
High Speed Precision Lathe
HIGH-SPEED PRECISION LATHE
MS TYPE

WHACHEON U.S.A., INC.
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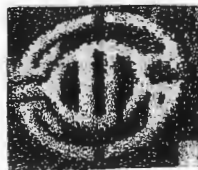
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SAFETY PRACTICES

Each machine is shipped with a variety of built-in safety devices. However, careless handling of the machine may lead to serious accidents.

To prevent such a situation from occurring, all operators must carefully read the manuals supplied by Mori Seiki so that they understand the machine before trying to operate it.

Because there are so many "things which cannot be done" and "things which must not be done", all prohibited information cannot be specified in the Instruction Manual.

Assume that something is impossible unless the manual specifically states that "it can be done".

The following pages describe fundamental safety information.

All items described must be carefully observed when operating the machine or performing maintenance work. Failure to observe fundamental safety information can lead to serious operator injury and machine damage. All operators must strictly follow this information.

[Signal Word Definition]

DANGER :

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING :

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION :

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damages to the machine.

NOTE :

Indicates comments and items for which care should be exercised.

1. PRECAUTIONS WHEN INSTALLING THE MACHINE

(1) Installation Site

WARNING : The machine must not be subject to direct sunlight. Chips, coolant, and oil must not be splashed on the machine. The machine must not be subject to any excessive vibrations.

Ambient temperature: 0 to 35°C

Humidity: 75%RH or less (without condensation)

(2) Power Supply

CAUTION : Excessive voltage drop due to insufficient power capacity will cause irregular spindle rotation. The power cables must be connected directly and independently to the plant power distribution board.

(3) Grounding

DANGER : The machine must be grounded independently of other machines. The ground wire must be as short as possible and have the same diameter as the input power cable.

Class 3 ground

Grounding resistance: 100 Ω or less

(4) Installation

WARNING : a) Maintenance space must be secured.

Install the machine so that the covers can be mounted or removed without interference.

Chips must be pulled out from the machine easily.

CAUTION : b) Make sure that the floor is strong enough to support the machine. The surface where the machine is installed must be smooth and flat.

CAUTION : c) If rust prevention coating has been applied to the slideway surfaces, it must be removed completely before operation. If any rust prevention coating remains on the slideway surfaces when the machine is operated, it will damage the slide seals.

CAUTION : d) Hooks are fitted to the machine for machine lifting and transporting. These hooks must be removed before turning on the power.

CAUTION : e) Select an installation site where dust and mist must be kept to a minimum.

DANGER : f) Use the specified wires and shackles that are strong enough to support the weight of the machine to hoist the machine.

CAUTION : g) After installing the machine, the machine must be leveled. The machine's crown and distortion values must be adjusted according to the Accuracy Test Results Chart delivered with the machine.

DANGER : h) Electrical work should be carried out only by authorized electrical engineers.

(5) Before Turning ON the Power After Installation

The following points must be checked after installation and before turning the power supply ON.

CAUTION : a) Make sure that all bolts are tightened securely.

CAUTION : b) Make sure that the all hoses and pipes are connected securely.

CAUTION : c) Power supply

Check the input voltage and all the L1/L2/L3 phases of input power.

The main power disconnect switch may be turned ON only after the results of the checkups described above is correct.

CAUTION : d) Do not begin cutting immediately after turning on the power supply.
Turn the handles on the apron to move the carriage and tool post slowly so that all slideway surfaces will be lubricated properly.

2. PRECAUTIONS FOR TURNING ON POWER IN DAILY OPERATION

- WARNING :** (1) Always check that there are no obstacles or people near the machine's movable parts before operating the machine.
- CAUTION :** (2) Before starting machine operation, make sure that the lubricating oil gage on the headstock indicates the correct value.
- CAUTION :** (3) Turn the handles on the apron to supply lubricating oil to the slideway surfaces first before starting to cut. Also, break in the spindle for at least 15 minutes.
- CAUTION :** (4) If the machine stops due to a power failure, turn the main switch (no-fuse circuit breaker) OFF immediately.
- CAUTION :** (5) The machine cannot operate unless the power is supplied correctly. A momentary power stoppage due to a power failure or lightening can cause an accident.
- CAUTION :** (6) Before turning off the power at the main switch, stop the spindle first.
- CAUTION :** (7) Before leaving the machine, stop the machine and turn off the power.

3. SAFETY PRACTICES DURING MANUAL OPERATION AND SETUP

- WARNING :** (1) The machine should be operated by one, well-trained person only.
- Injury can occur if more than one person operates the machine; for example, the machine could be started by one operator while the other operator is changing the fixture or chuck jaws.
- When two or more persons are working on the machine simultaneously, everyone must be able to communicate with each other and know what action everyone else is performing.
- WARNING :** (2) Always turn off the power before performing setup.
- CAUTION :** (3) Make sure that the tool holders, tools and jaws are all tightened securely. They should be mounted and well balanced so that they will not interfere with the workpiece or the machine.
- WARNING :** (4) When a manual chuck is used, always remove the clamp handle from the chuck after tightening.
- WARNING :** (5) Determine the spindle speed by taking cutting conditions into consideration.

4. SAFETY PRACTICES DURING MANUAL AND AUTOMATIC OPERATION

WARNING : (1) Never remove the covers unless absolutely necessary.

WARNING : (2) Never start the spindle without the side cover in place.

WARNING : (3) Never insert bar stock into the spindle while the spindle is rotating.

CAUTION : (4) When machining short bar stock, always use guide bushing.

When a short bar stock is to be machined, its length must be shorter than the spindle length and guide bushing must always be used. If the bar stock extends from the headstock, it will spin and constitute a hazard.

DANGER : (5) Never inadvertently open the cover while the spindle is rotating.

DANGER : (6) Turn the power OFF before touching parts which may rotate.

WARNING : (7) Never start machine operation without the safety devices in place.

CAUTION : (8) Never put any tools or instruments on the moving units of the machine or on any machine parts.

WARNING : (9) Cover your hair and do not wear loose clothing and jewelry to avoid becoming tangled or caught in the machine. Always wear proper shoes when operating the machine.

WARNING : (10) Clamp the workpiece and cutting tools securely. Depth of cut and cutting feed must be selected with small values.

WARNING : (11) Never stand in front of the rotating unit or the spindle. During setup or test cutting, the workpiece, cutting tools, or chuck jaws might fly out. Therefore, never stand in front of the chuck.

WARNING : (12) To remove chips entangled in the workpiece, stop the spindle. Never try to remove chips on the workpiece while the spindle is rotating.

CAUTION : (13) Be careful not to operate the wrong switch or lever.

Visually check the switches on the operation panel before operating them.

WARNING : (14) After completion of a cycle, before removing a machined workpiece and setting a new workpiece, always check that the spindle has stopped.

WARNING : (15) Carefully check the workpiece chucked conditions and the center pressing conditions for center work operations.

5. SAFETY PRACTICES DURING MAINTENANCE

- CAUTION :** (1) When cleaning the machine, do not use compressed air.
- The drain, provided in the spindle front cover to keep coolant from entering the spindle bearings, must be kept clean and unblocked by foreign matter.
- WARNING :** (2) If repair or cleaning must be performed inside the machine, always turn off the power.
- WARNING :** (3) Use only fresh, uncontaminated lubricating oil as specified in this manual. Clean the reservoirs and filters in the lubrication line periodically and check for damages to the lubrication equipment and piping.
- CAUTION :** (4) Disassemble and clean the chuck periodically. Apply grease to the chuck every day.
- CAUTION :** (5) Machine installation and repair should be carried out only by a specially-trained person following the procedure described in the Instruction Manual.
- Before beginning repair, always turn off the power.
- CAUTION :** (6) If the machine is to be modified, consult Mori Seiki.
- CAUTION :** (7) With a special specification machine, operate the machine to meet the machine specifications.

6. DAILY MAINTENANCE

- CAUTION :** (1) Clean the machine so that any abnormalities can be found easily.
- CAUTION :** (2) Make sure that lubricating oil is properly supplied to the slideways.

The machine is provided with variety of safety devices. However, to operate the machine safely, it is necessary that operators follow the cautions and related information given in the Instruction Manual and the labels on the machine. Whether the machine can be operated safely for a prolonged period depends on the user's correct daily inspection and maintenance.

7. SAFETY PRACTICES DURING MACHINE OPERATION

When operating a lathe, the accuracy of the finished product cannot be maintained unless the following check points are satisfied. Failure to observe these check points can also cause to accidents.

Check Points

- CAUTION :** (1) When chucking a workpiece, determine the chucking method and chuck pressure by considering the rigidity of the workpiece so that the workpiece will not be distorted by the chuck.
- WARNING :** (2) Allow a sufficient chucking amount so that the workpiece will not come out of the chuck due to the cutting force or centrifugal force generated by spindle rotation. Depending on the shape of the workpiece, it may need to be supported by the tailstock.
- CAUTION :** (3) Machine vibration will result when the center of gravity of a workpiece is not at the chuck rotating center. This, in turn, will deteriorate the accuracy of the machined workpiece.
- It is necessary to balance the workpiece with a balancing weight.
- NOTE :** (4) If any chips are entangled on the workpiece or cutting tool, surface roughness will be deteriorated. Select a cutting tool which will not cause entangled chips.
- CAUTION :** (5) Careless tooling will cause interference between the tools and the workpiece being cut or the tailstock. Check the tooling carefully to avoid interference.
- NOTE :** (6) Workpiece materials and shapes will vary widely.
- It is necessary to select the cutting conditions best suited to each workpiece in order to obtain the required accuracy.
- CAUTION :** (7) Before starting the day's operation, break in the spindle and the axes. This will minimize the influence of thermal distortion on workpiece accuracy.
- NOTE :** (8) If bar stock is used, its bend has critical influence on the accuracy of the finished workpiece. Use straight bar stock only.
- NOTE :** (9) When forged or cast workpieces are used, the cutting allowance varies greatly from the finished dimensions. To avoid this variation, either write a program in which takes the variation into consideration or perform pre-machining so that a uniform cutting allowance is left on the workpiece.

8. PRECAUTIONS WHEN SELECTING COOLANT

There are a variety of types of coolant available on the market. Mori Seiki does not specify the type of coolant to be used. Choose a coolant suitable for the user's applications by consulting the supplier, taking the following requirements into consideration.

- CAUTION :** (1) The coolant must be free of constituents with adverse effects (smell, poisoning, etc.) on human beings.
- CAUTION :** (2) The coolant must not deteriorate during storage.
- CAUTION :** (3) The coolant must not cause corrosion of the machine.
- CAUTION :** (4) The coolant must not peel the coating off the machine.
- CAUTION :** (5) The coolant must not cause swelling of rubber parts.
- CAUTION :** (6) The coolant must not cause deterioration of accuracy.

Note that Mori Seiki cannot be held responsible for any trouble arising from the use of coolant.

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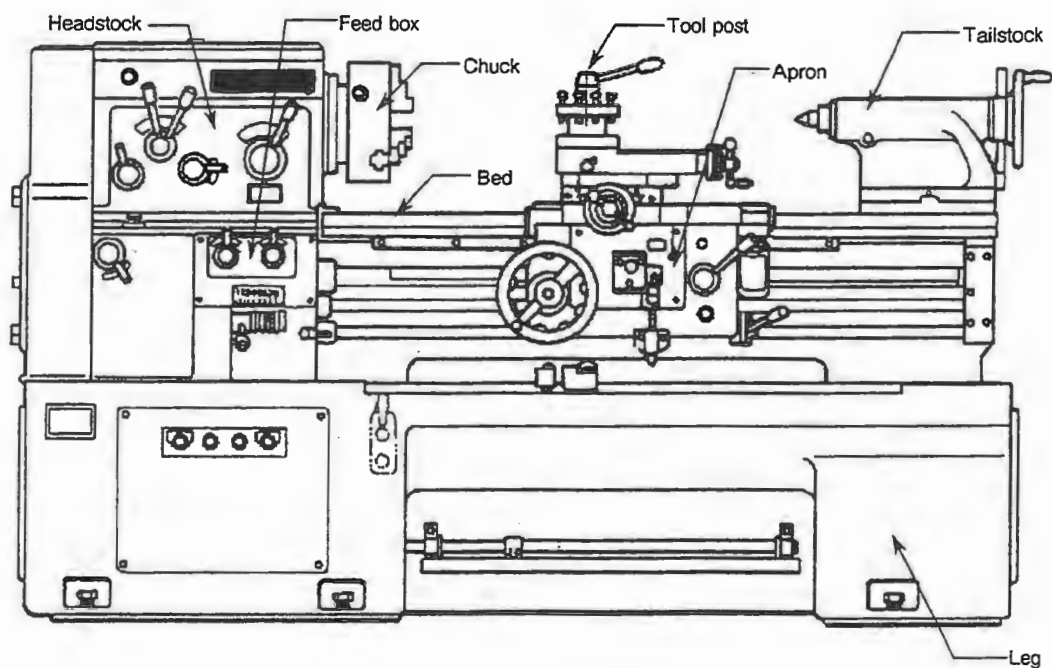
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1. NOMENCLATURE

1.1 Nomenclature of Major Machine Units



1.2 Parts Identification

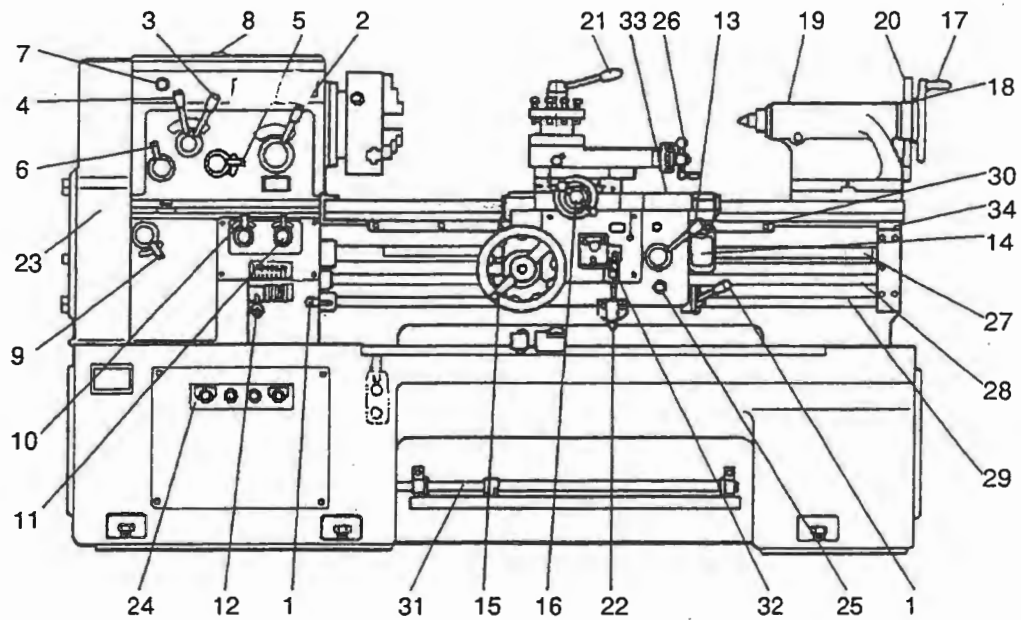


Table 1

No.	Name	No.	Name
1	Starting lever	18	Tailstock spindle micrometer collar
2	HIGH/LOW shift lever	19	Tailstock spindle clamp lever
3	Spindle speed shift lever (1)	20	Tailstock clamp lever
4	Spindle speed shift lever (2)	21	Tool post clamp lever
5	A/B feed lever	22	Automatic longitudinal feed stop
6	Normal/reverse feed lever	23	Change gear box
7	Headstock oil window	24	Operation panel
8	Headstock oil supply port	25	Apron oil window
9	Feed box C/D lever	26	Compound rest handle
10	Feed box G/F/E lever	27	Lead screw
11	Feed box I/STOP/H lever	28	Feed shaft
12	Quick changing lever	29	Starting rod
13	Thread cutting half-nut lever	30	Rack
14	Thread cutting indicator	31	Brake pedal
15	Longitudinal feed handle	32	Automatic feed lever
16	Cross feed handle	33	Carriage brake
17	Tailstock handle	34	3-shaft supporter

