See Electrical Section 4.6
Poor cable connection from Computer Module to LCD (Liquid Crystal Display)	Double-check the connection from the computer module to the LCD.
Fuse blown in pendant	Remove fuse and check continuity
Computer/Pendant failed	See Computer/Pendant Section 4.3

#### 3.3.2 Bad Picture on the Display

The display has strange characters, horizontal bars or other unfamiliar images, or the display continually rolls.

Possible Cause	Check This
Poor cable connection from Computer Module to LCD (Liquid Crystal Display)	Check connections on computer module.
Computer/Pendant failed	See Computer/Pendant Section 4.3

#### 3.3.3 Keyboard Lockup

The screen display is normal, but the system will not respond to key presses.

Perform the following Service Code and procedures:

- **Code 81** press each key on the pendant. The screen will display a keypad that signifies if a key is working. The pendant will also beep.

Possible Cause	Check This
Voltage drop/spike has occurred	Shut down the system and wait 10 seconds to reboot the system.
Remote Stop-Go (RSG) switch has a short (if connected)	Remove the RSG. Turn the system off and then on again. If the problem goes away and then re-appears when the RSG is plugged-in, replace the RSG.
Poor cable connections from the Computer Module to the Distribution Board and from the Distribution Board to the Keyboard	Re-seat cable connectors by pulling out and pushing back in.
Computer/Pendant failed	See Computer/Pendant Section 4.3

### 3.3.4 Fault X or Z

The program run or jogging operation is interrupted with a Fault Message on the display.

Perform the following Service Codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 12** Feed Forward Constant
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.

Possible Cause	Check This
Servo cables at pendant switched around.	Make sure during an installation the X and Z servo cables at the pendant are in the correct ports.
X and Z-axis Gibs are adjusted extremely tight	Check the adjustment of the X and Z-axis Gibs using the X and Z-axis Gib adjustment procedures. See X and Z-axis Gib Adjustments Section 5.2.1
Excessive friction in the slideways	See Machine Tool & Setup Section 4.1
Binding or looseness in the Drive Train	See Mechanical Drive Train (X, Z) Section 4.2
Incoming electrical power	Incoming voltage. See Electrical Section 4.6
Servo Drive failure	See Servo Driver - Section 4.5
Motor failure	See Motor diagnostics, Section 4.4
Computer/Pendant failure	See Computer/Pendant diagnostics, Section 4.3

### 3.3.5 Problems Reading the Floppy Disk; Programs Not Saved Properly

The floppy drive will not read or write programs from a disk.

Possible Cause	Check This
Improper Boot-up	Shut down the system and wait 10 seconds before rebooting
Floppy Disk failure	The Floppy Disk may be bad. See if the Floppy Disk can be read by a Personal Computer. Does the green light on the floppy drive come on when you access the disk? If so, power is getting to the floppy drive. If not check connections of floppy drive inside the computer module. See Computer/Pendant Section 4.3 for more information.
Floppy Disk full	Put the Floppy Disk into a Personal Computer to see how many bytes remain. A floppy holds 1.44 MB.

### 3.3.6 System Will Not Turn On or Boot-Up

Nothing happens when the switch is turned on or the system does not boot-up.

Possible Cause	Check This
Main Disconnect switch is off	Check the Main Disconnect switch.
110V switch on side of electrical cabinet is off	Check the Electrical Cabinet On/Off switch
Pendant On/Off switch is Off.	Check the Pendant On/Off switch
Fuse blown in pendant or the electrical cabinet	Remove fuses and check continuity.
Bad cable from the 110VAC Power Module to the Pendant.	Using a Voltmeter, check the out coming voltage from the 110VAC Power Cable to the Pendant. See Electrical Section 4.6
Flash Drive Failure	When the Computer Module starts the boot-up process, look at the 8 <sup>th</sup> line on the Display Screen. If the Mother Board of the Computer Module is communicating with the Flash Drive you will see "Detecting IDE Primary Master". If the Mother Board of the Computer Module is not communicating with the Flash Drive you will see "Detecting IDE Primary Master ... None". Also, check the wiring connection between the Flash Drive and the Mother Board. See Computer/Pendant diagnostics Section 4.3
Computer/Pendant has failed	See Computer/Pendant diagnostics Section 4.3
110V line is not plugged in	Check incoming 110V power source to electrical cabinet

### 3.3.7 System Reboots by Itself

During operation, the screen suddenly blanks and then shows that the system has begun the boot-up sequence.

Possible Cause	Check This
Interruption of 110 V power to pendant	Using a Voltmeter, check the incoming 110 VAC to the machine.
Poor wiring and cable connections	Check for any loose wiring.
Computer/Pendant failed	See Computer/Pendant diagnostics Section 4.3

### 3.3.8 System Shuts Off

During operation, the system shuts off and will not turn back on.

Possible Cause	Check This
Fuse blown in pendant	Remove fuse and check continuity
Interruption of 110 V power to pendant	Using a Voltmeter, check the incoming 110 VAC to the machine.
Poor wiring and cable connections	Check for any loose wiring. Also, check the 110 VAC Power Cable connection from the 110 VAC Power Strip to the Pendant. See Electrical Section 4.6
Bad cable from the 110 VAC Power Module to the Pendant.	Using a Voltmeter, check the out coming voltage from the 110 VAC Power Cable to the Pendant. See Electrical Section 4.6
Flash drive failure	Remove and reset flash disk. The flash disk is inside the computer module. See Section 5.1.4
Computer/Pendant has failed	See Computer/Pendant diagnostics Section 4.3

### 3.3.9 Will Not Hold Calibration

The control will not hold calibration. Go to the "Configuration Values" screen and write down the calibration values for the motor encoders. The calibration values are written in Hexadecimal. Recalibrate the system and see if the values change. Turn the system off and on and see if the values are held.

Perform the following service codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 313** Configuration Values.
- **Code 123** Calibration Mode.

Possible Cause	Check This
Not saving Calibration values	Replace Computer/Pendant module. See Computer/Pendant

If calibration factors are being saved, but the measurements are not repeating or are not accurate:

- See Measurements Are Not Repeating (Section 3.4.1)
- See Measurements Are Not Accurate (Section 3.4.2)

### 3.3.10 E-Stop Error

The E-Stop turns the power off to the axis and spindle motors.

- For the axis motors this is done by stopping 110V power from reaching the cable breakout box through the use of a relay in the pendant. The AC E-stop out connector on the pendant should not have 110 volts coming out of it when the e-stop is pressed.
- For the spindle motor, this is done by turning a relay off in the spindle control box. The 5-volt signal that energizes this relay comes down to the spindle control box through the spindle control cable on the pendant. When the relay opens, the run signal to the AC drive is disrupted and the AC drive will produce a fault and turn the spindle off.

Once power reaches the cable breakout box it distributes power to the axis motors, auxiliary functions. If power does not reach the cable breakout box then none of these functions will work.

If the E-Stop button is depressed, and no message is displayed on the screen, then either the E-Stop button or the Computer Module is at fault. The 1840, 1845 & 2460 have two E-Stop buttons. One button is located on the pendant. The second button is on the door of the 1840 and is on the carriage of the 1845 and 2460. The 1630 has only one E-stop button, which is on the pendant.

If the e-stop at the pendant works, but the remote e-stop does not, then the spindle control box is bad and should be replaced.

Possible Cause	Check This
Faulty E-Stop switch	Check the cable connections from the computer module to the E-Stop switch. Check the E-Stop switch for functionality.
Bad pendant	Does 110 V power come out of the cable breakout box power cord on the pendant? If yes, and the screen has an E-stop message, replace the pendant.
Poor cable connection	Check spindle control cable connection at the pendant and spindle control box.

### 3.3.11 Limit Switch Error (2460 only)

Limit switches are installed on the carriage and cross slide to prevent serious damage to the machine in the event of a crash. Each individual limit switch has two separate plungers. One plunger is responsible for triggering in the positive direction, while the other plunger is responsible for triggering in the negative direction. The limit switch will trigger when carriage or cross slide moves past the available travel. In the event a limit switch is triggered, the following error message will be displayed.

**Critical Error 5252: Limit Switch Active**  
The X-axis Limit Switch is activated.  
Use the Handwheels to Move off the Switch.

When this happens, the control will not allow the operator to continue to manually move the carriage or cross slide in the same direction.

To return the machine to its normal state of operation, perform the following procedure:

1. Use the electronic hand wheel to move the carriage or cross slide off the limit switch.
2. Press the "Mode" or "Return" key to reset the control.
3. Press the "DRO" key to enable the machine to once again jog.

Perform the following service code and procedure:

- **Code 312** Toggles limit switches on/off – this will turn the limit switches on or off. This is a temporary fix for the problem and allows the user to run the machine until a replacement part can be installed. If the limit switches are turned off and a problem occurs because of a crash, this will not be covered under warranty.

Possible Cause	Check This
Limit Switches are triggered	Reset the Limit Switches using the procedures described above.
Poor Limit Switch Cable connection	Check for any pins that are loose, pushed in, or bent. Verify that there is a good connection between the cable and the Auxiliary Module.
Limit Switch failure	Turn off all power to the machine. For the positive direction, check for continuity between pins 1 and 6 on the Limit Switch cable connector. You should hear a continuous beep from your Multi-meter. By hand, manually depress the plunger on the limit switch responsible for when the table, saddle, or ram is moving in the positive direction. The beep from your Multi-meter should stop beeping. This means the Limit Switch is triggering properly for the positive direction. For the negative direction, repeat the same procedure as described above using pins 5 and 9 on the Limit Switch cable connector.
Try this Switch 2 limit switch cables on the auxiliary module in the electrics box.	Does the limit switch problem move to the other axis? If it does then the switch is most likely the problem. If it stays with the original axis then it could be the auxiliary module or computer module. See below.
Limit switch jumpers in cable breakout box are making poor contact	Remove and reseat jumpers

## 3.4 Problem with the Measurements

### 3.4.1 X & Z-Axis Measurements Do Not Repeat

With a dial indicator mounted to the spindle, touch off a fixed surface either in the X or Z-axis direction and then set the DRO equal to 0. Crank away several inches and then touch off again at the same place. If the reading has not returned to 0 on the DRO, zero the display and repeat the procedure. If the measurement does not repeat, you have a repeatability problem that must be resolved.

Expected repeatability numbers should be 0.0005" or less.

Possible Cause	Check This
Machine Tool & Setup problem	Check for any looseness in the setup. See Machine Tool & Setup Section 4.1
X and Z-axis Gibs are loose	Check the adjustment of the X and Z-axis Gibs using the X and Z-axis Gib adjustment procedures.
X and Z-axis Drive Trains are loose	Check Repeatability using the Repeatability and Positional Accuracy procedure. Step by step, carefully inspect the Drive Train for any looseness. It may be necessary to disassemble and then reassemble the Drive Train. See Mechanical Drive Train (X, Z) Section 4.2
Encoder Disk or Reader Head on motor are loose	Swap the motor in question with a known good motor. If the symptom stays with the motor in question, then replace the motor. If not, then the motor is not at fault and something else is causing the problem.

### 3.4.2 X & Z-Axis Measurements Are Not Accurate

Measurements repeat, but with a dial indicator mounted to the spindle, traversing the length of a gage block or some other measurement standard, the measurement is not accurate.

*Note: If your part has incorrect dimensions, see Parts Have Incorrect Dimensions, Section 3.1.4.*

*Note: First check for repeatability of the DRO: With a dial indicator touch off a fixed surface either in the X or Z-axis direction and set the DRO equal to 0. Crank away several inches and touch off again at the same place. If the reading has not returned to 0 on the DRO, zero the display and repeat the procedure. If the measurement does not repeat, you have a repeatability problem that must be resolved before the accuracy problem can be resolved. See Measurements That Do Not Repeat, Section 3.4.1.*

Possible Cause	Do This
The Calibration is incorrect	Recalibrate the machine. See Calibration & Backlash Constants
Incorrect backlash values	If the machine does not repeat bi-directionally check the backlash on the axis in question. See Section 5.2.2.

### 3.4.3 The DRO Is Not Counting

The DRO for one axis is not counting when an axis is moved. Often times if this is the case the axis will fault. See Section 4.4.3.

Perform the following Service Codes:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 100** Axis open loop test. Used to check the maximum feedrate of an axis and if the encoders are counting.
- **Code 132** Electronic handwheel test.
- **Code 131** Manual DRO test.

Possible Cause	Check This
Electronic handwheel failure	Each handwheel should count 0.100" & 0.020" respectively for Z and X in fine mode, and count 0.400" & 0.100" in course mode.
Servo driver failure	Check the LED status on the axis in question. See Servo driver Section 4.5
Motor Encoder not counting	See Motor diagnostics
Computer/Pendant failure	See Computer/Pendant diagnostics

### 3.4.4 X & Z-Axis DRO Counting in Wrong Direction

The DRO is counting in the wrong direction.

The positive directions for each axis are:

- **X-axis** – cross slide moves toward the operator.
- **Z-axis** – carriage moves toward tailstock.

Perform the following service codes and procedures:

- **Code 33** Software Identification. This is needed if you call SWI Customer Service.
- **Code 313** Check the line that specifies the product.

If the product does not match the machine then the machine ID key will need to be replaced.

### 3.4.5 X & Z-Axis Electric Handwheels Count in Wrong Direction

The Electric Handwheels count in the wrong direction.

The positive directions for each Electric Handwheel are:

- **X-axis** - Electric Handwheel turns counterclockwise
- **Z-axis** - Electric Handwheel turns clockwise

Perform the following service codes and procedures:

- **Code 308** Reverse X-axis Handwheel Direction
- **Code 310** Reverse Z-axis Handwheel Direction

## 3.5 Problems with the Machine Tool

### 3.5.1 Spindle Stalls or Turns-Off During Machining

During machining, the spindle turns off and loses power. First check incoming voltage and connections.

Possible Cause	Check This
Machine Tool and Setup problem	Check the type of material being cut, type and size of cutting tool, RPM, and Feed rate. Also check the condition of the cutter to verify that the cutter is not dull. See Machine Tool & Setup Section 4.1
Motor drive Belt is slipping	Check the alignment, condition, and tension of the Drive Belt.
Cut more than the machine is capable	Check speeds, feeds and depth of cut
Spindle Drive Thermal Overload Relay has tripped	IOUT - Current Out (located on the Spindle Drive). When the Overload Relay is enabled, an "oL1" error occurs shutting off the Spindle Drive. The harder the Spindle Motor works trying to make heavy cuts, the more current the Spindle Motor utilizes. This can be caused by a cut so large that it exceeds the machine capability, or a problem with the spindle motor or AC drive.
Spindle Drive parameters are not correct	May need to re-download the Spindle Drive parameters. Contact Customer Service for assistance.

### 3.5.2 Spindle Motor Hums or Will Not Run

The spindle motor makes a constant humming noise during operation or will not turn on.

Possible Cause	Check This
Wrong voltage	Check the 220V voltage to the machine
Poor wiring connections	Check all the wiring connections to the electric's box.
Defective cable connections	Check all cable connections
Spindle Motor is bad	Check the resistance of the Spindle Motor windings on the Spindle Motor between L1 & L2, L2 & L3, and L1 & L3, using an Ohmmeter. The resistance should range from ".7 to 1.8 Ohm". If the Ohmmeter reads "0 Ohms" or "OL", then replace Spindle Motor. Next, check the resistance between L1 & Ground, L2 & Ground, and L3 & Ground, using an Ohmmeter. The resistance should read "OL". If not then replace Spindle Motor.

### 3.5.3 Spindle Runs Backwards

The spindle motor runs in the opposite direction. The spindle should always spin in the clockwise direction when the forward key on the pendant is pressed.

Possible Cause	Check This
3-Phase wires backwards	Need to switch any 2 of the 3 wires either coming out of the Spindle Drive (T1, T2, and T3) or going into the Spindle Motor (U, V, and W). Caution: Be sure to shut off all power to the machine before attempting to switch any wires.

### 3.5.4 Excess Gearbox Noise

Gearbox noise is louder than normal. Take note of the gear where the noise is most noticeable. Remove the gearbox lid and try to isolate where the noise is coming from.

Possible Cause	Check This
Headstock manual oil pump failure	Make sure oil is flowing in the site glass. The oil pump is run off a gear in the headstock.
Shift level out of position. Gears are not mating properly.	Move the shift lever in and out. Turn off spindle and put back in gear. Adjust the gear cluster in question to make sure it is mating properly.
Lack of lubrication to gear train	Check level of oil in gearbox
Spindle bearing not being lubricated properly, worn bearing	Check to make sure oil is finding its way to the bearings.
Spindle preload loose	Tighten spindle preload on bearing. The spindle preload should be approximately 10-15 in/lbs.

### 3.5.5 Headstock is Leaking Oil

A Form-A-Gasket sealant should be used to seal any leaking areas. Make sure the sealant fills the leaking area thoroughly. Sealant must cure for 24 hours for best results.

#### 3.5.5.1 Leaking Oil from Rear of Gearbox

Possible Cause	Check This
Leaking from behind belt drive pulley	Replace shaft seal - o-rings or gaskets.
Oil leaking from behind the spindle encoder.	Remove spindle encoder and check seal.
Oil leaking from the rear bearing assembly.	Make sure the rear backing plate is mounted correctly. There should be a tapped hole located at the 12 o'clock position. If the tapped hole is located at the 6 o'clock position the seal will leak.

#### 3.5.5.2 Leaking Oil From Front of Gearbox

Possible Cause	Check This
Oil leaking from seal between lid and gearbox	Remove gearbox lid and reseal. Thoroughly clean lid before resealing. Make sure the front backing plate matches up with the seal behind the cover.

### 3.5.6 Tailstock Barrel is Stiff

The tailstock barrel is stiff or not smooth moving through its travel. The tailstock barrel subassembly jams inside the tailstock

Possible Cause	Check This
Misalignment of tailstock housing	Realign bearing housing and tailstock screw. Loosen screw support and realign.
Too much grease.	Disassemble and remove excess grease.
Vernier Dial is binding or rubbing on screw support.	Remove dial and machine off a couple of thousandths or shim.

## 4.0 Diagnostics

This section explains the diagnostic procedures used to isolate service problems.

### 4.1 The Machine Tool & Set-Up

#### 4.1.1 Leveling

Leveling is one of the most important aspects of setting up the machine properly. Improper leveling can lead to a variety of machining problems.

The machine should be level to within .0008" longitudinally and .0005" transversely. See Leveling Procedures, Section 2.9.

#### 4.1.2 A Special Word About the X & Z Gib

The X gib is vital to the performance of your lathe.

Gibs should be:

- flat
- free of twist
- free of burrs
- free of blockages in the oil passages and channels

Defective or scarred gib must be replaced. Shimming of gib will not yield acceptable results.

It is good machining practice to avoid the use of shop air to clean the chips off a machine. This risks blowing chips into the sliding way surfaces and compromising the performance of the machine.

The Z gib is used to keep the carriage firmly planted down to the ways. There are two Z gib, one located on each way.

See Gib Adjustments, Section 5.2.1.

#### 4.1.3 Lubrication

Lubrication is one of the single, most important maintenance issues and plays a key role in assuring the performance and durability of the lathe. At the beginning of each day manually supply oil to the way surfaces by doing Service Code 300.

Lack of lubrication can lead to a variety of problems with your machine motion due to increased friction in the sliding ways. This increased friction may lead to part inaccuracies and decreased life expectancies of your ball screws and way surfaces.

Make sure the oil pump for the headstock is working properly at the start of each day. Check periodically the site glass for the headstock oil. The site glass is located under the spindle cover or under the shift lever on the nameplate. Lack of lubrication in the headstock can lead to increased wear of the gear train as well as premature wearing or failure of the spindle bearings. For the 1630, 1845 and 2460 oil flows to the site glass only when the spindle is on. For the 1840 oil should be flowing to the site glass whenever the 220-volt power is on. Not applicable to the 1630HS.

#### 4.1.4 Machining Set-Up

The machining set-up itself is always something that can greatly influence the performance of the lathe. The following are some things to keep in mind.

Problems With	Can Contribute To:
Feed and Speeds (spindle rpm) See below	Poor finish Excessive speeds and feeds can break cutting tools or wear out too fast.
Tooling Using the wrong cutter for an application	Poor finish Parts incorrect
Cutting too deep	Part dimensions incorrect Driving and cutting forces cause deflections, since no material is totally rigid
No coolant	Poor finish, decrease the life of the cutter

The following is a list of common machining problems and some possible solutions.

Problem	Check or Try This
Poor surface finish	Dull tool Reduce feedrate Increase spindle speed Use a higher rake angle tool Make sure tool is not dull or chipped Use proper grade of cutting tool Use coolant Check to see if tools are on the centerline
Long workpieces out of round	Use a follow or steady rest
Excessive chatter	Tool bit improperly ground or not on center Avoid extreme negative rake inserts Tool overhang too great, tool deflection Improper feeds and speeds X gib loose. See <i>Gib Adjustment</i> , Section 5.2.1. Work improperly supported Machine tool out of level - See <i>Leveling Procedures</i> , Section 2.9.

##### 4.1.4.1 Spindle Speeds

Spindle speeds are influenced by a number of variables:

- Material
- Rigidity of the Machine Setup
- Coolant
- Insert, geometry and material of insert
- Depth of cut

##### 4.1.4.2 Feedrates

Factors that affect feedrates:

- Depth of cut
- Design or type of insert
- Sharpness of the insert
- Workpiece material

- Type of finish or accuracy required

## 4.2 The Mechanical Drive Train (X,Z)

Indications:

- Troubleshooting instructions indicate that the drive train is potentially the problem and other, more easily checked, variables have been exhausted.
- Roughness, looseness, tightness or jamming movement in the carriage or cross slide.
- Carriage walk-up due to Z ball screw misalignment.

1. Check for machine considerations, especially X gib adjustments and leveling. See Gib Adjustments, Section 5.2.1.
2. Do the following special service codes:
  - **Code 12** - this is a procedure that helps the control adjust to the friction characteristics unique to the machine. Write down the resulting values from the display. If your problem is control related, check to see if this procedure has resolved the problem.
3. The torque required to manual turn the X and Z-axis ballscrews should be between 10 to 15 in-lbs. These values should be consistent in both directions and along all areas of the axis travel. Values that differ from that of above may correspond to misaligned ball screws.

The following steps take you in logical sequence through the assemblies. If the step doesn't isolate or resolve the problem, it will be necessary to disassemble the indicated item and move to the next step.

See Figures 17 through 22 in Section 5.0. The drawings for the 1845 can be found in the rear of the manual.

1. Ensure that the screws that hold the bearing housing in place are not loose.
2. Ensure that the Clamp Nut is secured. The following applies to the clamp nut: When loosening, make sure to back out the 10-32 screw from the clamp nut.
3. When tightening, snug the 10-32 screw to keep the clamp nut from spreading, tighten it again after the clamp nut is tight.
4. Take out the angular contact bearings in the X & Z-axis and inspect them. They should roll smoothly and be lightly greased. If not, replace them. The Z-axis has 2 bearing housings.

*NOTE: The bearing housing and spacer rings are matched sets - keep them together.*

5. With the motor and drives removed, inspect the ball screw, ball nut and yoke for the potential problems shown in the chart below.

### CAUTION!

Unlike a leadscrew, do not unscrew the ball screw from its nut. This will destroy the ball screw!

Potential Problem:	Check By:
Bad ball screw	<ul style="list-style-type: none"> <li>• Visual inspection of the ball nut - if the nylon seal is broken or deformed, if contamination has visibly entered the ball nut or if balls are out of the ball nut, replace the ball screw.</li> <li>• Cranking the ball screw through a significant part of its travel. If it jams, feel loose or has rough spots, replace the ball screw.</li> <li>• Dial indicator on a vertical flat of the ball screw indicates backlash between the ball screw and ball nut.</li> </ul>
Ball nut not tightened to the yoke	<ul style="list-style-type: none"> <li>• Inspection for space between the head of the bolt and the ball nut i.e. the retaining bolt has bottomed out in its thread and is not securing the ball nut to the yoke properly.</li> </ul>
Yoke loose in the carriage	<ul style="list-style-type: none"> <li>• Inspection for any motion of the yoke or looseness in the Yoke mounting screws.</li> </ul>
Oil lines sheared	<ul style="list-style-type: none"> <li>• Visual inspection.</li> </ul>
Oil line blockage	<ul style="list-style-type: none"> <li>• Pump the oil and ensure that it flows evenly to the ways, ball screws and cross-slide.</li> </ul>
Z Ball screws not aligned properly	<ul style="list-style-type: none"> <li>• Manually turn the ball screw through the length of its travel. Pay particular attention to the movement near the headstock, the middle and the tailstock.</li> </ul>

*NOTE: Ball screws are inspected throughout their entire travel for backlash and consistent torque. A ball screw should be good for millions of inches of travel if installed properly. Do not be too quick to replace a ball screw if there is insufficient indication that it is bad; this will just be a costly delay to resolving the real problem.*

See: *Z Ball Screw Removal*, Section 5.1.14

*X Ball Screw Removal*, Section 5.1.12

*Aligning Z Ball Screw*, Section 5.1.15

### 4.3 Computer/Pendant Diagnostics

The pendant consists of 2 separate modules: the computer module and the pendant enclosure.

In general, the pendant/computer module is best diagnosed by eliminating all other possible alternatives. The following table lists some problems and what these problems can lead to.

Possible problems	Can lead to
Poor cable connections	There are 6 cable connections to the left side of the pendant. Make sure all cables are properly fastened.
Pendant locks up	Press the E-stop button and see if lock up clears if not then do the following: Turn the pendant off, wait at least 30 seconds, and turn it back on and check to see if the malfunction has been reset.
No voltage to RSG port	RSG will not work – should be 5 volts present Check with a voltmeter.
Low voltage to flash drive or slave board.	Can cause the system to lock up and the flash drive to act abnormally. Check voltage to power cable at hard drive module with voltmeter. It should be 4.8 volts and above. Lower values than this can cause problems.

Possible problems	Can lead to
Flash drive failure	If the flash drive fails, the system will not boot up or operate. It will need to be replaced. All programs and machine configurations will be lost. Make sure to back up your flash drive from time to time. Only the flash drive module will need to be replaced.
Floppy disk failure	Will not allow user to save or pull up programs from a floppy disk. Can the floppy drive format a disk? See instructions below.
LCD backlight burns out	Check all cable connections to LCD, distribution board and computer module. Make sure the power is turned off before doing so.
Faulty E-stop switch	It can be stuck open or closed (pressed). If it is stuck closed the pendant will need to be replaced because the user will have no way to get rid of the message. If it is open it will allow the machine to still operate but it will be unsafe for the user. The pendant will still need to be replaced.
Overlay failure (keys on pendant)	Certain buttons on overlay do not work. Do code 81 to verify each key beeps.
Low voltage to pendant or current spikes	1 amp fuse in pendant blows. Pendant will not turn on.
Slave board not functioning	Machine will not run. If under Code 33 it says "Firmware Edge or Demo," it means the slave board is not functioning.

#### 4.3.1 Checking Floppy Drive by Formatting a Disk

1. Find a new disk and install in floppy drive.
2. Install keyboard into middle port.
3. Press CTRL ESC to get to start menu.
4. Press R for run.
5. Type Format a: - press enter.
6. If the format works your disk drive is working. If format does not work, reboot control and see if it now works. If it does not work replace the computer module.
7. Press ALT ESC to get back to PT4 software.

#### 4.4 Motor Diagnostics

The Motor subsystem is comprised of 2 parts: The Motor Encoder and the Motor. The motors are powered by 110 VAC voltage. The servo driver is also an integral part of servo system, which is discussed in detail in the next section.

**WARNING!**

Do not work with the motors unless the power is disconnected from the machine. The motors are run by 110 VAC. There is possibility of death by electrocution!

Rarely do both the X and Z motor/servo systems fail at the same time and in the same way. So, if your problem is occurring on both axes, its source is probably somewhere else.

#### 4.4.1 Cable Connections

Check the motor cable connections on the cable breakout box. Verify there are no pushed in pins on the connector.

#### 4.4.2 To Check the Motor Encoders

If the motor encoder inside the motor has failed or is not reading the machine will fault out on that axis. Do the following to verify this problem:

Run Service Code 100 or 131. This will display on the DRO if the motor encoder is counting. If this number does not move then the encoder is not counting. This means either the encoder or the cable is the problem. Visually check the cable for any problems. If the encoder has failed the motor must be replaced.

#### 4.4.3 Encoder Counts to Pendant

Before replacing the motor due to a bad motor encoder it is a good idea to check the cables that take those signals back to the pendant. If these signals are not getting back to the pendant then the axis will fault. Check the following cable connections.

- Umbilical #1 and #2 at the cable breakout box
- Umbilical #1 and #2 at the pendant
- Umbilical #1 carries the x-axis signals and umbilical #2 carries the z-axis signals

#### 4.4.4 Moving Problem from One Axis to Another

Another way to troubleshoot a problem with a particular axis is to swap parts from 1 axis to another to see if the problem moves. If the problem moves then that component is faulty. See the example below.

##### *Symptom – X Axis will not move and faults*

This particular problem can happen because of any of following reasons: bad motor, servo driver, power cable, or computer module. In some cases it is not always obvious which component is causing the problem. This example will help us pinpoint the problem through a trial and error process.

Let's assume we have narrowed it down to the servo or electrical systems and the Y-axis has no problems. Lets also assume it is not an obvious problem like a loose connection. This particular example was done on a machine with motor encoders only.

Swap these components	Results
Physically switch the X and Z motors	Has problem moved to Z-axis? If yes, replace motor. If no, the motor is not the problem.

## 4.5 Servo Drivers

The two (2) servo drivers are located in the electrical cabinet.

Indications:

- Problems moving just one axis. The axis faults out on the screen.

Servo Types:

- X is a light duty driver
- Z is a heavy duty driver

Objective:

- Isolate the problem to the particular Servo Driver

Steps:

1. Turn off and unplug the system.
2. Physically swap the servo module from the axis that is not working to one that is.

### **WARNING!**

Do not work with the Servo Driver unless the power is disconnected from the machine. There is possibility of death by electrocution!

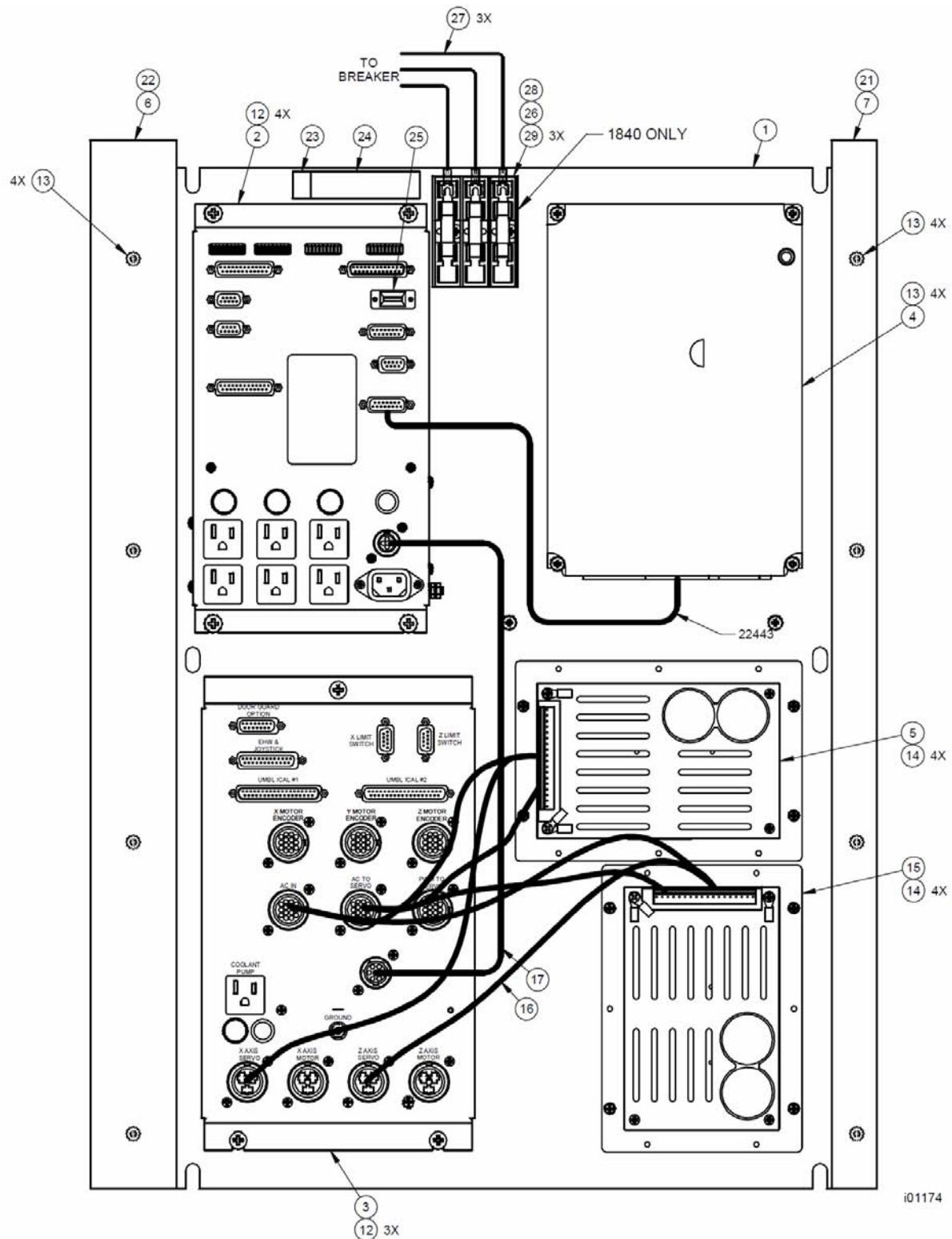
*Note: To avoid pulling the wires out of the connector, use the loop to pull the connector from the Servo Driver.*

If the problem moves to the other axis and clears up from the original axis, replace the Servo Driver.

### **WARNING!**

Do not run each axis very long when swapping servo's. They are not rated to run each motor for long periods of time.

## 4.6 Electrical



**Figure 12 Electrical Cabinet - 1540, 1630, 1840, 1845 & 2460**

## Electrical Cabinet Parts List

Item	Part Number	Description	Qty
1	24039	SHEETMETAL-SLX-DRIVE MODULE	0
2	24042	MODULE-SPINDLE CONTROL	1
3	23050-2	CABINET ASSY-PT4 -SL-CABLE BREAKOUT BOX-AUXILARY FUNCTIONS	1
4	25107-1630SX	AC DRIVE PROGRAMMED – 1630HSSX	1
	25107-1630HS-SX	AC DRIVE PROGRAMMED – 1630HSSX	1
	25108-1540SX	AC DRIVE PROGRAMMED – 1540SX	1
	25108-1840SX	AC DRIVE PROGRAMMED - 1840SX	1
	25108-1845SX	AC DRIVE PROGRAMMED - 1845SX	1
	25111-2460SX	AC DRIVE PROGRAMMED - 2460SX	1
5	20201	X AXIS SERVO DRIVER ASSY	1
6	22283-2-3-30	WIREWAY- TYPE G LIGHT GRAY	1
7	22283-1-3-30	WIREWAY- TYPE G LIGHT GRAY	1
12	1/4-20X3/8 31Z	SCREW-PH-PHIL-EXT SEMS-STL-ZINC	7
13	10-32X3/8 31Z	SCREW-PH-PHIL-EXT SEMS-STL-ZINC	12
14	6-32X5/8 31B	SCREW-PH-PHIL-EXT SEMS-STL-BO	8
15	20327-3	Z AXIS SERVO DRIVER ASSY - 4050D – 1630SX, 1540SX, 1840SX	1
	24101-7	Z AXIS SERVO DRIVER ASSY – 1630HSSX, 1845SX, 2460SX	1
16	20689	CABLE ASSY-L2 SERVO DRIVERS TO CONN PCB	1
17	24181	CABLE ASSY-LATHE CBB TO SPINDLE CONTROL	1
21	22392-1-30	COVER- WIREWAY- TYPE G	1
22	22392-2-30	COVER- WIREWAY- TYPE G	1
23	22778	LABEL-REVISION LEVEL	1
24	22779-21	LABEL	1
26	21892-9	FUSE BLOCK- 600 VOLT	1
27	24488	CABLE ASSY-HEADSTOCK OIL PUMP (1840 only)	3
28	8-32X3/8 20B	SCREW-RH-PHIL-STL-BO	2
29	21893-2	FUSE- 500 VOLT- SLO-BLO TYPE (1840 only)	3

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### 4.6.1 Checking A/C Voltage

This procedure tests for the 115V power for the control. Check the 110 VAC at the e-stop AC out connector on the pendant.

- Use a Voltmeter, reading A/C volts
- Acceptable range is 110V to 130V

*Note: systems running consistently close to the high or low values may have problems when normal voltage fluctuations push the voltage out of the acceptable range.*

### 4.6.2 Checking Fuses

There are 6 fuses that make up the system on the 1540, 1630, 1845 and 2460. There are 2 fuses in the pendant and 3 fuses on the spindle control module and 1 fuse in the cable breakout box. The 1840 has an additional 3 fuses on the electrical panel.

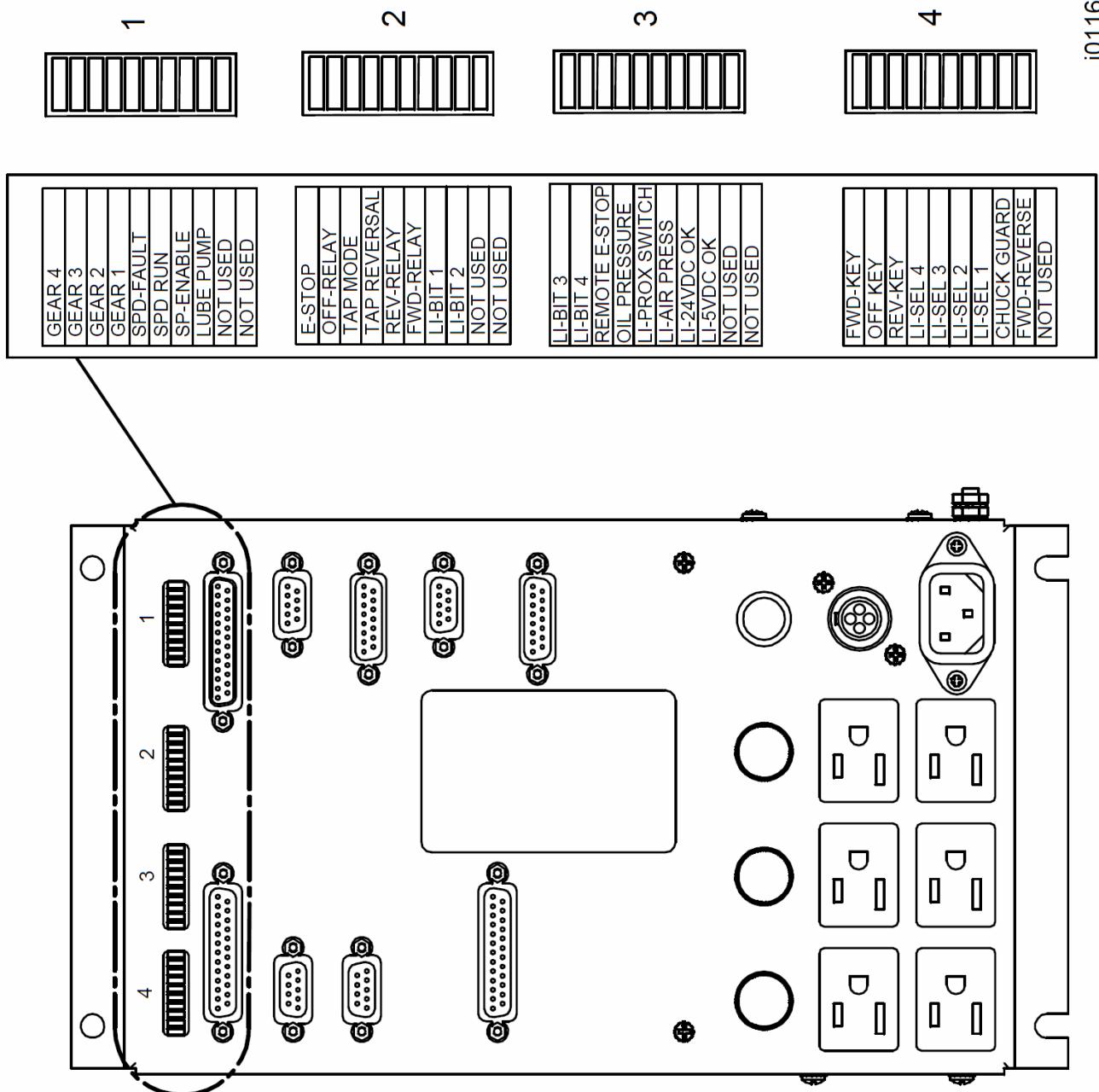
To check fuses:

1. Use a Volt/Ohmmeter; select "OHM" or " $\Omega$ ".
2. Remove the fuse completely from the pendant display or computer module.
3. Place a lead of the meter on each end of the fuse.
  - A good fuse reads 0 (zero) or close to it.
  - A bad fuse reads Open or Infinity or OL (overload).

### 4.6.3 Main Electrical Box

The electrical box is made up of the following main components:

1. AC drive – used to control the spindle motor.
2. 2 or 3 braking resistors – used to brake the spindle motor. To verify the resistors are good, measure the resistance across B1 and B2 of the AC drive. For the 1540, 1630 and 1840 it should read 16 ohms when both resistors are good and 32 ohms if 1 resistor is bad and one is good. Values lower or higher than this could be one or both resistors are bad. The 2460 uses (3) 32 ohm resistors. When good your meter should read approximately 10 ohms. The 1845 uses (3) 500 watt 32 ohm resistors. When good your meter should read approximately 10 ohms.
3. Spindle Control Module – used to control spindle related functions, indexer option, gear switch input, remote e-stop and 110 volt power source for various items.
4. Cable breakout box – see section 4.6.4.
5. Servo drivers – servo drivers for the X and Z-axis motors.



**Figure 13**  
**Spindle Control Module LEDs**

#### 4.6.3.1 *Spindle Control Module LED Segments*

##### **1<sup>st</sup> 10 LED Segment**

1. LED labeled GEAR 4 – not used.
2. LED labeled GEAR 3 – not used.
3. LED labeled GEAR 2 – this light should be on when the 1840/1845/2460 is in high gear and off when it is in low gear or neutral. The 1630 does not have a gear switch.
4. LED labeled GEAR 1 – this light should be on whenever the 1840/1845/2460 machine is in low gear. This light should be off when it is in high gear or neutral. This light is not on for the 1630 because it has no gears.
5. LED labeled SPD-FAULT – this light will be on whenever the AC drive is in a fault condition, which includes an E-stop message from the pendant.
6. LED labeled SPD-RUN – this light should be on whenever the spindle is on.
7. LED labeled SPD-ENABLE – this light should be on whenever you are in DRO, tool setup and RUN mode.
8. LED labeled LUBE PUMP – this light should be on whenever the lube pump is on and off when it is not on.

LED's 9 and 10 are not used.

##### **2<sup>nd</sup> 10 LED Segment**

1. LED labeled E-STOP OUT – this light should be on whenever the E-stop is in the out position. When the E-stop is pressed, this light should go off.
2. LED labeled OFF RELAY – this light should be on whenever the off button on the pendant is pressed.
3. LED labeled TAP MODE – light should be on whenever you are not tapping. Light will be off when in the tap event.
4. LED labeled TAP REVERSE – this light will be on when the spindle changes direction at the bottom of the hole on a tap event and back off after the spindle changes direction once outside of the tap event.
5. LED labeled REV-RELAY – this light should be on whenever the spindle is running in reverse.
6. LED labeled FWD-RELAY – this light should be on whenever the spindle is running in forward.
7. LED labeled LI-BIT 1 – this LED should be on whenever the lathe indexer is at any odd tool position.
8. LED labeled LI-BIT 2 – this LED should be on whenever the lathe indexer is at tool positions 2, 3, 6 or 7.

LED's 9 and 10 are not used.

### **3<sup>rd</sup> 10 LED Segment**

1. LED labeled LI-BIT 3 – this LED should be on whenever the lathe indexer is at tool positions 4, 5, 6 or 7. For the 4 tool indexer, if you program tools 5, 6, 7 or 8, the indexer will physically move to tools 1, 2, 3 or 4 respectively. For example, if you program tool 7, LED light LI BIT 3 should be on.
2. LED labeled LI-BIT 4 – this LED should be on whenever the lathe indexer is at tool position 8.
3. LED labeled REMOTE E-STOP – this LED should be on whenever the remote e-stop or pendant e-stop is in the out position.
4. LED labeled OIL PRESSURE – not used.
5. LED labeled LI-PROX SWITCH – this LED should be on whenever the lathe indexer is locked in position.
6. LED labeled LI-AIR PRESSURE – this LED should be on whenever the air pressure for the lathe indexer is incorrect.
7. LED labeled 24VDC OK – this LED should be on whenever the 24 volts for the lathe indexer is not present.
8. LED labeled 5VDC OK – this LED should be on whenever the 5 volts for the lathe indexer is not present.

LED's 9 and 10 are not used.

### **4<sup>th</sup> 10 LED Segment**

1. LED labeled FWD-KEY – this LED should be on whenever the FWD key on the pendant is being pressed.
2. LED labeled OFF-KEY – this LED should be on whenever the OFF key on the pendant is being pressed.
3. LED labeled REV-KEY – this LED should be on whenever the REV key on the pendant is being pressed.
4. LED labeled LI-SEL 4 – is not used and should never be on.
5. LED labeled LI-SEL 3 – this LED should be on whenever a tool position on the Dorian indexer is commanded which would increment the tool by 4 positions or decrement the tool by 1, 2, 3 or 4 positions. For increment, the Dorian indexer is rotating in a CCW path when facing the turret. May not apply to the 4-tool indexer.
6. LED labeled LI-SEL 2 – this LED should be on whenever a tool position on the Dorian indexer is commanded which would increment the tool by 1, 2 or 4 positions or decrement the tool by 1 or 4 positions. May not apply to the 4-tool indexer.
7. LED labeled LI-SEL 1 – this LED should be on whenever a tool position on the Dorian indexer is commanded which would increment the tool by 1, 3 or 4 positions or decrement the tool by 2 or 4 positions. May not apply to the 4-tool indexer.
8. LED labeled CHUCK GUARD – not used
9. LED labeled FWD-REVERSE – not used

LED 10 is not used.

#### 4.6.4 Cable Breakout Box Connections

The list below describes what takes place through each connection. Power reaches the cable breakout box through AC IN from the pendant. From there power is distributed through the system.

- **Umbilical #1 & Umbilical #2 Ports (To Pendant)** - The lathes have (2) motor-encoder signals that are transmitted between the Encoder module and the Pendant by use of (2) Umbilical cables. The X signal is communicated through umbilical #1 and the Z motor signal is transferred through umbilical #2.
- **Apron Port** - Communication for X & Z-Handwheel and jogstick logic signals between the Pendant and the cable breakout box and Z- servos.
- **X & Z - Motor Ports** - are used to receive power from the servo and distribute it to the motors.
- **X & Z-Motor Encoder Ports** - These ports are used to receive logic signals from each of the X & Z-Motor Encoders.
- **Spindle Encoder Port** - The port is used to receive logic signals from the spindle encoder, when it is engaged for a threading routine.
- **Logic to Servo (PWM)** - This port is used to keep continuous feedback between the servos and the cable breakout box.
- **110 VAC Outlet** - The outlet is for powering up the coolant pump. Beside the outlet is an LED light signifying power is reaching the pump when it is active, and a fuse to protect the pump.
- **E-Stop and Spindle Out Port** - used to disable power to the spindle motor when the E-Stop is engaged.

#### 4.6.5 Cable Connections

The lathe machines use 7+ cables to communicate between systems. It is often the case that what appears to be the failure of an electrical component is actually attributable to a poor connection.

Indications:

- Control problems, chronic or intermittent.
- Motor problems.
- Measurement problems.

Explanation:

1. Turn off and unplug the system from the wall.

##### **WARNING!**

Do not plug and unplug connectors with the system power on. This may cause damage to the connector board and harm to the technician.

2. Visually inspect the connections for excessive debris, moisture, or obvious damage.
3. Carefully clean any chips away from the connectors.

4. One-by-one, take out each connector and then plug them back in. Do the same at the computer/display.
5. Make sure the screws are tightened on each of the connectors.

## 4.7 Door & Gear Switch

All TRAK lathes use a door interlock switch to verify to the control that the door is closed in various modes of operation. This switch is wired normally open but is forced closed when the door is closed during CNC run mode. There should be continuity between pins 1 and 6 when the switch is forced closed and no continuity when the switch is in the open position.

### Gear Switch – 1840 & 2460SX

The switches are mounted under the sheet metal cover on the left side of the headstock. The switch closest to the headstock casting controls high gear and the other one controls low gear. If the gear shifter is in the middle of both gears, neither switch will be engaged, and the spindle will be in neutral. Both switches are wired normally closed. This means the switch is open when the switch is triggered. There should be no continuity between pins 1 and 6 when the high gear switch is forced closed and continuity when the switch is in the open position. There should be no continuity between pins 2 and 7 when the low gear switch is forced closed and continuity when the switch is in the open position.

### Gear Switch – 1845

The switches are mounted on the rear of the headstock (see drawing 27945) under the sheet metal cover. The switch closest to the headstock casting controls low gear and the other one controls high gear. If the gear shifter is in the middle of both gears, neither switch will be engaged, and the spindle will be in neutral. Both switches are wired normally closed. This means the switch is open when the switch is triggered. There should be no continuity between pins 1 and 6 when the high gear switch is forced closed and continuity when the switch is in the open position. There should be no continuity between pins 2 and 7 when the low gear switch is forced closed and continuity when the switch is in the open position.

## 4.8 Service Codes

Service codes are broken down into the 5 following categories: software, machine setup, diagnostics, user options/defaults and lubrication pump control.

All Service Codes are accessed in the SET-UP Mode by pressing the soft key for "SERV CODES". The service codes can be found under one of the headings listed on the main screen. Press the heading you want to access the code in question. If you know code # you want press the CODE # softkey and it will take you directly to the code in question. Press CODE #, enter the number you want, press SET.

### 4.8.1 Software Codes

The following codes pertain to software functions in the control. To get to any of these codes go to Service Codes, press "A" and press the code you wish to view.

Note - If you are working with the SWI Customer Service Group, write the values down for Code 33 or Code 313. These values will be valuable for troubleshooting.

#### 4.8.1.1        *CODE 33: Software ID*

The Code 33 is the software identification procedure. The two types of software in the control include:

- **Software Version** - the version of the system you have installed
- **Firmware Version** - the version of firmware software that is responsible for control to servo interface.
- **Converter Version** – the version of software that is responsible for converters and options.
- **Operating System Version** – shows the version of the XP operating system

#### 4.8.1.2        *CODE 141: Load Configuration File to the Computer*

This code allows you to load your configuration file from a selected drive to your hard drive. The configuration file consists of items such as calibration and backlash constants. This code is used when a computer module or hard drive has been replaced.

#### 4.8.1.3        *CODE 142: Save Configuration File from the Computer*

This code allows you to save your configuration file to an external thumb drive. The configuration file consists of items such as calibration and backlash constants. This code is used when a computer module or hard drive needs to be replaced. This stores the configuration file from the hard drive to an external thumb drive. It is a good idea to do this code after the machine is initially setup so these values can be saved and used in the future. If the computer or hard drive fails, then you will not have the ability to save the configuration file and the machine will need to be re-setup when the computer or hard drive is replaced.

#### 4.8.1.4        *CODE 313: Display Configuration File*

This code displays the configuration file. This file contains pertinent information about the machine. The file will look similar to the following. If the file becomes corrupt you can load default values by pressing the F4 softkey.

Product = 1845SX (displays machine ID key of machine)

Lube pump cycle time – 60 minutes

Lube pump discharge time – 15 seconds

Motor encoder calibration constants      X=242.0411      Z=242.0342

(These numbers above are typical numbers for the calibration constants)

Arc accuracy – 0.005"

Limit switches – on or off

Spindle on or off during run – On or Off

Code 128      X=0.001"      Z=0.0016"

Code 12 (+)    X=000005      Z=000006

                  (-)    X=000005      Z=000006

Code 100 (+)   X=352.7      Z=325.2

                  (-)    X=350.1      Z=333.1

#### 4.8.1.5        *CODE 316: Update Master Software*

Load upgrade disk in an external drive and press this service code. New software will automatically download and control will reboot.

#### 4.8.1.6 *CODE 317: Update Slave Software*

Load upgrade disk in an external thumb drive and press this service code. New software will automatically download.

#### 4.8.1.7 *CODE 318: Activate Converters or Options*

See programming and operating manual.

### 4.8.2 Machine Set-Up Codes

The following codes are used primarily when setting up a new machine. To get to any of these codes go to Service Codes, press "B" and press the code you wish to view.

#### 4.8.2.1 *CODE 12: Feed Forward Constant*

The Code 12 procedure helps the control "learn" the friction characteristics of the machine by sending a graduated series of motor signals and observing the results. The process takes less than 30 seconds to run. It is both a diagnostic routine that displays values, and a routine that sets the parameters of the control for the particular machine.

The Code 12 is used for diagnosing and resolving:

- Problems with machine motion.
- Machined parts come out bad – especially poor finish.

*Note: Code 12 routine will set the parameters for the particular machine and its particular situation. If the machine changes its friction characteristic, the Feed Forward Constant should change too, or the system will not servo properly. Whenever gibbs are adjusted or a heavy workpiece has been added to the table, you should run a Code 12. When the heavy workpiece is removed, Code 12 should be run again.*

#### Steps:

1. Position the table and addle in the center of travel. *Note: You will lose your DRO position reference.*
2. Go into the Service Codes and input the Code 12.
3. Press Auto
4. The system will run the routine automatically and then display values on the position readout.

#### Explanation

Typical values should be between 4.04 and 11.11 are considered normal for each axis. Higher values indicate excessive friction in the system. Lower values indicate a loose system and may mean a gib adjustment is necessary. Value 4.04 means the friction is a factor of 4 in one direction, and 4 in the other direction. The values should be within 3 or 4 of each other in both directions. A value of 6.08 would still be considered normal.

On S products, do not equate Code 12 values to torque on ballscrew. Measure friction in system with an in-lb torque wrench.

The feed forward gain can be adjusted manually by pressing the manual button. Choose the axis you would like to change and then enter values in the positive and negative direction to adjust. Adjusting the gain can help solve circularity problems. Default values can be set by pressing the Reset button. The manual feature should only be used in extreme cases where the AUTO routine did not solve the problem. Manual adjusts above 12 may lead to servo related problems.

#### 4.8.2.2 CODE 100: Axis Open Loop Test

Code 100 procedure is used to diagnose problems with the configuration of the system, the encoders and incoming A/C voltage.

##### IMPORTANT -- SAFETY NOTICE

During this procedure the designated axis will be given a command to move at maximum speed for 1 second in the direction you choose. Avoid crashes by making sure the quill is out of the way and by starting with the table and saddle centered. **MAKE SURE THAT NO ONE IS STANDING IN THE WAY OF THE TABLE OR SADDLE!**

*Note: You will lose the DRO reference position.*

This procedure is to be run for each axis that is servo-driven, and for both the plus and minus direction for each axis.

1. Center the table and saddle and raise the head. Make sure the gib locks are released.
2. On the Pendant display, go into the Service Codes and input the Code 100.
3. The conversation line will say: "SELECT AXIS". Input the axis. Either X or Z.
4. In the conversation line it will say "WHICH DIRECTION? PLUS".
  - If you want to run in the plus direction, press INC SET.
  - If you want to run in the minus direction, press +/-, then INC SET.
5. In the conversation line it will say "PRESS GO". Press Go after you are sure that the machine will not crash in the direction and axis that you have specified.
6. Afterward the screen will display values next to the DRO position axes.

Your input	Display	Data displayed.
X +	X	motor encoder reading
	Z	
	Feedrate	the maximum feedrate attained

Your input	X	motor encoder reading
X -		
	Z	
	Feedrate	the maximum feedrate attained

Your input	X	nothing (should be 0 )
Z +		
	Z	motor encoder reading
	Feedrate	the maximum feedrate attained

<b>Your input</b>  Z -	X	nothing (should be 0 )
	Z	motor encoder reading
	Feedrate	the maximum feedrate attained

The values for the encoder displays should be in the range of 4.0000" to 7.0000".

- If the motor encoder value is not within specification it may be the problem. If the encoder is not reading then it will need to be replaced.
- The feedrate should be a minimum of 120 ipm for the x-axis and a minimum of 180 ipm for the 1630 and 1840 for the z-axis and 300 ipm for the 1540, 1630HS, 1845 and 2460 for the z-axis. Shops with higher voltages will see higher values.
- If the feedrate is less than 120/300 ipm and inconsistent in both directions, check the incoming AC voltage and mechanics of the drive train.

#### 4.8.2.3        *CODE 123: Calibration*

See Section 5.22 for a further explanation of this code.

#### 4.8.2.4        *CODE 127 - Set X or Z Backlash Constant*

See Section 5.22 for a further explanation of this code.

#### 4.8.2.5        *CODE 128: Input Backlash Constant*

Code 128 allows you to enter the backlash values for each axis. It displays the value after it enters. This code is only used on machines with motor encoders only.

#### 4.8.2.7        *Code 308: Reverse X Hand Wheel Direction*

This service code reverses the direction of the X hand wheel.

#### 4.8.2.8        *Code 310: Reverse Z Hand Wheel Direction*

This service code reverses the direction of the Z hand wheel.

#### 4.8.2.9        *Code 311: Run Machine with Spindle Off*

This service code toggles this function on or off. It defaults to off from the factory, which means the spindle must be on for a program to run. If it is on and you forget to turn the spindle on, the tool will move to Z rapid and wait for the spindle to come on. This function will be needed if you are running a repeatability program with an indicator in the spindle. Make sure this feature is on when cutting parts.

#### **WARNING!**

Use only chucks which are rated to the maximum RPM of the lathe.

#### 4.8.2.10        *Code 337: Spindle RPM Calibration*

This service code calibrates the spindle using its encoder, simply follow the on screen instructions. Please note that when installing new machine, or replacing computer module, that if no configuration is present, spindle may not run properly. Press the F4

button to load spindle calibration defaults, if needed. This has no effect on other settings such as calibration, backlash, etc.

#### **4.8.2.11      *Code 312: Toggle Limit Switches On/Off***

This service code toggles the limit switches on or off. Code 313 also displays which state the limit switches are in.

### **4.8.3 Diagnostic Codes**

The following codes are used primarily when diagnosing a problem with the machine. To get to any of these codes go to Service Codes, press "C" and press the code you wish to view.

#### **4.8.3.1      *Code 54: Program Continuous Run***

This Code runs a program continuously without stopping for tool change commands. It is helpful in running a long period to identify an intermittent problem.

1. Prepare a program as you normally would.
2. Press **MODE, SET UP, "C", Code 54, INC SET**. The program run will start automatically.
3. Press **STOP** to stop, and **GO** to continue.

#### **4.8.3.2      *Code 81: Keyboard Test***

This code is used to check if the keyboard is functioning correctly. It allows you to test each key on the pendant individually. When you press the keys, the corresponding box for that key will highlight on the screen. The pendant will also beep, indicating that the key is working correctly. If one of the keys does not work the pendant assembly may need to be replaced. If none of the keys are working chances are that the computer module will need to be replaced.

#### **4.8.3.3      *Code 131: Manual DRO***

A manual diagnostic routine to check the motor encoder and table encoders. Turn the X hand wheel to display the encoder readings. This code will display the actual DRO counts and the raw encoder counts before the calibration and backlash factors have been factors into the counts.

#### **4.8.3.4      *Code 132 - Electronic Hand Wheel Test***

Turn the X or Z-axis electronic hand wheel. The display should show movement as the hand wheel is being turned. There should be no skipping and it should count smoothly while the hand wheel is being turned. One revolution of hand wheel should read 0.4000" for Z and 0.1000" for X in course, and 0.100" & 0.020" for fine mode.

#### **4.8.3.5      *Code 133 – Spindle Encoder Test***

Turn the spindle or run the spindle at low RPM's. The display should show the counts from the spindle encoder. It should count to 360 on the Z display and then reset. Each time it resets it displays the number in the X display area.

#### **4.8.3.6      *Code 314: Toggle Test Lights 'On' in Status Line***

This code toggles on and off 2 test lights that appear in status line. The top light signifies if the master software is working. If functioning it should flash a green light. The bottom light signifies if the slave firmware is functioning. It will appear orange in

run mode when it is processing information. Pressing the mode key will change this orange box to black. The orange box will also change to black when the program you are running reaches the 3<sup>rd</sup> event from the end of the program. If the firmware is locked up no keys will work. This code is useful for diagnosing intermittent problems with the control locking up.

#### **4.8.3.7        *Code 319: Error Log***

This code when turned on captures the commands that were sent to the servo system. It includes items such as positioning commands, errors, stop and go commands, etc. It may be helpful for identifying problems between programmed commands and executed commands. To turn on the error log press the F6 softkey. The page forward and backward keys allow you to scroll through the file one page at a time. The data forward and data backward keys allow you to scroll through the file one line at a time. The data bottom key takes you to the bottom of the file and then changes to data top which will take you back to the top. The file will capture data until the file reaches a size of approximately 600 KB. At this time the file is saved to a backup file and the original file is cleared and data is once again captured. Once again as the file reaches a size of 600 KB it copies over the previous backup file. From here the user can save the file to an external thumb drive by pressing the F8 softkey. Once this is done it prompts for which file you want to save to disk. The F1 key saves the current file to disk and the F2 key saves the backup file to disk. To clear the files press the F7 softkey.

#### **4.8.3.8        *Code 326: Error Message Display***

Error Message Display is used to describe error messages.

### **4.8.4    *Operator Defaults/Options Codes***

The following codes allow the user to set programming defaults or turn features on or off. To get to any of these codes go to Service Codes, press "D" and press the code you wish to view.

#### **4.8.4.1        *Code 66: Default Metric***

This code causes the control to turn on in the metric mode.

#### **4.8.4.2        *Code 67: Default English***

This code causes the control to turn on in the English mode.

#### **4.8.4.3        *Code 79: Beeper On***

This turns on the beeper to the control keys.

#### **4.10.4.4        *Code 80: Beeper Off***

This turns off the beeper to the control keys.

#### **4.8.4.5        *Code 129: Arc Accuracy***

When the VL control operates at high feedrates it may create small part machining errors as it goes around sharp corners. This exists on all CNC's and is commonly called a "following error." The control is factory preset to allow a maximum following error of 0.005 inch. The feedrate will automatically be adjusted around sharp corners so as to not violate this limit. This code only applies to arcs that are programmed and ones that are created in the tool path to generate the shape you want. This code will not make a difference on lathe moves.

You may adjust the maximum following error to a value as small as .0001 inch. However, the smaller the value, the slower the feedrate around corners.

To input a new Following Error use the following procedure:

Follow the instructions on the screen and input the Following Error value (from .0001 to .0100) and press **INC SET**.

#### **4.8.4.6      *Code 143: Toggle Tool Change Spindle Mode***

This code allows the spindle to stay on at tool changes when turned to the ON position.

#### **4.8.4.7 *Code 147: Initialize Indexer***

This code is to be used on machines with indexers only. It will reinitialize (reset) the indexer if the unit is in the wrong position. This type of situation may occur if the E-stop is pressed while the unit is rotating to a new tool position. This code will also need to be run, for example, if the indexer is in tool position 4 and the control thinks it is in some other tool position.

### **4.8.5 Lube Pump Codes**

The following codes are used for programming and operating the lube pump. To get to any of these codes go to Service Codes, press "E" and press the code you wish to view.

#### **4.8.5.1      *Code 300: Lube Pump Switch***

This code acts as a switch to turn the lube pump on for the programmed time set in Code 302.

#### **4.8.5.2      *Code 301: Set Lube Pump cycle time***

This code sets the interval time between lube cycles.

#### **4.8.5.3      *Code 302: Set Lube Pump discharge time***

This code sets the lube pumps discharge time.

