



Kent USA CSM-1440 CNC Lathe Operations Manual

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1.0 Safety Specifications

The safe operation of the NC Lathe depends on its proper use and the precautions taken by each operator.

- Read and study the NC 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 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

#

WARNING

Do not operate this spindle at a higher RPM than rated by the chuck manufacturer.

Take special precautions with chucks that have four or more jaws and unbalanced parts.

Do not shift headstock gears while spindle or motor is running.

WARNING



Do not operate in automatic mode with the door open.

1.2 Safety Precautions

WARNING!

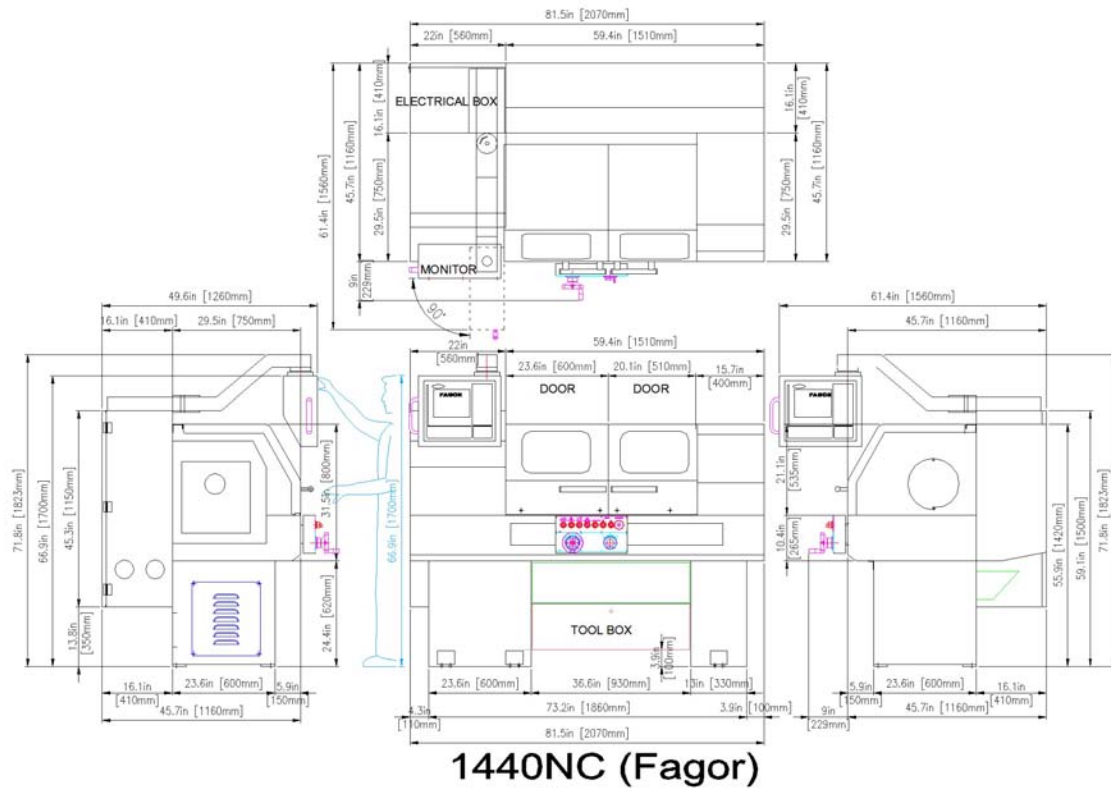
Use only chucks which are rated to the maximum RPM of the lathe.

- 1 Do not operate this machine before the NC Lathe and CNC Programming, Operating and Care Manual has been studied and understood.
- 2 Read and study this NC 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.

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

2.1 Floor Plan, Layout & Space Requirements



FOUNDATION PLAN FOR 1440NC LATHE

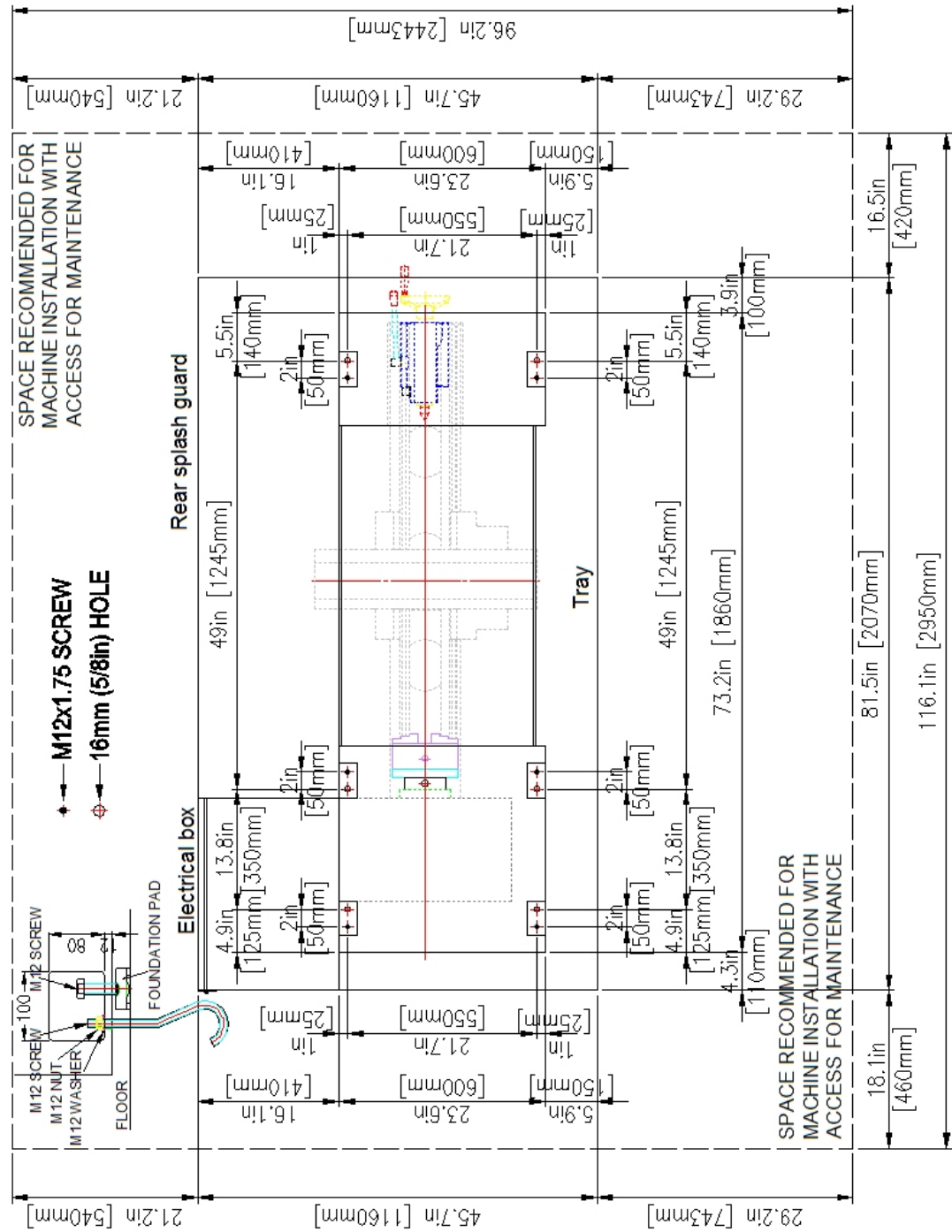


Figure 2-1

2.2 Specification

MODEL	1440NC
NOMINAL SIZE	
Swing over Bed	356mm 14in
Swing over Cross Slide	220mm 8-5/8in
Distance Between Centers	1000mm 40in
BED	
Width of Bedways	206mm 8-1/2in
Swing over Gap	515mm 20in
SPINDLE	
Range of spindle speeds	10-2500 RPM
Hole through spindie	38mm 1-1/2in
Spindle nose	D1-4 CAMLOCK
Taper of spindle bore	M.T.#5
TAIL STOCK	
Total travel of barrel	120mm 4-3/4in
Taper in tailstock barrel	M.T.#3
Diameter of barrel	Dia. 45mm 1-3/4in
X-axis	
Travel	203mm 8in
Ballscrew	25mm Pitch5
Max servo force	6.3Nm
Z-axis	
Travel	840mm 33-1/2in
Ballscrew	32mm Pitch5
Max servo force	6.3Nm
MAIN MOTOR	
Main spindle motor	FAGOR AC motor 7.5HP 5.7KW
Axis servo motor	FAGOR AC axis servo motor 1.1HP 1KW
PACKING	
SPACE	82 x 53 inch
PACKING SIZE	100 x 65 x 79 inch
Machine net weight	1150 kg
Gross weight	1250 kg
We reserve the right to modify and improve our products.	

ELECTRICAL EQUIPMENT			
CNC control	Model	Voltage	
FAGOR	8055i FL-TC-K	380V	
Item	Brand	Voltage	KW
X axis motor	FKM42.30A.E3.100	380V	1.1KW
X axis driver	ACSD-16H	380V	
Z axis motor	FKM42.30A.E3.100	380V	1.1KW
Z axis driver	ACSD-16H	380V	
Spindle	FS5-A055-S5C1	380V	7.5KW
Auto lubrication	3L 220V		
Coolant pump	1/8HP 220V		
Work lamp	10W 220V		
Electronic hand- wheels	HDW-AE-80 HDW-AE(F01003)		
Limit switch	Balluff BNS 819-B02-D12-61-12-10		
	Tend TZ-6002		
Spindle Encoder	MEMICON	HES-10-2MHC-800	1024 HZ

2.3 Uncrating

Carefully remove the wood crate and protective packaging, paying attention not to scratch, damage, or mar any parts of the machine. 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 (6 each)
- _____ Pendant Display
- _____ Toolbox with various tools
- _____ NC Lathe Safety, Operation & Programming Manual
- _____ NC Lathe Safety, Installation, Maintenance, Service & Parts List Manual

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 lathe.