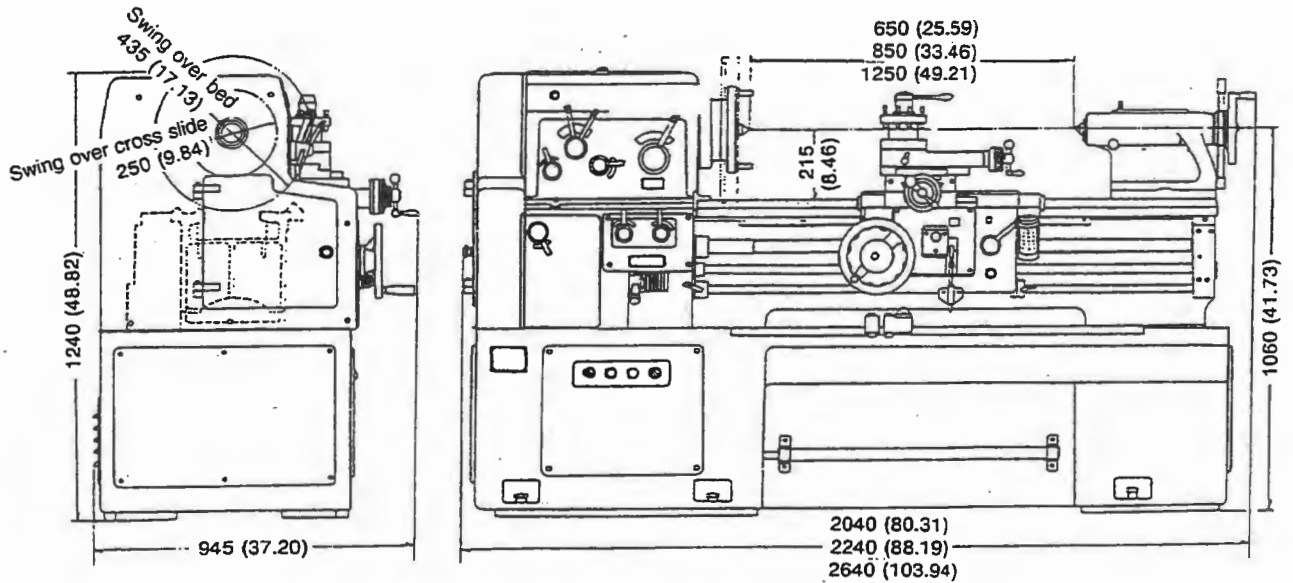
2. SPECIFICATIONS

2.1 Machine Specifications

Table 2

MS Series		MS-650	MS-850	MS-850G	MS-1250	MS-1250G
CAPACITY	Swing over bed mm (in.)	435 (17.13)				
	Swing over bed from face plate up to 180 mm (7") mm (in.)	490 (19.29)				
	Swing over cross slide mm (in.)	250 (9.84)				
	Swing over gap mm (in.)			650 (25.59)		650 (25.59)
	Distance from floor to spindle center mm (in.)	1075 (42.32)				
	Distance from bed to spindle center mm (in.)	215 (8.46)				
	Between centers mm (in.)	650 (25.59)	850 (33.46)		1250 (49.21)	
SPINDLE	Spindle nose	JIS A ₁ -6				
	Through spindle hole diameter mm (in.)	52 (2.05)				
	Spindle sleeve taper	MT6				
	Spindle center taper	MT4				
	Number of spindle speeds	12				
	Spindle speed range min ⁻¹ , {rpm}	32, 62, 82, 112, 160, 200, 285, 395, 510, 710, 1010, 1800				
FEEDS	Number of feed changes (both longitudinal and cross feeds)	40				
	Range of longitudinal feeds mm/rev (in./rev)	0.045-0.627, 0.090-1.254 (0.0018-0.0250, 0.0036-0.0500)				
	Range of cross feeds mm/rev (in./rev)	0.045-0.627, 0.090-1.254 (0.0010-0.0154, 0.0020-0.0304)				
THREAD CUTTING	Lead screw	31.75 mm (1-1/4") dia. x Acme thread 4 T.P.I. or 6 mm pitch				
	Inch threads	80-4 T.P.I.				
	Metric threads	0.25-7 mm pitch				
	D.P. threads	112-8				
	Module threads	0.5-3.5				
TOOL POST	Cross slide travel mm (in.)	255 (10.04)				
	Compound rest travel mm (in.)	150 (5.91)				
	Max. cutting tool size (X x Y) mm (in.)	25 (0.98)				
TAILSTOCK	Tailstock spindle travel mm (in.)	150 (5.91)				
	Spindle center taper	MT4				
BED	Bed width mm (in.)	352 (13.86)				
	Width of gap (from face plate) mm (in.)			220 (8.66)		220 (8.66)
	Bed length mm (in.)	1680 (66.14)	1880 (74.02)		2280 (89.76)	
MOTOR	Main motor kW (HP)	3.7 (5) × 4P				
	Coolant pump motor W (HP)	100 (1/8) × 2P				
MASS OF MACHINE kg (lb.)		1670 (3674)	1800 (3960)	1840 (4048)	2000 (4400)	

2.2 External View Unit : mm (in.)



2.3 Standard Accessories

Table 3

Accessory	Description
4-jaw independent chuck with handle	12", 1 set
Driving plate	240 mm (9-1/2") dia., 1 set
Change gear (72 teeth)	1
Worm gear	24, 20, 19, 14 teeth (only mm specification)
Center sleeve	MT6
Center	MT No. 4, 2 pcs. (1 pc. carbide tipped)
Installation blocks	6
Phillips head screwdriver	1
Hexagonal wrench	4, 5, 6, 8, 10, 14 (G type only) 1 each [1/4", 5/16" (for cam-lock type)]
Single-ended spanner	13, 32 1 each
Wrench	19
Box handle	□12, □24 1 each
Coolant pump	1 (optional on MS-650)

2.4 Optional Accessories

Table 4

Accessory	Accessory
3-jaw 10" scroll chuck (with soft jaw)	Copying attachment
Face plate 400 mm (15-3/4") dia.	Taper cutting attachment 300-type
Face plate 550 mm (21-5/8") dia., G type only	Steady rest
Worm gear (22, 13 teeth)	Follow rest
D.P. module change gears	Inverse tool post (rear-side turret)
1-stage carriage micro stop	Drill attachment
6-stage carriage stop	Chuck cover

NOTE : When the machine is delivered, the change gears installed in the machine are: 36 teeth gear in the headstock and 72 teeth gear (with shear pin) in the feed box.

As the worm gear, a P6 mm, 16 teeth gear is set in the machine for metric specification lathes and a $P = 1/4"$, 16 teeth gear is set in the machine for inch specification lathes.

Other gears are supplied in accessory packages.

The worm gear for module or D.P. gear cutting and gears for thread cutting are optional.

The gear combination chart for thread cutting is located at the back side of the door to change gear box (23) at the left side of the machine.

3. INSTALLATION

3.1 Foundation Work

To reduce vibration, Mori Seiki high-speed precision lathe MS type is constructed so that the legs and bed are formed as one piece, and major parts have been reinforced to withstand vibration. Vibration produced during cutting is transferred through the foundation and absorbed by the ground. To ensure high-speed, precision, and heavy-duty cutting while obtaining maximum performance of carbide cutting tools, foundation work is very important.

Foundation work should be completed 10 days before the delivery of the machine according to the foundation plan.

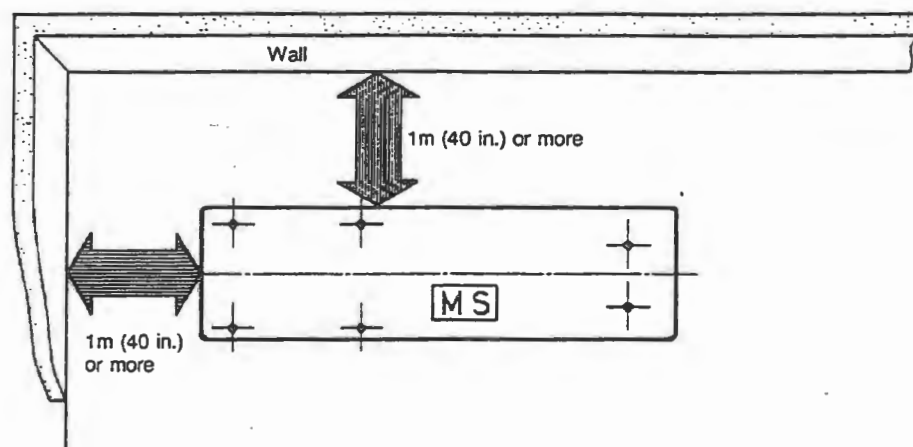
1) Preparations

Table 5

Part Name	Q'ty	Description
Anchor bolts (with nuts and washers)	6	12 mm (1/2") dia. (See foundation plan.)
Holder plate	6	Steel or iron plates of 130 x 180 x 20 - 25 mm (5" x 7" x 1")
Installation blocks	6	Standard accessory

2) Installation site

Since chips are disposed from the rear of the machine, a clearance of at least 1000 mm (40 in.) is required between the rear of the machine and the wall or any stationary object. At the left side of the machine, 1000 mm (40 in.) or more clearance is necessary as well.



3.2 Foundation Plan Unit : mm (in.)

< Plain View >

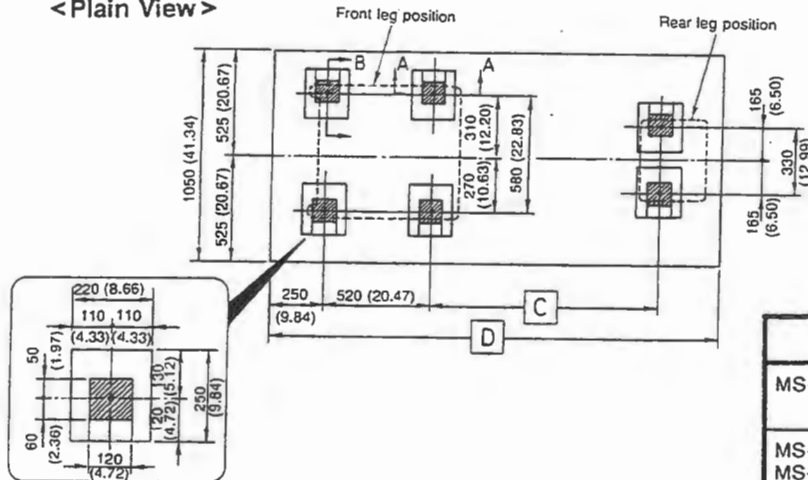
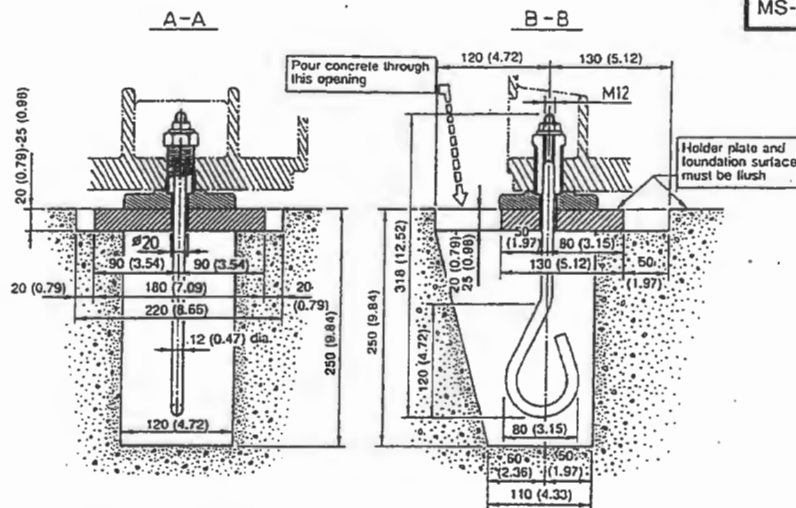


Table 6

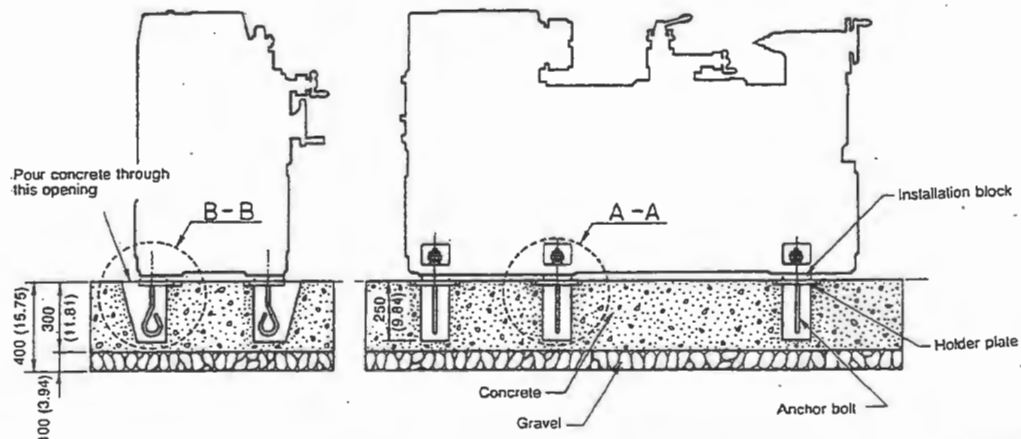
	C	D
MS-650	945 (37.20)	2000 (78.74)
MS-850 MS-850G	1145 (45.08)	2200 (86.61)
MS-1250 MS-1250G	1545 (60.83)	2600 (102.36)

Unit: mm (in.)

< Cross-sectional View >



NOTE : The dimensions below are for a foundation built on average ground. If the ground is less rigid than average, the concrete depth should be increased.



3.3 Unpacking

The machine is shipped with a rust-prevention oil coating.

After placing the machine at the installation site, remove the coating with an alcohol-soaked rag.