# 5.0 Procedures for Replacements & Maintenance

## 5.1 Replacements

### 5.1.1 Motor Replacement

1. Turn off power to the machine.
2. Each motor is mounted by the use of (4) 1/4-20 screws. Be careful not to over tighten these bolts and strip the threads.

### 5.1.2 Servo Driver Replacement

#### **WARNING!**

Do not work with the Servo Drivers unless the power is disconnected from the machine. The servo drivers are run by 110 VAC. There is possibility of death by electrocution!

The Servo Driver for each axis is located inside the electric cabinet.

#### **DANGER!**

Always engage (push in) the Emergency Stop switch, turn the ProtoTRAK SLX Control off, and disconnect the servo driver cable at the cable breakout box.

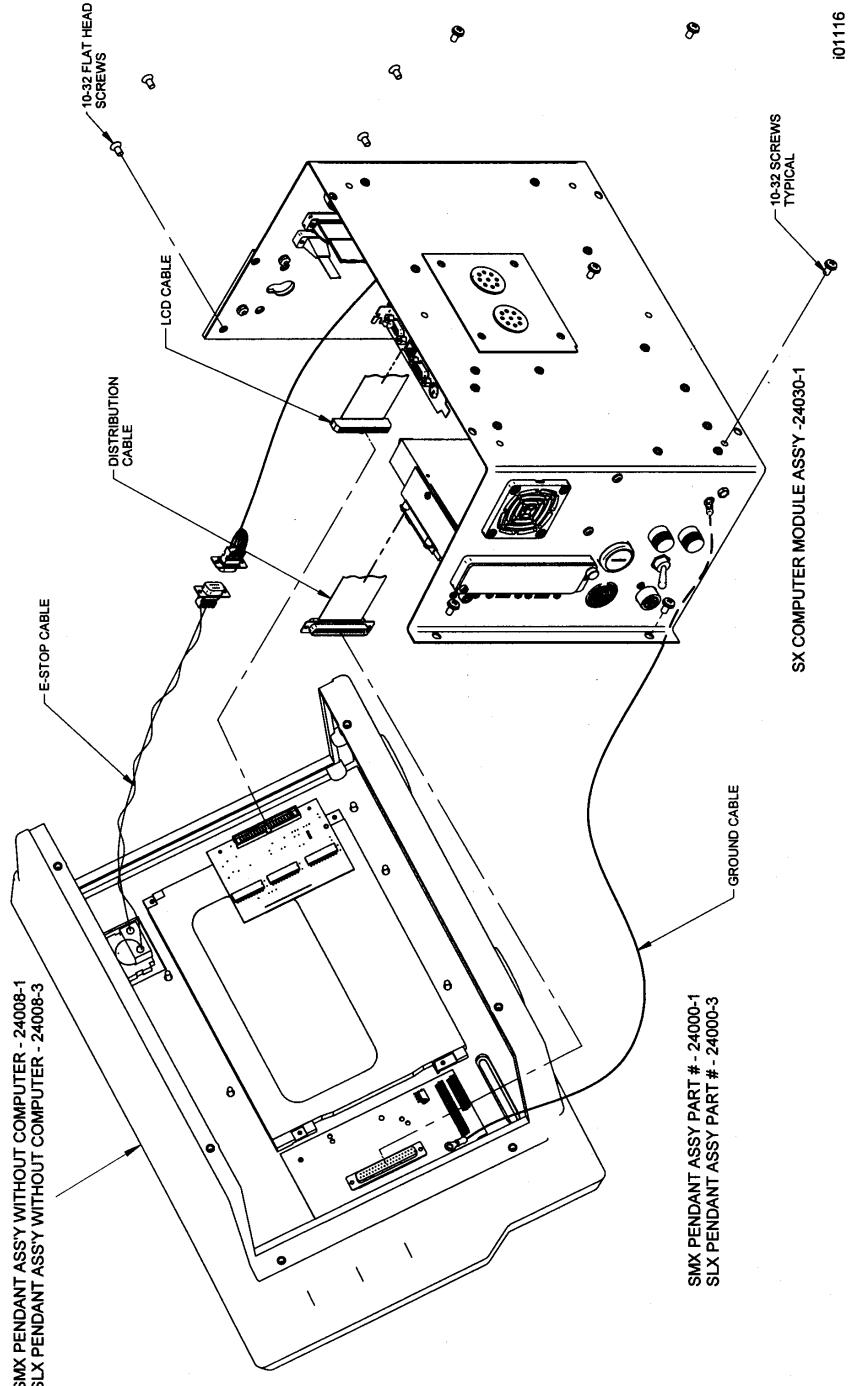
1. Press in the Emergency Stop.
2. Remove the servo driver from the panel, inside the electric cabinet.
3. Remove the 10 cap screws that hold the servo driver and its heat sink plate to the panel.
4. Disconnect the cable connector from the servo driver.
5. Reinstall the new servo driver with its heat sink plate.

### 5.1.3 Computer Module Replacement

1. Turn power off to the machine and control.
2. Unplug all the connectors on the pendant arm side of the pendant.
3. Remove 4 screws on the right side of the unit and 2 screws on the left side of the unit. The module is now free to slide toward the right side of the pendant.
4. Slide the computer module a few inches and stop. Pulling the computer module too far will damage the LCD cable.
5. Now reach from the pendant arm side of the unit inside and remove the 37-pin LCD cable.
6. Now slide the module about 1/2 way out of the pendant sheet metal.
7. Remove the ground stud from the side of the computer module.
8. Next remove the 37 and 9 pin connectors from the top of the computer module.
9. Lastly slide the unit completely out of the sheet metal.
10. Follow the instructions in reverse order when reinstalling the new computer module.

11. Make sure the connectors are fully seated before bolting the unit back in place.

*Note: if the flash drive is functional, you may want to remove the flash disk and install it in the new flash drive.*



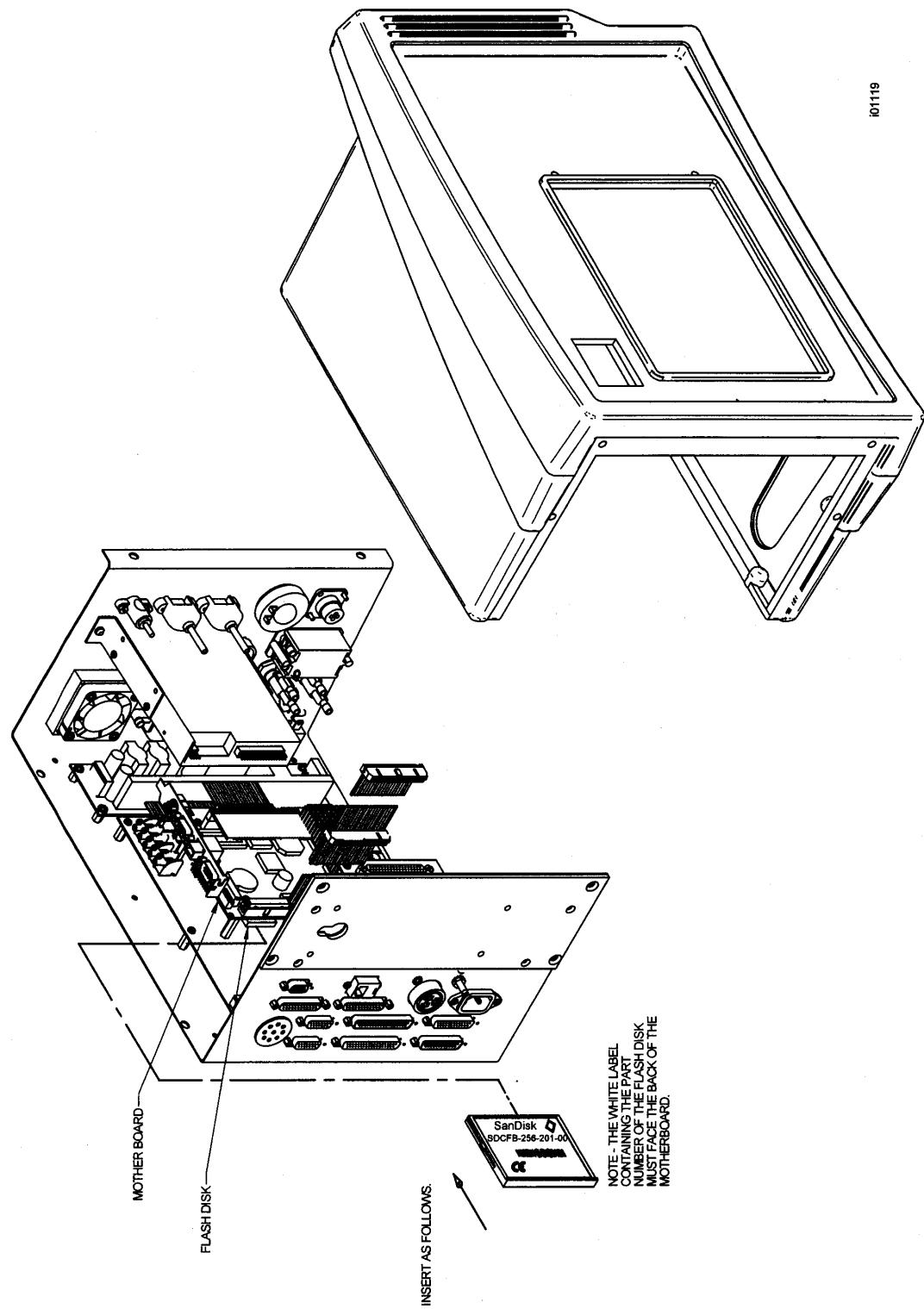
**Figure 14 Computer Module/LCD Replacement**

### 5.1.4 System Flash Disk Replacement

1. From the control, go to SETUP, SERV CODES, SECTION A, and then code 142 and save your Configuration file (calibration values, etc.) onto a floppy or an external thumb drive.
2. Turn power off to the machine and control.
3. Unplug all the connectors on the pendant arm side of the pendant.
4. Remove the pendant from the pendant arm by removing the (4) 1/4-20 x 3/4" SCHS that secure it in place.
5. Place the pendant assembly on a clean and secured table with the display pointing away from you.
6. Remove the (6) 10-32 x 3/8" Pan Phillips Head Screws and (4) 10-32 x 3/8" FHCS securing the computer module to the LCD/enclosure.
7. Pull the computer module a few inches and stop. Pulling the computer module too far will damage the ribbon cables.
8. Remove the defective System Flash Disk (located on the back side of the mother board) by pushing the eject button on the flash drive.
9. Firmly insert the replacement System Flash Disk into the drive, making sure that the label with the serial number is pointing towards the motherboard.
10. Secure the computer module back to the LCD/enclosure by following the instructions in reverse order.
11. Make sure that all connectors are properly seated before fastening the unit back in place.
12. Turn power on to the machine and control.
13. When the system boots, you may get a message stating that the system cannot find your configuration file. Press NO if asked to load defaults.
14. Update the System Software by inserting the PT4SX update disk into the floppy drive or download the software from our website to an external thumb drive. Go to service codes 316 and 317 found in section A. Update the master and slave software.
15. Restore the Configuration file saved on your backup configuration disk or external thumb drive with service code 141 found in section A of the service code section.

#### **CAUTION!**

It is a good idea to back up your flash disk from time to time via a network, external thumb drive or floppy disk. If your flash disk needs to be replaced, you will lose all of your programs. See your programming manual for instruction on how to do this.



**Figure 15**  
**Flash Drive Replacement**

### **5.1.5    Cable Routing on Machine**

Whenever you replace a cable or reroute a cable it is very important to keep the power cables and logic cables separated from each other. The power cables consist of the (2) 110-volt motor cables and (2) 110-volt power cables for the pendant, and a coolant pump or solenoid power cable. The logic cables are used to carry encoder signals between the cable breakout box and computer module. Mixing of the power and logic cables may cause noise from the power cables to interrupt the signals in the logic cables. This can lead to intermittent axis faults or repeatability problems.

### **5.1.6    Electronic Handwheels & Jogstick**

There are 2 electronic handwheels on the lathes and 1 jogstick to move the carriage quickly into position. Each unit is replaced as an assembly. Disconnect the handwheels and jogstick from the apron cable. (See Figure 50, Section 7)

### **5.1.7    Cable Routing in Electrics Box**

Whenever you replace a cable or reroute a cable it is very important to keep the power cables and logic cables separated from each other. The power cables consist of the (2) 110-volt servo motor cables and (4) 110-volt power cables for the pendant, spindle motor fan, coolant pump, and lube pump. The logic cables are used to carry signals between modules, handwheels, encoders, etc. Mixing of the power and logic cables may cause noise from the power cables to interrupt the signals in the logic cables. This can lead to intermittent axis faults or repeatability problems.

### **5.1.8    Spindle Drive Belt Replacement**

The spindle drive motor is located inside the base pedestal, underneath the headstock gearbox. Access is gained by opening the upper door on the headstock and removing the lower access panel on the pedestal. When removing the belt, loosen nut "G" and advance nut "H" until the belt has sufficient slack to be removed from the pulleys.

When installing the belt, retract nut "H" and tighten nut "G". Initially, tension the belt such that there is no slippage when the lathe is started at its maximum speed.

Belt tension should be checked frequently during the first days of operation, and periodically thereafter. Keep the pulleys and belt clean and free of any foreign material to ensure long life and maximum traction.

### **5.1.9    Spindle Encoder Replacement**

1. Unplug or remove all power from the lathe.
2. Remove the spindle cover to gain access to the encoder.
3. Loosen setscrews on flexible coupling and the bolts that hold the encoder on.
4. Slide the encoder off.
5. The spindle encoder assembly is only available as a complete unit. Do not disassemble.

*Note: on the 1540 make sure the belt between the spindle and encoder bracket is properly fastened.*

### 5.1.10 Spindle Drive Belt Tightening/Replacement

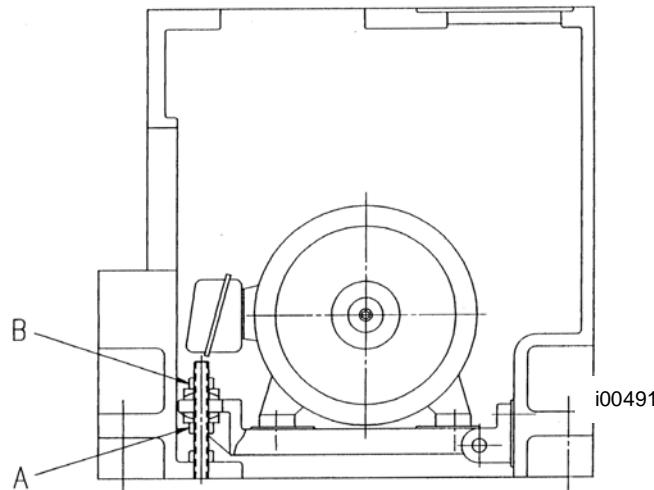
The spindle drive motor is located inside the base pedestal, underneath the headstock. Access is gained by opening the upper cover on the headstock and removing the lower access panel on the pedestal.

When removing the belt, loosen the top nut and raise motor with the bottom nut until the belt is loose.

To tighten the spindle belt, loosen the bottom nut "A" under the motor bracket and use the top nut "B" to tighten the belt. See the figure below. Make sure the tension on the belt is such that there is no slippage when the lathe is started at its maximum speed.

The belt tension can be checked by pulling on one of the belts in the center of its travel with a scale until you reach 15 lbs. on the scale. At this point the deflection of the belt relative to the other belt should be no more than 1/2". If the deflection is more than 1/2" tighten the belt.

Belt tension should be checked frequently during the first days of operation, and periodically thereafter. Keep the pulleys and belt clean and free of any foreign material to ensure long life and maximum traction.



**Figure 16**  
**Spindle Motor Belt Adjustment**

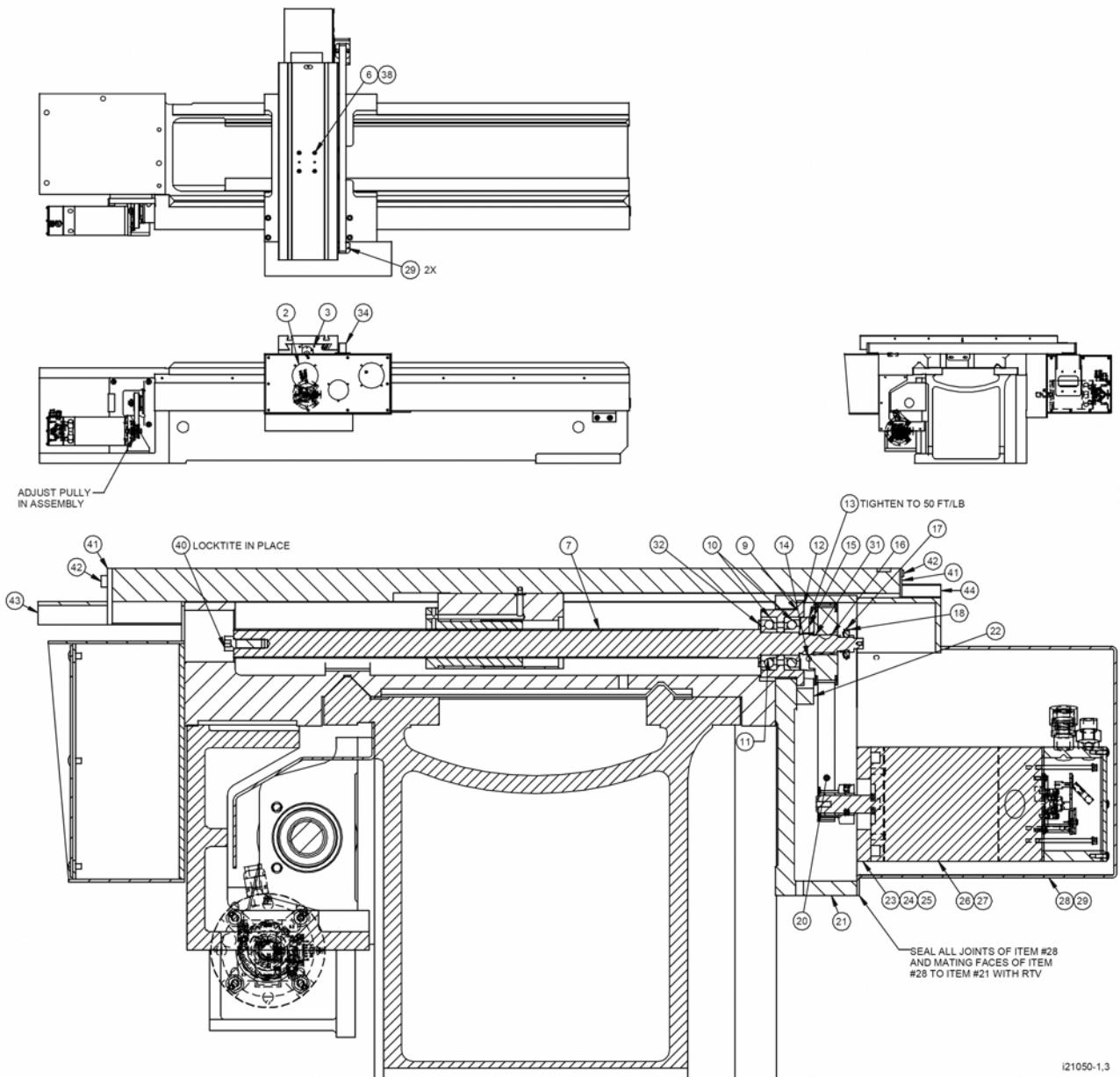
### **5.1.11 Spindle Motor Removal**

1. Unplug or remove all power from the lathe.
2. Loosen the belt tension. See section 5.1.8..
3. Mark and remove motor electrical leads.
4. The motor is secured with four screws to a flange plate. See figure 17
5. Because of the weight and size of the spindle motor, and the restricted working space, extreme caution should be used in sliding the motor from its mounting plate..

### **5.1.12 X-Axis Ball Screw Removal**

1. Unplug or remove all power from the lathe.
2. Access to the X-axis ball screw is gained by removing the back cover in the chip guard and removing the X-axis motor cover.
3. Remove the motor.
4. Remove all items on the right end of the ball screw. See Figures 18 and 19.
5. Unbolt the ballscrew nut from the yoke.
6. The X ball screw is removed through the exposed hole when the cross slide is removed.

See section 7 for a drawing and part lists of the X axis drive train on the 1845.

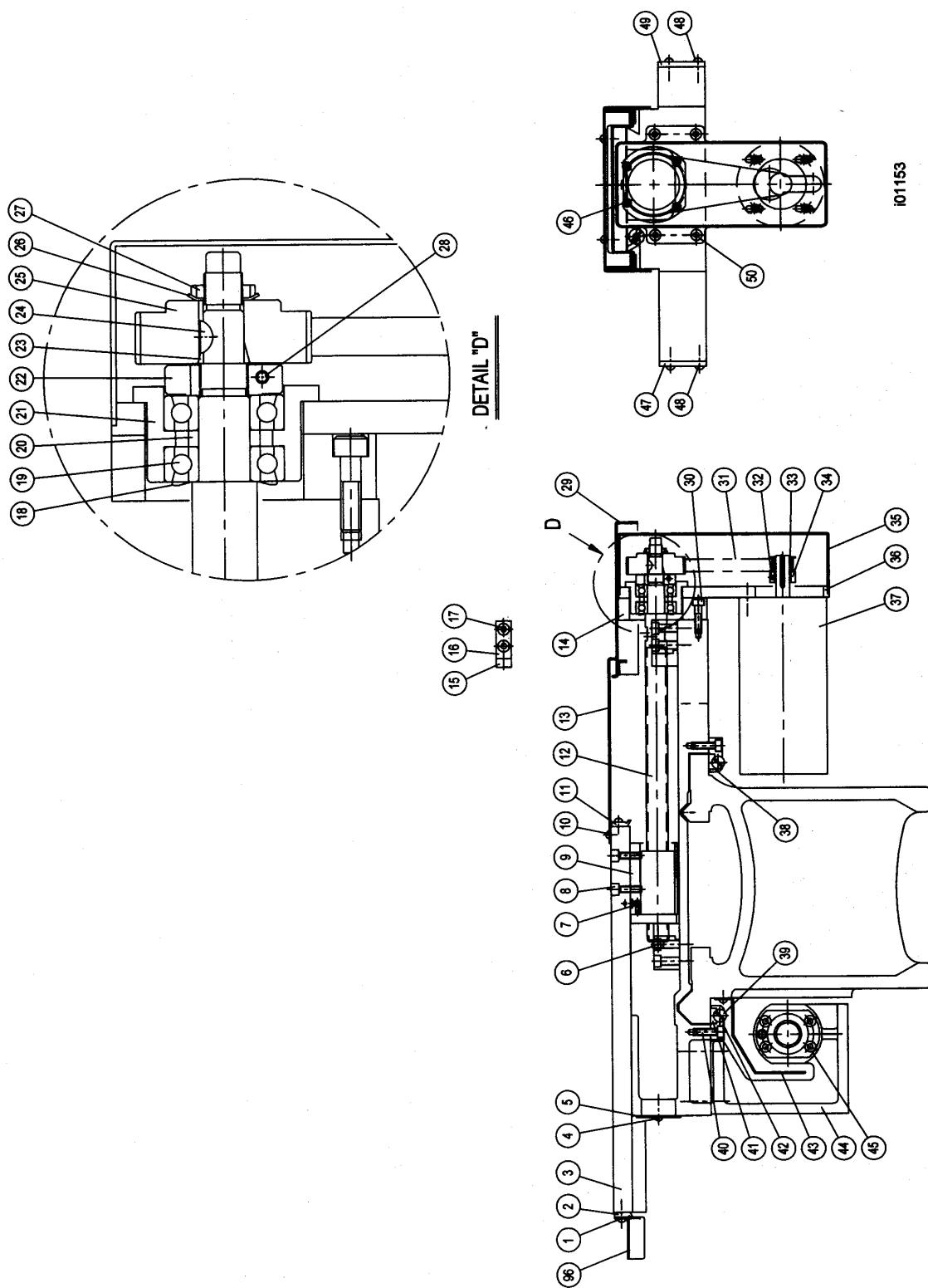


**Figure 17**  
**X Axis Drive Train – 1540 & 1840**

## X Axis Drive Train Parts List – 1540 & 1840

X-DRIVE TRAIN			
Item	P/N	Description	Qty
2	20996	COVER PLATE-TRL 1840 X AXIS	1
3	M6-1.0X12 25B	SCREW-SHCS-STL-BO	2
7	20984	BALLSCREW-LX X-AXIS	1
9	16300-1	BEARING HOUSING-SET	1
10	20373	BEARING-ANGULAR CONTACT	2
11	15885	RING-BEARING HOUSING	1
12	M6-1.0X25 25B	SCREW-SHCS-STL-BO	4
13	16314	NUT CLAMP-X AXIS	1
14	10-32X3/4 25B	SCREW-SHCS-STL-BO	1
15	16350	FERRULE-SPROCKET	1
16	16983-1	PULLEY-SOLID 44 TEETH W/O GUIDES	1
17	W02	LOCKWASHER	1
18	N02	NUT- LOCK X-AXIS	1
20	475-5M-15	BELT-TIMING 5MM POWERGRIP	1
21	20953	BRACKET-MOTOR MOUNTING	1
22	M10-1.5X80 25B	SCREW-SHCS-STL-BO-FULLY THD	4
23	24463	X-AXIS SERVO MOTOR BRACKET	1
24	M8 73B	WASHER-SPLIT LOCK-STL-BO	4
25	M8-1.25X30 25B	SCREW-SHCS-STL-BO	4
26	24316	MOTOR ASSY-PT4-MX EURO	1
27	1/4-20X1 25B	SCREW-SHCS-STL-BO	4
28	20957	COVER-X AXIS MOTOR	1
31	98481A090	KEY WOODRUFF #404-1/8 X 1/2	1
32	7204-AVH	NILOS RING-7204	1
34	20988	CABLE WAY	1
38	24009-1	WASHER - BELLEVILLE SPRING LOCK	4
40	M8-1.25X20 25B	SCREW-SHCS-STL-BO	1

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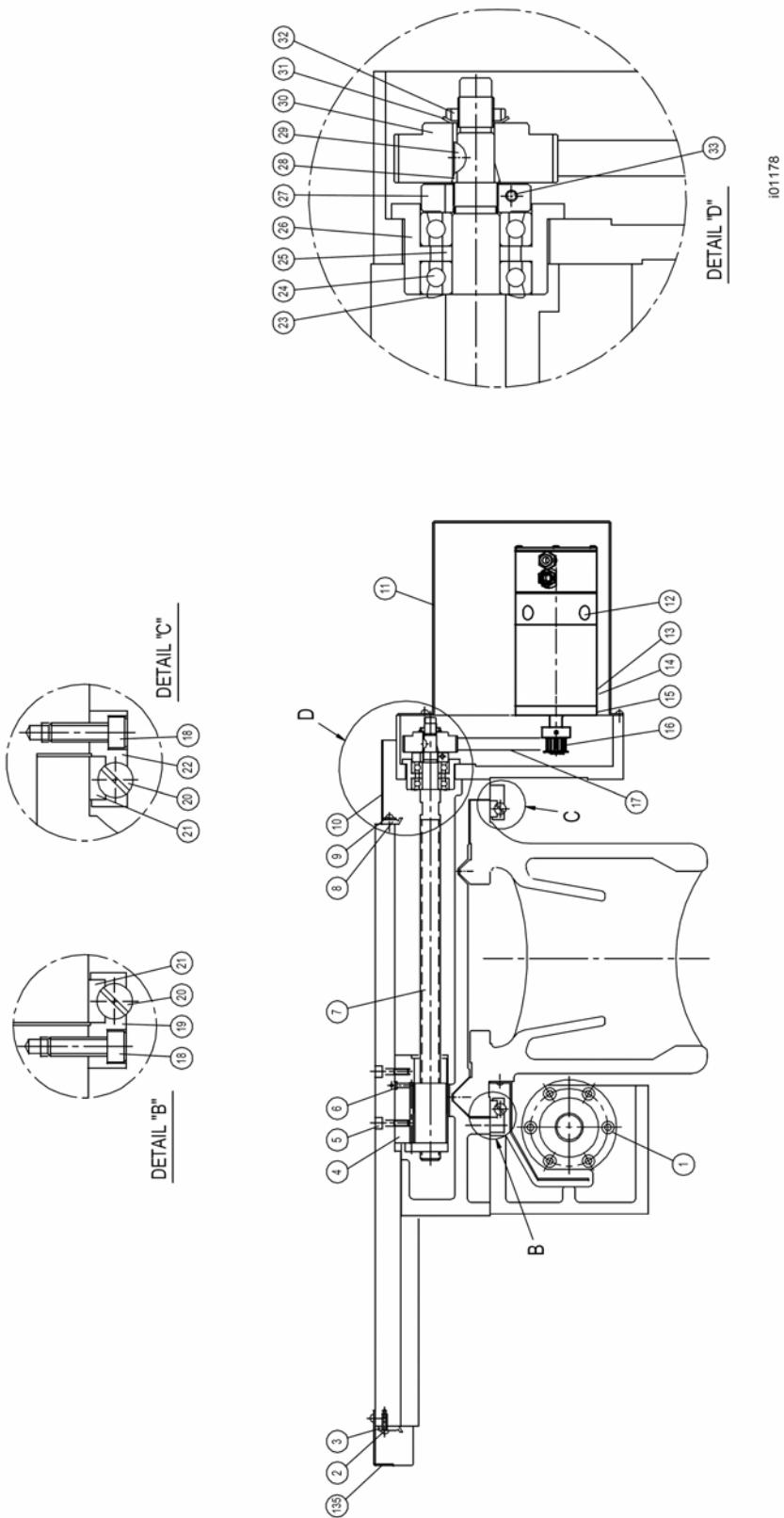
**Figure 18**  
**X Axis Drive Train – 1630**

## X Axis Parts List-1630 & 1630HS

Item	Parts No.	Description	Material	Specification	Q'ty
1		Hexagon Socket Screw		M6x16L	6
2	24698	Wiper - Crosslide (front)	Rubber	25-0220	1
2.1	24698-1	Wiper - Crosslide (front) turcite on crossslide-1630	Rubber	25-0220A-01	1
3	25-0215	Cross Slide	FC25		1
4		Socket Button Head Screw		M6x10L	2
5	25-0739	Front Cover Plate	SS41		1
6		Socket Head Cap Screw		M8x16L	1
7		O-Ring		P7	1
8		Socket Head Cap Screw		M8x30L	4
9	25-0212	Seat - Nut	FC25		1
10		Socket Button Head Screw		M6x10L	4
11	24699	Wiper - Crosslide (Rear)	Rubber	25-0221	1
11.1	24699-1	Wiper - Crosslide (Rear) turcite on crosslide-1630	Rubber	25-0221A-01	1
12	20984	Ballscrew - X Axis	SCM415	25-0211	1
13	25-0218	Rear Cover Plate - order along with item 29	SS41		1
14	25-0209	Clamping Block	FC20		1
15	25-0206	Bumper	PU		2
16	25-0205	Cam	SS41		2
17		Socket Head Cap Screw		M8x35L	4
18		Cover - Bearing		7204AVH	1
19	23930	Bearing Set - Angular Contact Ball		7204BECBP	1
20	15885	Spacer	S45C		1
21	16300	Bearing Housing	S45C		1
22	16314	Nut - Clamp	S45C	ø19x16UNF	1
23	24A-0216	Cone Clamping Element	Brass		1
24	98481A090	Woodruff Key		#3(1/8"x1/2")	1
25	16983-1	Pulley-ballscrew	S45C	5Mx44T	1
26	W02	Lock Washer		W02(ø15)	1
27	NT02	Lock Nut		N02(ø15x32UNF)	1
28		Socket Head Cap Screw		10-32x3/4"	1
29	25-0219	Rear Cover Plate - order along with item 13	SS41		1
30		Socket Head Cap Screw		M8x30L	4
31	450-5M-15	Belt-X Axis		5M-450-15	1
32		Set Screw		M5x6L	3
33		Pulley	Aluminum	5Mx16T	1
34		Lock Ring	SS41		1
35	25-0208	Plate - Cover - X Axis Motor	SS41		1
36	25-0207	Plate - Motor	SS41		1
37	24316-1	Motor - X Axis Servo			1
38	24-0315	Clamping Block (Rear)	FC25		1
39	50-0325-00	Screw - Adjusting	S30C		4
40		Socket Head Cap Screw		M8x25L	10
41	23337-28	Gib - Z Axis	FC25	24-0313	2
42	24-0314	Clamping Block (Front)	FC25		1
43	25-0712	Cover - Protection	SS41		1
44	24-0311	Apron	FC25		1

45		Socket Head Cap Screw		M8x30L	4
46		Socket Head Cap Screw		M6x30L	4
47	23337-72	Wiper - Bedway (Right, Rear)	Rubber	24-0337	1
48		Crossed Recessed Head Screw		M6x16L	12
49	23337-73	Wiper - Bedway (Left, Rear)	Rubber	24-0336	1
50		Hexagon Socket Screw		M5x6L	8
51	24607	Chip Wiper Set - consists of items 2, 11 & Z axis chip wipers - complete set			1
52	24607-1	Chip Wiper Set - consists of items 2.1, 11.1 & Z axis chip wipers - complete set (turcite on crosslide)-1630			1
96	25-0223	Cover Plate (front)		SS41	1

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**Figure 19**  
**X Axis Drive Train – 2460**

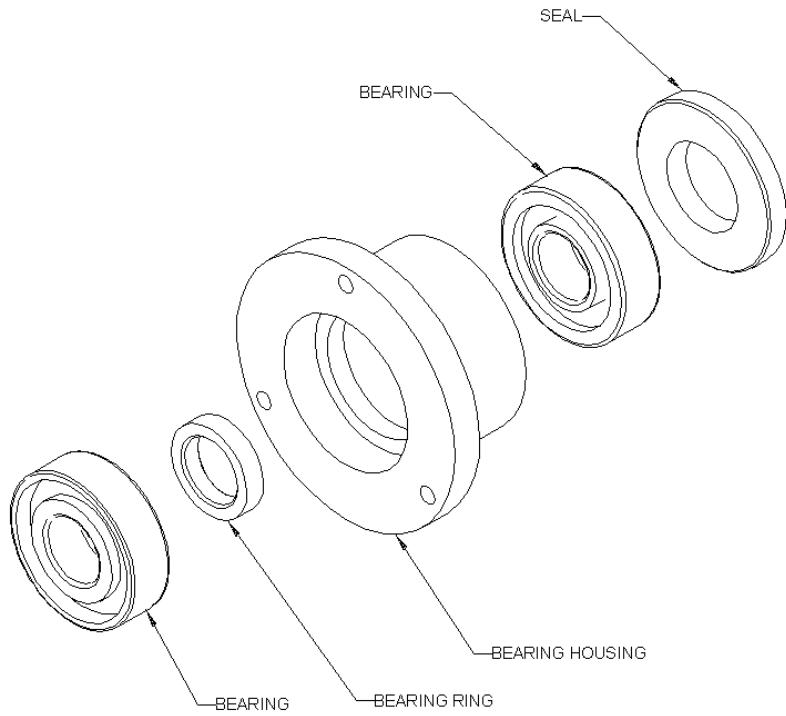
## X Axis Drive Train Part List- 2460

Item	Parts No.	Description	Material	Specifications	Q'ty
1		Socket Head Cap Screw		M8x30L	6
2	25200-1	Wiper - Bedway (Front)	Rubber	87-0244	1
3		Hexagon Socket Screw		M6x16L	4
4	77USA-0213	Nut Seat	FC25		1
5		Socket Head Cap Screw		M8x30L	4
6		O-Ring		P7	1
7	20984	X-Axis Ballscrew	SCM415	24-0211	1
8	25200-2	Wiper - Bedway (Rear)	Rubber	87-0245	1
9		Hexagon Socket Screw		M6x20L	4
10	87-0228	Rear Cover Plate	SS41		1
11	24-0728	X-Axis Motor Cover Plate	SS41		1
12	24316	Motor-Lathe-40/20			1
13		Socket Head Cap Screw		M8x25L	4
14		Spring Washer		M8	4
15	24-0208	Motor Plate	S20C		1
16		Symchronous Pulley	Aluminum		1
17	475-5M-15	Belt-Timing-5mm Powergrip			1
18		Socket Head Cap Screw		M8x25L	8
19	77A-0202	Lock Block	FC25		1
20	50-0325	Adjusting Screw	S30C		4
21	21050-3F	Gib - Z Axis	FC25	77A-0218	1
22	77A-0216	Lock Block	FC25		1
23	7204-AVH	Ring - Nilos			1
24	23930	Bearing Set - Angular Contact		7204BECBP	1
25	15885	Spacer	S45C		1
26	16300	Bearing Housing	S45C		1
27	16314	Nut - Clamp	S45C	ø19x16UNF	1
28	16350	Ferrule	Brass		1
29	98481A090	Key - Woodruff		#3 (1/8"x1/2")	1
30	16983-1	Pulley - Ballscrew			1
31	W02	Lock Washer		W02 (ø 15)	1
32	NT02	Lock Nut		N02 (ø 15x32UNF)	1
33		Socket Head Cap Screw		10-32x3/4"	1
34		Socket Head Cap Screw		M8x16L	2
35		Flat Washer		M8	2
36		Spring Washer		M8	2
37	87-0738	Clamping Block	SS41		1
38		Socket Head Cap Screw		M10x90L	4
39		Socket Head Cap Screw		M6x10L	2
40		Flat Washer		M6	2
41		Spring Washer		M6	2
42	77USA-0698	Cam	SS41		1
43		Socket Head Cap Screw		M8x30L	4
44		Flat Washer		M8	4
45		Spring Washer		M8	4
46		Socket Head Cap Screw		M6x20L	4
47		Flat Washer		M6	2
48		Spring Washer		M6	4
49	87-0730	Bracket	FC20		1
50		Wire Protector		88x45ax1850L	1

51		Hexagon Socket Screw		M5x10L	11
52	24-0729	End Cover	SS41		1
53		Socket Head Cap Screw		M8x20L	2
54		Flat Washer		M8	2
55		Spring Washer		M8	2
56	77USA-0307	Switch Seat	SS41		1
57		Socket Head Cap Screw		M6x20L	2
58	22551-1	Switch - Limit		NBNS543-BO2D12-61-12-10	1
59		Socket Head Cap Screw		M6x16L	2
60		Flat Washer		M6	2
61		Spring Washer		M6	2
62	77USA-0698	Cam	SS41		2
63	24-0207	X Axis Transmission Box	FC30		1
64		Cross Recessed Head Screw		M6x16L	6
65	25200-6	Wiper - Bedway (Right, Rear)	Rubber	63-0362	1
66	25200-7	Wiper - Bedway (Left, Rear)	Rubber	63-0363	1
67		Socket Head Cap Screw		M6x25L	2
68		Spring Washer		M6	2
69		Micro Switch		BNS543-BO2D12-61-12-10	1
70		Socket Head Cap Screw		M6x16L	2
71		Flat Washer		M6	2
72		Spring Washer		M6	2
73	87-0714	Cam	SS41		1
74	25200-4	Wiper - Bedway (Left, Front)	Rubber	63-0360	1
75	25200-5	Wiper - Bedway (Right, Front)	Rubber	63-0361	1
76		Cross Recessed Head Screw		M6x16L	6
77	87-0715	Cam	SS41		2
78		Socket Head Cap Screw		M5x16L	4
79		Flat Washer		M6	4
80		Spring Washer		M6	4
81		Socket Head Cap Screw		M6x16L	4
82		Flat Washer		M6	4
83		Spring Washer		M6	4
84	24-0723	Operation Box	SS41		1
85	24-0724	Operation Box Cover	SS41		1
86		Hexagon Socket Screw		M5x6L	8
87	77USA-0311	Apron	FC25		1
88	77USA-0605	Ballscrew Cover	SS41		1
89		Cover - Round Hole		φ 30	1
90	N04	Lock Nut	S45C	N04(φ 20x16UNF)	1
91	W04	Lock Washer		W04	1
92	22446	Bearing - Ball - Double Row Angular Contact		2204E-2RSITN9	1
93	77USA-0307	Nut Seat	FC20		1
94		Socket Head Cap Screw		M12x50L	4
95		Spring Washer		M12	4
96	77USA-0316	Bedway - Wiper (Right)	Rubber		1
97		Cross Recessed Head Screw		M6x16L	3
98		Rod	S45C		1
99	87-0727	Support Bracket	SS41		1
100	97-0716	Cross Slide Cover	SS41		1

101		Hexagon Socket Screw		M6x10L	5
102	25200-3	Gib - X Axis	FC30	87-2017	1
103	17-0321	Adjusting Screw	S30C		2
104		Socket Head Cap Screw		M8x25L	4
105	87-0215	Cross Slide	FC25		1
106	87-0201	Saddle	FC25		1
107		Socket Head Cap Screw		M12x90L	4
108		Cross Recessed Head Screw		M6x16L	3
109	77A-0317	Bedway Wiper (Left)	Rubber		1
110	23983	Ballscrew - Z Axis	SCM415	77A-0310A	1
111	7205-AVH	Ring - Nilos		AVH7205	1
112	23940	Bearing Set - Angular Contact		7205 BECBP	2
113		Spacer	S45C		1
114	16295-1	Housing - Bearing	S45C		1
115		Socket Head Cap Screw		M8x25L	4
116	16314	Nut - Clamp	S45C	ø 19x16UNF	1
117	16350	Ferrule	Brass		1
118	16983-1	Pulley - Ballscrew			1
119	98481A090	Woodruff Key		#3 (1/8"x1/2")	1
120	W01	Lock Wsaher		W01 (ø 12)	1
121	N01	Lock Nut		N01 (ø 12x32UNF)	1
122		Socket Head Cap Screw		M8x25L	4
123		Spring Washer		M8	4
124		Socket Head Cap Screw		10-32x3/4"	1
125		Socket Head Cap Screw		M12x35L	4
126		Spring Washer		M12	4
127	400-5M-15	Belt - Z Axis			1
128	24-0304	Z Axis Motor Seat	FC30		1
129	24427	SprocketAssy-26 Teeth-40/55			1
130		Socket Head Cap Screw		M6x25L	4
131		Flat Washer		M6	4
132		Spring Washer		M6	4
133	24-0306	Z Axis Motor Plate	S20C		1
134	24425	Motor Assy-Lathe-40/55			1
135	87-0229	Front Cover Plate	SS41		1

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**Figure 20**  
**Angular Contact Bearings**

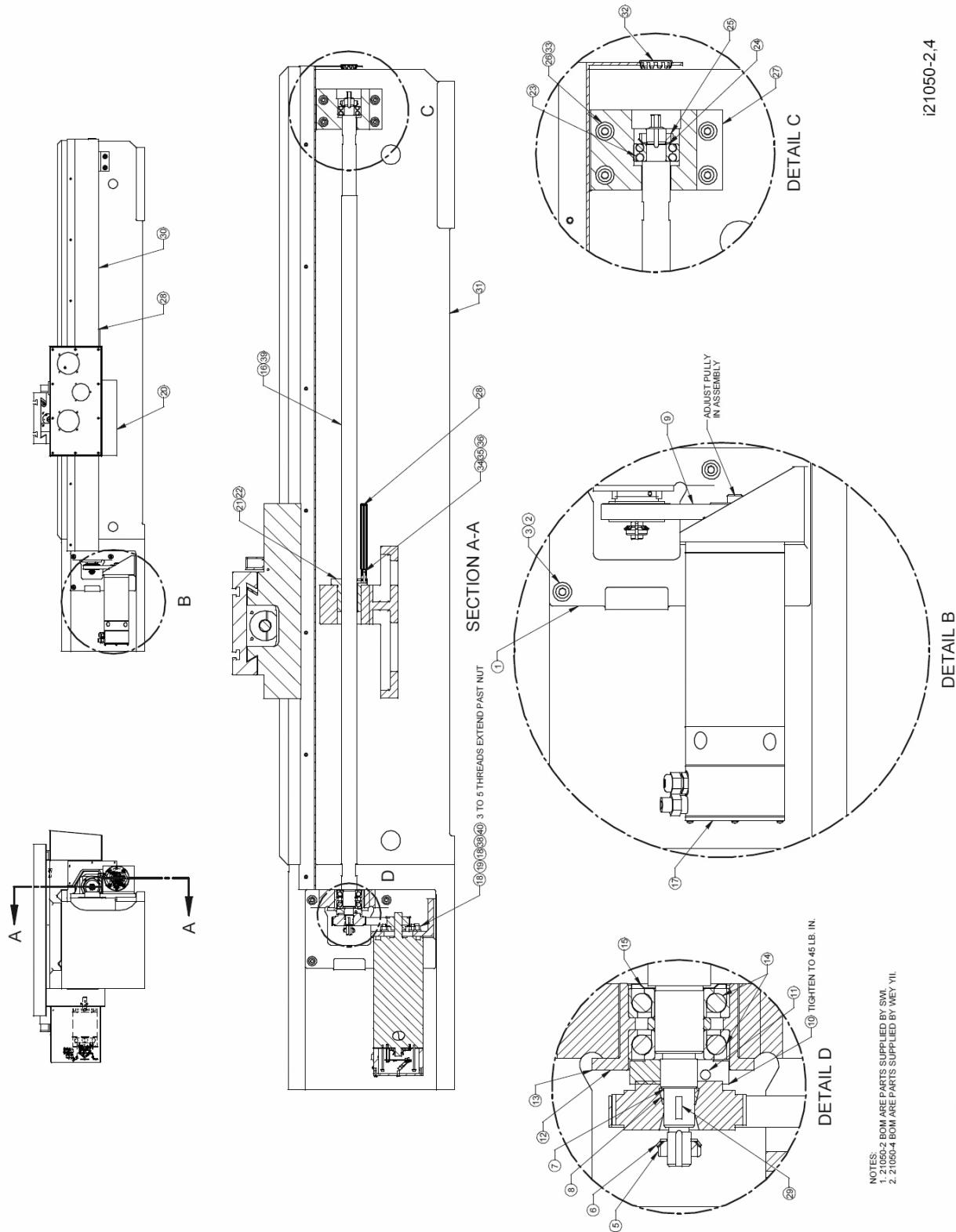
### 5.1.13 Installing Angular Contact Bearings

1. On the inner race of the angular contact bearings, the thin walls face each other.
2. 50 ft/lb. torque is needed to tighten the clamp nut. See the figure above.

### 5.1.14 Z-Axis Ball Screw Removal

1. Unplug or remove all power from the lathe.
2. The Z-axis ball screw is attached to the lathe in three places:
  - a. The left end where the Z-axis motor, the pulley, the clamp and the pair of angular contact bearings are mounted.
  - b. Behind the apron assembly where the ball nut is attached to the yoke and the oil line is located.
  - c. The right end where the floating bearing is located.
3. Access to the left end is gained by removing the sheet metal panel below the headstock nameplate.
4. Access to the ball nut and the yoke is gained by removing the apron assembly.
5. For easy access to the ballscrew, remove the ballscrew cover.

See section 7 for a drawing and part lists of the Z axis drive train on the 1845.

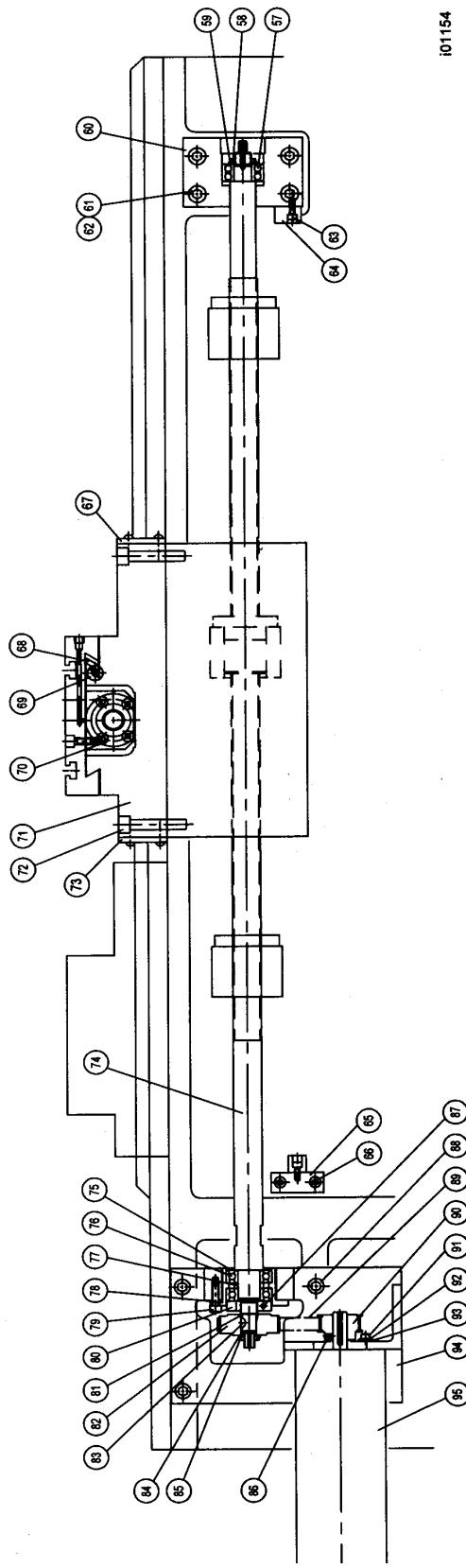


**Figure 21 Z Axis Drive Train – 1540, 1840, & 2460**

## Z-Axis Drive Train Parts List – 1540, 1840, & 2460

Item	P/N	Title	Qty
5	N01	LOCKNUT	1
6	W01	LOCKWASHER	1
7	16983-1	PULLEY-SOLID 44 TEETH W/O GUIDES	1
8	16350	FERRULE-SPROCKET	1
9	400-5M-15	BELT - TIMING 5MM POWERGRIP	1
10	16452	NUT CLAMP-X ,Y, & Z AXIS	1
11	10-32X3/4 25B	SCREW-SHCS-STL-BO	1
12	M8-1.25X30 25B	SCREW-SHCS-STL-BO	7
13	16295-1	HOUSING- BEARING Z-AXIS	1
14	23940	BEARING SET (2)-ANGULAR CONTACT	1
15	7205-AVH	NILOS RING-7205	1
16	21025	DRIVE ASSY TRL 1540/1840 Z-AXIS	1
17	16775-1	MOTOR ASSY-PT4-1840CSS-Z AXIS	1
18	15759	WASHER-1/4 HARD BLK OX 1/8 THK	8
19	23053	STUD-1/4-20X1 1/2-FULLY THREADED-GRADE 2	4
21	M8-1.25X25 25B	SCREW-SHCS-STL-BO	1
22	24009-1	WASHER - BELLEVILLE LOCK	4
23	22446	BEARING-SELF ALIGNING	1
24	W04	LOCKWASHER	1
25	N04	LOCKNUT	1
28	20086-3	STOP TRL1840	1
29	98481A090	KEY WOODRUFF #404-1/8 X 1/2	1
32	21155	PLUG-Z AXIS COVER	1
34	185210	CONTROL UNIT CSA-5	1
35	186251	COMPRESSION NUT	1
36	106254	COMPRESSION SLEEVE	1
38	1/4-20 50B	NUT-HEX-STL-BO	4
39	23983	BALLSCREW - Z-AXIS	1
40	24425	MOTOR ASSY - LATHE - 40/55	1

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## Figure 22 Z Axis Drive Train - 1630

## Parts List – 1630 & 1630HS Z-Axis Drive Train (P/N: 24497-1)

Item	Parts No.	Description	Material	Specification	Qty
57	22446	Bearing - self aligning		2204E-2RS1TN9	1
58	N04	Lock Nut	S45C	N04 ( 20x16UNF)	1
59	W04	Lock Washer		W04	1
60	16295-1	Bearing Housing	FC20		1
61		Socket Head Cap Screw		M12x50L	4
62		Washer - Spring		M12	4
63		Socket Head Cap Screw		M6x20L	2
64	25-0321	Bumper	Rubber		2
65	25-0320	Cam	SS41		1
66		Socket Head Cap Screw		M8x70L	2
67	23337-82	Wiper - Bedway (Right, Front)	Rubber	25-0335	1
68	24714	Gib - X Axis	FC30	25-0217	1
69	17-0321-00	Screw - Adjusting	S30C		2
70		Socket Head Cap Screw		M8x25L	4
71	25-0201	Saddle	FC25		1
72		Socket Head Cap Screw		M12x65L	4
73	23337-81	Wiper - Bedway (Left, Front)	Rubber	25-0334	1
74	24704	Ballscrew - Z Axis	SCM415	25-0310	1
75		Cover - Bearing		AVH7205	1
76	23940	Bearing Set (2) - Angular Contact Ball		7205 BECBP	1
77	16302	Spacer	S45C		1
78	24A-0308	Seat - Bearing	S45C		1
79		Socket Head Cap Screw		M8x25L	4
80	16452	Nut - Clamp	S45C	19x16UNF	1
81	24A-0216	Cone Clamping Element	Brass		1
82	16983-1	Pulley - ballscrew	Aluminum		1
83	98481A090	Woodruff Key		#3 (1/8"x1/2")	1
84	W01	Lock Washer		W01 ( 12)	1
85	N01	Lock Nut		N01 ( 12x32UNF)	1
86		Set Screw		M5x10L	3
87		Socket Head Cap Screw		10-32x3/4"	1
88		Socket Head Cap Screw		M12x35L	4
89	400-5M-15	Belt - Z Axis		400-5M-15	1
90		Pulley	Aluminum	5M-30T	1
91		Socket Head Cap Screw		1/4-20UNCx30L	4
92		Washer - Flat		1/4"	4
93		Washer -Spring		1/4"	4
94	77USDA-0304	Base - Motor - Z Axis	FC30		1
95	16775-1	Motor – Z Axis Servo – 1630			1
	24425	Motor – Z Axis Servo – 1630HS			

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### **5.1.15 Align Z-Axis Ballscrew Assembly**

See Figures 22 and 23.

1. Recheck machine level. Adjust as necessary.
2. Move carriage to middle of travel.
3. Loosen headstock bearing housing and mounting bracket and loosen tailstock bearing housing.
4. Snug but do not tighten the yoke mounting bolts.
5. Move the ball screw manually and move the carriage to the tail stock end.
6. Tighten the yoke; this will align it vertically.
7. Tighten the tailstock bearing housing.
8. Loosen the yoke and retighten to realign ball horizontally.
9. Using a 3/8" socket extension, move the carriage to the headstock.
10. Tighten the Z-axis housing.
11. Tighten the bearing housing.
12. Turn the ball screw manually with the 3/8" socket extension and move the carriage to the middle of the travel.
13. Loosen the yoke mounting bolts to readjust the apron plate after the bearings have been tightened.
14. Retighten the yoke.
15. Move the ball screw manually and move the carriage through the entire length of the Z-axis. Pay special attention to the areas near the headstock, tailstock, and in the middle of the travel. If there is any binding or rough spots, the alignment procedure must be repeated. The axis should feel equally free throughout the entire range.
16. Using a torque wrench, measure the torque to move the z-axis at each end, and in the middle of the axis travel. The torque reading should be a maximum of 10-15 in-lb.

### **5.1.16 Headstock Taper Adjustment**

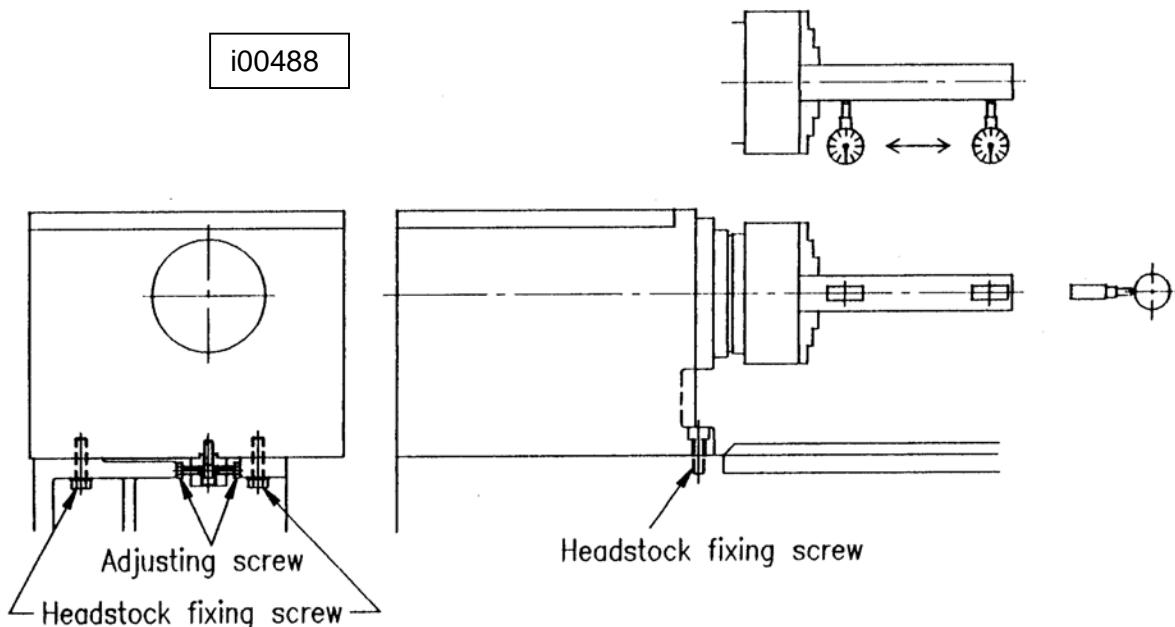
The headstock may be adjusted to remove turning a taper if the taper is caused by a lack of parallelism of the spindle to the bed ways. Ensure that the level of the bed is correct prior to any headstock adjustments.

#### **1630/1840/1845/2460 Machine – See Figure 25**

To adjust the headstock alignment, loosen the four socket head cap screws that attach the headstock housing to the bed. Using the adjusting screw located at the rear of the headstock, (see Figure 25) adjust the headstock position in the direction necessary to remove the taper. Note that the headstock will pivot about a pin located between the two front attaching screws. Tighten the attaching screws and test for taper.

To access the front two cap screws the front cover guard will have to be removed.

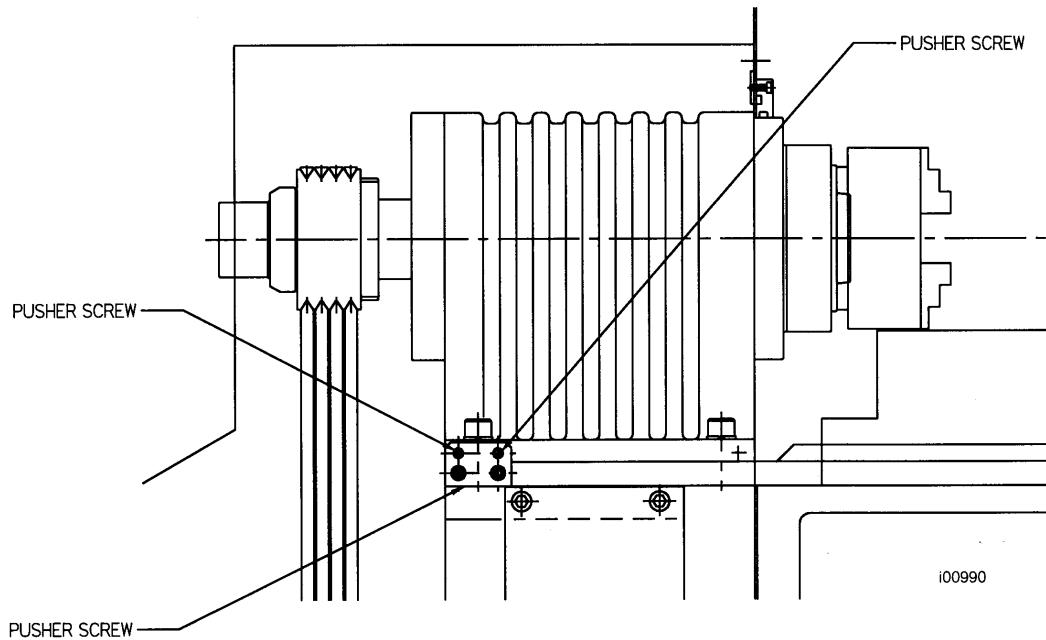
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**Figure 23**  
**1630/1630HS/1840/1845/2460 Headstock Taper Adjustment**

**1540 Machine – See Figure 24**

1. Remove the headstock sheet metal cover.
2. Loosen the bolts holding the headstock splashguard. This should be fine if the adjustments are minor.
3. Loosen the 4 bolts that hold the headstock down to the lathe bed.
4. Use the adjusting screws to pivot the headstock in or out. When facing the encoder side of the headstock the right screw on the adjusting bracket will push the headstock away from you while the left screw will pull the headstock toward you.
5. After the necessary adjustments are made, tighten the 4 bolts that hold the headstock in place. Be careful when tightening these bolts that the headstock does not move.
6. Replace the sheet metal cover.



**Figure 24**  
**1540 Headstock Taper Adjustment**

### 5.1.17 Spindle Bearing Preload

1. Run the lathe for 10 minutes to insure the bearings are lubricated and slightly warmed. Run the lathe at 500 RPM.
2. Stop lathe and set the gearbox in neutral between low and high gears for the 2460, 1845 and 1840. Using the torque wrench, measure the spindle rolling torque. The acceptable range of rolling torque is around 10 - 15 in-lb. Note that the torque required to start ("breaking away torque") the spindles rotation will be higher. For the 1630, you will have to remove the spindle motor belt as this machine does not have a neutral. For the 1540, the spindle bearings are not adjustable.
3. If torque is out of tolerance. Remove the spindle belt cover. You will then need to remove a bearing cover to gain access to the spindle-adjusting nut. Loosen the three setscrews on the spindle-adjusting nut before tightening or loosening (Figure 43). The spindle-adjusting nut on the 1630 is outside the gearbox, so the headstock access cover will not need to be removed.
4. Torque too low: Lock the spindle in low gear. With a spanner wrench tighten the adjusting nut. Return the speed selection lever to the neutral position. Measure the rolling torque and repeat until 10 – 15 in -lb. of rolling torque is achieved. Tighten the three setscrews to retain the adjustment.
5. Torque too high: Lock the spindle in gear. With a spanner wrench loosen the adjusting nut two full turns. Place an aluminum block over the end of the spindle and with a hammer drive the spindle forward until it is loose. (Near zero rolling torque)

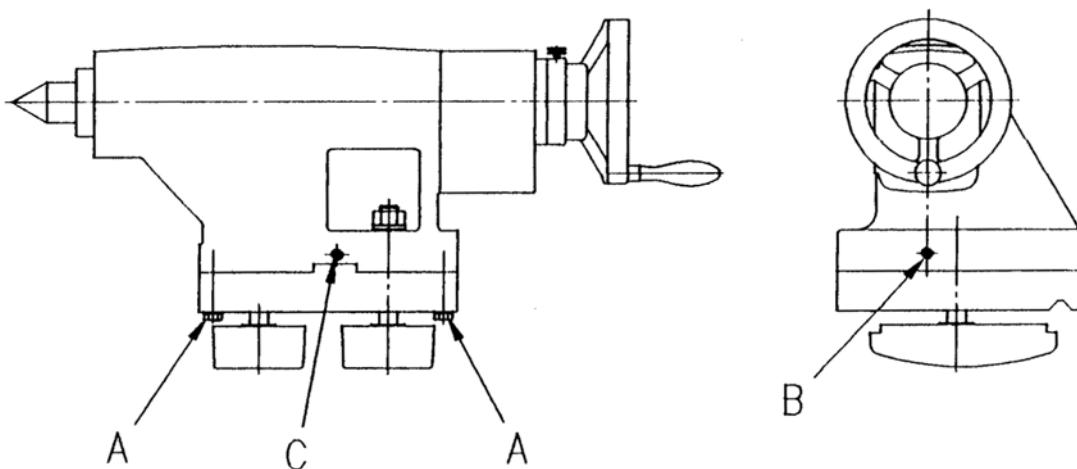
With a spanner wrench tighten the adjusting nut. Return the speed selection lever to the neutral position. Measure the rolling torque and repeat until 10 - 15 in -lb. of rolling torque is achieved. Tighten the three setscrews to retain the adjustment.

### 5.1.18 Aligning Tailstock to Spindle

If there is taper appearing on the workpiece while machining when using the tailstock, the tailstock will need to be realigned to the spindle. Follow the steps below.