...	1.	Shut off power to the machine.
...	2.	Visually inspect the 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.
...	3.	Clean the machine if needed and remove any remaining grease.
...	4.	Ensure the pendant is securely mounted to the mounting arm.
...	5.	Check all the electrical connections from the pendant to the electric box. See the pendant and electric box wiring diagrams.
...	6.	To make sure Slide the door slides smoothly.
...	7.	Remove the protective plastic covers from the headstock and the window on the sliding door.
...	8.	Turn on the power to the machine and to the pendant.
...	9.	Check the oil level on the sight glass on the headstock. Fill if low. Ensure that the coolant pump is rotating in the correct direction.
...	10.	Lubricate all the way surfaces and the ballscrews by the automatic lubrication pump
...	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.
...	12.	Position the saddle and tailstock to the center of the bed for leveling.
...	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.
...	14.	Check the tailstock and the tailstock barrel locks by locking and unlocking. Run the tailstock barrel in and out to ensure proper function.
...	15.	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.
...	16.	Make sure the X and Z electronic handwheels are functional.
...	17.	Check to make sure that the E-Stop button is functioning correctly.
...	23.	Run the spindle throughout each gear at each speed.
...	24.	Flip the coolant switch on and off to make sure coolant is working properly – optional.
...	25.	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.
...	26.	Wipe down the machine prior to leaving.

CAUTION!

To 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 us, 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 1200 rpm.

2.6 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 figure 2-2. Be certain to lift the lathe toward the headstock.

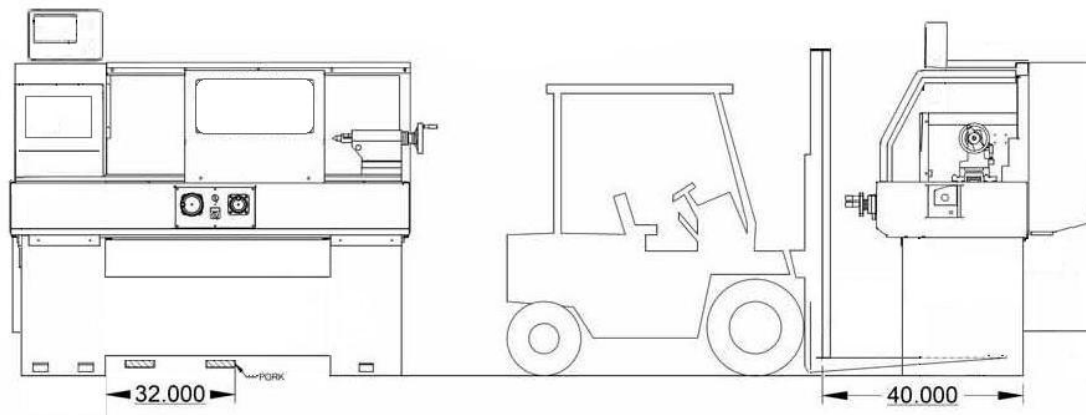


Figure 2-2

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 six (6) rest pads.

For proper operation, the machine should be set on a substantial floor capable of supporting the weight safely.

2.7 Cleaning

- 1 Remove rust protective coating from the machine before moving slideway.
- 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 or slideways can occur.

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

#

2.8 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 6 rest pads, it must be leveled by the use of the 6 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: Next to each leveling screw is another hole used to bolt the machine to the floor.

NOTE: The use of a precision level having a minimum accuracy of 0.1mm over 25mm 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 corners of the bedways (Figure 2-3, Positions 3 & 4). To take a reading off the level transversely, place it on top of .7500" parallels at each end of the bedways (Figure 2-3 Positions 1 & 2).

Using the four (4) interior leveling screws on the lathe base, level the bedways longitudinally within 0.2mm over the total length and transversely within 0.12mm. After leveling with the four (4) interior leveling screws, bring the exterior leveling screws on the lathe (see Figure 2-1) into contact with the leveling pads using care not to disturb the level.

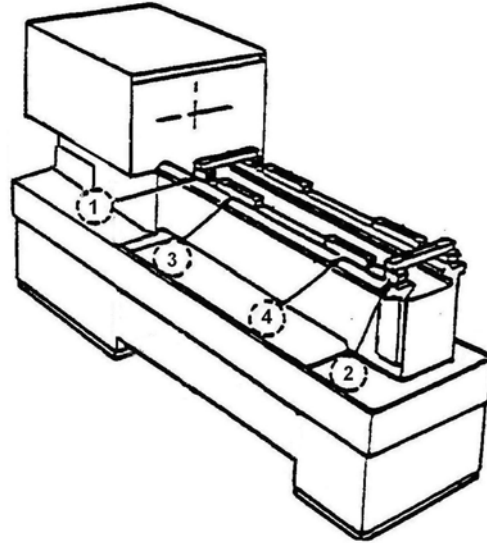


Figure 2-3

For a newly installed machine, check the level once every week.

Once the foundation is rigid enough, then check it once per month.

Note: Each 1/2" leveling screw hole is accompanied by a 5/8" bolt hole to fasten the lathe to the ground.

2.9 Lubrication

The NC Lathe lube system provides centralized lubrication for the carriage, cross slide and ballscrews. The lube pump has a 1/2 quart reservoir filled with Mobil Vactra Oil No. 2 or non-detergent 30 weight.

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.

CAUTION!

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

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2.9.1 Headstock Oil Reservoir

Before turning on the spindle, check to make sure the headstock oil reservoir is full. A site glass is located on the headstock. The reservoir holds approximately 2 gallons. If low, fill the site level with SAE 30 weight oil or equivalent oil through the plug located on the headstock cover.

2.10 Cutting the Test Part

Tools Required

- Chuck
- Tool Post
- Cutting Tool right-hand face

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 450 RPM.

To load a 50mm dial aluminum bar on the spindle chuck. Load a standard right hand cutting tool into the tool-post. Align and lock the tool onto the tool post. Set the depth of cut to a maximum of 0.05mm. Set the spindle to an acceptable speed for turning the test piece. A speed range from 640 to 830 RPM is recommended. (Figure 2-4)

2.11 Measurement of the Test Part

Tools Required:

- Micrometers

Using a calibrated micrometer to measure and record the generated dimension at 3 spacing. The acceptable measurement of parallelism of spindle axis to carriage movement (taper of test piece) is 0.002mm in 200mm. 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.

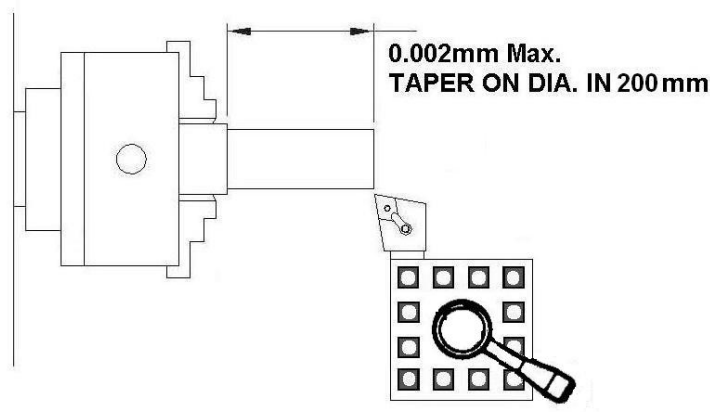


Figure 2-4

3.0 Diagnostics

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

3.1 The Machine Tool & Set-Up

3.1.1 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 0.002mm longitudinally and 0.01mm transversely.

3.1.2 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 gibs must be replaced. Shimming of gibs 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 gibs, one located on each way.

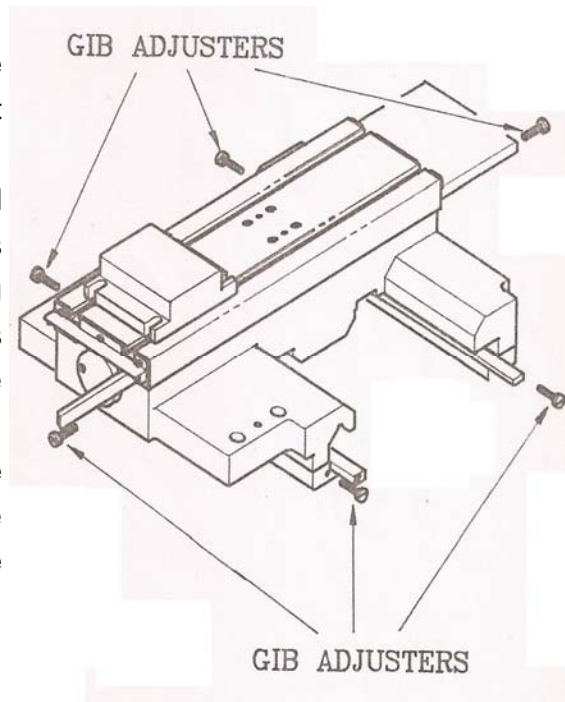


Figure 3-1

3.1.3 Lubrication

Lubrication is most important maintenance issues and plays a key role in assuring the performance and durability of the lathe.

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 ballscrews and way surfaces.

3.1.4 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
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 Gib Adjustment, Section 4.2.1. Work improperly supported Machine tool out of level - See Leveling Procedures, Section 2.8.

3.1.4.1 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

The spindle speed range is 10~2500RPM.

3.1.4.2 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

4.0 Procedures for Replacements & Maintenance

4.1 Replacements

4.1.1 Servo Motor Replacement

- Turn off power to the machine.
- Each motor is mounted by the use of (4) ¼-20 screws. Be careful not to over tighten these bolts and strip the threads.

WARNING!

Do not work with the Servo Motors unless the power is disconnected from the machine. The servo motors are run by 380 VAC. There is possibility of death by electrocution!

