CNC LATHE

LU15

OPERATION & MAINTENANCE MANUAL
(12th Edition)

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OKUMA

SAFETY PRECAUTIONS

The machine is equipped with safety devices which serve to protect personnel and the machine itself from hazards arising from unforeseen accidents. However, operators must not rely exclusively on these safety devices: they must also become fully familiar with the safety guidelines presented below to ensure accident-free operation.

This instruction manual and the warning signs attached to the machine cover only those hazards which Okuma can predict. Be aware that they do not cover all possible hazards.

1. BEFORE TURNING ON THE POWER

(1) Make sure that the doors to the operation panel and the electric control cabinet are closed.

(2) Make sure that there are no obstacles around the machine.

(3) Turn on the main power disconnect switch before turning on the CONTROL ON switch on the operation panel.

2. CHUCK PRECAUTIONS

(1) Always close the front shield before starting the spindle or cutting operations.

(2) Always observe the spindle speed maximums for the installed chunk.

Never run the spindle exceeding the maximum allowable spindle speed.

(3) If a chunk or fixture is unique to your application, check the maximum allowable spindle speed and stay within the limit. Also, take note of the workpiece gripping force and balance.

(4) The maximum spindle speed can be limited by inputting a G50 command with the spindle speed. The G50 command helps to ensure safety in operation.

(5) If the spindle must be rotated close to the maximum allowable spindle speed, observe the following points:

- Make sure that the workpiece clamped in the chunk is balanced.
- Apply the allowable maximum amount of pressure to grip the workpiece because centrifugal force reduces the chuck gripping force.

The maximum allowable spindle speed and application pressure are indicated on the name plate on the front shield and on the chuck body. The allowable maximum speed and the applicable pressure ensure a chucking force that is more than one-third over the original chunk gripping force with the standard soft-top jaw set in line with the periphery of the chuck body.

(6) If special jaws (larger than standard soft-top jaws) are used, observe the following points:

- Lower the spindle speed because centrifugal force and lower efficiency reduce the chuck gripping force.
- If the jaw tightening nut (jaw nut) is outside of the periphery of the chuck, only one tightening bolt is holding the jaws in place. This is a potentially dangerous condition. Jaw nuts must always be within the periphery of the chuck.
- Machine the jaws to the workpiece shape.

(7) Securely tighten the bolts on the chuck body, the jaws, and the block to the specified torque. Use lubrication oil. Make sure that the torque is at least 392 to 490 N [40 to 50 kgf (88 to 110 lbf)].

3. GENERAL CHECKS

(1) Check the amount of lubricating oil every day before starting operation.

(2) Always use the specified brand of lubricating oil.

(3) Use the recommended type of cutting fluid (coolant) when possible.

(4) It is recommended to use a water-soluble coolant to prevent fire. Do not attempt unmanned operation if a non-soluble coolant is used.

(5) Change and replenish the lubricating oil and coolant in each reservoir according to the schedules in the manual.

(6) Clean the filters according to the schedules in the manual.

(7) Make sure that each pressure gauge on the air and hydraulic lines display the correct value as described in this manual.

(8) Always turn off the power before beginning any work inside the front shield. In addition, turn off the power before beginning work at the back of the machine that requires an operator to enter the machine operating zone.

4. BEFORE STARTING OPERATION

(1) Always follow the instructions in the operation manual.

(2) Never operate the machine with all of the protective covers and shields in place.

(3) Always close the front shield before starting operation.

(4) Never attempt to run a new program without checking its operation. Run the program without a workpiece set in the chuck and make sure that there is no interference. After making sure that the program has no bugs, cut a workpiece in the single block mode. If no problems are discovered, automatic operation may be started.

(5) Before attempting the following operations, make sure that they can be accomplished safety.

- Spindle rotation
- Turret indexing
- Axis movement

(6) Never touch chips or the workpiece while the spindle is rotating.

(7) Never attempt to stop a moving object by hand or with a tool.

(8) Check the jaw installation conditions, the hydraulic pressure, and the maximum allowable spindle speed for the power chuck.

(9) Check the installation and arrangement of the tools.

(10) Check the tool offset settings.

(11) Check the zero offset settings.

(12) Make sure that the spindle speed and feedrate override settings are at 100%.

(13) Before feeding the turret, check the software limit setting and the emergency limit LS (limit switch) dog positions for both the X- and Z-axes.

(14) Check the turret index/rotation position.

(15) Check the tailstock body position.

(16) Make sure the cutting operation is within the allowable transmission power and torque ranges.

(17) Make sure that the workpiece securely fitted in the chuck or fixture.

(18) Check the cutting fluid nozzle positions. They must be set to properly supply cutting fluid to the appropriate points.

5. PRECAUTIONS AGAINST FIRE

(1) Use meticulous care to prevent fire especially when performing untended operation.

(2) Use nonflammable coolant.

(3) Do not leave any flammables around the machine.

(4) Do not heap up chips.

(5) Check the tool cutting edge, cutting conditions, and tool life.

6. SETUP

(1) Make sure that setup is complete.

(2) If the setup is changed, operate the machine step-by-step to make sure that cutting can performed without any problems.

(3) Before changing the chuck and/or chuck jaws, make sure that the chuck fits the intended jog.

(4) If two or more workers must work together, establish signals so that they can communicate (for example, when lifting or setting heavy objects). Each worked should be aware when a new process is about to begin.

(5) Use the crane or equivalent tool to handle heavy objects.

(6) When attempting an unfamiliar setup, recheck the setup before beginning operation.

7. WORKPIECE LOADING AND UNLOADING

(1) Make sure that workpieces are loaded and unloaded securely.

(2) Before loading or unloading a workpiece, retract the turret so that the cutting tools in the turret cannot injure the operator.

(3) Before loading and unloading a workpiece, make sure that the spindle has come to a complete stop.

(4) Before running a new program, rotate the spindle to make sure that the workpiece is securely clamped in the chuck.

(5) Before machining an irregularly-shaped workpiece, make sure that it is balanced properly.

(6) When handling heavy workpieces, use the a crane, hoist, or other similar tool.

(7) Before loading a workpiece, make sure that the workpiece has a portion that can be used for proper chucking.

8. AT THE END OF THE DAY

(1) Clean the machine.

(2) Move the turret to the predetermined retraction position.

(3) Turn off the CONTROL ON switch on the operation panel, before turning off the main power disconnect switch.

(4) Make sure all power switches are turned off.

9. WHEN A PROBLEM OCCURS

(1) Stop the machine immediately by pressing the EMERGENCY STOP switch on the operation panel.

(2) Consult with the person in charge of maintenance to determine what corrective measures need to be taken.

(3) If two or more workers must work together, establish signals so that they can communicate (for example, when lifting or setting heavy objects). Each worked should be aware when a new process is about to begin.

(4) Only use specified replacement parts and fuses.

10. GENERAL PRECAUTIONS

(1) Wear appropriate clothing.

(2) Keep the machine and the area around it clean and organized.

(3) Never touch controls or switches with wet hands.

11. SAFETY DEVICES AND FUNCTIONS

Contents	Location	Remark
1. Front shield with grated glass and polycarbonate	Machine	
2. Shield open/close interlock	Machine	
3. Chuck interlock	Electric control cabinet	
4. Tailstock spindle interlock	Electric control cabinet	
5. Tailstock spindle position confirmation	Electric control cabinet	optional
6. Foot pedal protection cover	Machine	optional
7. Emergency limit setting LS (limit switch)	Machine	
8. Software limit	Operation panel	
9. Chuck barrier	Operation panel	
10. Turret barrier	Operation panel	
11. Tailstock barrier	Operation panel	optional
12. Emergency stop button	Operation panel	
13. Slide hold button	Operation panel	
14. Alarm display	Operation panel	
15. Leakage circuit breaker	Electric control cabinet	optional
16. Self-lock cylinder for chuck	Machine	
17. Cycle start requiring simultaneous depression of both buttons	Machine	optional
18. Turret rotation at low speeds (manual)	Machine	

12. SYMBOLS

The following warning indications are used in this manual to draw attention to information of particular importance.

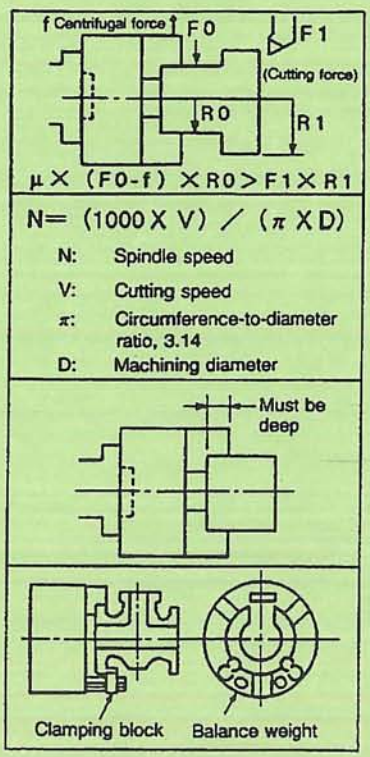
⚠DANGER : Indicates an imminent hazard which, if not avoided, will result in death or serious injury.

⚠WARNING : Indicates hazards which, if not avoided, could result in death or serious injury.

⚠CAUTION : Indicates hazards which, if not avoided, could result in minor injuries or damage to NC unit or other equipment.

NOTICE : Indicates precautions relating to NC unit operations.

13. FOR SAFE CHUCK WORK

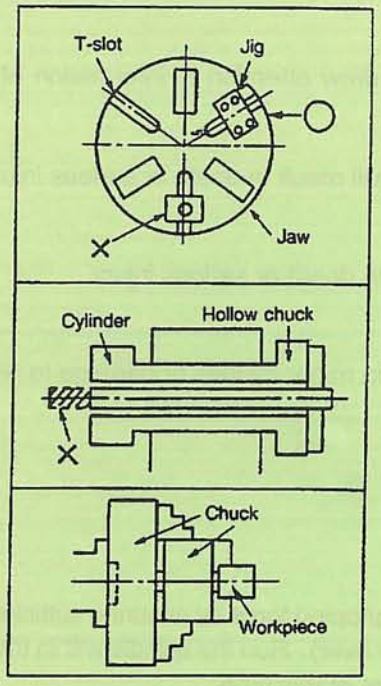


1. Set the chuck gripping force by ensuring sufficient factor of safety (2 to 3 or over). Run the spindle within the allowable speed range set at this time.

2. In constant peripheral speed cutting, calculate the actual machining speed before designating G50 (max. speed limit function).

3. Secure the jaw gripping depth as much as possible.

4. Before machining an unbalanced workpiece, carry out balancing of the workpiece weight by gradually changing the spindle speed.



5. Never attempt to install jigs using T-nut.

   Be sure to fix the jigs with bolts.

   No chucks prepared by Okuma have T-groove.

6. When inserting a bar material into the hollow chuck, ensure that the bar does not protrude from the rear end of the cylinder.

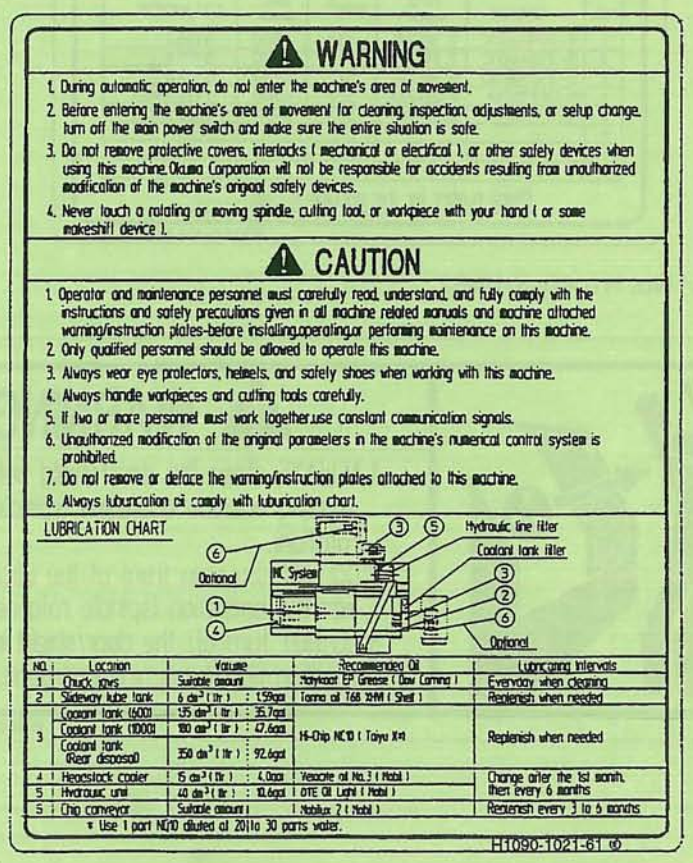
7. Never use double chucking method.

14. CAUTION PLATE

- The machine and its components are fitted with various caution plates. Carefully read these plates and follow the instructions described there.
- Do not tear or damage the caution plates. In case a plate has been lost or become illegible, ask us for a new plate, quoting the Okuma part number written in this manual.

(1) Caution Plates and Okuma Part Numbers

1) Okuma Part No. H1090-1021-61



⚠ WARNING

1. During automatic operation, do not enter the machine's area of movement.
2. Before entering the machine's area of movement for cleaning, inspection, adjustments, or setup change, turn off the main power switch and make sure the entire situation is safe.
3. Do not remove protective covers, interlocks (mechanical or electrical), or other safety devices when using this machine. Okuma Corporation will not be responsible for accidents resulting from unauthorized modification of the machine's original safety devices.
4. Never touch a rotating or moving spindle, cutting tool, or workpiece with your hand (or some makeshift device).

⚠ CAUTION

1. Operator and maintenance personnel must carefully read, understand, and fully comply with the instructions and safety precautions given in all machine related manuals and machine attached warning/instruction plates-before installing,operating,or performing maintenance on this machine.
2. Only qualified personnel should be allowed to operate this machine.
3. Always wear eye protectors, helmets, and safety shoes when working with this machine.
4. Always handle workpieces and cutting tools carefully.
5. If two or more personnel must work together,use constant communication signals.
6. Unauthorized modification of the original parameters in the machine's numerical control system is prohibited.
7. Do not remove or deface the warning/instruction plates attached to this machine.
8. Always lubrication oil comply with lubrication chart.

LUBRICATION CHART

NO.	Location	Volume	Recommended Oil	Lubricating Intervals
1	Chuck jaws	Suitable amount	Molykote EP Grease (Dow Corning)	Everyday when cleaning
2	Sideway lube tank	6 dm³ (1ℓ) : 1.59gal	Tonna oil T68 32MM (Shell)	Replenish when needed
3	Coolant tank (600ℓ)	135 dm³ (1ℓ) : 35.7gal	Hi-Chip NC10 (Taiyu Kyu)	Replenish when needed
	Coolant tank (1000ℓ)	180 dm³ (1ℓ) : 47.6gal		
	Coolant tank (Rear disposal)	350 dm³ (1ℓ) : 92.6gal		
4	Hydrostatic cooler	15 dm³ (1ℓ) : 4.0gal	Vescote oil No.3 (Mobil)	Change after the 1st month, then every 6 months
5	Hydraulic unit	40 dm³ (1ℓ) : 10.6gal	DTE Oil Light (Mobil)	
6	Chip conveyor	Suitable amount	Mobilux 2 (Mobil)	Replenish every 3 to 6 months

* Use 1 part NC10 diluted at 20 to 30 parts water.