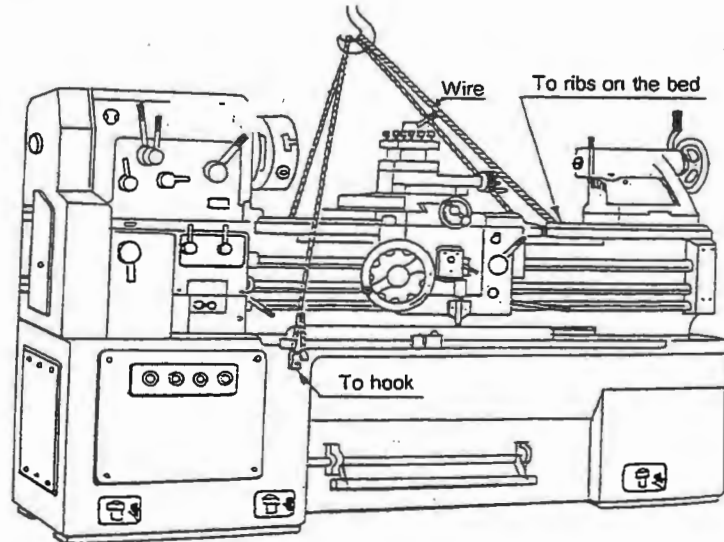
NOTE : Do not use thinner. Thinner will attack the paint coated on the machine and the numbers on the graduation rings.

3.4 Hoisting the Machine

DANGER : *The machine should be lifted only by an authorized person.*

Hoist the machine only in the manner as illustrated below. In this way, the machine can be hoisted without damage.

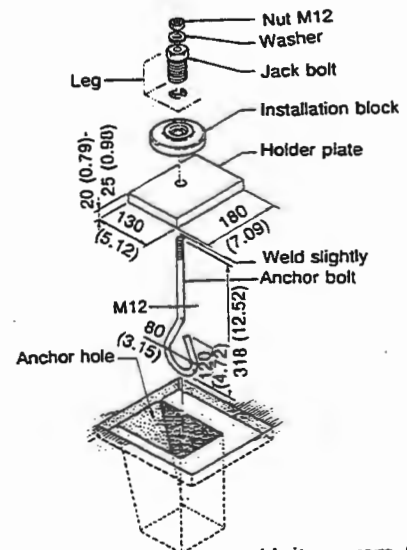
Lift or lower the machine gently. Be especially careful when placing the machine on the floor so that the machine will not be bumped against the floor.



3.5 Installation

Move the machine to the installation site. Set the anchor bolts, holder plates, installation blocks and jack bolts as illustrated right. Gradually lower the machine over the anchor holes and level the machine approximately using the jack bolts.

Level the machine precisely using anchor bolts and jack bolts after the secondary concrete is completely cured.



Unit : mm (in.)

3.6 Adjusting Machine Level

Adjust the machine level so that straightness at the bed slideway surfaces is within 0.02 mm per 1 m both in the longitudinal and transverse directions. Adjust the machine level after tightening the jack bolts and anchor bolts securely.

Since the machine level will change gradually after adjustment, it should be checked at least every 6 months.

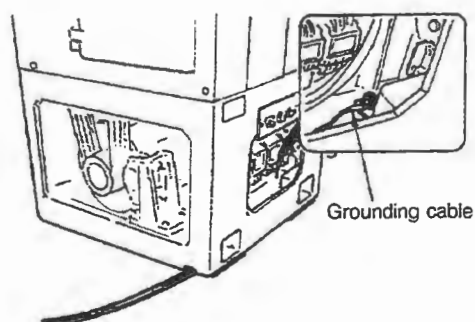
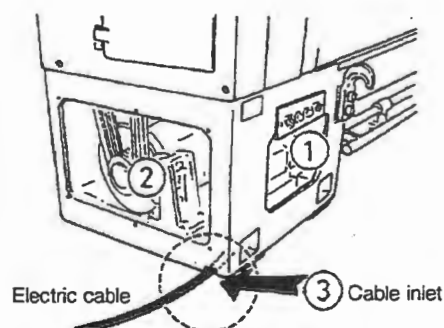
Accuracy of the machined workpieces depends on the accuracy of the machine level. Pay sufficient care to the machine level.

3.7 Electrical Connection

DANGER : *Electrical connections should be performed only by authorized electricians.*

- 1) Remove covers (1) and (2).
- 2) Run the electric cable (14 mm²) through cable inlet (3) at the left side of the leg.
- 3) Connect the cable to the terminal block.
- 4) Connect the grounding cable (14 mm²) to the terminal.

CAUTION : Grounding resistance: 100 Ω or less



4. PREPARATIONS FOR OPERATION

4.1 Checking Phase Rotation Direction

Check the rotation direction of the phases of the supplied power using a phase rotation meter.

NOTE : If a phase rotation meter is not available, check the phase rotation direction by checking the spindle rotation direction. If the phase rotation direction is incorrect, coolant has not been supplied.

[Check]

When the spindle is rotating in the counterclockwise direction, viewed from the tailstock side, the phase rotation direction is correct. If the spindle rotation direction is opposite, change the connection of the cable at the terminals.

- 1) Turn off the power switch.
- 2) Turn off the main disconnect switch (circuit breaker) at the shop power distribution board.
- 3) Exchange the cable connections at two of the three terminals.

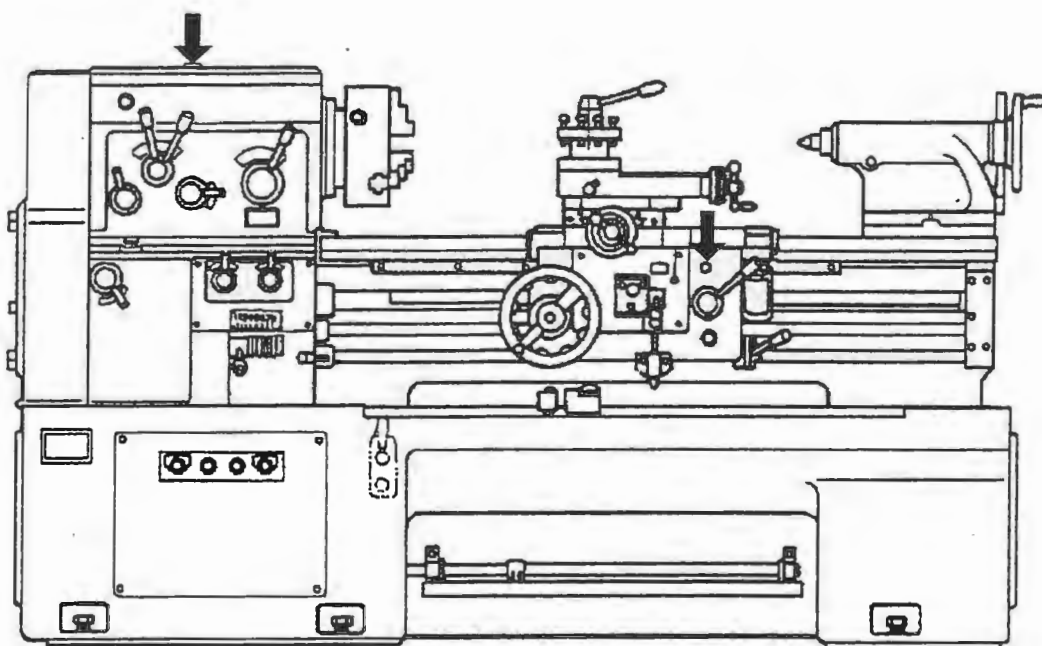
4.2 Check Points Before Operating the Machine

Check the lubricating oil at each lubricating point according to Section 5, "LUBRICATION".

- 1) Lubricating oil level in the headstock
 - 2) Lubricating oil level at the apron
 - 3) Lubricating oil level at the cross slide
 - 4) Lubricating oil level in the feed box
 - 5) Lubrication of lead screw
 - 6) Lubrication of 3-shaft supporter
 - 7) Lubricating oil level in the tailstock
 - 8) Lubrication oil level in the shafts
-

5. LUBRICATION

Before starting machine operation, supply lubricating oil to the machine. Supply lubricating oil to each lubricating point according to the tables below.



Headstock

Table 7

	Manufacturer	Lubricating Oil Name	Q'ty
Recommendation	Idemitsu	Daphne Mechanic Oil 32	16 ℓ (4.22 gal)
Equivalent	Shell	Tellus Oil C32	

Apron and Cross Slide

Table 8

	Manufacturer	Lubricating Oil Name
Recommendation	Idemitsu	Daphne Multiway 32
Equivalent	Shell	Tonna Oil T32

CAUTION: Use only the lubricating oils specified above. Never mix the lubricating oil of a different type.

Mori Seiki cannot be held responsible for malfunctions that may occur either as the result of mixing lubricating oils or from the use of a non-recommended lubricating oils.

5.1 Forced Lubrication of Headstock

5.1.1 Lubricating Oil Amount

The lubricating oil reservoir for headstock lubrication is provided beneath the headstock. The trochoid pump mounted at the front of the headstock supplies filtered, clean lubricating oil to the bearings inside the headstock.

For 15 to 20 seconds after operating starting lever (1), the flow of the lubricating oil can be checked through headstock oil window (7).

Even if the spindle does not rotate, a fixed volume of lubricating oil will be supplied when starting lever (1) is operated by the rotation of the motor (pulley shaft).

After the machine has been installed, the lubricating oil may be stored in the tank inside the bed due to inclination of the machine during transportation. Thus, oil may not be visible at the oil level gage at the rear of the headstock. In this case, operate the machine for a short period of time and the lubricating oil will return to the reservoir, permitting the oil level to be checked with the gage. Oil level will increase gradually after stopping machine operation; the level at which oil level increase comes to a rest is the actual oil level.

NOTE : During machine operation, the oil level will lower a little from the center line of the oil level gage. Never replenish lubricating oil, in this case.

5.1.2 Replenishing Lubricating Oil

Remove drain plug (B) in the cleaner at the right side of the lubricating oil reservoir every month to discharge the deposit in the cleaner. Then, replenish with fresh lubricating oil through the headstock oil supply port until the oil level reaches the upper level line in the oil level gage.

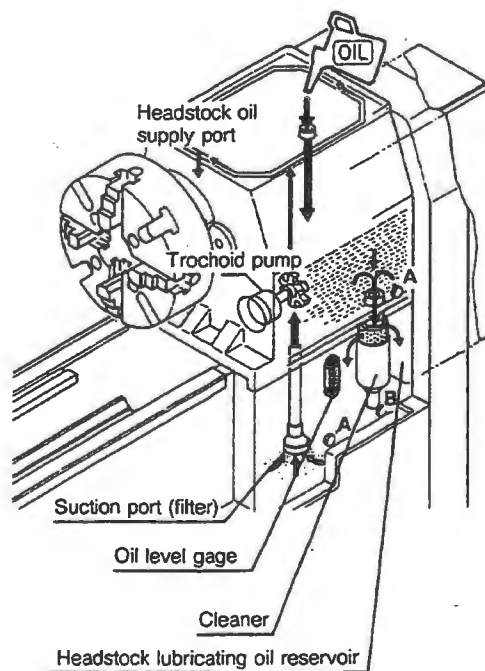
5.1.3 Exchanging Lubricating Oil

When exchanging lubricating oil, remove two drain plugs (A), at the bottom of the headstock, and drain plug (B) at the cleaner to completely discharge the lubricating oil from the lubricating oil reservoir inside the headstock. Clean the reservoir inside and fill it with fresh lubricating oil.

Recommendation: Daphne Mechanic 32

Exchange period: Every 6 months

Use only the recommended oil or equivalent.



5.2 Lubrication of Carriage Slideways

5.2.1 Lubricating Oil Feed Method

The inside of the apron is used as the lubricating oil reservoir. The pump inside the reservoir operates every 4 turns of longitudinal feed handle (15) to feed lubricating oil to the oil sumps in the carriage.

The lubricating oil fed to the oil sumps is supplied to the slideways (bed guideways on which the carriage moves and carriage guideways on which the cross slide moves.)

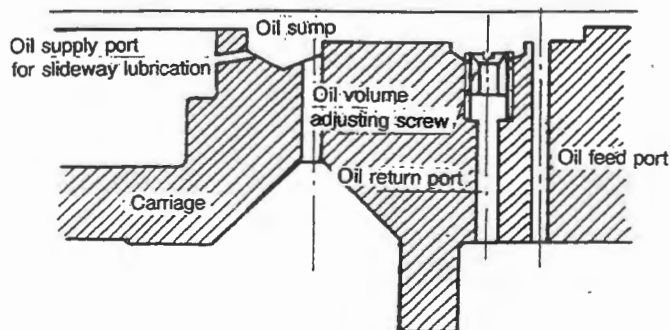
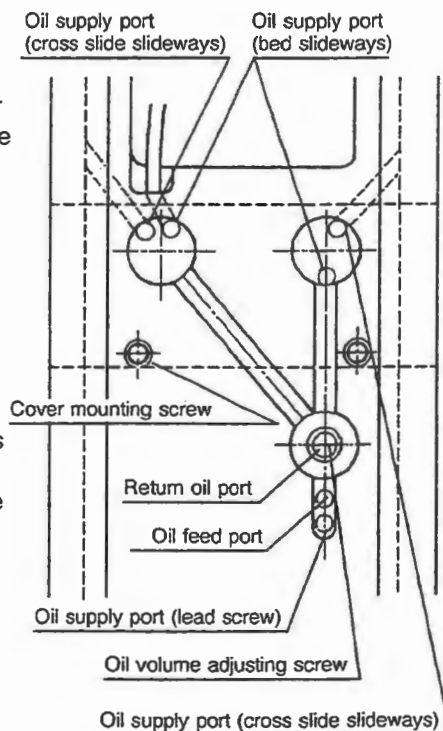
NOTE : Care should be taken so that the slideways are always wet with lubricating oil film.

5.2.2 Adjusting Lubricating Oil Supply Volume

The oil volume adjusting screw is located at the return oil port. When its position is higher than the supply port of the lubricating oil to the slideways, the return oil volume will decrease and the oil volume supplied to the slideways increases. Conversely, if it is set lower than the supply port, the return oil volume will increase.

The return oil is supplied to the component parts in the apron.

CAUTION : Although the supply volume of lubricating oil to the slideways is adjustable in the manner as described above, do not change the factory-set supply volume unnecessary.

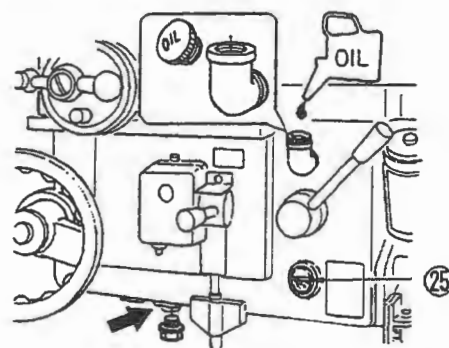


5.2.3 Replenishing Lubricating Oil

To replenish the lubricating oil, remove the cap (marked as OIL) at the oil filler port on the upper right part of the apron. Apron oil window (25) is located below the filler port. The oil level must be kept at the center mark in this window.