4.1.2 Motor brush replacement

1. This procedure assumes the motor assembly has either been removed from the machine and/or no power is applied to the machine.
2. When the motor is mounted to the casting that holds the Servo Driver, it is necessary to remove the four Phillips head bolts at the shaft end of the motor, which hold the motor to the housing to access all four brush assemblies. DO NOT Remove/Disconnect any wires, it is not necessary.
3. Before removing caps, please note they are made of plastic and care must be taken when removing them to not damage the screw slots. To this end, apply firm downward force while gently turning the caps counter clockwise.
4. Note there are four (4) caps to be removed to access and replace all of the brush assemblies. When the caps are loose and before removing it, hold your finger over the top of the cap/hole to contain the parts
5. Remove the O-ring, Keeper and brush assembly.
6. Insert new brush assembly, re-insert keeper (Note: No Keeper is used on the FAGOR Motor) and install new O-Ring taking care to use the edge of a small screw driver to gently force the O-Ring into the hole down onto the Washer/Keeper. If the O-ring is installed properly, it will hold the brush assembly in place while you install the cap.
7. Install Cap to complete installation and repeat this process for the remaining three (3) brush assemblies.
8. Re-assemble motor to housing while pushing wiring back into housing taking care to not pinch it.
9. Re-install the assembly to the machine.

4.1.3 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 380 VAC. There is possibility of death by electrocution!

The Servo Driver for each axis is integrated into the servo motor casting.

DANGER!

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

1. Press in the Emergency Stop.
2. Remove the servo motor/driver assembly from its mounting bracket.
3. Remove the 10 cap screws that hold the servo driver and its heat sink plate to the motor casting.
4. Disconnect the cable connector. Do not pull on the wires.
5. Reinstall the new servo driver with its heat sink plate. Be certain the gasket properly seals the assembly.
6. Reinstall the motor/driver assembly. Make certain the belt is tight so that there is little play if pinched in the middle.

4.1.4 Electronic Handwheels

There are 2 electronic handwheels. Each unit is replaced as an assembly. Disconnect the handwheels from the apron cable.

4.1.5 Spindle Encoder Replacement

The encoder is held onto the spindle by setscrews.

1. Turn off the all power of the lathe.
2. Open the Headstock door to gain access to the spindle encoder.
3. Loosen the locknut on the encoder.
4. Disconnect the encoder's cable from the pendant and remove it.
5. Reverse procedure and set the cable into the pendent.

4.1.6 Spindle Drive Belt Tightening/Replacement

The spindle drive motor is located inside the base pedestal, underneath the headstock. Open the belt cover on the headstock and remove 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 figure 4-2. Make sure the tension on the belt is such that there is no slippage when the lathe is started at its maximum speed. Check the belt tension by pulling on one of the belts in the mid-span 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.

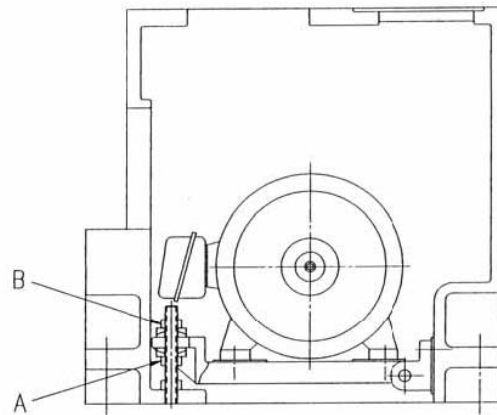


Figure 4-2

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.

4.1.7 Spindle Motor Removal

1. Turn off the all power of the lathe.
2. Loosen the belt tension.
3. Mark and remove motor electrical leads.
4. The motor is secured with four screws to the motor mounting plate.
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.

4.1.8 X-Axis Ballscrew Removal

1. Turn off the all power of the lathe.
2. Access the X-axis ballscrew by removing the back cover on the rear splashguard and removing the X-axis belt guard. Figure 5-12
3. Remove the 4 ¼-20 Cap Screws.
4. Remove the motor.
5. Remove the belt pulley, 2 bearings, and the bearing housing.
6. Remove the cross slide
7. Remove the ballscrew and X-axis yoke in one piece.
8. Unbolt the ballscrew nut from the yoke.

4.1.9 Z-Axis Ballscrew Removal

1. Turn off the all power of the lathe.
2. Remove Z-axis motor belt. Figure 5-13
3. Remove ballscrew pulley, bearing, and bearing housing on left end of ballscrew.
4. Remove bearing housing, locknut, and bearings from right side of ballscrew.
5. Disconnect ball nut from Z-axis yoke.
6. Disconnect oil line.
7. Remove ballscrew

4.1.10 Z-Axis Ballscrew Alignment

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 ballscrew 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 ballscrew 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 ballscrew manually and move the carriage through the entire length of the Z-axis. To pay special attention to the areas near the headstock, tailstock, and in the middle of the travel. If there have 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.

4.1.11 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.

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 4-3) 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.

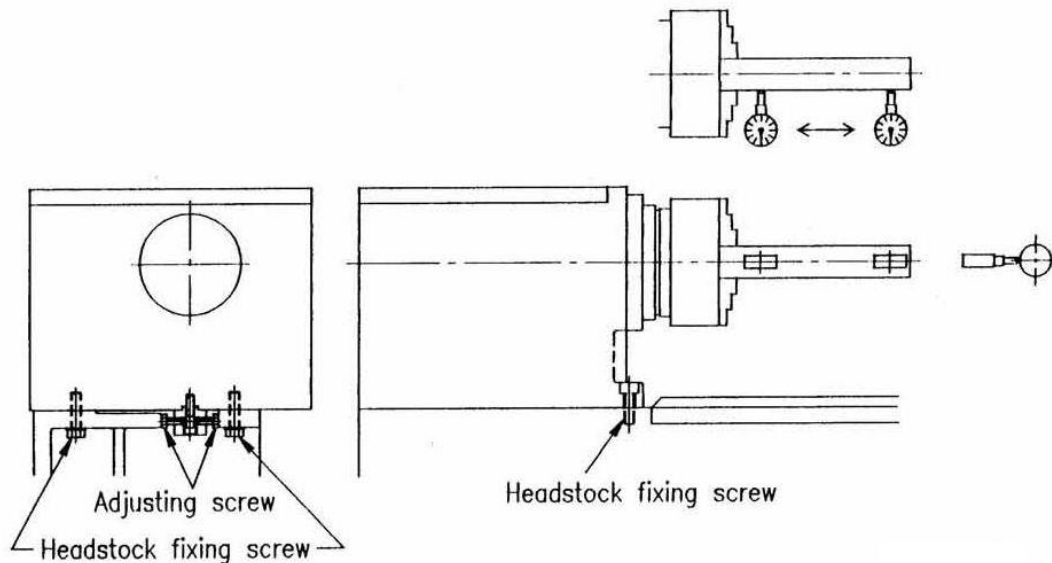


Figure 4-3

4.1.12 Spindle Bearing Preload

1. Run the lathe for 10 minutes to insure the bearing are lubricated and slightly warmed. Run the lathe at 450 RPM.
2. Turn off the power. Loosen the bolt of main motor base. remove the spindle belt. With a rolling torque meter, check the rolling torque on the spindle. The acceptable range of rolling torque is 10-15 in-lb.
3. If torque is out of tolerance, remove the rear bearing cover to gain access to the spindle-adjusting nut. Loosen the three setscrews on the spindle-adjusting nut before tightening or loosening. The spindle-adjusting nut is outside the gearbox, so the headstock access cover will not need to be removed.
4. Torque too low: 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: 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.

4.1.13 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 gauge mandrel between centers in both the spindle and tailstock with the tailstock quill retracted as much as possible. Attach a magnetic base indicator to the cross slide and contact the side of the mandrel with the indicators stylus. Move the carriage in the Z-axis direction from end to end of the mandrel and record the indicator reading.
2. Release the tailstock clamping lever holding the tailstock to the bed.
3. Adjust screws A on both sides of the tailstock to move the tailstock laterally across the tailstock base until desired alignment is achieved. Lock both screws to retain alignment.
4. Lock the tailstock clamping lever and indicate the mandrel to confirm desired alignment.

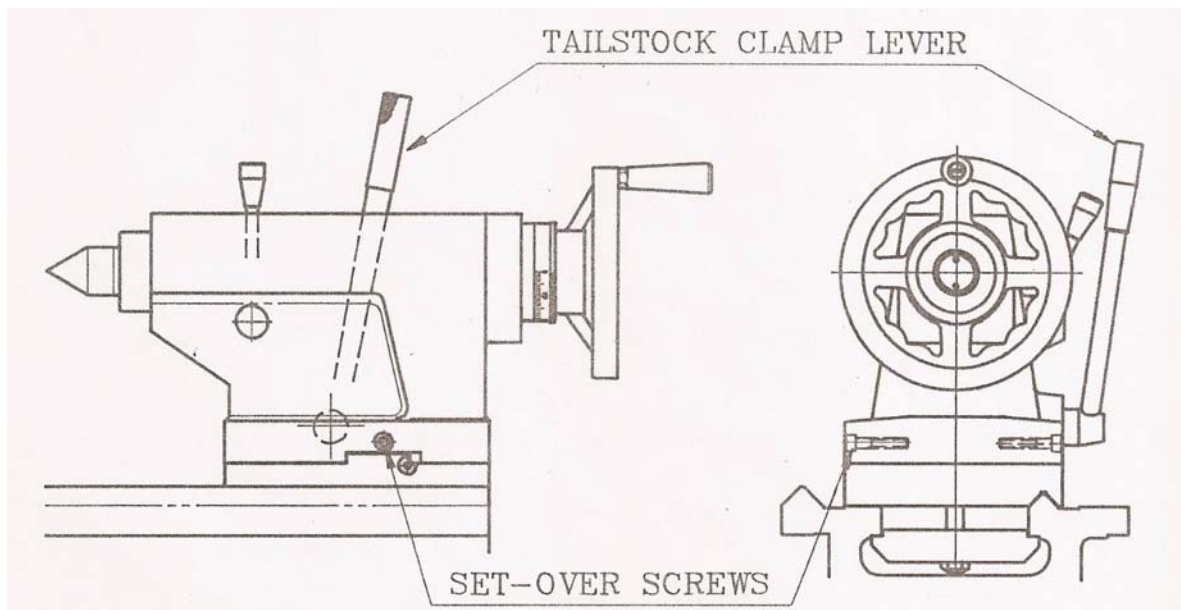


Figure 4-4

4.1.14 Spindle Motor Wiring

The spindle motor of NC lathe can be wired for 220 or 440 volts. 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. The ground screw in the box is identified on the block diagram in the junction box lid. Any wire there should be green or green/yellow.