1. Insert a gage bar between the spindle and tailstock, attach a base of a dial indicator to the saddle, apply the needle of the indicator to the surface of the bar, then move the saddle through the longitudinal travel. Document the measurement of its maximum difference from end to end for later adjustment.
2. Release the 4 bolts labeled "A" in the drawing.
3. Release the screw labeled "B".
4. Adjust screw "C" until the tailstock is aligned with the spindle.
5. Tighten up the locking nuts "A".

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**Figure 25 – Tailstock Adjustment**

### 5.1.19 Spindle Motor Wiring

The TRAK Lathe spindle motors are wired for 220 volts (low voltage configuration). The wiring consists of 3-phase power for the motor and 110 V power for the spindle motor fan. Please see the motor junction box diagram for wiring information.

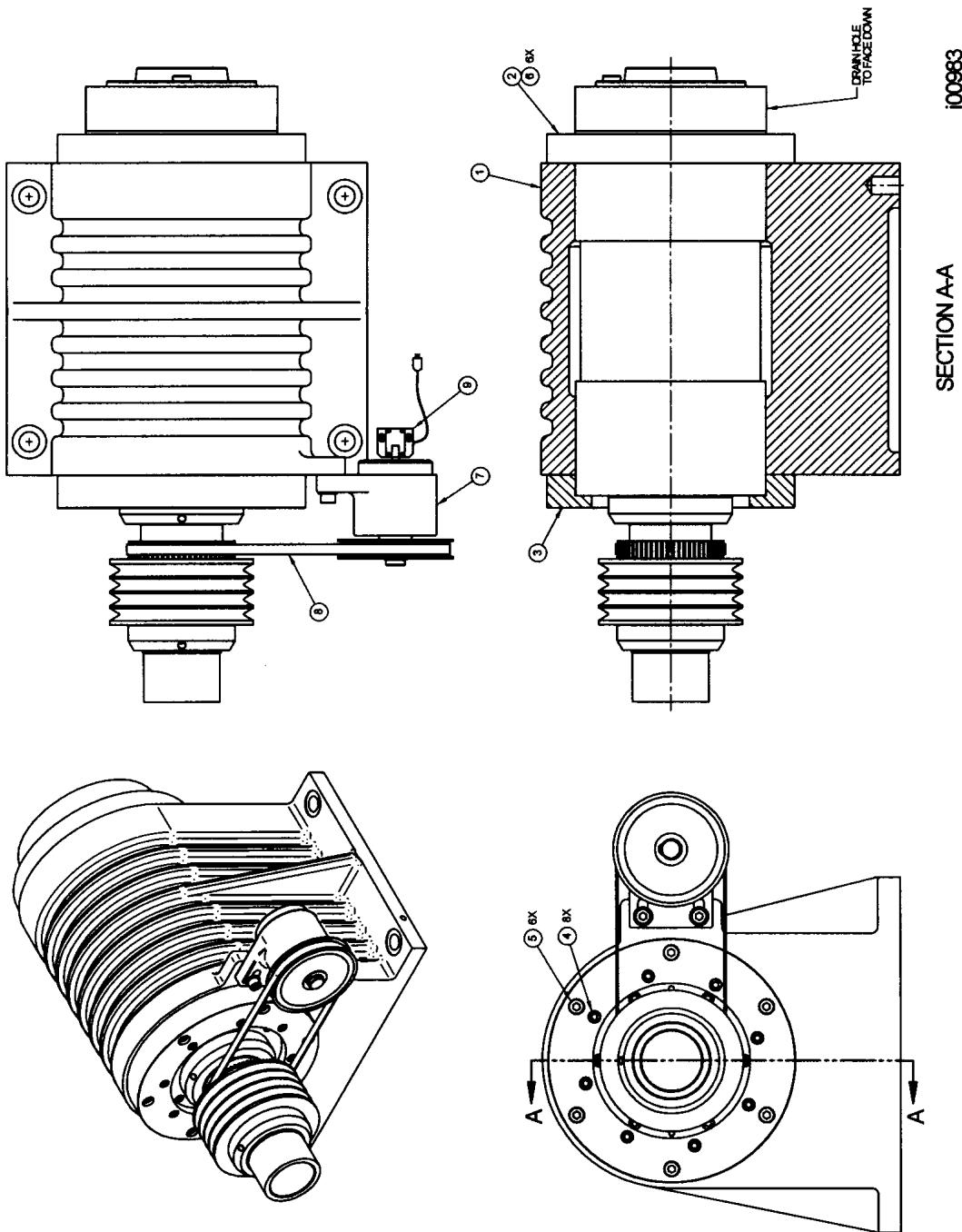
Each junction box contains 6 terminals. Make sure to hook up the wires to the same terminals after the replacement motor is installed. Failure to do so may cause the motor to run in the wrong direction.

The spindle motor fan wires are also found in the junction box. There is 1 hot wire, 1 neutral wire and 1 ground wire. It does not matter which wires are connected to the hot and neutral wires. All grounds from each cable are connected to either of the screws in the junction box.

### **5.1.20 Spindle Cartridge Replacement – 1540SX Only (see Figure 26)**

The spindle and bearings on the 1540 lathe are to be replaced as an assembly. The spindle and bearings are encased within a cartridge that bolts to the headstock. Problems with the spindle or bearings are to be solved by replacing the entire cartridge.

1. Remove the headstock sheet metal cover.
2. Remove the spindle encoder belt.
3. Remove the chuck guard from the headstock splash shield.
4. Loosen the spindle motor and remove belt from spindle to headstock pulley.
5. Remove headstock splash shield for easier access to the cartridge.
6. Remove the rear clamping plate from the headstock casting (Item 3) by removing 8 (M6) SHCS and 6 (M8) SHCS. This will allow the spindle assembly to easily slide through the opening of the casting. This plate may be left on but it makes it more difficult to remove the cartridge. If it is left on the M6 SHCS will still need to be removed.
7. Remove the 6 (M12) SHCS that hold the front of the cartridge to the headstock. Once these are removed the cartridge should slide out of the headstock. This assembly weighs over 100 lbs please get additional help to remove the cartridge.
8. Slide the new cartridge into the casting. Make sure to place the drain holes pointed down towards the floor when mounting. This will allow any coolant that makes it in between the spindle and cartridge to drain out.
9. Reverse the steps to install the new cartridge.



**Figure 26**  
**1540 Headstock Cartridge Removal**

## 1540 Headstock Cartridge Parts List

Item	P/N	Description	Use As	Qty
1	22171	24-0101-00	EA	1
2	22170	SPINDLE ASSY - 1540SX LATHE -PT4	EA	1
3	22183	24-0113-00	EA	1
4	M6-1.0X20 25B	SCREW-SHCS-STL-BO	EA	8
5	M8-1.25X35 25B	SCREW-SHCS-STL-BO	EA	6
6	M12-1.75X35 25B	SCREW-SHCS-STL-BO	EA	6
7	22206	ENCODER DRIVE ASSY - LATHE	EA	1
8	23359	BELT - HEADSTOCK ASSY - 1540SX	EA	1
9	16873	SPINDLE ENCODER ASSY	EA	1

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### 5.1.21 Spindle Removal – 1630HSSX only (See figure 27)

The following procedure is to remove the spindle for the 1630HS lathe.

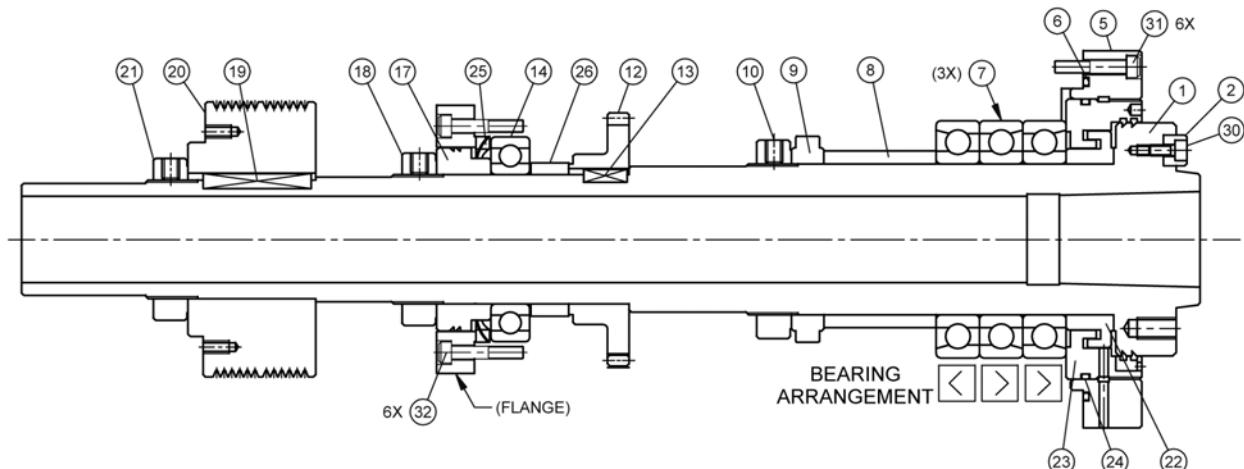
- 1.) Remove both spindle pulley belts.
- 2.) Loosen three set screws on locknut item #21. Remove locknut.
- 3.) Remove belt pulley item #20. Mark orientation of pulley to spindle shaft
- 4.) Remove two keys item #19.
- 5.) Loosen three set screws on locknut item 18. Remove locknut.
- 6.) Remove six M6 socket head cap screws item #4
- 7.) Cover end of spindle with aluminum or brass drift to prevent damage. Strike to remove spindle. Carefully remove seal ring item #17 and encoder drive gear item #12 as spindle is driven forward. Remove O-ring item #6.
- 8.) Remove two bearings item #14

Note – the initial design of the spindle was different from what is reflected in figure 27 and in the parts list below. The spindle bearings are a 7013 bearing, p/n 24747.

## 1630HSSX Headstock Part List

Item	P/N	Title	Qty
1	24751	SPINDLE - 1630HS	1
2	24750	KEY	1
5	24752	COVER, FRONT	1
6	24753	O-RING	1
7	24754	BEARING-ANGULAR CONTACT U/ SET (3)-7014 P4	1
8	24755	SPACER SET	1
9	24756	COLLAR	1
10	24757	NUT-LOCK	1
12	24758	GEAR	1
13	24759	KEY	1
14	24760	BEARING-DEEP GROOVE-6012ZZ	1
17	24762	COLLAR	1
18	24763	NUT-LOCK	1
19	24764	KEY	1
20	24765	PULLEY, SPINDLE	1
21	24766	NUT-LOCK	1
22	24767	COLLAR	1
23	24770	CLAMP RING	1
24	24771	O-RING	1
25	25014	WASHER-WAVE SPRING	1
26	25015	SPACER-REAR BEARING-SPINDLE	1
30	M5-0.8X16 25B	SCREW-SHCS-STL-BO	1
31	M6-1.0X30 25B	SCREW-SHCS-STL-BO	6
32	M6-1.0X20 25B	SCREW-SHCS-STL-BO	6

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**Figure 27**  
**1630HSSX Headstock**

## 5.2 Maintenance

### 5.2.1 Gib Adjustments

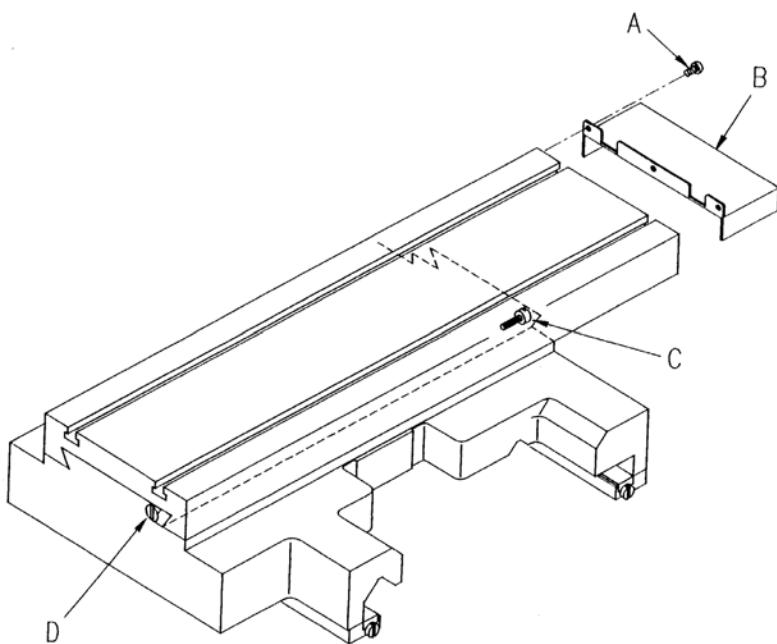
The objective of adjusting the gib is to eliminate as much play in the table, saddle and ram sliding surfaces as possible without having the tightness of the gib interfere with their free movement and cause a decrease in the accuracy and/or performance of the machine due to excessive friction.

#### 5.2.1.1 Cross Slide Gib Adjustment

1. Remove the yoke bolts from the top of the cross slide and slide it back and forth and feel for any looseness in the system. If it is loose tighten up the adjusting screws.

*NOTE: Adjustments should be made where the gib are worn the worst.*

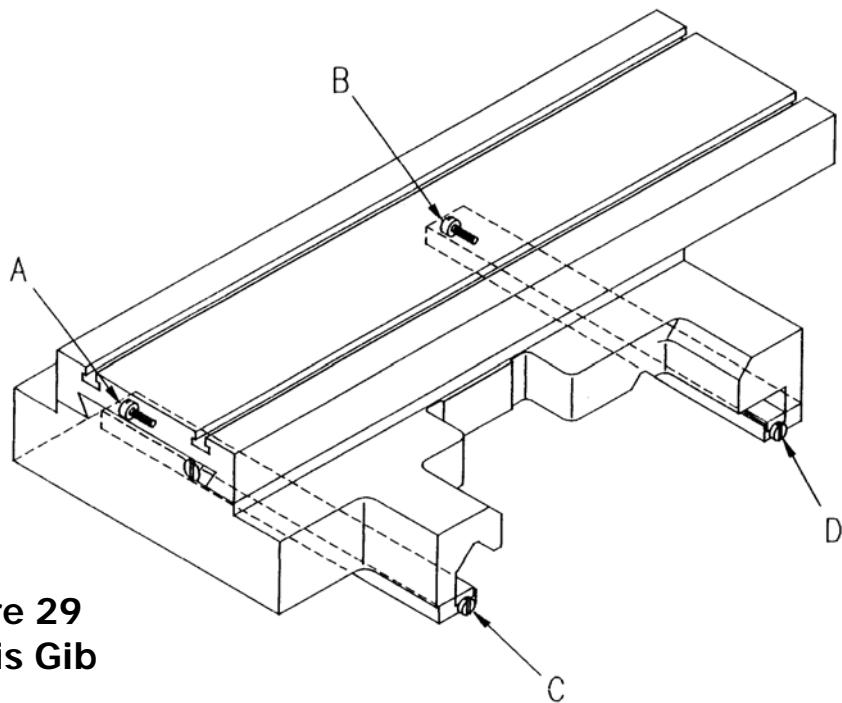
2. Turn the X-axis ball screw with a torque wrench and measure the torque. The torque should be less than 15 in/lb. and consistent over the travel of the X-axis. If the measurement is higher than this then loosen the gib. Make sure the cross slide is aligned properly. One easy way to check for this is to remove the yoke bolts and see if the yoke springs back into position. Misalignment is also evident if the torque is higher when the yoke is up against the rear bearing housing.



**Figure 28 X Axis Gib**

#### 5.2.1.2 Z-Axis Gib Adjustment

1. Mount a dial indicator on the Z-axis ways and locate on top of the carriage.
2. Lift the carriage up to measure the amount of play. The dial indicator should not move more than 0.001". If it moves more, tighten the gib. Make sure not to over tighten the gib.
3. This procedure with the dial indicator will need to be done in the front and rear of the saddle.



**Figure 29**  
**Z-Axis Gib**

### 5.2.2 Calibration & Backlash Constants

Calibration and backlash constants were set as part of the installation and set-up of your system. They should be re-set when indicated in the Troubleshooting section or after the replacement of the computer module, or any parts of the drive train.

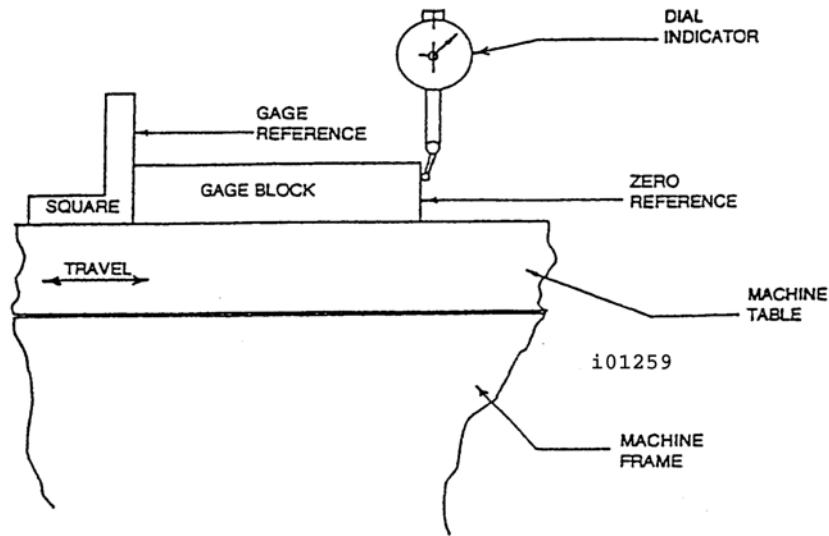
Calibration is used to teach the machine a known distance. We typically calibrate our machines over a 150 mm distance. There is no limit to how far you can calibrate the machine.

#### 5.2.2.1 Calibration

*NOTE: Calibration usually is only done after replacing a computer module or adjusting the drive train.*

1. Recheck machine level and adjust as necessary.
2. Press the "SERV CODE" soft key.
3. Input 123 on the keyboard, then press the "INC SET" key.
4. Input the "X" key to tell the control the x-axis is being calibrated.
5. Place the .0001 indicator in the spindle and set up the metric standard on the cross slide. Make sure the standard is parallel to the cross slide by using a combination square. Ensure that the standard is set up so that the readings will be taken with the cross slide extended towards the operator and moving in towards the motor end of the X-axis.
6. When the indicator is zeroed at the beginning of the standard press the "INC SET" key.
7. Move the cross slide towards the motor side of the x-axis until the indicator zeros on the end of the standard. Input 300 on the keyboard.
8. If the calibration was successful the screen will return to the set up screen.
9. Press the "SERV CODE" soft key.

10. Input 123 on the keyboard, then press the "INC SET" key.
11. Press the "Z" key to tell the control that the z-axis is being calibrated.
12. Set up the metric standard on the Z-axis ways.
13. Set up the magnetic base and .0001 indicator on the cross slide.
14. When the indicator is zeroed at the beginning of the standard press the "INC SET" key.
15. Move the saddle towards the chuck until the indicator zeros on the end of the standard, then press the "INC SET" key.
16. Input 150 on the keyboard.
17. If the calibration is successful the screen will change to the set up screen.



**Figure 30**  
**Calibration Set-Up**

#### 5.2.2.2 Backlash Compensation

##### **Code 127: Calculate X or Z Backlash Constant**

Every mechanical system has at least a little backlash or lost motion. It is produced by the small amount of play between the gib and ways, and mostly by the accumulative bending or elasticity of all the parts of the drive train under load. The backlash constant is factory set, but may need to be adjusted periodically.

1. Set a .0001-inch dial indicator in the spindle, and touch off on a block or the vise along the direction (X or Z) you wish to check, or set the backlash constant.
2. Turn on the ProtoTRAK and at the Main Menu, follow the procedure below precisely:

Conversation Says	You Do
a. ---	a. Press MODE
b. Select Mode	b. Press SET UP
c. Select	c. Press SERV CODES
d. Select	d. Press "B"
e. Select Code 127	e. Press X or Z
f. Backlash Value = -----	f. What is shown is the current value. Follow the instruction on the screen and press the appropriate soft keys. Wait a few seconds between each press of INCR VALUE or DECR VALUE.
g. The following is an example of what you might see when running this code.	For example, if the up and down "Oscillation Value" shown in the conversation line is .00278 inch, and the dial indicator is moving back and forth .0012, then the true backlash value is .00278 - .0012 = .00158 inch. Input this by pressing MODE, SET UP, SERV CODE, 128, SET and then .00158, SET, RETURN.

3. The X backlash identified and stored in Step 2 should be less than 0.003" on a new machine. If it is appreciably larger, inspect the drive train for loose bolts, brackets, bearings, etc.

The backlash can also be found manually with a 0.0001" indicator using the following method.

- Load the indicator to zero from one direction and zero out the DRO.
- Move the indicator to 0.002" and then back to zero. Do not over shoot 0, otherwise start over.
- Whatever number appears on the screen is the backlash value.
- Enter this value into service code 128.
- After entering this number redo the process. The DRO and indicator should now both read 0.

#### **CODE 128: Input Backlash Constant**

Code 128 allows you to enter the backlash values for each axis. It displays the value after it enters.

Be sure not to enter too much backlash on any given axis. Too much backlash in the system may cause bi-directional repeatability problems or axis motor searching.

### **5.2.3 Lubrication**

#### 5.2.3.1 Headstock Lubrication

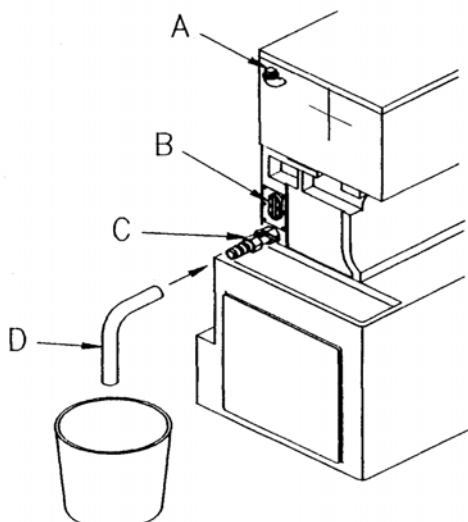
**1630, 1845, 2460: The pump needs to be primed if left unused for a couple days. Priming the pump entails turning the spindle on at 1000 RPM for a few seconds.**

An oil pump provides lubrication for an even distribution of oil to all the gears and bearings in the headstock. One of the oil lines pumps oil to a site glass located on the headstock. Periodically check to see that oil is flowing. Oil flows to this site glass only

when the spindle is running for the 1630 and 2460. For the 1840, oil should be flowing when the 220-volt power is on. On the 1840 only, if there is no oil pumping at the sight glass, reverse any two legs of the 220v to the oil pump to reverse the rotation of the pump. This action will not affect the direction of rotation of the spindle on the 1840ZX lathe. The 1540 does not require headstock oil.

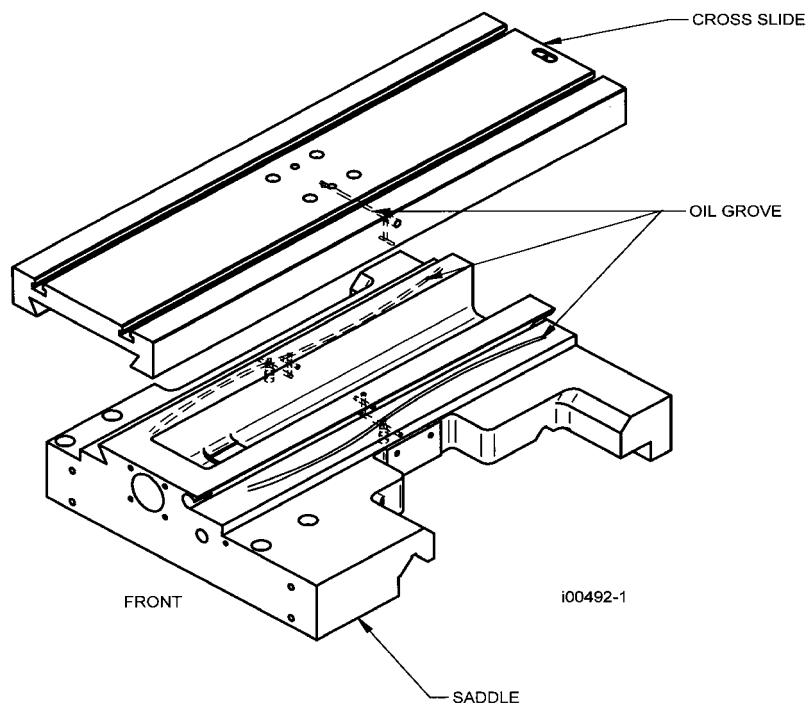
The plug to drain the headstock is located under the spindle cover towards the bottom of the casting. See the figure below. Oil can be added to the reservoir by a plug in the top of the headstock cover or by removing the cover and pouring it into the headstock. There is a level site glass located under the spindle cover. The headstock reservoir holds approximately 3 gallons. Fill the headstock with Mobil DTE 24 oil or an equivalent grade.

The headstock gearbox oil must be drained and flushed after the first 150 hours of operation. A small percentage of kerosene may be added to the gearbox to flush out dirt and sediment. Operate the machine for several minutes without load so that the flushing oil can circulate through the reservoir and remove the dirt. The flushing oil must then be drained and new oil added. Do not flush with solvents, as that will soften the paint. Thereafter, the oil should be flushed and drained every 1500-2000 hours of operation.

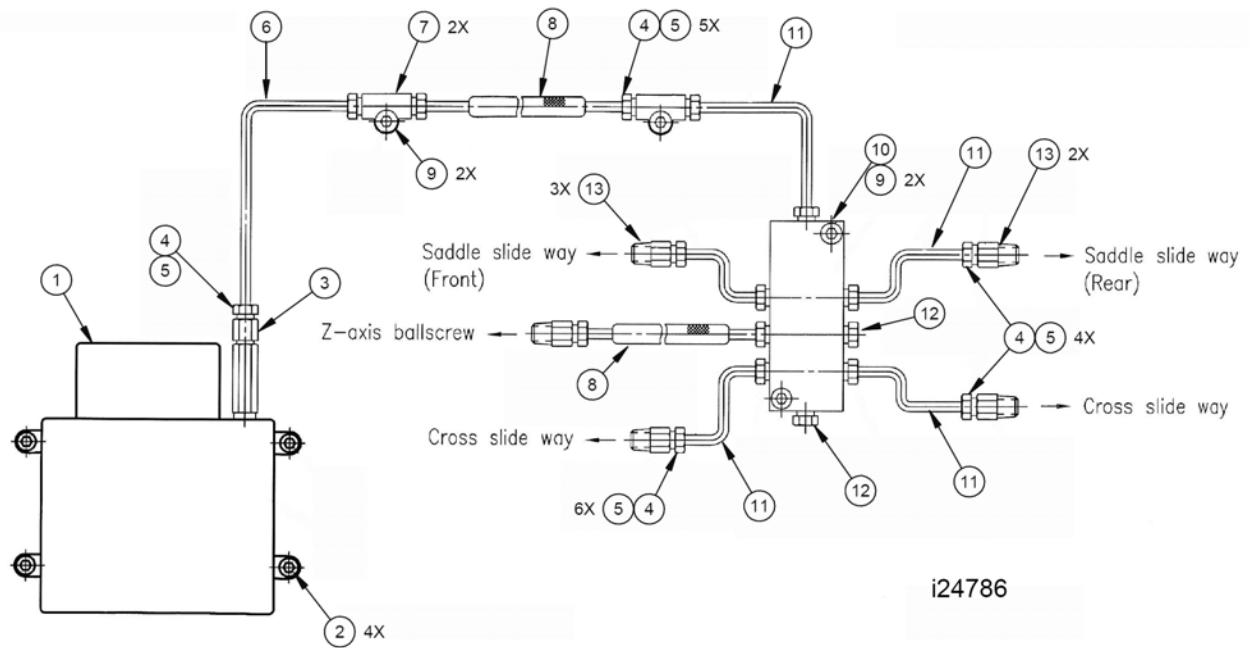


i00514

## Figure 31 Headstock Oil Removal



**Figure 31a System Lubrication-1630**

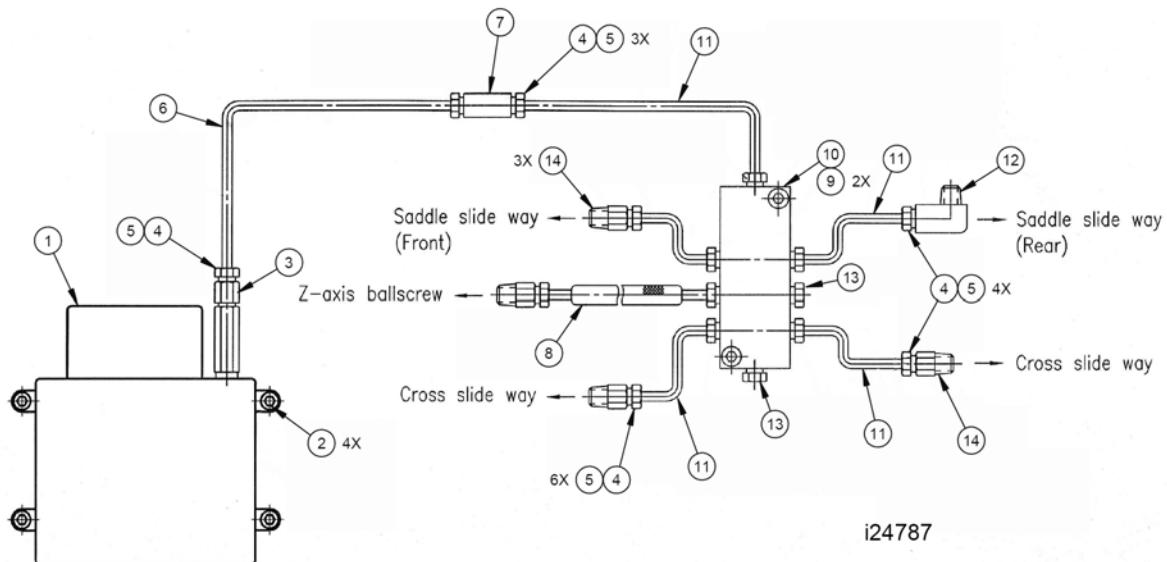


**Figure 31a System Lubrication-1630 Parts List**

Item	P/N	Title	Qty
1	22291	LUBRICATION PUMP-WITH CABLE	1
2	M6-1.0X12 25B	SCREW-SHCS-STL-BO	4
3	PC4	VALVE-CHECK 1/8"	1
4	PA4	NUT-COMPRESSION 4mm	16
5	PB4	SLEEVE-COMPRESSION 4mm	16
6	16386	TUBING NYLON 4MM DIA #5N25C	A/R
7	PN-6	UNION-FEMALE	2
8	106711	HOSE- FLEXIBLE 4MM	A/R
9	M5-0.8X20 25B	SCREW-SHCS-STL-BO	4
10	D12	OIL DISTRIBUTION JUNCTION	1
11	A4	TUBING-4MM ALUM	A/R
12	PG004	PLUG- M8 X 1.0	2
13	PD-401	ADAPTER-STRAIGHT	5

i24786

**Figure 31b System Lubrication-1840**



i24787

**Figure 31b System Lubrication-1840 Parts List**

Item	P/N	Title	Qty
1	22291	LUBRICATION PUMP-WITH CABLE	1
2	M6-1.0X12 25B	SCREW-SHCS-STL-BO	4
3	PC4	VALVE-CHECK 1/8"	1
4	PA4	NUT-COMPRESSION 4mm	14
5	PB4	SLEEVE-COMPRESSION 4mm	14
6	16386	TUBING NYLON 4MM DIA #5N25C	A/R
7	PN-6	UNION-FEMALE	1
8	106711	HOSE- FLEXIBLE 4MM	A/R
9	M5-0.8X25 25B	SCREW-SHCS-STL-BO	2
10	D12	OIL DISTRIBUTION JUNCTION	1
11	A4	TUBING-4MM ALUM	A/R
12	PH-401	JOINT-ANGLED	1
13	PG004	PLUG- M8 X 1.0	2
14	PD-401	ADAPTER-STRAIGHT	4

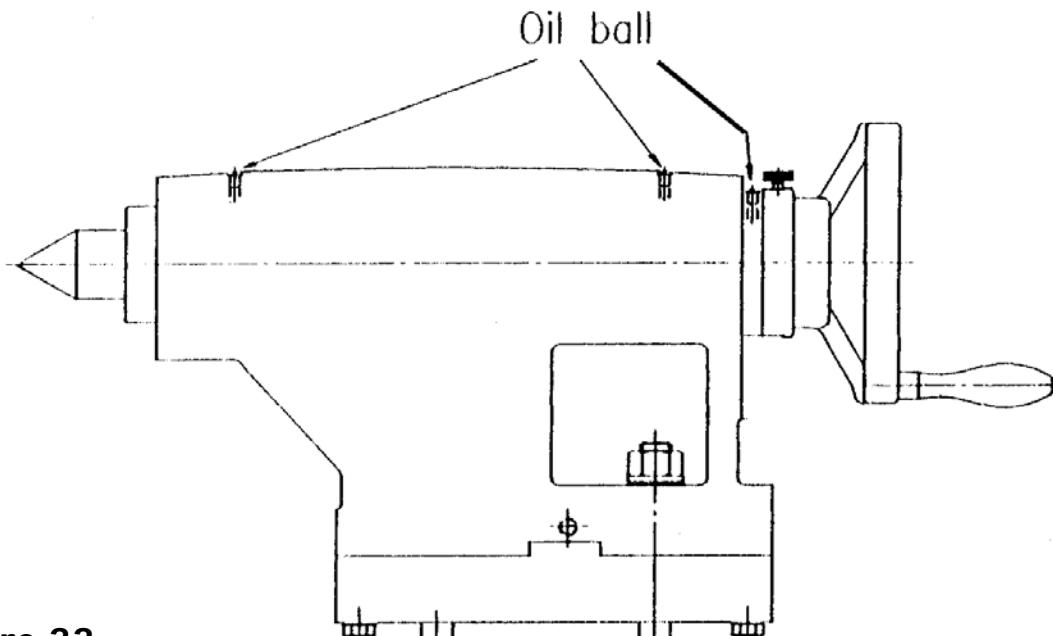
i24787

For the 1845 lathe, see section 7 for a way lubrication diagram.

#### 5.2.3.2 Tailstock

Three oilers located on top of the spindle housing lubricate the spindle and screw. The bedways on which the tailstock slides should be cleaned and oiled frequently.

i00494



**Figure 33**  
**Tailstock Lubrication**

### 5.2.3.3 Miscellaneous Information

For all oilers on the machine, use medium S.A.E. NO. 30 machine oil. Before filling reservoirs or oil cups, always wipe off with a clean rag any accumulation of old oil, grease or dirt that might get into a part being lubricated.

Do not mix detergent type automotive oil, or multi-purpose oils with the regular grade of S.A.E. No. 30 lubricating oil.

### 5.2.4 X & Z Limit Switch Adjustments (applicable to 2460 only)

#### 5.2.4.1 X-Axis Limit Switch-Stop Installation & Adjustment

The limit switch-stops for the X-axis are mounted to the side of the crosslide. They are slotted for adjustment front to back. Each limit switch-stop must be set to a specific distance from the end of the crosslide in order to maximize travel and simultaneously prevent serious damage to the machine in the event of a crash. All limit switches are set at the factory for maximum travel. The switch is mounted to the carriage. The switch and the stops are covered by a sheet metal cover.

***Procedure for setting X limit switch:***

1. Loosen the stops on each side of the crosslide.
2. Slowly move the crosslide to the extremes of travel.
3. In DRO mode set X = 0 ABS.

**CAUTION!**

The limit switch must be triggered a minimum of  $\frac{1}{2}$ " before the machine reaches its travel limits in both directions. This allows sufficient room for the servomotors to stop when the limit switch is hit at 250 ipm.

4. Using the DRO display, back the table off  $\frac{1}{2}$ ".
5. Tighten the stops in place.
6. Jog the table at 250ipm to each side and verify that the limit switches are working properly. Also, make sure that the table does not exceed its travel and crash.

#### 5.2.4.2 Z-Axis Limit Switch-Stop Installation & Adjustment

The limit switch-stops for the Z-axis are mounted on the side of the bed at the headstock side and attached by a bracket to the tailstock for the positive direction. Each limit switch-stop must be set to a specific distance from the headstock and tailstock to maximize travel and simultaneously prevent serious damage to the machine in the event of a crash. The limit switch bracket and stops contains slotted holes, which allow for side-to-side positioning adjustments of the limit switch assembly.

***Procedure for setting Z limit switch:***

1. Slowly move the carriage to the front of the spindle with the handwheel until you are approximately  $\frac{3}{4}$ " from the spindle.

**CAUTION!**

The limit switch must be triggered a minimum of  $\frac{1}{2}$ " before the machine reaches its travel limits in both directions. This allows sufficient room for the servomotors to stop when the limit switch is hit at 250 ipm.

2. Lock the stop in place and make sure when you hit the stop the switch is triggered and the carriage comes to rest before hitting the spindle. Make sure you have adjusted the stop far enough away to prevent a crash.

**WARNING!**

The Z-axis limit switch at the headstock end is set to prevent crashes into the spindle. It is not adjusted for the various chuck or collet closer combinations.

3. Perform a similar adjustment at the tailstock end of the bed. Make sure the carriage does not hit the tailstock when the limit switch is triggered at maximum feedrate. At the tailstock end there is slight adjustment up and down and more adjustment side to side.

## 6.0 Indexer Options

### 6.1 Dorian Indexer Option

#### 6.1.1 Field Installation Instructions

1. Turn power on to the machine.
2. Verify air has been hooked up to the machine. The air regulator is mounted to the bottom left of the electrical cabinet.
3. Make sure the on/off switch on the white box on top of the chip guard is turned on. When it is on a green light will be illuminated.
4. Go to SETUP mode under TOOL GROUPS to verify the indexer softkey is activated. Then press the INDEXER key to activate the indexer. It will turn gray when activated.
5. Go to DRO mode and press **TOOL #** and enter a number from 1 to 8. The indexer should move to this tool number. The tool number on the indexer is found right above the tool slot. If the tool # in the control and on the indexer is in the wrong position, enter Service Code 147 to re-initialize the indexer.
6. To verify the indexer is working properly, run a program with all 8 tools. To run the program, enter a home position in Setup Mode. Make sure you set the X and Z absolute zero position 12 to 18 inches from the chuck. Set the home position to X = 3 and Z = 3. Run a program and make sure the indexer moves to the correct tool stations programmed. Verify that the indexer positions to each tool station. If there is a problem refer to the troubleshooting section.

#### 6.1.2 Removing the Indexer from the Lathe

1. Turn the main power off to the machine.
2. Unhook the air line from the air regulator.
3. Disconnect 2 air lines and 2 electrical lines. The 2 air lines need to be disconnected at the white box that is mounted on the top of the chip enclosure. The fittings are the quick-disconnect type where you push in on the connector and pull the air lines loose. One electrical cable needs to be removed from the white electrical box and one cable from the black electrical box. All four connections to the indexer are inside a flexible black conduit. See Figure 36 at the end of this section for layout of cable connections.
4. Unhook the black cable from the brackets that run on top of the chip enclosure.
5. Remove the cabling that goes runs across the crosslide.
6. Remove the indexer from the cross slide. It is fastened down with 6 socket head cap screws to the riser block. Remove the riser block from the cross slide. You may want to remove the indexer and riser block assembled together but it may be difficult to slide the whole thing out of the T-slots. Be careful, the indexer weighs approximately 80 lbs.
7. To re-install the indexer, follow these steps in reverse order. Make sure you install the riser block at least  $2 \frac{1}{4}$ " from the front of the cross slide, **not the front bracket**. Failure to do this will cause the indexer to hit the sliding door when the cross slide is all the way toward the operator.

### 6.1.3 Troubleshooting the Indexer

The following fault messages will appear on the screen when there is a problem with the indexer. There are also LED's in the black box on top of the chip guard that may be helpful when troubleshooting the indexer. Please refer to that section below.

- *Fault 85 – Impossible Tool Position*

This message will appear if the indexer goes to a tool number that you did not select. For example, the operator chose Tool 2 and the indexer went to Tool Station 6. To fix this problem, re-initialize the system by choosing Service Code 147. If this does not solve the problem, refer to the LED troubleshooting section.

- *Fault 86 – Indexer Power Problem*

This message will appear if the power is interrupted to the indexer. It could indicate that no power or low power is getting to the indexer. The black box on top of the chip enclosure receives 115V power from the main electrical cabinet and sends it to the white box. From there it is reduced to 24V by a power supply in the black box and reduced to 12V in the white box by a transformer. If there is a power problem you will need to back track to find out where the power is being interrupted. If voltage drops outside of the 20–28 volts range in the black box this message could also appear. To make sure power is getting to the white box verify that the green light on the side of the box is illuminated. If it is not, check the fuse next to the light.

- *Fault 87 – Indexer Air Pressure Problem*

This message will appear if the air pressure sensor senses low air or no air pressure. The recommended air pressure for the indexer is 80 psi. The air pressure should be at least 70 psi and no more than 150 psi for the indexer to work correctly. **Do not exceed 150 psi. This will void the warranty on the indexer.** Check to make sure the air regulator is set to at least 80 psi.

- *Fault 88 – Indexer Not Initialized*

This message will appear if the indexer does not know its present position. An example of this would be if the turret stops in the middle of a tool change. An interruption of power or air may cause this fault. Pressing the E-stop button can also cause this problem if the tool is not in a known position. Initialize with Service Code 147.

- *Fault 89 – Indexer Time Out*

This message appears if the indexer does not get to position after a few seconds. This may be caused by an internal problem inside the indexer such as a broken gear or jammed component. Very low air pressure may also cause this fault. It should take no longer than 2 or 3 seconds for the indexer to move between positions.

### 6.1.4 Troubleshooting from LED's in Black Box

Inside the black box, which is mounted on top of the chip enclosure, there is an LED that signifies indexer position. It reads numbers from 1 to 8. There are also directional LED's to signify how far and in what direction the indexer is told to rotate by the control. Remove the lid from the box in order to see the LED's. The number in the black box should correspond to the tool number of the indexer. If these numbers are different, re-initialize the indexer with Service Code 147. The directional LED's will be helpful in verifying that the command from the control is getting to the black box and to the indexer. If the command is getting to the black box but not the indexer, there is a problem with the indexer. For example, if you command the indexer to move from Tool 1 to Tool 3 the LED for -90° should light up for a second. When facing the indexer, the rotation of the turret in a CW direction signifies a negative move and a CCW move signifies a positive move. Since the indexer takes the shortest path between tool changes, it can only move 45, 90, 135 in the positive direction, and 45, 90, 135 in the negative direction.

### **6.1.5 Indexer Encoder Re-Alignment**

This procedure is necessary only if the indexer does not return to a true home position after initializing with Service Code 147. If the encoder is misaligned, the turret will consistently be off by some angle. In order to perform the operation, it may be necessary to use two people. One will adjust the encoder while the other watches the strobe 2 light inside the black box on top of the chip enclosure. If the encoder is misaligned, an LED labeled strobe 2 will be lit.

1. Remove the 4 screws that hold the back cover onto the indexer. The encoder is mounted to the far right of the indexer if you are at the front of the machine and facing it. Please refer to the Dorian manual that is included with the machine for an illustration.
2. If initialization does not work, attempt to index the indexer until it sits in a true position. A true position means the tool stations are parallel to the crosslide. This can be done by reversing the air lines on the indexer. Reverse the blue and red air lines and then use a breaker bar or piece of square stock to rotate the turret manually to a true position. Make sure to reverse the air lines back when complete. It will be obvious when the indexer is back to a true position. The indexer moves in approximately 15° increments.
3. Using an allen wrench, loosen the setscrew holding the encoder onto the shaft.
4. Rotate the encoder with the allen wrench until the strobe 2 light turns off in the black box. Carefully tighten down the set screw making sure not to move the encoder. If the encoder moves, the number in the box will disappear and it will be necessary to re-align the encoder.
5. Reassemble the unit.

### **6.1.6 Indexer Maintenance**

Dorian recommends that the indexer be lubricated twice a year after the first year. The worm and worm gear should be lubricated with quality lithium based grease every 6 months after the first year. Remove the side cover, top cover and stepper motor and grease the gears. When re-mounting, ensure that the O-ring and side seal are intact so that no coolant can enter the turret. Refer to the Dorian manual that is supplied with each machine for more information and drawings.

### **6.1.7 Warranty Issues**

Dorian warrants the Dorian Indexer for 1 year. If it is determined that there is a problem with the indexer it will need to be sent back to Dorian for repair. Please refer to the Dorian manual that was shipped with the indexer. Control problems are warranted by Southwestern Industries, Inc. for 1 year.

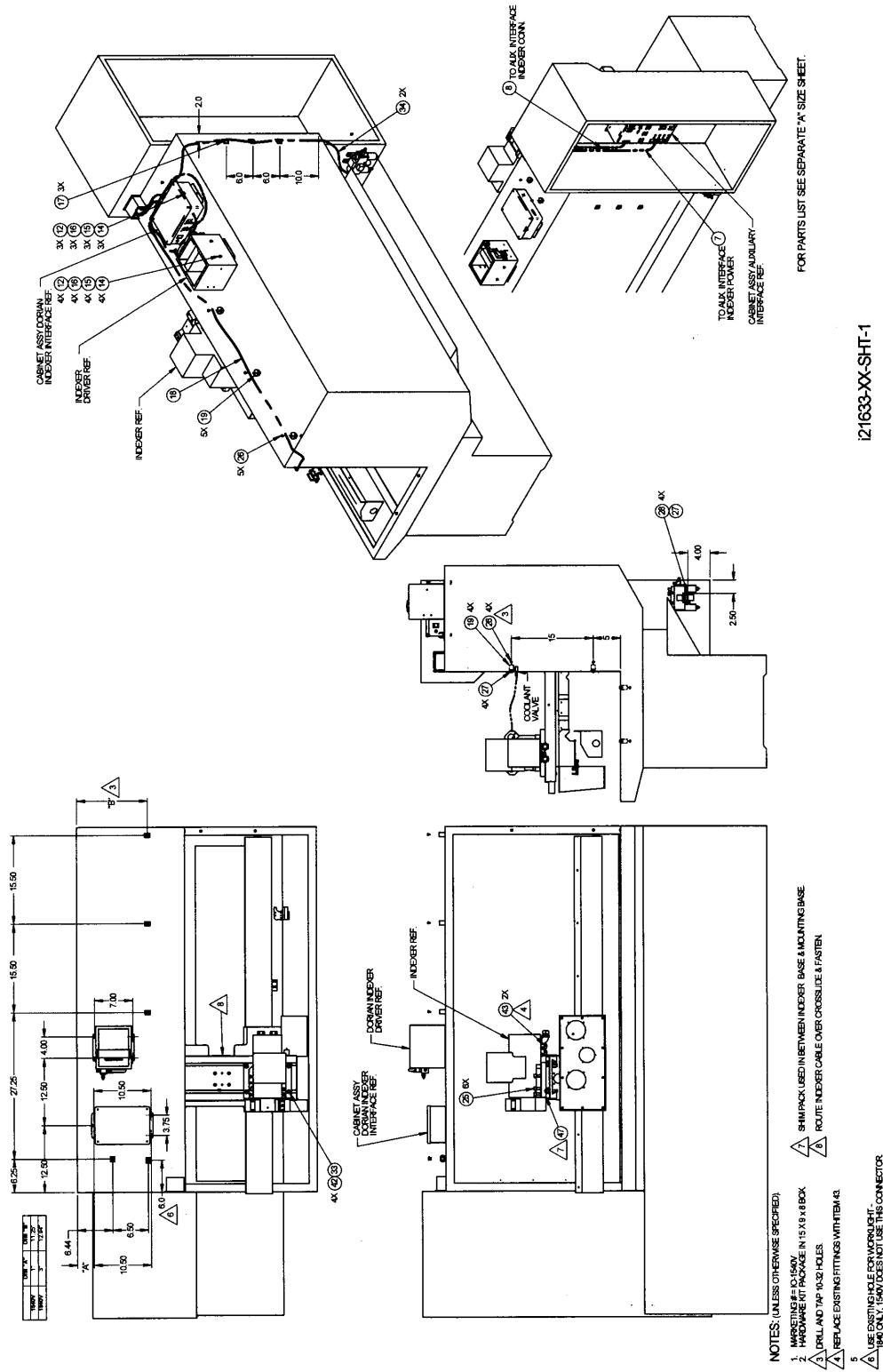
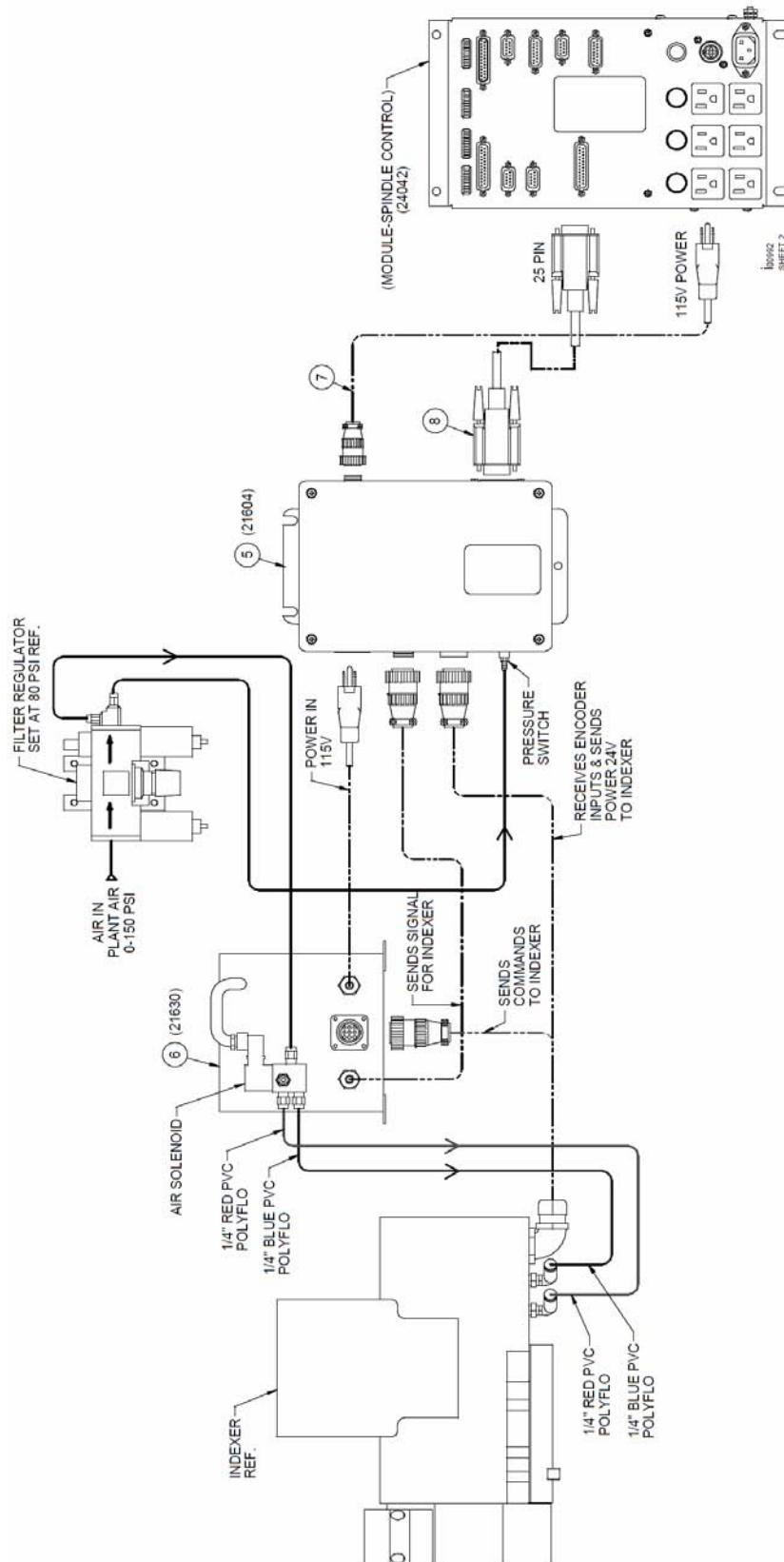


Figure 34 Indexer Mounting



**Figure 35 Indexer Cable Routing**

## Dorian Indexer Spare Parts List

Item	P/N	Description
1	22852	CABLE ASSY-DORIAN POWER INDEXER
2	22556-15	CABLE ASSY-PT4-PARALEL PORT-EB TO PENDANT
3	21615	INDEXER ASSY - MODIFIED DORIAN - 3/4 IN
4	21615-2	INDEXER ASSY - MODIFIED DORIAN - 1 IN
5	21604	CABINET ASSY-DORIAN INDEXER INTERFACE
6	21630	INTERFACE BOX – DORIAN – WHITE
7	22065-2	MODULE ASSY-PT4-EB-SPIN/AUX I/F-LATHE

## 6.2 4 Tool Indexer Option

### 6.2.1 Field Installation Instructions

1. Turn power on to the machine.
2. Go to SETUP mode under TOOL GROUPS to verify the indexer softkey is activated. Then press the INDEXER key to activate the indexer. It will turn gray when activated.
3. Run service code 147 to initialize the indexer.
4. Go to DRO mode and press **TOOL #** and enter a number from 1 to 8. The indexer should move to this tool number. The tool number on the indexer is found on top of each tool.
5. To verify the indexer is working properly, run a program with all 4 tools. To run the program, enter a home position in Setup Mode. Make sure you set the X and Z absolute zero position 12 to 18 inches from the chuck. Set the home position to X = 3 and Z = 3. Run a program and make sure the indexer moves to the correct tool stations programmed. Verify that the indexer positions to each tool station. If there is a problem refer to the troubleshooting section.

### 6.2.2 Removing the Indexer from the Lathe

1. Turn the main power off to the machine.
2. Disconnect 2 cables from the black box mounted on top of the lathe. See Figure 39 at the end of this section for layout of cable connections.
3. Unhook the black cable from the brackets that run on top of the chip enclosure.
4. Remove the cabling that goes runs across the crosslide.
5. Remove the indexer together with the mounting base from the cross slide. It is fastened down with 4 socket head cap screws to the crossslide. Be careful, the indexer weighs approximately 70 lbs.
6. To re-install the indexer, follow these steps in reverse order. Make sure you install the riser block at least 2 1/4" from the front of the cross slide, **not the front bracket**. Failure to do this will cause the indexer to hit the sliding door when the cross slide is all the way toward the operator.

### 6.2.3 Troubleshooting the Indexer

The following fault messages will appear on the screen when there is a problem with the indexer. There are also LED's in the black box on top of the chip guard that may be helpful when troubleshooting the indexer. Please refer to that section below.

- ❖ *Fault 85 – Impossible Tool Position*

This message will appear if the indexer goes to a tool number that you did not select. For example, the operator chose Tool 2 and the indexer went to Tool Station 3. To fix this problem, re-initialize the system by choosing Service Code 147.

- ❖ *Fault 86 – Indexer Power Problem*

This message will appear if the power is interrupted to the indexer. It could indicate that no power or low power is getting to the indexer.

- ❖ *Fault 87 – Indexer Air Pressure Problem*

This message will appear if the air pressure sensor jumper is faulty on the black cable breakout box on top of the lathe.

- ❖ *Fault 88 – Indexer Not Initialized*

This message will appear if the indexer does not know its present position. An example of this would be if the turret stops in the middle of a tool change. An interruption of power or air may cause this fault. Pressing the E-stop button can also cause this problem if the tool is not in a known position. Initialize with Service Code 147.

- ❖ *Fault 89 – Indexer Time Out*

This message appears if the indexer does not get to position after a few seconds. This may be caused by an internal problem inside the indexer such as a broken gear or jammed component. Very low air pressure may also cause this fault. It should take no longer than 2 or 3 seconds for the indexer to move between positions.

### 6.2.4 Troubleshooting the Cable Breakout Box

The following describes the inputs and outputs from the PLC used to run the 4-tool indexer.

#### 6.2.4.1 PLC Inputs

There are 8 inputs to the PLC, 7 of which are used for the 4-tool indexer. For inputs 1 through 4, the corresponding LED light will be on depending on which tool is in position. In other words, when the indexer is locked for tool 1, the I1 LED on the PLC will be lit. For inputs 5, 6 and 7, the LED light for these will only be on for a second or so when a new command is sent to the PLC from the control. A change of tool in DRO mode or within a program will cause these lights to come on. See below for which lights will come on when changing tools.

I1 = Turret proximity sensor position #1

I2 = Turret proximity sensor position #2

I3 = Turret proximity sensor position #3

I4 = Turret proximity sensor position #4

I5 = Select #1

I6 = Select #2

I7 = Select #3

I8 = not used

I1 - I4 is from the 4-tool indexer - identifies turret position

I5 - I7 is from SWI control - identifies index command

The 3 select lines give us 8 possible incremental moves as follows. A few examples have also been given.

+1 tool (select 1 and 2)

For example, if you command the indexer to move 1 tool position, like from tool 2 to 3, you will see the select 1 and 2 lights come on briefly.

+2 tools (select 2)

For example, if you command the indexer to move 3 tool positions, like from 1 to 4, you will see the select 1 light come on briefly.

+3 tools (select1)

+4 tools (select 1, 2, and 3) – tool stays where it is

For example, if you command the indexer to move from tool 4 to tool 2, you will see the select 1 and 3 lights come on briefly.

-1 tool (select2 and 3)

this means no commands were sent; therefore, no lights

-2 tools (select 1 and 3)

come on.

-3 tools (select 3)

don't move (nothing active)

come on.

The following table reflects the description above:

ITEM	+ 1 Tool	+ 2 Tools	+ 3 Tools	+ 4 Tools	- 1 Tool	- 2 Tools	- 3 Tools	DON'T MOVE
<b>SELECT 1</b>	1	0	1	1	0	1	0	0
<b>SELECT 2</b>	1	1	0	1	1	0	0	0
<b>SELECT 3</b>	0	0	0	1	1	1	1	0

#### 6.2.4.2.1 PLC Outputs

There are 6 outputs from the PLC to the 4-tool indexer.

Q1 = Motor on - fwd direction

This light will be on when the indexer motor is running forward

Q2 = Motor on - rev direction

This light will be on when the indexer motor is running reverse

See the table below for the bit patterns for corresponding tools.

Q3 = Bit #1

Q4 = Bit #2

Q5 = Bit #3

Q6 = Bit #4

Q1 & Q2 goes to the motor driver PCB

Q3 - Q6 goes to SWI control - identifies position feedback to control

The following table reflects the meaning of the bit signals back to the control. Keep in mind that the 4-tool indexer reports back up to 4 absolute positions to the PLC, and the PLC will output up to 8 absolute positions back to the control.

ITEM	TOOL 1	TOOL 2	TOOL 3	TOOL 4	TOOL 5	TOOL 6	TOOL 7	TOOL 8
<b>BIT 1</b>	1	0	1	0	1	0	1	0
<b>BIT 2</b>	0	1	1	0	0	1	1	0
<b>BIT 3</b>	0	0	0	1	1	1	1	0
<b>BIT 4</b>	0	0	0	0	0	0	0	1

You can verify the bit pattern below by getting a voltmeter and seeing if a 5 volt signal is present when a bit reads 1 in the above table. For example, if the indexer is physically on

tool 3, bits 1 and 2 should read 5 volts and bits 3 and 4 should read 0 volts. This procedure is best done when checking the inputs 1 through 4 above with the outputs.

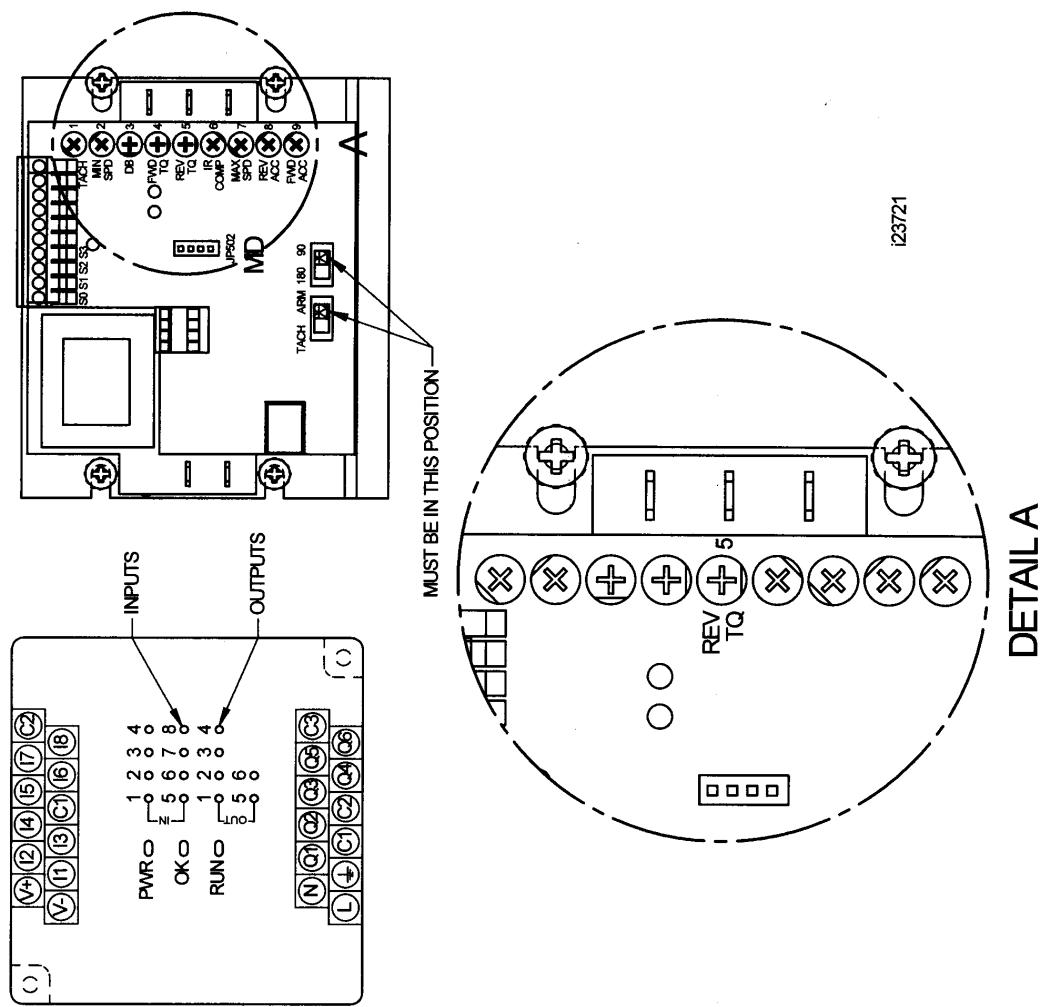
To measure a bit with your voltmeter you will need to do the following. For example, for bit 1, place your meter across Q3 on the PLC and a ground point.