H1090-1021-61 Ⓞ

2) Okuma Part No. H1044-1062-28-2

⚠ CAUTION

1. DO NOT rotate chuck and other workholding devices above their maximum speed limits.*
2. Make sure rotating components have adequate and balanced gripping forces.*

*Refer to workholder manufacturer specifications.
Hydraulic chuck maximum pressure and rotation limits:

NO.	CHUCK	MPa (kg/cm²)	lb/in²	min⁻¹ (rpm)	CYLINDER
1	B-208A601C	2.30(23)	333	4500	S1552
2	B-210A601C	2.91(29)	422	4200	S1552
3	B-210A801D	2.38(24)	345	3800	S1870
4	N-08A0601A	2.22(22)	322	4500	Y1225R(E)
5	N-10A0601A	2.57(26)	373	4010	Y1225R(E)
6					
7					
8					

Chuck number for this machine is : NO. ☐

H1044-1062-28-2 Ⓔ

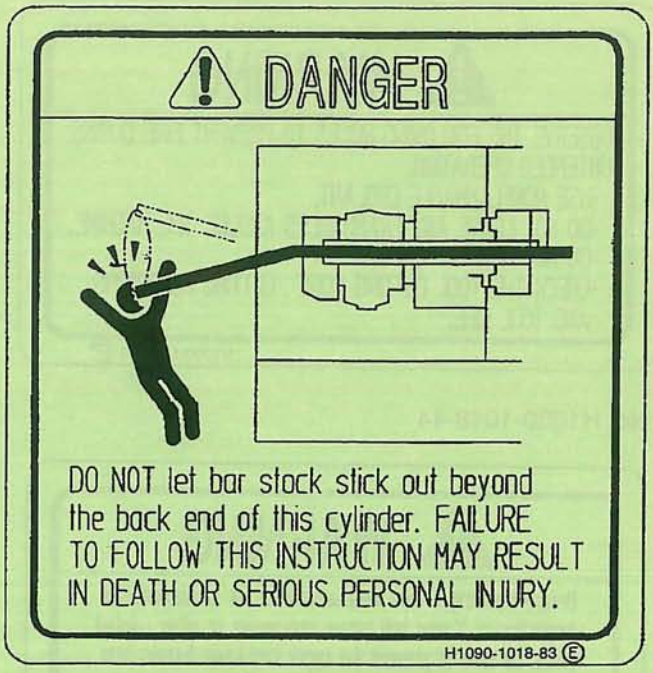
3) Okuma Part No. H1090-1018-82

⚠ WARNING

1. ALWAYS close the door/shield before starting machine operation (spindle rotation).
2. DO NOT stand in front of the door during machine operation (spindle rotation).
3. DO NOT turn off the door/shield interlock function during machine operation.

H1090-1018-82 Ⓔ

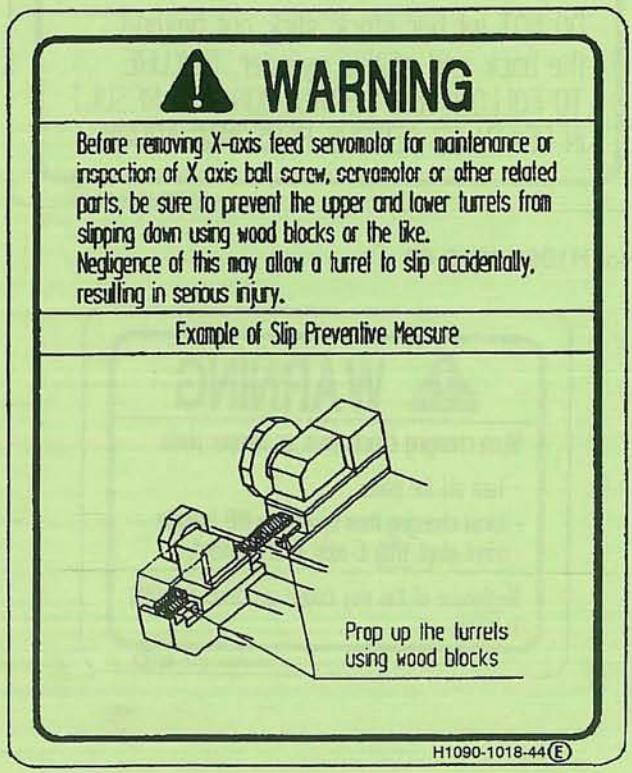
4) Okuma Part No. H1090-1018-83



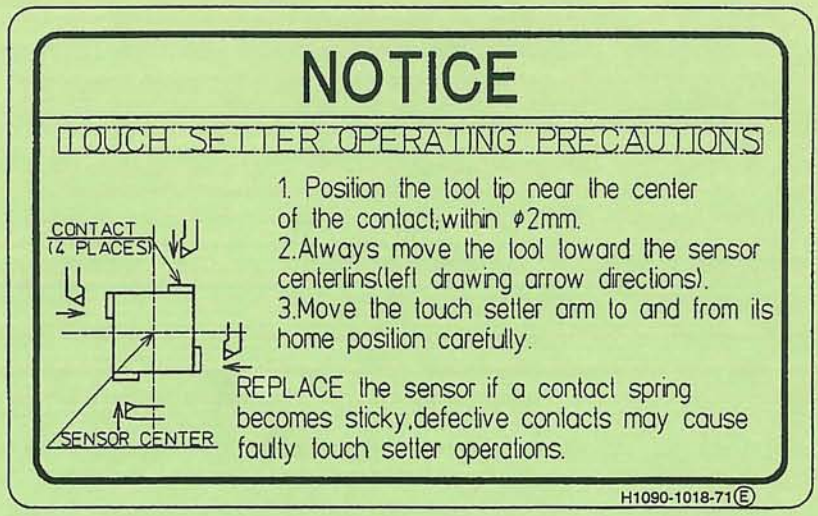
5) Okuma Part No. H1090-1018-62

6) Okuma Part No. H1090-1018-35

7) Okuma Part No. H1090-1018-44



8) Okuma Part No. H1090-1018-71



INTRODUCTION

Thank you for choosing an Okuma Model LU15 CNC lathe. We are proud to have you among our Okuma family of users.

This instruction manual contains concise information on the installation, setup, operation and maintenance of your Model LU15 CNC lathe. To make the most of its outstanding performance over a long period, the machine must be properly installed, and operating and maintenance procedures must be clearly understood and carefully followed. You are encouraged to study this instruction manual carefully before the machine is installed and to keep it on file for future reference.

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SECTION 1 MACHINE SPECIFICATIONS

1. SPECIFICATION TABLE

Item	Unit	Specifications		
		2SC × 600	2ST × 350	2SC × 1000
CAPACITY:				
No. of controlled axes		4		
Swing over bed	mm (in.)	530 (20.87)		
Swing over carriage	mm (in.)	380 (14.96)		
Swing over cross-slide	mm (in.)	330 (12.99)		
Distance between centers	mm (in.)	600 (23.62)	——	1000 (39.37)
Max. turning diameter × length	mm (in.) × mm (in.)	ϕ360 × 600 (14.17 × 23.62)	ϕ360 × 350 (14.17 × 13.78)	ϕ360 × 1000 (14.17 × 39.37)
SPINDLE:				
Spindle diameter	mm (in.)	ϕ100 (3.94) [ϕ120 (4.72)]*1		
Spindle nose type		JIS A2-6 [JIS A2-8]*1		
Taper hole	mm (in.)	ϕ70 (2.76) × 1/10 [ϕ90 (3.54) × 1/10]*1		
Through-spindle hole	mm (in.)	ϕ62 (2.44) [ϕ80 (3.15)]*1		
No. of spindle speed ranges		Stepless × automatic 2 step		
Spindle speed	min^{-1} {rpm}	45 to 4500 [38 to 3800]*1		
CROSS-SLIDE (X-AXIS):				
Axis travel	mm (in.)	Upper: 180 + 80 (7.09 + 3.15) Lower: 105 + 35 (4.13 + 1.38)		
Feedrate	mm/rev (ipr)	0.001 to1000.000 (0.00001 to 39.37) Upper: 180 + 80 (7.09 + 3.15) Lower: 105 + 35 (4.13 + 1.38) 0.001 to1000.000 (0.00001 to 39.37)		
Rapid feedrate	mm/min (ipm)	15000 (590.55)		
CARRIAGE (Z-AXIS):				
Axis travel	mm (in.)	Upper: 640 (25.20) Lower: 615 (24.21)		Upper: 1040 (40.94) Lower: 1015 (39.96)
Feedrate	mm/rev (ipr)	0.001 to 1000.000 (0.00001 to 39.37)		
Rapid feedrate	mm/min (ipm)	20000 (787.40)		

Item		Unit	Specifications		
			2SC × 600	2ST × 350	2SC × 1000
TURRET:					
Type			Upper: V12 Lower: V8		
No. of tools			20		
Tool size	OD turning tools	mm (in.)	□25 (0.98)		
	ID turning tools	mm (in.)	ϕ40 (1.57)		
TAILSTOCK:					
Tailstock spindle diameter		mm (in.)	ϕ90 (3.54)	——	ϕ90 (3.54)
Tailstock spindle taper hole			MT No. 5	——	MT No. 5
Tailstock spindle travel		mm (in.)	120 (4.72)	——	120 (4.72)
MOTOR:					
Spindle drive motor		kW (hp)	15/22 (20/30) (cont./20 min)		
Carriage feed (Z-axis)		kW (hp)	4 (5.4)		
Cross-slide feed (X-axis)		kW (hp)	Upper: 2.4 (3.2) Lower: 1.5 (2)		
Hydraulic power unit pump		kW (hp)	2.2 (3)		
Guideway lubrication pump		kW (hp)	0.025 (0.034)		
Spindle lubrication pump		kW (hp)	0.25 (0.34)		
MACHINE HEIGHT		mm (in.)	1931.6 (76.05)		2030 (79.92)
FLOOR SPACE REQUIRED		mm (in.) × mm (in.)	3305 × 2100 (130.12 × 82.68)		4415 × 2162 (173.82 × 85.12)
NET WEIGHT		kg (lb)	5300 (11660)	4800 (10560)	6700 (14740)

*1 For optional large-diameter spindle

2. DIMENSIONAL DRAWINGS

(1) 2SC × 600

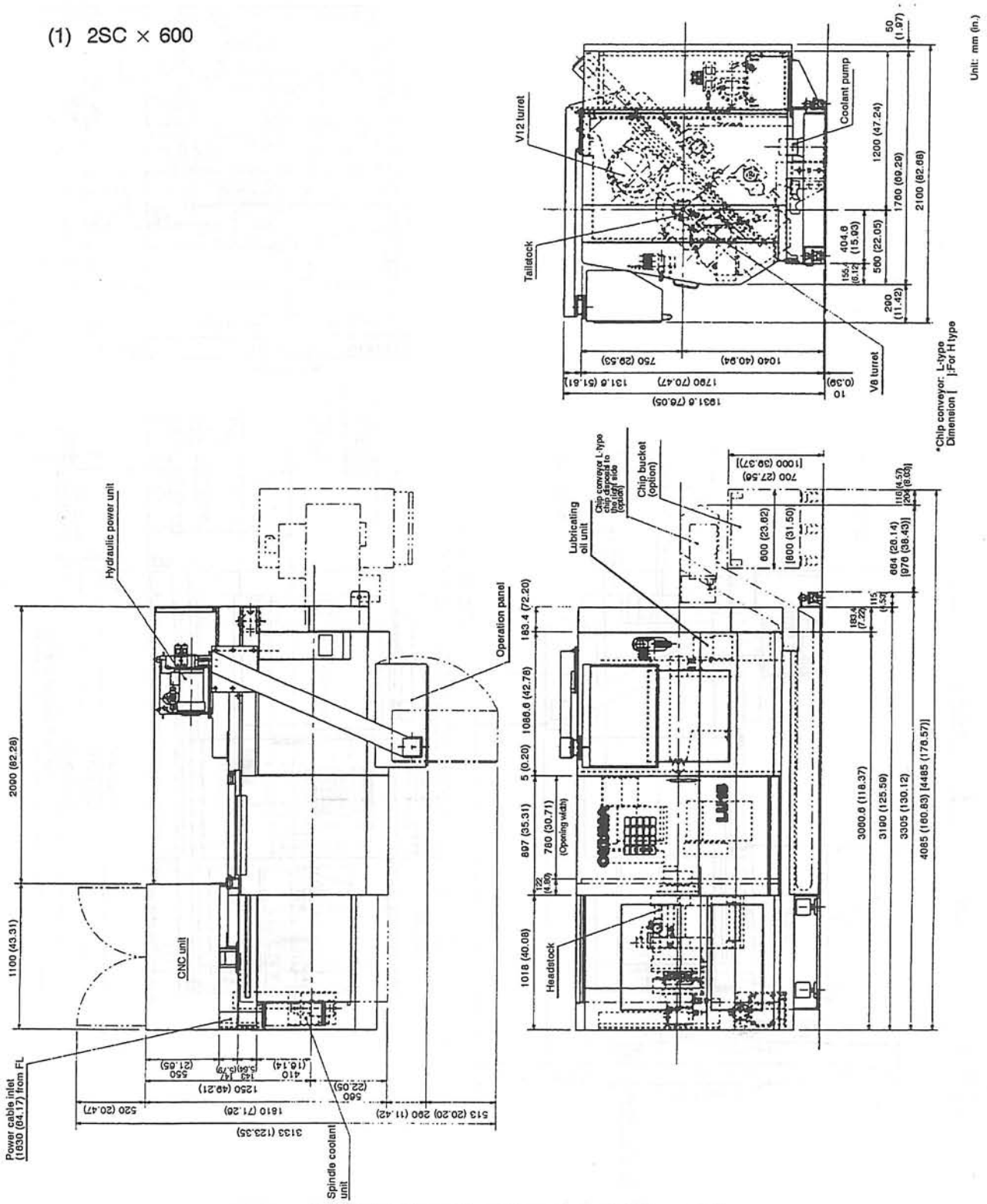


Fig. 1-1 Dimensional Drawings (2SC × 600)