4.1.15 Spindle Removal (Figures 5-11)

The following procedure is to remove the spindle for the NC lathe.

1. Remove Z-axis servomotor cover to gain access to two screws that hold belt guard sheet metal.
2. Remove headstock nameplate attaching screws.
3. Remove belt guard.
4. Remove headstock cover, item 2 on Figure 5-6.
5. Remove encoder and its mounting bracket. See Figure 4-1.
6. Remove proximity ring from the spindle.
7. Remove cover item #17. See Figure 5-10 for the items mentioned below.
8. Remove locknut item #15
9. Remove chuck guard assembly
10. Remove socket head cap screws item #6
11. Remove snap ring item #13
12. Cover end of the spindle with an aluminum drift.
13. Using a mallet to drift the spindle forward to remove.
14. Slide gears item #10 and #11 off of the spindle as it is moved forward.
15. Spindle will remove with item #4 and bearing cone from item #5.

4.2 Maintenance

4.2.1 Gib Adjustments

The objective of adjusting the gibs is to eliminate as much play in the cross slide and saddle 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.

4.2.1.1 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 gibs are worn the worst.

2. Turn the X-axis ballscrew 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.

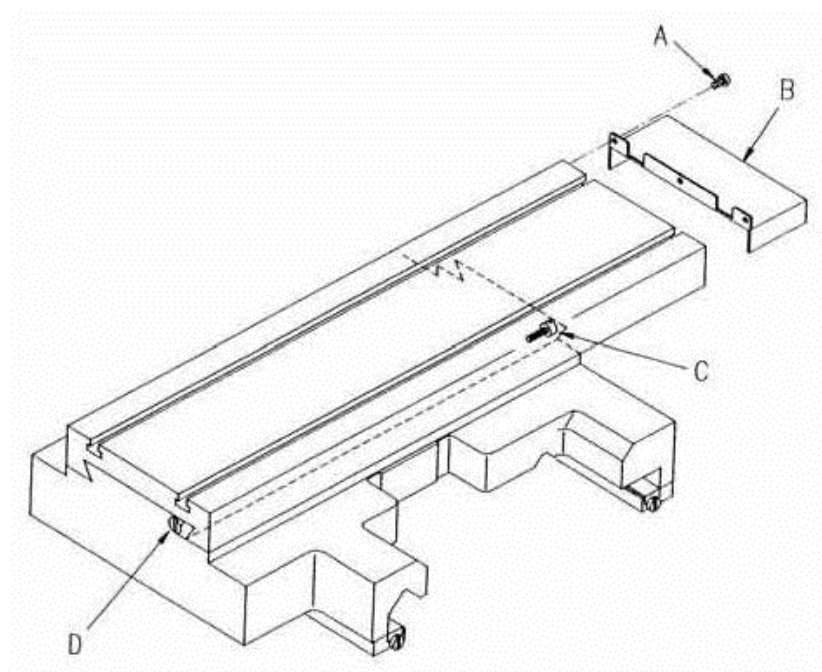


Figure 4-7

4.2.1.2 Z-Axis Gib Adjustment

Mount a dial indicator on the Z-axis ways and locate on top of the carriage.

Lift the carriage up to measure the amount of play. The dial indicator should not move more than 0.02mm. If it moves more, tighten the gibs. Make sure not to over tighten the gibs.

This procedure with the dial indicator will need to be done in the front and rear of the saddle.

Note: The two Z-axis gibs are in opposite configuration with respect to one another. In other words, the thick and thin ends are on opposite sides.

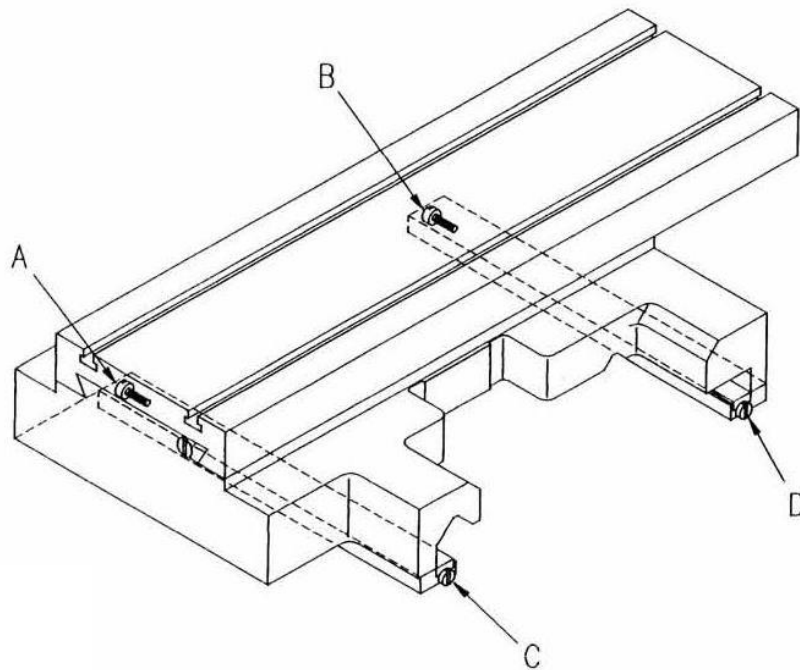


Figure 4-8

4.2.2 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.

4.2.2.1 Calibration

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

1. Recheck machine level and adjust as necessary.
2. Input the "X" key to tell the control the X-axis is being calibrated.
3. Place the 0.0001 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.
4. When the indicator is zeroed at the beginning of the standard input the control system.
5. Move the cross slide towards the motor side of the X-axis until the indicator zeros on the end of the standard. Input control system.
6. If the calibration was successful the screen will return to the set up screen.
7. Press the "Z" key to tell the control that the Z-axis is being calibrated.
8. Set up the metric standard on the Z-axis ways.
9. Set up the magnetic base and 0.0001 indicator on the cross slide.
10. When the indicator is zeroed at the beginning of the standard input the control system.
11. Move the saddle towards the chuck until the indicator zeros on the end of the standard, then input control system.
12. If the calibration is successful the screen will change to the set up screen.

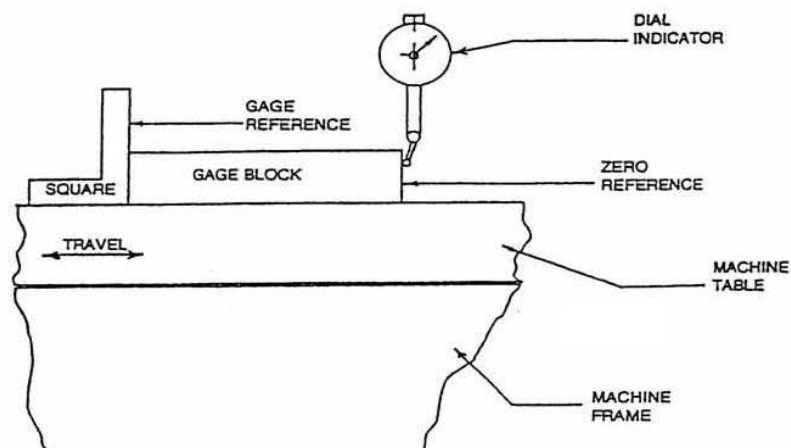


Figure 4-9

4.2.2.2 Backlash Compensation

Every mechanical system has at least a little backlash or lost motion. It is produced by the small amount of play between the gibs 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 0.002mm dial indicator in the spindle, and touch off on a block along the direction (X or Z) you wish to check, or set the backlash constant.
2. Turn on control system and find out the backlash menu.
3. The X backlash identified and stored in control system should be less than 0.07mm 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 0.002 indicator using the following method.

- Load the indicator to zero from one direction and zero out the DRO.
- Move the indicator to 0.05mm 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 control system.
- After entering this number redo the process. The DRO and indicator should now both read 0.

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.

4.2.3 Lubrication

4.2.3.1 Headstock Lubrication

A splash system provides lubrication for an even distribution of oil to all the gears and bearings in the headstock. A sight glass on the front of the headstock displays the oil level. Periodically check to see that oil is present.

The plug to drain the headstock is located under the spindle cover towards the bottom of the casting. See figure 4-10. Oil can be added through the cover on top of the headstock. The headstock reservoir holds approximately 3 gallons. Fill the headstock with SAE 30 weight 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.