#### *6.2.4.3 Motor Driver Settings*

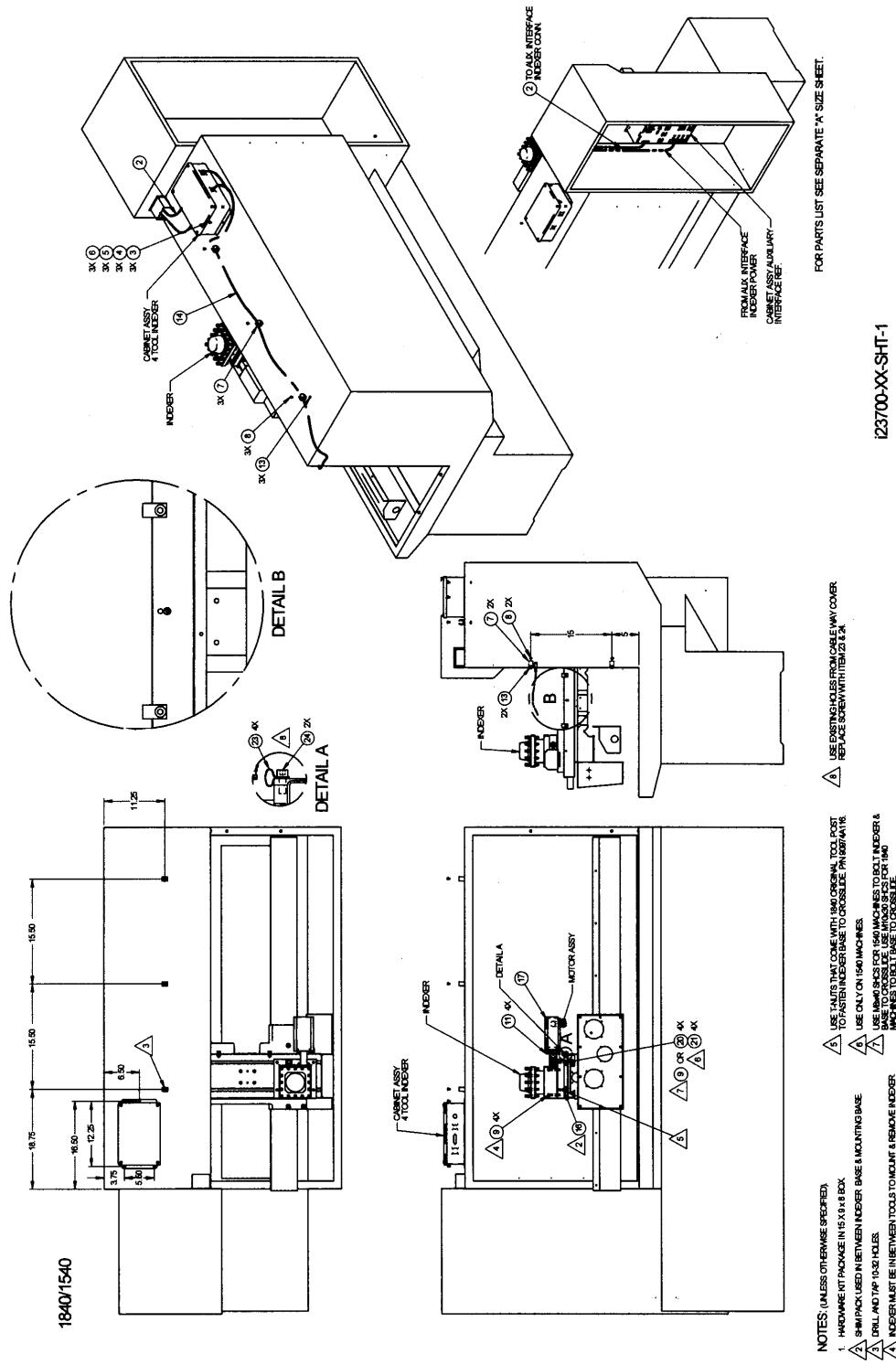
Please see the following drawing for an illustration of how the pots are to be adjusted on the motor driver board in the cable breakout box. The flat part of the pot should be in the location shown in the figure on the next page. Customer service may require a visual inspection of these settings. Also, please verify the position of 2 switches on the motor drive board.

**CAUTION!**

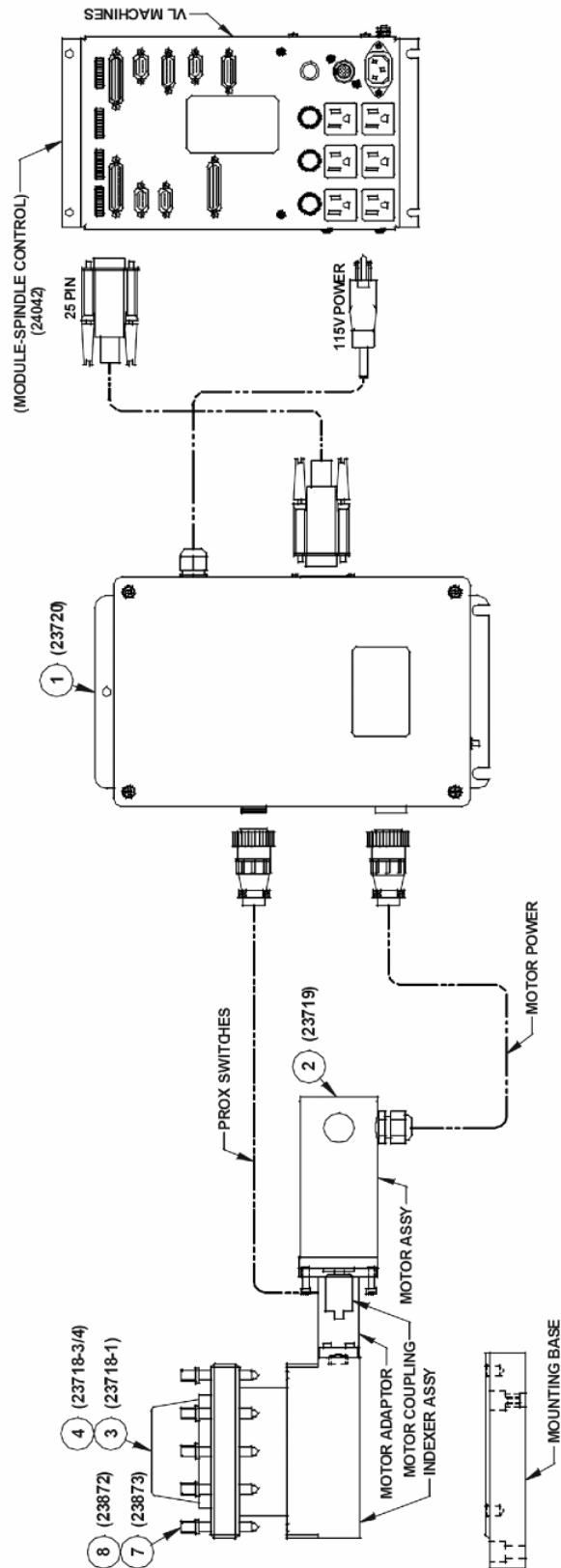
Do not adjust any of these settings. This may cause the indexer to not run correctly or not run at all and will void the warranty of the hardware.



**Figure 36**  
**Motor Driver Adjustments & PLC Inputs and Outputs**



## Figure 37 Indexer Mounting



4 TOOL INDEXER COMPONENTS

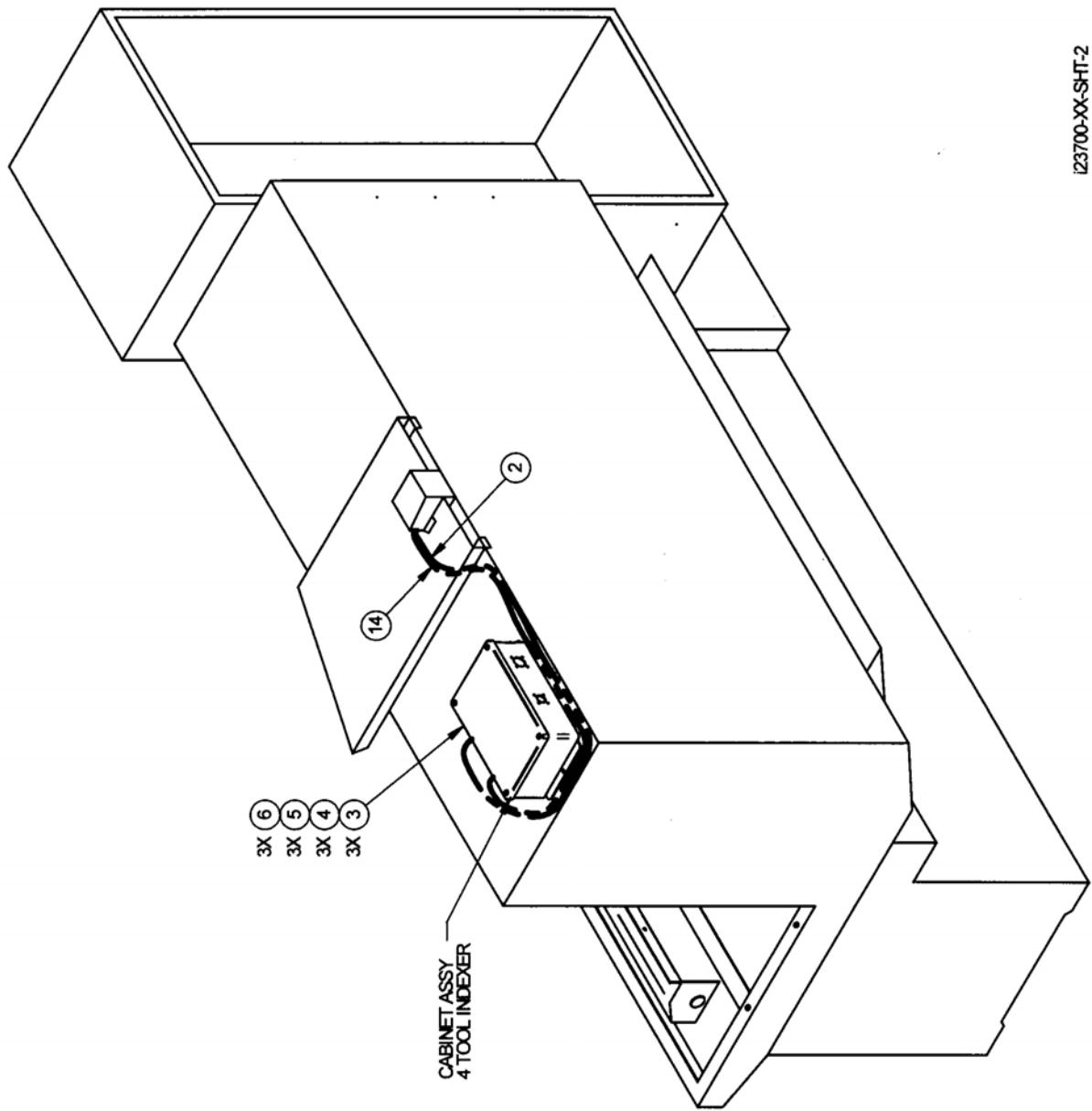
123700-XX-SHT3-1

**Figure 38 - 4 Tool Indexer Cable Routing**

## 4 Tool Indexer Spare Parts List

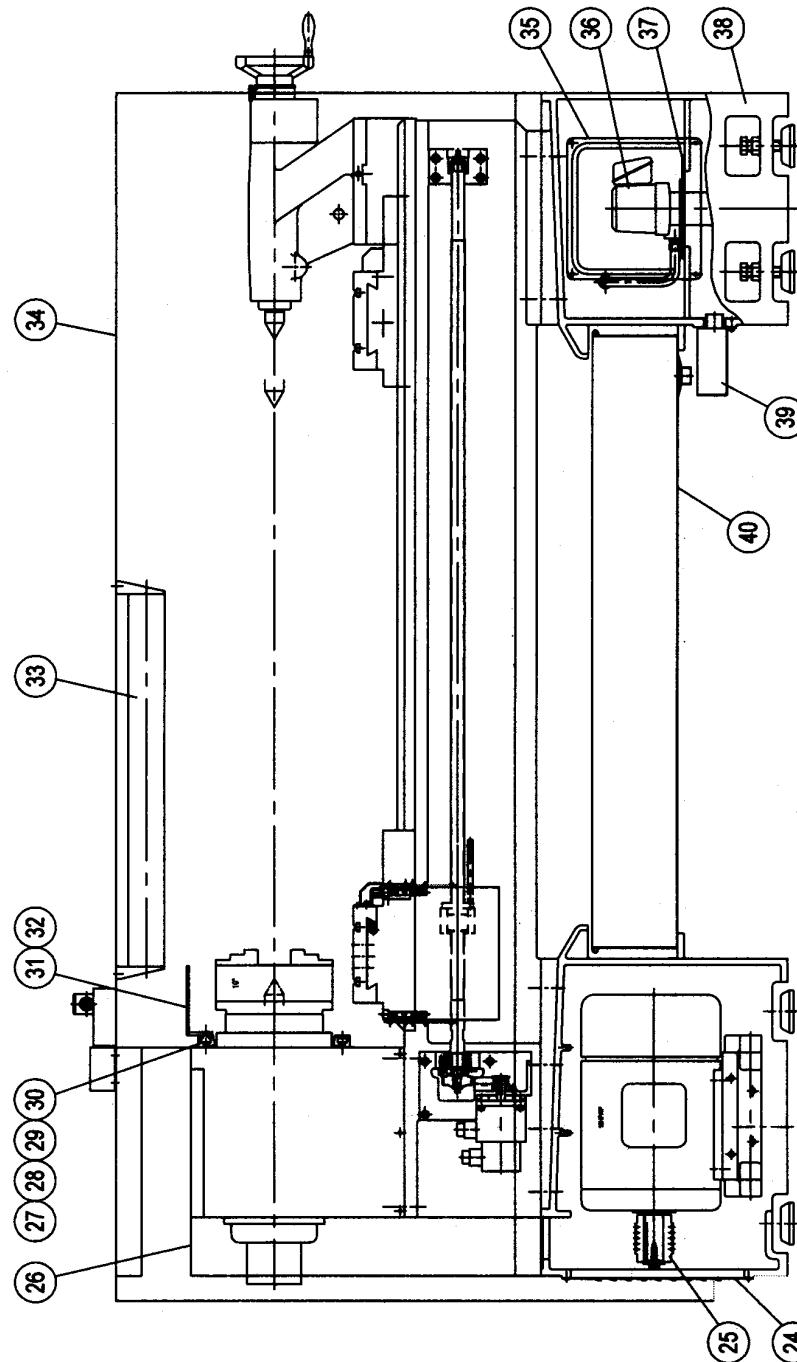
Item	P/N	Description
1	23720	CABINET ASSY-4 TOOL INDEXER
2	23719	MOTOR ASSY-4 TOOL INDEXER
3	23718-1	INDEXER ASSY-MODIFICATION-4 TOOL INDEXER-1"
4	23718-3/4	INDEXER ASSY-MODIFICATION-4 TOOL INDEXER-3/4"
5	23771-M10	T-HANDLE - 3/4" 4-TOOL INDEXER
6	23771-M12	T-HANDLE - 1" 4-TOOL INDEXER
7	23872	SQUARE HEAD SCREW M10 - 3/4" 4-TOOL INDEXER
8	23873	SQUARE HEAD SCREW M12 - 1" 4-TOOL INDEXER
9	23712	MOUNTING BASE-4 TOOL INDEXER-1540V-3/4"
10	24660	MOUNTING BASE-4 TOOL INDEXER-1630-3/4"
11	23543	MOUNTING BASE-4 TOOL INDEXER-1840V-3/4"
12	23713	MOUNTING BASE-4 TOOL INDEXER-1840V-1"
13	24670-1	MOUNTING BASE-4 TOOL INDEXER-2460-1"
14	23867	PROXIMITY RING with screws - 3/4", 4 TOOL INDEXER
15	23868	PROXIMITY RING with screws - 1", 4 TOOL INDEXER

i23700-Sht3-1

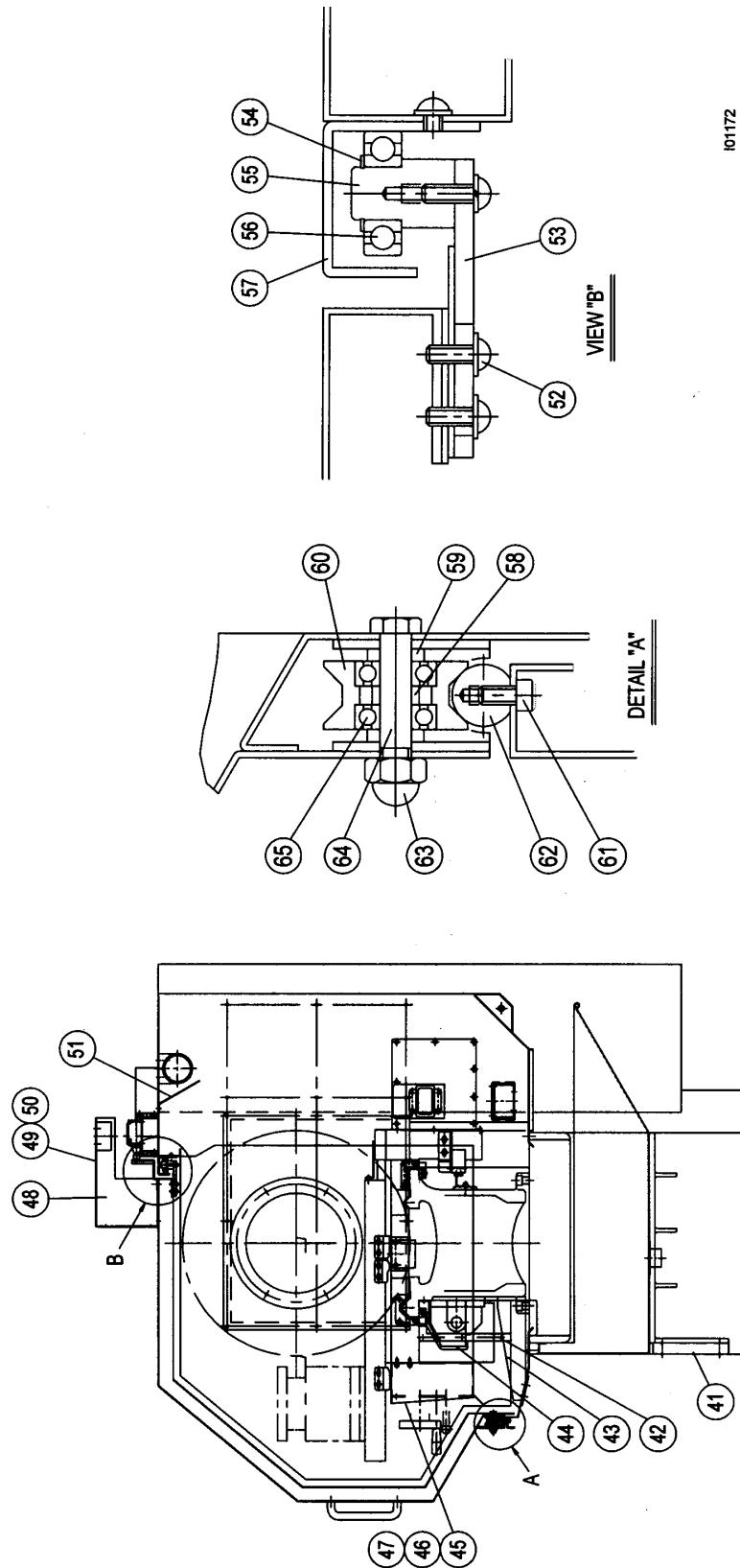


**Figure 39**  
**4 Tool Indexer Cable Routing**

## 7.0 Drawings & Parts Lists

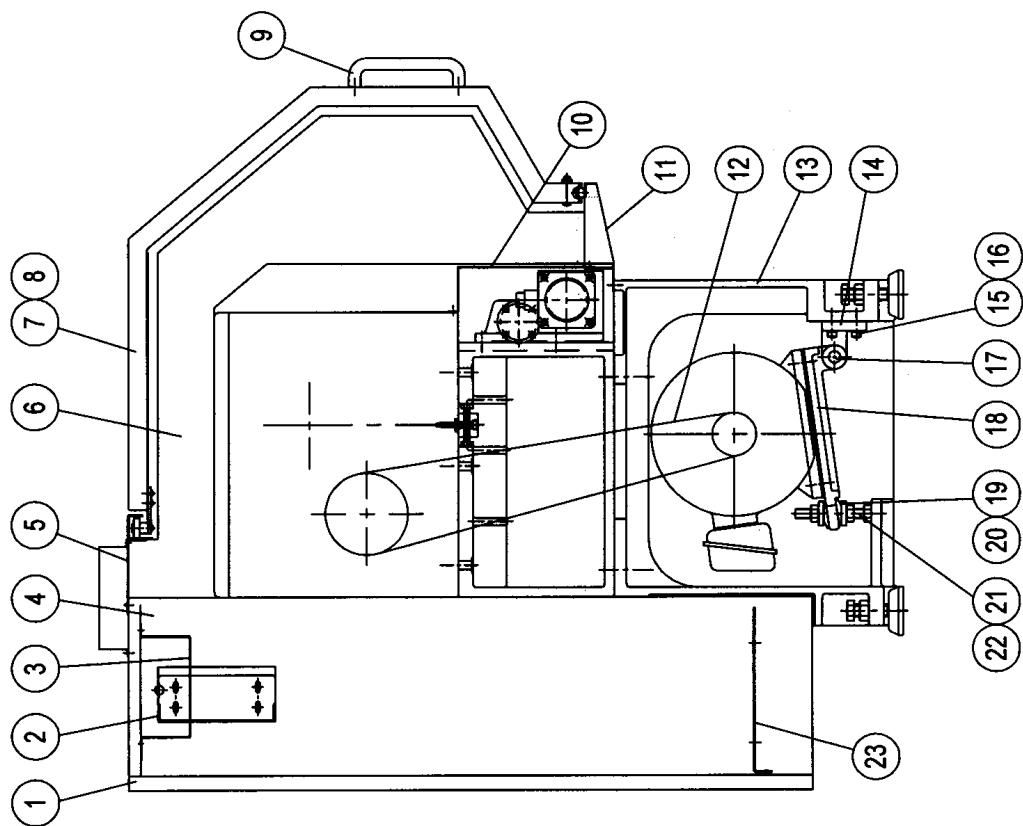


**Figure 40**  
**2460SX Overall Machine Drawing**

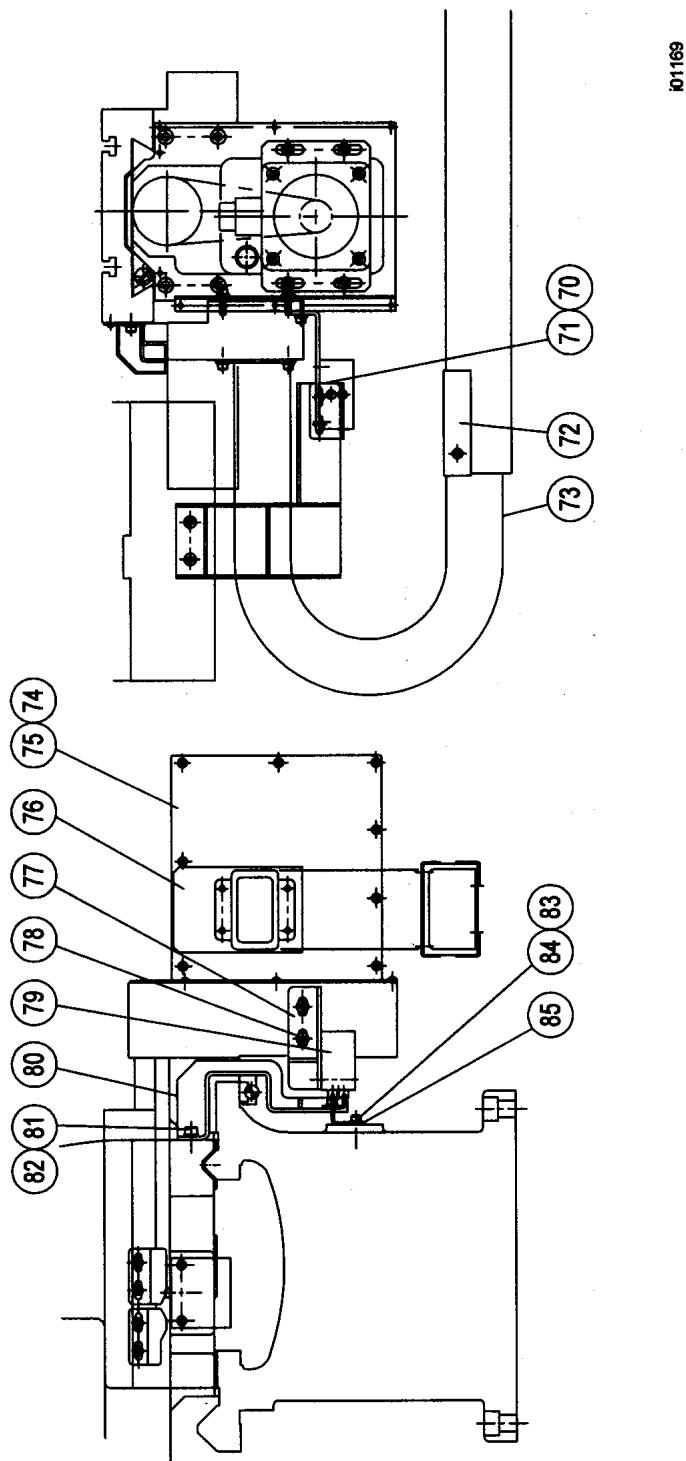


**Figure 40-1**  
**2460SX Overall Machine Drawing**

i01170



**Figure 40-2**  
**2460SX Overall Machine Drawing**



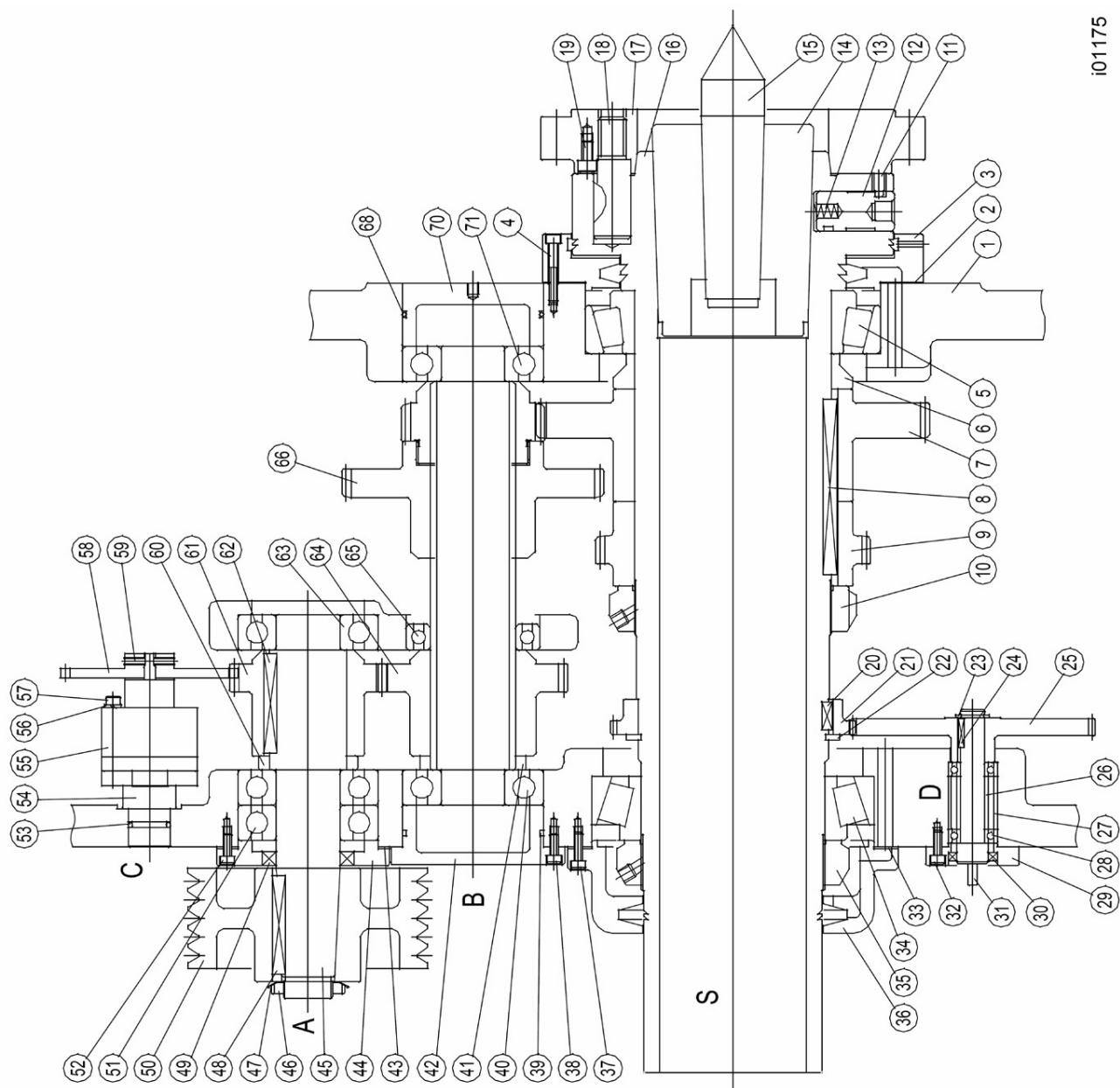
**Figure 40-3**  
**2460SX Overall Machine Drawing**

## Parts List - 2460SX Machine Parts List

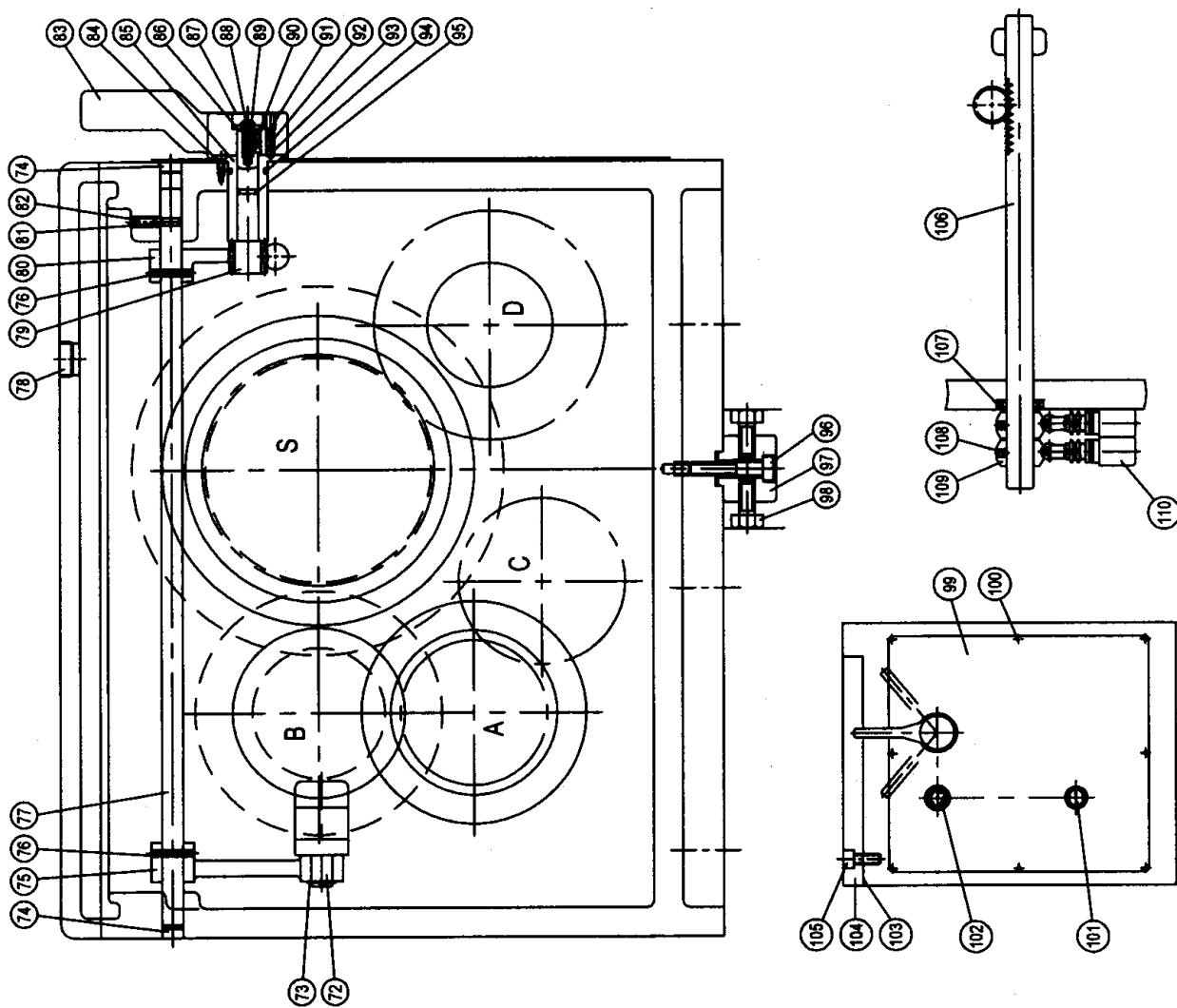
Item	Parts No.	Description	Material	Specification	Qty
1	87-0707	Electrical Control Box Door	SS41		1
2	24-0748	Switch Seat	SS41		1
3	24-0735	Protection Cover	SS41		1
4	87-0706	Electrical Control Box	SS41		1
5	87-0728	Support Plate	SS41		1
6	87-0704	Protection Guard	SS41		1
7	87-0721	Safety Door	SS41		1
8	25050-5	Safety Glass		87-0722	1
9	21241-36	Handle - door	Rubber		2
10	87-0711	Z Axis Motor Cover Plate	SS41		1
11	87-0709	Front Protection Guard	SS41		1
12	25002	Belt Set – Spindle Motor		2R-11M-2000 – 25050-2 3R-11M-2000 – 25050-3	1
13	87-0674	Left Stand Casting	FC25		1
14	87-0676	Bracket	FC25		1
15		Socket Head Cap Screw		M12x45L	4
16		Spring Washer		M12	4
17	87-0677	Shaft	S45C		1
18	87-0678	Motor Plate	FC25		1
19	50-0681	Adjusting Washer	SS41		2
20	50-0682	Adjusting Washer	SS41		2
21		Adjusting Screw	S45C	M20x2.5x175L	1
22		Hexagon Nut		M20x2.5	3
23	87-0708	Bottom Plate	SS41		1
24	87-0733	End Cover	SS41		1
25	25050-1	Motor – Spindle – 15 HP	FC20	87-0684	1
26	87-0731	Cover	SS41		1
27	87-0617	Anti-Leaking Guard	SS41		1
28		O-Ring		G270	1
29		O-Ring		G290	1
30		Socket Head Cap Screw		M6x12L	6
31	87-0618	Headstock Chuck Guard	SS41		1
32		Socket Head Cap Screw		M10x20L	3
33	22714-26 23341	Tube – Lamp Bulb - Worklight		A-W515DB	1
34	87-0701	Rear Protection Guard	SS41		1
35	24-0741	Cover	SS41		1
36	23265	Pump – Coolant		1/8HP	1
37	24-0742	Pump Seat	SS41		1
38	87-0675	Right Stand Casting	FC25		1
39	25-0723	Coolant Tank	SS41		1
40	87-0734	Chip Tray	SS41		1
41	87-0732	Front Connection Plate	SS41		1
42	87-0705	Cover	SS41		1

43	87-0735	Support Bracket	SS41		1
44	87-0712	Protection Cover	SS41		1
45	87-0723	Operation Box	SS41		1
46	87-0724	Operation Box Cover	SS41		1
47		Hexagon Socket Screw		M5x6L	8
48	24-0714	Connection Tube	SS41		1
49	24-0711	Cover	SS41		1
50		Wiring Protector		0450.41-2200L-KR52	1
51	24-0703	Plate	SS41		1
52		Socket Head Cap Screw		M6x16L	9
53	77A-0615	Upper Roller Setting Base	SS41		3
54		Retaining Ring		S17	3
55	77A-0614	Shaft	S20C		3
56	AK118	Deep Groove Ball Bearing		#6203ZZ	3
57	87-0713	Upper Door	SS41		1
58	77-0627	Spacer	S20C		4
59	77-0628	Spacer	S20C		2
60	77-0626	Roller	S45C		2
61		Socket Head Cap Screw		M6x12L	5
62	87-0725	Lower Guide Way	S45C		1
63		Domed Cap Screw		M10	4
64	77-0629	Shaft	S45C		4
65	22714-58	Deep Groove Ball Bearing		#6000ZZ	4
66	77USA-06125	Cam	SS41		1
67		Micro Switch			1
68	77USA-0672	Cover Plate	SS41		1
69	87-0726	Cover Plate	SS41		1
70	77B-0698	Cam	SS41		1
71		Socket Head Cap Screw		M6x12L	2
72	77A-0610	Cover Plate	SS41		1
73	25050-4	Carrier - cable		80x45SA2000L	1
74	24-0728	X-Axis Motor Cover	SS41		1
75	24-0729	End Cover	SS41		1
76	87-0730	Bracket	FC20		1
77	77USA-0307	Micro Switch Seat	SS41		1
78		Socket Head Cap Screw		M8x12L	2
79	22551-1	Switch - Limit		BNS543B03D12	1
80	87-0738	Cam Setting Seat	SS41		1
81		Socket Head Cap Screw		M8x12L	2
82		Flat Washer		M8	2
83		Socket Head Cap Screw		M6x12L	2
84		Flat Washer		M6	2
85	77USA-0698	Cam	SS41		1
86	22683	Switch – Door			1

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**Figure 41**  
**2460SX Headstock Drawing**



## Figure 41-1 2460SX Headstock Drawing

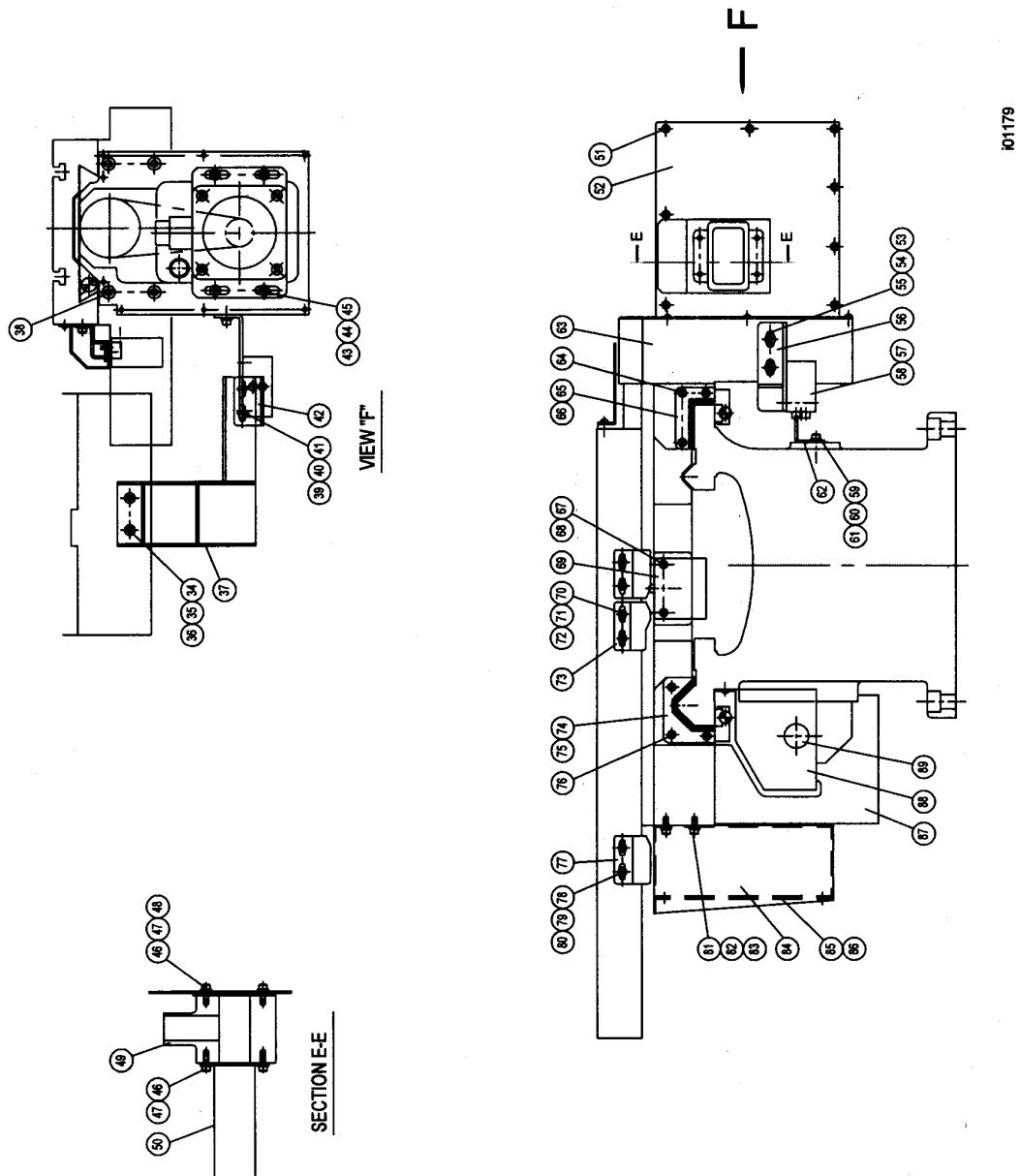
## Parts List - 2460SX Headstock Parts List

Item	Parts No.	Description	Material	Specifications	Qty
1	87-0101	Headstock Casting	FC25		1
2	87-0106	Gasket			1
3	25100-2	Cover - Bearing (Front)	AC2	87-0105	1
4		Socket Head Cap Screw		M6x40L	6
5	25100-3	Taper Roller Bearing		#32028XJ	1
6	25100-4	Spacer	S45C	87-0107	1
7	25100-5	Gear 0 Low - Main Shaft	SCM415	87-0108	1
8	25100-6	Key - Double Round Head		16x10x125	1
9	25100-7	Gear - High - Main Shaft	SCM415	87-0109	1
10	25100-8	Lock Nut	YSF140x2.0	69-0147	1
11	87-0127	Detent Screw	S45C	M10x16L	6
12	69-01110-A0	Cam	SCM21		6
13	50-01111	Detent Spring	SWP		6
14	69-01117	Center Sleeve	SK2		1
15	63-01118	Center	SK5		1
16	25100-1	Spindle	SCM440	87-0102	1
17	63-01122A	Back Plate for 3-Jaw Chuck	FC20	10"	1
18	63-01119	Cam Lock Stud	SCM21		6
19		Socket Head Cap Screw		5/16"-18UNCx16L	6
20	25100-9	Key - Double Round Head		8x7x20L	1
21	25100-10	Gear - Encoder - Main Shaft	S45C	87-0110	1
22	25100-11	Snap Ring		S135	1
23		Retaining Ring		S17	1
24		Double Round Head Key		4x4x20L	1
25	25100-15	Gear - Encoder	S45C	87-0126	1
26	25100-16	Spacer	SS41	87-0144	1
27	25100-17	Spacer	SS41	87-0145	1
28	6003-2RS	Deep Groove Ball Bearing		#6003	2
29	25-0142	Bearing Cover	FC20		1
30	25100-18	Oil Seal		TC22x35x6	1
31	25100-19	Shaft - Encoder	S45C	87-0143	1
32		Socket Head Cap Screw		M6x16L	3
33	87-0111	Gasket			1
34	25100-12	Taper Roller Bearing		#32026XJ	1
35	25100-13	Lock Nut	YSF130x2.0	69-0146	1
36	25100-14	Cover - Bearing (Front)	FC20	87-0112	1
37		Socket Head Cap Screw		M6x20L	6
38		Socket Head Cap Screw		M6x16L	4
39		O-Ring		G95	1
40	25100-22	Deep Groove Ball Bearing		#6309	1
41	87-0118	Collar	SS41		1
42	87-0119	Bearing Cover	FC20		1
43	25100-34	Gasket		88-0125	1
44	25100-33	Bearing Cover	FC20	87-0122	1
45	25100-29	Input Shaft	SCM415	87-0121	1
46	2510-36	Lock Nut		AN07	1
47	25100-37	Lock Washer		AW07	1
48	25100-35	Key - Double Round Head		14x9x70L	1
49	25100-32	Oil Seal		TC45x65x10	1

50	25100-38	Pulley	FC20	88-0149B	1
51	25100-22	Deep Groove Ball Bearing		#6309	2
52		Socket Head Cap Screw		M6x16L	4
53	25100-42	O-Ring		P24	1
54	25100-41	Seat - Pump	SS41	50-01131	1
55	25100-39	Pump - Oil - Manual		LP01AM2	1
56		Spring Washer		M6	3
57		Socket Head Cap Screw		M6x55L	3
58	25100-40	Gear - Oil Pump	UMC-1	87-0125	1
59		Set Screw		M5x16L	2
60	25100-31	Spacer	SS41	87-0124	1
61	25100-28	Gear	SCM415	87-0120	1
62	25100-30	Key - Double Round Head		14x9x70L	1
63	25100-22	Bearing - Deep Groove Ball		#6309	1
64	25100-27	Gear	SCM415	87-0117	1
65	25100-24	Bearing - Deep Groove Ball		#6012	1
66	25110	Cluster Gear & Shaft Ass'y			1
68	25100-20	O-Ring		G95	1
70	25100-21	Bearing Plug	FC20	87-0113	1
71	25100-22	Bearing - Deep Groove Ball		#6309	1
72	25100-44	Change Spped Jaw	BC2	87-0130	1
73		Retaining Ring		S16	1
74	17-0629	Plug	SS41		2
75	25100-45	Swing Arm	FC20	87-0129	1
76		Spring Pin		5x30L	2
77	25100-43	Shaft	SS41	87-0128	1
78		Oil Plug		PT-3/4	1
79	65-0177	Speed Changing Shaft	S45C		1
80	82-0152	Quadrant Gear	FC20		1
81		Steel Ball		Ø1/4	1
82		Socket Head Set Screw		M8x16L	1
83	77A-0133	Speed Changing Knob	FC20		1
84		Cross Recessed Head Head Screw		M5x12L	2
85	65-0193	Sleeve	SS41		1
86	50-0167	Washer	SS41		1
87	65-0174	Indicator	ALP		1
88	17-0542	Screw	S30C		1
89		Socket Head Cap Screw		M5-0.08 x 20L	1
90		Double Round Head Key		5x5x15L	1
91		Socket Head Set Screw		M8x8L	1
92		Compression Spring		Ø6 x Ø0.8 x 30L	1
93		Steel Ball		Ø1/4	1
94	21234-101	O-Ring		P24	1
95	21234-158	O-Ring		P12	1
96		Socket Head Cap Screw		M12x55L	1
97	50-01114	Adjusting Block	SS41		1
98		Socket Head Cap Screw		M12x25L	1
99	87-0131	Indicator	ALP		1
100		Rivet		Ø2x5L	8
101	50-01145	Oil Sight Glass		HE30	1
102	50-01146	Oil Sight Glass		HFTX22	1

103	87-0104	Gasket			1
104	87-0103	Headstock Cover	FC20		1
105		Socket Head Cap Screw		M8x20L	6
106	77U-0152	Position Rack	S45C		1
107		Oil Seal		TC20x35x7	1
108		Set Screw		M6xP1.0x8L	1
109	77A-0153	Cam	S20C		2
110	22680	Switch - Gear			2

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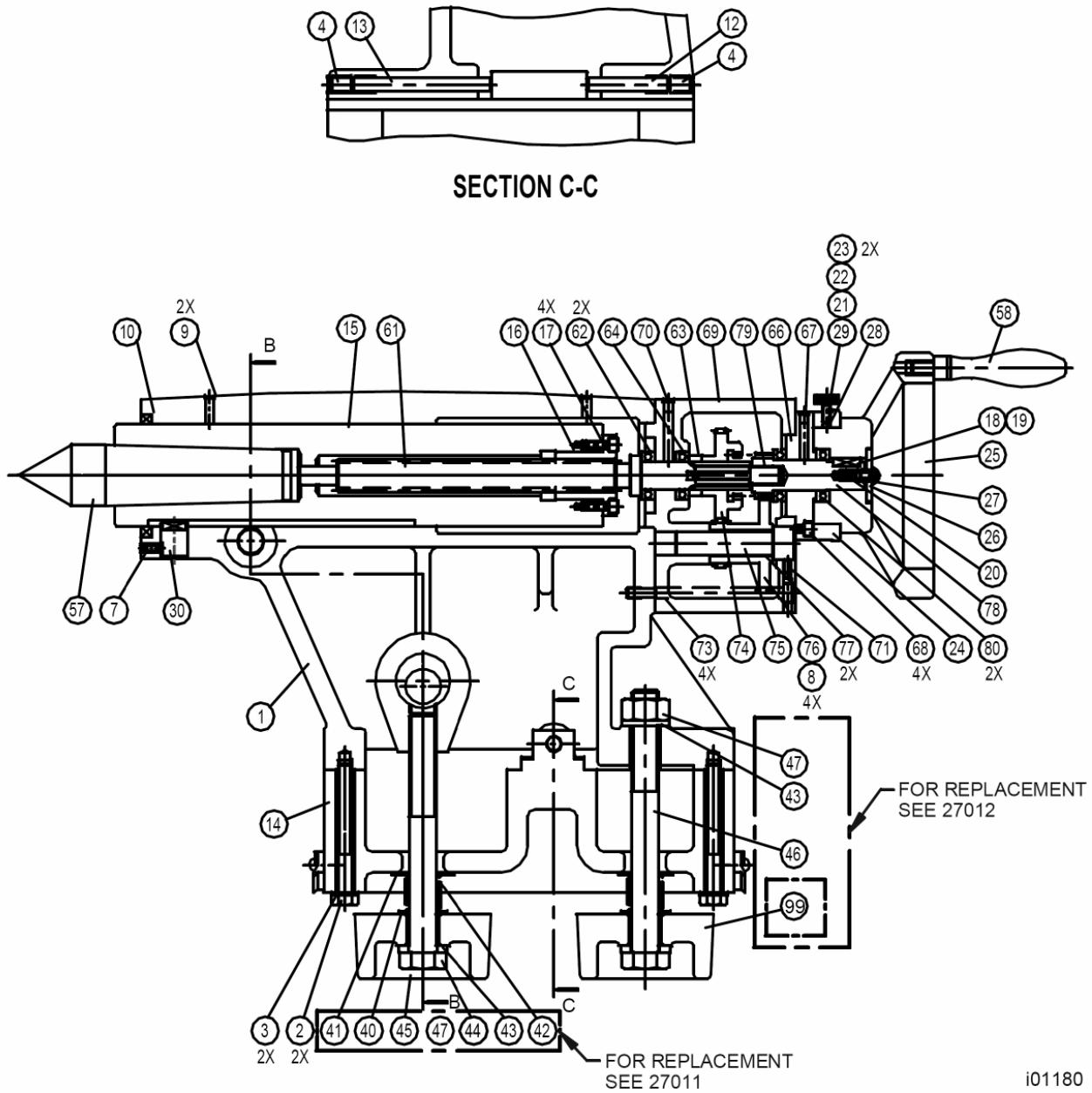


**Figure 42**  
**2460SX Carriage Side View**

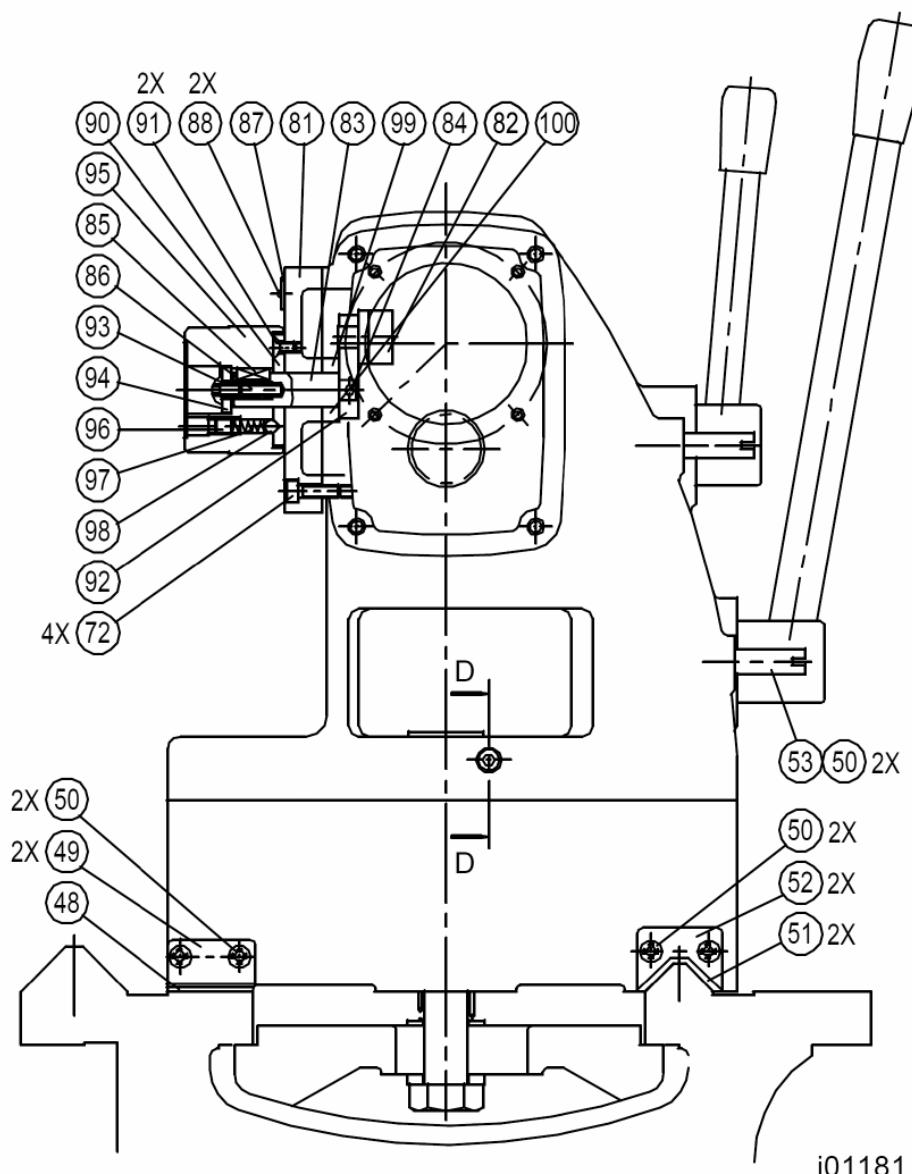
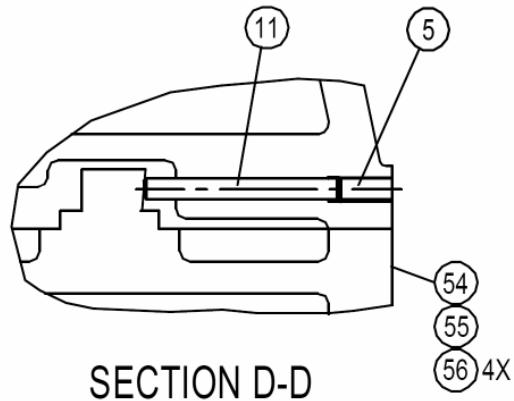
## Parts List for Figure 44 - 2460SX Carriage Side View

Item	Parts No.	Description	Material	Specifications	Qty
34		Socket Head Cap Screw		M8x16L	2
35		Flat Washer		M8	2
36		Spring Washer		M8	2
37	87-0738	Clamping Block	SS41		1
38		Socket Head Cap Screw		M10x90L	4
39		Socket Head Cap Screw		M6x10L	2
40		Flat Washer		M6	2
41		Spring Washer		M6	2
42	77USA-0698	Cam	SS41		1
43		Socket Head Cap Screw		M8x30L	4
44		Flat Washer		M8	4
45		Spring Washer		M8	4
46		Socket Head Cap Screw		M6x20L	4
47		Flat Washer		M6	2
48		Spring Washer		M6	4
49	87-0730	Bracket	FC20		1
50		Wire Protector		88x45ax1850L	1
51		Hexagon Socket Screw		M5x10L	11
52	24-0729	End Cover	SS41		1
53		Socket Head Cap Screw		M8x20L	2
54		Flat Washer		M8	2
55		Spring Washer		M8	2
56	77USA-0307	Switch Seat	SS41		1
57		Socket Head Cap Screw		M6x20L	2
58	22551-1	Switch - Limit		NBNS543-BO2D12-61-12-10	1
59		Socket Head Cap Screw		M6x16L	2
60		Flat Washer		M6	2
61		Spring Washer		M6	2
62	77USA-0698	Cam	SS41		2
63	24-0207	X Axis Transmission Box	FC30		1
64		Cross Recessed Head Screw		M6x16L	6
65	25200-6	Wiper - Bedway (Right, Rear)	Rubber	63-0362	1
66	25200-7	Wiper - Bedway (Left, Rear)	Rubber	63-0363	1
67		Socket Head Cap Screw		M6x25L	2
68		Spring Washer		M6	2
69		Micro Switch		BNS543-BO2D12-61-12-10	1
70		Socket Head Cap Screw		M6x16L	2
71		Flat Washer		M6	2
72		Spring Washer		M6	2
73	87-0714	Cam	SS41		1
74	25200-4	Wiper - Bedway (Left, Front)	Rubber	63-0360	1
75	25200-5	Wiper - Bedway (Right, Front)	Rubber	63-0361	1
76		Cross Recessed Head Screw		M6x16L	6
77	87-0715	Cam	SS41		2
78		Socket Head Cap Screw		M5x16L	4
79		Flat Washer		M6	4
80		Spring Washer		M6	4
81		Socket Head Cap Screw		M6x16L	4
82		Flat Washer		M6	4

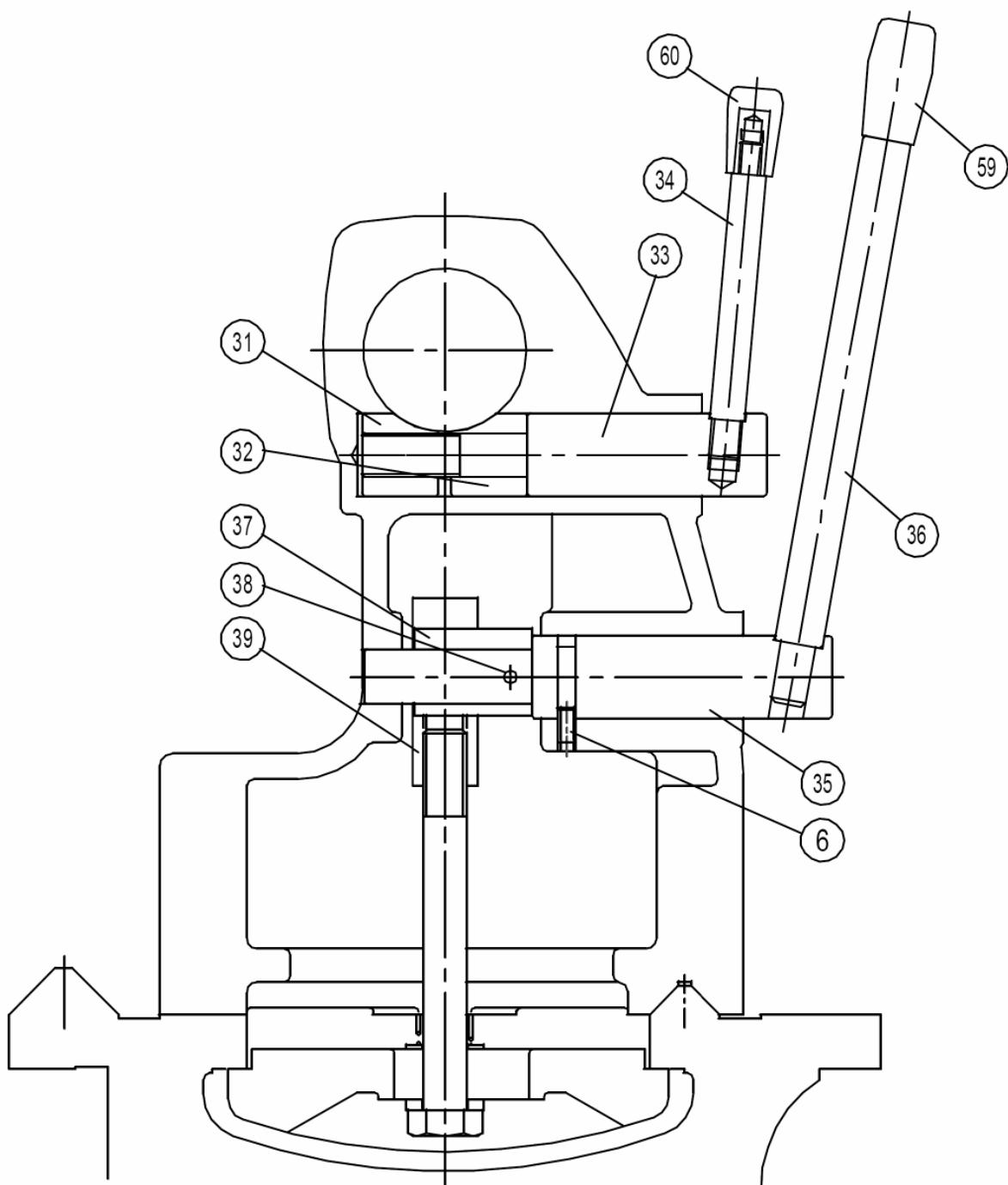
Item	Parts No.	Description	Material	Specifications	Qty
83		Spring Washer		M6	4
84	24-0723	Operation Box	SS41		1
85	24-0724	Operation Box Cover	SS41		1
86		Hexagon Socket Screw		M5x6L	8
87	77USA-0311	Apron	FC25		1
88	77USA-0605	Ballscrew Cover	SS41		1
89		Cover - Round Hole		Ø 30	1



**Figure 43**  
**2460SX Tailstock Assembly**



**Figure 43-1**  
**2460SX Tailstock Assembly**



SECTION B-B

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**Figure 43-2**  
**2460SX Tailstock Assembly**

## Parts List – 2460SX Tailstock Assembly

Item	Parts No.	Description	Material	Specification	Qty
1	63-0501-00	Tailstock Body	FC-25		1
2		Hexagon Head Screw		M10x80L	2
3		Washer	SS41B-D	M10	2
4		Socket Head Set Screw		M12x16L	2
5		Socket Head Set Screw		M12x25L	1
6		Socket Head Set Screw		M8x16L	1
7		Socket Head Set Screw		M6x30L	1
8		Socket Head Cap Screw		M6x30L	4
9		Ball Cup		Ø1/4"	2
10		Oil Seal		TC75x90x8	1
11		Parallel Pin		Ø10x90L	1
12		Parallel Pin		Ø10x60L	1
13		Parallel Pin		Ø10x100L	
14	63-0502-00	Tailstock Base	FC-25		1
15	63-0503-00	Quill	S-45C		1
16	25026	Feed Nut (Imperial)	BC2	63-0505-00	1
17		Socket Head Cap Screw		M6x12L	4
18	63-0507-00	Feed Screw (Imperial)	S45C-D		1
19		Double Round Head Key		6x6x20L	1
20		Socket Head Set Screw		M5x20L	1
21	50-0508-00	Bracket			1
22		Ball Cup		Ø1/4"	1
23		Thrust Bearing		#51104	2
24	50-0510-00	Dial (Imperial)	FC-20		1
25	50-0511-00	Handwheel	FC-20		1
26	50-0513-00	Washer	SS41B-D		1
27	17-0504-00-2	Socket Button Head Screw			1
28	50-0538-00	Pad Piece			1
29	50-03111-00	Screw			1
30	27013	Guide Pin		63-0514-00	1
31	63-0515-00	Lock Nut			1
32	63-0516-00	Lock Sleeve			1
33	63-0517-00	Lock Rod	S45C-D		1
34	50-0518-00	Lever	SS41B-D		1
35	63-0519-00	Shaft			1
36	63-0520-00	Lever			1
37	50-0521-00	Eccentric Collar			1
38		Spring Pin		Ø6x40L	1
39	50-0522-00	Adjusting Block			1
40	50-0523-00	Washer			1
41	50-0524-00	Washer			1
42	50-0525-00	Compression Spring			1
43	50-0526-00	Washer			2
44	63-0527A-00	Hexagon Head Screw			1
45	63-0528-00	Clamping Block			1
46	63-0527B-00	Hexagon Head Screw			1
47		Nut		M20xP2.5	1
48	25025	Wiper - Bedway		50-0362-00	2