(2) 2ST × 350

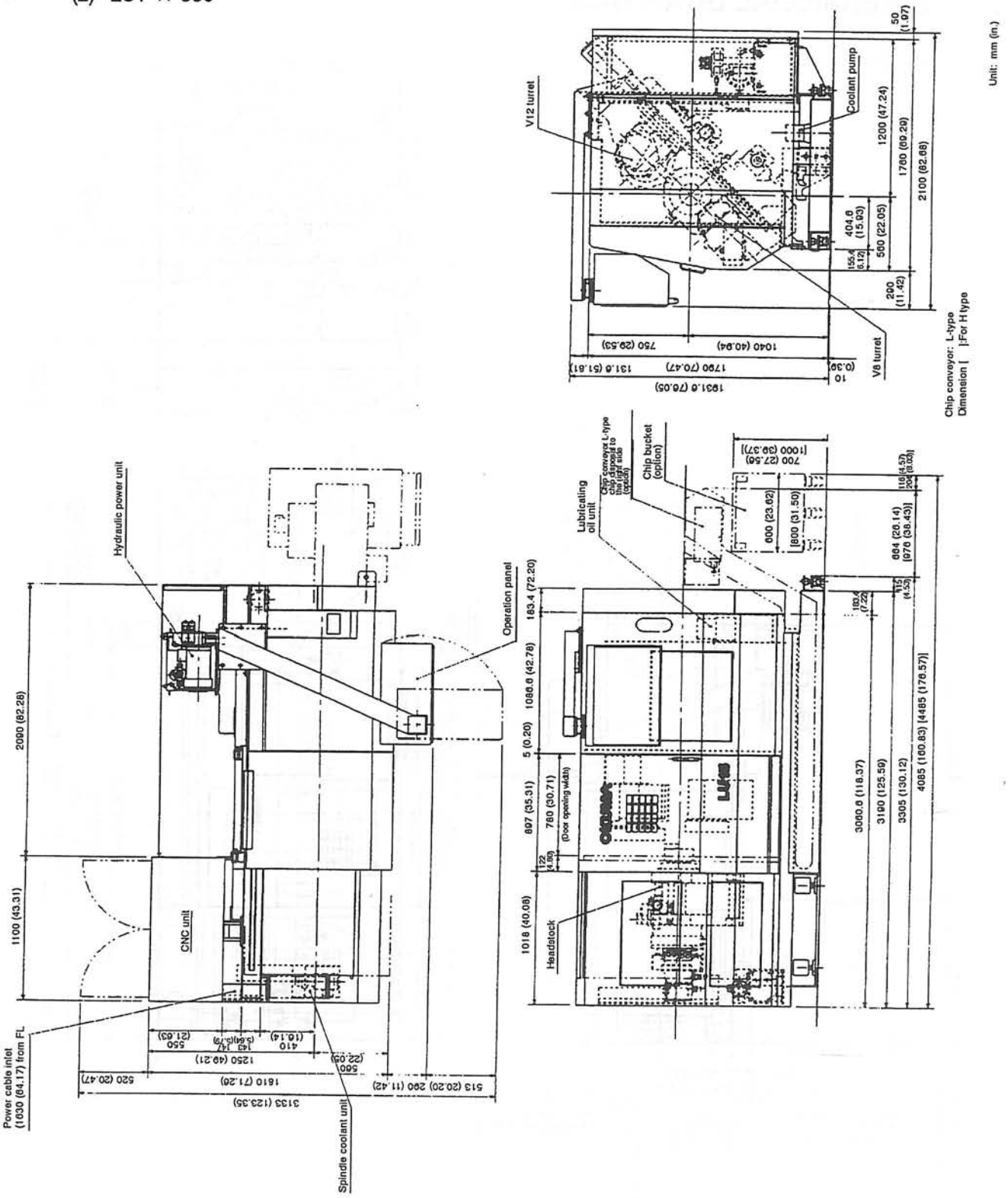


Fig. 1-2 Dimensional Drawings (2ST × 350)

(3) 2SC × 1000

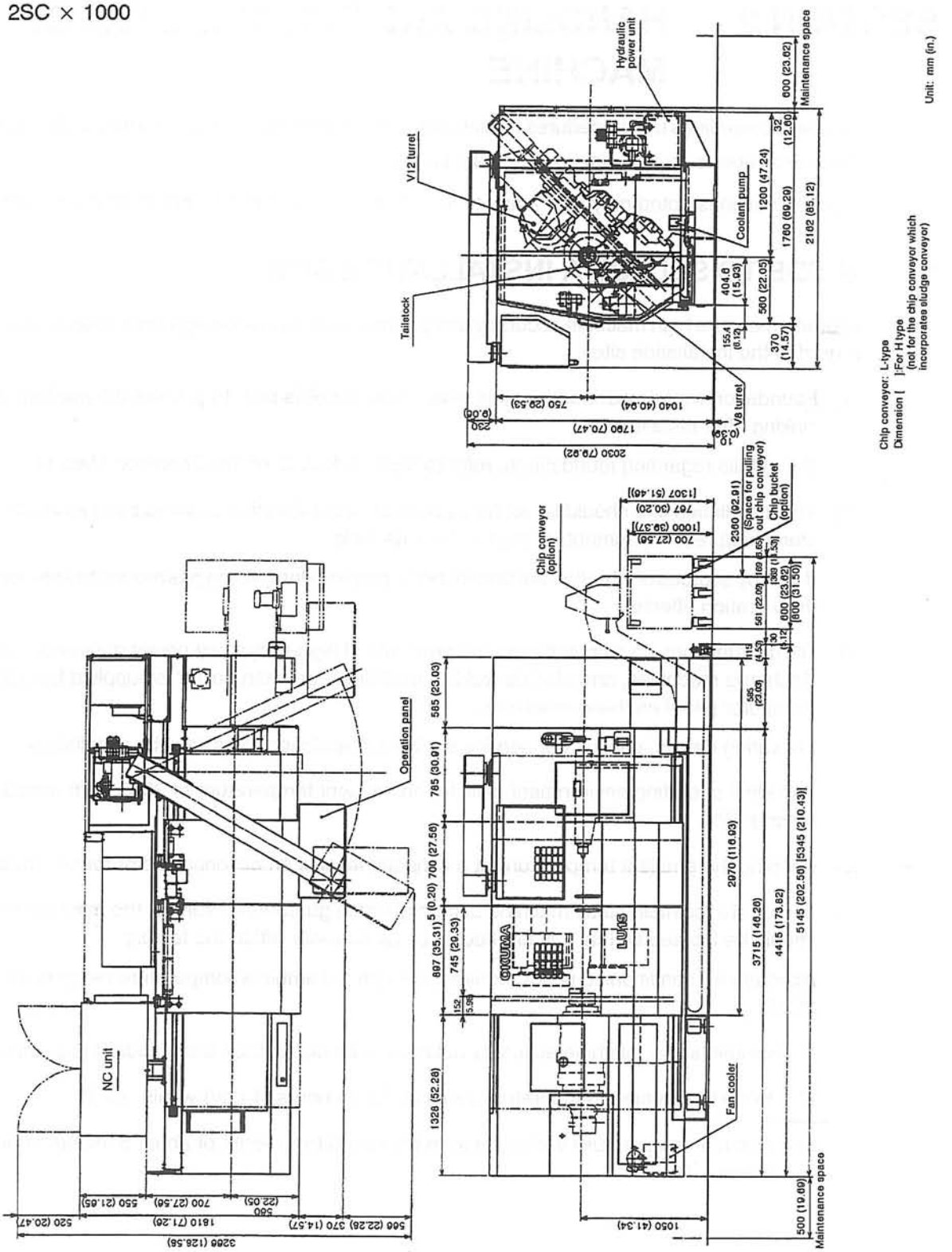


Fig. 1-3 Dimensional Drawings (2SC × 1000)

SECTION 2 HANDLING AND INSTALLATION OF MACHINE

This section outlines the procedures for handling and installing your CNC lathe when it has to be moved to a place area due to any change in your plant layout.

Most precautions noted may also apply to the initial installation of an CNC lathe at your plant.

1. GUIDE TO SELECT A INSTALLATION SITE

In order to ensure high machine accuracy and performance, the following points should be considered with regard to the installation site.

(1) Foundation work is advised for sites where the subsoil is soft, to prevent the machine from tilting or sinking after installation.

For details regarding foundations, refer to SECTION 2, 2. of the Operation Manual.

(2) The installation site should be as far as possible from vibration sources such as roads, stamping/press equipment, or planer machine tools.

If nearby sources of vibration are unavoidable, prepare dampening pits around the foundation to reduce the vibration effects.

(3) NC malfunctions could result from the proximity of high-frequency power generators, electric discharge machines, and electric welding machines, or when power is supplied from the same distributor panel as these machines.

For wiring details, consult our service engineer dispatched to assist with installation.

(4) The ideal operating environment calls for an ambient temperature of 20°C, with humidity between 40 and 75%.

(5) Keeping the ambient temperature at a constant level is an essential factor for accurate machining.

(6) In order to maintain static machine accuracy within guaranteed values, the machine installation site should be located so that it is unaffected by air currents within the factory.

Although air-conditioning is not required, the optimal ambient temperature range is 17°C to 25°C.

(7) To maintain static machine accuracy at levels even higher than the standard guaranteed values:

a) Keep the ambient temperature variance for 24 hours (1 day) within ±2°C.

b) Ambient temperature variances from floor level to a height of about 5 meters should be held within 1°C.

1-1. Care in Handling a Precision Machine

The CNC lathe consists essentially of four major components: the machine, the electric control box, the hydraulic power unit and the CNC unit. Model LU15 CNC lathe is built in one unit and it can be easily moved without separating it into consisting units. (Note that the coolant tank is installed separately.)

Lifting and moving machine:

There are two different methods for moving the entire machine to any desired location; by an overhead crane, using lifting hooks supplied together with the machine and by rolls over which the machine is pushed by manual labor.

(1) Machine Lifting

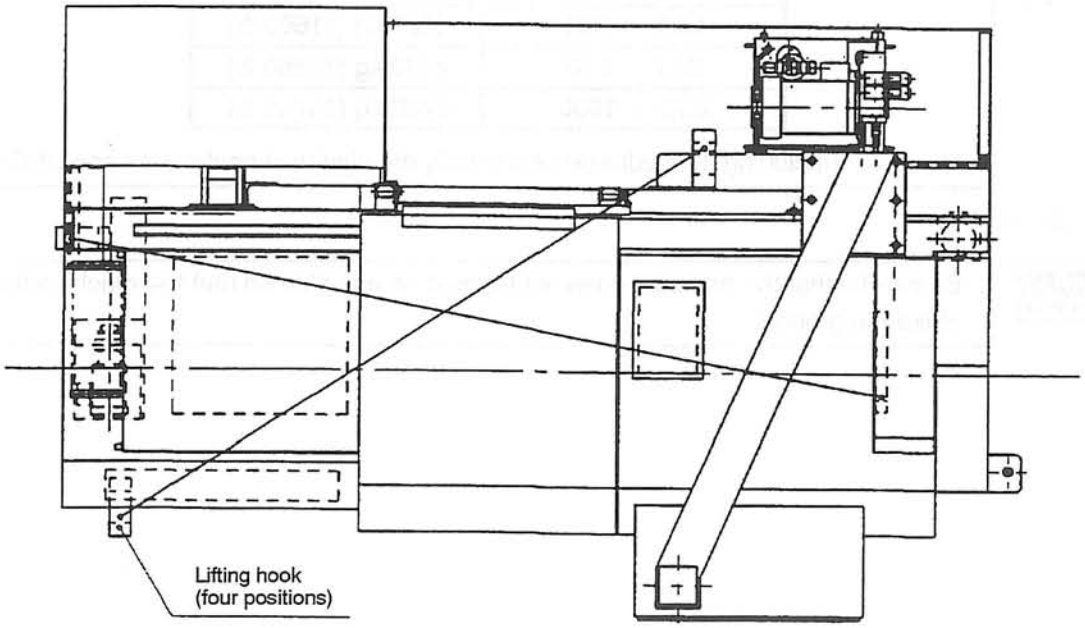


Fig. 2-1 Machine Lifting

Procedure:

a) Move the saddle and the tailstock to the left end and clamp the tailstock in place.

b) Remove the side covers of the coolant pump that is located at the lower right side of the machine.

c) Disconnect the cables and hoses from the coolant pump.

d) Pull out the coolant tank.

e) Remove the upper cap from the right front cover.

f) Remove the upper cap and the front lower cap from the left front cover, and the lower cap from the left side cover.

g) Fix the lifting hooks at the predetermined positions.

(2) Precautions for Lifting

WARNING : (1) The cables should have a nominal diameter of 20 mm (0.79 in.) or larger.

(2) Change an angle formed by each cable line so that the cables will not contact the finished surfaces of the machine. (The cables may not form an angle larger than 40 degrees to the perpendicular line.)

(3) Check for balance and be very careful when lifting the machine.

(4) Use extra care to lower the machine gently onto the floor; NEVER APPLY SHOCKS TO THE MACHINE WHEN PLACING IT ON THE FLOOR.

Approximate Weight of Machine	
2SC × 600	5300 kg (11660 lb)
2ST × 350	4800 kg (10560 lb)
2SC × 1000	6700 kg (14740 lb)

(Including the hydraulic power unit, the electrical control box and CNC unit.)

(3) Rolling

WARNING : Be careful that the machine does not tip over on any side so that the machine base may not strike the ground.

2. FOUNDATION REQUIREMENTS

2-1. General Precautions for Building a New Foundation

NOTICE

: If the following conditions are satisfied, no foundation work is required for general machining activities, and foundation bolts are not necessary.

- The subsoil must be solid.
- The concrete floor thickness must be approximately 200 mm (7.87 in.).
- There must be no gap between the floor and the subsoil.

For long-maintained accuracy and where sub-soil or ground under the floor is not strong enough, a new concrete foundation should be set up in accordance with the Foundation Plan attached to this Manual. (See 3.)

(1) Foundation requirements vary depending on the characteristics of the sub-soil. Under any soil conditions, it is important that sub-soil should be well compacted to keep the foundation from unsettling once the machine has been installed.

(2) Where sub-soil is too soft, it is necessary to drive concrete piles into the sub-soil.

(3) The Foundation Plan attached to this Manual is prepared for laying a typical concrete foundation specifically for the machine. The concrete thickness or depth should be determined in terms of the ground condition in each case.

3. GENERAL PROCEDURE FOR INSTALLATION

(1) Place leveling plates, 150 × 150 × 19 mm (5.91 × 5.91 × 0.75 in.) over individual foundation bolt-holes.

Refer to the Foundation Plan.

(2) Place foundation washers (furnished together with the machine) on the leveling plates and then place the machine on them.

(3) Pass foundation bolts through the hole in the leveling plate and a center bore through the built-in jack screw assembly.

Secure each foundation bolt carefully, using a washer and a nut on its upper end.

(4) Use wedge pieces, shims, or leveling blocks under the machine base to level the machine approximately.

(5) Pour mortar into the foundation bolt holes and allow it to set.

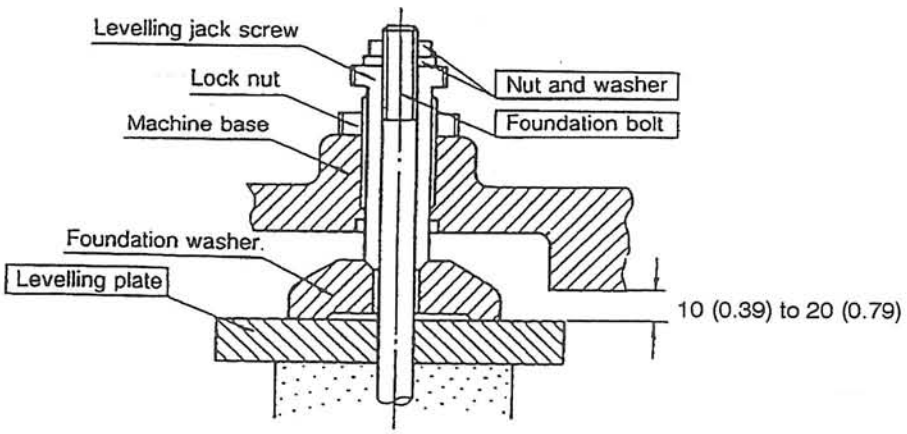
(6) After the mixture has become hard enough, remove the shims or leveling blocks from under the machine base, and level the machine within the specified limits.

3-1. Precautions for Installation

(1) Keep the underside of the leveling plates free from any oily substance.

(2) With leveling jack screws resting on foundation washers, the bottom surfaces of the machine base casting should be about 10 to 20 mm (0.39 to 0.79 in.) above concrete floor level.

(3) Fill the foundation bolt holes with mortar so as to reach the underside of the respective leveling plates. Be sure to compact the mortar thoroughly.



The part names shown in [ ] are not supplied as standard equipment.