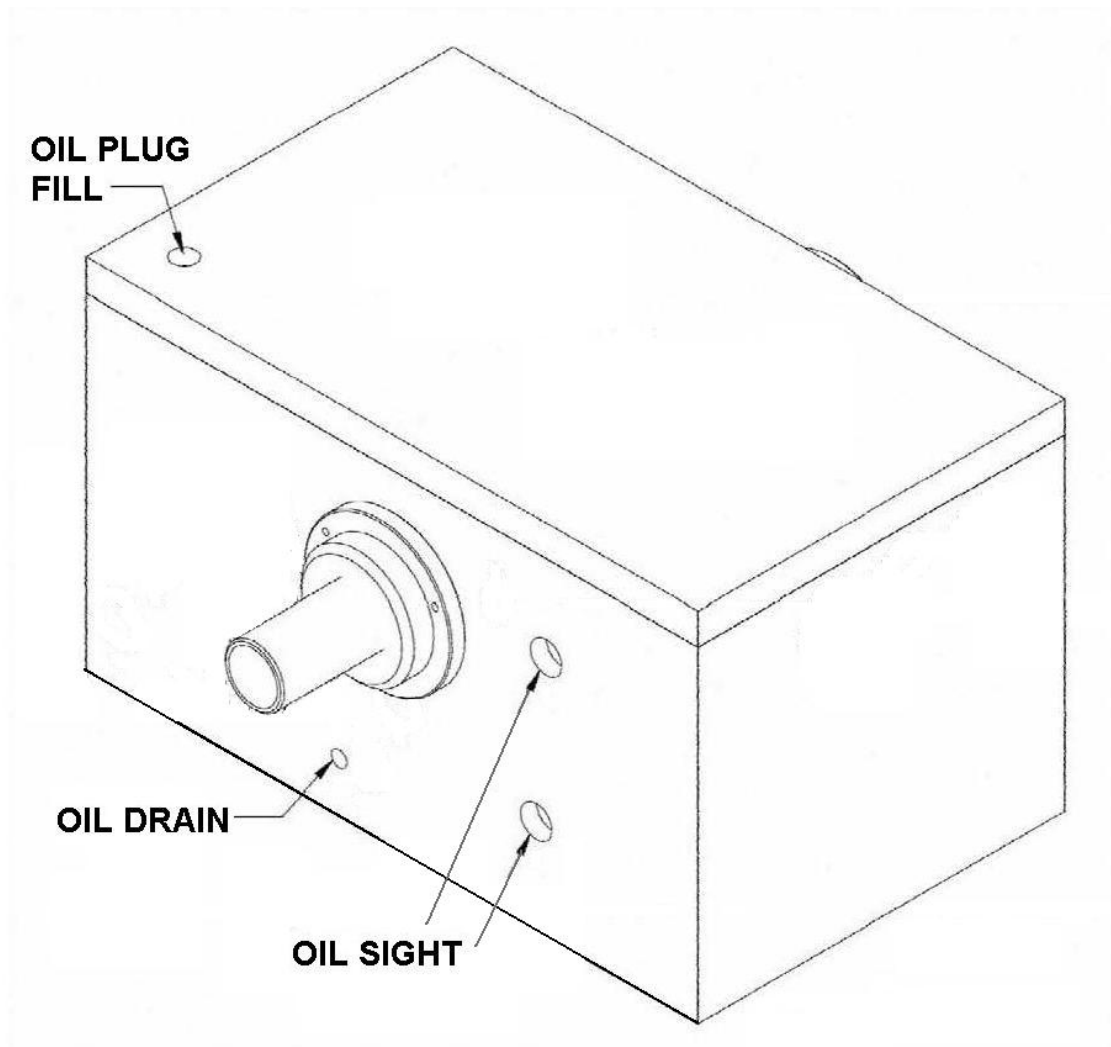


Figure 4-10

4.2.3.2 Way Lubrication

The NC Lathe lube system provides centralized lubrication for the carriage, cross slide and ballscrews. The lube pump has a ½ quart reservoir filled with Mobil Vactra Oil No. 2 or non-detergent 30 weights.

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.

We recommend that you set automatic lubrication input oil at the start of every day and every hour during the day.

CAUTION!

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

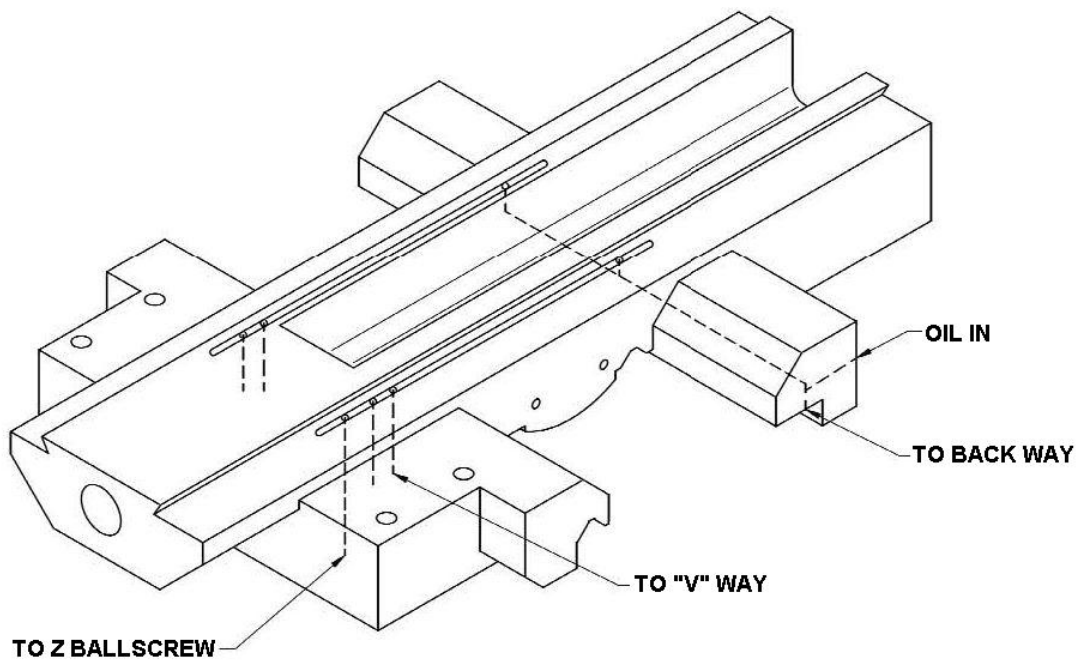


Figure 4-11

4.2.3.3 Tailstock

Two oil point located on top of the casting and tail end of leadscrew oiler point are provide for daily attention from a standard oil gun.