49	50-0363-00	Bedway Wiper Plate	SS41PL		2
50		Cross Recessed Head Screw		M6x16L	4
51	25024	Wiper - Bedway		63-0532-00	2
52	63-0533-00	Bedway Wiper Plate	SS41PL		2
53	50-0534-00	Stud			2
54	50-0536-00	Set-Over Indicating Chart			1
55	50-0537-00	Indicator			1
56		Button Head Rivet		Ø2x5L	4
57	63-01118-00	Center	SK5	MT#4	1
58	50-0431-00	Handle	ABS		1
59	50-0166-00	Knob	ABS		1
60	50-01138-00	Knob	ABS		1
61	25021	Feed Screw (Imperial)	S45C-D	63-0507B-00	1
62	25023	Bearing- Thrust-51104		20x35x10	2
63	80-0541-00	Lock Nut			1
64		Lock Washer		AW04	1
65					
66	80-0508B-00	Bracket			1
67		Ball Cup		Ø1/4"	1
68		Socket Head Cap Screw		M6x16L	4
69	63-0539-00	Speed Change Box			1
70		Ball Cup		Ø1/4"	1
71		Socket Head Set Screw		M6x10L	1
72		Socket Head Cap Screw		M6x20L	4
73	80-0540-00	Socket Head Cap Screw			4
74	80-0542-00	Clutch Gear		M1.5x44T	1
75	80-0543-00	Shaft			1
76	80-0544-00	Gear		M1.75x40T M1.5x22T	1
77		Dry Bearing		Ø17xØ19x15L	2
78	80-0545-00	Gear Shaft		M1.75x16	1
79		Dry Bearing		Ø12xØ14x15L	1
80	25022	Bearing- Thrust-51105		25x42x11	2
81	80-0546-00	Speed Change Box Cover			1
82	80-0547-00	Shifting Block			1
83	63-0548-00	Shaft			1
84		Spring Pin		Ø4x25L	1
85		Double Round Head Key		5x5x15L	1
86		Socket Head Set Screw		M5x20L	1
87	80-0551-00	Indicator	ACP		1
88		Button Head Rivet		Ø2x5L	2
89					
90	80-0552-00	Setting Plate			1
91		Counter Sunk Flat Screw		M5x8L	2
92	28-0229-00	Shifting Arm			1
93	17-0504-00-2	Socket Button Head Screw	S30C	M8x20L	1
94	50-0167-00	Washer			1
95	50-0246-01	Feed Selector Knob			1
96		Socket Head Set Screw		M8x8L	1
97		Compression Spring		Ø6xØ0.8x30L	1
98		Steel Ball		Ø1/4	1

99	27046	Clamping Block Rear		63-0529-00	1
100	63-0549-00	Spacer			1

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## Replacement Parts List-27011 2460SX Tailstock Assembly

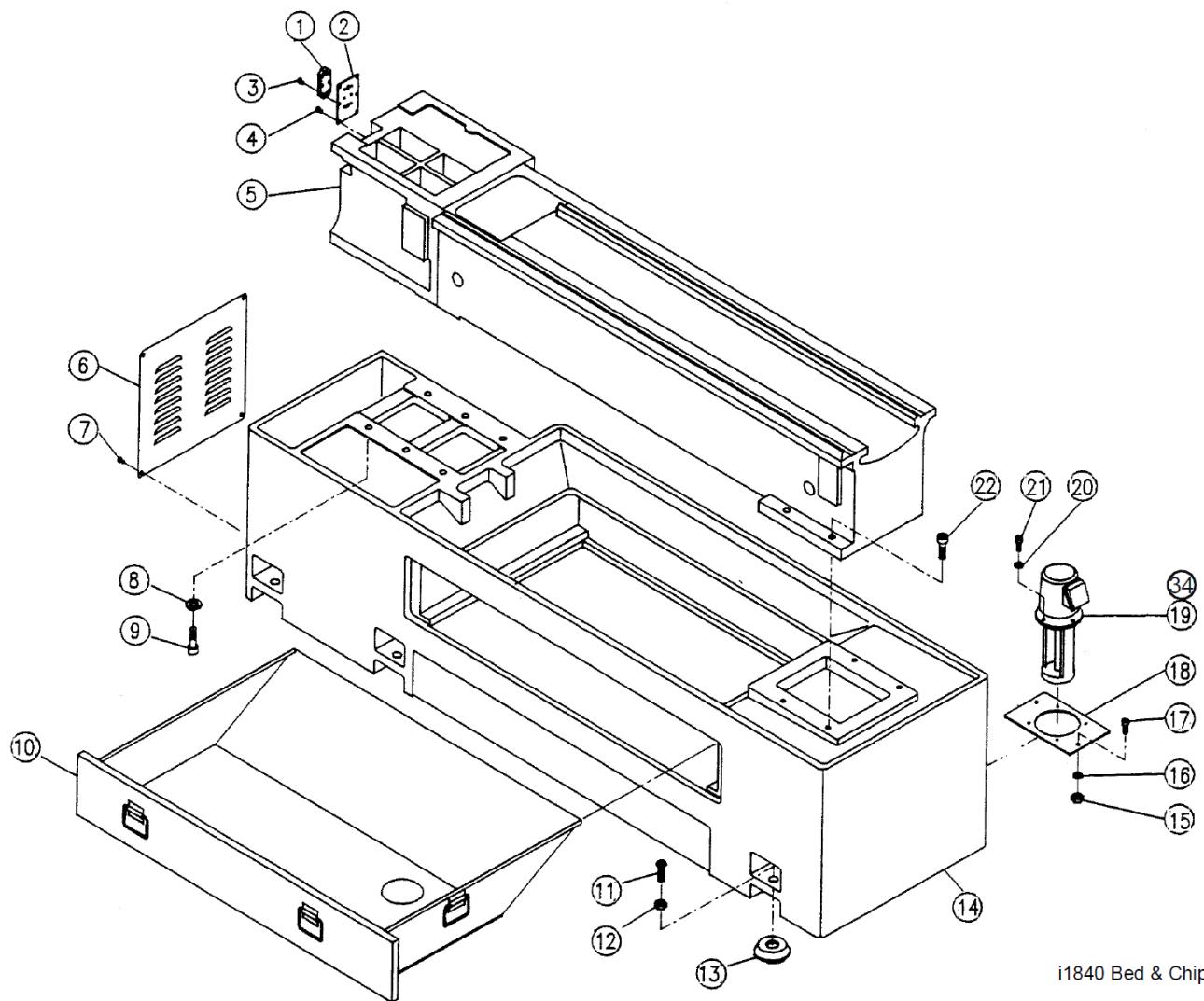
Item	P/N	Title	Qty
1	63-0528-00	CLAMPING BLOCK-TAILSTOCK-FRONT	1
2	63-0527A-00	HEXAGON HEAD SCREW	1
3	50-0523-00	FLAT WASHER	1
4	50-0524-00	FLAT WASHER	1
5	50-0525-00	COMPRESSION WASHER	1
6	50-0526-00	FLAT WASHER	1
7	M20XP2.5	NUT	1

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## Replacement Parts List-27012 2460SX Tailstock Assembly

Item	P/N	Title	Qty
1	63-0529-00	CLAMPING BLOCK-REAR	1
2	50-0526-00	FLAT WASHER	1
3	63-0527B-00	HEXAGON HEAD SCREW	1
4	M20XP2.5	NUT	1

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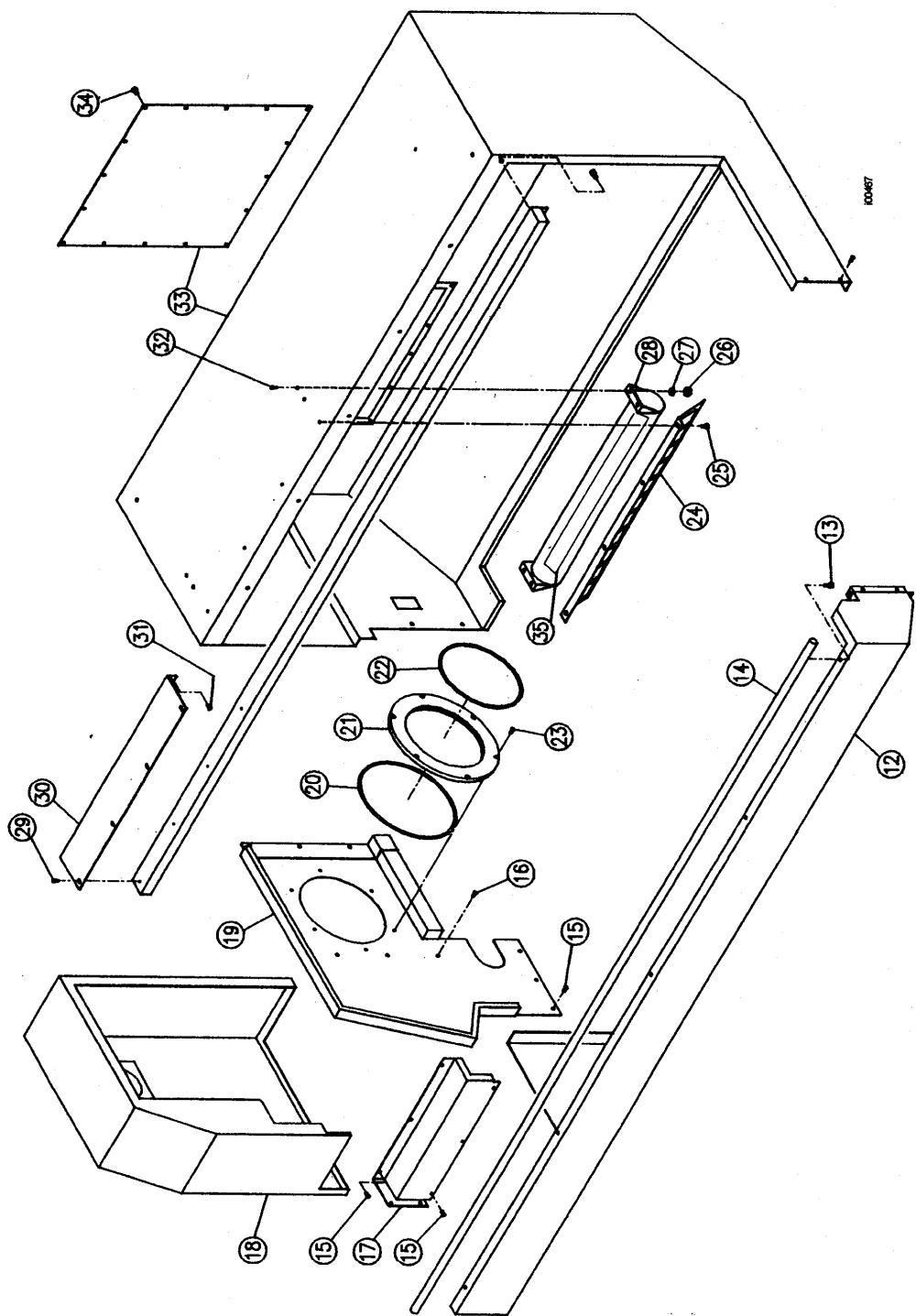
**Figure 44**  
**1840 Bed & Chip Pan Assembly**

## 1840 Bed & Chip Pan Assembly Parts List

Item	P/N	Title	UseAs	Qty
1	21239-01	COVER	EA	2
2	21239-02	OIL SIGHT GLASS	EA	2
3	21239-03	ROUND SCREW M5X10L	EA	12
4	21239-04	SOCKET HEAD CAP SCREW M5X10L	EA	12
5	20980	BED-TRL 1840 CSS	EA	0
6	21239-06	END COVER	EA	1
7	21239-07	ROUND SCREW M6X8L	EA	4
8	21239-08	SPRING WASHER M16	EA	6
9	21239-09	SOCKET HEAD CAP SCREW M16 X60L	EA	6
10	21239-10	CHIP TRAY	EA	1
11	21239-11	ADJUSTING SCREW	EA	6
12	21239-12	LOCKING NUT	EA	6
13	21239-13	INSTALLATION BLOCK	EA	6
14	21239-14	STAND	EA	1
15	21239-15	HEXAGON NUT M8	EA	2
16	21239-16	SPRING WASHER M8	EA	2
17	21239-17	SOCKET HEAD CAP SCREW M8 X30L	EA	2
18	22714-31	PUMP BRACKET	EA	1
19	23265	COOLANT PUMP 1/8HP	EA	1
20	21239-20	SPRING WASHER M6	EA	0
21	21239-21	SOCKET HEAD CAP SCREW M6X16L	EA	4
22	21239-22	SOCKET HEAD CAP SCREW M16 X50L	EA	4
23	21239-23	LUBE PUMP-HEADSTOCK	EA	1
24	23973	BELT SET-SPINDLE MOTOR	EA	1
25	21239-25	SPINDLE MOTOR	EA	1
27	22157-32	BRAKE RESISTOR	EA	1
28	21239-28	MAIN ELECTRIC SWITCH	EA	1
29	21239-29	CABLE CARRIER-METAL	EA	1
30	21239-30	MOVING DOOR-GLASS	EA	1
31	21239-31	MOTOR PULLEY-SPINDLE	EA	1
32	22291-1	LUBRICATION PUMP-WAY	EA	1
33	21239-33	OIL FILTER	EA	1
34	21050-3D	HOSE - COOLANT HOSE, 3/8" X 78"	EA	1

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**ITEMS 23-34 ARE NOT ON FIGURE**

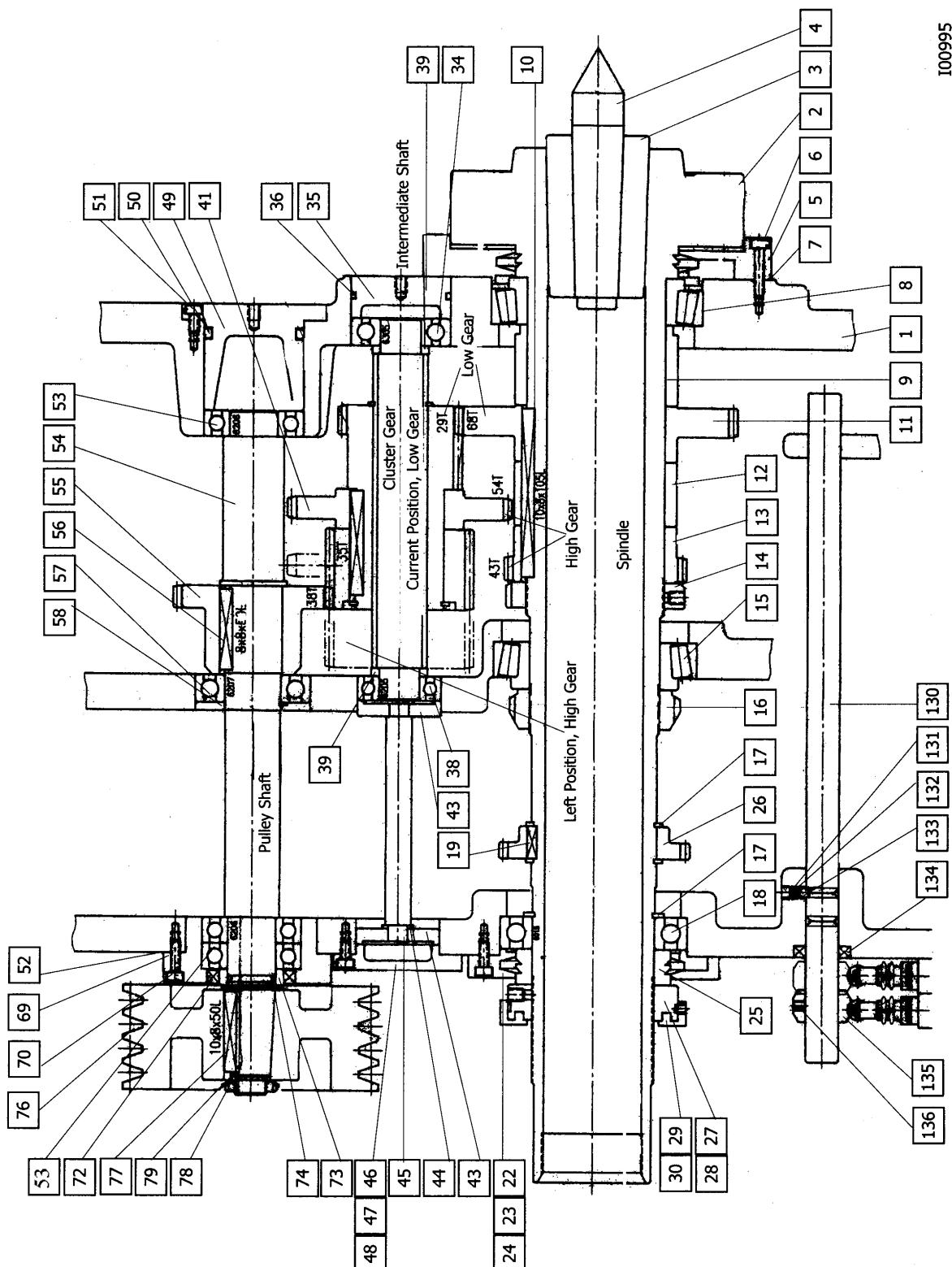


**Figure 45**  
**1840 Splash Guard & Cover Assembly**

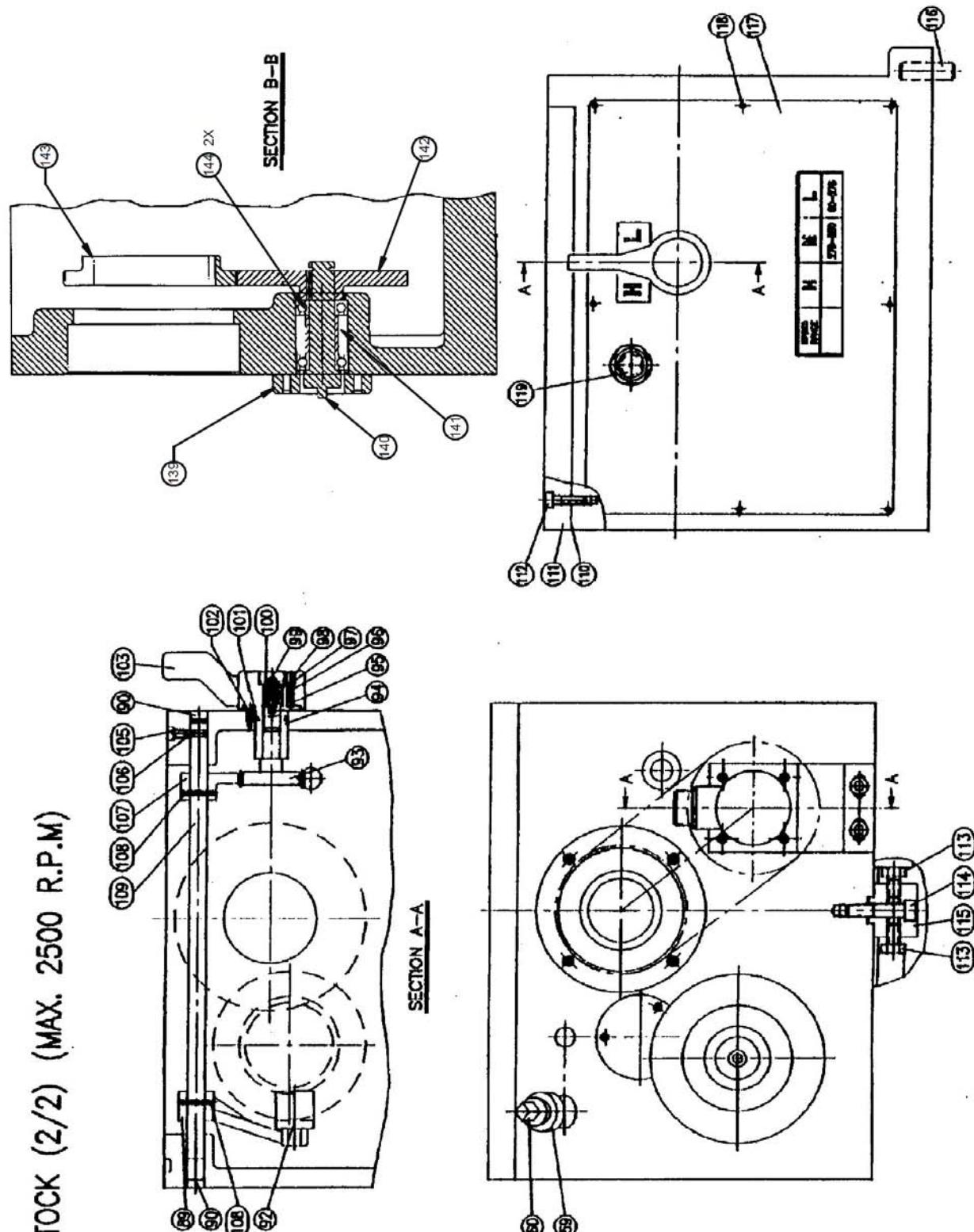
## 1840 Splash Guard & Cover Assembly Parts List

Item	P/N	DESCRIPTION	Qty
12	21241-12	PROTECT COVER (FRONT)	1
13	21241-13	SOCKET HEAD CAP SCREW M6X10L	5
14	21241-14	SLIDE WAY	1
15	21241-15	ROUND SCREW M5X6L	20
16	21241-16	ROUND SCREW M6X10L	5
17	21241-17	PLATE-Z-AXIS MOTOR	1
18	21241-18	END COVER	1
19	21241-19	PROTECTOR PLATE	1
20	21241-20	O-RING G250	1
21	21241-21	ANTI-LEAKING PLATE	1
22	21241-22	O-RING G210	1
23	21241-23	SOCKET HEAD CAP SCREW M5X10L	6
24	21241-24	PLATE	1
25	21241-25	ROUND SCREW M5X6L	4
26	21241-26	HEXAGON NUT M6	4
27	21241-27	FLAT WASHER M6	4
28	21241-28	LAMP TUBE	1
29	21241-29	ROUND SCREW M5X6L	4
30	21241-30	SUPPORTING PLATE	1
31	21241-31	ROUND SCREW M5X6L	4
32	21241-32	ROUND SCREW M6X16L	4
33	21241-33	REAR PROTECTOR COVER	1
34	21241-34	ROUND SCREW M5X6L	16
35	23341	WORK LIGHT BULB	1
36	21241-36	DOOR HANDLE	2

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**Figure 46 1840 Headstock Assembly**



**Figure 47 1840 Headstock Assembly**

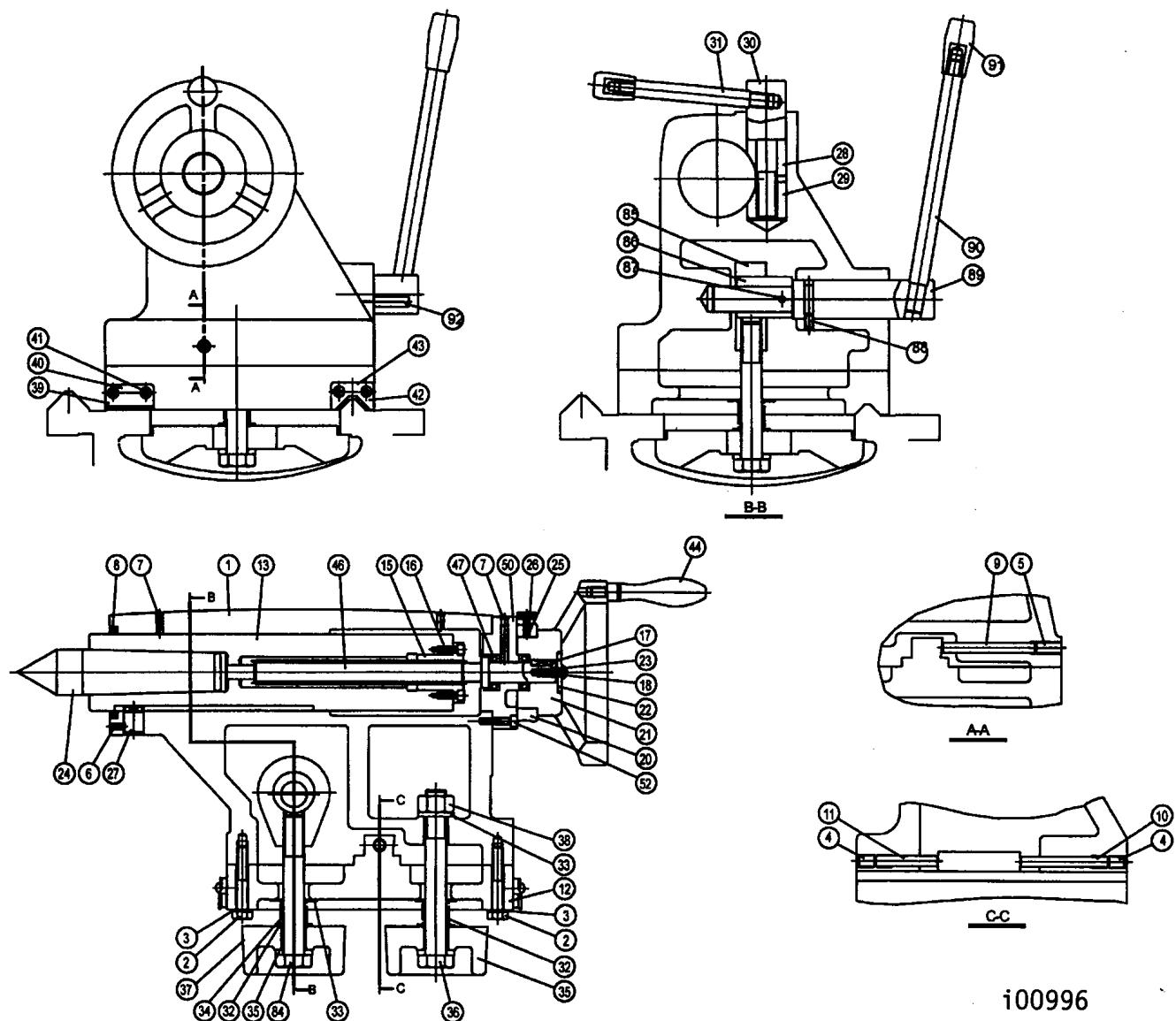
## Parts List

Item	P/N	Title	Use As	Qty
1	21234-001	HEADSTOCK CASTING	EA	4
2	21234-002	SPINDLE D1-6	EA	4
3	21234-003	CENTER SLEEVE	EA	4
4	21234-004	CENTER	EA	4
5	21234-005	BEARING COVER (FRONT) D1-6	EA	4
6	21234-006	SOCKET HEAD CAP SCREW M6X30L	EA	24
7	21234-007	PACKING	EA	4
8	21234-008	TAPER ROLLER BEARING #32017XC/P5	EA	4
9	21234-009	SPACER	EA	4
10	21234-010	DOUBLE ROUND HEAD KEY 10X8X105L	EA	4
11	21234-011	LOW SPEED GEAR	EA	4
12	21234-012	SPACER	EA	4
13	21234-013	HIGH SPEED GEAR	EA	4
14	21234-014	LOCKING NUT	EA	4
15	21234-015	TAPER ROLLER BEARING #32016XC/P5	EA	4
16	21234-016	LOCKING NUT	EA	4
17	21234-017	RETAINING RING #STW75	EA	4
18	21234-018	TAPER ROLLER BEARING #6015	EA	4
19	21234-019	DOUBLE ROUND HEAD KEY 8X7X18L	EA	8
22	21234-022	PACKING	EA	3
23	21234-023	BEARING COVER (REAR)	EA	3
24	21234-024	SOCKET HEAD CAP SCREW M6X16L	EA	12
25	21234-025	SPACER	EA	12
26	21234-026	SYNCHRONOUS BELT	EA	3
27	21234-027	DYNAMIC BALANCING COLLAR	EA	3
28	21234-028	SOCKET HEAD SET SCREW M8X8L	EA	6
29	21234-029	DYNAMIC BALANCING BLOCK	EA	9
30	21234-030	SOCKET HEAD SET SCREW M6X8L	EA	18
34	21234-034	BALLBEARING-DEEP GROOVE #6305	EA	3
35	21234-035	BEARING PLUG	EA	3
36	21234-036	O-RING G55	EA	3
38	21234-038	BALLBEARING-DEEP GROOVE #6205	EA	3
39	21234-039	SPACER	EA	6
41	24934	CLUSTER GRAR & SHAFT ASS'Y - 1840	EA	1
42	21234-042	GEAR	EA	3
43	21234-043	SPACER	EA	6
44	21234-044	WASHER	EA	3
45	21234-045	ROD	EA	3
46	21234-046	PACKING	EA	3
47	21234-047	BEARING PLUG	EA	3
48	21234-048	SOCKET HEAD CAP SCREW M6X12L	EA	9
49	21234-049	BEARING COVER	EA	3
50	21234-050	O-RING P52	EA	3
51	21234-051	SOCKET HEAD CAP SCREW M6X12L	EA	9
52	21234-052	PACKING	EA	3

53	21234-053	BALLBEARING-DEEP GROOVE #6206	EA	3
54	21234-157	INPUT SHAFT (77U-0131-02)	EA	3
55	21234-055	GEAR	EA	3
56	21234-056	DOUBLE ROUND HEAD KEY 8X8X50L	EA	3
57	21234-057	BALLBEARING-DEEP GROOVE #6207	EA	3
58	21234-058	RETAINING RING	EA	3
59	21234-059	ELBOW	EA	3
60	21234-060	DRAIN PLUG	EA	3
69	21234-069	COVER	EA	3
70	21234-070	SOCKET HEAD CAP SCREW M6X20L	EA	9
72	21234-072	OIL SEAL TC38X55X8	EA	3
73	21234-073	SPACER	EA	3
76	21234-076	PULLEY	EA	3
77	21234-077	DOUBLE ROUND HEAD KEY 10X8X50L	EA	3
78	21234-078	LOCKING NUT AN04	EA	3
79	21234-079	LOCK WASHER AN04	EA	3
80	21234-080	CAM	EA	18
81	21234-081	DETENT SPRING	EA	18
82	21234-082	DETENT SCREW	EA	18
83	21234-083	CAM STUD	EA	18
84	21234-084	SOCKET HEAD CAP SCREW 3/8-16UNCX16L	EA	18
85	21234-085	DRIVING PLATE	EA	3
86	21234-086	DRIVING COLLAR	EA	3
87	21234-087	SOCKET HEAD CAP SCREW M12X25L	EA	3
88	21234-088	DRIVING PIN	EA	6
89	21234-089	SHIFTING ARM	EA	3
90	21234-090	PLUG	EA	6
92	21234-092	SHIFTING FORK	EA	2
93	21234-093	CHANGE SPEED SHAFT	EA	2
94	21234-094	SLEEVE	EA	2
95	21234-095	STEEL BALL 1/4	EA	2
96	21234-096	COMPRESSION SPRING 6X 0.8X30L	EA	2
97	21234-097	SOCKET HEAD SET SCREW M8X8L	EA	2
98	21234-098	DOUBLE ROUND HEAD KEY 5X15L	EA	2
99	21234-099	SCREW	EA	2
100	21234-100	WASHER	EA	4
101	21234-101	O-RING P24	EA	2
102	21234-102	SOCKET HEAD SET SCREW M5X12L	EA	4
103	21234-103	KNOB	EA	2
105	21234-105	SOCKET HEAD SET SCREW M8X8L	EA	4
106	21234-106	STEEL BALL	EA	2
107	21234-107	QUADRANT GEAR	EA	2
108	21234-108	SPRING PIN 5X30L	EA	4
109	21234-109	CHANGE SPEED ROD	EA	2
110	21234-110	PACKING	EA	2

111	21234-111	HEADSTOCK COVER	EA	2
112	21234-112	SOCKET HEAD CAP SCREW M8X30L	EA	12
113	21234-113	SOCKET HEAD CAP SCREW M12X25L	EA	2
114	21234-114	SOCKET HEAD CAP SCREW M12X55L	EA	2
115	21234-115	ADJUSTING BLOCK	EA	2
116	21234-116	POSITIONING PIN	EA	2
117	21234-117	HEADSTOCK NAME PLATE	EA	2
118	21234-118	REVIT 2X5L	EA	16
119	21234-119	OIL SIGHT GLASS	EA	2
121	21234-121	COLLAR	EA	2
122	21234-122	DOUBLE ROUND HEAD KEY 5X5X20L	EA	2
123	21234-123	BALLBEARING-DEEP GROOVE #6006ZZ	EA	4
124	21234-124	INTERNAL RING	EA	2
125	21234-125	SYNCHRONOUS BELT 270L050	EA	2
126	21234-126	SYNCHRONOUS PULLEY	EA	2
127	21234-127	DOUBLE ROUND HEAD KEY 5X5X20L	EA	2
128	21234-128	WASHER 8.5X 30X3T	EA	2
129	21234-129	SPRING WASHER M8	EA	2
130	21234-130	SOCKET HEAD CAP SCREW M8 X25L	EA	2
131	21234-131	SHAFT	EA	2
132	21234-132	EXTERNAL RING	EA	2
133	21234-133	BRACKET	EA	2
134	21234-134	SOCKET HEAD CAP SCREW M10 X30L	EA	4
135	21234-135	FLAT WASHER M10	EA	4
136	21234-136	SPEED CODER	EA	2
137	21234-137	SOCKET HEAD CAP SCREW M5X25L	EA	4
138	21234-138	SPRING WASHER M5	EA	4
139	21037-01	BEARING CAP	EA	1
140	21037-02	GEAR SHAFT	EA	1
141	21037-03	SLEEVE	EA	1
142	21037-04	GEAR	EA	1
143	21037-05	GEAR	EA	1
144	6003-2NSE	BALLBEARING-DEEP GROOVE	EA	2
150	21234-150	POSITION CHECK ROD	EA	1
151	21234-151	SOCKET HEAD SET SCREW M8 X8L	EA	1
152	21234-152	COMPRESSION SPRING	EA	1
153	21234-153	STEEL BALL 1/4	EA	1
154	21234-154	OIL SEAL TC20X35X7	EA	1
155	21234-155	SET SCREW M6X8L	EA	1
156	21234-156	TOUCH BLOCK	EA	1
157	21037	HEADSTOCK ASSY MODIFICATIONS	EA	1

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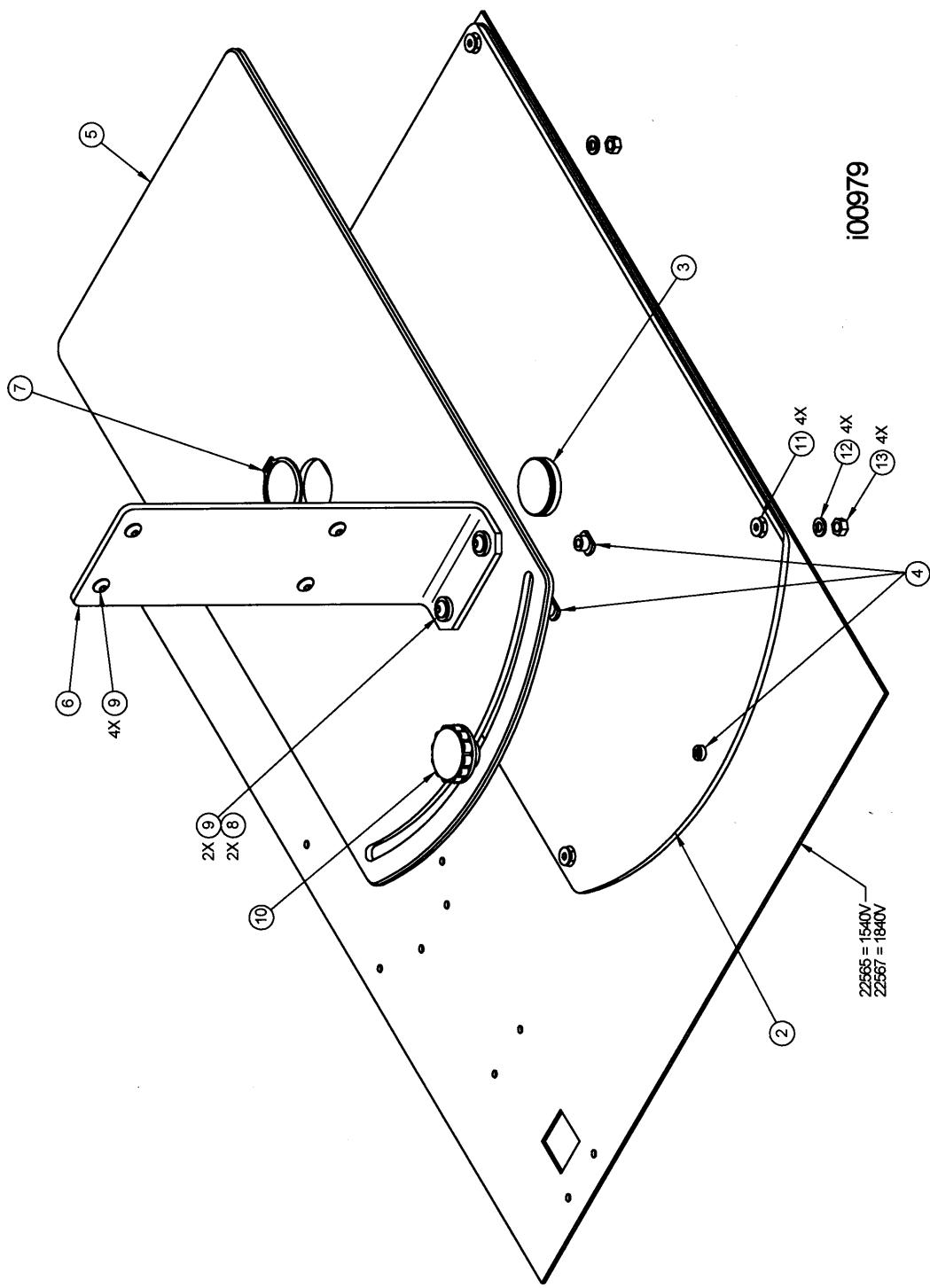
**Figure 48**  
**1840 Tailstock Assembly**

## 1840 Tailstock Assembly Parts List

Item	P/N	Description	Use As	Qty
1	21236-01	TAILSTOCK BODY	EA	1
2	21236-02	SOCKET HEAD CAP SCREW M10X60L	EA	2
3	21236-03	FLAT WAHER M10	EA	2
4	21236-04	SOCKET HEAD SET SCREW M12X16L	EA	2
5	21236-05	SOCKET HEAD SET SCREW M12X25L	EA	1
6	21236-06	SOCKET HEAD SET SCREW M6X10L	EA	1
7	21236-07	BALL CUP 1/4"	EA	2
8	21236-08	OIL SEAL TC75X90X8	EA	1
9	21236-09	STRAIGHT PIN 10X85L	EA	1
10	21236-10	STRAIGHT PIN 10X60L	EA	1
11	21236-11	STRAIGHT PIN 10X90L	EA	1
12	21236-12	TAILSTOCK BASE	EA	1
13	21236-13	SLEEVE	EA	1
15	21236-15	FEED SCREW NUT IMPERIAL	EA	1
16	21236-16	SOCKET HEAD CAP SCREW M6X12L	EA	4
17	21236-17	DOUBLE ROUND HEAD KEY 6X6X20L	EA	1
18	21236-18	SOCKET HEAD SET SCREW M5X20L	EA	1
20	21236-20	DIAL- INCH	EA	1
21	21236-21	HANDWHEEL	EA	1
22	21236-22	WASHER	EA	1
23	21234-099	SCREW & SET SCREW ASSEMBLY	EA	1
24	21236-24	CENTER	EA	1
25	21236-25	PAD-BRASS	EA	1
26	21236-26	ROUND SCREW	EA	1
27	21236-27	PIN	EA	1
28	21236-28	LOCKING BLOCK	EA	1
29	21236-29	CLAMPING BLOCK	EA	1
30	21236-30	LOCKING ROD	EA	1
31	21236-31	SHIFTING ROD	EA	1
32	21236-32	FLAT WASHER	EA	2
33	21236-33	FLAT WASHER	EA	2
34	21236-34	COMPRESSION SPRING	EA	2
35	21236-35	FLAT WASHER	EA	3
36	21236-36	HEXAGON SCREW M20X160L	EA	1
37	21236-37	CLAMPING BLOCK	EA	2
38	21236-38	HEXAGON NUT M20XP2.0	EA	1
39	21236-39	BEDWAY WIPER	EA	2
40	21236-40	BEDWAY WIPER PLATE	EA	2
41	21236-41	CROSS RECESS HEAD SCREW M6X16L	EA	8
42	21236-42	BEDWAY WIPER	EA	2
43	21236-43	BEDWAY WIPER PLATE	EA	2
44	21236-44	KNOB	EA	1
46	21236-46	FEED SCREW IMPERIAL	EA	1
47	21236-47	THRUST BEARING #51104	EA	2

50	21236-50	BRACKET	EA	1
52	21236-52	SOCKET HEAD CAP SCREW M6X16L	EA	4
84	21236-84	HEXAGON SCREW M20X125L	EA	1
85	21236-85	ADJUSTING BLOCK	EA	1
86	21236-86	ECCENTRIC COLLAR	EA	1
87	21236-87	SPRING PIN 6X40L	EA	1
88	21236-88	SOCKET HEAD SET SCREW M8X 12L	EA	1
89	21236-89	SHAFT	EA	1
90	21236-90	LEVER	EA	1
91	21236-91	KNOB	EA	1
92	21236-92	STUD	EA	1
93	21247	NUT AND FEED SCREW ASSY	EA	1

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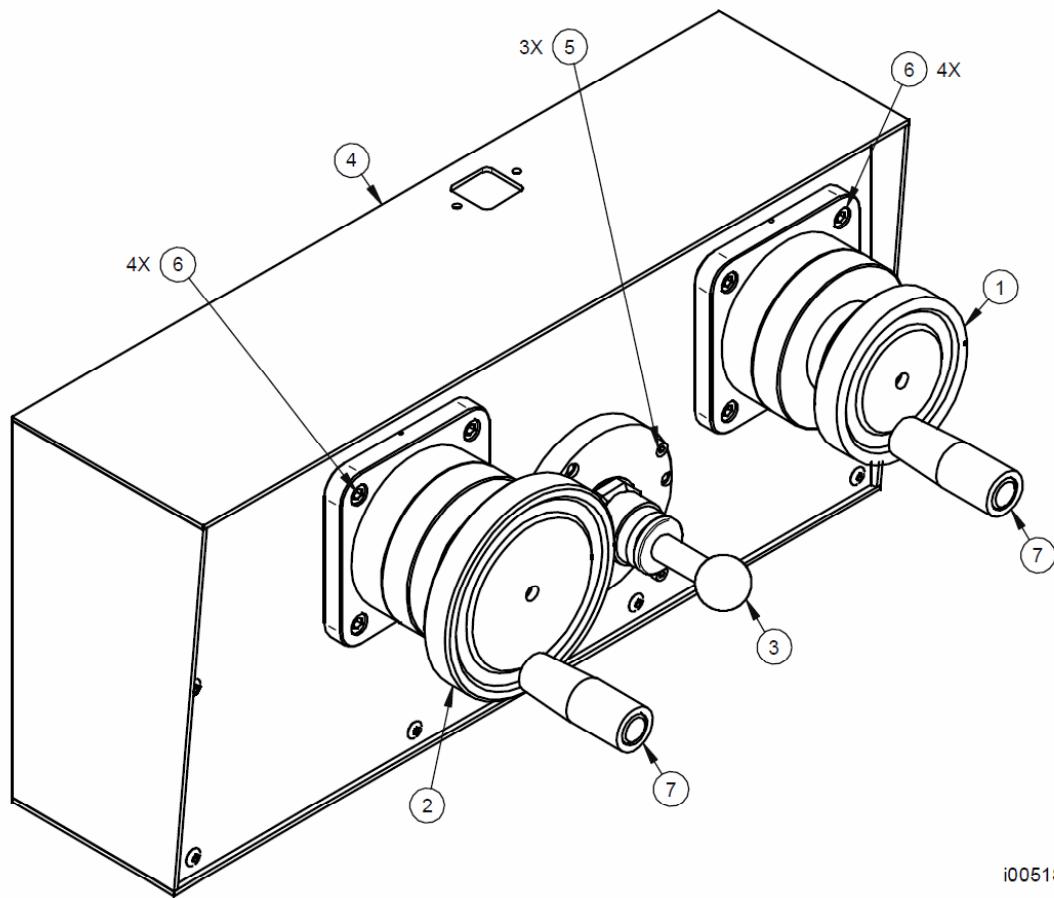


**Figure 49**  
**1840 Pendant Mounting Assembly**

## 1840 Pendant Mounting Assembly Parts List

Item	P/N	Description	Use As	Qty
2	22473	SWIVEL PLATE BASE-1840V/1540V WEY YII	EA	1
3	21063	PIVOT PIN	EA	1
4	21062	T-NUT	EA	3
5	22474	SWIVEL PLATE-1840V/1540V WEY YII	EA	1
6	22484	PENDANT BRACKET - 1840V/1540V	EA	1
7	21104-150	SNAP RING-TYPE SH 1.5 DIA	EA	1
8	15759	WASHER-1/4 HARD BLK OX 1/8 THK	EA	2
9	1/4-20X1/2 27B	SCREW-BHCS-STL-BO	EA	6
10	21103	KNOB - MODIFIED	EA	1
11	M6-1.0X16 26B	SCREW-FHCS-STL-BO	EA	4
12	M6 73B	WASHER-SPLIT LOCK-STL-BO	EA	4
13	M6-1.0 50P	NUT-HEX-STL-PLAIN	EA	4

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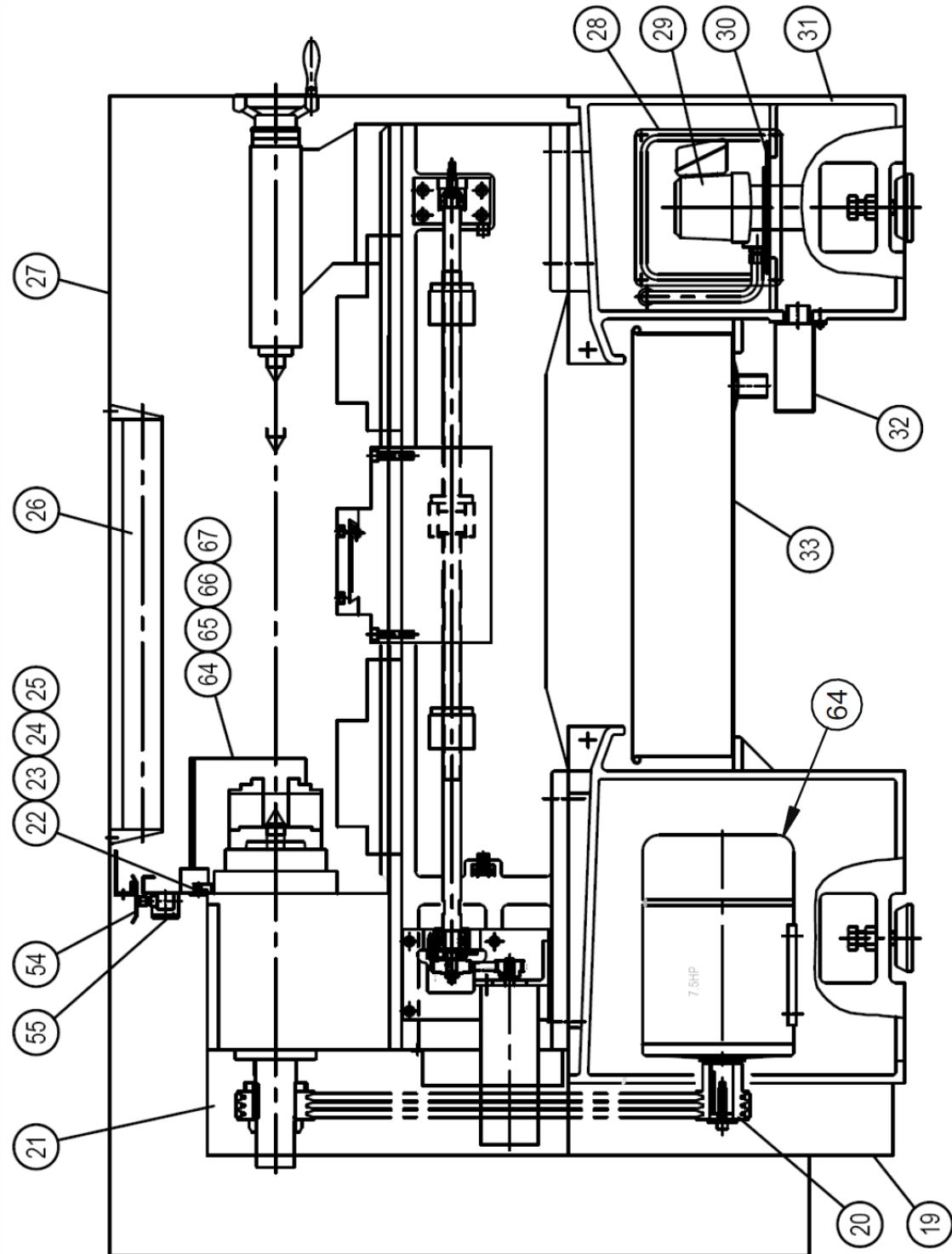
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**Figure 50**  
**Lathe Apron Assembly**

**Lathe Apron Assembly Parts List**

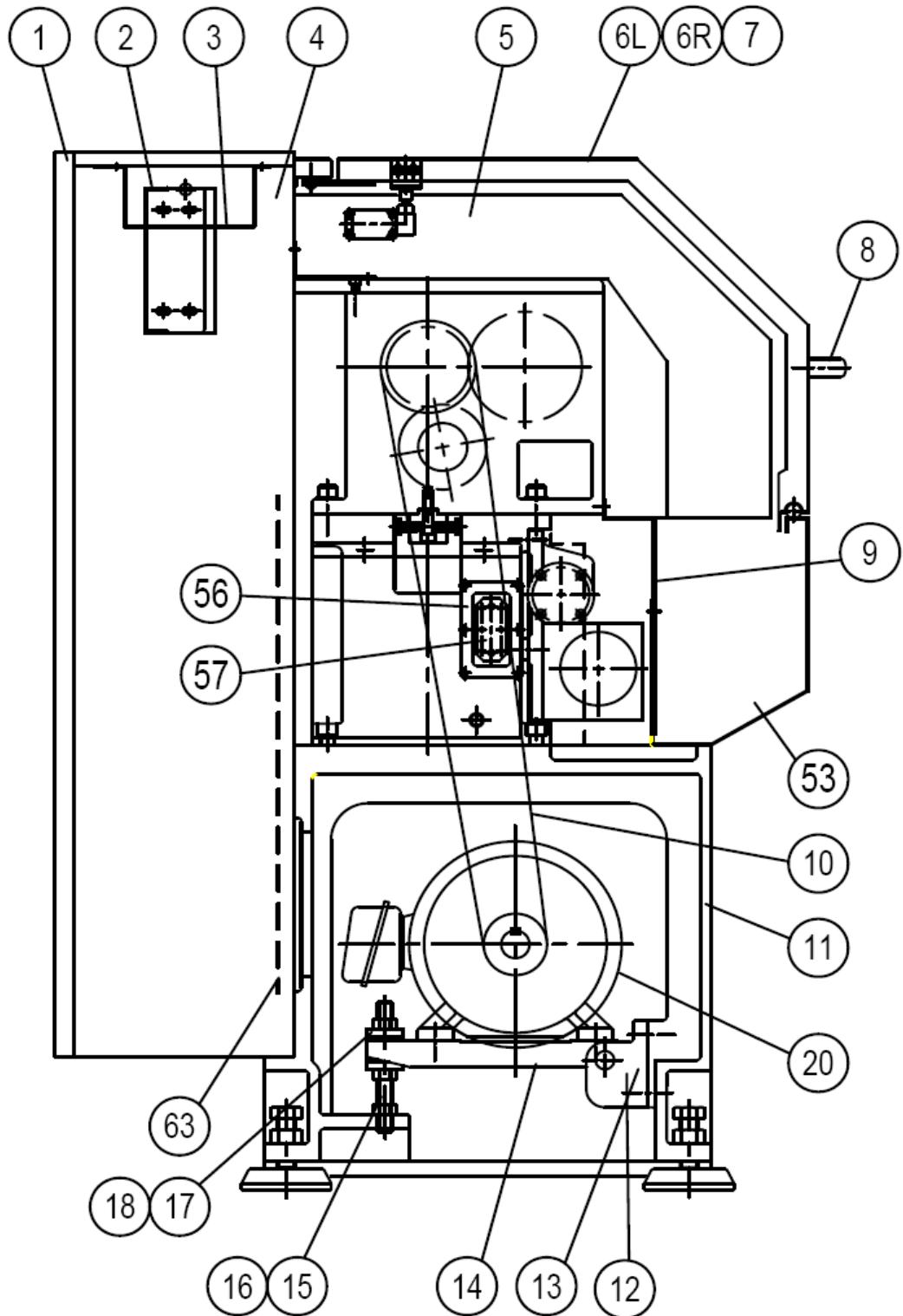
Item	P/N	Title	Qty
1	20082-2	ELECTRONIC HANDWHEEL-X-AXIS TRL	1
2	20082-3	ELECTRONIC HANDWHEEL-Z-AXIS TRL	1
3	20295	JOGSTICK-ASSY	1
4	21046	HOUSING & PANEL ASSY. HANDWHEEL (VER: II)	0
5	M4-0.7X16 25B	SCREW-SHCS-STL-BO	3
6	M6-1.0X12 25B	SCREW-SHCS-STL-BO	8
7	30889	HANDLE REVOLVING	2

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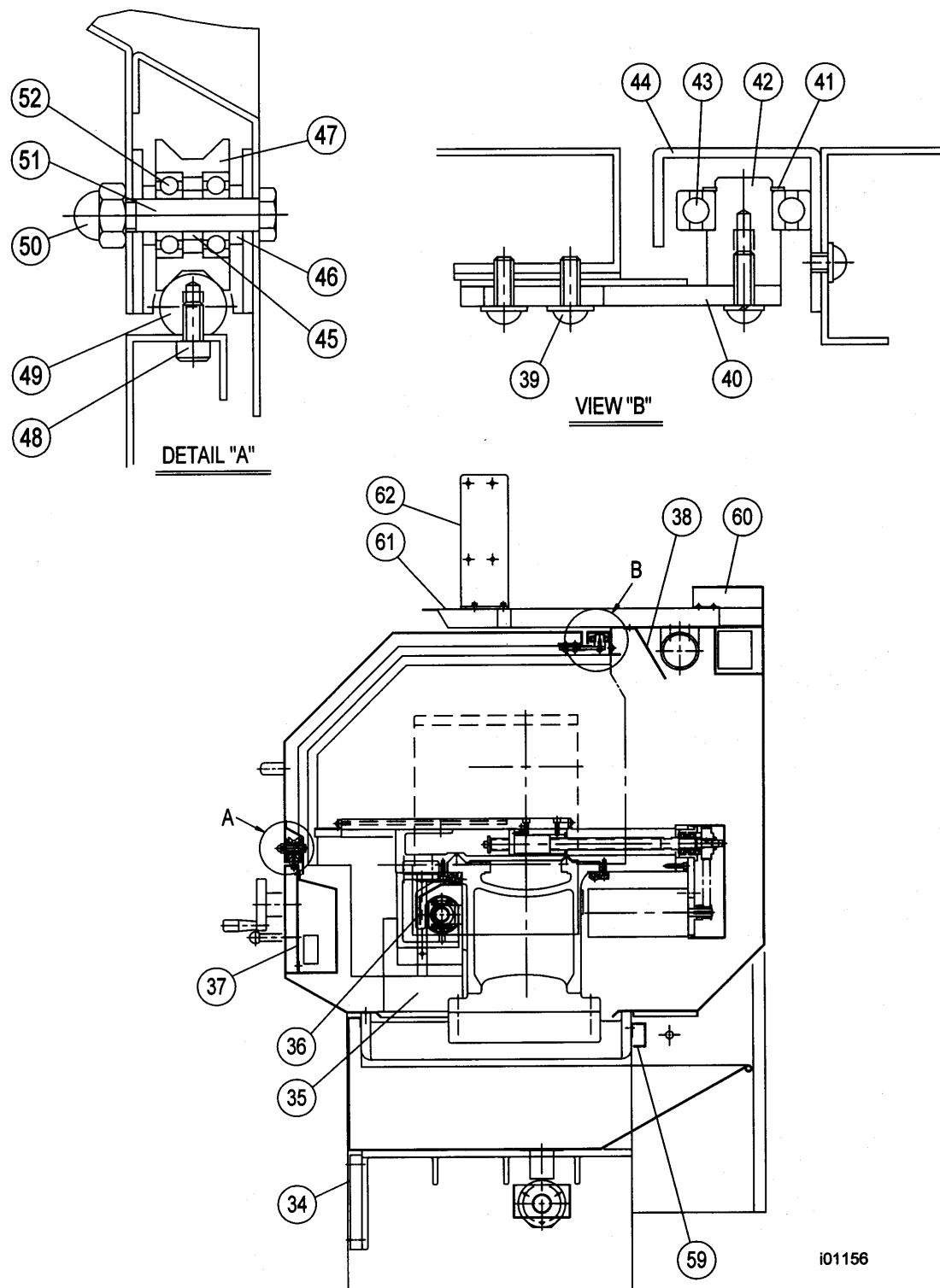


i1630 & 1630HS

**Figure 51**  
**1630 and 1630HS Machine Assembly**



**Figure 52**  
**1630 and 1630HS Machine Assembly**



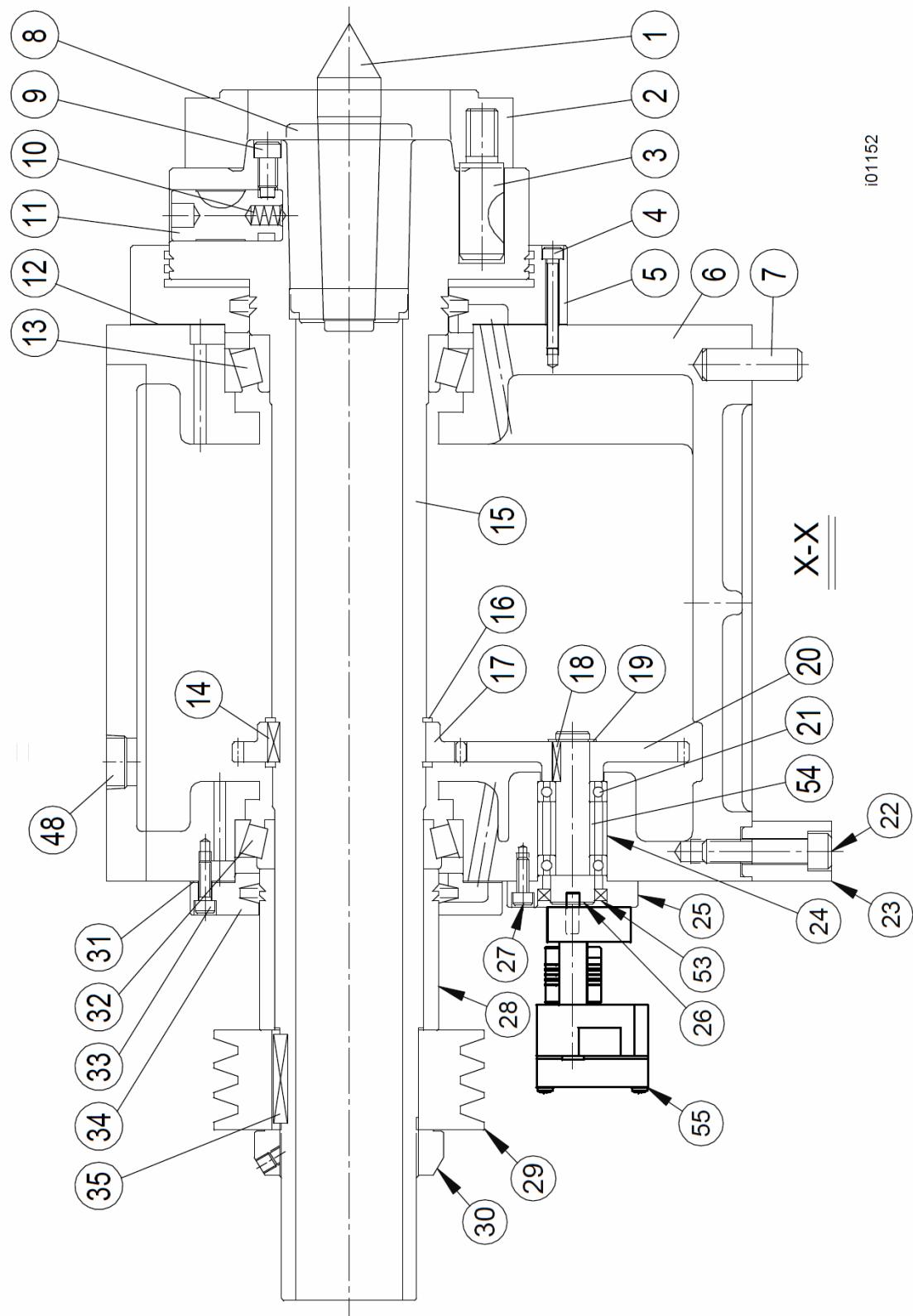
**Figure 53**  
**1630 and 1630HS Machine Assembly**

## 1630 and 1630HS Machine Assembly Parts List

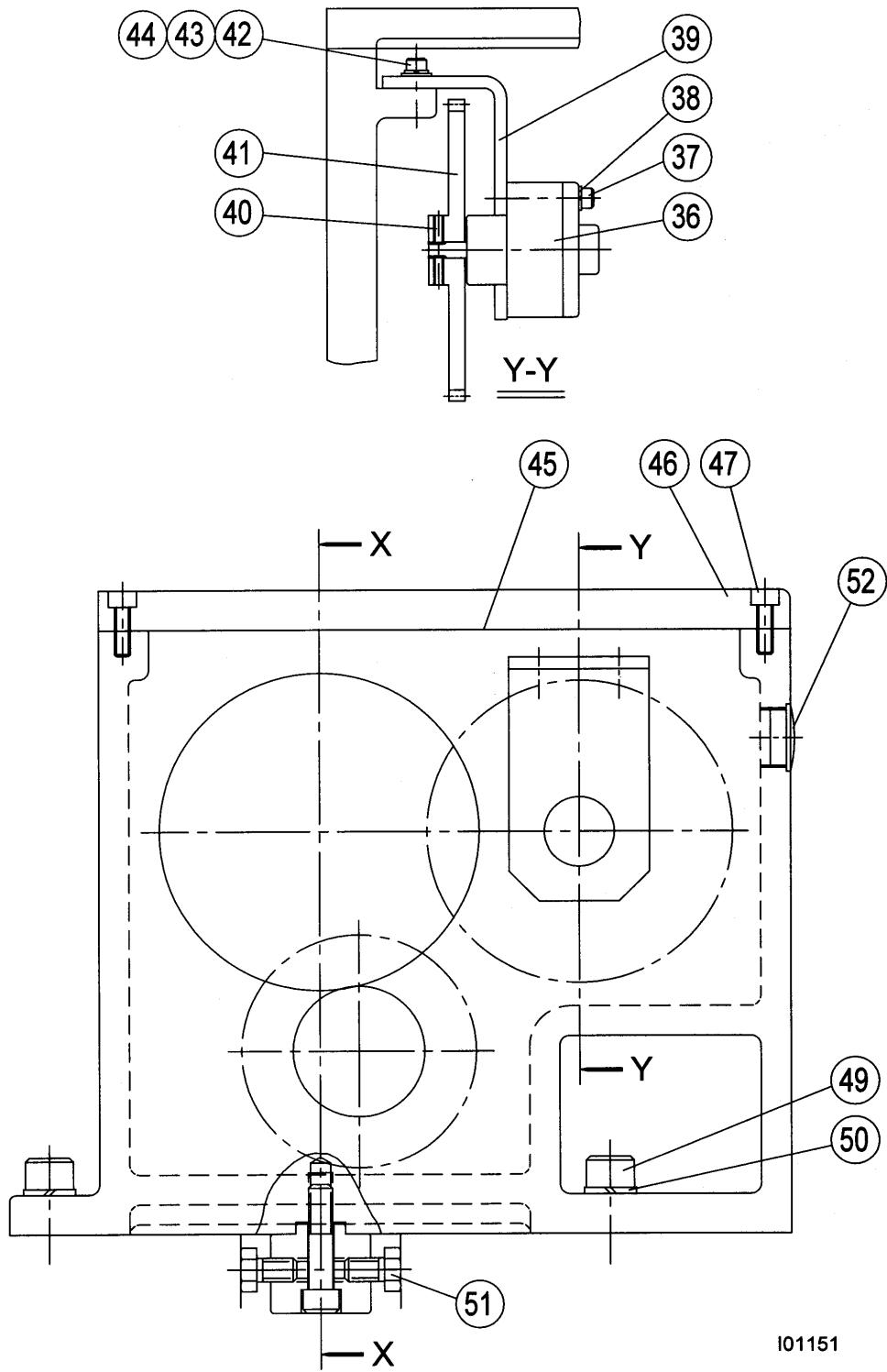
Item	Parts No.	Description	Material	Specification	Q'ty
1	25-0707	Electrical Control Box Door	SS41		1
2	24-0748	Seat - Switch	SS41		1
3	24-0735	Cover - Protection	SS41		1
4	25-0706	Electrical Control Box	SS41		1
5	25-0704	Guard - Protection	SS41		1
6	25-0721	Safety Door	SS41		1
7	24693	Glass - safety	25-0722		1
8	21241-36	Handle - Door	Rubber		2
9	25-0711	Cover Plate	SS41		1
10	24694	Belt Set – Spindle Motor (3 belts)		A-76"	1
11	25-0674	Left Stand Casting	FC25		1
12	50-0676	Bracket - Motor	FC25		1
13	50-0677	Shaft	S45C		1
14	50-0678	Plate - Motor	FC25		1
15		Screw - Adjusting	S45C	M20x2.5x220L	1
16		Hexagon Nut		M20x2.5	3
17	50-0681	Spherical Washer (Concave)	SS41		2
18	50-0682	Spherical Washer (Convex)	SS41		2
19	25-0733	Stand End Cover	SS41		1
20	24695	Motor - Spindle			1
21	25-0731	Headstock Plate	SS41		1
22	24-0716	Anti-Leaking Cover	SS41		1
23		O-Ring		G220	1
24		O-Ring		G250	1
25		Socket Head Cap Screw		M6x12L	6
26	22714-26 23341	Tube – Lamp Bulb - Worklight		A-W515DB	1 1
27	25-0701	Guard - Protection	SS41		1
28	24-0741	Base Rear Cover	SS41		1
29	23265	Pump – Coolant		1/8HP	1
30	24-0742	Seat - Pump	SS41		1
31	25-0675	Right Stand Casting	FC25		1
32	25-0723	Coolant Tank	SS41		1
33	25-0734	Chip Tray	SS41		1
34	25-0732	Base Cover Plate (Front)	SS41		1
35	25-0705	Cover	SS41		1
36	25-0712	Cover – Protection - Ballscrew	SS41		1
37	25-0724	Operation Box Cover	SS41		1
38	24-0703	Protection Guard	SS41		1
39		Socket Head Cap Screw		M6x16L	6
40	77A-0615	Upper Roller Setting Base	SS41		3