Fig. 2-2 Precautions for Installation

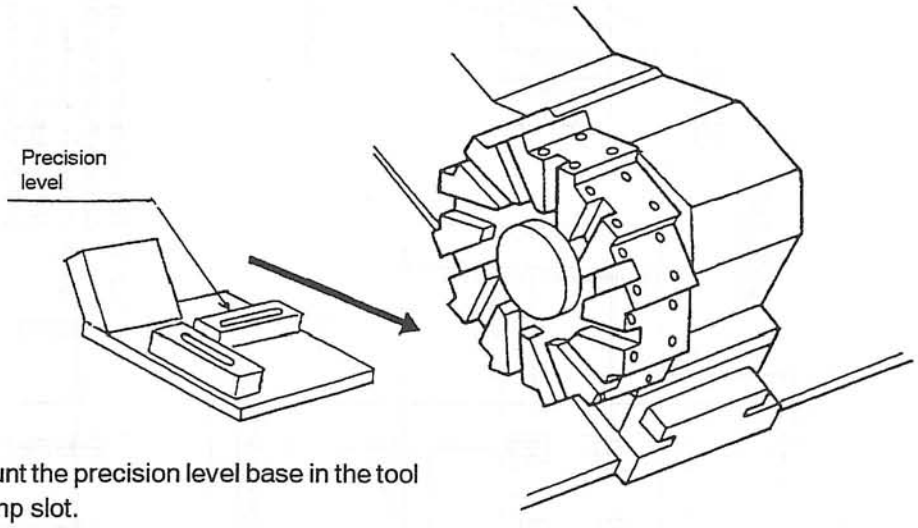
4. LEVELING THE MACHINE

The Machine must be carefully leveled because the accuracy of the level at the initial installation will greatly affect the working accuracy and the service life of the machine.

Model	No. of Leveling Jack Screws	Remarks
2SC × 600	10	Pass foundation bolt.
2ST × 350		
2SC × 1000	12	

4-1. Leveling Procedure

(1) Measure the machine level at both right and left ends of bedways in the X- and Z-axis directions.



Mount the precision level base in the tool clamp slot.

Fig. 2-3 Leveling Procedure

(2) Readings are taken on both longitudinal and transverse directions while both the leveling jack screws and the foundation bolt nuts are tightened firmly.

Tolerance	:	0.02 mm per 1000 mm (0.00025 in./ft)
Accuracy of level	:	1 div. = 0.01 mm per 1000 mm (0.000125 in./ft)

5. FOUNDATION PLAN

(1) 2SC × 600
2ST × 350

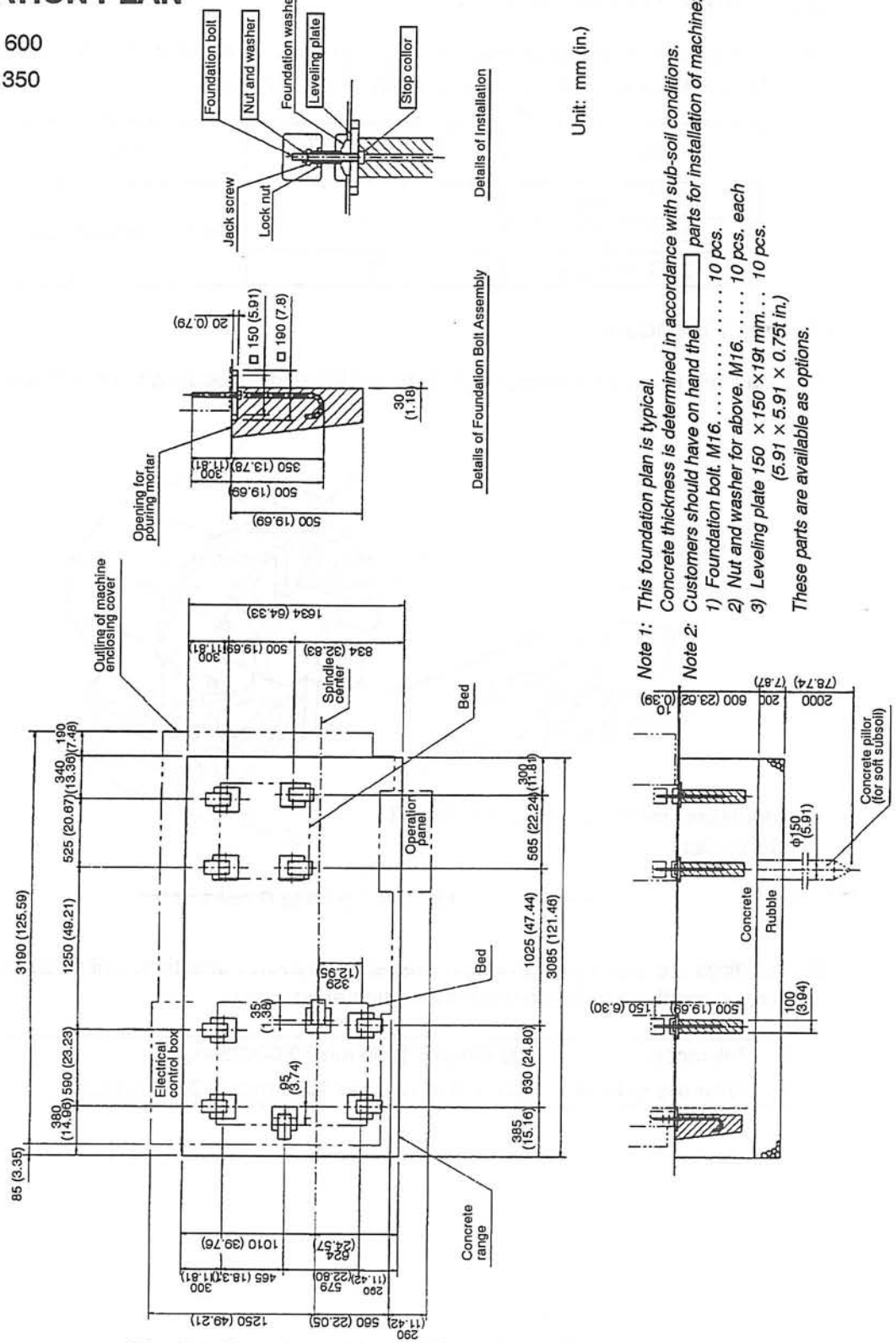
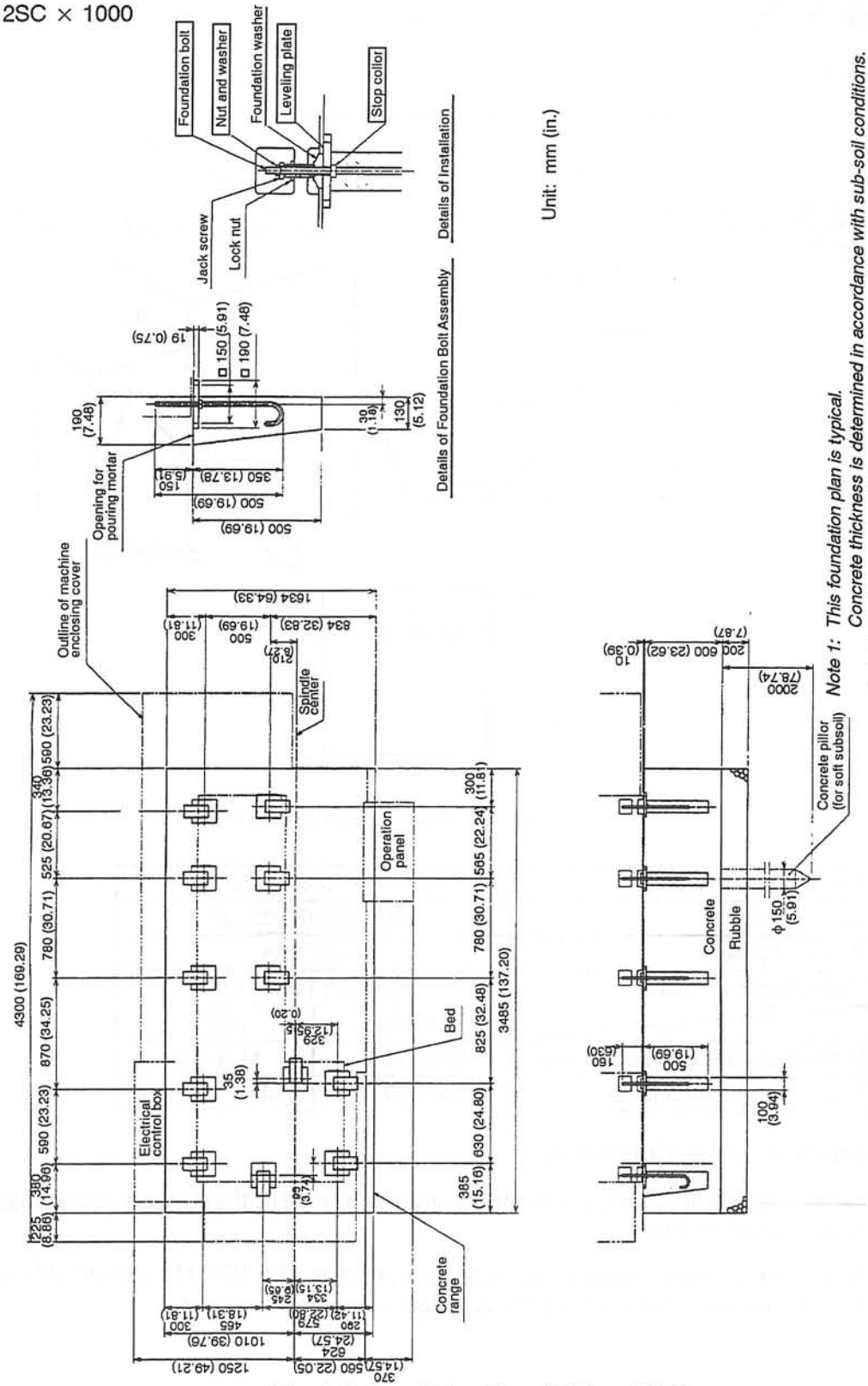


Fig. 2-4 Foundation Plan (2SC × 600, 2ST × 350)

(2) 2SC × 1000



Note 1: This foundation plan is typical.
Concrete thickness is determined in accordance with sub-soil conditions.

Note 2: Customers should have on hand the ☐ parts for installation of machine:
1) Foundation bolt. M16. . . . . 12 pcs.
2) Nut and washer for above. M16. . . . . 12 pcs. each
3) Leveling plate 150 × 150 × 19t mm. . . 12 pcs.
(5.91 × 5.91 × 0.75t in.)
These parts are available as options.

Fig. 2-5 Foundation Plan (2SC × 1000)

6. POWER REQUIREMENTS

Fusing capacity: 125 A min.

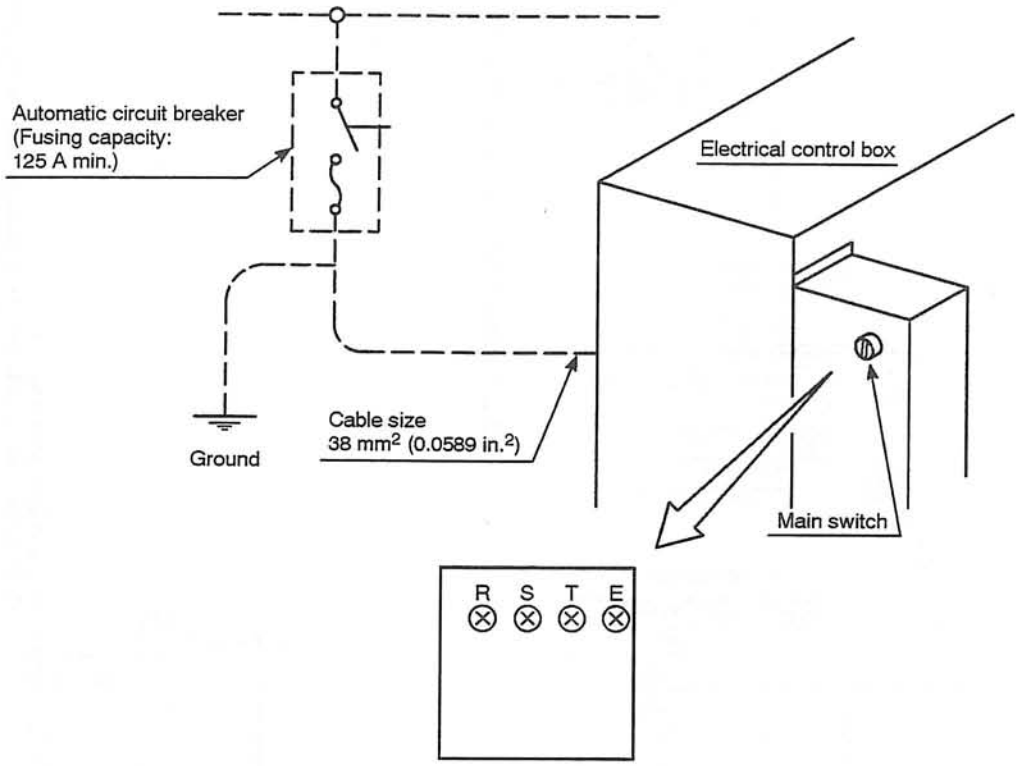


Fig. 2-6 Power Requirements

Power source: 3-phase	200 V ±10%, 50/60 Hz	
Main motor	22/15 kW (30/20 hp)	
Apparent power	30.09 kVA	
Power requirements	36.47 kW (48.87 hp)	
	200 V	220 V
Momentary voltage variation ratio	Max. 15%	Max. 6%
Inductance power source	Max. 230 μH	Max. 110 μH

6-1. Inspection of Cable Connection

The operator can check correctness of cable connection by reading the pressure gauge whether it indicates the specified pressure level.

Confirm that the pressure gauge indicates the set pressure [4.4 MPa {45 kgf/cm² (640 psi)}]. When it indicates the specified pressure level, the electrical connection is correct.

6-2. Electrical Work

⚠CAUTION :

(1) Connect the ground to the external protector connection terminal (PE) located inside the control box.

(2) Do not connect the power cord and the grounding wire in serial; if attempted, it will give adverse affect to other equipment or cause malfunctioning of the leak breaker, etc.

(3) When a leak breaker is used, select the one meeting the following rating.

- For inverter circuit use
- Sensitive current of 100 mA or more
- Middle-sensitivity high-speed inverter type

(4) If more than one machine tool is connected to the same single power source, the value of "inductance of power source" for each machine is obtained by dividing the value in the table by the number of machine tools to be connected.

(5) Wiring inductance in 50 m (164.05 ft) cable is approximately 12 μH when general KIV cable is used.

(6) The momentary voltage variation ratio is calculated in the manner as explained below.

If the "excessive voltage variation ratio" warning function which functions if power source inductance is higher than the allowable limit does not give warning signal and if the momentary voltage variation ratio is lower than the value indicated in the table above, then it is assumed that the power source inductance is lower than the limit.

(7) For further information on the momentary voltage variation ratio and power source inductance, please contact your local Okuma service representative.

Calculating momentary voltage variation ratio:

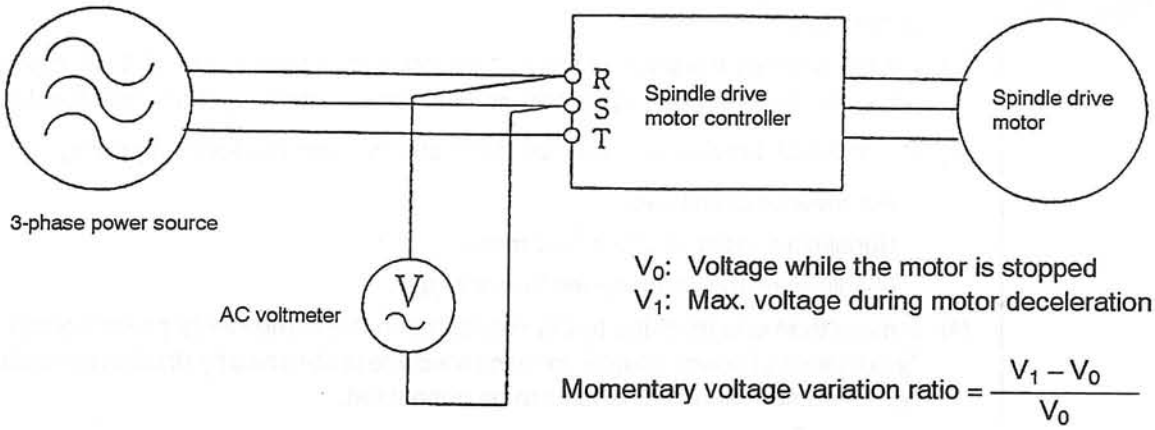


Fig. 2-7

(1) As indicated in the illustration above, connect the AC voltmeter to the power supply terminals at the spindle drive motor controller or the machine.