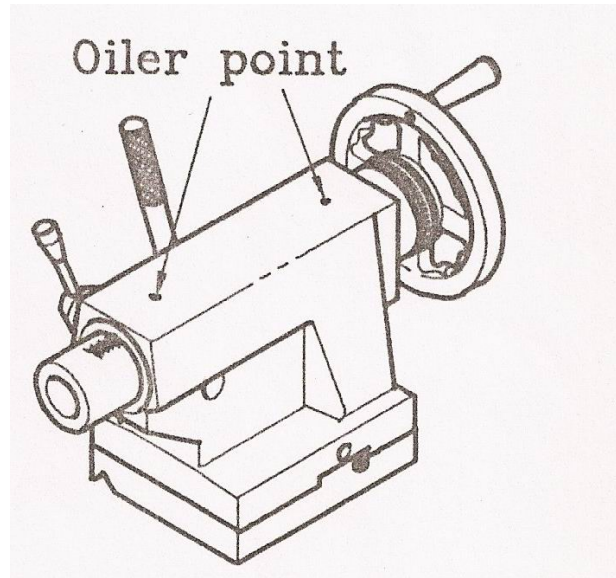


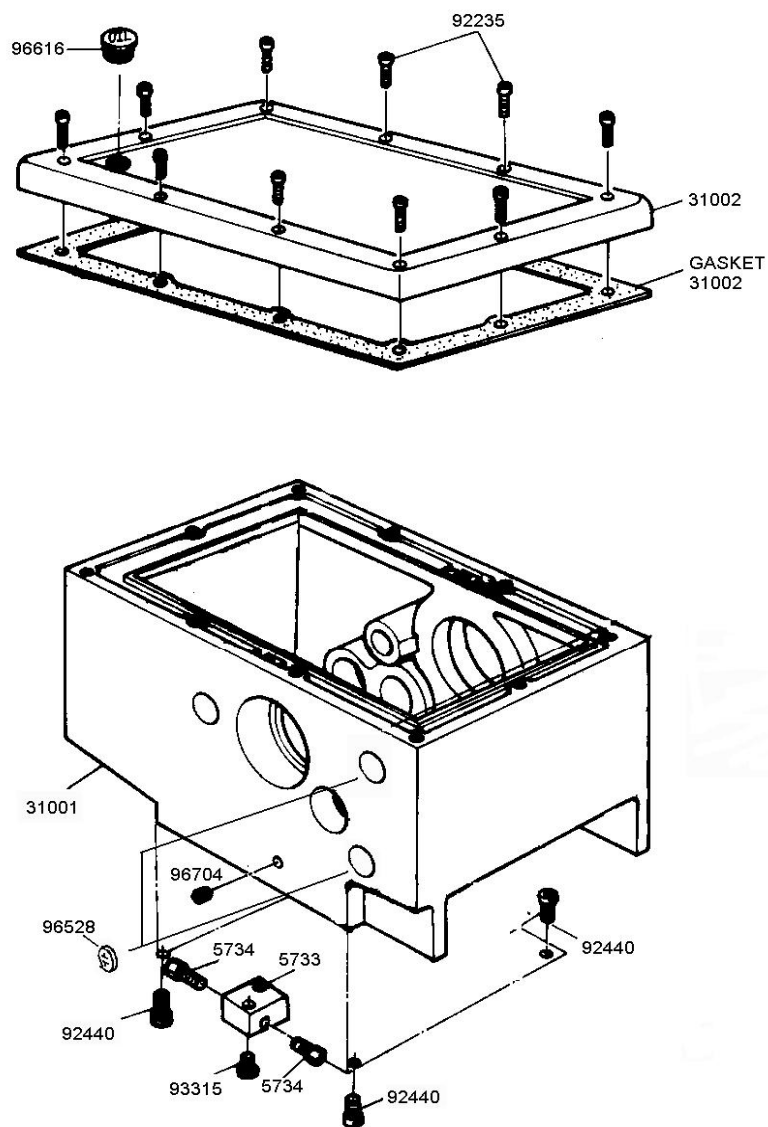
Figure 4-12

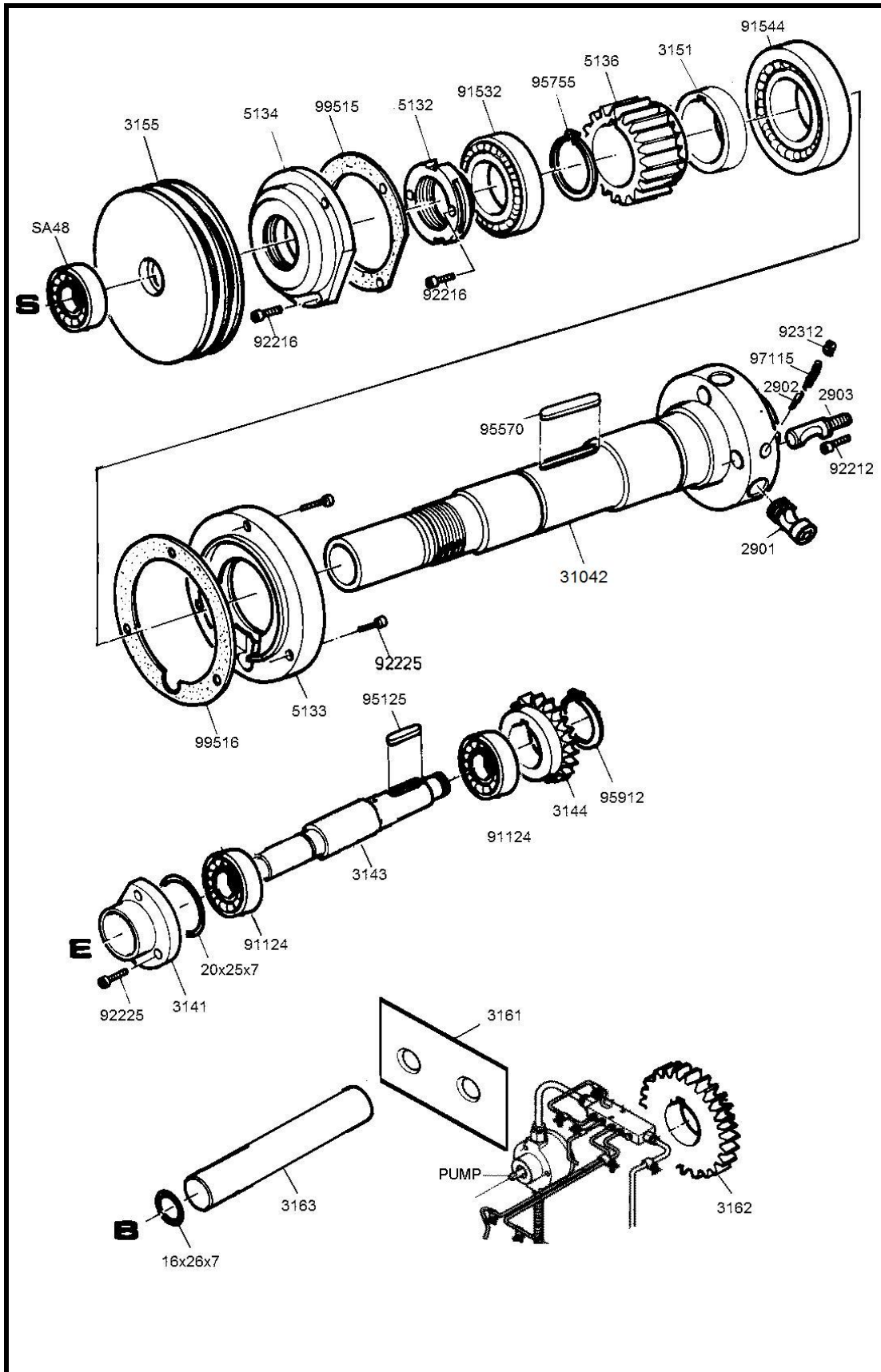
4.2.3.4 Miscellaneous Information

For all oil pointers 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 SAE 30 lubricating oil.