To discharge the lubricating oil, remove the drain plug at the bottom of the apron.

Because lubricating oil is not returned to the reservoir, the oil level should be checked occasionally so that it is maintained at the correct level.

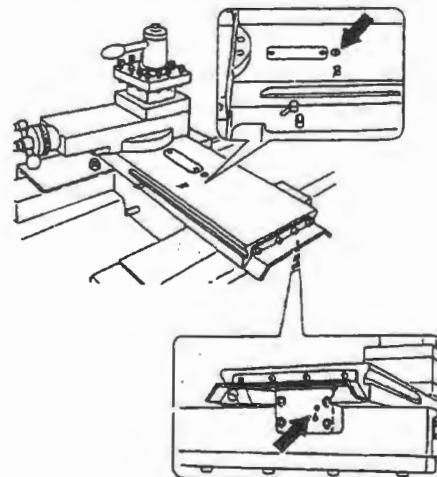


5.3 Lubricating Cross Feed Screw

The cross feed screw nut is immersed in the lubricating oil.

The oil filler port of the nut lubricating oil is located at the center of the cross slide. This port is easily identified because the word "OIL" is stamped on it. Add lubricating oil until the oil comes flowing out of the hole in the bearing block located at the rear of the carriage.

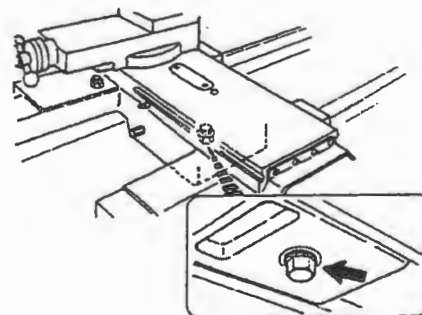
The oil drain screw is located at the bottom of the carriage. Drain the oil every month.



5.4 Supplying Lubricating Oil to Feed Box

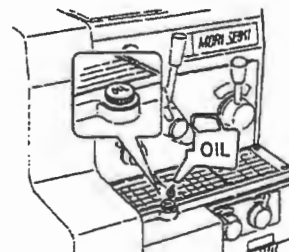
The oil filler port is located at the top of the feed box. Lubricating oil supplied from this port is fed to the bearings through the pipe.

Because the lubricating oil supplied to the bearings is not returned, the lubricating oil must be supplied every day.



5.5 Other Lubrication

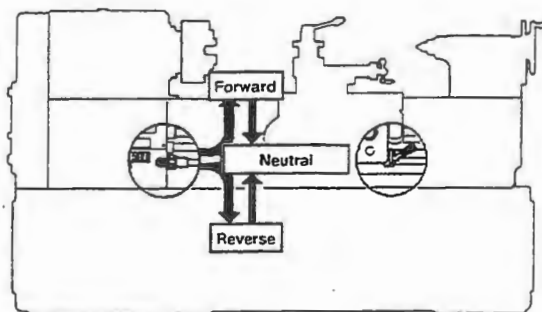
A filler port is provided for each of the following units: tailstock, cross feed screw, compound rest feed screw, and 3-shaft supporter that supports the lead screw, feed shaft, and starting rod. Supply lubricating oil occasionally.



6. OPERATIONS

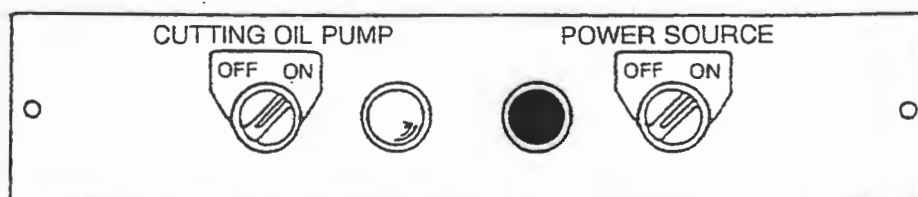
6.1 Starting and Stopping the Spindle

The spindle starting lever is located at the right side of both the feed box and the apron and is used to control spindle rotation (forward, neutral, and reverse).

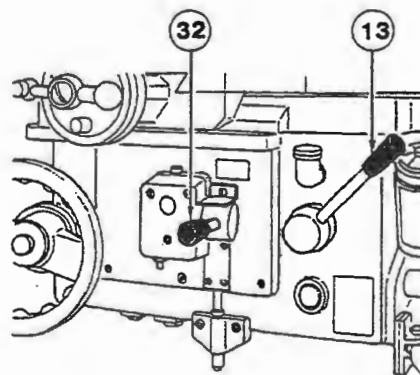


6.1.1 Preparation for Operation

- 1) Place the starting lever in the neutral position.
 - 2) Turn the POWER SOURCE switch to the ON position.
- After the red indicator lights, the machine is ready to start.

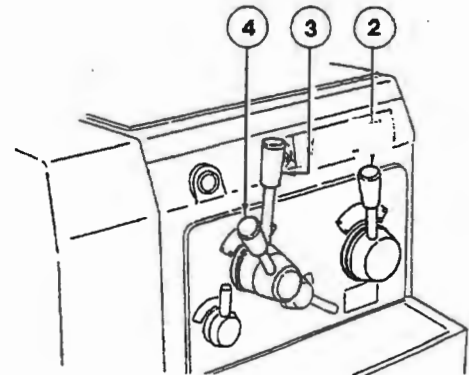


- 3) Place automatic feed lever (32) in the neutral position.
- 4) Make sure that thread cutting half-nut lever (13) is in the position as illustrated right.

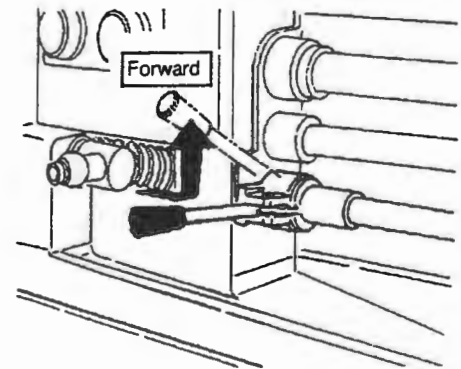


6.1.2 Rotating the Spindle in the Forward Direction

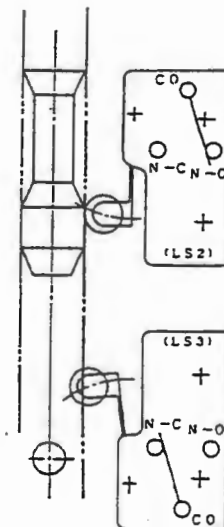
- 1) Set HIGH/LOW shift lever (2) and spindle speed shift levers (3), and (4) in the position to obtain the required spindle speed. For details of the lever settings, refer to Section 6.2, "Changing Spindle Speed".



- 2) Raise the starting lever while pushing it to the right. The spindle starts rotating at the speed set in step 1).



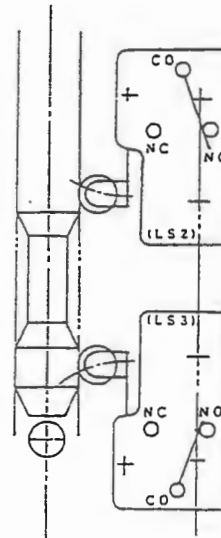
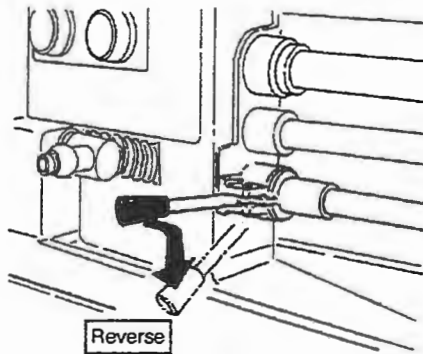
NOTE : The starting lever cannot be moved up or down unless it is pushed to the right for safety.



Limit Switch Status

6.1.3 Rotating the Spindle in the Reverse Direction

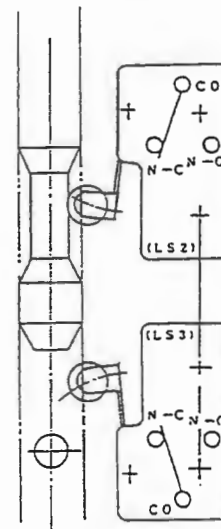
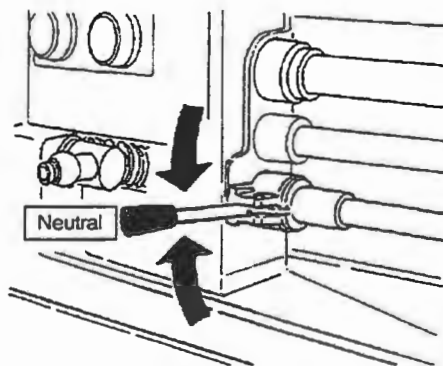
The spindle rotates in the reverse direction when the starting lever is pressed down. The lever cannot be pressed down unless it is pushed to the right, similar to starting the spindle in the forward direction.



Limit Switch Status

6.1.4 Stopping the Spindle (Neutral)

The spindle stops rotating when the starting lever is returned to the neutral position.

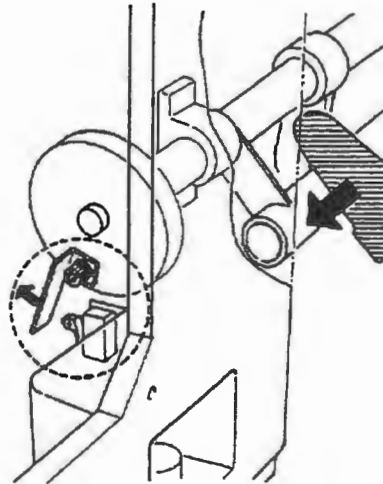


Limit Switch Status

6.1.5 Stopping the Spindle Immediately

To stop the spindle immediately, step on brake pedal (31). Once the spindle has been stopped with the brake pedal, the spindle will not start again unless the pedal is released.

To start the spindle again, return starting lever (1) to the neutral position. Then, operate the starting lever into the forward or reverse rotation start position.



6.2 Changing Spindle Speed

Spindle speed can be changed using the three levers located in front of the headstock. These levers are HIGH/LOW shift lever (2) and spindle speed shift levers (3) and (4).

HIGH/LOW shift lever (2) is used to select the high or low spindle speed range. With the combination of two spindle speed shift levers (3) and (4), the required spindle speed can be obtained.

Spindle Speed :- Lever Setting Plate

		○ / MIN ⊗		
		3 2		2 8 5
		6 2		3 9 5
		8 2		5 1 0
		1 1 2		7 1 0
		1 6 0		1 0 1 0
		2 0 0		1 8 0 0

The speeds obtained in the HIGH and LOW setting are:

HIGH ... 1800, 1010, 710, 510, 395, 200 rpm

LOW ... 285, 160, 112, 82, 62, 32 rpm

CAUTION : Before changing the spindle speed, be sure to stop the spindle first.

6.3 Tailstock Operations

- 1) Tailstock clamp lever (20) is used to clamp the tailstock body to the bed.
- 2) Tailstock handle (17) is used to move the tailstock spindle in the forward and reverse directions. Rotating the handle clockwise moves the spindle forward.

The tailstock spindle center is extracted by turning the handle counterclockwise to fully retract the tailstock spindle.

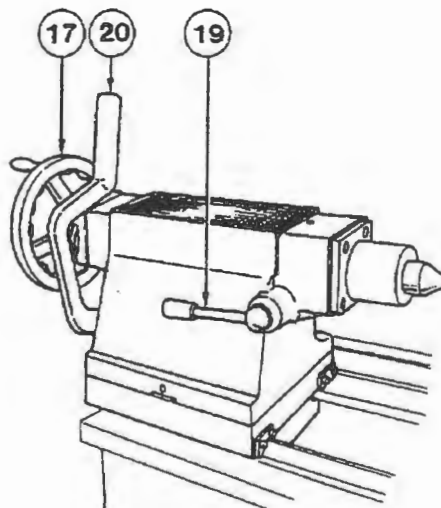
- 3) Tailstock spindle clamp lever (19) is used to clamp the tailstock spindle.

The graduation ring on tailstock handle (17) indicates the tailstock spindle movement amount: 0.5 mm (0.005")/div. and 5 mm (0.25")/turn. The graduation ring can be set to any required position.

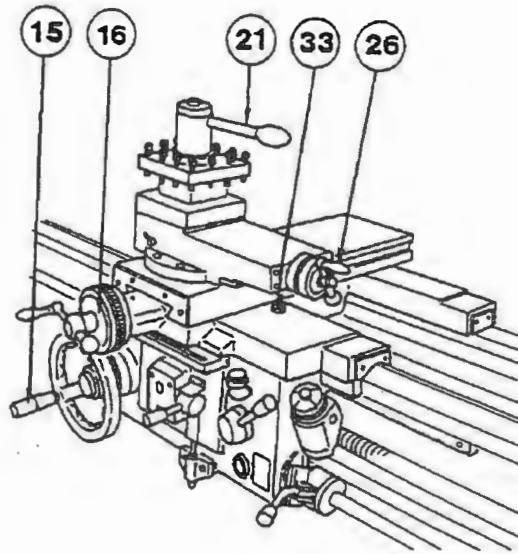
- 4) A flat slot is located inside the tailstock spindle bore. When using a drill with a tongue, hold the drill with the tongue set horizontally and insert it into the spindle bore with the spindle projecting a small amount from the tailstock.

The bore inside the tailstock spindle has a MT No. 4 taper.

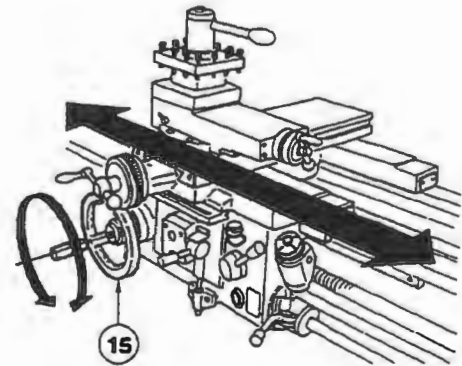
CAUTION : Make sure that the drill and center inserted into the tailstock spindle bore is free of scratches or other defects on the tapered surface.



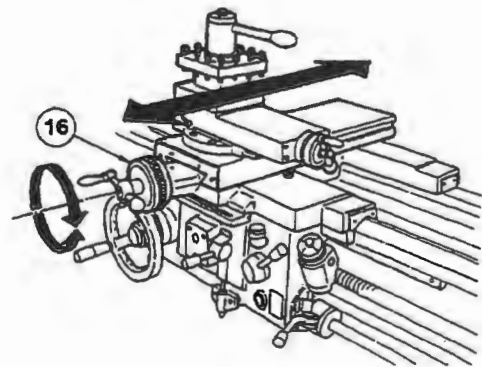
6.4 Manual Operations



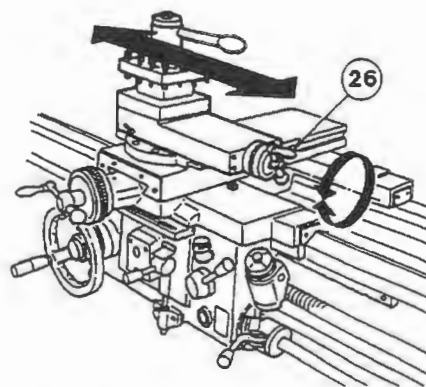
- 1) Use longitudinal feed handle (15) to feed the carriage.