(2) Measure the voltage while the spindle drive motor is stopped. Take this value as "V_0".

(3) Measure the voltage while the spindle drive motor is decelerating. Take this value as "V_1".

(4) Calculate the momentary voltage variation ratio using the following formula:

Momentary voltage variation ratio = $(V_1 - V_0)/V_0$

Note 1: Since a digital AC voltmeter has slow response, momentary voltage variation ratio obtained using the voltage measured with the digital AC voltmeter is lower than the actual value. To obtain the precise value, it is recommended to use an analog voltmeter.

Note 2: Voltage "V_1" cannot be measured accurately if motor decelerating time is short. Therefore, it is recommended to start deceleration from as high spindle speed as possible.

Note 3: If the "excessive voltage variation ratio" warning function which functions if power source inductance is higher than the allowable limit gives a warning, output is restricted by the spindle drive motor controller. Therefore, the momentary voltage variation ratio calculated using voltage which has been measured under such situation does is not reliable.

7. LUBRICANT OIL REQUIRED AT INSTALLATION

The user is responsible for supplying the lubricant oil specified in SECTION 4 of this manual (Lubrication Chart and Lubricating Oil Specification).

(For optional specification systems, contact your OKUMA representative regarding the appropriate lubricant oil.)

SECTION 3 MACHINE OPERATION

1. BEFORE STARTING OPERATIONS

This section deals mainly with the operating procedures of your CNC lathe under manual control. So the information given here is essential to every operator, whether you are new to a CNC lathe or an "old pro".

Follow these three points:

(1) Actually operate the CNC lathe by yourself inreference to this Instruction Manual.

(2) Learn the symbols for the numerical control terms.

(3) After you have a general idea of how your CNC lathe operates, read this manual repeatedly and also the Programming Manual.

⚠CAUTION : Bring the machine to a complete stop by turning off the main switch before operations such as setup or adjustments inside the chip guard are carried out.
Also turn off the main switch before you attempt to work inside the machine at the rear side of the machine.

1-1. NC Operation

Before you begin to operate the machine automatically by tape, make it a rule to check the following points against a process sheet, a program manuscript, or any other chart giving detailed machining instructions:

(1) Setting of hydraulic power chuck jaws and their gripping pressure

(2) Installation and arrangement of individual cutting tools with respect to their operating sequence

(3) Setting of tool offsets

(4) Setting of zero offsets

(5) Setting of feedrate override to 100%

(6) Setting of softwired limit positions for each axis

(7) Positioning of the turret to the turret indexing position

(8) Positioning of tailstock (when the machine is equipped with tailstock)

All essential information on the setup and check-up procedures is described in the sections that follow.

1-2. Setting Zero Offsets

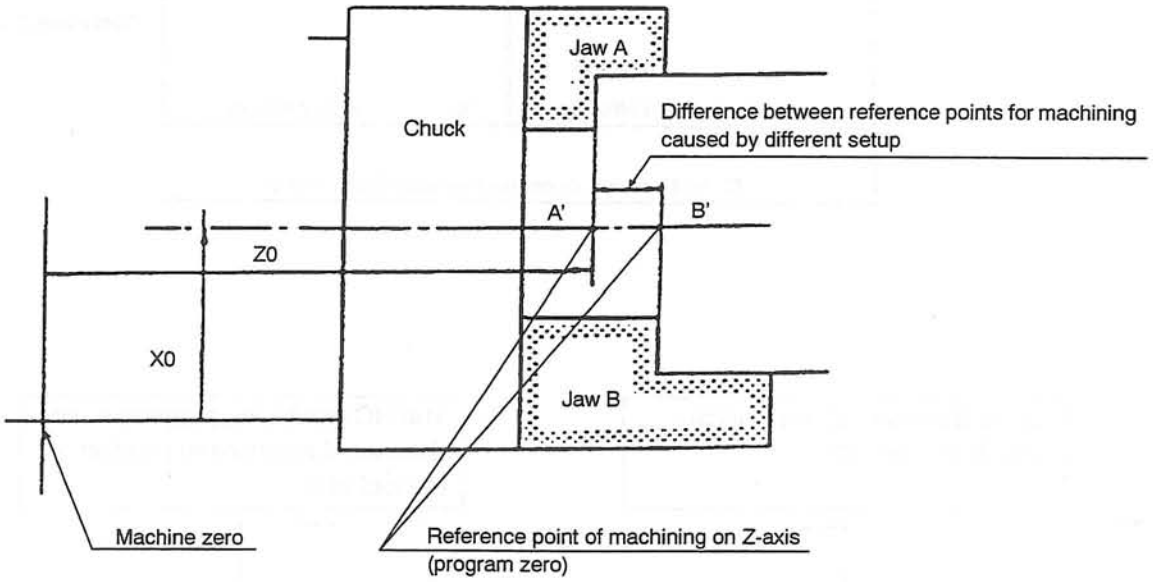
(1) What is Zero Offset?

The common coordinate position from which a complete program is made for a particular component is termed "zero point or program zero".

The programming zero is located at the fixed position (center of the spindle) on the X-axis. However, the program zero on the Z-axis will vary depending on the setup (incl. chuck, jaws, etc.).

With the NC lathe, the program origin (program starting point) is fixed anywhere on the Z-axis, that is, on the longitudinal axis of the spindle. It may vary with respect to the direction of Z-axis, according to the chucking requirements. As shown below, there is a difference in the coordinate position of zero points between one program using jaws A and another program using jaws B. This is caused by the difference in jaw sizes used in respective programs.

The zero offset feature provides for shifting the zero point of the program with respect to the zero point of the machine to match differences in individual workpieces or setups.

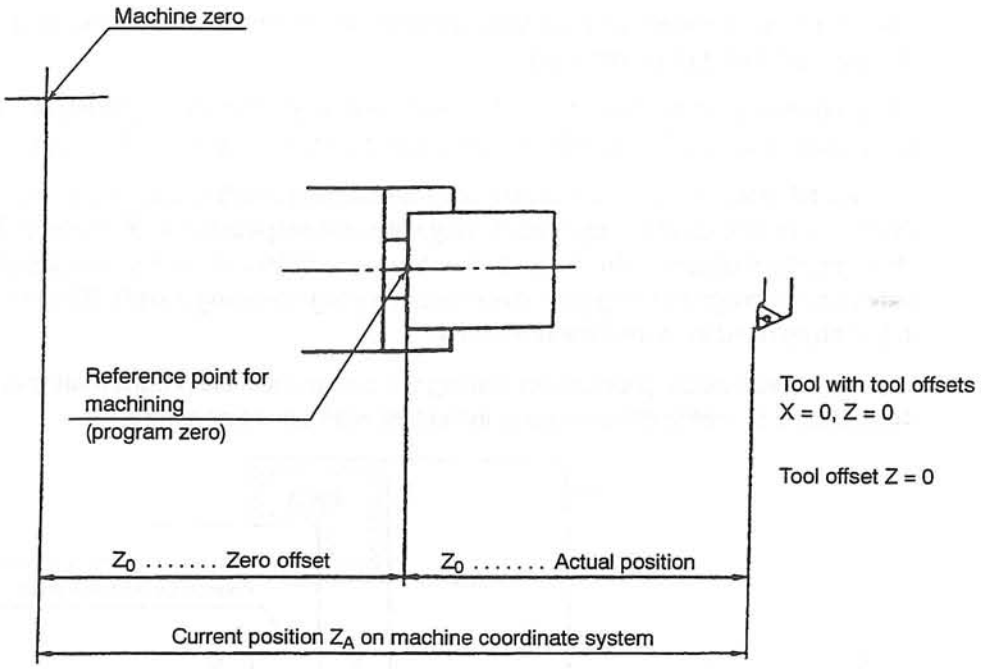


The operator can establish the reference point for machining (zero point of a program) by entering X_0 and Z_0 through the keyboard dimensioned from the fixed zero point of the machine.

"X_0, Z_0" is called Zero Offset Values.

(2) Relation between Machine Zero, Program Origin, Zero Offset Value and Actual Position

Shown below is the positional relationship between the factors involved in the zero offset function:



Current position Z_A on machine coordinate system

The NC machining program needs distance Z as absolute position of the tool at A.

The control always performs calculation "$Z_A5 - Z_05$" to obtain distance Z, i.e., the absolute position of the tool.

The operator can set the reference point of machining (machining origin) at any desired point by entering zero offset value Z_0.

(3) Setting Zero Offset Values

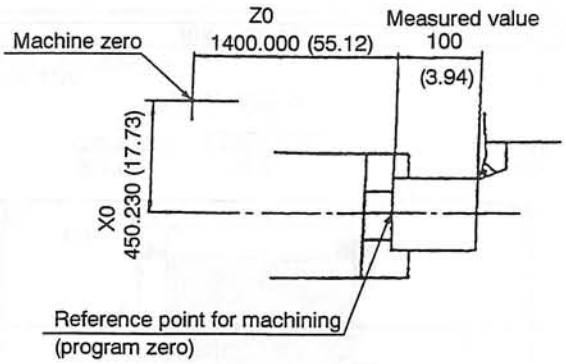
There are three possible cases for entering zero offset values:

a) Where zero offset values are unknown, as in cutting the first workpiece for instance.

b) Where zero offset values are known, as in cutting workpieces of repetitive lots.

c) Where the stored offset values are modified.

Explanation for each case is provided in this paragraph with the following example.



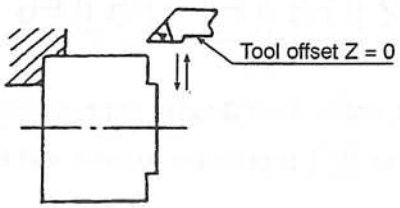
a) Case where zero offset value is unknown:

The explanation below is provided with 1 mm (0.04 in.) unit system.

To set the zero offset value of Z-axis, proceed as follows.

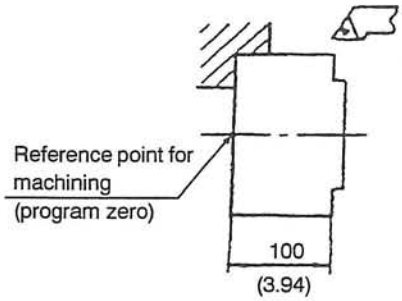
Procedure:

1) Turn the end face of the part with a proper depth of cut in the manual mode.

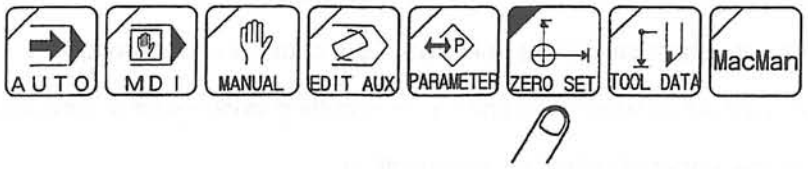


2) Measure the workpiece length to obtain the actual position of the tool dimensioned from the program zero.

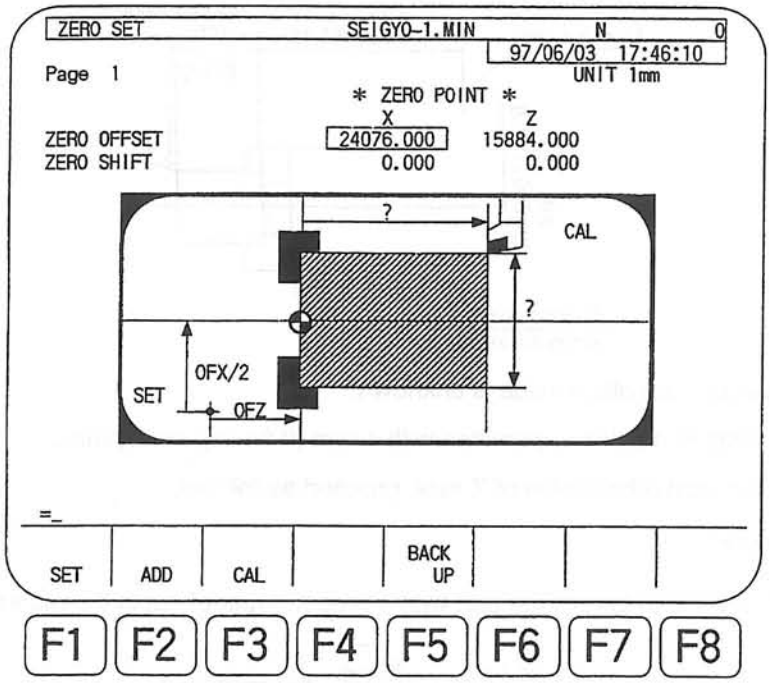
Assume this dimension is measured as 100 mm (3.94 in.) (100.000).



3) Select the ZERO SET mode by pressing the ZERO SET key.

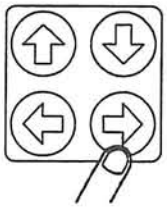


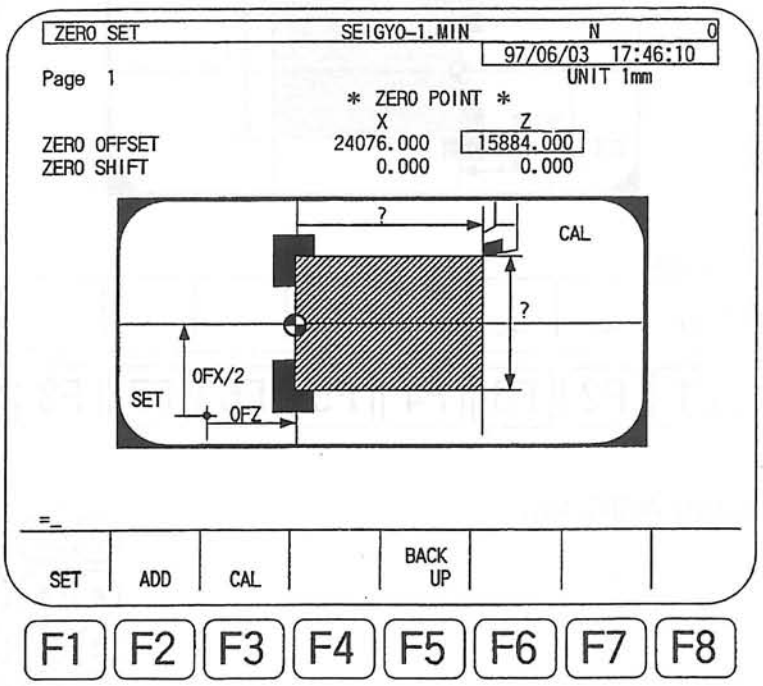
4) The display screen is as shown below.



5) Select the turret, either A- or B-turret (for two-saddle and two-turret models).
Each time [A] or [B] is pressed, turret A and B is selected alternately.

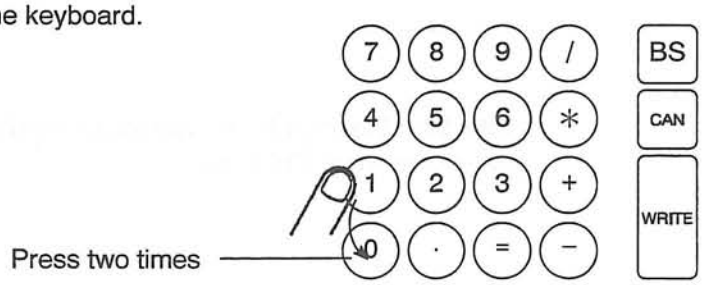
6) With the cursor control keys, move the cursor to the data column of ZERO OFFSET - ZA.