## 1630 and 1630HS Overall Machine Parts List

Item	Parts No.	Description	Material	Specification	Q'ty
41		Ring - Retaining		S17	3
42	77A-0614	Shaft	S20C		3
43	FVS65	Bearing - Deep Groove Ball		#6203ZZ	3
44	25-0713	Guide Way - Upper Door	SS41		1
45	77-0627	Spacer	S20C		4
46	77-0628	Spacer	S20C		2
47	77-0626	Roller	S45C		2
48		Socket Head Cap Screw		M6x12L	5
49	25-0725	Guide Way - Lower	S45C		1
50		Domed Cap Screw		M10	2
51	77-0629	Shaft	S45C		2
52	22714-58	Bearing - Deep Groove Ball		#6000ZZ	4
53	25-0709	Front Connection Plate	SS41		1
54	25-0726	Safety Door Touch Block	SS41		1
55	24696	Switch - Door			1
56	25-0714	Cover	SS41		1
57		Oil Sight Glass			1
58	25-0724	Anti-Leaking Pad	Rubber		1
59	25-0718	Carrier - Cable	SS41		1
60	25-0720	Cover	SS41		1
61	25-0719	Plate	SS41		1
62	25-0735	Bracket	SS41		1
63	25-0708	Bottom Plate	SS41		1
64	25-0708	Fan Assy, 110/220V			1



**Figure 54 1630 Headstock Assembly**



**Figure 55**  
**1630 Headstock Assembly**

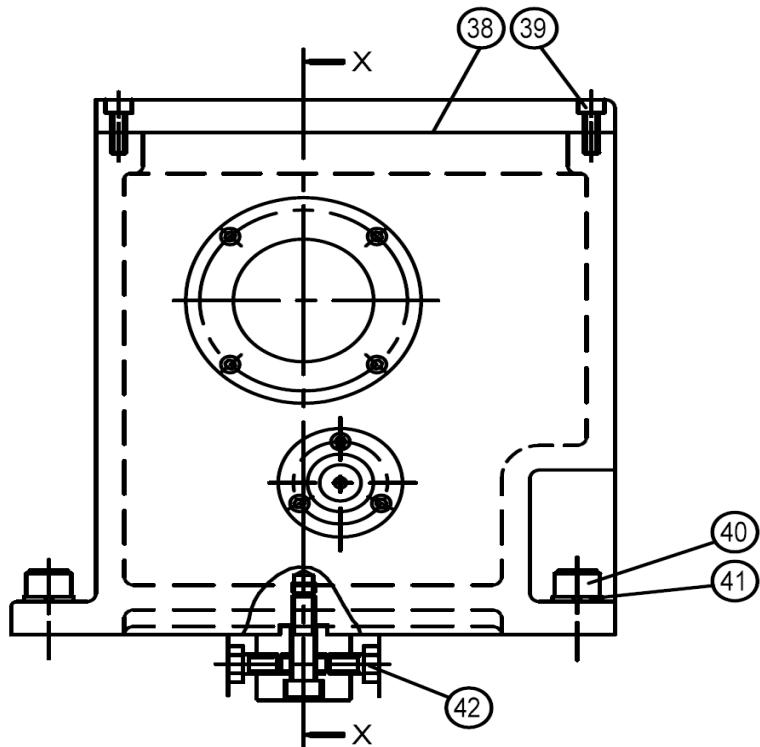
## 1630 Headstock Parts List

Item	Parts No.	Description	Material	Specification	Qty
1	21234-004	Center	SK5	MT#4	1
2	50-01120A	Driving Plate - 8"	FC25	D1-6	1
3	50-01119	Cam Lock Stud	SCM415	D1-6	6
4		Socket Head Cap Screw		M6x45L	6
5	24715	Cover - Bearing (Front)	FC20	25-0105	1
6	25-0101	Headstock Casting	FC25		1
7	50-01113	Positioning Pin	S45C		1
8	21234-003	Center Sleeve	SK5	MT#6xMT#4	1
9	24728	Detent Screw	SS41	50-01112	6
10	24729	Detent Spring	SWP	50-01111	6
11	24730	Cam	SCM415	50-01110	6
12	24727	Gasket		25-0106	1
13	21234-015	Bearing - Taper Roller - front		#32016XJ	1
14	24718	Key – spindle encoder gear		6x6x20L	1
15	24705	Spindle	SCM440	25-0102	1
16	24717	Snap Ring		S-78	2
17	24706	Gear – Main Spindle	S45C	77USA-0146	1
18	24732	Key		6x6x20L	1
19	24733	Snap Ring		S-17	1
20	24707	Gear – Spindle Encoder	S45C	77USA-0145	1
21	6003-2RS	Deep Groove Ball Bearing		6003	2
22		Socket Head Cap Screw		M12x1.75X55L	1
23	50-01114	Adjusting Block	SS41		1
24	24724	Spacer	SS41	24-0127	1
25	24722	Ring – Mounting, spin enc	FC20	25-0142	1
26	24721	Shaft – spindle encoder	S45C	25-0143	1
27		Socket Head Cap Screw		M6xP1.0x16L	3
28	24719	Spacer - spindle	S45C	25-0109	1
29	24708	Pulley - Spindle	FC30	25-0110	1
30	24709	Lock Nut – Spindle Pulley	SS41	SK70 60-0163	1
31	24726	Gasket		25-0108	1
32	24710	Bearing - Taper Roller - rear		#32015XJ	1
33		Socket Head Cap Screw		M6x20L	6
34	24716	Cover - Rear	FC20	25-0107	1
35	24720	Key – spindle pulley		8x7x45L	2
36	24711	Pump – Oil - Manual		AM2A	1
37		Hexagon Head Screw		M6x45L	3
38		Washer - Spring		M6	3
39	24723	Bracket – oil pump	SS41	25-0112	1
40		Socket Head Set Screw		M5x16L	2

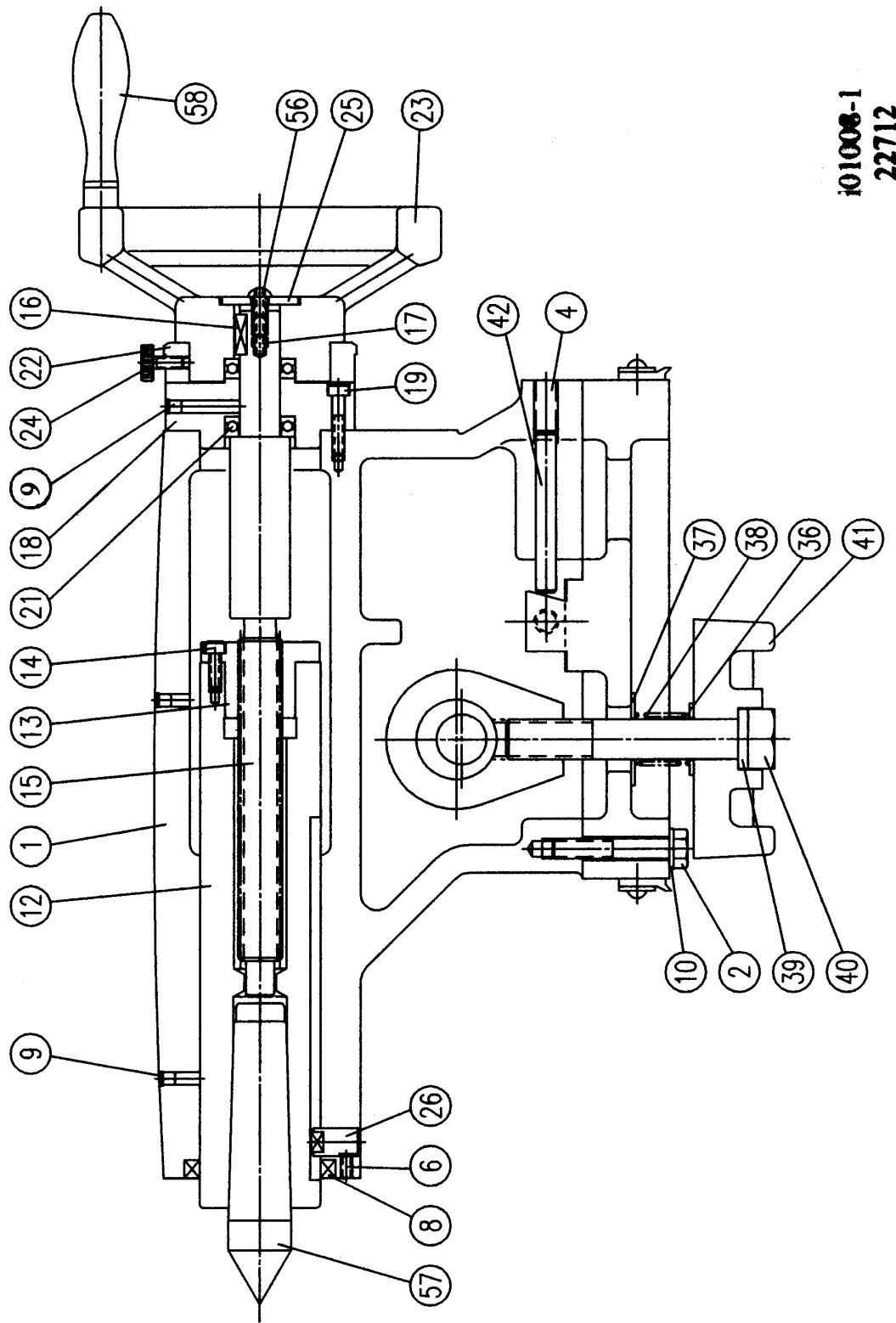
## 1630 Headstock Parts List

Item	Parts No.	Description	Material	Specification	Qty
41	24712	Gear – Oil Pump	UMC1	25-0111	1
42		Socket Head Cap Screw		M6x20L	2
43		Washer - Flat		M6	2
44		Washer - Spring		M6	2
45	24731	Gasket		25-0104	1
46	25-0103	Cover - Headstock	FC20		1
47		Socket Head Cap Screw		M8x25L	6
48		Plug - Oil		PT-3/4	1
49		Socket Head Cap Screw		M16x50L	4
50		Washer - Spring		M16	4
51		Hexagon Head Screw		M12x1.75X20L	2
52	21234-119	Oil Sight Glass	50-01146	HFTX22	1
53	24713	Seal - Oil		TC22x35x6	1
54	24725	Spacer	SS41	77USA-0144	1
55	16873	Encoder Assy-Spindle			1

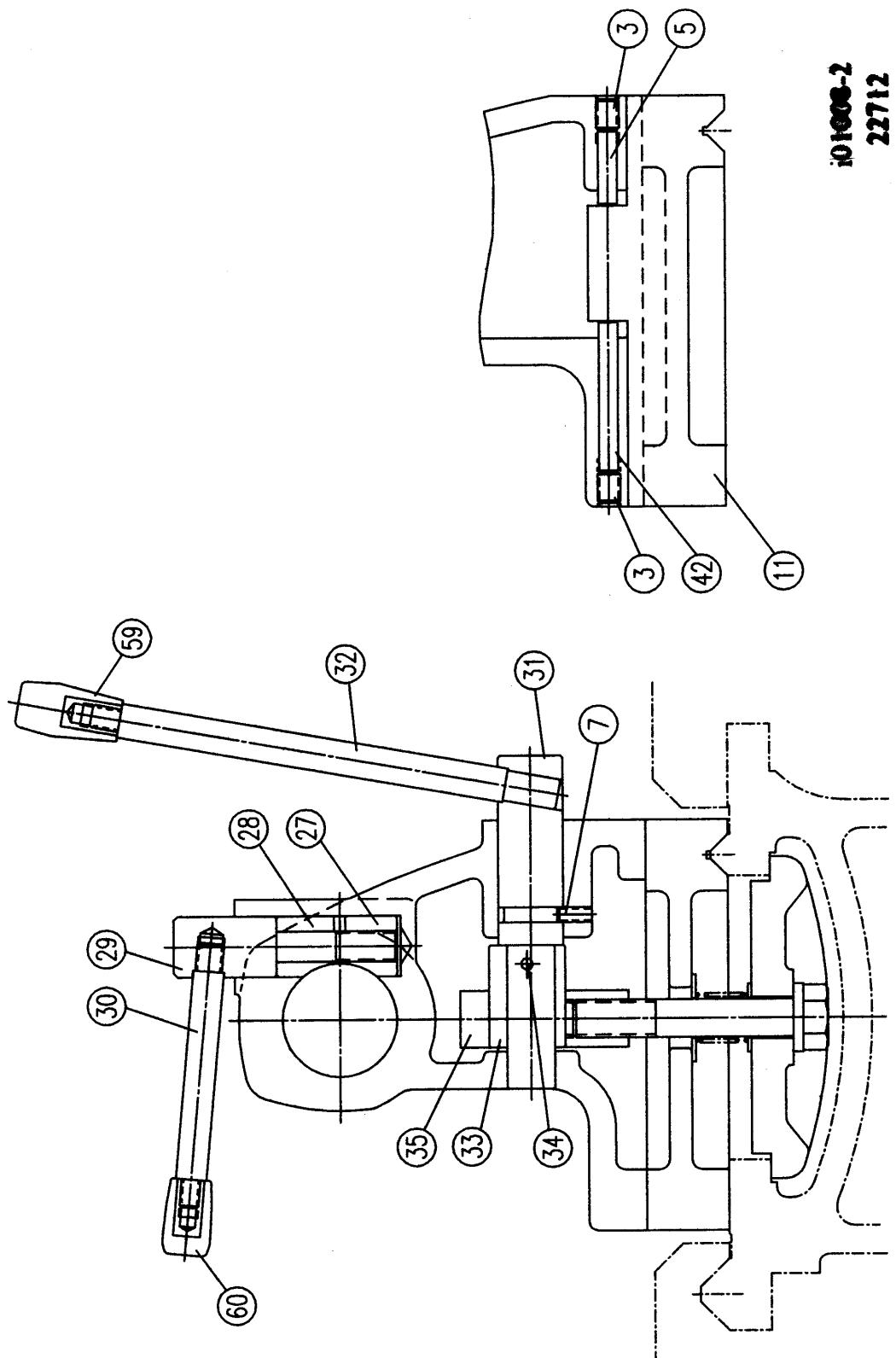
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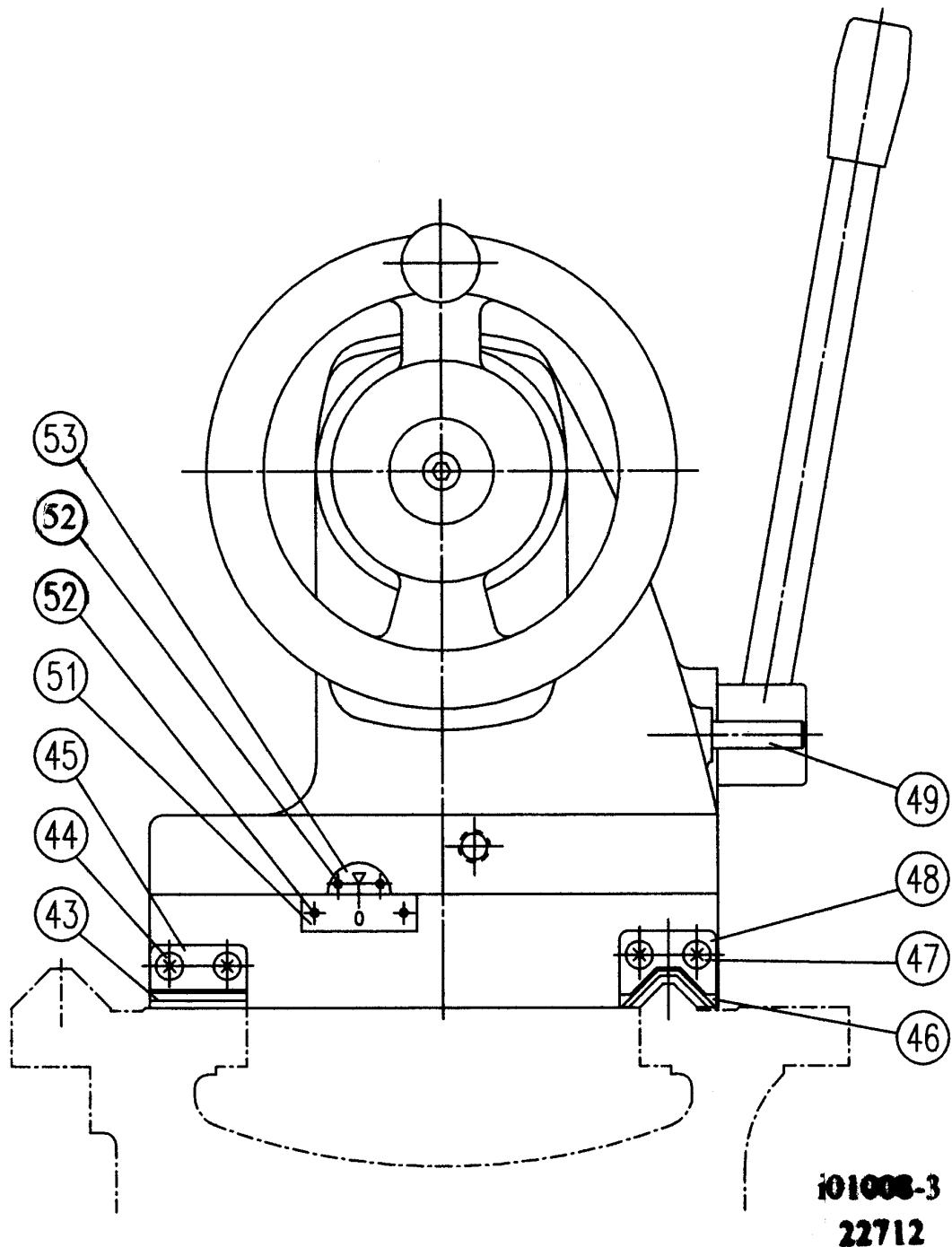
**Figure 56**  
**1630HS Headstock**



## Figure 58 1630 and 1630HS Tailstock Assembly



**Figure 59**  
**1630 and 1630HS Tailstock Assembly**



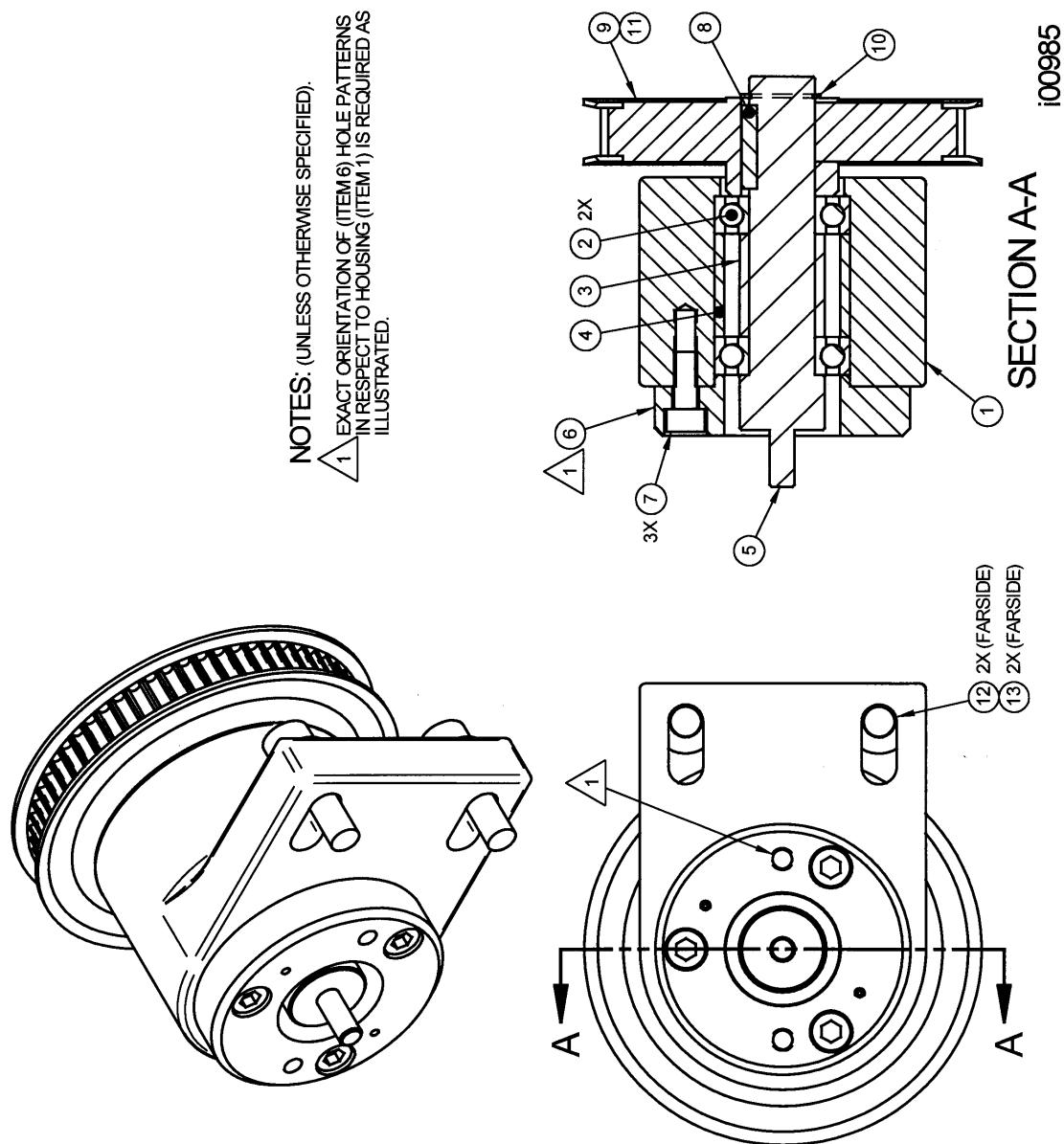
**Figure 60**  
**1630 and 1630HS Tailstock Assembly**

## Parts List

Item	P/N	Mfr P/N	Description	Use As
1	22712-1	24-0501-00	TAILSTOCK BODY	EA
2	M10-1.5X60 25B		SCREW-SHCS-STL-BO	EA
3	M12-1.75X16 25B		SCREW-SHCS-STL-BO	EA
4	M12-1.75X25 25B		SCREW-SHCS-STL-BO	EA
5	22712-5	10X40LG	STRAIGHT PIN	EA
6	M6-1.0X10 40B		SCREW-SOC SET-STL-BO-CUP	EA
7	M8-1.25X10 40B		SCREW-SOC SET-STL-BO-CUP	EA
8	22712-8	TCØ60XØ75X9	OIL SEAL	EA
9	22712-9	Ø1/4	BALL CUP	EA
10	22712-10	23-0112-00	WASHER-Ø10.5X25.4XT2	EA
11	22712-11	24-0502-00	TAILSTOCK BASE	EA
12	22712-12	50-0503-00	SLEEVE-TAILSTOCK BARREL	EA
13	22712-13	50-0505-00	FEED NUT-IMPERIAL	EA
14	22712-14	50-0505-01	SHCS-M6-1.0X12	EA
15	22712-15	24-0507-00	FEED SCREW-IMPERIAL	EA
16	22712-16	6X6X20LG	DOUBLE ROUND HEAD KEY	EA
17	M5-0.8X20 40B		SCREW-SOC SET-STL-BO-CUP	EA
18	22712-18	50-0508-00	BRACKET	EA
19	M6-1.0X30 25B		SCREW-SHCS-STL-BO	EA
21	22712-21	51104	THRUST BEARING	EA
22	22712-22	50-0510-00	DIAL-IMPERIAL	EA
23	22712-23	50-0511-00	HANDWHEEL	EA
24	22712-24	50-03111-00	LOCKSCREW	EA
25	22712-25	50-0513-00	WASHER	EA
26	22712-26	50-0514-00	PIN	EA
27	22712-27	50-0515-00	LOCKING BLOCK	EA
28	22712-28	50-0516-00	CLAMPING BLOCK	EA
29	22712-29	50-0517-00	LOCKING ROD	EA
30	22712-30	50-0518-00	LEVER	EA
31	22712-31	50-0519-00	SHAFT	EA
32	22712-32	50-0520-00	LEVER	EA
33	22712-33	50-0521-00	ECCENTRIC COLLAR	EA
34	22712-34	Ø6X40LG	SPRING PIN	EA
35	22712-35	50-0522-00	ADJUSTING BLOCK	EA
36	22712-36	50-0523-00	FLAT WASHER	EA
37	22712-37	50-0524-00	FLAT WASHER	EA
38	22712-38	50-0525-00	COMPRESSION WASHER	EA
39	22712-39	50-0526-00	FLAT WASHER	EA
40	22712-40	S35C	HEX SCREW	EA
41	22712-41	24-0528-00	CLAMPING BLOCK	EA
42	22712-42	24-0528-00	CLAMPING BLOCK	EA
43	22712-43	24-0530-00	BEDWAY WIPER	EA
44	M6-1.0X16 10B		SCREW-PH-PHIL-STL-BO	EA
45	22712-45	24-0531-00	BEDWAY WIPER PLATE	EA

46	22712-46	24-0532-00	BEDWAY WIPER	EA
47	M6-1.0X15 10B		SCREW-PH-PHIL-STL-BO	EA
48	22712-48	24-0533-00	BEDWAY WIPER PLATE	EA
49	22712-49	50-0534-00	SET SCREW	EA
51	22712-51	50-0536-00	INDICATOR	EA
52	22712-52	Ø2X5LG	RIVET-Ø2x5LG	EA
53	22712-53	50-0537-00	INDICATOR	EA
56	21234-099		SCREW & SET SCREW ASSEMBLY	EA
57	22712-57	14-0129	CENTER-MT#4	EA
58	22712-58	50-0431-00	KNOB	EA
59	22712-59	50-0166-00	GRIP	EA
60	22712-60	50-01138-00	GRIP	EA

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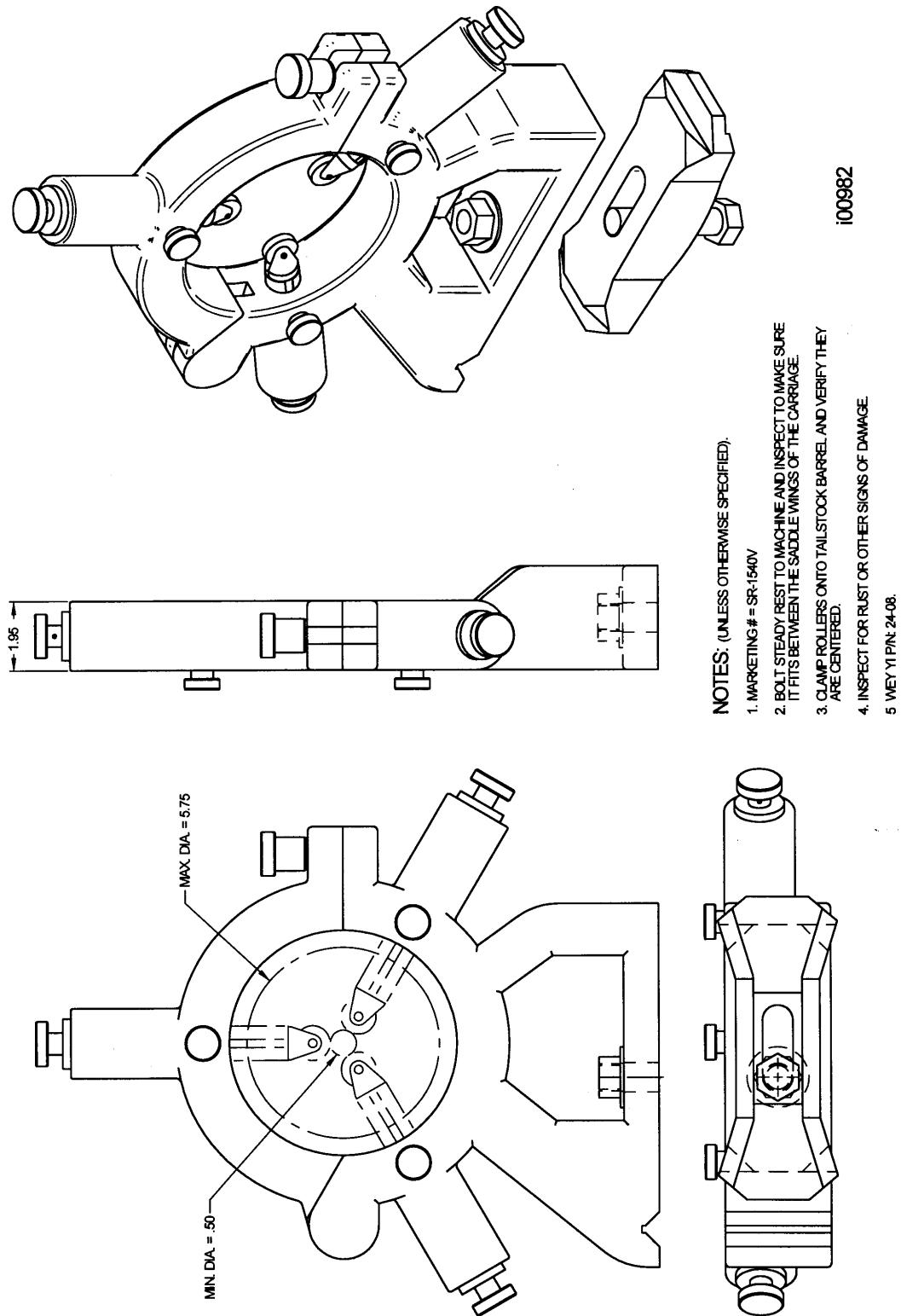


**Figure 61**  
**1540SX Spindle Encoder Drive Assembly**

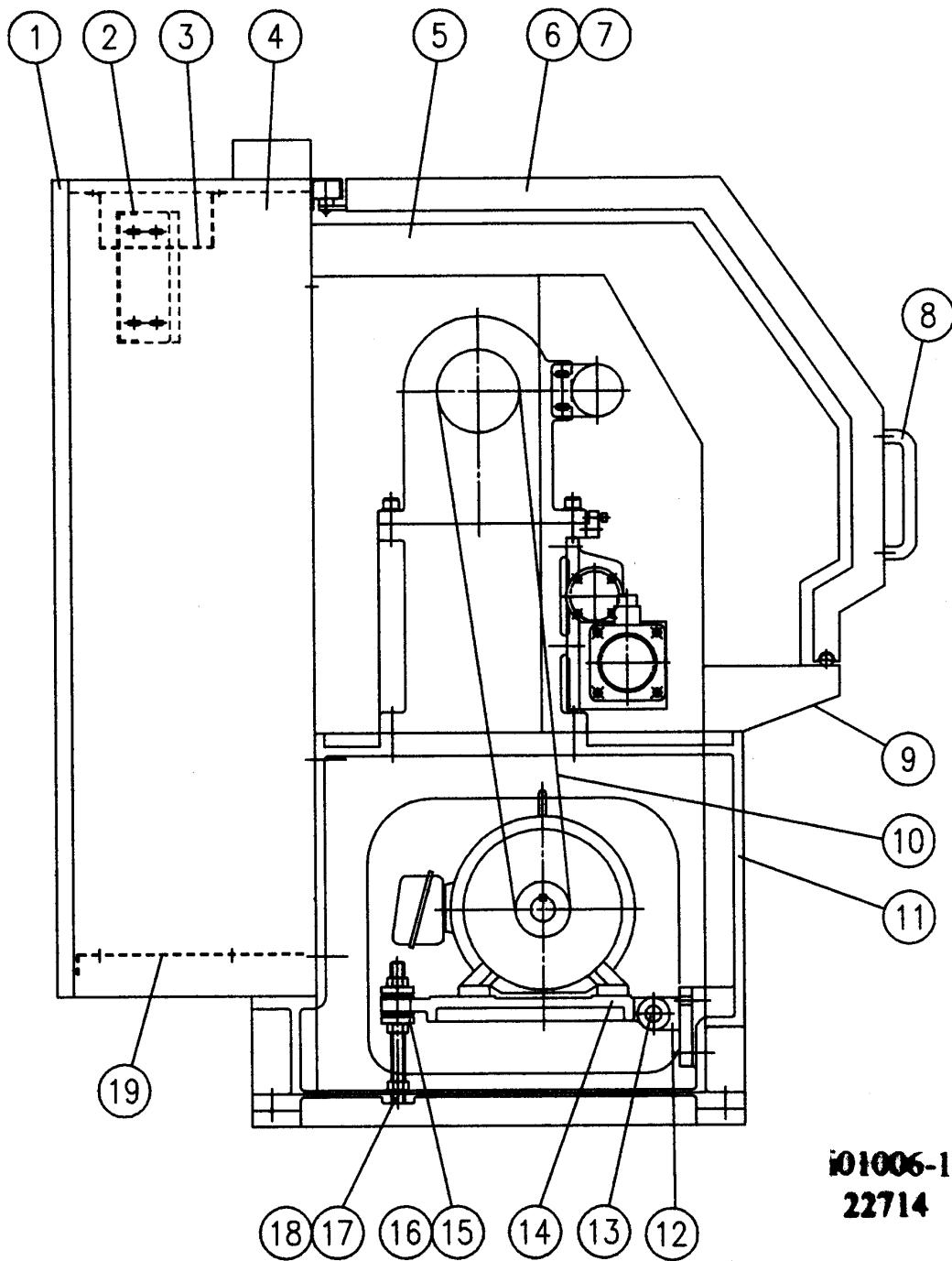
## Parts List – 1540SX Spindle Encoder Drive Assembly

Item	P/N	Description	Use As	Qty
1	22205	HOUSING - SPINDLE ENCODER DRIVE	EA	1
2	6003-2RS	BEARING (SWI P/N 21047)	EA	2
3	21037-03	SPACER	EA	1
4	21037-06	SNAP RING	EA	1
5	22203	SHAFT - SPINDLE ENCODER DRIVE	EA	1
6	21037-01	ADAPTOR - ENCODER MOUNTING	EA	1
7	M6-1.0X15 25B	SCREW-SHCS-STL-BO	EA	3
8	22202	KEY 4x4x22	EA	1
9	22204	SPROCKET ASSY - SPINDLE ENCODER DRIVE	EA	1
10	5100-66	RETAINING RING - 17mm	EA	1
11	670-5M-09	BELT	EA	1
12	M8 70B	WASHER-FLAT USS-STL-BO	EA	2
13	M8-1.25X30 25B	SCREW-SHCS-STL-BO	EA	2

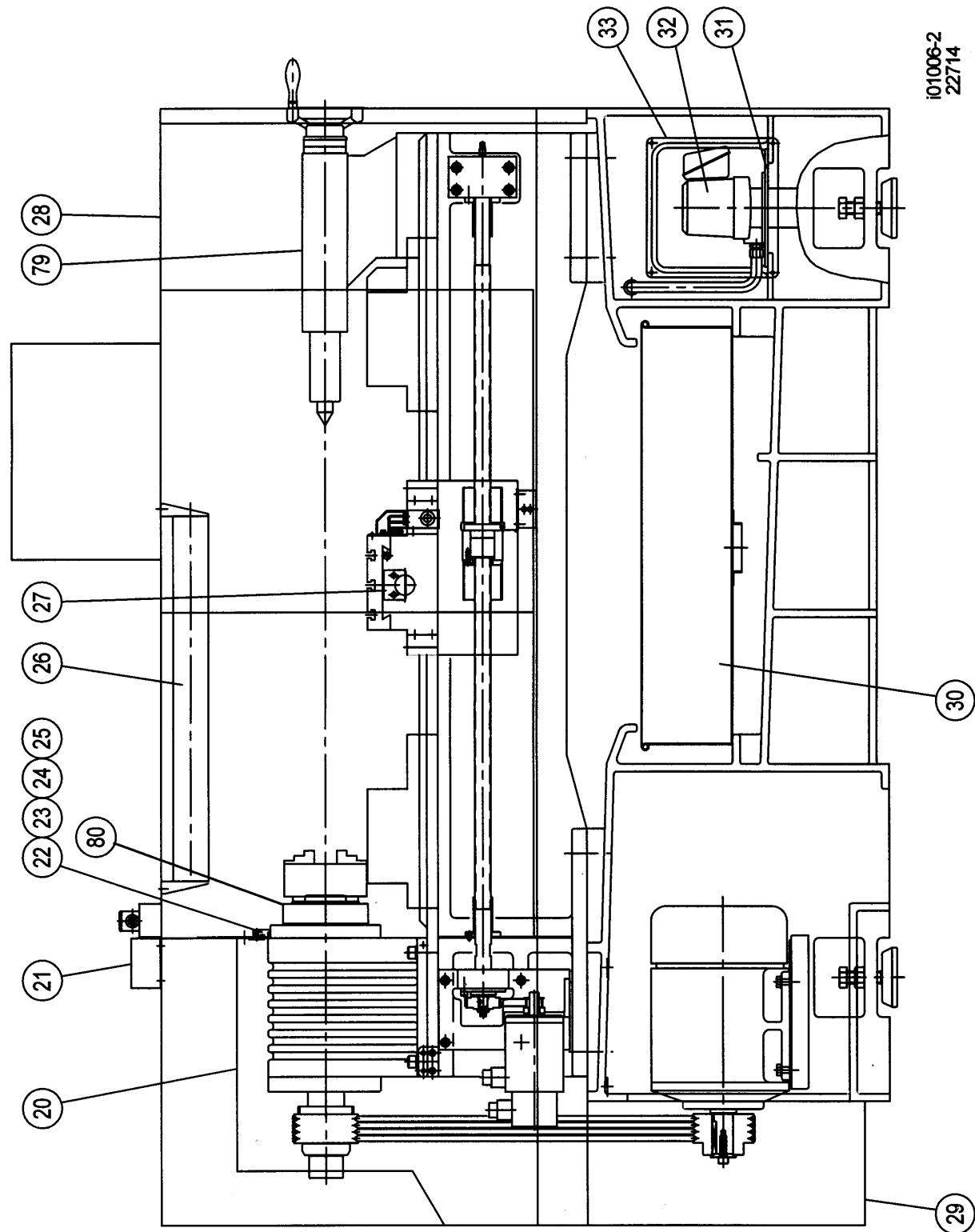
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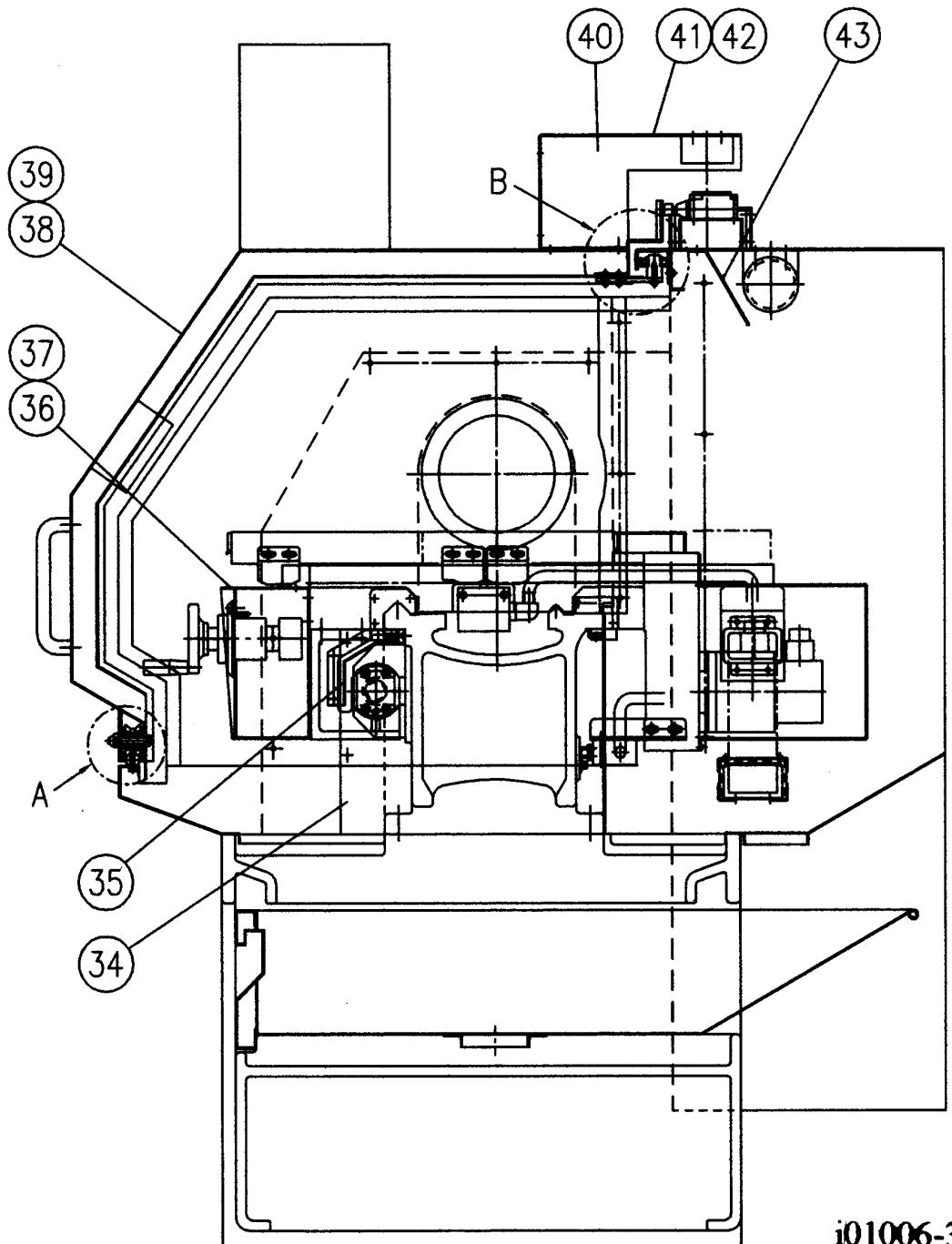
**Figure 62**  
**1540SX Steady Rest**



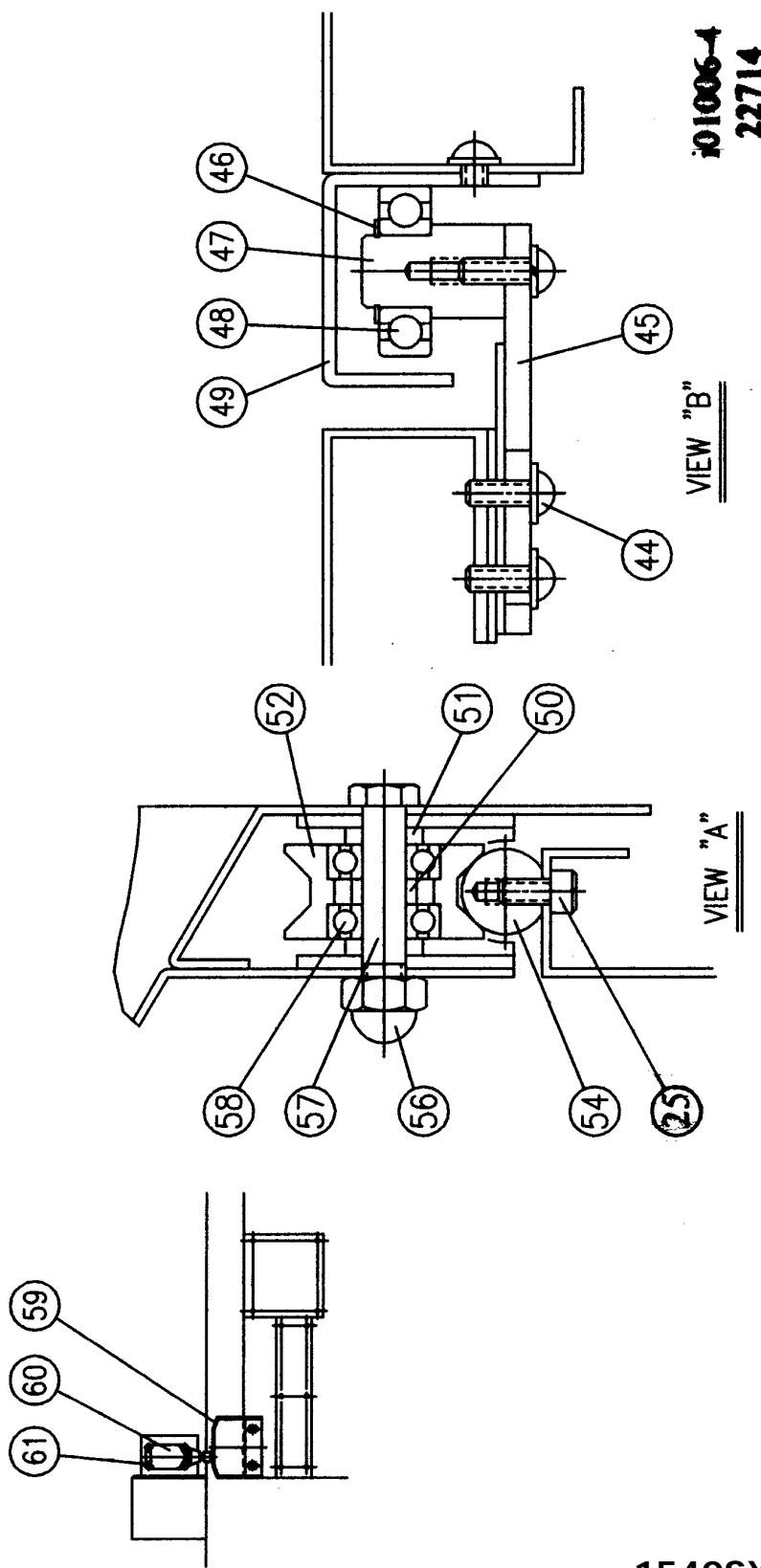
**Figure 63**  
**1540SX Overall Machine**



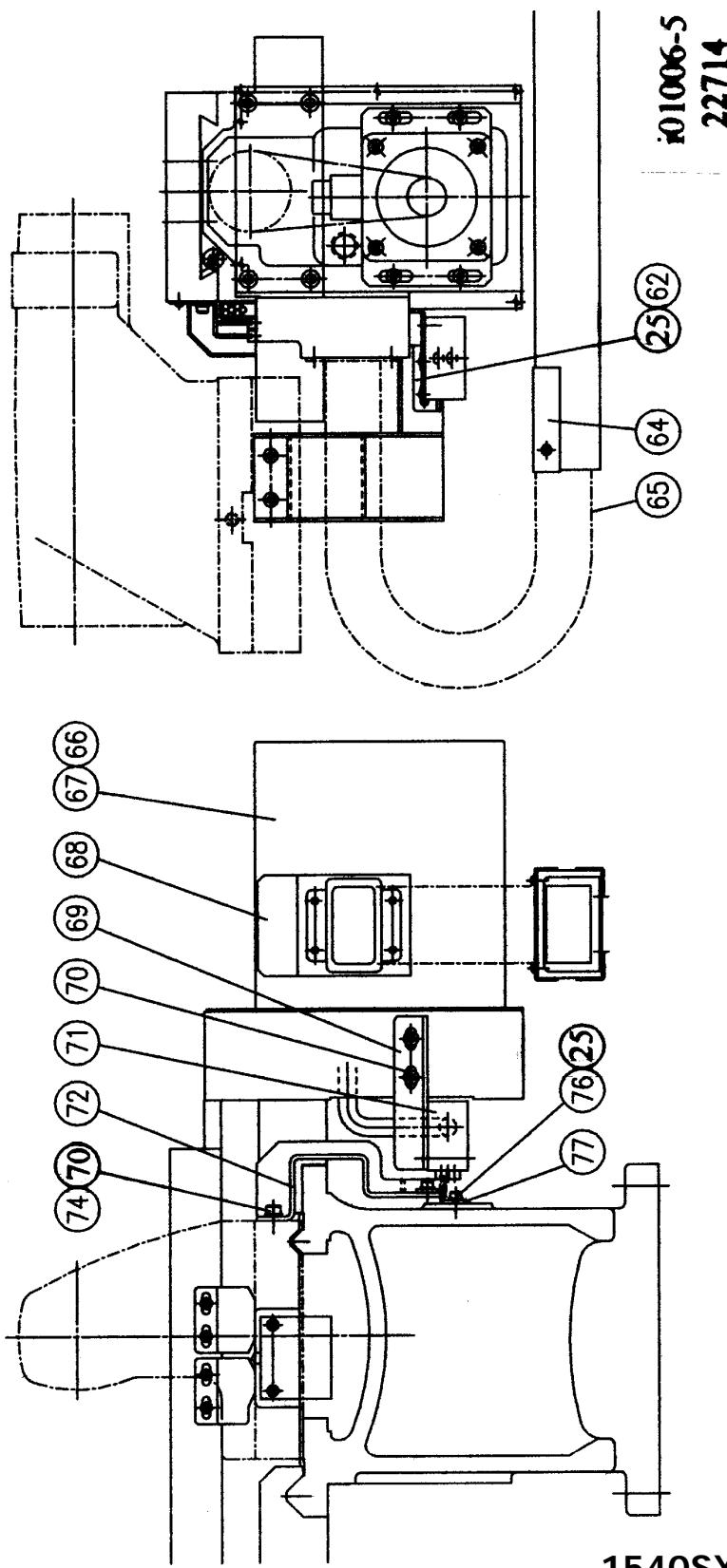
**Figure 64-1**  
**1540SX Overall Machine**



**Figure 64-2**  
**1540SX Overall Machine**



**Figure 64-3**  
**1540SX Overall Machine**



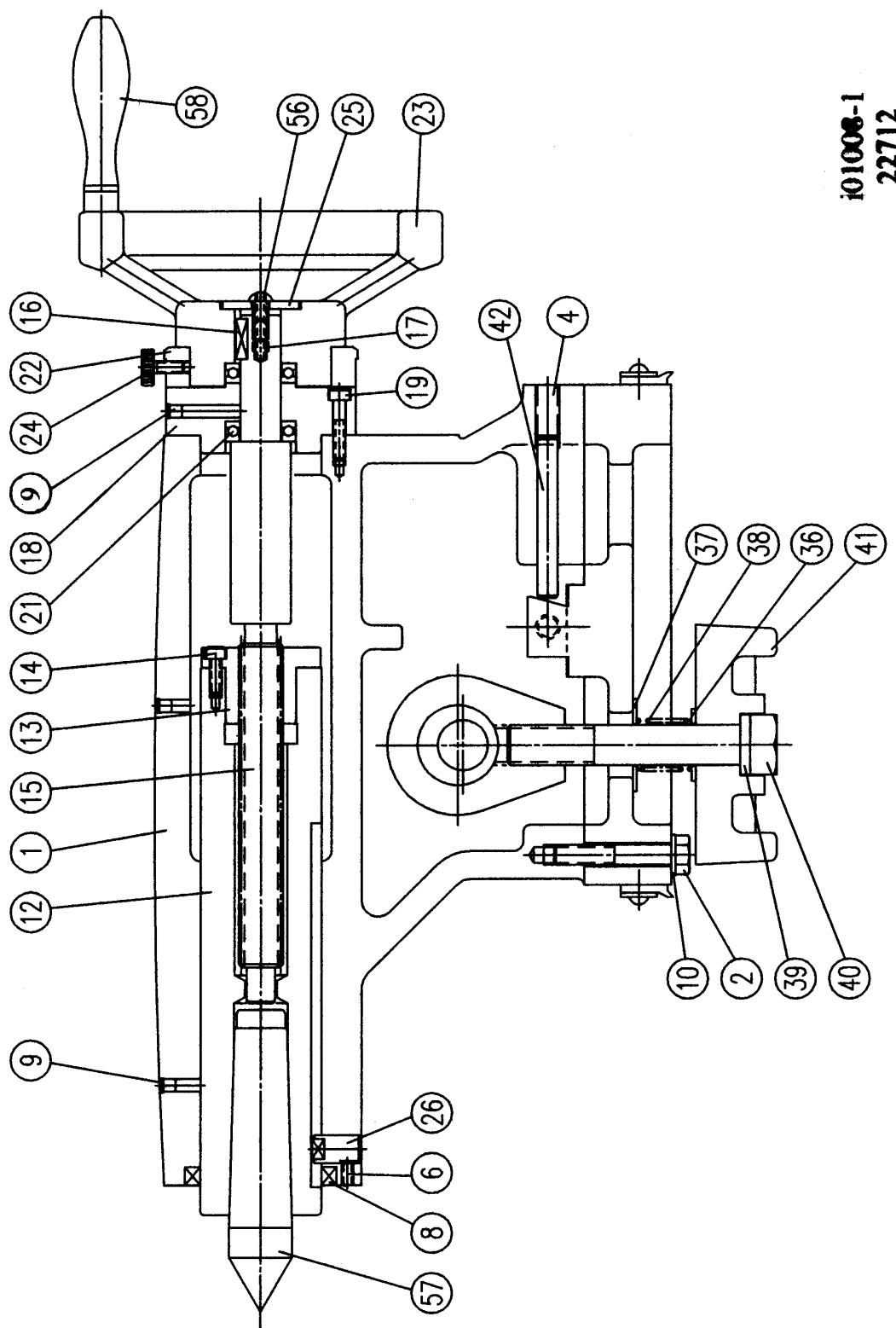
**Figure 64-4**  
**1540SX Overall Machine**

## Parts List – 1540SX Overall Machine

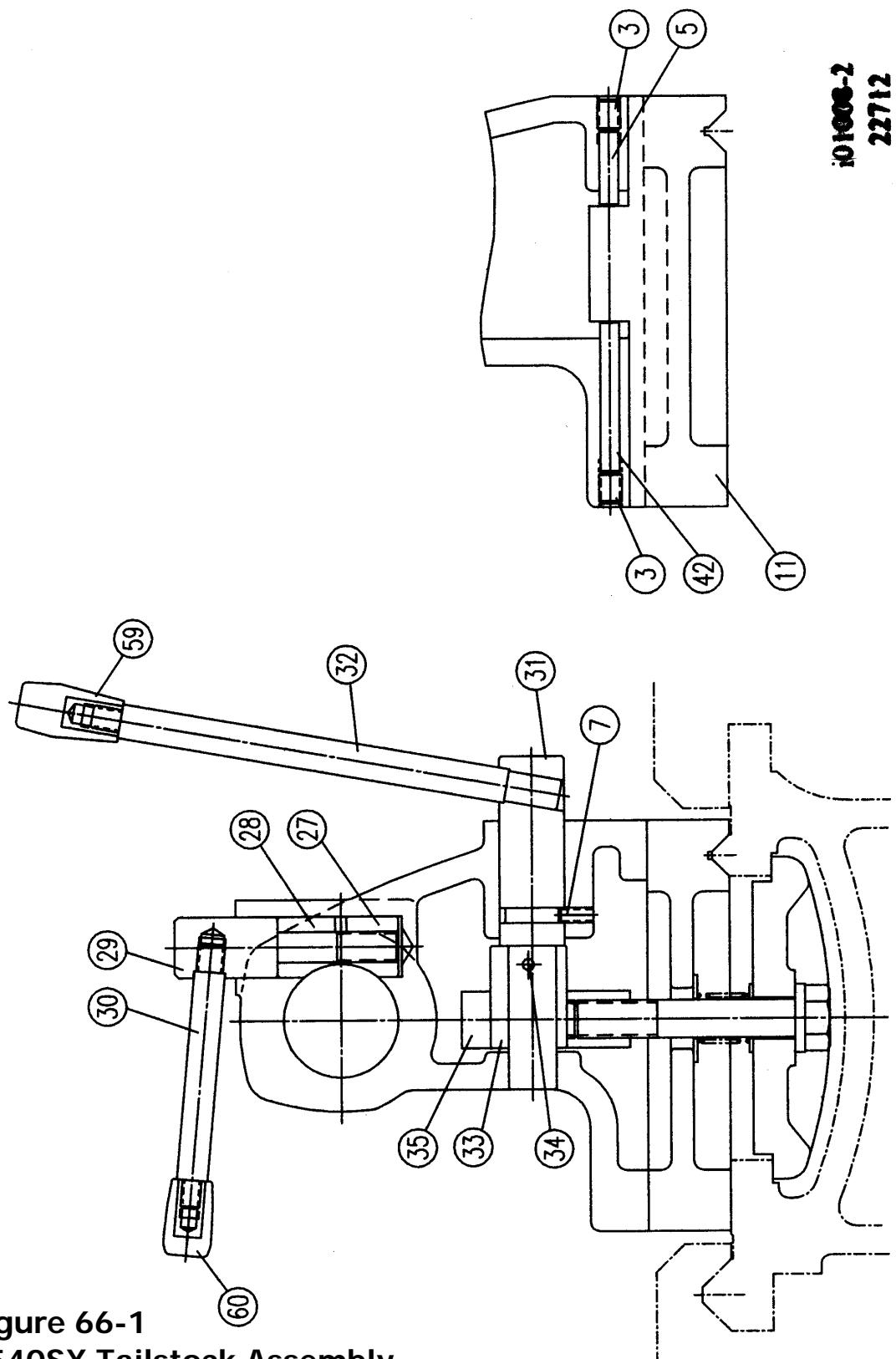
Item	P/N	Mfr P/N	Description	Use As	Qty
1	22714-1	24-0707	ELECTRICAL CONTROL BOX DOOR	EA	1
2	22714-2	77A-0648	SWITCH SEAT	EA	1
3	22714-3	24-0735	ELECTRICAL CONTROL BOX	EA	1
4	22714-4	24-0706	ELECTRICAL CONTROL BOX	EA	1
5	22714-5	24-0704	PROTECTION COVER	EA	1
6	22714-6	24-0719	LEFT MOVING DOOR	EA	1
7	22714-7	24-0720	SAFETY GLASS	EA	1
8	21241-36	77A-06103-AI	DOOR HANDLE	EA	1
9	22714-9	24-0709	FRONT PROTECTION GUARD	EA	1
10	21239-24	2R-11M-1950	BELT-SPINDLE MOTOR	EA	2
11	22714-11	24-0674	STAND	EA	1
12	22714-12	24-0676	BRACKET	EA	1
13	22714-13	24-0677	SHAFT	EA	1
14	22714-14	24-0678	MOTOR PLATE	EA	1
15	22714-15	50-0681	ADJUSTING WASHER	EA	2
16	22714-16	50-0682	ADJUSTING WASHER	EA	2
17	M20-2.5 X22		ADJUSTMENT SCREW	EA	1
18	M20-2.5 50B		NUT-HEX-STL-BO	EA	3
19	22714-19	24-0708	SETTING PLATE	EA	1
20	22714-20	24-0731	COVER PLATE	EA	1
21	22714-21	24-0726	COVER PLATE	EA	1
22	22714-22	24-0716	ANTI-LEAKING COVER	EA	1
23	22714-23	G220	O-RING	EA	1
24	22714-24	G250	O-RING	EA	1
25	M6-1.0X12 25B		SCREW-SHCS-STL-BO	EA	15
26	22714-26	A-W515DB	LAMPTUBE	EA	1
27	22714-27	24-0739	PLATE	EA	1
28	22714-28	24-0701	REAR PROTECTION GUARD	EA	1
29	22714-29	24-0733	END COVER	EA	1
30	22714-30	24-0734	CHIP TRAY	EA	1
31	22714-31	24-0742	PUMP BRACKET	EA	1
32	23265		PUMP COOLANT 1/8 HP	EA	1
33	22714-33	24-0741	REAR COVER	EA	1
34	22714-34	24-0705	COVER PLATE	EA	1
35	22714-35	24-0712	BALL SCREW COVER	EA	1
36	22714-36	24-0723	OPERATION BOX	EA	1
37	22714-37	24-0724	COVER	EA	1
38	22714-38	24-0721	RIGHT MOVING DOOR	EA	1
39	22714-39	24-0722	SAFETY GLASS	EA	1
40	22714-40	24-0710	CABLE CARRIER	EA	1
41	22714-41	24-0711	COVER	EA	1
42	22714-42	80X45SS2000L	WIRE PROTECTOR	EA	1
43	22714-43	24-0703	PLATE	EA	1
44	M6-1.0X16 25B		SCREW-SHCS-STL-BO	EA	18
45	22714-45	77A-0615	SETTING BASE	EA	6
46	22714-46	S17	RETAINING RING	EA	6
47	22714-47	77A-0614	SHAFT	EA	6
48	FVS65		BALL BEARING (2 REQ.) 6203ZZ	EA	6
49	22714-49	24-0713	UPPER DOOR GUIDE	EA	1

Item	P/N	Mfr P/N	Description	Use As	Qty
50	22714-50	77-0627	SPACER	EA	8
51	22714-51	77-0628	SPACER	EA	4
52	22714-52	77-0626	ROLLER	EA	4
54	22714-54	24-0725	SLIDE WAY	EA	1
56	M10-1.5 54B		NUT-ACORN-BLK OX	EA	4
57	22714-57	77-0629	SHAFT	EA	4
58	22714-58	6000ZZ	TAPER ROLLER BEARING	EA	4
59	22714-59	24-0743	TOUCH BLOCK	EA	1
60	22683	TZ-5109	LIMIT SWITCH- DOOR LIMIT	EA	1
61	22714-61	77A-0672	COVER PLATE	EA	1
62	22714-62	77B-0698	Z AXIS TOUCH BLOCK	EA	1
64	22714-64	77A-0610	COVER PLATE	EA	1
65	22714-65	80X45SA150000L	WIRE PROTECTOR	EA	1
66	22714-66	24-0728	X AXIS MOTOR COVER	EA	1
67	22714-67	24-0729	END COVER	EA	1
68	22714-68	24-0730	BRACKET	EA	1
69	22714-69	24-0307	MICRO SWITCH SEAT	EA	1
70	M8-1.25X12 25B		SCREW-SHCS-STL-BO	EA	4
71	22551-2		LIMIT SWITCH ASSY-PT4-LEFT	EA	1
72	22714-72	24-0738	BRACKET	EA	1
74	M8 70B		WASHER-FLAT USS-STL-BO	EA	2
76	M6 70B		WASHER-FLAT USS-STL-BO	EA	2
77	22714-77	24-0698	BRACKET	EA	1
78	22551-1		LIMIT SWITCH ASSY-PT4-RIGHT	EA	1
79	22712		TAIL STOCK-1540SX	EA	1
80	22170		SPINDLE ASSY	EA	1