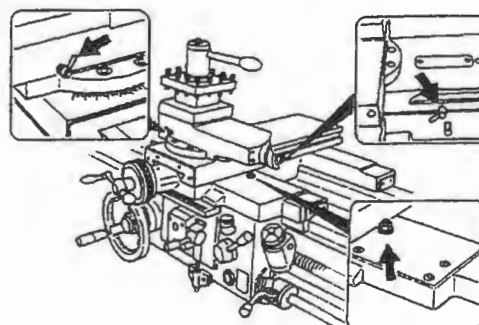
- 2) Use cross feed handle (16) to feed the cross slide.



- 3) Use compound rest handle (26) to feed the compound tool post.



- 4) Clamp the individual brake levers to hold the carriage, the cross slide, or the compound tool post in the required position.



6.5 Micrometer Collars

- 1) The micrometer collar on longitudinal feed handle (15) indicates the carriage feed amount.
0.2 mm (0.0125")/div, and 26 mm (1.0625")/turn
- 2) The micrometer collar on cross feed handle (16) indicates the cross slide feed amount.
0.025 mm (0.002")/div (0.05 mm in diameter), and 5 mm (0.2")/turn
- 3) The micrometer collar on compound rest handle (26) indicates the tool post feed amount.
0.02 mm (0.001")/div, and 4 mm (0.2")/turn
- 4) The compound tool post is clamped with four M12 cap bolts. To turn the tool post, loosen these cap bolts and turn it to the required angular position using the graduation lines marked on the cross slide as reference.

NOTE : Do not loosen the cap bolts excessively.

- 5) The micrometer collar on tailstock handle (17) indicates the tailstock spindle feed amount.
0.5 mm (0.005")/div, and 5 mm (0.25")/turn

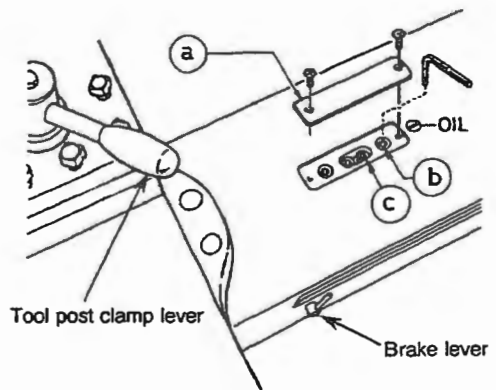
6.6 Adjusting Backlash in Cross Feed Motion

If backlash becomes excessive during cross feed, adjust the backlash by following the steps described below.

- 1) Remove cover (a).
- 2) Loosen clamp screw (b) slightly.
- 3) Tighten backlash adjusting screw (c) to reduce backlash.

After completing the backlash adjustment, tighten clamp screw (b) securely.

NOTE : If backlash adjusting screw (c) is tightened excessively, the screw will be distorted.



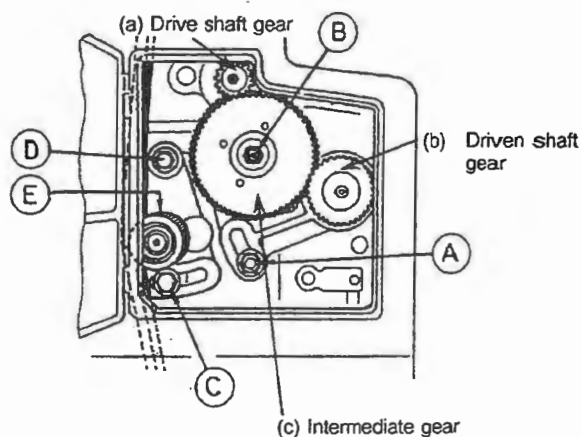
6.7 Changing Gears and Belts

6.7.1 Changing the Gears

When changing gear (a) on the drive shaft, follow the steps described below.

- 1) Loosen clamp nut (A).
- 2) Loosen nut (B) on driven shaft gear (b).
- 3) Change gear (b) or intermediate gear (c).
- 4) Adjust the engagement of gears (b) and (c) with nut (B).
- 5) Adjust the engagement of gears (a) and (c) with nut (A).

NOTE : When adjusting the engagement between gears (c), a proper amount of backlash must be obtained.



6.7.2 Changing the Belt and Adjusting Belt Tension

To change the belt, follow the steps described below.

- 1) Turn off the power supply to the machine.
- 2) Remove the upper and lower covers at the left side of the machine.
- 3) Loosen nuts (C) and (D) which clamp tension pulley plate (E).
- 4) The belts are slackened. Remove the belts one by one starting with the closest one.
- 5) Set the new belts starting with the innermost pulley V-groove.

Place a belt on the V-groove at the innermost position of the motor side pulley (lower side) and set it on the upper pulley. Turn the pulley by hand slowly to set the belt in the V-groove.

CAUTION : Be careful that fingers are not caught between the belt and the pulley V-groove.

- 6) After setting all belts, make sure that the belts are not twisted.
- 7) Push tension pulley plate (E) toward the belt.

8) Tighten nuts (C) and (D) slightly.

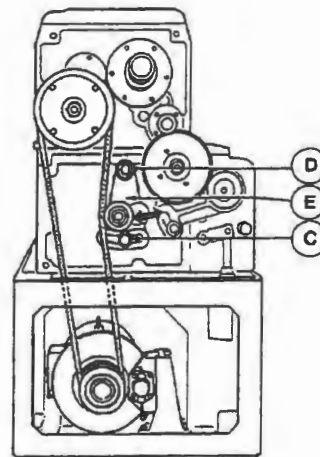
9) Check belt tension.

If the belts are tightened excessively, it will cause shorter life of belts and bearings. Conversely, if the belts are loose, they will slip and motor output will not be transmitted properly.

10) Tighten nuts (C) and (D) securely.

11) Mount the upper and lower covers at the left side of the machine.

To adjust the belt tension, follow the steps above in the order of 1), 2), 3), and 7) through 11).



6.8 Automatic Feed Operations and Changing Feedrates

6.8.1 Operating the Feed Shaft

1) Place normal/reverse feed lever (6) in the required position.

2) Place A/B feed lever (5) in either the A or B position.

3) Engage drive shaft gear (a) and driven shaft gear (b) with the intermediate gear (120 teeth).

4) Place feed box C/D lever (9) in the C position.

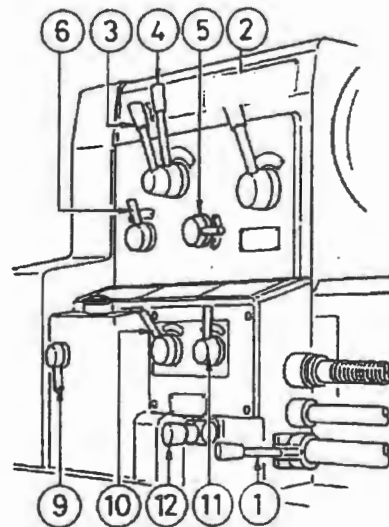
5) Place feed box G/F/E lever (10) in either the G or F position. (E position is used for thread cutting.)

6) Place feed box I/STOP/H lever (11) in the STOP position. If this lever is placed in the I or H position, the lead screw will rotate.

7) Fit quick changing lever (12) in any of the notches (1 through 8).

NOTE : Shift quick changing lever (12) into the required notch position while pulling the knurled knob, and release the knob at the required notch. The pin is fitted into the notch.

Feed shaft (28) will rotate as the spindle is started.



6.8.2 Changing Feed Direction Using Automatic Feed Lever

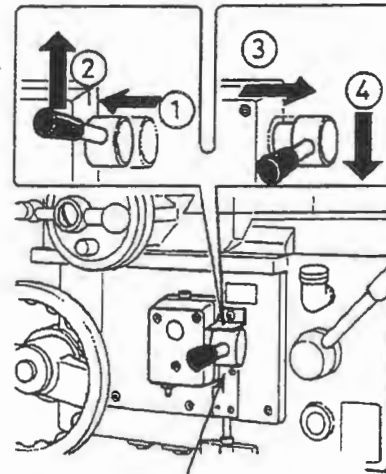
<Standard Type>

To feed the apron longitudinally

- ① Press automatic feed lever (32) to the left.
- ② Pull it up.

To feed the apron in the crosswise direction

- ③ Press automatic feed lever (32) to the right.
- ④ Push it down.



Apron automatic feed lever

<G Type>

- 1) To feed the apron longitudinally

- ① Press automatic feed lever (32) to the right.
- ② Pull it up.

- 2) To feed the apron in the crosswise direction

- ① Press automatic feed lever (32) to the left.
- ② Push it down.

6.8.3 Changing Feed Direction

Use the normal/reverse feed lever (6) at the headstock to change the feed direction.

6.8.4 Changing Feedrates

Feedrates can be changed by the combination of settings of the following three levers. A total of 32 feedrates are possible.

- 1) A/B feed lever (5)
- 2) Feed box G/F/E lever (10) (Position E is not used for feed.)
- 3) Quick changing lever (12) (1 through 8)

With the settings of the change gear as illustrated below, 8 more feedrates can be set and thus 40 feedrates can be obtained.

Change gear replacement:

- A. Feedrates displayed on the indication plate

0.045 to 0.627 mm/rev.
(0.0018 to 0.025"/rev.)

a = 36 teeth gear

b = 72 teeth gear

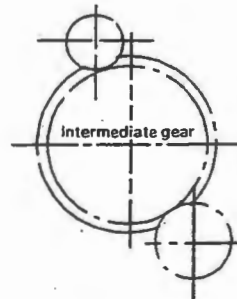
- B. Feedrates doubled as those displayed on the indication plate

0.090 to 1.254 mm/rev.
(0.0036 to 0.050"/rev.)

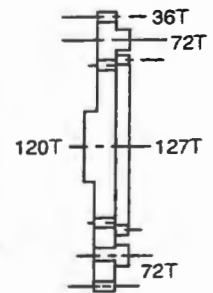
a = 72 teeth gear (change gear)

b = 72 teeth gear

a Drive shaft gear









b Driven shaft gear



NOTE : By changing the 36 teeth gear on the drive shaft with the change gear of 72 teeth gear, feedrates two times the values specified in the following chart can be obtained.










Feedrates (MS type) - For metric system



  	Port No.	1	2	3	4	5	6	7	8
	Handle Setting								
  	A-C-F	.627	.558	.528	.502	.456	.418	.386	.359
	A-C-G	.314	.279	.264	.251	.228	.209	.193	.179
	B-C-F	.157	.139	.132	.125	.114	.105	.097	.090
	B-C-G	.079	.070	.066	.062	.057	.052	.048	.045

Feedrates (MS type) - For inch system



  	Port No.	1	2	3	4	5	6	7	8
	Handle Setting								
  	A-C-F	.0250	.0220	.0200	.0180	.0170	.0165	.0150	.0140
	A-C-G	.0125	.0110	.0099	.0090	.0086	.0080	.0076	.0070
	B-C-F	.0062	.0055	.0049	.0045	.0043	.0040	.0038	.0035
	B-C-G	.0031	.0027	.0025	.0023	.0022	.0020	.0019	.0018
  	A-C-F	.0154	.0137	.0125	.0112	.0106	.0100	.0095	.0085
	A-C-G	.0077	.0068	.0062	.0056	.0053	.0050	.0047	.0042
	B-C-F	.0038	.0034	.0031	.0028	.0026	.0025	.0023	.0021
	B-C-G	.0019	.0017	.0015	.0014	.0013	.0012	.0011	.0010

6.9 Thread Cutting

6.9.1 Operating Lead Screw

- 1) Place feed box I/STOP/H lever (11) in either the I or H position to start the lead screw rotation.
- 2) Lower thread cutting half-nut lever (13).

By the operations above, the half nut engages with the lead screw permitting carriage feed for thread cutting.

[Changing type of thread to be cut]

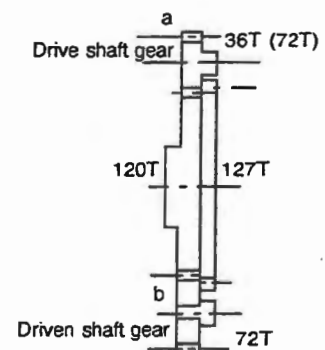
- 1) Use normal/reverse feed lever (6) to change the thread cutting direction.
- 2) Thread pitch is selectable from the indicated range of thread pitches according to the combination of the settings of A/B feed lever (5), feed box G/F/E lever (10), and quick changing lever (12).

NOTE : Inch/metric changeover is possible using feed box C/D lever (9).

6.9.2 Cutting Thread on Inch System Lathe (with inch lead screw)

[Cutting inch threads]

- 1) Set the 36 teeth gear on the drive shaft and the 72 teeth gear on the driven shaft, and engage them with the 120 teeth intermediate gear.
- 2) Place feed box C/D lever (9) in the C position. Place the levers in any of the following combinations:
A-C-F-H, A-C-G-H, B-C-F-H, and B-C-G-H.
- 3) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 8 to 80 TPI.



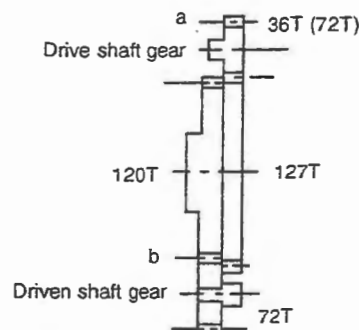
[Cutting 4, 4-1/2, 4-3/4, 5, 5-1/2, 6, 6-1/2, or 7 TPI thread]

- 1) Place the levers in any of the following combinations:
A-C-F-H, A-C-G-H, B-C-F-H, B-C-G-H, and B-C-G-I
- 2) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 4 to 80 TPI.

NOTE : When operating thread cutting half-nut lever (13), do so very carefully because the thread engaging point (clutch point) varies depending on the thread size. For details, refer to Section 6.10, "Thread Cutting Indicator".

[Cutting metric threads]

- 1) Set the 36 teeth gear on the drive shaft and engage it with the 127 teeth intermediate gear.
- 2) Set the 72 teeth gear on the driven shaft and engage it with the 120 teeth intermediate gear.
- 3) Place feed box C/D lever (9) in the D position.
- 4) Place feed box G/F/E lever (10) in the E position. (Positions G and F are not used for cutting metric threads.)
- 5) Place the levers in any of the following combinations:
A-D-E-H, A-D-E-I, B-D-E-H, and B-D-E-I
- 6) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 0.25 to 3.5 mm.