5.0 Drawings & Parts Lists

5.1 Headstock



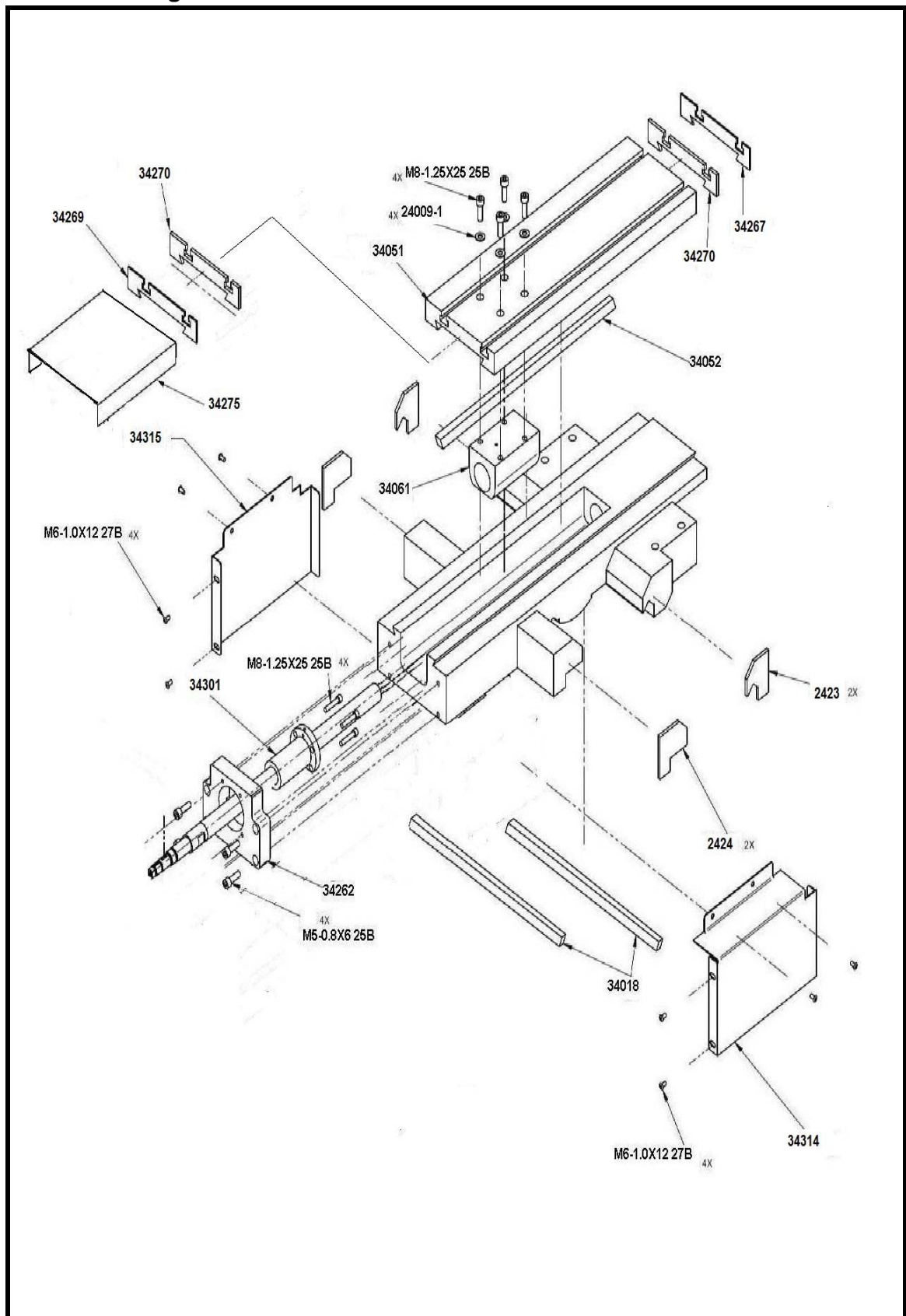


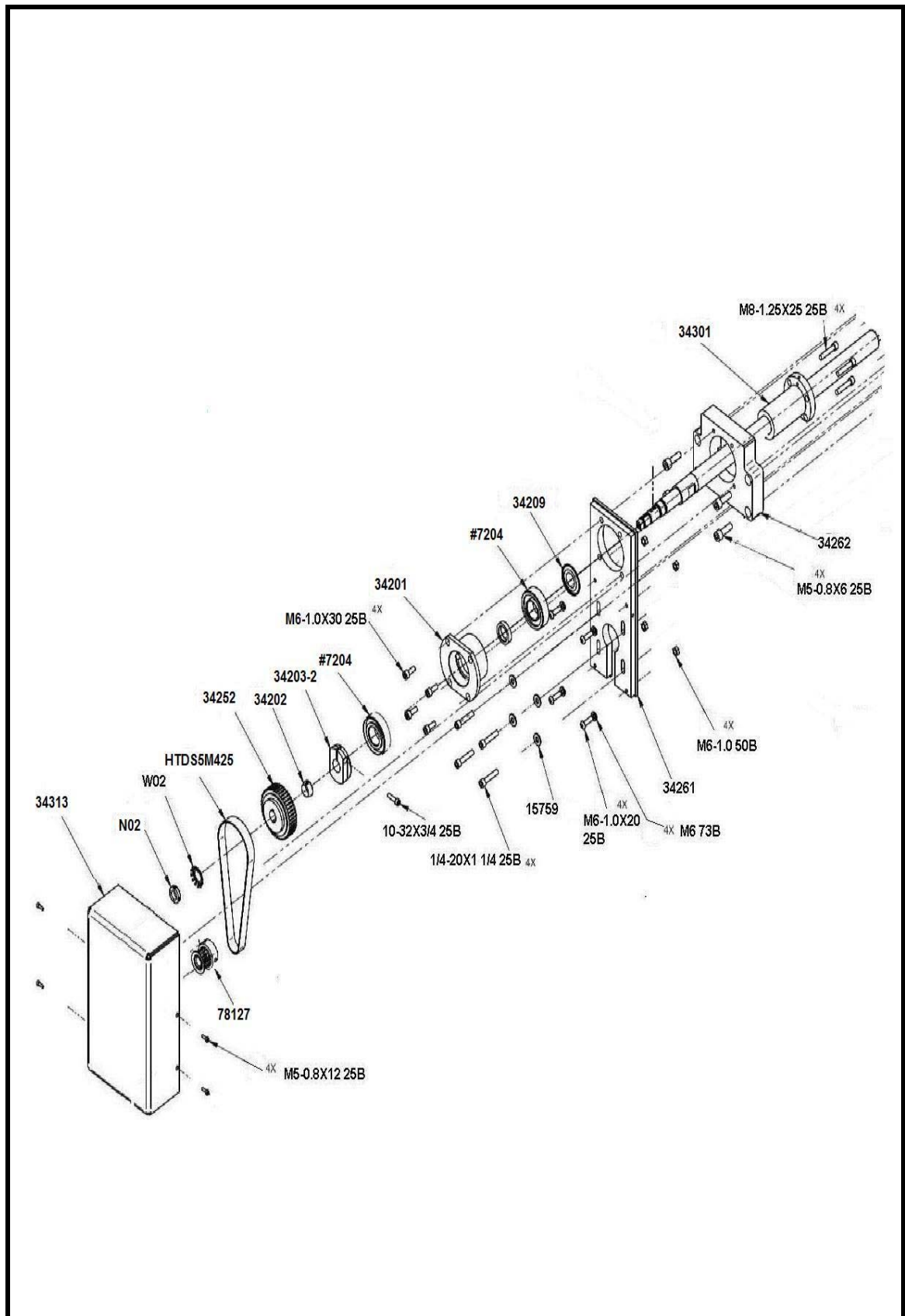
Headstock part list

Item	P/N	Title	Qty
1	31001	Casting - Headstock	1
2	31002	Cover - Headstock	1
3	92235	CAP SCREW M6X35	10
4	96616	PLUG	1
5	96528	OIL SIGHT 28MM	1
6	96704	PLUG 1/2 GP	1
7	5734	SCREW	2
8	5733	SWING FRAME	1
9	92440	CAP SCREW M10X40	4
10	SA48	COLLAR SA48	1
11	3155	PULLEY	1
12	5134	COVER	1
13	99515	GASKET	1
14	5132	NUT	1
15	91532	BEARING #30210	1
16	95755	CIRCLIP S55	1
17	5136	GEAR	1
18	3151	COLLAR	1
19	91544	BEARING #32212	1
20	99516	GASKET	1
21	5133	COVER	1
22	92225	SCREW M6X35	6
23	95570	KEY	1
24	31042	SPINDLE	1
25	2901	CAM	3
26	2902	DETENET PLUGER	3
27	2903	CAM LOCK STUD	3
28	92212	CAP SCREW M6X12	3
29	92312	CAP SCREW M8X12	3
30	97115	SPRING 3/16"X15	3
31	3141	COVER	1
32	20x25x7	O-RING 20X25X7MM	1
33	91124	BEARING #6004Z	2
34	3143	SHAFT	1
35	95125	KEY 4X25MM	1

36	3144	GEAR	1
37	95912	CIRCLIP S12	1
38	16x26x7	O-RING 16X26X7MM	1
39	3163	SHAFT	1
40	3161	BASE	1
41	3162	GEAR	1

5.2 Carriage



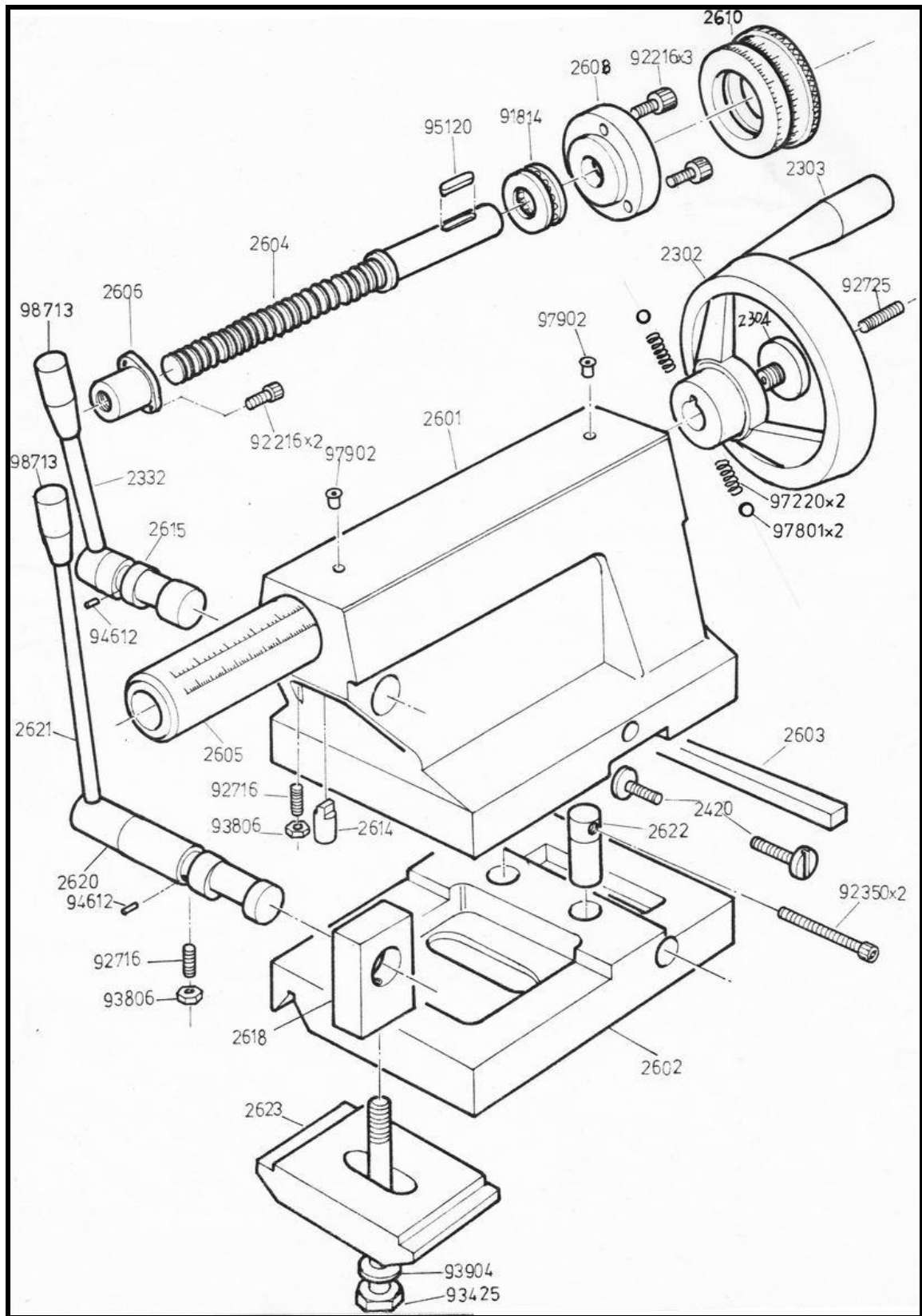


Carriage Parts List

Item	P/N	Title	Qty
1	98481A090	KEY WOODRUFF #404-1/8 X 1/2	1
2	34252	PULLEY- BALL SCREW	1
3	W02	LOCKWASHER	1
4	N02	NUT-LOCK	1
5	HTDS5M425	BELT-TIMING	1
6	1/4-20X1 1/4 25B	SCREW-SHCS-STL-BO	4
7	15759	WASHER-1/4 HARD BLK OX 1/8 THK	4
8	34202	FERRULE-SPROCKET	1
9	34313	COVER-X-AXIS MOTOR PULLEY	1
10	34203-2	NUT CLAMP-X-AXIS	1
11	10-32X3/4 25B	SCREW-SHCS-STL-BO	1
12	#7204	BEARING SET(2)-7204 BECBP	2
13	M6-1.0X30 25B	SCREW-SHCS-STL-BO	4
14	34201	BEARING HOUSING	1
15	34209	NILOS RING-AVH 7204	1
16	34261	MOTOR PLATE	1
17	M5-0.8X6 25B	SCREW-SHCS-STL-BO	4
18	34262	CLAMPING BLOCK	1
19	34301	BALLSCREW X-AXIS	1
20	34051	CROSS SLIDE	1
21	M8-1.25X25 25B	SCREW-SHCS-STL-BO	8
22	34018	GIB-Z-AXIS	2
23	34052	GIB-X-AXIS	1
24	24009-1	WASHER - BELLEVILLE SPRING LOCK	4
25	34061	YOKE	1
26	M5-0.8X12 25B	SCREW-SHCS-STL-BO	2
27	34267	CHIP WIPER CROSS SLIDE(2445 FRONT)	1
28	2423	CHIP-WIPER-SADDLE FRONT	2
29	2424	CHIP-WIPER-SADDLE REAR	2
30	78127	SERVO MOTOR PULLEY X AXIS	1
31	34315	COVER-X-AXIS MOTOR	1
32	34275	END COVER –CROSS SLIDE	1
33	M6 73B	WASHER-SPLIT LOCK-STL-BO	4
34	M6-1.0 50B	NUT-HEX-STL-BO	4
35	M6-1.0X20 25B	SCREW-SHCS-STL-BO	4

36	M6-1.0X12 27B	SCREW-BHCS-STL-BO	8
37	34270	CHIP WIPER CROSS SLIDE(2448 REAR)	1
38	34269	CHIP WIPER CROSS SLIDE PLATE	1
39	34267	CHIP WIPER CROSS SLIDE PLATE	1