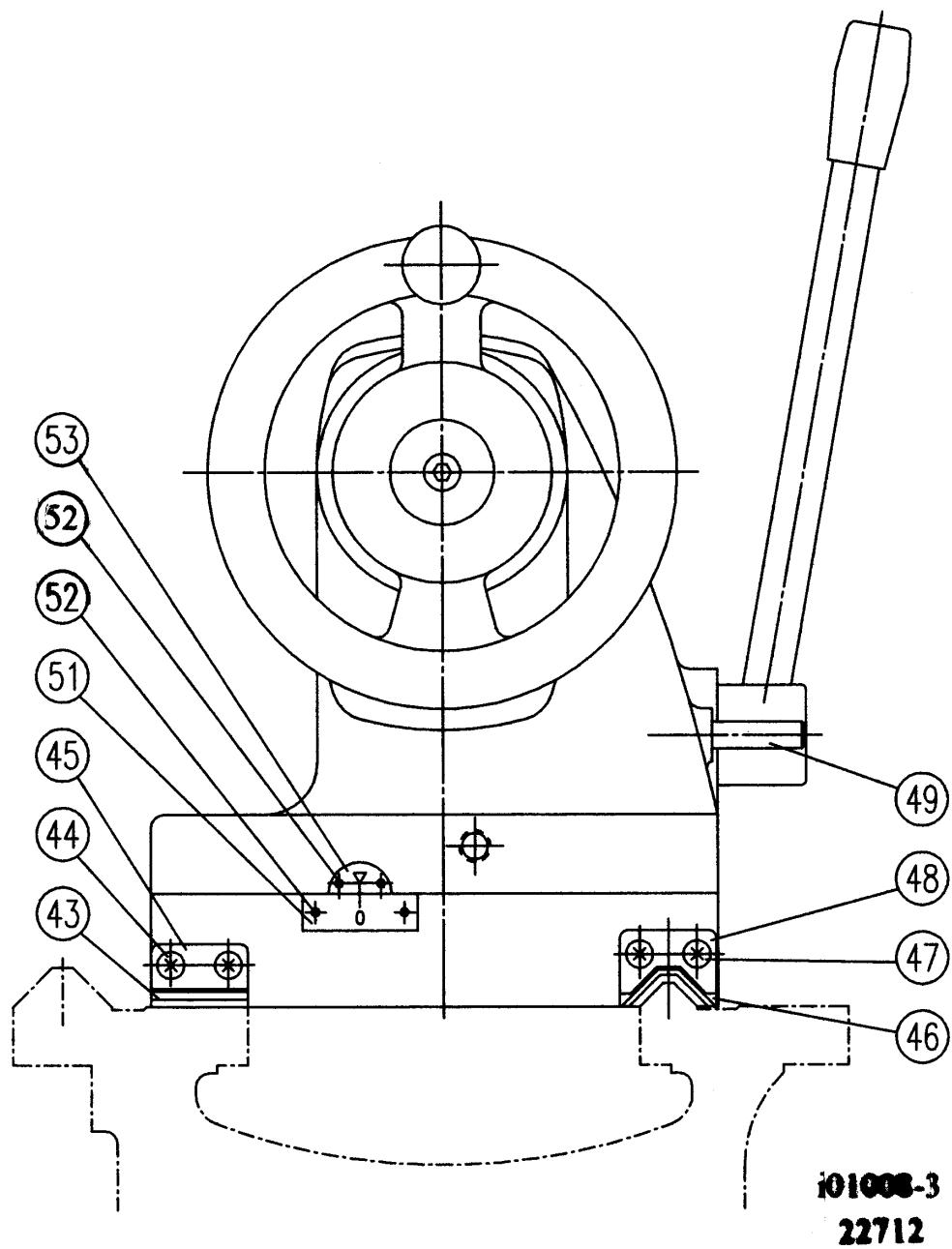
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**Figure 65**  
**1540SX Tailstock Assembly**



**Figure 66-1**  
**1540SX Tailstock Assembly**



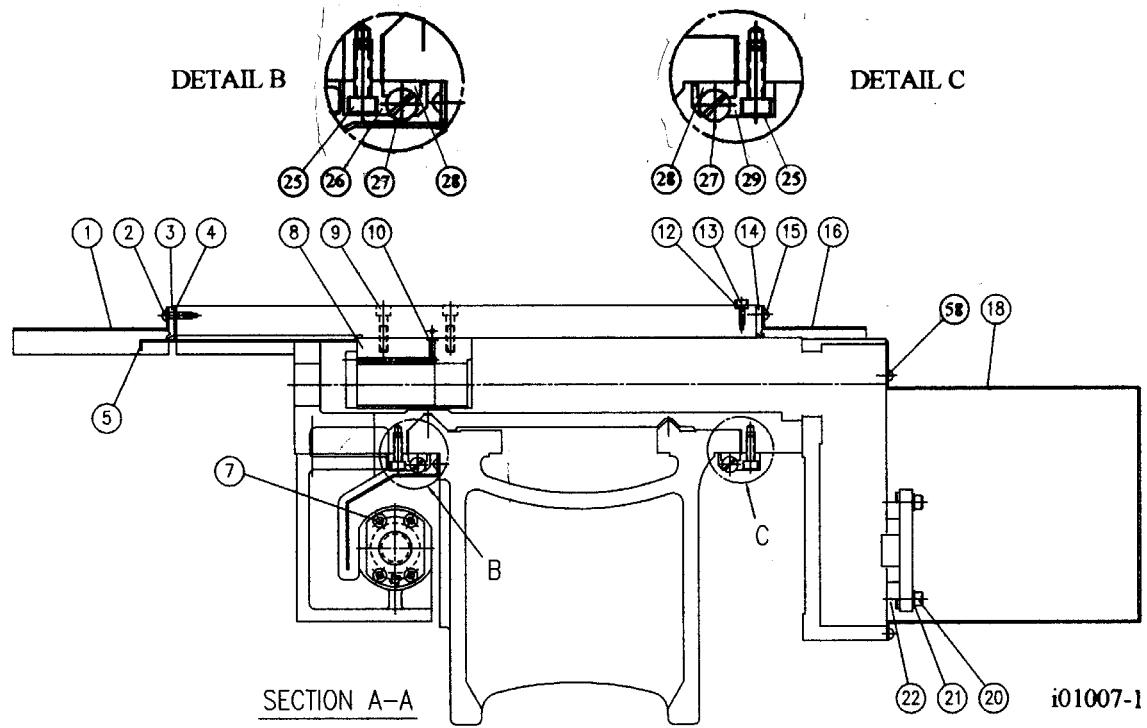
**Figure 66-2**  
**1540SX Tailstock Assembly**

## Parts List – 1540SX Tailstock Assembly

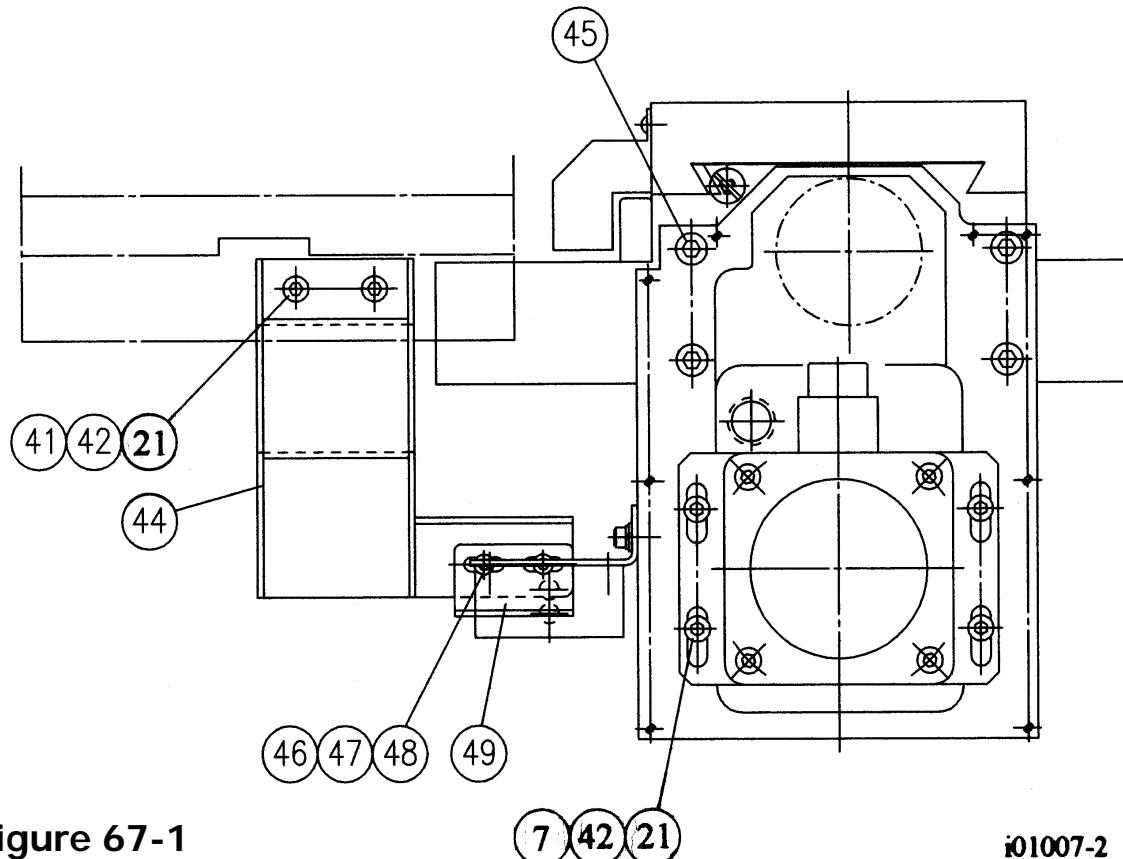
Item	P/N	Mfr P/N	Description	Use As	Qty
1	22712-1	24-0501-00	TAILSTOCK BODY	EA	1
2	M10-1.5X60 25B		SCREW-SHCS-STL-BO	EA	2
3	M12-1.75X16 25B		SCREW-SHCS-STL-BO	EA	2
4	M12-1.75X25 25B		SCREW-SHCS-STL-BO	EA	1
5	22712-5	10X40LG	STRAIGHT PIN	EA	1
6	M6-1.0X10 40B		SCREW-SOC SET-STL-BO-CUP	EA	1
7	M8-1.25X10 40B		SCREW-SOC SET-STL-BO-CUP	EA	1
8	22712-8	TC060X075X9	OIL SEAL	EA	1
9	22712-9	Ø1/4	BALL CUP	EA	3
10	22712-10	23-0112-00	WASHER-Ø10.5X25.4XT2	EA	2
11	22712-11	24-0502-00	TAILSTOCK BASE	EA	1
12	22712-12	50-0503-00	SLEEVE-TAILSTOCK BARREL	EA	1
13	23974	50-0505-00	FEED SCREW/NUT ASS'Y FEED NUT - 22712-13	EA	1
14	22712-14	50-0505-01	SHCS-M6-1.0X12	EA	4
15	23974	24-0507-00	FEED SCREW/NUT ASS'Y FEED SCREW -IMPERIAL - 22712-15	EA	1
16	22712-16	6X6X20LG	DOUBLE ROUND HEAD KEY	EA	1
17	M5-0.8X20 40B		SCREW-SOC SET-STL-BO-CUP	EA	1
18	22712-18	50-0508-00	BRACKET	EA	1
19	M6-1.0X30 25B		SCREW-SHCS-STL-BO	EA	4
21	23982	51104	THRUST BEARING SET – INDIVIDUAL BEARING - 22712-21	EA	2
22	22712-22	50-0510-00	DIAL-IMPERIAL	EA	1
23	22712-23	50-0511-00	HANDWHEEL	EA	1
24	22712-24	50-03111-00	LOCKSCREW	EA	1
25	22712-25	50-0513-00	WASHER	EA	1
26	22712-26	50-0514-00	PIN	EA	1
27	22712-27	50-0515-00	LOCKING BLOCK	EA	1
28	22712-28	50-0516-00	CLAMPING BLOCK	EA	1
29	22712-29	50-0517-00	LOCKING ROD	EA	1
30	22712-30	50-0518-00	LEVER	EA	1
31	22712-31	50-0519-00	SHAFT	EA	1
32	22712-32	50-0520-00	LEVER	EA	1
33	22712-33	50-0521-00	ECCENTRIC COLLAR	EA	1
34	22712-34	Ø6X40LG	SPRING PIN	EA	1
35	22712-35	50-0522-00	ADJUSTING BLOCK	EA	1
36	22712-36	50-0523-00	FLAT WASHER	EA	1
37	22712-37	50-0524-00	FLAT WASHER	EA	1
38	22712-38	50-0525-00	COMPRESSION WASHER	EA	1
39	22712-39	50-0526-00	FLAT WASHER	EA	1
40	22712-40	S35C	HEX SCREW	EA	1
41	22712-41	24-0528-00	CLAMPING BLOCK	EA	1
42	22712-42	24-0528-00	CLAMPING BLOCK	EA	2
43	22712-43	24-0530-00	BEDWAY WIPER	EA	2
44	M6-1.0X16 10B		SCREW-PH-PHIL-STL-BO	EA	4
45	22712-45	24-0531-00	BEDWAY WIPER PLATE	EA	2
46	22712-46	24-0532-00	BEDWAY WIPER	EA	2
47	M6-1.0X15 10B		SCREW-PH-PHIL-STL-BO	EA	4
48	22712-48	24-0533-00	BEDWAY WIPER PLATE	EA	2

Item	P/N	Mfr P/N	Description	Use As	Qty
49	22712-49	50-0534-00	SET SCREW	EA	2
51	22712-51	50-0536-00	INDICATOR	EA	1
52	22712-52	Ø2X5LG	RIVET-Ø2x5LG	EA	4
53	22712-53	50-0537-00	INDICATOR	EA	1
56	21234-099	17-0504-0-2	SCREW & SET SCREW ASSEMBLY	EA	1
57	22712-57	14-0129	CENTER-MT#4	EA	1
58	22712-58	50-0431-00	KNOB	EA	1
59	22712-59	50-0166-00	GRIP	EA	1
60	22712-60	50-01138-00	GRIP	EA	1

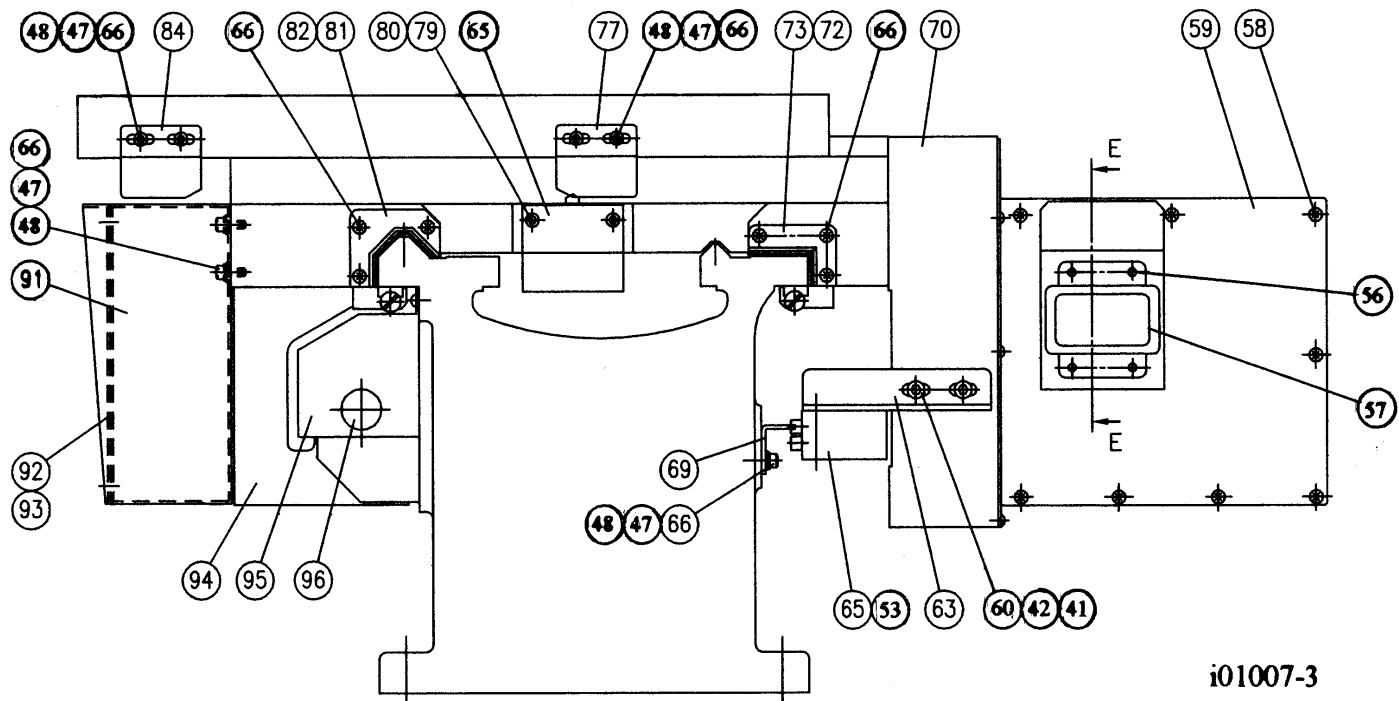
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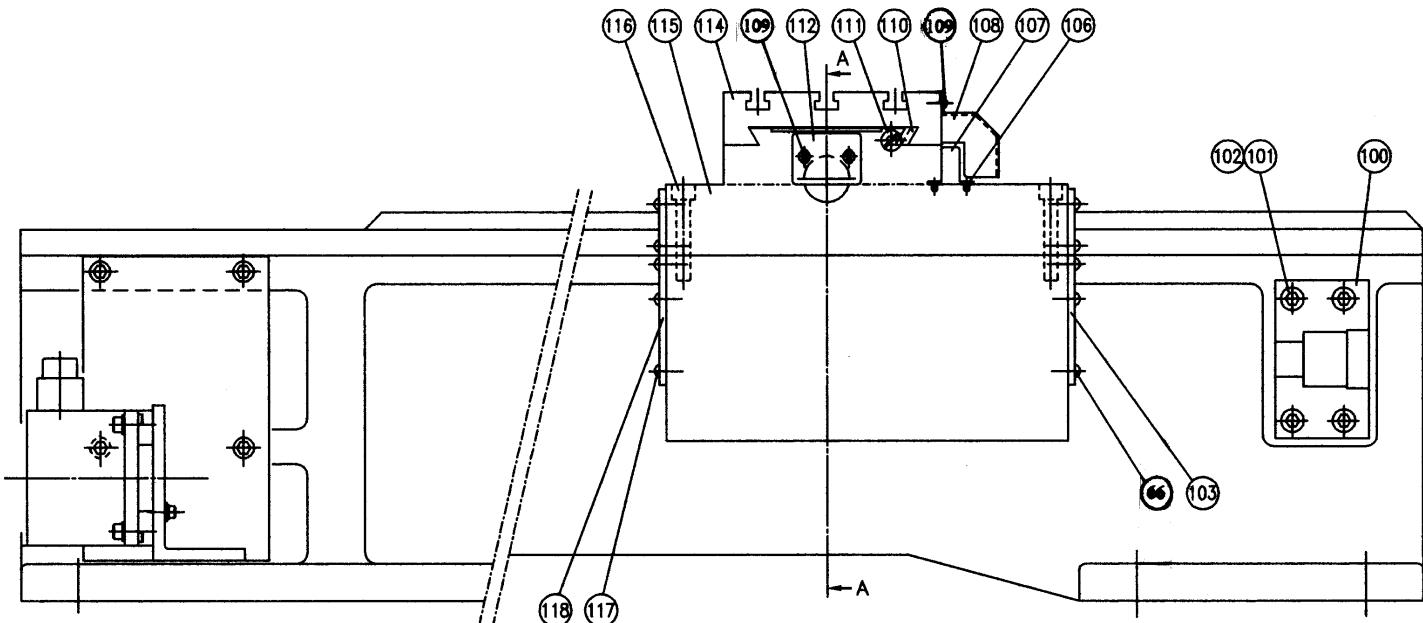
**Figure 67**  
**1540SX Bed & Carriage**



**Figure 67-1**  
**1540SX Bed & Carriage**



**Figure 67-2**  
**1540SX Bed & Carriage**



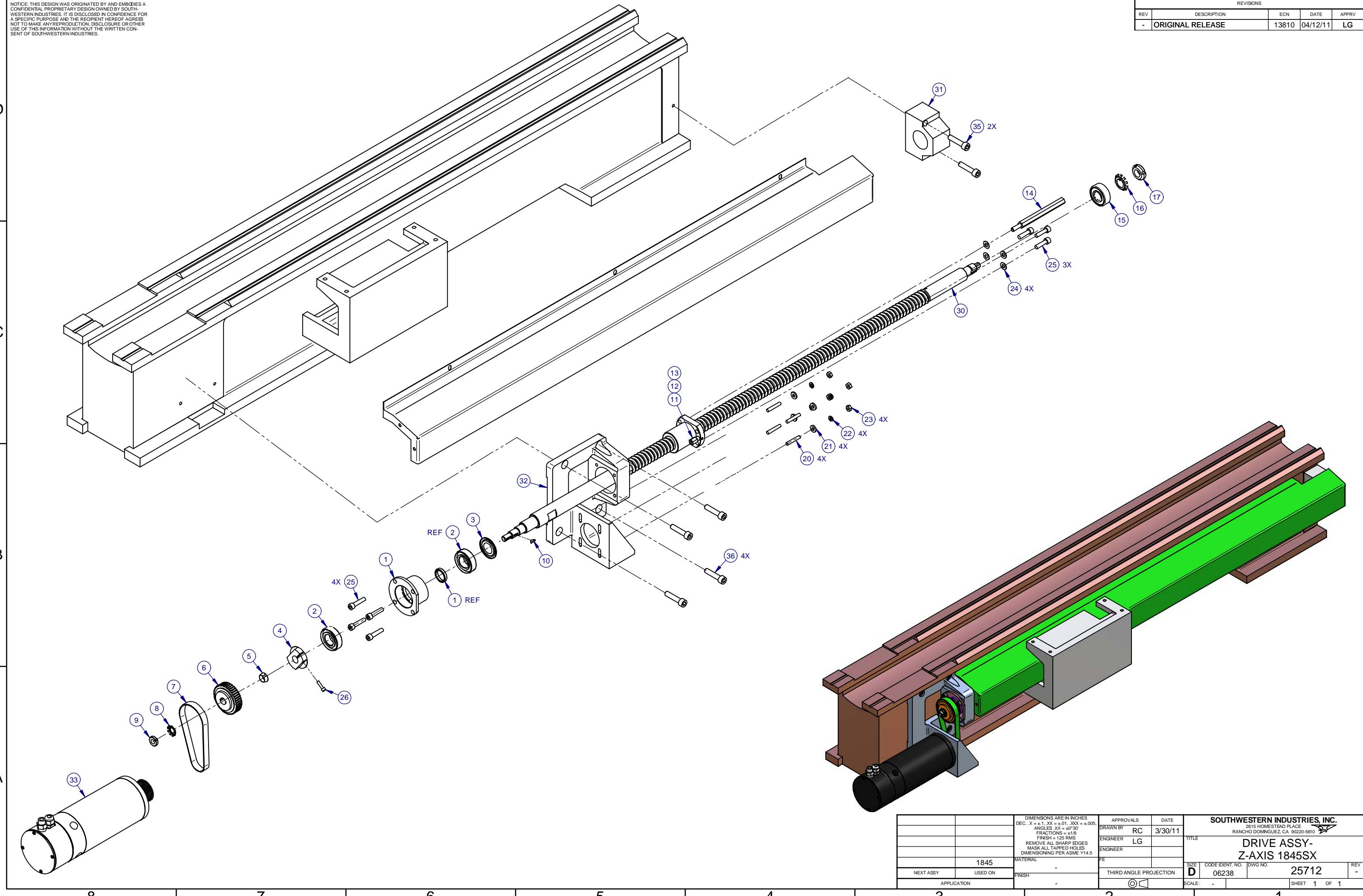
**Figure 67-3**  
**1540SX Bed & Carriage**

## Parts List – Bed & Carriage

Item	P/N	Mfr P/N	Description	Use As	Qty
1	23337-1	24-0227-00	CROSS SLIDE WAY COVER-FRONT	EA	1
2	M6-1.0X16 10Z		SCREW-PH-PHIL-STL-ZINC	EA	6
3	23337-3	24-0220-00	WAY WIPER-FRONT-RUBBER	EA	1
4	23337-4	24-0222-00	WIPER PLATE	EA	1
5	23337-5	24-0223-00	SADDLE COVER	EA	1
7	M8-1.25X30 25B		SCREW-SHCS-STL-BO	EA	8
8	23337-8	77USA-0213-00	X AXIS YOKE	EA	1
9	M8-1.25X40 25B		SCREW-SHCS-STL-BO	EA	4
10	23337-10	P7	O RING	EA	1
12	23337-12	24-0218-00	KEY	EA	1
13	M5-0.8X16 25B		SCREW-SHCS-STL-BO	EA	1
14	23337-14	24-0221-00	WAY WIPER-REAR-RUBBER	EA	1
15	M6-1.0X25 10B		SCREW-PH-PHIL-STL-BO	EA	6
16	23337-16	24-0228-00	CROSS SLIDE WAY COVER-REAR	EA	1
18	22714-66	24-0728	X AXIS MOTOR COVER	EA	6
20	M5-0.8X25 25B		SCREW-SHCS-STL-BO	EA	4
21	M8 73B		WASHER-SPLIT LOCK-STL-BO	EA	12
22	23337-22	24-0208-00	X AXIS MOTOR ADAPTER	EA	1
26	23337-26	24-0314-01	GIB BLOCK-FRONT	EA	1
27	23337-27	50-0325-00	ADJUSTMENT SCREW	EA	4
28	23337-28	24-0313-01	GIB	EA	1
29	23337-29	24-0315-01	GIB BLOCK-BACK	EA	1
41	M8-1.25X16 25B		SCREW-SHCS-STL-BO	EA	2
42	M8 70B		WASHER-FLAT USS-STL-BO	EA	8
44	23337-44	24-0738	BRACKET	EA	1
45	M10-1.5X90 25B		SCREW-SHCS-STL-BO-FULLY THD	EA	4
46	M6-1.0X10 25B		SCREW-SHCS-STL-BO	EA	2
47	M6 70B		WASHER-FLAT USS-STL-BO	EA	16
48	M6 73B		WASHER-SPLIT LOCK-STL-BO	EA	16
49	23337-49	24-0698	BRACKET	EA	1
53	M6-1.0X20 25B		SCREW-SHCS-STL-BO	EA	44
56	23337-56	24-0730	BRACKET-CABLE CARRIER	EA	1
57	23337-57	88X45SAX1350L	CABLE CARRIER	EA	1
58	M5-0.8X10 10B		SCREW-PH-PHIL-STL-BO	EA	17
59	23337-59	24-0729	END COVER	EA	1
60	M8-1.25X20 25B		SCREW-SHCS-STL-BO	EA	2
63	23337-63	24-0307	MICRO SWITCH SEAT	EA	1
65	22551-1		LIMIT SWITCH ASSY-PT4-RIGHT	EA	2
66	M6-1.0X16 25B		SCREW-SHCS-STL-BO	EA	22
69	23337-69	24-0697-00	Z AXIS STOPPER	EA	1
70	23337-70	24-0207-01	MOTOR MOUNTING BRACKET	EA	1
72	23337-72	24-0337-00	REAR WIPER-RIGHT-RUBBER	EA	1
73	23337-73	24-0336-00	REAR WIPER-LEFT-RUBBER	EA	1
77	23337-77	24-0226-01	X AXIS STOPPER	EA	1

79	M6-1.0X25 25B		SCREW-SHCS-STL-BO	EA	2
81	23337-81	24-0334-00	FRONT WIPER-LEFT-RUBBER	EA	2
82	23337-82	24-0335-00	FRONT WIPER-RIGHT-RUBBER	EA	1
84	23337-84	24-0225-00	X AXIS STOPPER	EA	1
91	22714-36	24-0723	OPERATION BOX	EA	1
92	22714-37	24-0724	COVER	EA	1
93	M5-0.8X6 10B		SCREW-PH-PHIL-STL-BO	EA	8
94	23337-94	24-0311-00	YOKE	EA	1
95	22714-35	24-0712	BALL SCREW COVER	EA	1
96	23337-96	Ø30	CAP	EA	1
100	23337-100	77USA-0308-00	BEARING HOUSING TAILSTOCK	EA	1
101	M12-1.75X16 25B		SCREW-SHCS-STL-BO	EA	4
102	M12 73B		WASHER-SPLIT LOCK-STL-BO	EA	4
103	23337-103	24-0316-00	WIPPER RIGHT-RUBBER	EA	1
106	M5-0.8X12 12B		SCREW-FH-PHIL-STL-BO	EA	3
107	23337-107	24-0727-01	CABLE WAY	EA	1
108	23337-108	24-0224-01	LIMIT SWITCH COVER	EA	1
109	M6-1.0X10 27B		SCREW-BHCS-STL-BO	EA	9
110	23337-110	24-0217-00	X AXIS GIB	EA	1
111	23337-111	17-0321-00	ADJUSTMENT SCREW	EA	2
112	23337-112	SS41	FRONT COVER	EA	1
114	23337-114	24-0215-02	CROSS SLIDE	EA	1
115	23337-115	24-0201-01	SADDLE	EA	1
116	M12-1.75X70 25B		SCREW-SHCS-STL-BO	EA	4
117	M6-1.0X16 10B		SCREW-PH-PHIL-STL-BO	EA	3
118	23337-118	24-0317-00	WIPPER LEFT-RUBBER	EA	1

i01007



**25712**

DRIVE ASSY-Z AXIS-1845SX

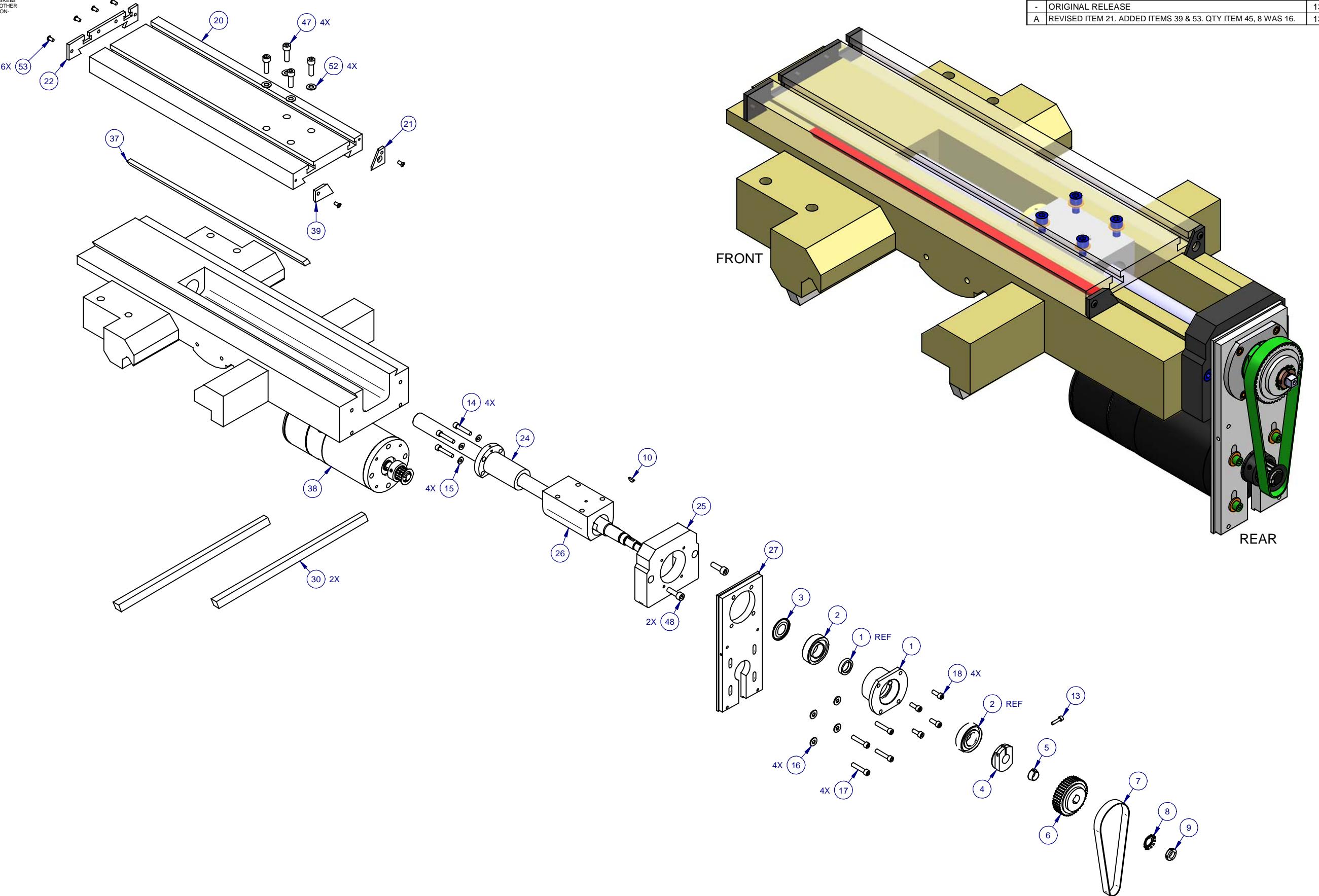
Type	PL	Dwg Size	D
Revision	-	Product	1845
Status	R	Engineer	LG
Date	11/9/2010	Planner Code	
By	RC	Comm Code	

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Reference(t)	Mfr P/N
1	16295-1	BEARING HOUSING ASSY-Z AXIS	1	EA	-	R			
2	23940	BEARING-ANGULAR CONTACT-U/SET (2)-7205	1	EA	A	R			
3	7205-AVH	NILOS RING-7205	1	EA		R			
4	16452	NUT CLAMP-X ,Y, & Z AXIS	1	EA	C	R			
5	16350	FERRULE-SPROCKET	1	EA	-	R			
6	16983-1	PULLEY-SOLID 44 TEETH W/O GUIDES	1	EA	C	R			
7	375-5M-15	BELT- TIMING	1	EA		R			
8	W01	LOCKWASHER	1	EA		R			
9	N01	LOCKNUT	1	EA		R			
10	98481A090	KEY WOODRUFF #404-1/8 X 1/2	1	EA		R			
11	185210	CONTROL UNIT CSA-5	1	EA		R			
12	186251	COMPRESSION NUT	1	EA		R			
13	106254	COMPRESSION SLEEVE	1	EA		R			
14	20086-4	STOP TRL1845	1	EA	-	R			
15	22446	BEARING-BALL-SELF ALIGNING-2204-2RS	1	EA	A	R			
16	W04	LOCKWASHER	1	EA		R			
17	N04	LOCKNUT	1	EA		R			
20	23053	STUD-1/4-20X1 1/2-FULLY THREADED-GRADE 2	4	EA	-	R	91565A546		
21	15759	WASHER-1/4 HARD BLK OX 1/8 THK	4	EA	-	R			
22	1/4 73B	WASHER-SPLIT LOCK-STL-BO	4	EA		R			
23	1/4-20 50B	NUT-HEX-STL-BO	4	EA		R			
24	24009-1	WASHER - BELLEVILLE LOCK	4	EA	-	R	5/16" OR M8 - SERRATED		

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Reference(t)	Mfr P/N
25	M8-1.25X25 25B	SCREW-SHCS-STL-BO	7	EA		R			
26	10-32X3/4 25B	SCREW-SHCS-STL-BO	1	EA		R			
30	21025	BALLSCREW LX Z-AXIS METRIC	(1)	EA	A	R			
31	26152-1	HOUSING- BEARING	(1)	EA	-	R	1845SX		
32	26150-1	BRACKET-Z-AXIS MOTOR	(1)	EA	-	R	1845SX		
33	24425	MOTOR ASSY - LATHE - 40/55	(1)	EA	A	R			
35	M10-1.5X45 25B	SCREW-SHCS-STL-BO	(2)	EA		R			
36	M10-1.5X35 25B	SCREW-SHCS-STL-BO	(4)	EA		R			

NOTICE: THIS DESIGN WAS ORIGINATED BY AND EMBODIES A CONFIDENTIAL PROPRIETARY DESIGN OWNED BY SOUTHWESTERN INDUSTRIES. IT IS DISCLOSED IN CONFIDENCE FOR A SPECIFIC PURPOSE AND THE RECIPIENT HEREOF AGREES NOT TO MAKE ANY REPRODUCTION, DISCLOSURE OR OTHER USE OF THIS INFORMATION WITHOUT THE WRITTEN CONSENT OF SOUTHWESTERN INDUSTRIES.

REVIEWS			
REV	DESCRIPTION	ECN	DATE
-	ORIGINAL RELEASE	13810	04/08/11 LG
A	REVISED ITEM 21. ADDED ITEMS 39 & 53. QTY ITEM 45, 8 WAS 16.	13895	11/30/11 PM

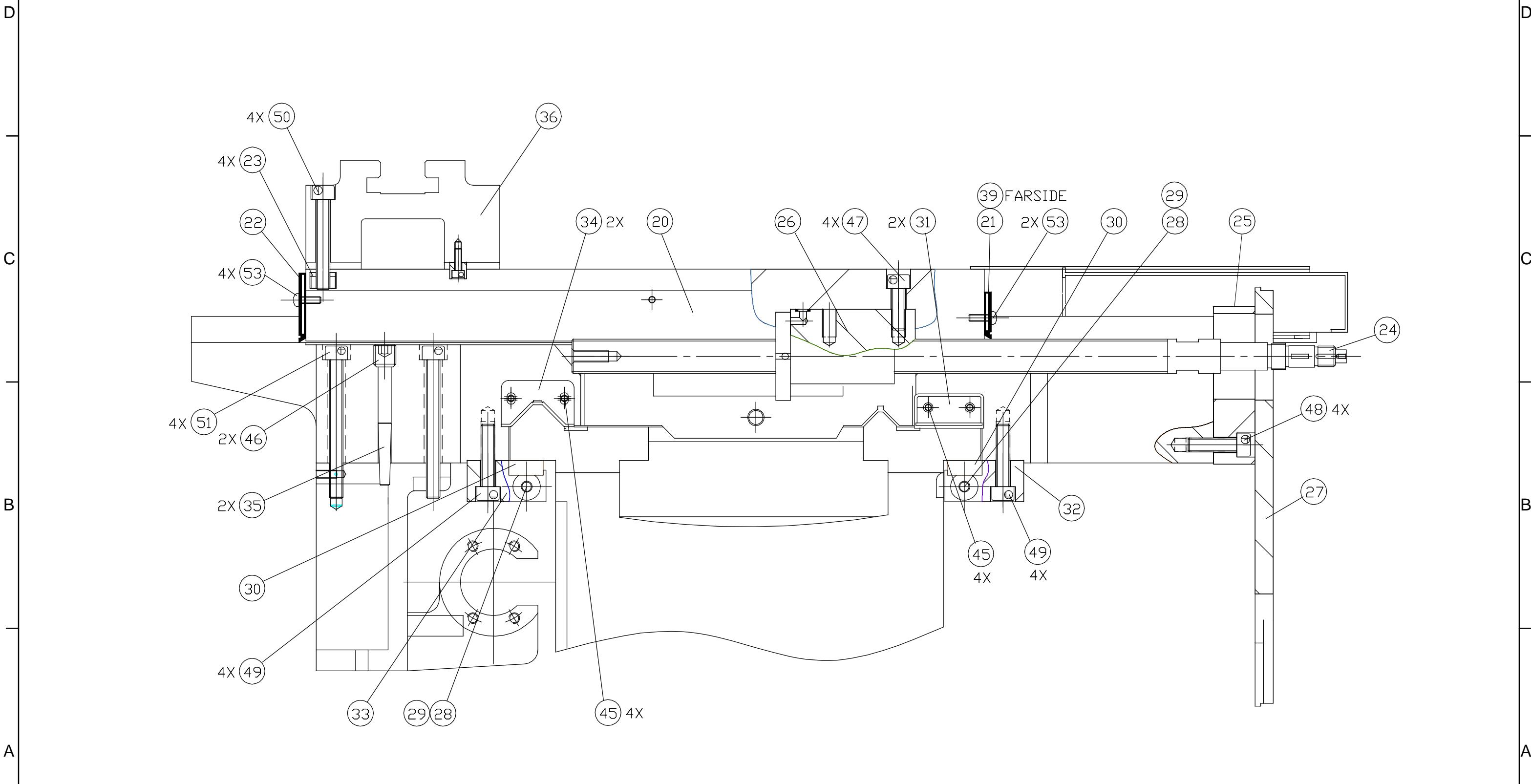


DIMENSIONS ARE IN INCHES	APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC.	
DEC. J = $\pm .1$ , XX = $\pm .01$ , XXX = $\pm .005$ , ANGLES XX = $\pm 30^\circ$ PROF. = 0.0625 FINISH = 125 RMS REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5	DRAWN BY	Sal	04/08/11	2015 HOMESTEAD PLACE RANCHO DOMINGUEZ, CA 90220-5610
	ENGINEER	LG	04/08/11	
	ENGINEER			
MATERIAL	FE			
NEXT ASSY	USED ON			
APPLICATION	FINISH			
THIRD ANGLE PROJECTION				
SIZE	CODE IDENT. NO.	DWG NO.	25711	REV A
D	06238			
SCALE:				
SHEET	1	OF	2	

NOTICE: THIS DESIGN WAS ORIGINATED BY AND EMBODIES A  
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SENT OF SOUTHWESTERN INDUSTRIES.

REVISIONS

REV	DESCRIPTION	ECN	DATE	APPRV
-	ORIGINAL RELEASE	13810	04/08/11	LG
A	REVISED ITEM 21. ADDED ITEMS 39 & 53. QTY ITEM 45, 8 WAS 16.	13895	11/30/11	PM



NOTES: (UNLESS OTHERWISE SPECIFIED).

		DIMENSIONS ARE IN INCHES		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC.	
DEC.	X = ±.1, XX = ±.01, XXX = ±.005,	DRAWN BY	Sal	04/08/11		2015 HOMESTEAD PLACE	
ANGLES	XX = ±0°30'	ENGINEER	LG	04/08/11		RANCHO DOMINGUEZ, CA 90220-5610	
PROPS	XX = ±.005	FINISH	= 125 RMS				
REMOVED		REMOVE ALL SHARP EDGES					
ALL TAPPED HOLES		MASK ALL TAPPED HOLES					
		DIMENSIONING PER ASME Y14.5					
		MATERIAL	FE				
NEXT ASSY	USED ON	FINISH	-			SIZE	CODE IDENT. NO.
		APPLICATION	-			D	DWG NO.
						06238	25711
						REV	A
						SCALE:	-
						SHEET	2 OF 2

Parts List for Assembly P/N: 25711

Printed 11/30/2011

**25711**

DRIVE ASSY-X AXIS-1845SX  
1845

Type	PL	Dwg Size	D
Revision	A	Product	1845
Status	R	Engineer	LG
Date	11/9/2010	Planner Code	30
By	Sal	Comm Code	MANUF

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
1	16300	BEARING HOUSING ASSY-X AXIS		-	EA	1	R	
2	23930	BEARING SET (2)-ANGULAR CONTACT-7204 BECBP		-	EA	1	R	
3	7204-AVH	NILOS RING-7204			EA	1	R	
4	16314	NUT CLAMP-X AXIS		D	EA	1	R	
5	16350	FERRULE-SPROCKET		-	EA	1	R	
6	16983-1	PULLEY-SOLID 44 TEETH W/O GUIDES		C	EA	1	R	
7	535-5M-15	BELT - TIMING 5MM POWERGRIP		-	EA	1	R	
8	W02	LOCKWASHER			EA	1	R	
9	N02	LOCKNUT			EA	1	R	
10	98481A090	KEY WOODRUFF #404-1/8 X 1/2			EA	1	R	
13	10-32X3/4 25B	SCREW-SHCS-STL-BO			EA	1	R	
14	M8-1.25X25 25B	SCREW-SHCS-STL-BO			EA	4	R	
15	24009-1	WASHER - BELLEVILLE LOCK	5/16" OR M8 - SERRATED	-	EA	4	R	
16	15759	WASHER-1/4 HARD BLK OX 1/8 THK		-	EA	4	R	
17	1/4-20X1 25B	SCREW-SHCS-STL-BO			EA	4	R	
18	M6-1.0X30 25B	SCREW-SHCS-STL-BO			EA	4	R	
20	27982	CROSS SLIDE		-	EA	(1)	R	KING RICH
21	27991-1	WIPER-REAR LEFT		-	EA	(1)	R	KING RICH
22	27992	WIPER-CROSS SLIDE - FRONT		-	EA	(1)	R	KING RICH
23	27983	DOG-NUT-T		-	EA	(4)	R	KING RICH

## Parts List for Assembly P/N: 25711

DRIVE ASSY-X AXIS-1845SX  
1845

25711

Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
24	20984	BALLSCREW-LX X-AXIS		A	EA	(1)	R	
25	27984	BRACKET		-	EA	(1)	R	KING RICH
26	27985	YOKES-X AXIS		-	EA	(1)	R	KING RICH
27	27986	BRACKET-MOTOR-X AXIS		-	EA	(1)	R	KING RICH
28	KR050020	ADJUSTABLE SCREW		-	EA	(2)	R	KING RICH
29	KR050030	ADJUSTABLE SCREW		-	EA	(2)	R	KING RICH
30	27987	GIB-Z AXIS		-	EA	(2)	R	KING RICH
31	27988	WIPER-FLAT		-	EA	(2)	R	KING RICH
32	LS050050	GIB SEAT		-	EA	(1)	R	KING RICH
33	LS050060	GIB SEAT		-	EA	(1)	R	KING RICH
34	27989	WIPER-VEE		-	EA	(2)	R	KING RICH
35	AKP207045	PIN-TAPER- NO 7 x 45L		-	EA	(2)	R	KING RICH
36	27990	TOOL POST-BASE		-	EA	(1)	R	KING RICH
37	27997	GIB - X AXIS		-	EA	(1)	R	KING RICH
38	24316	MOTOR - ASSY - LATHE- 40/20		-	EA	(1)	R	
39	27991-2	WIPER-REAR RIGHT		-	EA	(1)	R	KING RICH
45	M5-0.8X16 27B	SCREW-BHCS-STL-BO	NON-STOCKABLE	-	EA	(8)	R	
46	M16-2.0X16 40B	SCREW-SOC SET-STL-BO-CUP	NON-STOCKABLE	-	EA	(2)	R	
47	M10-1.5X30 25B	SCREW-SHCS-STL-BO			EA	(4)	R	
48	M10-1.5X35 25B	SCREW-SHCS-STL-BO			EA	(4)	R	PJ
49	M10-1.5X45 25B	SCREW-SHCS-STL-BO			EA	(8)	R	
50	M10-1.5X65 25B	SCREW-SHCS-STL-BO			EA	(4)	R	
51	M10-1.5X100 25B	SCREW-SHCS-STL-BO			EA	(4)	R	
52	24009-2	WASHER - BELLEVILLE SPRING LOCK	3/8" OR M10 - SERRATED	-	EA	(4)	R	MCMASTER-C ARR

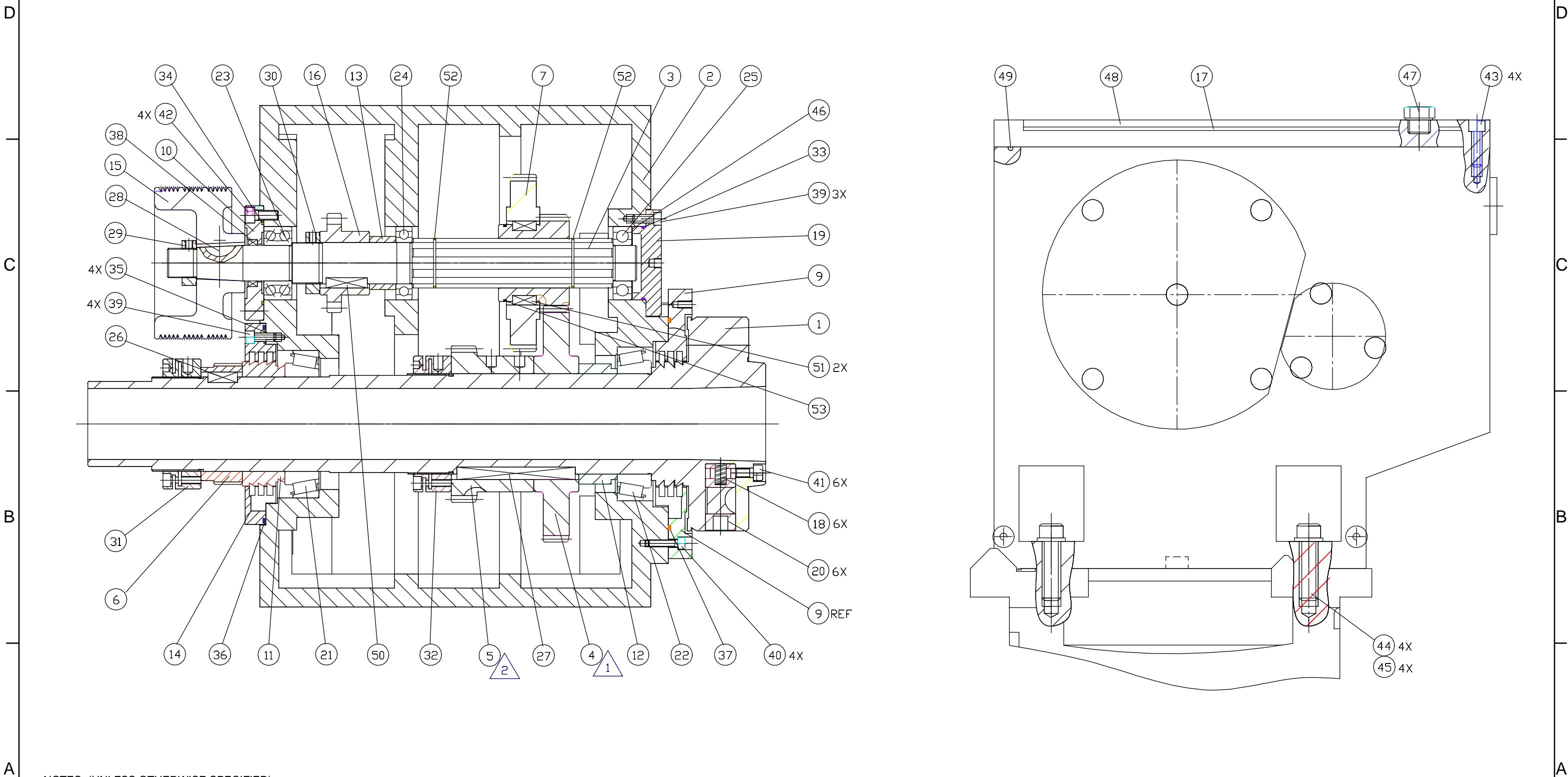
**Parts List for Assembly P/N: 25711**DRIVE ASSY-X AXIS-1845SX  
1845**25711**

Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
53	M5-0.8X10 27B	SCREW-BHCS-STL-BO		-	EA	(6)	R	

REVISIONS			
REV	DESCRIPTION	ECN	DATE
-	ORIGINAL RELEASE	13809	02/18/11 LG
A	2C5 ITEM 59 WAS: 64; SHT 3 REVISED SPEED SELECTOR ASSY. DELETED ITEMS 55 & 77 WAS: 27956 & 27959.	13957	01/30/12 PM



NOTES: (UNLESS OTHERWISE SPECIFIED).

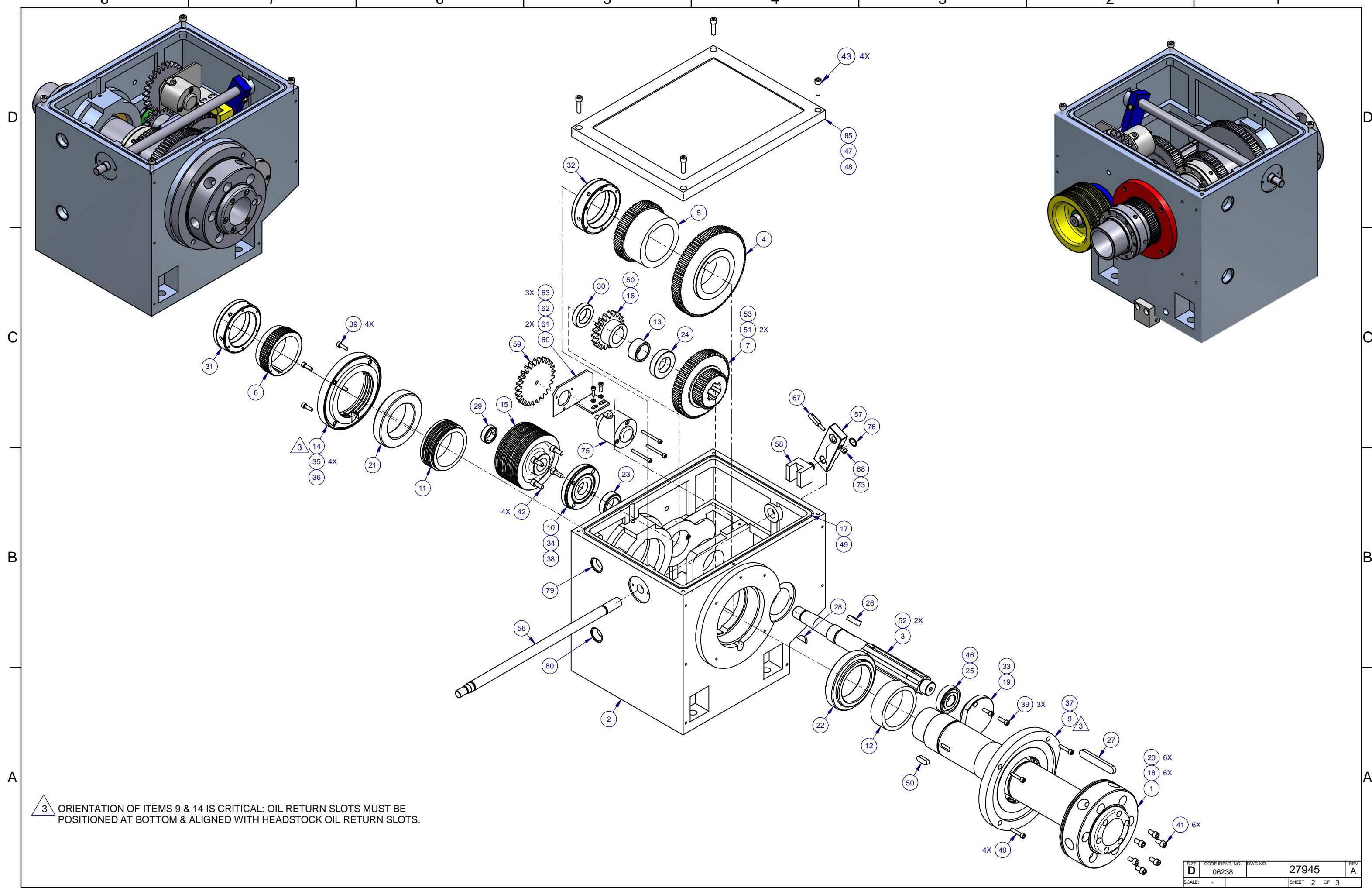
1 WHEN ITEM 4 & 7 ARE ENGAGED, MACHINE IS IN LOW GEAR.