[Cutting 4, 4.5, 4.75, 5, 5.5, 6, 6.5, or 7 mm thread]

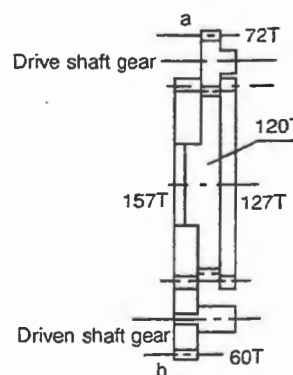
- 1) Set the 72 teeth gear on the drive shaft.
- 2) Place the levers in any of the following combinations:
A-D-E-H, A-D-E-I, B-D-E-H, and B-D-E-I

With these lever settings, thread cutting is possible in a range from 0.5 to 7 mm.

NOTE : Keep thread cutting half-nut lever (13) in the lower position until thread cutting is completed. Lever operations and the thread pitch table are given inside the door of change gear box (23).

[Cutting D.P. (diametral pitch) threads]

- 1) Set the 157 teeth gear as the intermediate gear.
- 2) Set the 72 teeth gear on the drive shaft and engage it with the 120 teeth intermediate gear.
- 3) Set the 60 teeth gear on the driven shaft and engage it with the 157 teeth intermediate gear.
- 4) Place feed box C/D lever (9) in the C position.
- 5) Place the levers in any of the following combinations:
A-C-F-H, A-C-G-H, B-C-F-H, and B-C-G-H
- 6) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 8 to 112 D.P. threads.

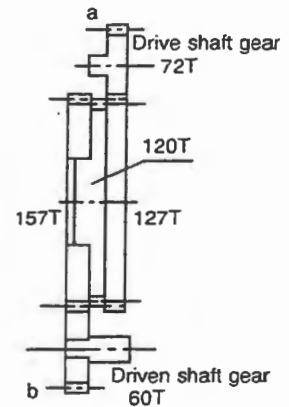


NOTE : Keep thread cutting half-nut lever (13) in the lower position until thread cutting is completed. Lever operations and the thread pitch table are given inside the door of change gear box (23).

The 157 and 60 teeth gears are optional.

[Cutting module threads]

- 1) Set the 157 teeth gear as the intermediate gear.
- 2) Set the 72 teeth gear on the drive shaft and engage it with the 127 teeth intermediate gear.
- 3) Set the 60 teeth gear on the driven shaft and engage it with the 157 teeth intermediate gear.
- 4) Place feed box C/D lever (9) in the D position.
- 5) Place feed box G/F/E lever (10) in the E position. (Positions G and F are not used for cutting module threads.)
- 6) Place the levers in any of the following combinations:
A-D-E-H, A-D-E-I, B-D-E-H
- 7) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 0.5 to 3.5 module threads.



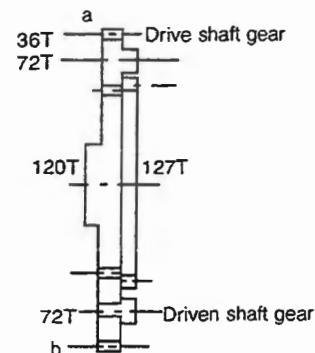
NOTE : Keep thread cutting half-nut lever (13) in the lower position until thread cutting is completed. Lever operations and the thread pitch table are given inside the door of change gear box (23).

The 157 and 60 teeth gears are optional.

6.9.3 Cutting Thread on Metric System Lathe (with metric lead screw)

[Cutting metric threads]

- 1) Set the 36 teeth gear on the drive shaft and the 72 teeth gear on the driven shaft, and engage them with the 120 teeth intermediate gear.
- 2) Place feed box C/D lever (9) in the D position.
- 3) Place feed box G/F/E lever (10) in the E position. Positions G and F are not used for cutting metric thread.
- 4) Place the levers in any of the following combinations.
A-D-E-H, A-D-E-I, B-D-E-H, and B-D-E-I
- 5) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 0.25 to 3.5 mm.



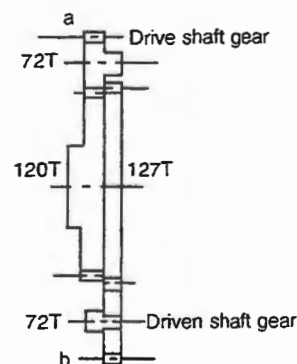
[Cutting 4, 4.5, 4.75, 5, 5.5, 6, 6.5, or 7 mm thread]

- 1) Set the 72 teeth gear on both the drive shaft and the driven shaft.
- 2) Place the levers in any of the following combinations:
A-D-E-H, A-D-E-I, B-D-E-H, and B-D-E-I
- 3) With these lever settings, thread cutting is possible 0.5 to 7 mm.

NOTE : When operating thread cutting half-nut lever (13), refer to Section 6.10, "Thread Cutting Indicator" because the clutch point and the number of teeth of the worm gear vary according to the thread pitch to be cut.

[Cutting inch threads]

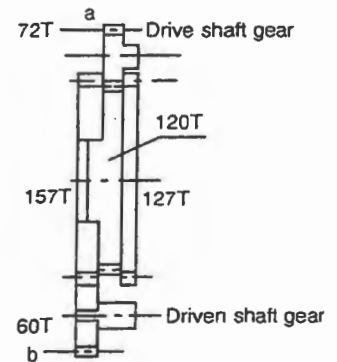
- 1) Set the 72 teeth gear on the drive shaft and engage it with the 120 teeth intermediate gear.
- 2) Set the 72 teeth gear on the driven shaft and engage it with the 127 teeth intermediate gear.
- 3) Place feed box C/D lever (9) in the C position.
- 4) Place the levers in any of the following combinations:
A-C-F-H, A-C-G-H, B-C-F-H, B-C-G-H, and B-C-G-I
- 5) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 4 to 80 TPI.



NOTE : Keep thread cutting half-nut lever (13) in the lower position until thread cutting is completed. Lever operations and the thread pitch table are given inside the door of change gear box (23).

[Cutting module threads]

- 1) Set the 157 teeth gear as the intermediate gear.
- 2) Set the 72 teeth gear on the drive shaft and engage it with the 120 teeth intermediate gear.
- 3) Set the 60 teeth gear on the driven shaft and engage it with the 157 teeth intermediate gear.
- 4) Place feed box C/D lever (9) in the D position.
- 5) Place feed box G/F/E lever (10) in the E position. (Positions G and F are not used for cutting module threads.)
- 6) Place the levers in any of the following combinations:
A-D-E-H, A-D-E-I, and B-D-E-H
- 7) Insert quick changing lever (12) pin in any of the 8 notch positions. With these lever settings, thread cutting is possible in a range from 0.5 to 3.5 module threads.



NOTE : Keep thread cutting half-nut lever (13) in the lower position until thread cutting is completed. Lever operations and the thread pitch table are given inside the door of change gear box (23).

The 157 and 60 teeth gears are optional.

6.10 Thread Cutting Indicator

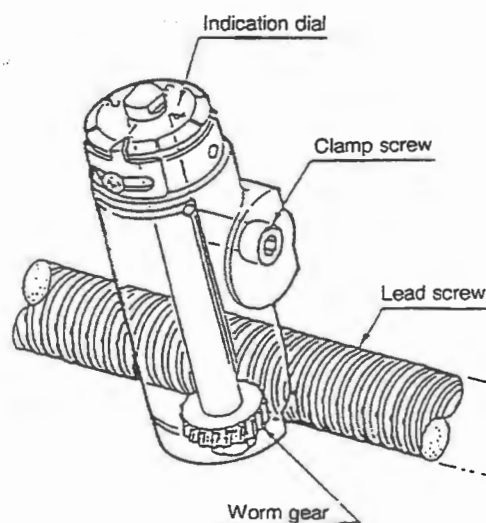
Thread cutting indicator (14) is located at the right side of the apron (left side for G type) and is used by engaging it with the lead screw when necessary during thread cutting operation.

- 1) For cutting metric threads with the metric lead screw, select the worm gear (14, 19, 20, or 24 teeth) according to pitch of thread to be cut.

Refer to the table on the following page.

NOTE : The 13 teeth (6.5 and 3.25 mm pitch) and the 22 teeth (5.5 and 2.75 mm pitch) worm gears are optional.

- 2) For cutting inch threads with the inch lead screw, only the 16 teeth worm gear should be used. Change the clutch point according to the thread size to be cut.



When cutting inch threads and module threads with a metric lead screw, or cutting metric threads, D.P. threads, and module threads with an inch lead screw, thread cutting is completed when thread cutting half-nut lever (13) is operated. Therefore, the thread cutting indicator is not used during these thread cutting operations.

Clutch Points of Thread Cutting Indicator

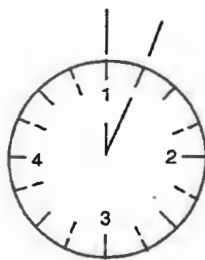
On lathes equipped with metric lead screw

Metric Thread Size	Clutch Point	Worm Gear	Metric Thread Size	Clutch Point	Worm Gear
4.5, 2.25	8	24T	6.0, 3.0, 2.0, 1.5, 1.0, 0.75, 0.5, 0.25	16	16T
5.5, 2.75	2	22T (optional)	4.0	8	16T
5.0, 2.5, 1.25	4	20T	7.0, 3.5, 1.75	2	14T
4.75	1	19T	6.5, 3.25	1	13T (optional)

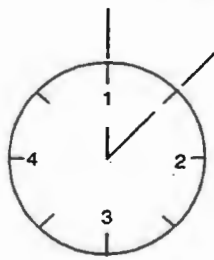
On lathes equipped with inch lead screw (Worm gear: 16 teeth)

Inch Thread Size	Clutch Point	Inch Thread Size	Clutch Point
4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 64, 72, 80	16	4-1/2, 5 1/2, 6 1/2, 9 1/2	2
6, 10, 14, 18, 22, 26, 38	8	4-3/4	1
5, 7, 9, 11, 13, 19	4		

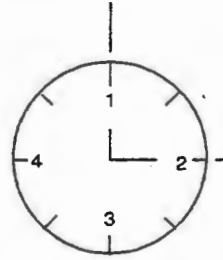
Clutch Points



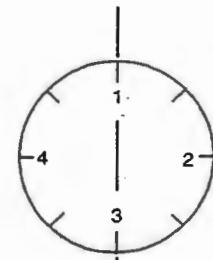
16 points



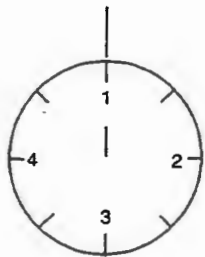
8 points



4 points



2 points



1 point

Lathes with inch lead screw

For cutting inch threads



25.4 MM



1	2	3	4	5	6	7	8
4	4-1/2	4-3/4	5	5-1/2	6	6-1/2	7
8	9	9-1/2	10	11	12	13	14
16	18	19	20	22	24	26	28
32	36	38	40	44	48	52	56
64	72		80				

2	3	4	5	6
4-1/2	5	5-1/2	5-3/4	6
9	10	11	11-1/2	12
18	20	22	23	24
36	40	44	46	48
72	80			

For cutting metric threads



MM

1	2	3	4	5	6	7	8
4	4.5	4.75	5	5.5	6	6.5	7
2	2.25		2.5	2.75	3	3.25	3.5
1			1.25		1.5		1.75
0.5					0.75		
0.25							

2	3	4	5	6
4.5	5	5.5		6
2.25	2.5	2.75		3
	1.25			1.5
				0.75

For cutting D.P. threads

1" π 

1	2	3	4	5	6	7	8
8	9		10	11	12	13	14
16	18		20	22	24	26	28
32							56
							112

2	3	4	5	6
9	10	11		12
18	20	22		24

For cutting module threads

/ π

1	2	3	4	5	6	7	8
2	2.25		2.5	2.75	3	3.25	3.5
1			1.25		1.5		1.75
0.5					0.75		

2	3	4	5	6
2.25	2.5	2.75		3
	1.25			1.75
				0.75

NOTE : The right diagram shows inch thread for 11-1/2 T.P.I. series.

Lathes with metric lead screw

For cutting metric threads



MM

Change Gears	Port No.		1	2	3	4	5	6	7	8	Port No.	
	Handle Setting										Handle Setting	
			4	4.5	4.75	5	5.5	6	6.5	7	A-D-E-H	
	A-D-E-H		2	2.25		2.5	2.75	3	3.25	3.5	A-D-E-I	
	A-D-E-I		1			1.25		1.5		1.75	B-D-E-H	
	B-D-E-H		0.5					0.75			B-D-E-I	
	B-D-E-I		0.25									
	36/72		Change gears a/b								72/72	

For cutting inch threads



25.4 MM



Change Gears	Port No.		1	2	3	4	5	6	7	8	Port No.	
	Handle Setting										Handle Setting	
			4	4-1/2	4-3/4	5	5-1/2	6	6-1/2	7	A-C-F-H	
	A-C-F-H		8	9	9-1/2	10	11	12	13	14	A-C-G-H	
	A-C-G-H		16	18	19	20	22	24	26	28	B-C-F-H	
	B-C-F-H		32	36	38	40	44	48	52	56	B-C-G-H	
	B-C-G-H		64	72		80					B-C-G-I	
	36/72		Change gears a/b								72/72	

For cutting module threads



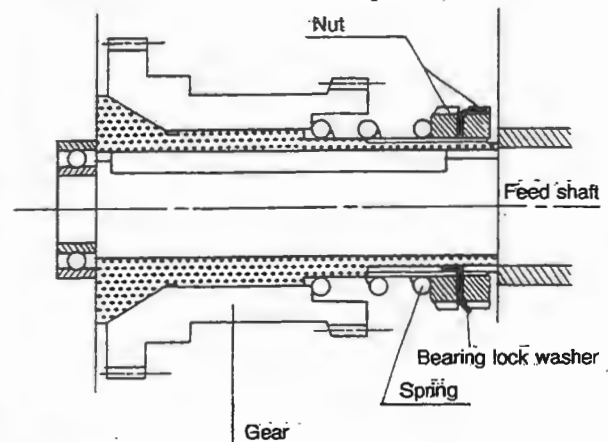
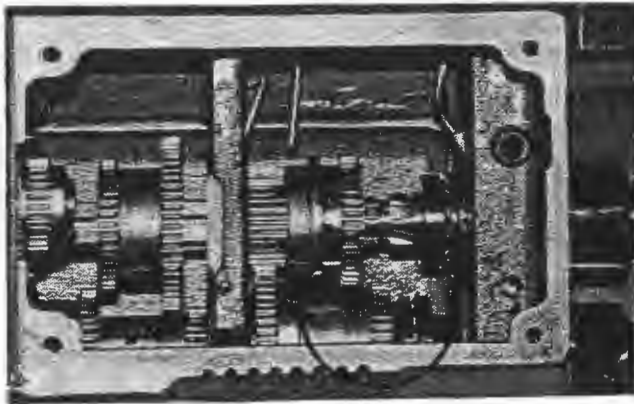
/π

Change Gears	Port No.		1	2	3	4	5	6	7	8
	Handle Setting									
	A-D-E-H		2	2.25		2.5	2.75	3	3.25	3.5
	A-D-E-I		1			1.25		1.5		1.75
	B-D-E-H		0.5					0.75		

7. SAFETY DEVICES

7.1 Feed Box Safety Device

The feed shaft automatically stops if excessive cutting power is produced. Automatic feed stop is actuated by the safety device built in the gears inside the cover on which levers (10) and (11) are mounted.