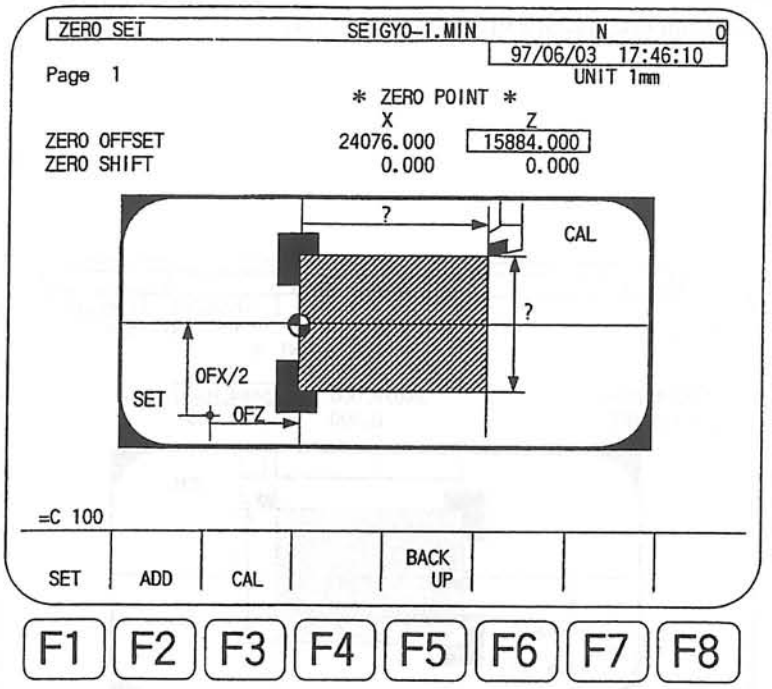




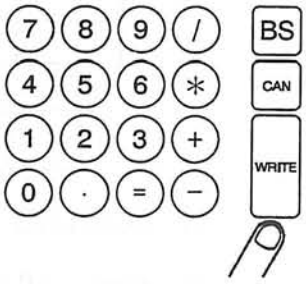
7) Press function key [F3] (CAL).

8) Key-in [1][0][0] through the keyboard.



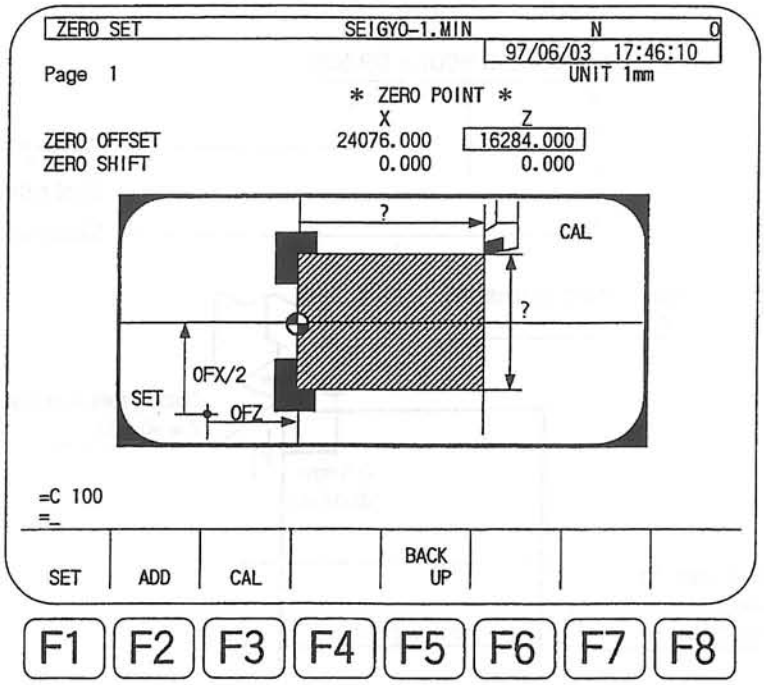


9) Press the WRITE key.



With this, the coordinate system is established so that the present tool position takes coordinate value Z100 mm.

10) The display screen displays the results of calculation or set value.



11) This completes setting the zero offset value.

CAUTION

: (1) Never move the turret in the Z-axis direction until zero offset setting is complete.

(2) For the X-axis, the reference point does not change even when the checking method or setup changes. Therefore, there is no need to carry out zero offset each time the set up changes.

(3) Use a tool with offset values of X = 0, Z = 0, where practicable, for zero offset setting. If the tool offset values are not zero, the zero offset setting procedure will differ from the procedure indicated above. Refer to the following page.

When a tool with tool offset values is used to set the zero offset value:

The numeral data to be entered through the keyboard is the sum of "measured valuer" and "tool offset value".

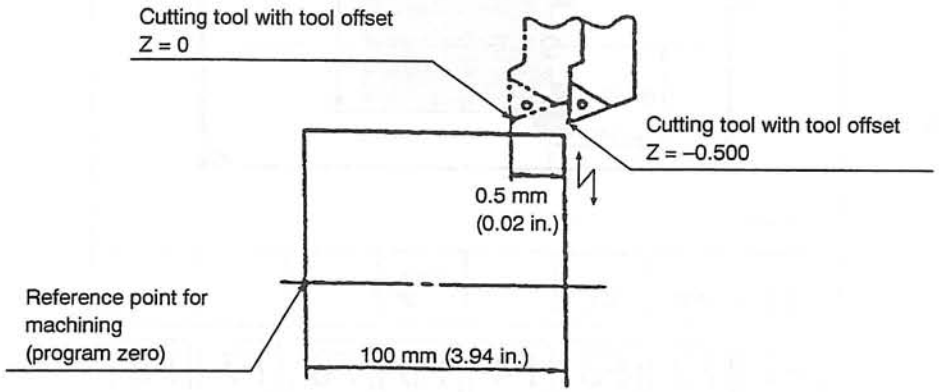
Setting value = Measured value + Tool offset value

Example: A tool with a tool offset value of Z = –0.500 is used.

The zero offset value is calculated as

100.000 + (–0.500) = 99.500

Setting value
Tool offset value
Measured value



If the workpiece length is 100 mm (3.94 in.)when it has been cut using a tool with a tool offset of Z = –0.500 mm (0.02 in.), the position of the tool with a tool offset of Z = 0 is 99.5 mm (3.92 in.) from the reference point (program zero).

A procedure that does not require a modification of the set zero offset value is described below.

1) Carry out steps 1) and 2) as explained before.

2) Enter tool offset data to tool offset #1 register.

   To enter tool offset, refer to 3-2-3.

3) Cut the end face of the part by moving only the X-axis in the MDI mode with T01 01 active. (Refer to 3-3.)

Tool No. Tool offset No.

4) Carry out steps 3) through 9) as explained before.

With the procedure above, it is not necessary to modify the set zero offset value by taking the tool offset value into consideration.

[Supplement] : Never reset the control after cutting the part in the MDI mode.

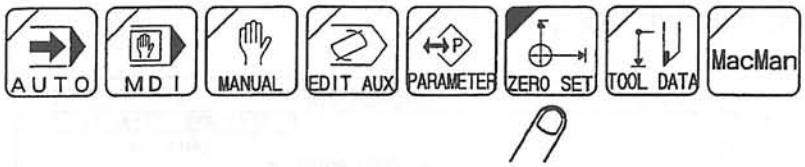
b) Where the zero offset value is known:

To set zero offset value of X-axis, proceed as follows:

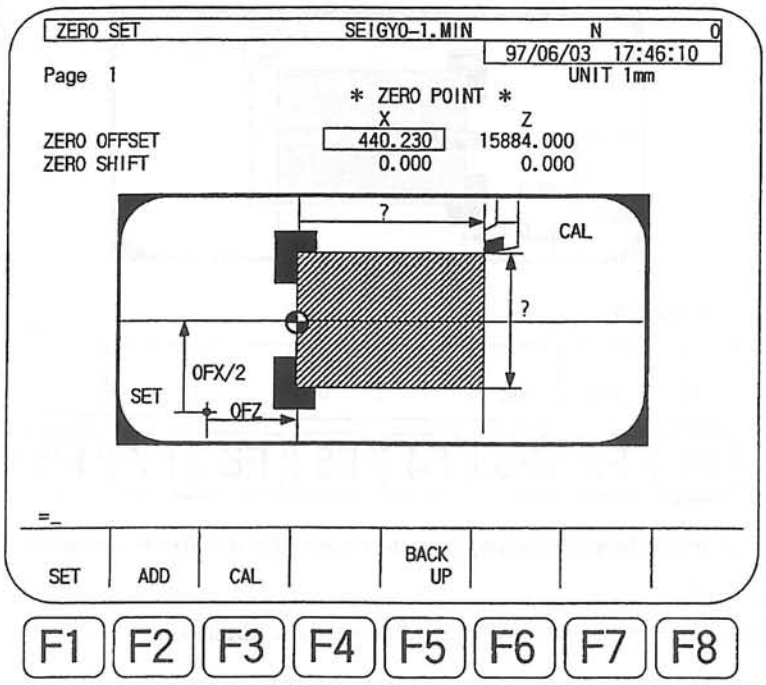
Example: X_0 = 450.230
Z_0 = 1400.000

Procedure:

1) Select the ZERO SET mode by pressing the ZERO SET key.



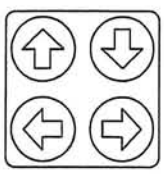
2) The display screen is as shown below.



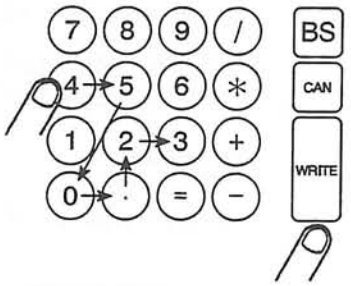
3) Select the turret, either A- or B-turret (for two-saddle and two-turret models).

Each time [1A] or [1B] is pressed, turret A and B is selected alternately.

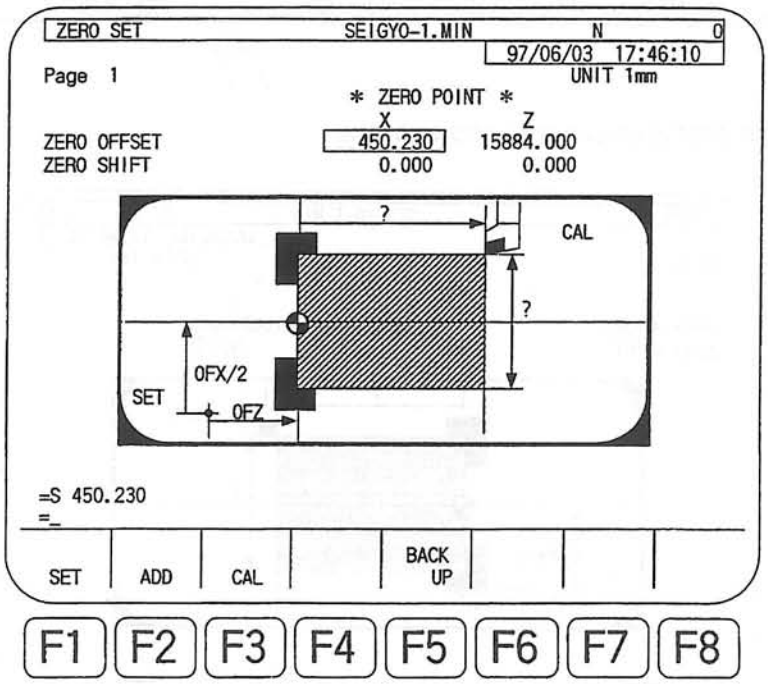
4) With the cursor control keys, move the cursor to the data column of ZERO OFFSET - XA.



5) After pressing function key [F1] (SET), key in [4][5][0][.][2][3] through the keyboard.



6) Press the WRITE key.



With the steps indicated above, keyed-in zero offset value is stored in the zero offset area of the memory.

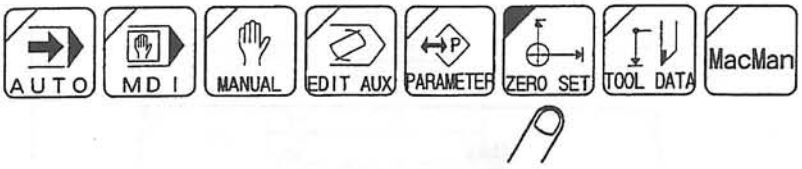
For Z-axis zero offset entry, the same procedure applies.

c) Where the stored zero offset value is to be modified:

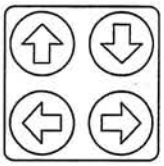
Example: X_0 = 450.230 ..... to subtract 10.000
Z_0 = 1400.000 ..... to add 10.000

Procedure:

1) Select the ZERO SET mode by pressing the ZERO SET key.

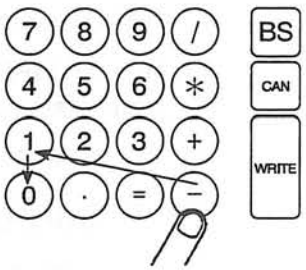


2) With the cursor control keys, move the cursor to the data column ZERO OFFSET - XA.

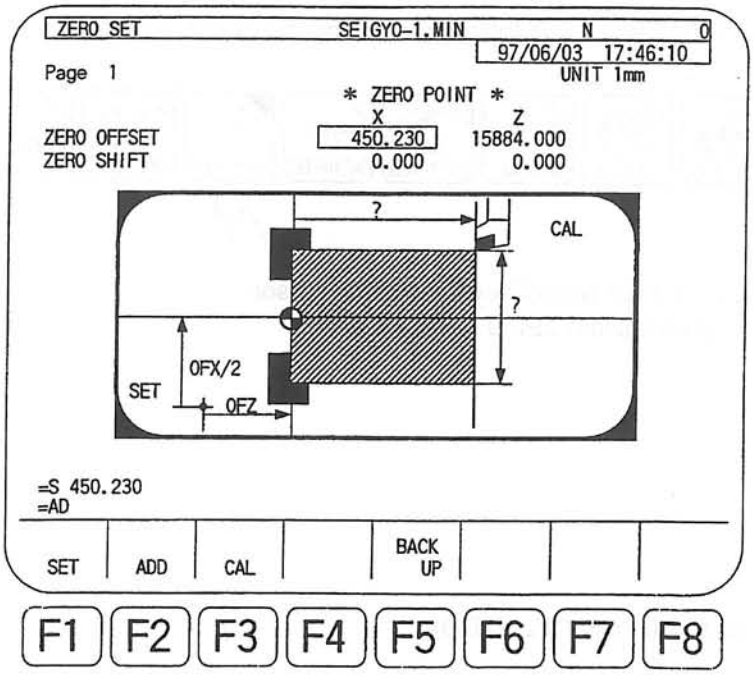


3) Press function key [F2] (ADD).

4) Key in [–][1][0] through the keyboard.