2 WHEN ITEM 5 & 7 ARE ENGAGED, MACHINE IS IN HIGH GEAR.

(SEE SHEETS 2 & 3 FOR ADDITIONAL NOTES)

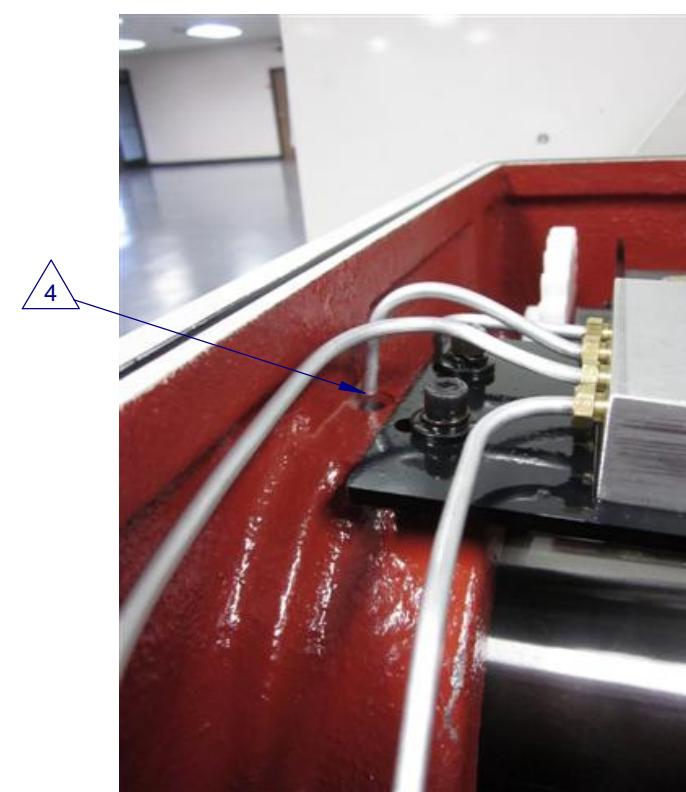
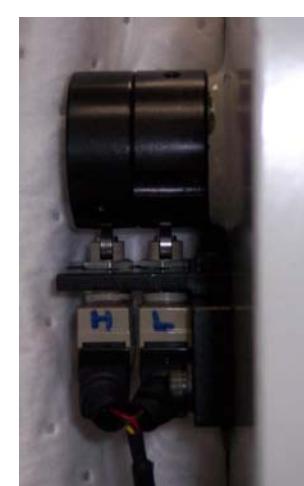
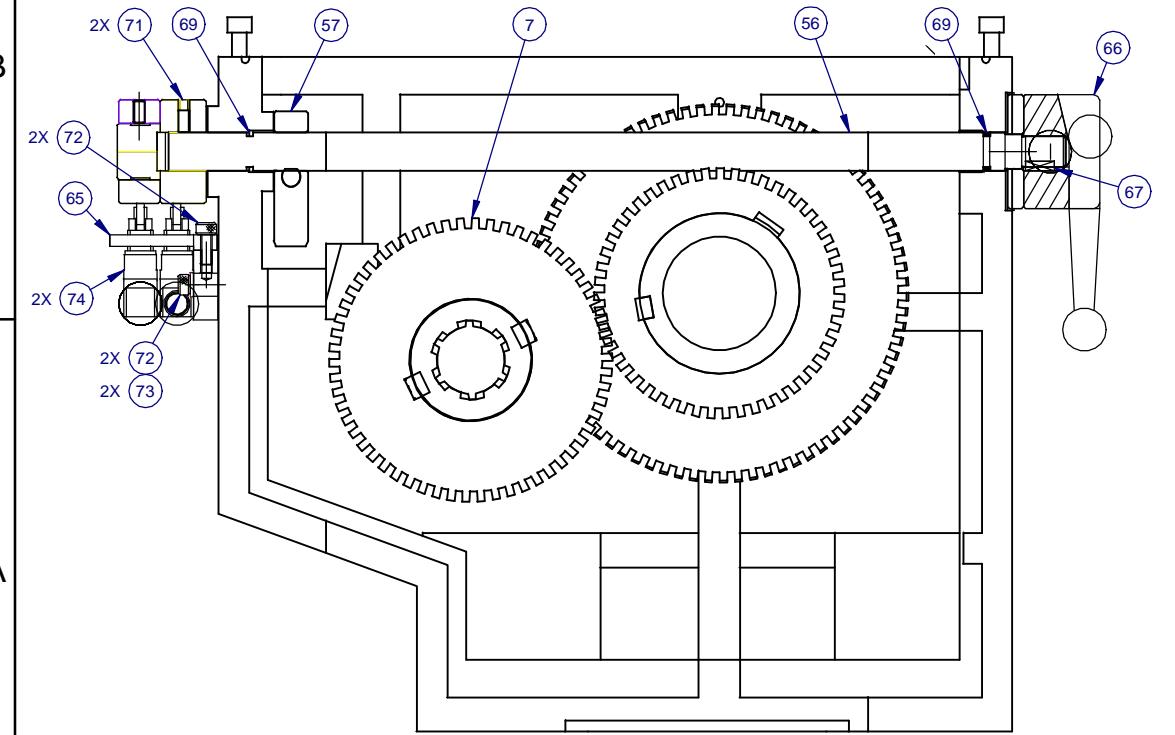
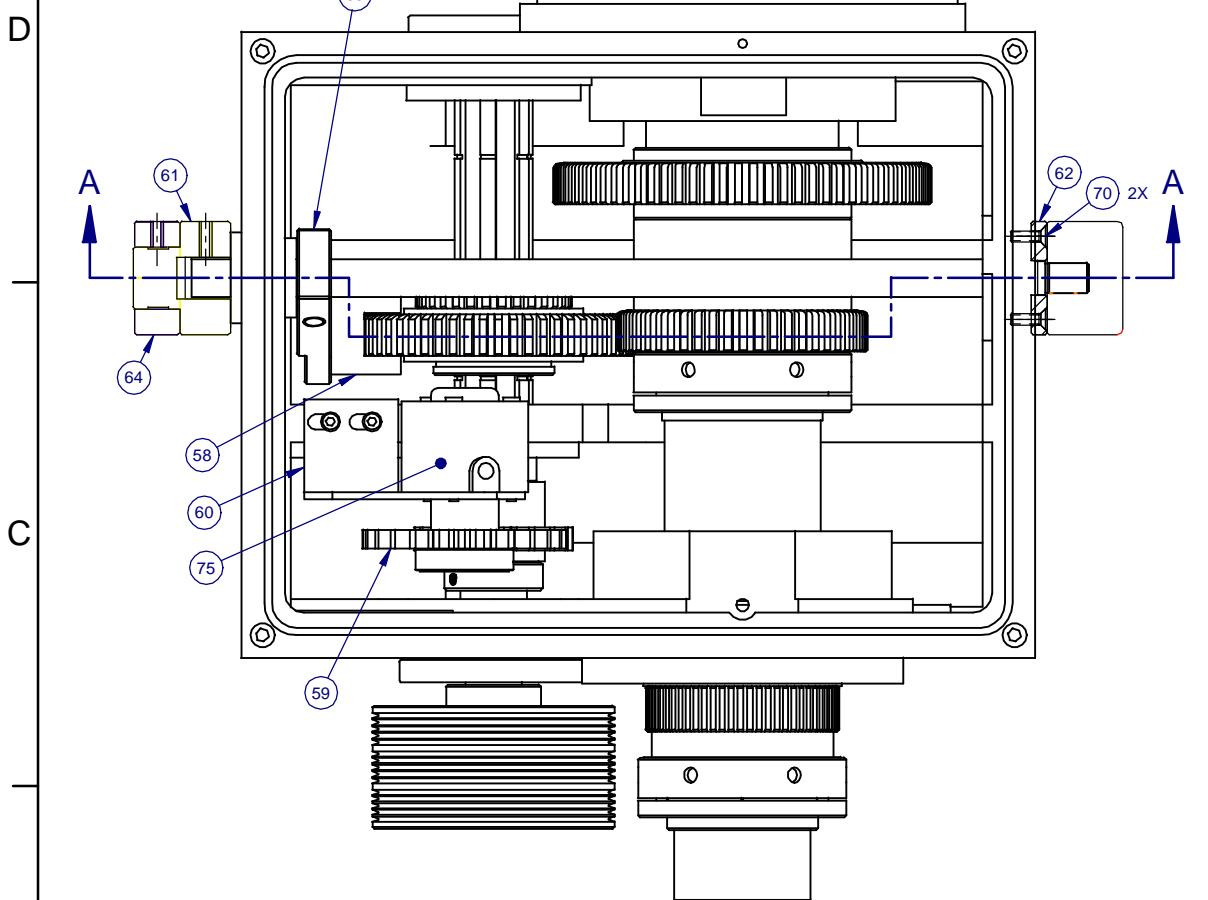
		DIMENSIONS ARE IN INCHES DEC. X = $\pm 1$ , XX = $\pm .01$ , XXX = $\pm .005$ , ANGLES = $\pm 10'$ FRACTIONS = 1/16 FINISH = 125 RMS REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5	APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2015 HOMESTEAD PLACE RANCHO DOMINGUEZ, CA 90220-5610	
DRAWN BY	Sal	02/22/11	ENGINEER	TO	02/22/11	
ENGINEER			ENGINEER			
FE			FE			
NEXT ASSY	USED ON		THIRD ANGLE PROJECTION			
FINISH	-					
APPLICATION						
SHEET	1	OF	3			

HEADSTOCK ASSY-1845  
SIZE D CODE IDENT. NO. 06238 DWG. NO. 27945 REV A



8 7 6 5 4 3 2 1

Speed Selector Assembly



4 BOTTOM OF LUBRICATING LINE MUST BE 3mm ABOVE HOLE IN CASTING.

SIZE D CODE IDENT. NO. 06238 DWG NO. 27945 REV A  
SCALE: - SHEET 3 OF 3

**27945**

HEADSTOCK ASSY-1845

Type	PL	Dwg Size	D
Revision	A	Product	1845
Status	R	Engineer	LG
Date	2/17/2011	Planner Code	
By	Sal	Comm Code	

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Mfr	Mfr P/N
1	27946	SPINDLE	1	EA	-	R		KING RICH	LU010031
2	LU010300	HEAD CASTING	1	EA	-	R		KING RICH	
3	LU010060	SHAFT-SLIDE	1	EA	-	R		KING RICH	
4	27947	GEAR	1	EA	-	R		KING RICH	LU010070
5	27948	GEAR	1	EA	-	R		KING RICH	LU010080
6	27949	PULLEY- TIMING BELT	1	EA	-	R		KING RICH	LU010090
7	27950	GEAR CLUSTER ASSY	1	EA	-	R		KING RICH	LU010120
9	LU010180	COVER-FRONT-SPINDLE FLANGE	1	EA	-	R		KING RICH	
10	LU010230	END CAP-REAR-SLIDE SHAFT	1	EA	-	R		KING RICH	
11	LU010270	SPACER	1	EA	-	R		KING RICH	
12	LU010280	SPACER	1	EA	-	R		KING RICH	
13	LU010290	SPACER	1	EA	-	R		KING RICH	
14	LU010040	COVER-REAR-SPINDLE FLANGE	1	EA	-	R		KING RICH	
15	27952	PULLEY-SPINDLE DRIVE	1	EA	-	R		KING RICH	LU010400
16	27953	GEAR	1	EA	-	R		KING RICH	LU010730
17	LU570130	GASKET-TOP HEAD COVER	1	EA	-	R		KING RICH	
18	KR010170	SPRING	6	EA	-	R		KING RICH	
19	KR010220	END CAP-FRONT-SLIDE SHAFT	1	EA	-	R		KING RICH	
20	27954	CAMLOCK	6	EA	-	R		KING RICH	LS010050
21	21234-015	BEARING-TAPER ROLLER-32016XC/P5	1	EA	-	R			
22	21234-008	BEARING-TAPER ROLLER-32017XC/P5	1	EA		R			
23	27957	BEARING-ANGULAR CONTACT-DOUBLE ROW-3206	1	EA		R		KING RICH	AB3206

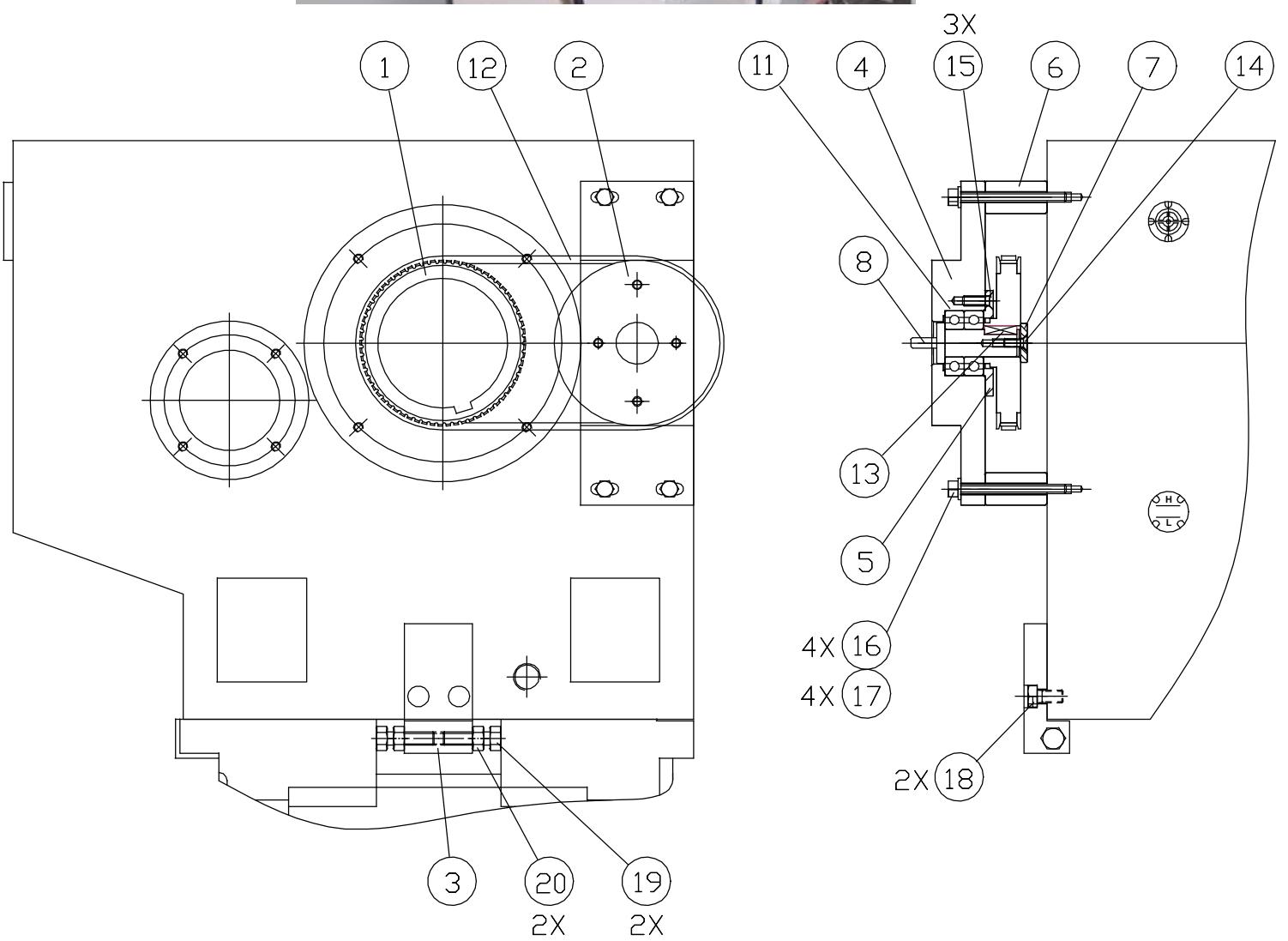
Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Mfr	Mfr P/N
24	27966	BEARING-DEEP GROOVE 6007	1	EA	-	R		KING RICH	AB6007
25	21234-071	BEARING-DEEP GROOVE-6206	1	EA	-	R			
26	AK1008025	KEY	1	EA	-	R	10 x 8 x 25L	KING RICH	
27	AK1610100	KEY	1	EA	-	R	16 x 10 x 100L	KING RICH	
28	AKR106014	KEY -WOODRUFF	1	EA	-	R	R14 X 6t	KING RICH	
29	27951	LOCKNUT-M25 X 1.5	1	EA	-	R		KING RICH	ANN415025
30	27951-1	LOCKNUT-M35 X 1.5	1	EA	-	R		KING RICH	ANN415035
31	27951-2	LOCKNUT-M80 X 2.0	1	EA	-	R		KING RICH	ANN520080
32	27951-3	LOCKNUT-M85 X 2.0	1	EA	-	R		KING RICH	ANN520085
33	27960	O-RING-ID 58 x W2	1	EA	-	R		KING RICH	AOR020058
34	27960-1	O-RING-ID 64 x W2	1	EA	-	R		KING RICH	AOR020064
35	27960-2	O-RING-ID 6.8 x W1.9	4	EA	-	R		KING RICH	AOR190006
36	27960-3	O-RING-ID 158.42 x W2.62	1	EA	-	R		KING RICH	AOR260158
37	27960-4	O-RING-ID 171.12 x W2.62	1	EA	-	R		KING RICH	AOR260171
38	27961	SEAL-OIL- ID 30mm x OD 58mm x W12	1	EA	-	R		KING RICH	AOS304008
39	M6-1.0X20 25B	SCREW-SHCS-STL-BO	7	EA		R			
40	M6-1.0X25 25B	SCREW-SHCS-STL-BO	4	EA		R			
41	M8-1.25X15 25B	SCREW-SHCS-STL-BO	6	EA		R			
42	M8-1.25X20 25B	SCREW-SHCS-STL-BO	4	EA		R			
43	M8-1.25X30 25B	SCREW-SHCS-STL-BO	4	EA		R			
44	M16-2.0 X 50 25B	SCREW-SHCS-STL-BO	4	EA	-	R	NON-STOCKABLE		
45	AWMS01016	WASHER	4	EA	-	R			
46	AWME01030	WASHER-ELASTIC	1	EA	-	R			
47	27962	COVER-HEAD-PLASTIC	1	EA	-	R			
48	27955	COVER-RUBBER	1	EA	-	R		KING RICH	LU010310
49	27960-5	O-RING-ID 4 x W1400	1	EA	-	R		KING RICH	

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Mfr	Mfr P/N
50	AK1008035	KEY	1	EA	-	R	10 x 8 x 35L	KING RICH	
51	AK1008020	KEY	2	EA	-	R	12 x 8 x 20L	KING RICH	
52	ARS118042	RETAINING RING-EXT	2	EA	-	R		KING RICH	
53	ARS125065	RETAINING RING-EXT	1	EA	-	R		KING RICH	
56	LU010330	SHAFT	1	EA	-	R		KING RICH	LU010330
57	LU010370	SWING ARM	1	EA	-	R		KING RICH	
58	LU010380	CATCH BLOCK	1	EA	-	R		KING RICH	
59	27963	GEAR	1	EA	-	R		KING RICH	
60	LU010760	FIXED PLATE	1	EA	-	R		KING RICH	
61	LU010810	GEAR SHIFTER-DETENT COLLAR	1	EA	-	R		KING RICH	
62	LU010930	BUSH-FIXED	1	EA	-	R		KING RICH	
63	KR010450	PIN-FIXED	1	EA	-	R		KING RICH	
64	KR010800	GEAR SHIFTER-DETENT COLLAR	1	EA	-	R		KING RICH	
65	LG010820	BRACKET	1	EA	-	R		KING RICH	
66	27964	LEVER-SPEED SELECTOR	1	EA	-	R		KING RICH	LS010940
67	AK0505015	KEY- 5 x 5 x 15L	1	EA	-	R		KING RICH	
68	M6-1.0 50B	NUT-HEX-STL-BO	1	EA		R			
69	27960-6	O-RING-ID 16 x W2	2	EA	-	R		KING RICH	AOR2600016
70	M6-1.0X10 16B	SCREW-FH-PHIL-STL-BO	2	EA	-	R	NON-STOCKABLE	PJ	
71	M6-1.0X16 40B	SCREW-SOC SET-STL-BO-CUP	3	EA	-	R	NON-STOCKABLE	PJ	
72	M6-1.0X16 25B	SCREW-SHCS-STL-BO	4	EA	-	R			
73	M6 70B	WASHER-FLAT USS-STL-BO	3	EA	-	R			
74	22680	LIMIT SWITCH- GEAR LIMIT	2	EA	-	R		OMRON	SHL-Q2155
75	27967	PUMP-OIL	1	EA	-	R		KING RICH	1RA-3FS
76	M5100-16	RETAINING RING-EXT-16mm	1	EA	-	R			
78	M6-1.0X12 16B	SCREW-FH-PHIL-STL-BO	2	EA	-	R	NON-STOCKABLE		

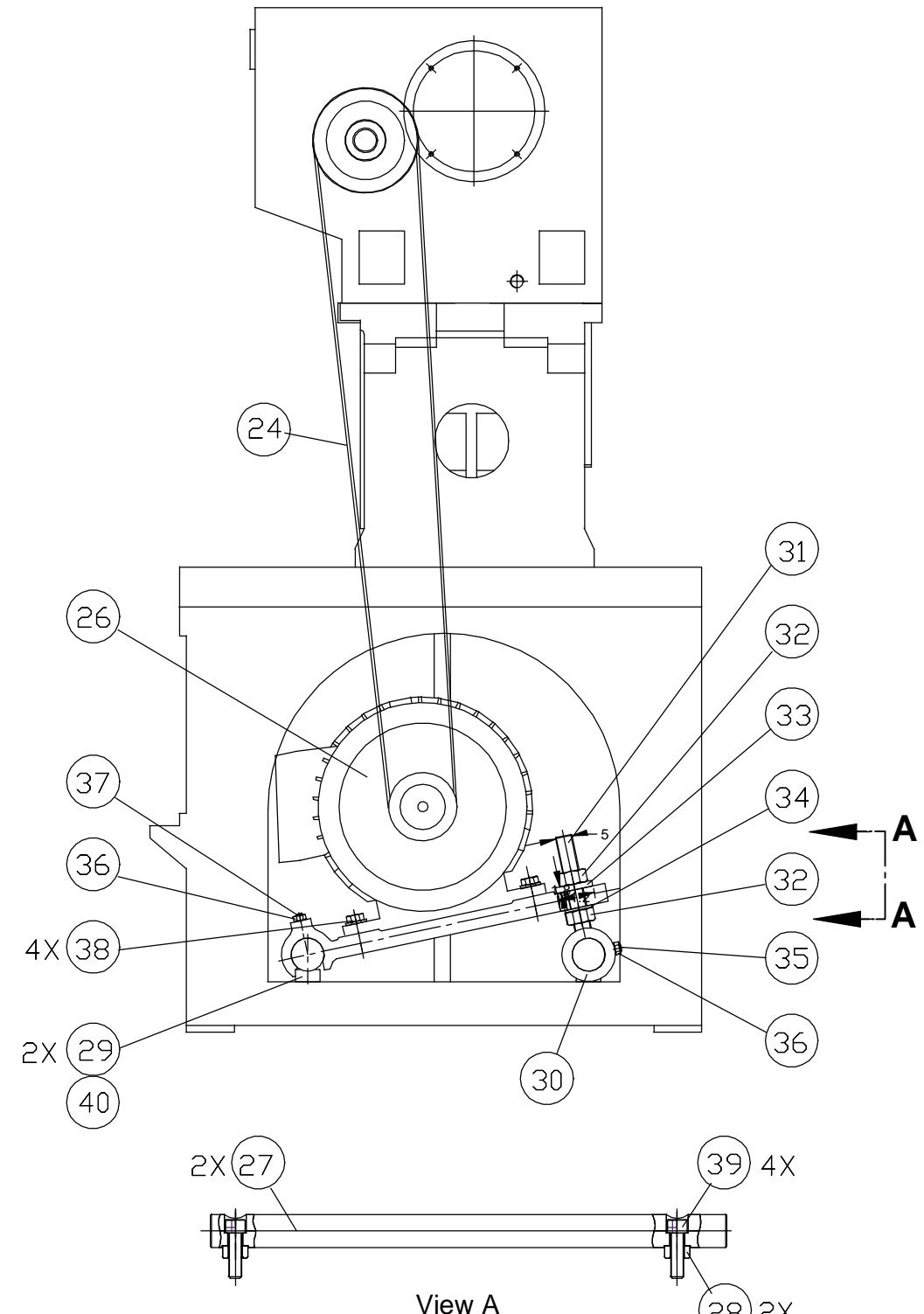
Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Mfr	Mfr P/N
79	27968	SIGHT-OIL LEVEL-GLASS	2	EA	-	R	VO-29	KING RICH	KR530070
80	27968-1	SIGHT-OIL LEVEL-GLASS	1	EA	-	R	VH-29	KING RICH	KR530080
81	22681-1	CABLE ASSY- GEAR LIMIT SWITCH	1	EA	-	R			
85	LU010310	COVER-HEADSTOCK	1	EA	-	R		KING RICH	

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REVISIONS				
REV	DESCRIPTION	ECN	DATE	APPRV
-	ORIGINAL RELEASE	13809	03/29/11	LG



# Encoder Assembly



## Spindle Motor Drive Assembly

NOTES: (UNLESS OTHERWISE SPECIFIED).

	DIMENSIONS ARE IN INCHES DEC. X = $\pm .1$ , XX = $\pm .01$ , XXX = $\pm .005$ , ANGLES XX = $\pm 40^\circ$ PROFILS $\pm .005$ RMS FINISH = 125 RMS		APPROVALS	DATE	<b>SOUTHWESTERN INDUSTRIES, INC.</b> 2815 HOMESTEAD PLACE RANCHO DOMINGUEZ CA 90220-5610			
	REMOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		DRAWN BY ENGINEER ENGINEER	03/29/11 LG 				
	MATERIAL		FE		<b>SPINDLE MOTOR &amp; ENCODER ASSY</b>			
NEXT ASSY	USED ON	-						
APPLICATION		-	THIRD ANGLE PROJECTION		SIZE <b>D</b>	CODE IDENT. NO. 06238	DWG NO. <b>27939</b>	REV -
				SCALE: -	SHEET 1 OF 1			

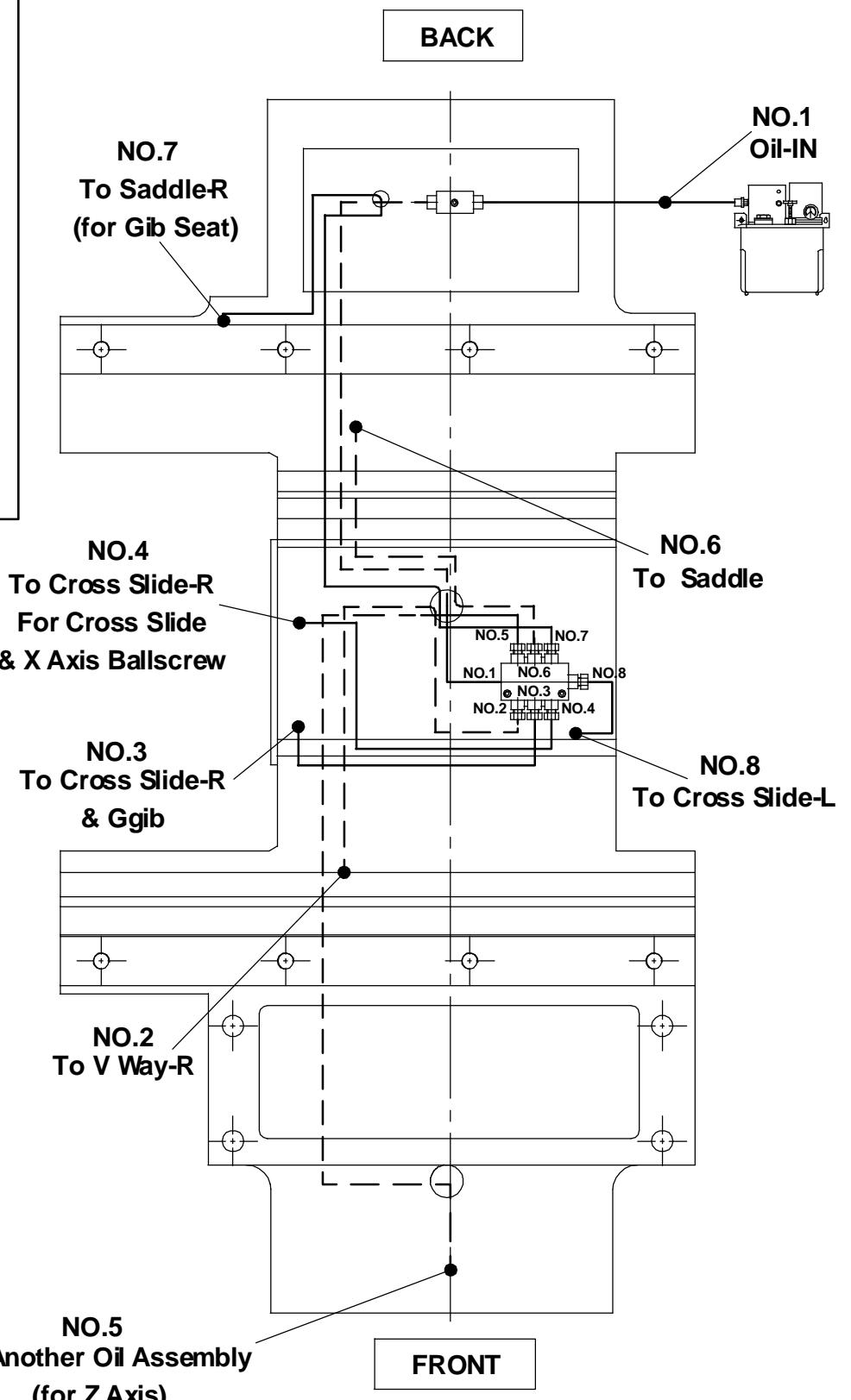
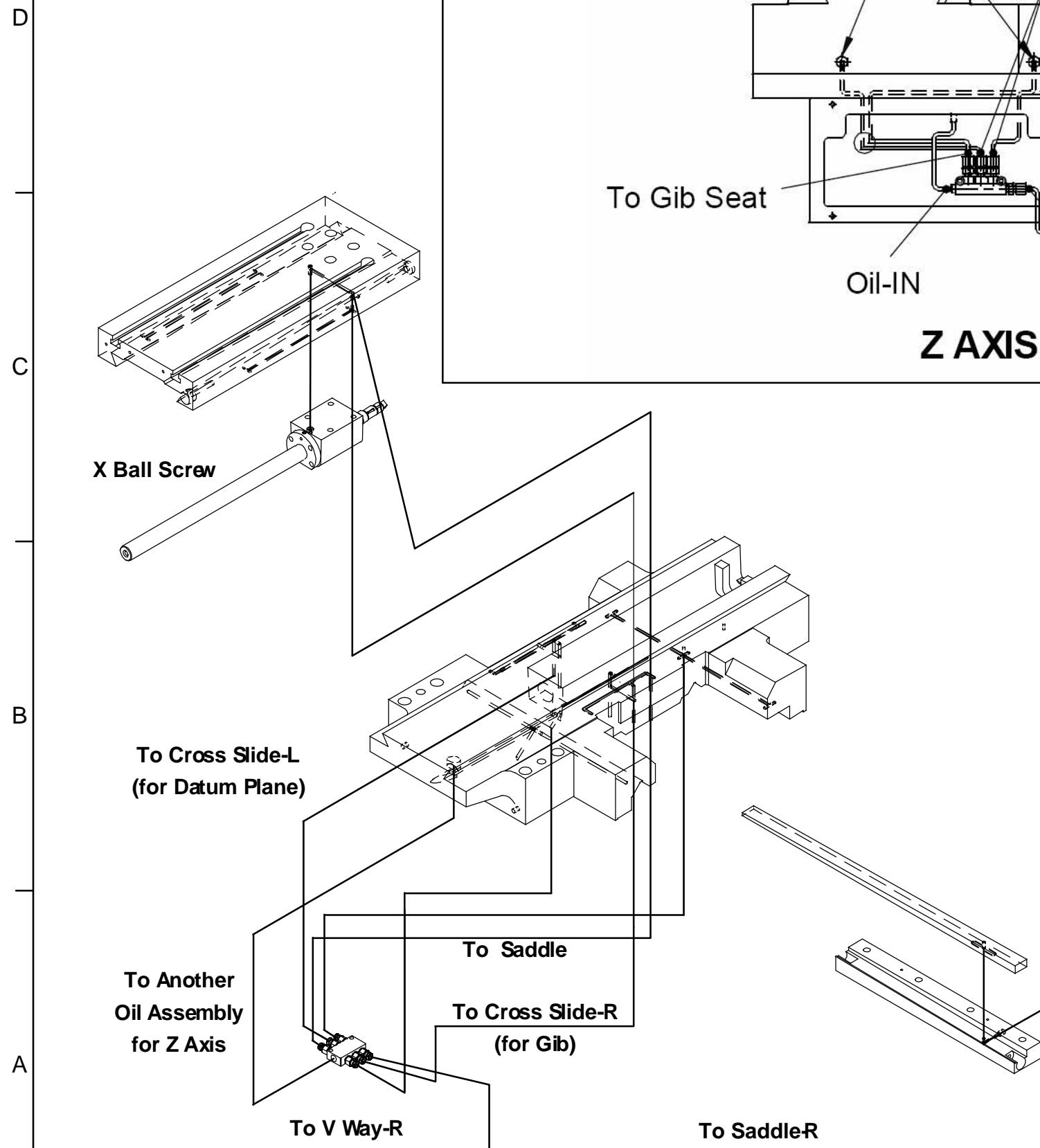
**27939**

SPINDLE MOTOR &amp; ENCODER ASSY

Type	PL	Dwg Size	D
Revision	-	Product	1845
Status	R	Engineer	LG
Date	3/24/2011	Planner Code	
By	Sal	Comm Code	

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Reference(t)	Mfr P/N
1	27970	GEAR-SPINDLE ENCODER	1	EA	-	R			LU010090
2	27971	GEAR-ENCODER SHAFT	1	EA	-	R			LU010550
3	LU010860	DOG	1	EA	-	R			
4	KR010571	BRACKET	1	EA	-	R			
5	KR010580	COVER	1	EA	-	R			
6	KR010590	CYLINDER-CIRCULAR	4	EA	-	R			
7	KR010600	SPACER	1	EA	-	R			
8	27972	SHAFT-ENCODER	1	EA	-	R			KR010610
11	23954	BEARING-DEEP GROOVE-SET (2)-6203ZZ	1	EA	A	R			
12	27973	BELT-HTD-5M-565-9W	1	EA	-	R			ABE02056 5
13	AK0505030	KEY- 5 x 5 x 20	1	EA	-	R			
14	M5-0.8X16 12B	SCREW-FHCS-PHIL-STL-BO	1	EA	-	R			
15	M6-1.0X20 12B	SCREW-FHCS-PHIL-STL-BO	3	EA	-	R	NON-STOCK ABLE		
16	M6-1.0X65 25B	SCREW-SHCS-STL-BO	4	EA	-	R			
17	M6 73B	WASHER-SPLIT LOCK-STL-BO	4	EA	-	R			
18	M8-1.25X16 25B	SCREW-SHCS-STL-BO	2	EA		R			
19	M8-1.25X30 25B	SCREW-SHCS-STL-BO	2	EA		R			
20	M8-1.25 50B	NUT-HEX-BLK OX	2	EA	-	R	NON-STOCK ABLE		
21	16873	ENCODER ASSY- SPINDLE	1	EA	D	R			
24	27976	BELT-SET-SPINDLE MOTOR	1	SET	-	R	FOR INDIVIDUAL BELT SEE 27976-1		6PK-1930

Item	P/N	Title	Qty	UseAs	Rev	Stat	Detail	Reference(t)	Mfr P/N
26	27974	MOTOR ASSY-SPINDLE	1	EA	-	R			
27	KR040030	GUIDE BAR	2	EA	-	R			
28	KR040050	SPACER	2	EA	-	R			
29	KR040051	SPACER-MACHINING	1	EA	-	R			
30	KR040060	PIVOT	1	EA	-	R			
31	KR040070	SCREW-ADJUSTABLE	1	EA	-	R			
32	M20-1.5 50B	NUT-HEX-STL-BO	2	EA	R	NON-STOCK ABLE			
33	KR040170	WASHER-M20 x 45 OD x 7 THK	1	EA	-	R			
34	M20 70Z	WASHER-FLAT USS	1	EA	-	R	NON-STOCK ABLE		
35	M8-1.25X20 40B	SCREW-SOC SET-STL-BO-CUP	1	EA	R				
37	M8-1.25X30 40B	SCREW-SOC SET-STL-BO-CUP	1	EA	R				
38	M12-1.75X35 25B	SCREW-SHCS-STL-BO	4	EA	R				
39	M16-2.0 X 50 25B	SCREW-SHCS-STL-BO	4	EA	-	R	NON-STOCK ABLE		
40	M12-BELLEVILE- 12.2 ID X 25 OD X 1.5 THK	DISC SPRING	1	EA	-	R			

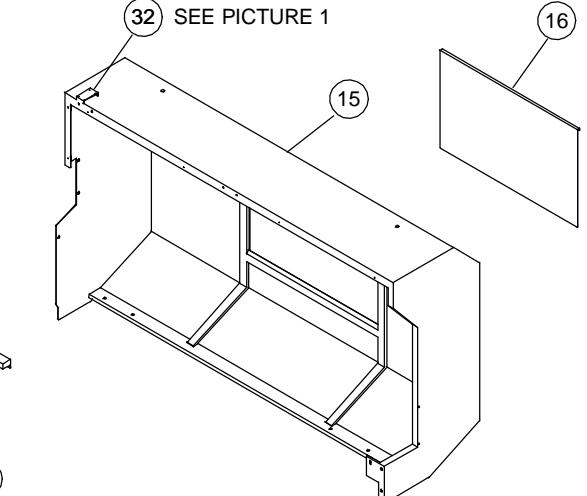
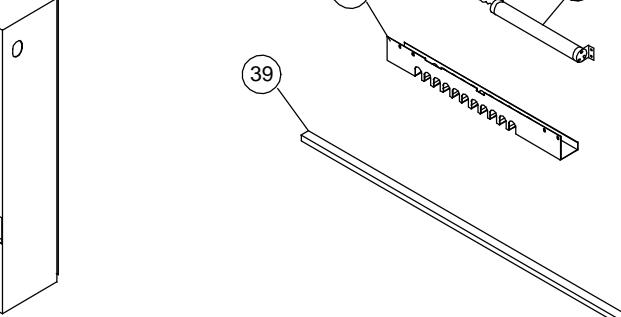
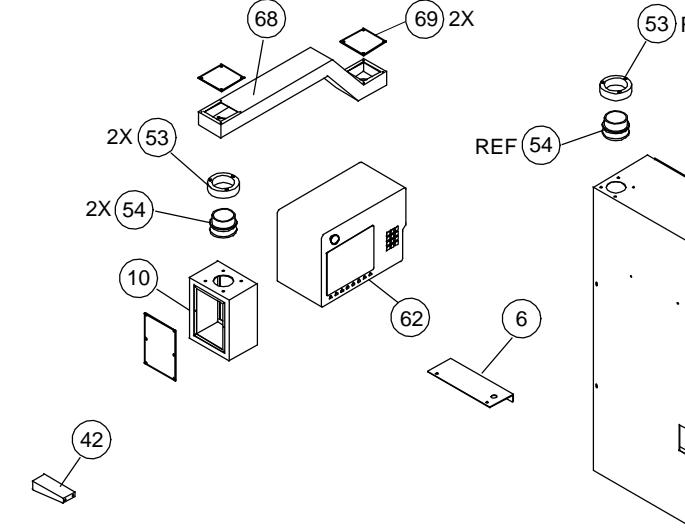
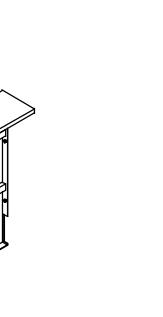
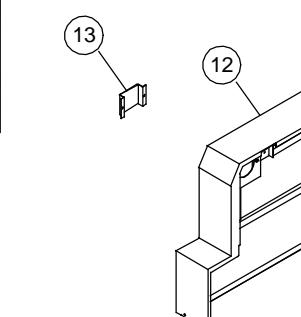
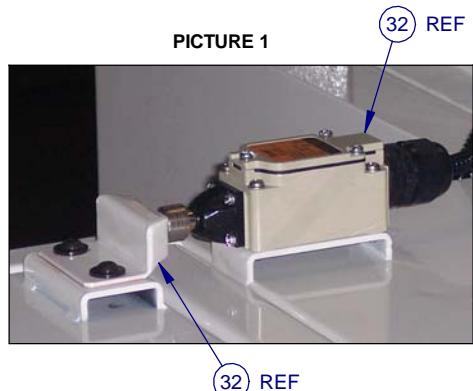


NOTES: (UNLESS OTHERWISE SPECIFIED).

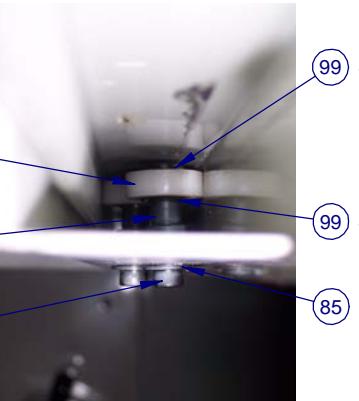
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REVISIONS				
REV	DESCRIPTION	ECN	DATE	APPRV
-	ORIGINAL RELEASE	13809	02/06/11	LG
A	ADDED PICS 2, 3, 4 & ITEMS 92, 96, & 98 - 101.	13895	11/30/11	LG

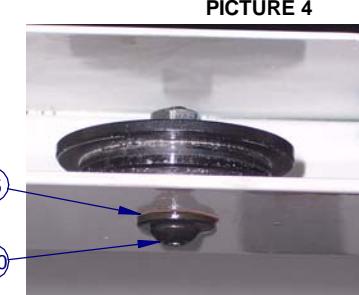
## PICTURE 1



## PICTURE 2



**PICTURE 3**

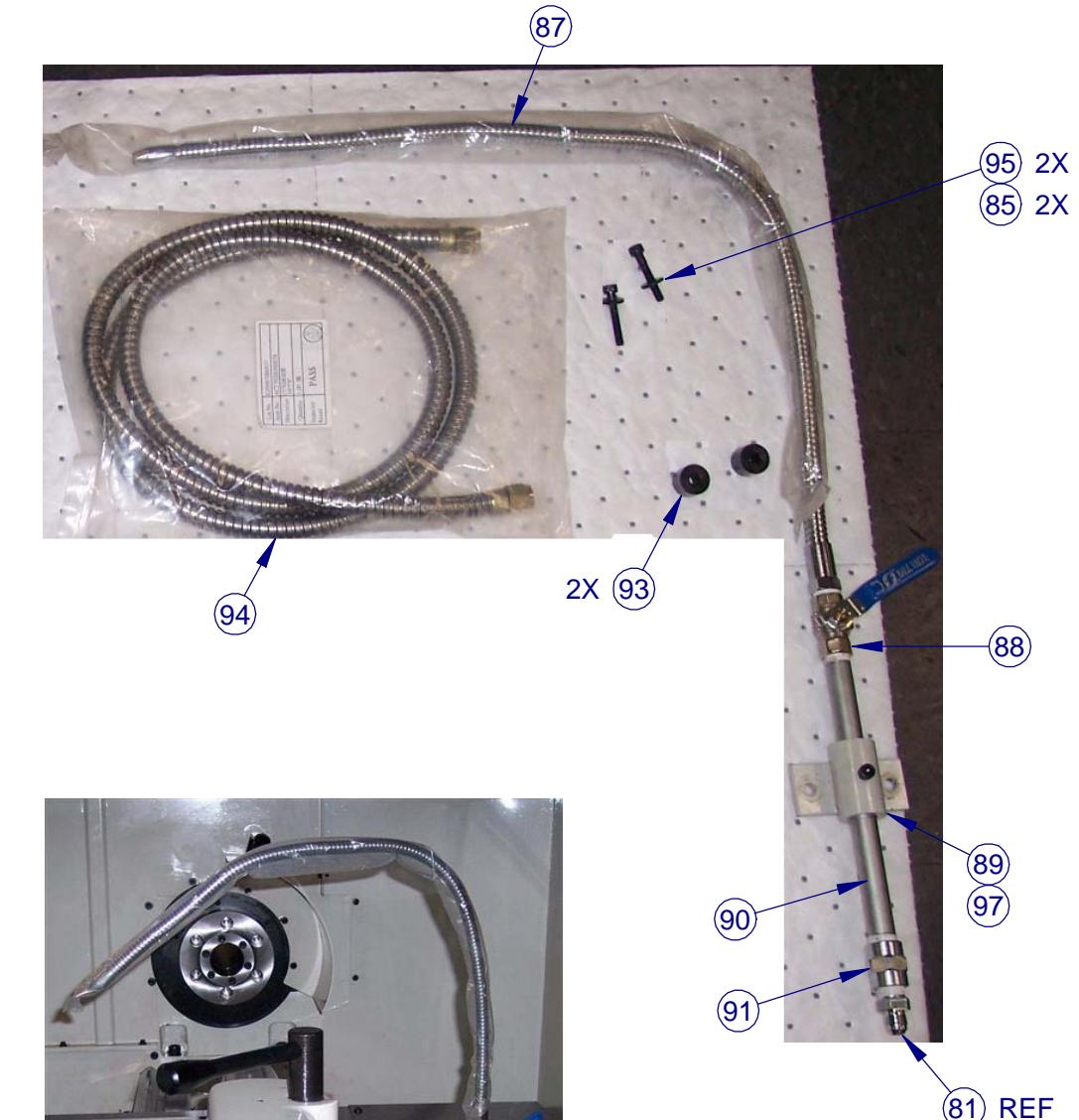
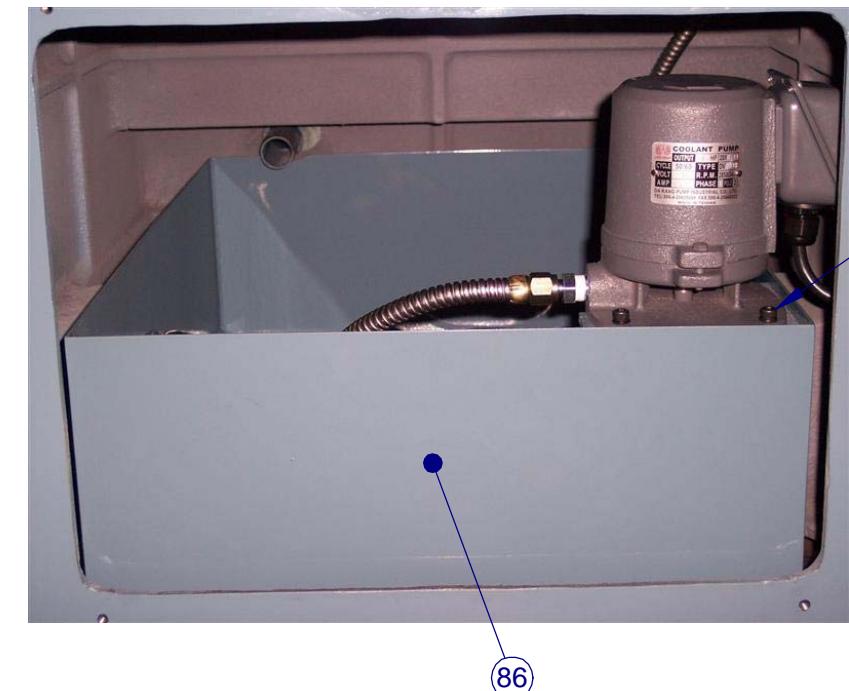


SEE SEPARATE "A" SIZE FOR PARTS LIST

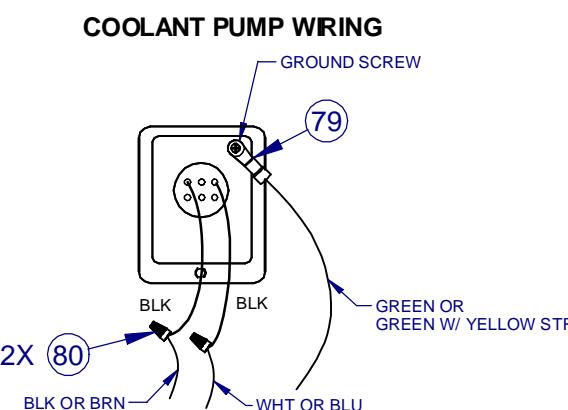
NOTES: (UNLESS OTHERWISE SPECIFIED).

SEE PICTURE 3 & 4

		DIMENSIONS ARE IN INCHES DEC. X $\pm 1$ , XX $\pm .01$ , XXX $\pm .005$ , ANGLES $\pm 10^\circ$ FRACTIONS $= \pm 1/8$ FINISH = 125 RMS		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC. 2615 HOMESTEAD PLACE RANCHO DOMINGUEZ, CA 90220-5610		
		DRAWN BY	Sal	02/16/11	ENGINEER	LG	02/16/11	TITLE
		ENGINEER			ENGINEER			SHEET METAL ASSY- 1845
		MOVE ALL SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5		FE	FE	FE	FE	
		MATERIAL	-	SIZE	CODE IDENT. NO.	DWG NO.	REV	
NEXT ASSY		USED ON	FINISH	D	06238	27914	A	
APPLICATION		-	THIRD ANGLE PROJECTION	SCALE:	-		SHEET	1 OF 2



**ITEMS 86-97 SHOWN IN ASSEMBLED STATE**



		DIMENSIONS ARE IN INCHES DEC. X = .1, XX = .01, XXX = .005, ANGLES, XX = $\pm 30^\circ$ FRACTIONS = $\pm 1/8$ FINISH = 125 R/M	APPROVALS DRAWN BY Sal	DATE 02/16/11	SOUTHWESTERN INDUSTRIES, INC. 2615 HOMESTEAD PLACE RANCHO DOMINGUEZ, CA 90220-5610			
		REMOVE SHARP EDGES MASK ALL TAPPED HOLES DIMENSIONING PER ASME Y14.5	ENGINEER LG	02/16/11	TITLE SHEET METAL ASSY- 1845			
	MATERIAL	FE			SIZE D	CODE IDENT. NO. 06238	DWG NO. 27914	REV A
NEXT ASSY	USED ON	-	THIRD ANGLE PROJECTION					
APPLICATION		-			SCALE: -	SHEET 2 OF 2		

**Parts List for Assembly P/N: 27914**

Printed 11/30/2011

**27914**

SHEET METAL ASSEMBLY-1845

Type	PL	Dwg Size	D
Revision	A	Product	1845
Status	R	Engineer	LG
Date	2/15/2011	Planner Code	
By	Sal	Comm Code	

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
2	LU050240	SPACER		-	EA	1	R	
3	LU050250	DOG		-	EA	1	R	
4	LU050250-A	SPACER		-	EA	2	R	
5	LU400011	ELECTRICAL CABINET-1845		-	EA	1	R	
6	LU400040	COVER-HEAD REAR		-	EA	1	R	
8	LU400060	COVER-SPINDLE MOTOR		-	EA	1	R	
9	LU400070	COVER-HEAD END-FRONT		-	EA	1	R	
10	LU400081	CONTROL BOX		-	EA	1	R	
11	LU400090	COVER		-	EA	1	R	
12	LU400211	COVER-HEAD END		-	EA	1	R	
13	27917	COVER-SPINDLE THROUGH HOLE		-	EA	1	R	KING RICH
14	LU400260	COVER-HEAD END FRONT		-	EA	1	R	
15	LU400281	GUARD-REAR		-	EA	1	R	
16	LU400290	COVER-PLATE-REAR		-	EA	1	R	
17	27969	GUARD-FRONT DOOR		-	EA	1	R	KING RICH
18	LU400321	GUARD-LEFT		-	EA	1	R	
19	LU400331	GUARD-FRONT		-	EA	1	R	
20	LU400330-A	SPACER		-	EA	5	R	
21	LU400410	COVER-Z AXIS BALL SCREW		-	EA	1	R	
22	27977	COVER PLATE-X AXIS MOTOR		-	EA	1	R	KING RICH
23	27978	COVER-X AXIS MOTOR		-	EA	1	R	KING RICH

## Parts List for Assembly P/N: 27914

SHEET METAL ASSEMBLY-1845

27914

Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
24	27979	COVER PLATE-X AXIS MOTOR		-	EA	1	R	KING RICH
25	27916	COVER-X AXIS		-	EA	1	R	KING RICH
26	27980	COVER PLATE-X AXIS BRACKET		-	EA	1	R	KING RICH
27	LU400480	COVER-SADDLE		-	EA	1	R	
28	27921	COVER-BED		-	EA	1	R	KING RICH
29	27981	CHIP PAN		-	EA	1	R	KING RICH
30	27919	WINDOW-DOOR		-	EA	1	R	KING RICH
31	27920	GUARD-CHUCK		-	EA	1	R	KING RICH
32	22683	LIMIT SWITCH- DOOR LIMIT	10A 250VAC	-	EA	1	R	REAL TEND ELECTRIC LTD
33	LU400620	BOX		-	EA	1	R	
34	LU400721	COVER		-	EA	1	R	
35	LU400730	COVER-LOWER		-	EA	1	R	
36	LU400860	COVER-TOP		-	EA	1	R	
37	LU400870	COVER-BOTTOM		-	EA	1	R	
38	LU410220	DOOR RAIL		-	EA	1	R	
39	LU410230	BRACKET		-	EA	1	R	
40	LU410240	BRACKET		-	EA	1	R	
41	LU410250	COVER		-	EA	1	R	
42	LU410260	COVER		-	EA	1	R	
43	LU410270	COVER		-	EA	1	R	
44	LU410291	COVER-PROTECT		-	EA	1	R	
45	LU410300	COVER		-	EA	1	R	
46	LU410300-A	COVER		-	EA	1	R	
47	LU410340	ROLLER		-	EA	4	R	

## Parts List for Assembly P/N: 27914

SHEET METAL ASSEMBLY-1845

27914

Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
48	LU410351	COVER		-	EA	1	R	
49	LUPE0041	PANEL		-	EA	1	R	
50	MS360050	ROLLER		-	EA	4	R	
51	MS360060	SHAFT		-	EA	4	R	
52	MS430160	ROLLER		-	EA	2	R	
53	KR400170	SLEEVE-SWIVEL TABLE		-	EA	2	R	
54	KR400180	CONTROL BOX-SWIVEL TABLE		-	EA	2	R	
57	LU410370	PLATE-FIXED		-	EA	1	R	
59	LU010660	COLLAR-UPPER		-	EA	1	R	
60	LU010660-1	COLLAR-LOWER		-	EA	1	R	
61	22291	LUBRICATION PUMP-WITH CABLE		B	EA	1	R	
62	24000-3	PENDANT-SLX-USA		F	EA	1	R	
63	22714-26	LAMP ASSY		-	EA	1	R	WEY YII
64	23341	BULB-WORK LIGHT		-	EA	1	R	WEY YII
65	25151-1	TUBE - WORKLIGHT - 29"		-	EA	1	R	
66	27936	DOOR ASSY		-	EA	1	R	
67	27937	HANDLE-DOOR		-	EA	1	R	
68	LU400051	BRACKET-ARM		-	EA	1	R	
69	LU400051-1	COVER-BRACKET-ARM		-	EA	2	R	KING RICH
70	LU040010	BED		-	EA	1	R	
71	LU040180	BASE-LEFT		-	EA	1	R	KING RICH
72	LU040201	BASE-RIGHT		-	EA	1	R	KING RICH
73	27941	SCREW-LEVELING		-	EA	6	R	KING RICH
74	27942	NUT-LEVELING		-	EA	6	R	KING RICH

## Parts List for Assembly P/N: 27914

SHEET METAL ASSEMBLY-1845

27914

Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
75	27943	BLOCK-LEVELING		-	EA	6	R	KING RICH
76	23265	PUMP COOLANT 1/8 HP	9022	C	EA	1	R	
77	22608	CABLE ASSY - AC POWER	10 FT	C	EA	1	R	
78	22293	FITTING-LIQUID TIGHT STRAIGHT THRU	3213	-	EA	1	R	HEYCO
79	21953-18	TERMINAL- RING TONGUE	18G	E	EA	1	R	PANDUIT
80	22522	NUT-WIRE CONNECTOR-GRAY	20-22 AWG.	A	EA	2	R	IDEAL
81	26126	FITTING-3/8 MALE TAPER PIPE TO 3/8 MALE FLARE	OBSOLETE SEE 24151	OBS	EA	1	R	
82	23262-1	CABLE CLAMP	1.5"X1.5"	-	EA	5	R	HELLERMANN TYTON
83	22475	TIE WRAP-4 IN-PLASTIC		-	EA	11	R	
84	M6-1.0X16 25B	SCREW-SHCS-STL-BO		-	EA	7	R	
85	M6 71B	WASHER-FLAT SAE-STL-BO		-	EA	13	R	
86	26359	TANK-COOLANT		-	EA	1	R	
87	26352	NOZZEL-3/8-COOLANT		-	EA	1	R	
88	26353	VALVE-3/8-COOLANT		-	EA	1	R	
89	26354	BRACKET		-	EA	1	R	
90	26355	PIPE-3/8 x 8 MALE TO MALE		-	EA	1	R	
91	26356	COUPLER-FEMALE TO FEMALE		-	EA	1	R	
92	24644	BEARING-SELF ALIGNING-2201 Z		-	EA	2	R	
93	26358	SPACER	ID 6mm X OD 20MM X 20 MM LONG	-	EA	2	R	
94	26357	HOSE-FLEXIBLE		-	EA	1	R	
95	M6-1.0X35 25B	SCREW-SHCS-STL-BO		-	EA	2	R	GOSAN
96	24645	ROLLER		-	EA	2	R	
97	M6-1.0X12 25B	SCREW-SHCS-STL-BO			EA	1	R	

**Parts List for Assembly P/N: 27914**

SHEET METAL ASSEMBLY-1845

**27914**

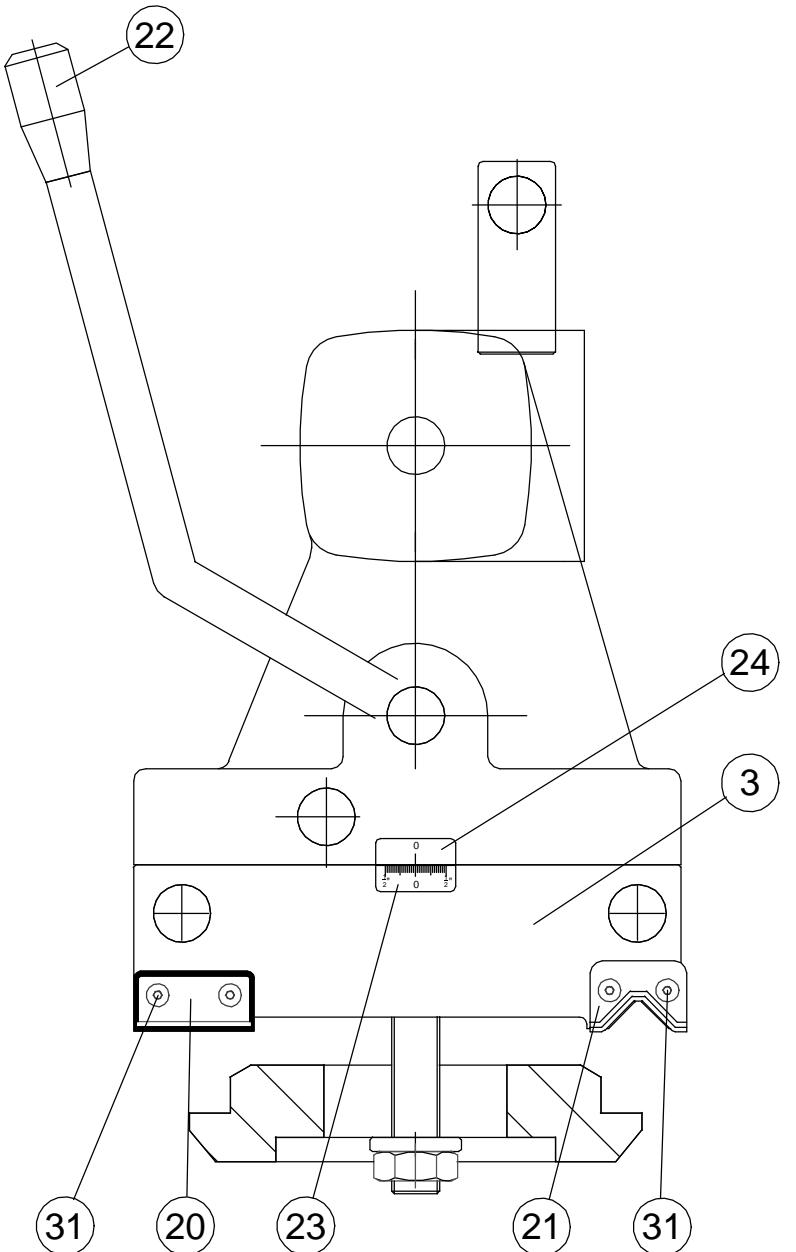
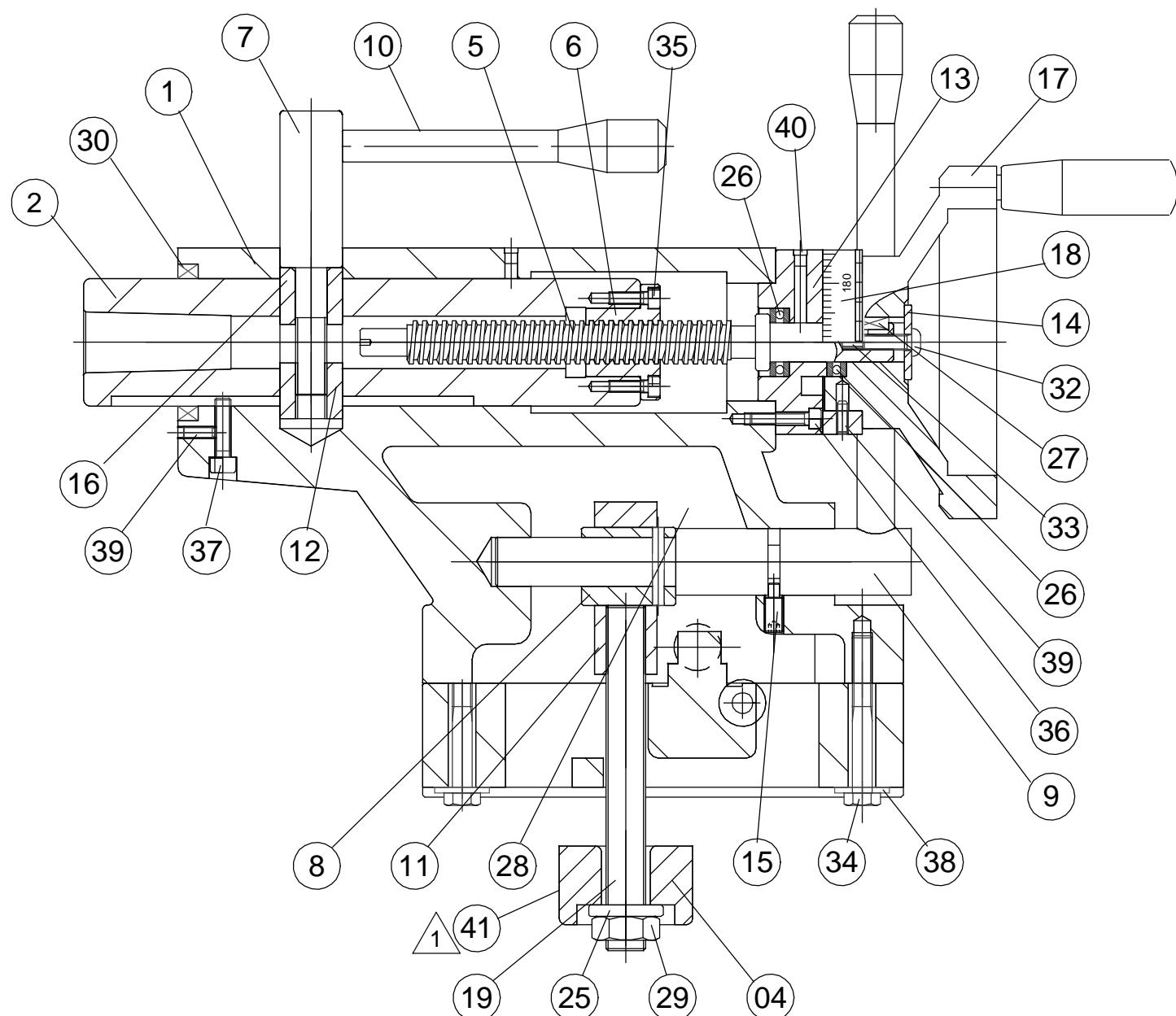
Rev A

Printed 11/30/2011

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr
98	MK430120	STAND OFF		-	EA	4	R	
99	24158-1	SNAP RING-EXTERNAL-10mm		-	EA	8	R	MCMASTER-C ARR
100	M6-1.0X25 27B	SCREW-BHCS-STL-BO		-	EA	2	R	
101	M6-1.0 50P	NUT-HEX-STL-PLAIN		-	EA	2	R	

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REVISIONS			
REV	DESCRIPTION	ECN	DATE
-	ORIGINAL RELEASE	13809	02/16/11 LG



NOTES: (UNLESS OTHERWISE SPECIFIED).

1 ITEM 41 CONSISTS OF ITEMS 4, 19, 25, & 29.

		DIMENSIONS ARE IN INCHES		APPROVALS	DATE	SOUTHWESTERN INDUSTRIES, INC.	
DEC. J = $\pm .1$ , XX = $\pm .01$ , XXX = $\pm .005$		DRAWN BY	Sal	02/16/11		2015 HOMESTEAD PLACE	RANCHO DOMINGUEZ, CA 90220-5610
ANGLES XX = $\pm 40^\circ 30'$	PROF. = 0.06	ENGINEER	LG	02/16/11		TITLE	
FINISH = 125 RMS	REMOVE ALL SHARP EDGES	ENGINEER				TAILSTOCK-	
MASK ALL TAPPED HOLES	DIMENSIONING PER ASME Y14.5	MATERIAL	FE			1845	
APPLICATION	FINISH	NEXT ASSY	USED ON	THIRD ANGLE PROJECTION	SIZE	CODE IDENT. NO.	DWG NO.
					D	06238	27925
					REV		
					SCALE:		
					SHEET	1	OF 1

**Parts List for Assembly P/N: 27925**

Printed 4/8/2011

**27925**

TAILSTOCK ASSY-1845

Type	PL	Dwg Size	D
Revision	-	Product	1845
Status	R	Engineer	LG
Date	2/16/2011	Planner Code	
By	Sal	Comm Code	

Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr	Mfr P/N
1	LU090010	BODY-TAILSTOCK		-	EA	1	R	KING RICH	
2	27926	QUILL-TAILSTOCK		-	EA	1	R	KING RICH	LU090020
3	LU090030	BASE-TAILSTOCK		-	EA	1	R		
4	27927	PLATE-CLAMP		-	EA	1	R	KING RICH	LU090041
5	27928	LEADSCREW		-	EA	1	R	KING RICH	LU090060
6	27929	NUT-LEADSCREW		-	EA	1	R	KING RICH	LU090070
7	LU090080	SHAFT-QUILL CLAMP		-	EA	1	R	KING RICH	
8	LU090090	SLEEVE		-	EA	1	R	KING RICH	
9	LU090100	LEVER-HAND		-	EA	1	R	KING RICH	
10	27930	LEVER-HAND		-	EA	1	R	KING RICH	LU090110
11	LU090130	BLOCK-ADJUSTABLE		-	EA	1	R	KING RICH	
12	LU090140	BLOCK-QUILL CLAMP		-	EA	1	R	KING RICH	
13	LU090160	RING-ROUND INDEX		-	EA	1	R	KING RICH	
14	M8 70B	WASHER-FLAT USS-STL-BO			EA	1	R		
15	LU090200	SCREW-ADJUSTABLE		-	EA	1	R	KING RICH	
16	LU090210	BLOCK-QUILL CLAMP		-	EA	1	R	KING RICH	
17	27931	HANDWHEEL		-	EA	1	R	KING RICH	LU090220
18	LU090230	RING-INDEX		-	EA	1	R	KING RICH	
19	LU090270	BOLT-M20 x 176L		-	EA	1	R	KING RICH	
20	27933	WIPER-TAILSTOCK FLAT		-	EA	2	R	KING RICH	LU090280
21	27934	WIPER-TAILSTOCK VEE		-	EA	2	R	KING RICH	LU090290

## Parts List for Assembly P/N: 27925

TAILSTOCK ASSY-1845

27925

Rev -

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Item	P/N	Title	Detail	Rev	UseAs	Qty	Stat	Mfr	Mfr P/N
22	27935	HANDLE-PLASTIC		-	EA	1	R	KING RICH	LU090320
23	LU090340	INDICATOR SCALE PLATE		-	EA	1	R	KING RICH	
24	LU090350	INDICATOR PLATE		-	EA	1	R	KING RICH	
25	M20 70P	WASHER-FLAT USS-STL-PLAIN			EA	1	R		
26	27932	BEARING-THRUST-51104		-	EA	1	R		
27	AK0606020	KEY	6 x 6 x 20L	-	EA	1	R		
28	AKP10640	PIN	Ø6	-	EA	1	R		
29	M20-1.5 50B	NUT-HEX-STL-BO	NON-STOCK ABLE		EA	1	R		
30	27961-1	SEAL-OIL- ID 65mm x OD 80mm x W10		-	EA	1	R	KING RICH	AOS658010
31	M5-0.8X12 27B	SCREW-BHCS-STL-BO			EA	8	R		
32	M8-1.25X25 27B	SCREW-BHCS-STL-BO			EA	1	R		
33	M5-0.8X25 40B	SCREW-SOC SET-STL-BO-CUP	NON-STOCK ABLE	-	EA	1	R		
34	M10-1.50X80 25B	SCREW-SHCS-STL-BO	NON-STOCK ABLE	-	EA	2	R		
35	M6-1.0X20 25B	SCREW-SHCS-STL-BO			EA	4	R		
36	M6-1.0X30 25B	SCREW-SHCS-STL-BO			EA	4	R		
37	M8-1.25X30 25B	SCREW-SHCS-STL-BO			EA	1	R		
38	M10 71B	WASHER-FLAT SAE-STL-BO			EA	2	R		
39	M10-1.5X12 40B	SCREW-SOC SET-STL-BO-CUP			EA	2	R		
40	LU090410	BALL		-	EA	3	R		
41	27938	CLAMPING BLOCK ASSY-TAILSTOCK		-	EA	1	R		

## **Southwestern Industries, Inc**

# **TRAK WARRANTY POLICY**

### **Warranty**

TRAK products are warranted to the original purchaser to be free from defects in work-manship and materials for the following periods:

Product	Warranty Period	
	Materials	Factory Labor
New TRAK	1 Year	1 Year
Any EXCHANGE Unit	90 Days	90 Days

The warranty period starts on the date of the invoice to the original purchaser from Southwestern Industries, Inc. (SWI) or their authorized distributor.

If a unit under warranty fails, it will be repaired or exchanged at our option for a properly functioning unit in similar or better condition. Such repairs or exchanges will be made FOB Factory/Los Angeles or the location of our nearest factory representative or authorized distributor.

### **Disclaimers of Warranties**

- This warranty is expressly in lieu of any other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of SWI (or any producing entity, if different).
- Warranty repairs/exchanges do not cover incidental costs such as installation, labor, freight, etc.
- SWI is not responsible for consequential damages from use or misuse of any of its products.
- TRAK products are precision mechanical/electromechanical measurement systems and must be given the reasonable care that these types of instruments require:
- Replacement of chip scrapers and wipers is the responsibility of the customer. Consequently, the warranty does not apply if chips have been allowed to enter the mechanism.
- Accidental damage, beyond the control of SWI, is not covered by the warranty. Thus, the warranty does not apply if an instrument has been abused, dropped, hit, disassembled or opened.
- Improper installation by or at the direction of the customer in such a way that the product consequently fails, is considered to be beyond the control of the manufacturer and outside the scope of the warranty.