Adjustment:

If the feed shaft does not rotate or if feeding stops just from a slight overload, adjust the safety device actuating point by following the steps described below.

- 1) Remove the feed box cover on which levers (10) and (11) are mounted.
- 2) A bearing lock washer is mounted between the nuts and a tooth of the washer is bent into the slot of the nut to prevent the nut from loosening. Unbend the tooth.
- 3) Tighten the nut and the shaft will be able to rotate normally.

NOTE : Do not tighten the nut excessively. If it is tightened excessively, the safety device will not actuate.

After adjusting the safety device, bend one of the teeth to secure the nuts in position.

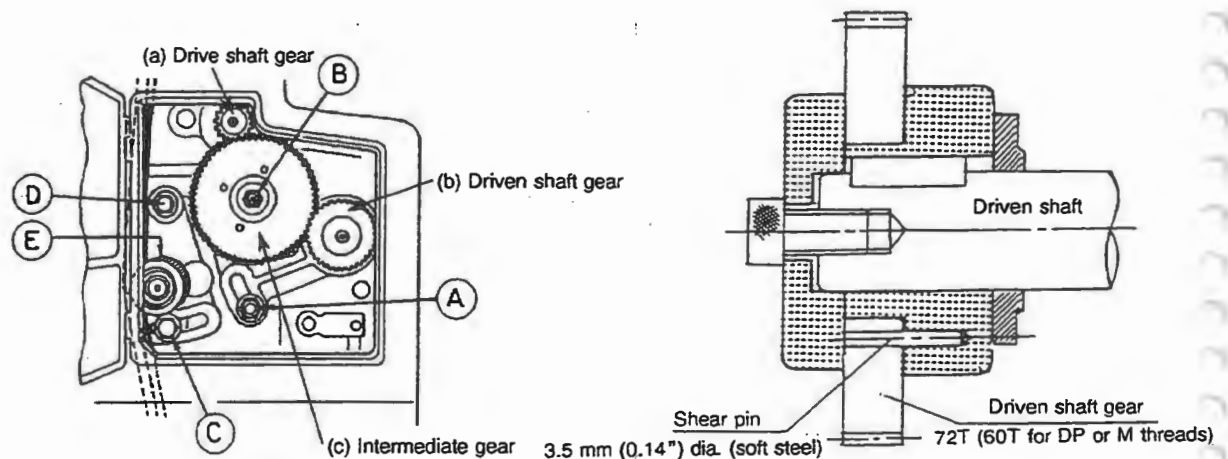
The safety device is factory-set before shipping.

7.2 Safety Device for Change Gear

This safety device is fitted to the 72 teeth gear on the driven shaft. If excessive load is applied, the incorporated shear pin is broken to allow the gear to rotate with the driven shaft disconnected, thereby preventing damages to other parts.

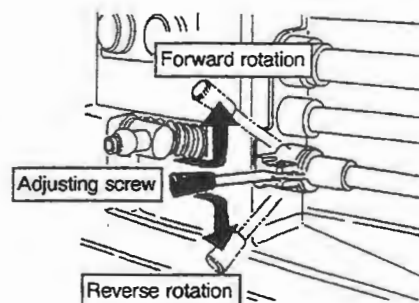
NOTE : Use a 3.5 mm dia., 25 mm long soft steel pin for replacement. Do not use a pin of other material harder than this.

NOTE : There may be cases where the shear pin is not broken if an excessively high speed feed is applied during thread cutting.



7.3 Safety Device for Starting Lever

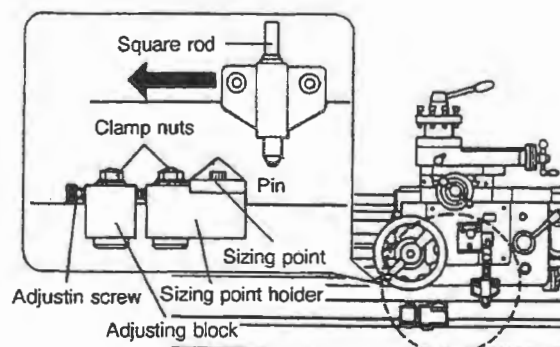
The starting lever is interlocked so that it cannot be operated up or down unless it is pushed to the right.



7.4 Automatic Longitudinal Feed Stop Device

This device stops the automatic longitudinal feed of the carriage when automatic feed lever (32) on the apron is returned to the neutral position.

The carriage is fed longitudinally when the automatic feed lever is pressed upward from the neutral position; this lever operation presses the square rod down so that it contacts the pin head. As the carriage is fed, the pin begins climbing the slope of the sizing point which, in turn, pushes the square rod upward causing automatic feed lever (32) to return to the neutral position.



Feed stop position is adjustable by rotating the adjusting screw in the adjusting block after loosening the clamp nut of the sizing point holder.

NOTE : The feed stop position will fluctuate depending on the cutting conditions. For fine feed stop control, use the bed stopper in combination with the automatic longitudinal feed stop device. (The bed stopper is optional.)

The automatic longitudinal feed stop device can also be used as a safety device.

7.5 Automatic Feed and Thread Cutting

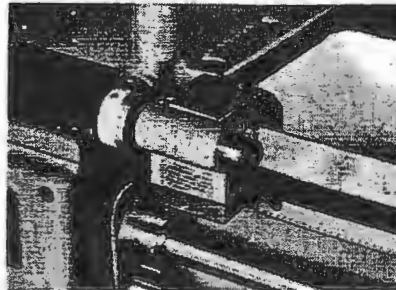
Automatic feed lever (32) and thread cutting half-nut lever (13) are interlocked with each other so that they cannot be operated at the same time.

7.6 Bed Stopper (Option)

The bed stopper, used as a sizing device, can be easily mounted to the bed.

Fine adjustment is possible using a micrometer dial graduated in 0.0025" (0.1 mm).

NOTE : The bed stopper must not contact the carriage. This is not a device to stop automatic feed.



8. ELECTRIC UNIT

8.1 Construction

The electric units used in the machine are: spindle drive motor, operation panel, control panel, microswitches, coolant pump (excluding MS-650), etc.

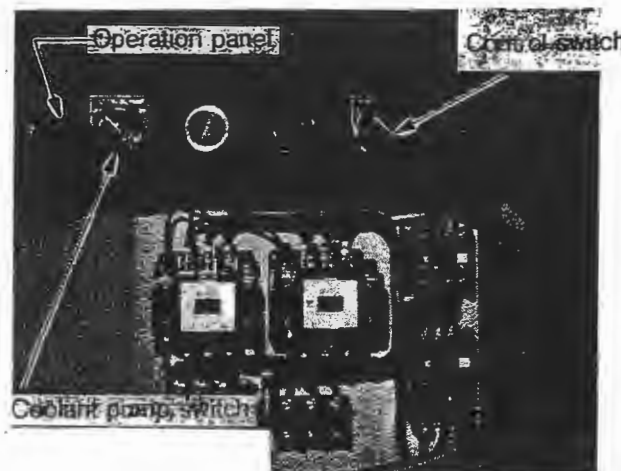
- 1) A waterproof 3-phase induction motor is used as the spindle drive motor. Output is 5 HP (3.7 kW) 4 poles.
- 2) The power supply on/off switch and its pilot lamp, and the coolant pump on/off switch* and its pilot lamp are arranged on the operation panel.

* Not available for MS-650

- 3) The reversible magnet switch for the spindle drive motor, the auxiliary relays, the magnet switch for the coolant pump*, etc. are incorporated in the control panel.

* Not available for MS-650

- 4) The starting lever is provided with two microswitches - one for spindle forward/reverse rotation and the other for outputting the spindle stop signal.
- 5) The brake pedal is provided with a microswitch. The magnet switch for the spindle drive motor is tripped when the brake pedal is stepped on.



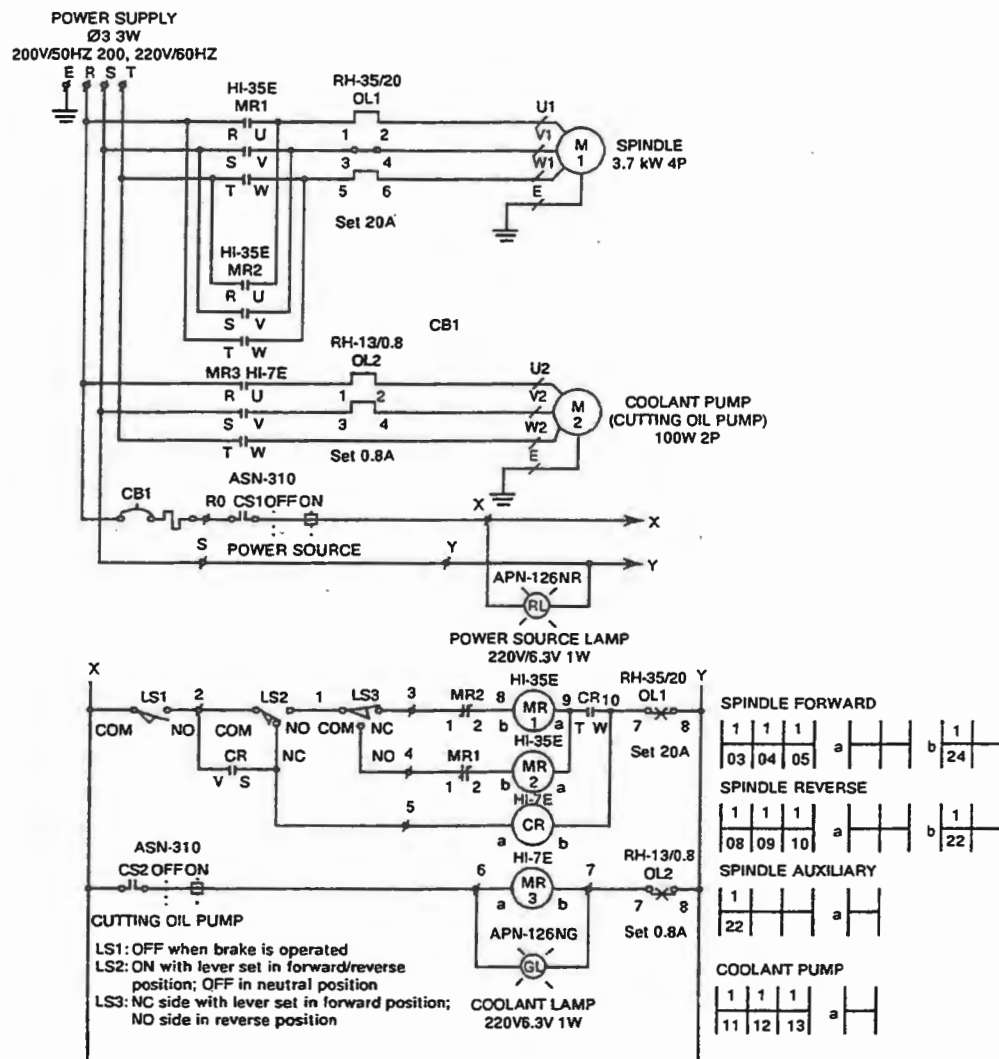
8.2 Thermal Relay

Frequent "spindle inching (start and stop)" operation can cause overcurrent to the motor, leading to motor burn out. To prevent such a problem, a thermal relay is incorporated inside the control panel.

If the spindle does not rotate even when the starting lever is operated, the thermal relay might have been tripped causing magnet switch tripping. In this case, return the starting lever to the neutral position and allow the relay and the magnet switch to cool for approx. 2 minutes. The thermal relay and the magnet switch are reset automatically.

If the thermal relay is tripped frequently, selected cutting conditions may cause overload or the motor may be faulty. After checking the machine, please contact your local Mori Seiki representative if the cause of the problem cannot be located.

8.3 Wiring Diagram



Symbol	Part Name	Manufacturer	Type	Specification
MR1	Magnet switch	Yaskawa	HI-35E	Coil AC200V 50Hz 50A AC200/220V 60Hz
MR2	Magnet switch	Yaskawa	HI-35E	Coil AC200V 50Hz 50A AC200/220V 60Hz
MR3	Magnet switch	Yaskawa	HI-7E	Coil AC200V 50 Hz 8A AC200/220V 60Hz
CR	Aux. relay	Yaskawa	HI-7E	Coil AC200V 50 Hz 8A AC200/220V 60Hz
OL1	Thermal relay	Yaskawa	RH-35/20	16-24A
OL2	Thermal relay	Yaskawa	RH-13/0.8	0.6-1.0A
CS1	Select switch	Izumi	ASN-310	250V 3A 600V 1A
CS2	Select switch	Izumi	ASN-310	250V 3A 600V 1A
RL	Pilot lamp	Izumi	APN-126NR	220V/6.3V 1W Red
GL	Pilot lamp	Izumi	APN-126NG	220V/6.3V 1W Green
LS1	Limit switch	OMRON	Z-15GW2255	250V 15A
LS2	Limit switch	OMRON	Z-15GW2255	250V 15A
LS3	Limit switch	OMRON	Z-15GW2255	250V 15A
TB	Terminal block	Mibu	TK-301	30A 4P
TB	Terminal block	Mibu	TK-152	15A 10P
M1	Spindle drive motor	Yaskawa	BDQ3.7kW4P	OUTPUT 3.7kW 4POLE
M2	Coolant pump motor	Yaskawa	YFPC-10FJF	OUTPUT 100W 2POLE
CB1	Circuit protector	Hitachi	CP31-AS	3A

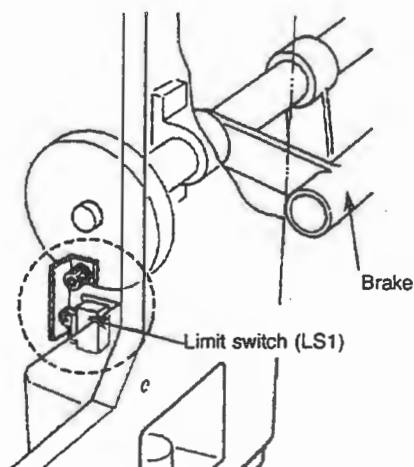
9. BRAKE

Stepping on the brake pedal with the starting lever placed in either the forward or reverse rotation position causes the NO-CO circuit in LS1 to be opened and the magnet switch for the spindle drive motor and the auxiliary relay (CR) to be tripped. At the same time, the disk brake of the spindle drive motor is actuated to stop the spindle immediately.

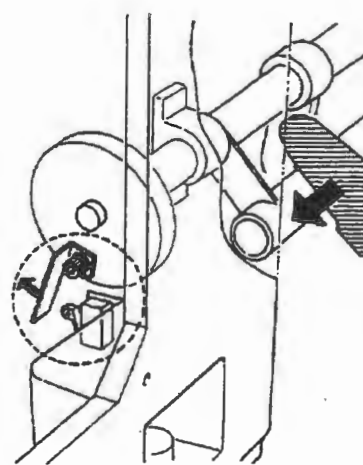
The spindle does not start rotating even when the brake pedal is released.