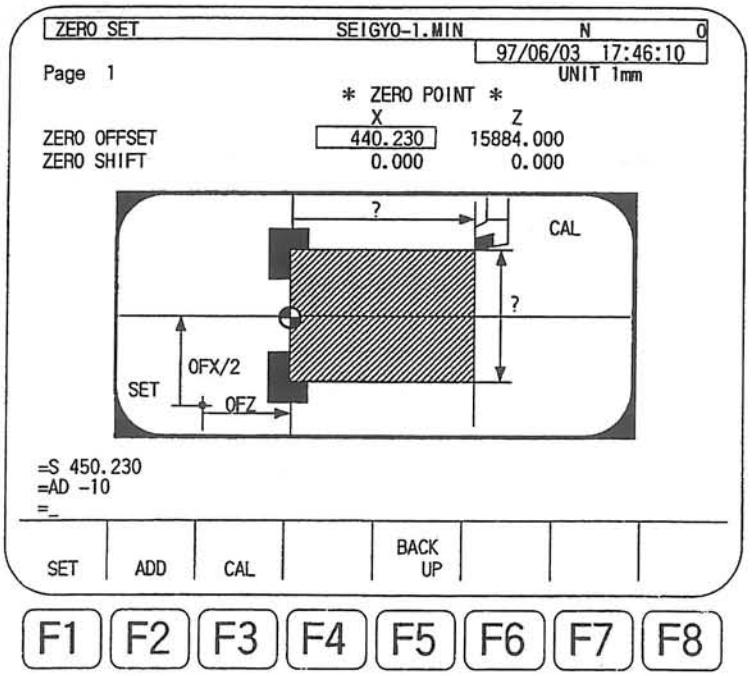
5) The corresponding display screen is:



6) Press the WRITE key, and the display screen changes as shown below.

With the WRITE key pressed, the following calculation is performed in the control and the result is stored as the X-axis zero offset value.

450.230 + (–10.000) = 440.230



For Z-axis zero offset entry, the same procedure applies.

2. MACHINE OPERATION

2-1. Hydraulic Unit

Standard

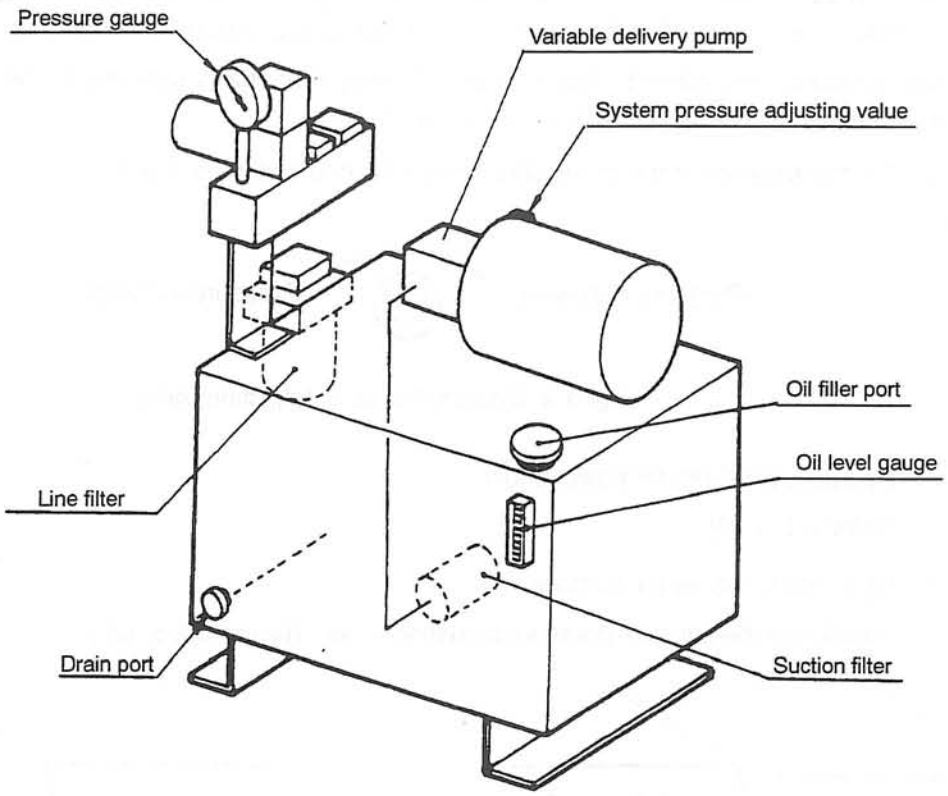


Fig. 3-1 Hydraulic Unit

(1) Pressure Indication

Pressure setting for the hydraulic unit should be:

Pressure setting	4.4 MPa {45 kgf/cm^2 (640 psi)}

(2) Adjustment of Hydraulic Pressure

The following outlines the methods of setting individual functional units for operating pressure. Since the pressure lines for the turret(s) have been adjusted at our factory before shipment, they will not require readjustments, during the initial installation and subsequent normal service of the machine.

When readjustment is to be made by your plant personnel, extreme caution must be taken in accordance with the instructions given here to avert any mechanical trouble in the drive lines.

Any necessary adjustment must be made only by authorized personnel, and under all operating conditions, careless tampering must be avoided.

a) System pressure adjustment (Adjustment is not usually required.)

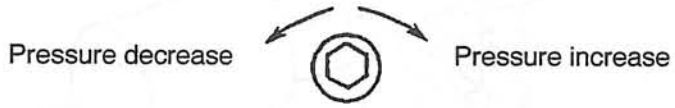


Fig. 3-2 System Pressure Adjusting Valve

b) Hydraulic pressure for power chuck

Refer to 2-3. (2).

c) Hydraulic pressure for tailstock

Adjust with the tailstock pressure adjusting valve. (Refer to 2-5. (2).)

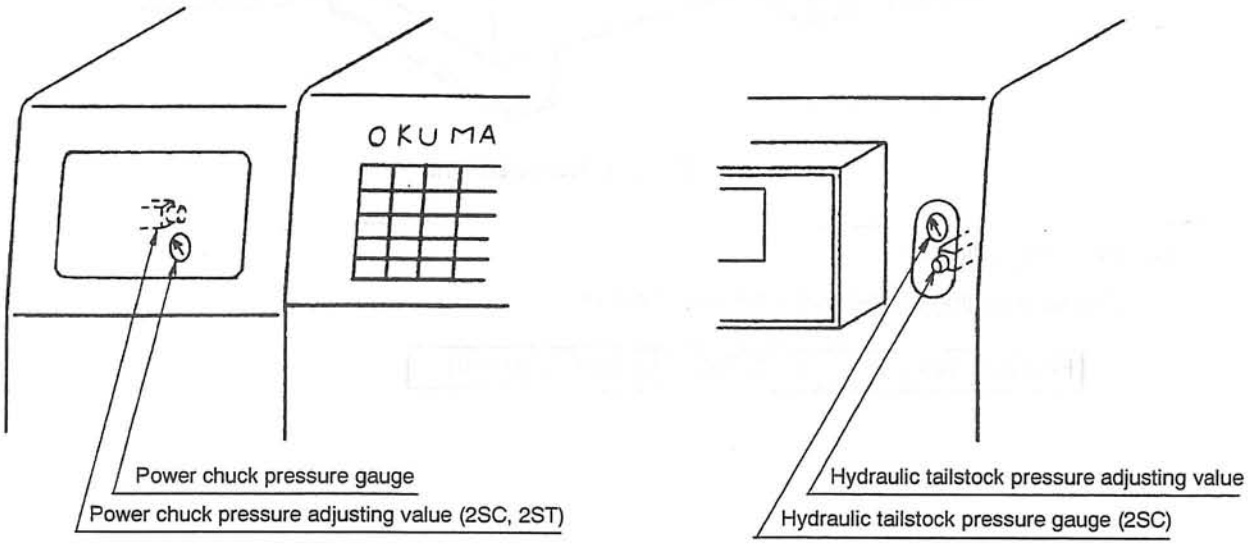


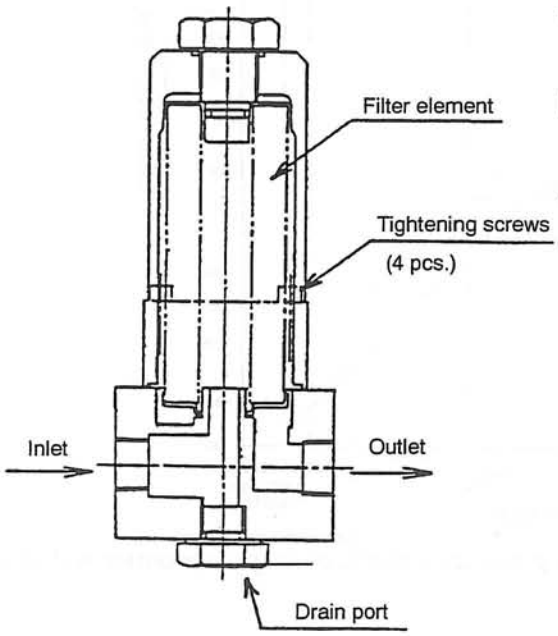
Fig. 3-3 Hydraulic Pressure for Tailstock

(3) Hydraulic Oil

Oil Specification	HL32 (MAS)
Amount	40 liter (10.56 gal)
Oil Change Interval	Change after first month of operation and every 6 months thereafter.

NOTICE : Clean the suction filter, the line filter, and the tank when changing the oil. Check the pressure for respective actuators.

Since use of clogged cartridge filter allows "dirty" oil to be circulated through the system leading to serious trouble, it is necessary to change the filters following the procedure indicated below.



a) After loosening the tightening screws, remove the filter element upwards.

b) Discharge the oil through the drain port and clean inside the case.

c) Change the filter element.

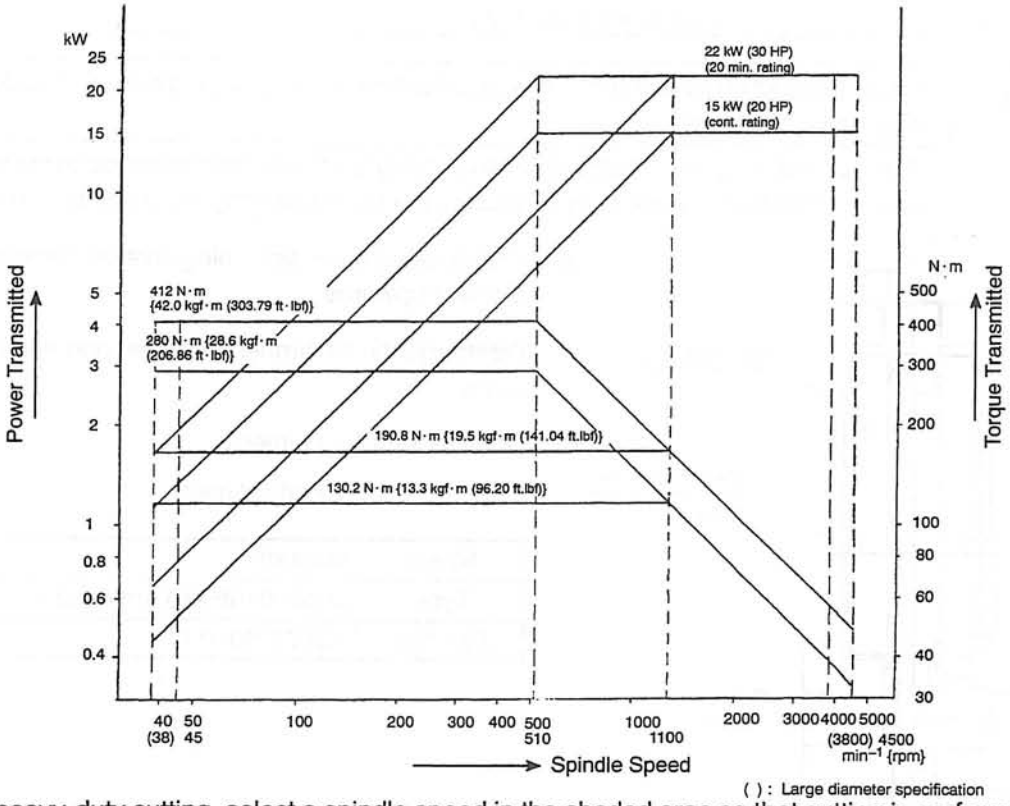
Filter Element Specifications:

Maker	Masuda
Type	U038-010P (10 μm mesh)
Part No.	H0032-0010-03

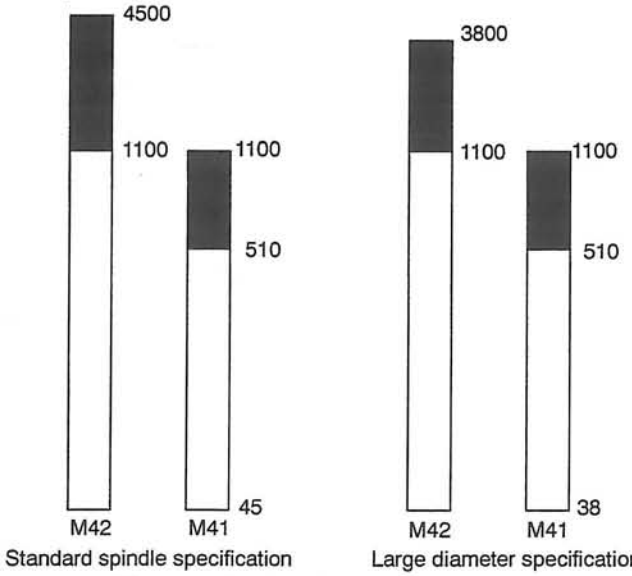
2-2. Selection of Spindle Drive Gear Range

(1) Spindle Power Transmission Torque Diagram

- Standard Spindle: 4500 min^{-1} {rpm} (Large Diameter Spindle 3800 min^{-1} {rpm})



For heavy-duty cutting, select a spindle speed in the shaded area so that cutting is performed within a constant output range.



The low-speed/high-speed range can be changed by changing the VAC motor coil connection.
(This change takes approx. 1 sec.)

Fig. 3-4 Spindle Power Transmission Torque Diagram

2-3. Hydraulic Chuck

(1) Construction

The construction of hydraulic chuck is shown below.

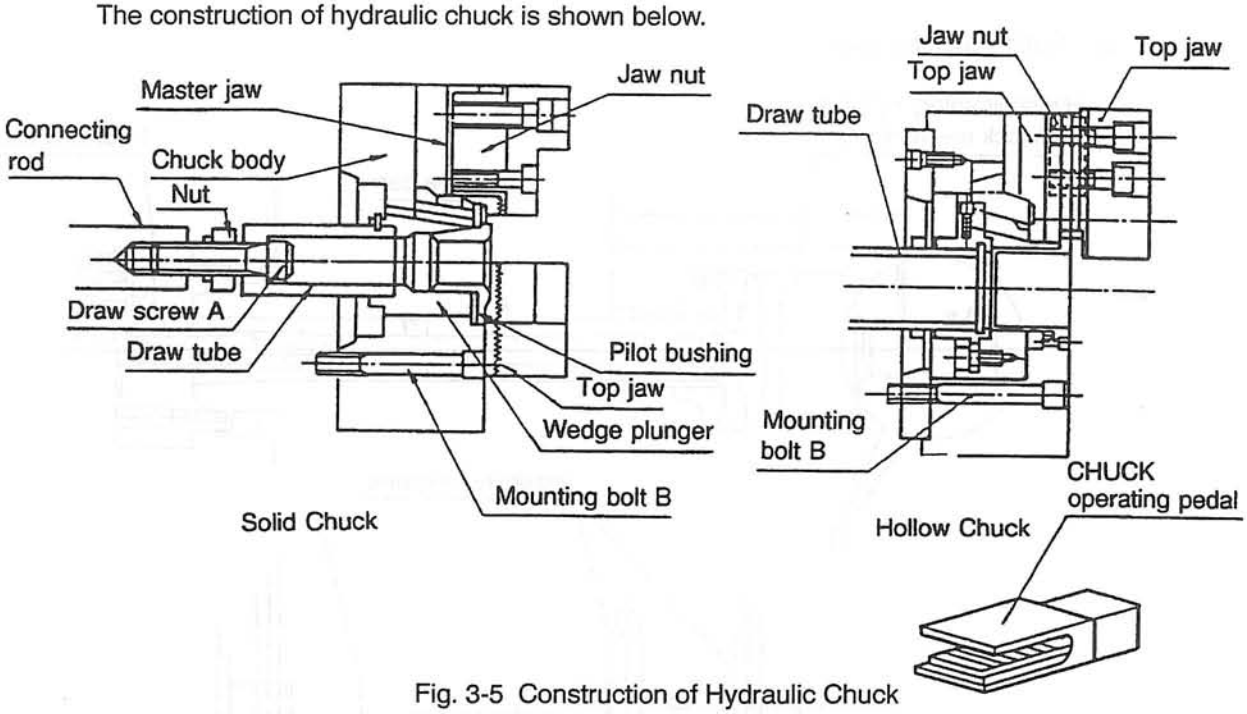


Fig. 3-5 Construction of Hydraulic Chuck

(2) Installation of Hydraulic Chuck

Procedure:

a) Press the CONTROL ON/RESET button on the operation panel to turn on the machine control circuit, and depress the CHUCK operating foot pedal. This causes the connecting rod in the spindle bore to move forward.