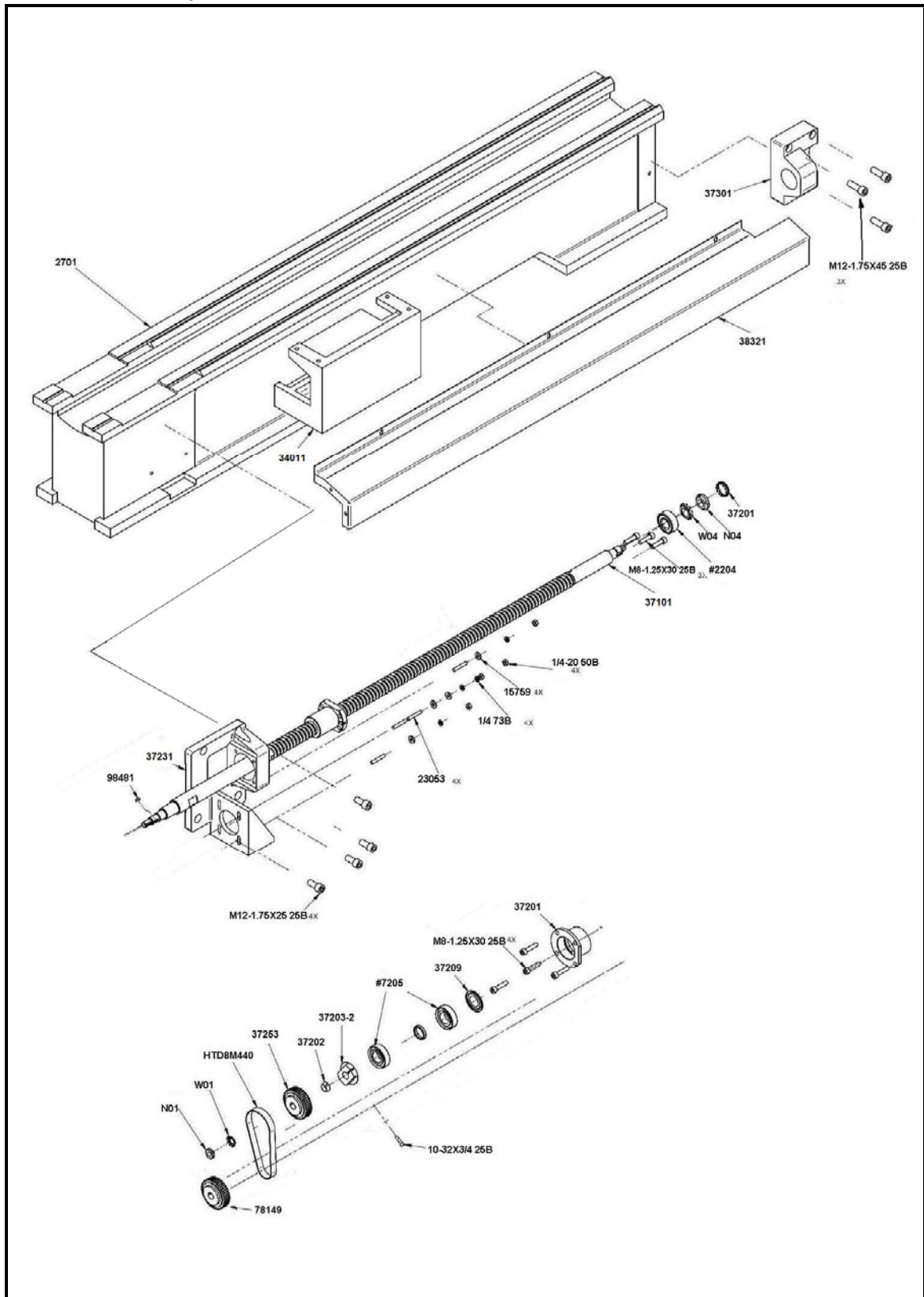
5.3 Tailstock



Tailstock Part list

Item	P/N	Title	Qty
1	2606	NUT-LEAD SCREW	1
2	2604	LEADSCREW	1
3	2603	HANDLE-HANDWHEEL	1
4	98713	KNOB (3/8")	2
5	91814	BEARING- Thrust(#51103)	1
6	2302	HANDWHEEL	1
7	2623	CLAMP-PLATE	1
8	2605	QUILL-TAILSTOCK	1
9	2601	TAILSTOCK	1
10	2602	BASE	1
11	2614	KEY	1
12	93904	WASHER-1/2	1
13	2615	SHAFT	1
14	2620	SHAFT	1
15	93425	NUT-HEX-1/2X13	2
16	2629	SCREW-HOIST	1
17	92216	CAP SCREW M6X15	5
18	2608	ASSY- KEEP	1
19	2610	INDEX RING	1
20	92725	SCREW M6X15	1
21	2332	HANDLE-QUILL LOCK	1
22	2621	HANDLE-BASE LOCK	1

5.4 Bedway



Bedway Parts List

Item	P/N	Title	Qty
1	98481A090	KEY WOODRUFF #404-1/8 X 1/2	1
2	37253	Z AXIS BALLSCREW PULLEY	1
3	W01	LOCKWASHER	1
4	N01	LOCKNUT	1
5	HTD 8M 440	BELT- TIMING	1
6	23053	STUD-1/4-20X1 1/2-FULLY THREADED-GRADE 2	4
7	15759	WASHER-1/4 HARD BLK OX 1/8 THK	4
8	37202	FERRULE-SPROCKET	1
9	1/4 73B	WASHER-SPLIT LOCK-STL-BO	4
10	1/4-20 50B	NUT-HEX-STL-BO	4
11	37201	PLUG-Z-AXIS COVER	1
12	37231	BRACKET-Z-AXIS MOTOR	1
13	M12-1.75X25 25B	SCREW-SHCS-STL-BO	4
14	37203-2	NUT CLAMP-X ,Y, & Z-AXIS	1
15	10-32X3/4 25B	SCREW-SHCS-STL-BO	1
17	37201	HOUSING- BEARING Z-AXIS	1
18	#7205	BEARING SET (2) -ANGULAR CONTACT-7205 BECBP	2
19	37209	NILOS RING-7205 AVH	1
20	37301	BALLSCREW - Z-AXIS	1
21	34011	YOKE-Z-AXIS	1
22	M8-1.25X30 25B	SCREW-SHCS-STL-BO	7
23	#2204	BEARING-SELF ALIGNING	1
24	W04	LOCKWASHER	1
25	N04	LOCKNUT	1
26	M12-1.75X45 25B	SCREW-SHCS-STL-BO	3
27	37301	HOUSING-TAILSTOCK BEARING	1
28	78149	SERVO MOTOR PULLY	1
29	38231	COVER-Z-AXIS	1
30	2701	BEDWAY	1

Exploded view diagram of a machine assembly, showing various components and their assembly relationships. The diagram includes the following labeled parts:

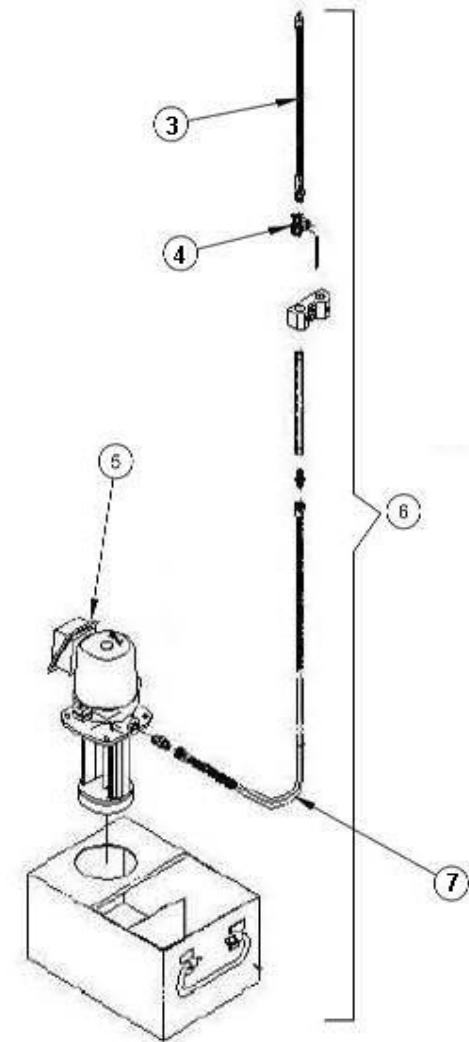
- 38682
- 38681
- 38677
- 38690
- 78217
- 38689
- 38689-2
- 38665
- 38664
- 38663
- 38662
- 38114
- 38652
- 38305
- 38722
- 38623
- 38622
- 38631-4
- 38678
- 38204
- 38721
- 38614-4
- 38614
- 38410
- HEADSTOCK
- BEDWAY
- 38115
- 38647
- 34314
- 34315
- 34313
- 78167
- 38653
- 38649
- 38659-5
- 38731
- 38735
- 38726
- 38726-6

Part list of NC lathe

Item	P/N	Title	Qty
1	38682	Electrical Box Door	1
2	38681	Electrical Box	1
3	38677	Electrical Panel	1
4	38685	Power Switch base	1
5	38731	Splash guard	1
6	38735	Splash guard cover	1
7	38609	Panel Arm	1
8	78217	Disk	2
9	38689	Panel Box	1
10	38689-2	Panel back cover	1
12	38647	Cable stand	1
13	38313	X-axis Motor Right cover	1
14	38314	X-axis Motor Left cover	1
15	38315	X-axis Motor Back cover	1
16	38115	Chuck Guard	1
17	78167	Z axis limit switch stand	1
18	38663	Headstock Cover	1
19	38664	End cover Door	1
20	38665	Spindle hole cover	1
22	38662	Headstock Right cover	1
23	38114	Cover	1
24	38726	Tailstock Cover	1
25	38726-6	Tailstock End Cover	1
27	78649	Guide - Upper	1
28	38678	Shaft - Bearing - Door - Upper	4
29	38682	Left Door	1
30	38653	Right Door	1
31	38204	Window frame	2
32	38659	Guide - Bottom	1
33	38305	Tray - Chip	1
34	38721	Z axis Motor cover	1
35	38722	Hand wheel Box	1
36	38631-4	Tray - Chip - Bottom	1
37	38621	Tool Cabinet	1
38	38614-4	Tool Cabinet Door	1

39	38614	Base	1
40	38410	Coolant pump cover	1
41	38622	Motor side cover	1
42	38623	Motor front cover	1

5.6 Handwheels & coolant assembly



Item	P/N	Title	Qty
3	26161	Pipe - Spraying	1
4	26162	Valve - Gate	1
5	23265	Pump Coolant 1/8 HP	1
6	26160	Coolant Pump Kit	1
7	26166	Hose - Flexible	1

6.0 EQUIPMENT & ACCESSORY CHECK LIST

ITEM		SPECIFICATION	QTY	REMARK
1	3 Jaw Chuck	6"	1	
2	Steady Rest		1	
3	Follow Rest		1	
4	Manual	Machine, control	1	
5	Feed		6	
6	Toolbox		1	
7	Center	MT3	2	
8	Sleeve	MT3	1	
9	Oil Gun		1	
10	Wrench	12x14, 17x19	2	
11	Hex key	3, 4, 5, 6, 8,	5	
12	Screw driver	Slot, Phillip	2	
13	Camlock spindle wrench		1	
INSPECTOR :		INSPECTION RESULT :		