To restart the spindle, return the starting lever to the neutral position once and then place it in the forward or reverse position.

<LS1 status >



< Brake pedal stepped >



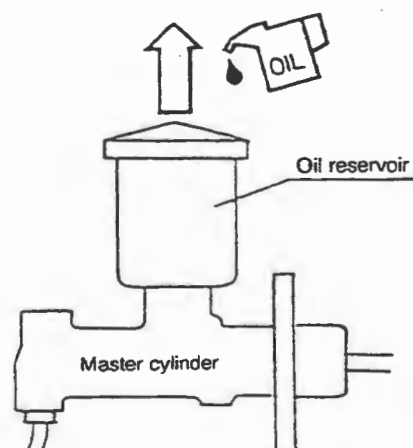
9.1 Brake Oil

When the brake oil level in the master cylinder oil reservoir decreases to 70% level of the specified level, it is necessary to replenish the oil. If the machine is continuously operated without replenishing the oil, air will enter into the brake system, causing poor braking.

For the procedure to bleed the air, refer to Section 9.3, "Air Bleeding Procedure".

Use only brake fluid.

CAUTION : Never use mineral oil.



9.2 Air Bleeding

If air enters into the brake system, the brake will not work properly.

The following cases require the air to be bled to ensure safe operation.

- 1) Air entered the brake system because the brake oil level in the master cylinder reservoir decreased to 70% of the specified level. The brake oil level must be kept higher than the 70% level.
- 2) Air entered the brake system from a loose connection.
- 3) A joint has been disconnected once in the brake system.

9.3 Air Bleeding Procedure

Refer to the illustration of the sectional view of disk brake.

- 1) To bleed the air from the brake system, first fill the master cylinder reservoir with the specified brake oil.
- 2) Make sure that all joints in the brake system are securely tightened.
- 3) Connect a transparent hose to bleed screw (1) and immerse the other end of the hose in the brake oil reserved in the pan.
- 4) Push the push rod of the master cylinder (the same condition as when the brake pedal is stepped). Loosen bleed screw (1) while pushing the push rod of the master cylinder. After the brake oil trapping the air bubbles flows through the hose, tighten bleed screw (1) and return the push rod.

Repeat this several times.

- 5) After making sure that air bubbles do not flow through bleed screw (1) any more, tighten bleed screw (1) while pushing the push rod.

NOTE : During air bleeding, check to be sure that a sufficient volume of oil is reserved within the reservoir. Add oil if necessary.

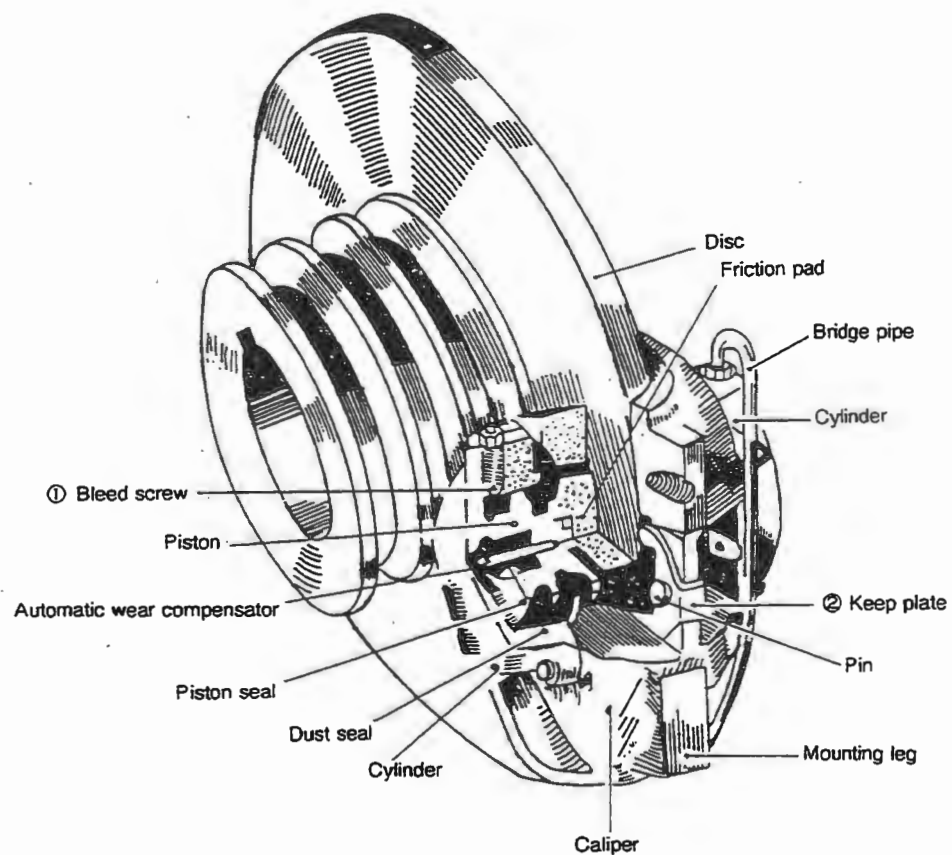
- 6) After completing air bleeding, fill the master cylinder reservoir with the specified brake oil.
 - 7) Apply the brake for 2 to 3 minutes to make sure that there are no leaks in the brake system.
-

9.4 Brake Pad

A new brake pad is 16.7 mm (0.66") thick. A pad can be used until worn to 10 mm (0.39") thick. The brake pad must be changed when it has been worn to less than 10 mm (0.39") thick.

NOTE : If the brake does not work properly, check the brake pad for wear.

When changing the brake pad, never remove the cylinder from the calipers or the calipers from the bracket. The brake pad can be changed without removing the calipers through the hole in the bracket. For the brake pad changing procedure, refer to Section 9.5, "Changing Brake Pad".

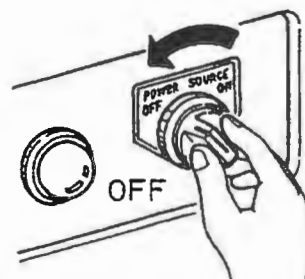


Sectional View of Disk Brake

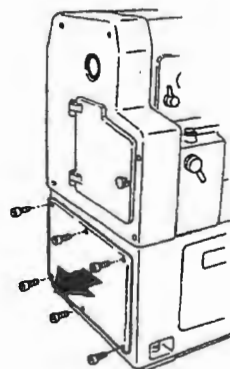
9.5 Changing Brake Pad

If the brake comes to slip due to wear of brake pad, change the brake pad following the procedure below. Serviceable limit of the brake pad thickness is 10 mm (0.39 in.). New brake pad is 16.7 mm thick.

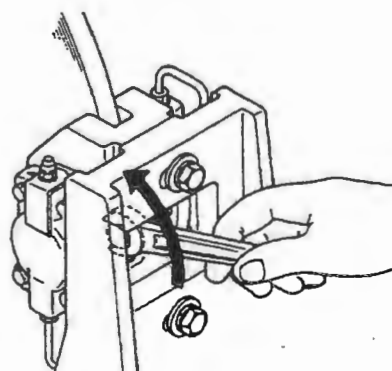
- 1) Turn off the power.



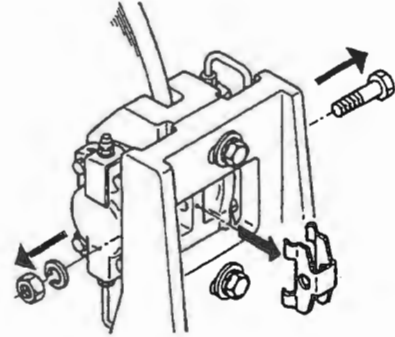
- 2) Remove the left side cover.



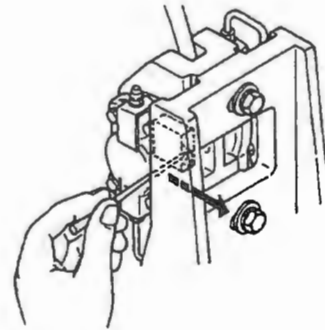
- 3) Loosen the keep plate mounting bolt and nut.



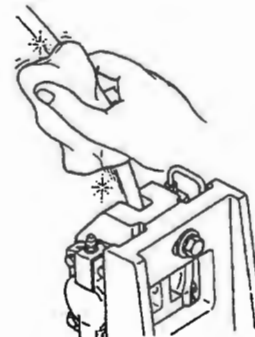
- 4) Remove the keep plate.



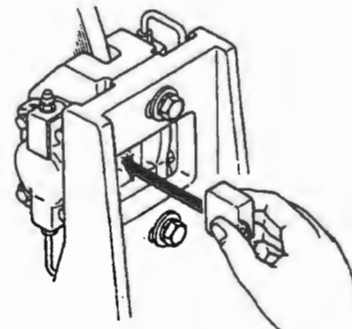
- 5) Remove the pad assembly.



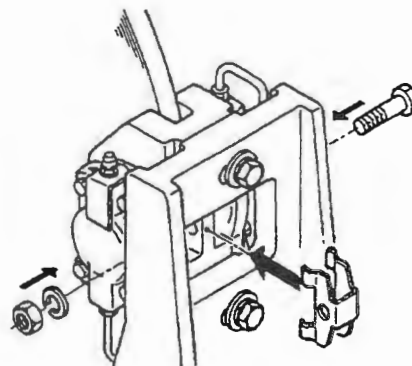
- 6) Clean the disk.



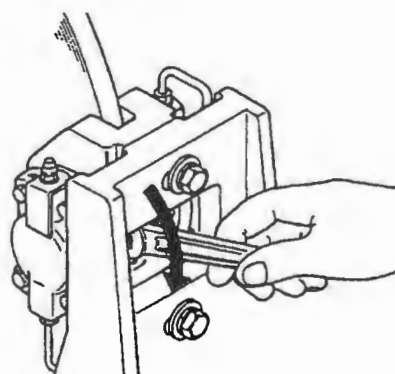
- 7) Mount the new pad assembly.



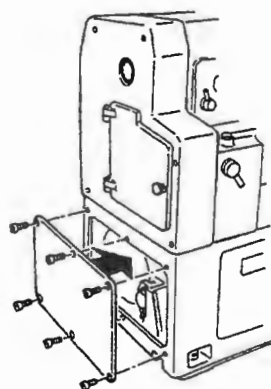
- 8) Mount the keep plate.



- 9) Tighten the keep plate mounting bolt and nut.



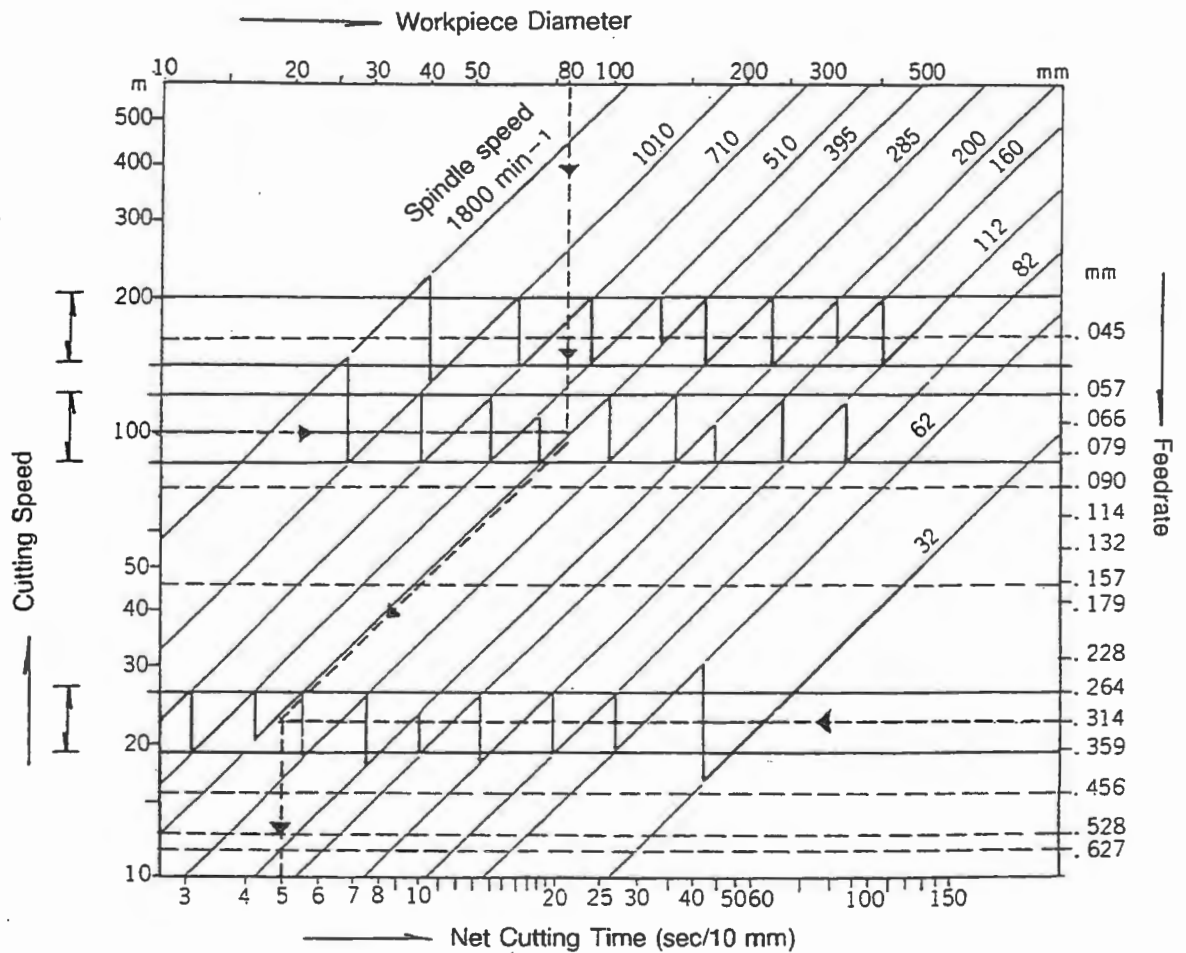
- 10) Mount the side cover.



10. CUTTING SPEED CHART

The cutting speed plays a very important role in the efficient use of carbide-tipped tools.

With MS series, the most appropriate cutting speed can be set using the 12 steps of spindle speed changes according to the diameter of the workpiece to be cut. In addition, the spindle speed change ratio is set small within the range which is used most frequently.



The chart above shows how to determine the spindle speed based on the workpiece diameter and required cutting speed. It also gives the approximate cutting time using the feedrate. With a carbide tipped tool, the cutting speed should be selected in the range higher than 80 m/min.

11. REMOVING GAP

To remove the gap, loosen the six clamp bolts and lift up the gap bed until the guide pin completely comes off. Then, slide the gap to remove it. The guide pin will be left at the machine bed when the gap is removed. Store the removed gap taking care against damages and rust.

Use the guide pin as a guide to install the gap again. Before installing the gap, clean the gap mounting surfaces and guide pin holes.