↓ Connecting rod advance (Draw tube advance)

b) Fasten the draw screws A to the connecting rod.

(Connecting the draw tube in the spindle with the chuck) ↓ Use the Allen wrench furnished with the machine.

c) Secure the chuck body onto the spindle end, using mounting bolts B.

↓

d) Adjust the draw screw A so that the outer ends of the master jaws become flush with the peripheral surface of the chuck body when the top jaws are in the OPEN condition.

The individual chuck jaws can be moved in the "opening" direction as the draw screw A is turned in the counterclockwise direction. Removal of the hydraulic chuck from the spindle is the reverse of installation in steps from c) to b).

⚠WARNING : If you enter the area inside the cover to change the chuck, jaws, contact block, etc.,

- shut off the power and ensure the safety for your work.
- do not carry out your work by using M19 (spindle orientation) or M110 (C-axis joint) command.

(3) Chuck Grip Confirmation

To ensure your safety in using the chuck grip confirmation unit, read the following information carefully to understand the function and construction of the unit and observe the instructions.

a) Solid chuck cylinder

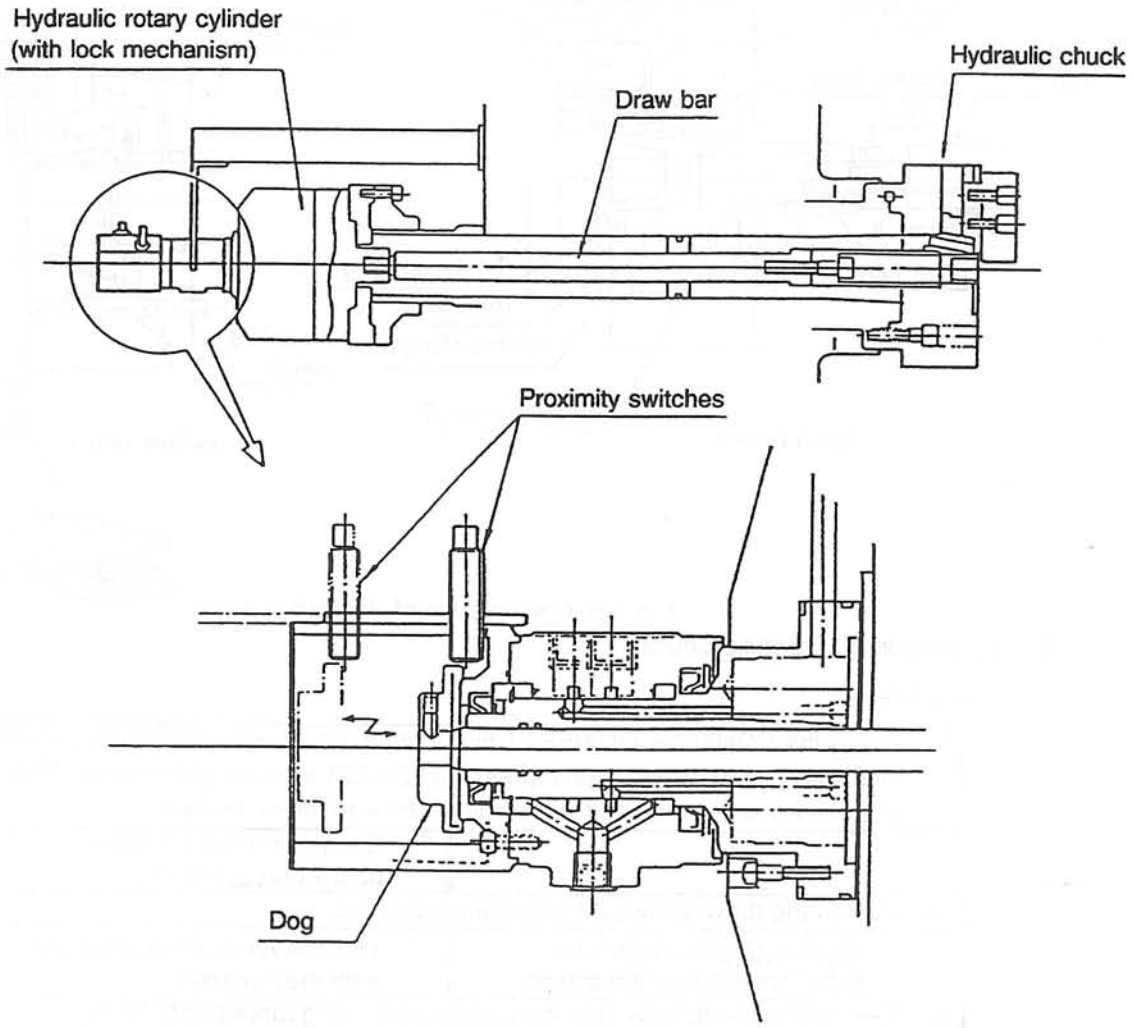


Fig. 3-6 Solid Chuck Cylinder

Position of the dog moving with the hydraulic rotary cylinder piston is detected by the proximity switches to confirm the chuck jaw position. (optional)

b) Hollow chuck cylinder

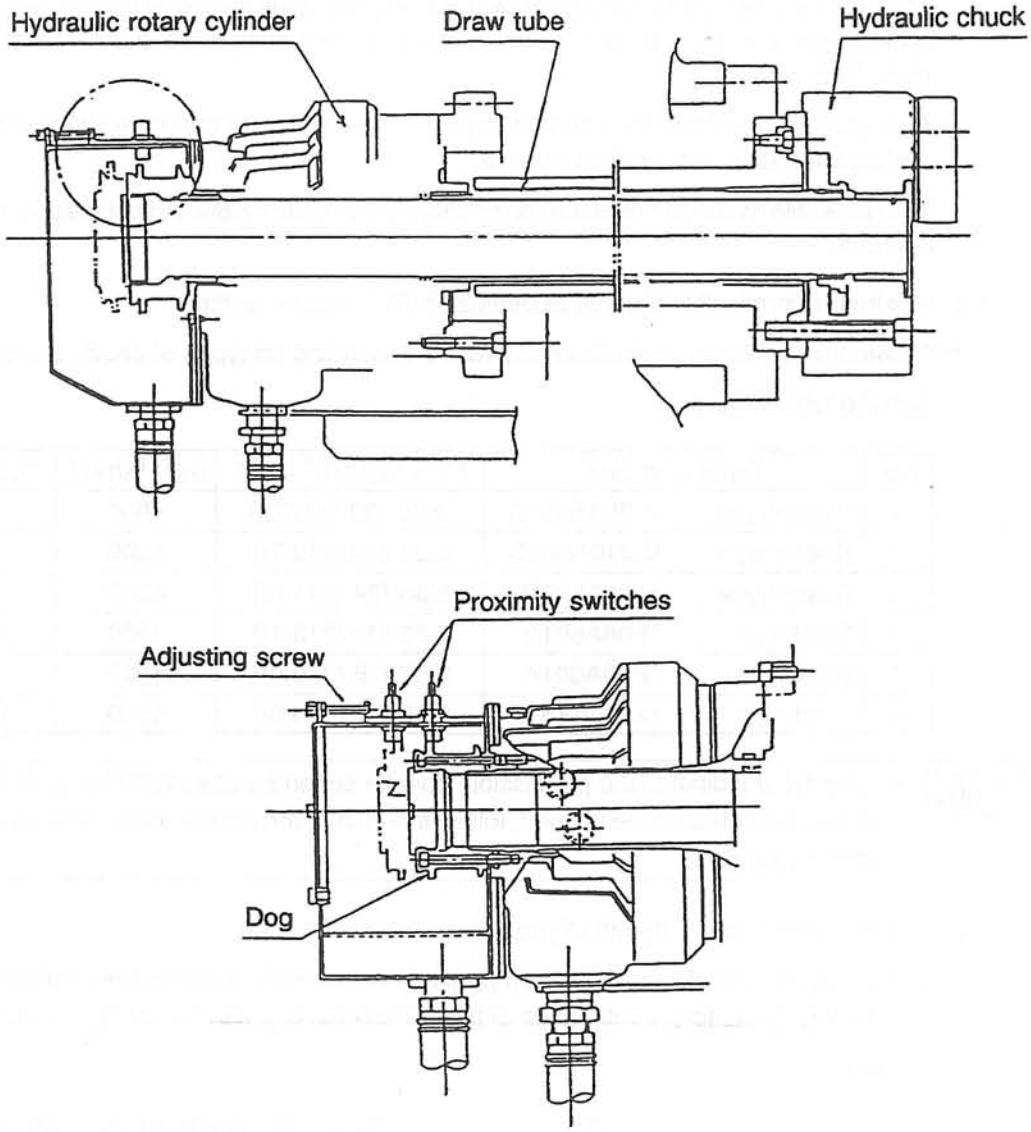


Fig. 3-7 Hollow Chuck Cylinder

Position of the dog moving with the hydraulic rotary cylinder piston is detected by the proximity switches to confirm the chuck jaw position. (optional)

(4) Adjustment of Oil Pressure for Hydraulic Chuck

The gripping pressure of the chuck jaws is dependent upon the working pressure of hydraulic fluid which is determined by the setting of the chuck pressure adjusting valve installed at the front of the machine (See 2-1.).

A clockwise turn of the valve knob decreases the working oil pressure directed into the chuck cylinder and counterclockwise turn increases it.

The allowable maximum pressure is indicated in the table below. Adjust the pressure meeting the types of chuck.

(5) Maximum Permissible Spindle Speeds and Oil Pressure Setting

Maximum permissible spindle speed varies depending on types of chuck and cylinder to be used.

See the table below:

No.	Types and Size		MPa {kgf/cm^2 (psi)}	min^{-1} {rpm}	Type of Cylinder
1	Hollow type	B-208A601C	2.30 {23 (327.3)}	4500	S1552
2	Hollow type	B-210A601C	2.91 {29 (412.7)}	4200	S1552
3	Hollow type	B-210A801D	2.38 {24 (341.5)}	3800	S187001
4	Solid type	N-08A601A	2.22 {22 (313.1)}	4500	Y1225R (E)
5	Solid type	N-10A601A	2.57 {26 (370.0)}	4010	Y1225R
6	Solid type	H01MA8S	2.05 {21 (298.8)}	4500	HH4CB125

⚠CAUTION : This table indicates the permissible spindle speed for standard chuck. If a chuck other than those indicated above is used, follow the instruction on the name plate at the front cover of the machine.

(6) How to Set Maximum Spindle Speed

The maximum spindle speed, which is limited due to chuck specifications, influence of centrifugal force on chuck gripping force, imbalance of the workpiece, etc. can be set by program.

Format:

G50 S○○○○ ..... To be specified in a block without other command

Specify the required maximum spindle speed.

Programmed maximum spindle speed is effective until another spindle speed is designated.

(7) Adjusting Proximity Switch Longitudinal Position (optional)

a) For solid cylinder

Loosen the screws clamping the two proximity switch plates to slide them with the proximity switch to determine the position. After determining the position, tighten the proximity switch plate clamp screws.

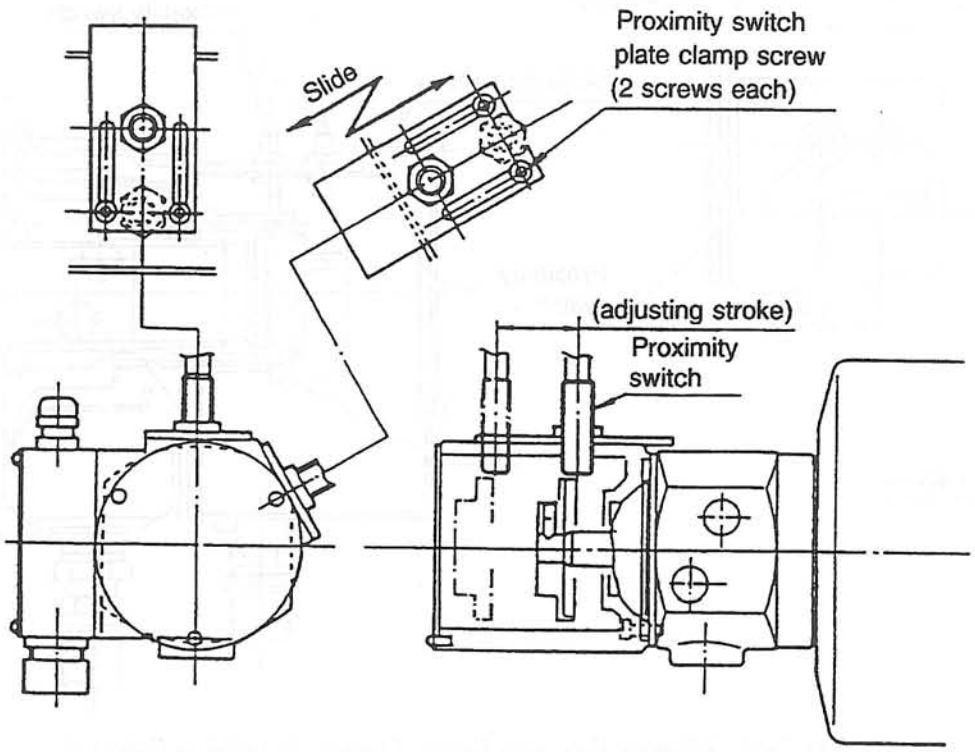


Fig. 3-8 Adjusting Proximity Switch Position (for Solid Cylinder)

CAUTION : The proximity switch position is adjusted to provide the required clearance to the dog (1 mm (0.04 in.)) before shipment. Thus, adjustment is not required usually.

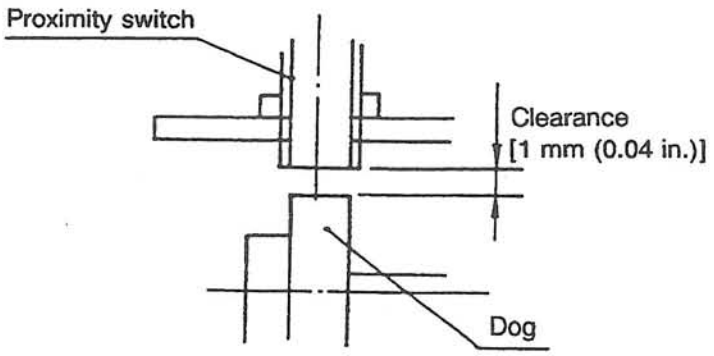


Fig. 3-9 Clearance between Proximity Switch and Dog

b) For hollow cylinder

Loosen the screws clamping the two proximity switch plates to slide them with the proximity switch to determine the position. After determining the position, tighten the proximity switch plate clamp screws.

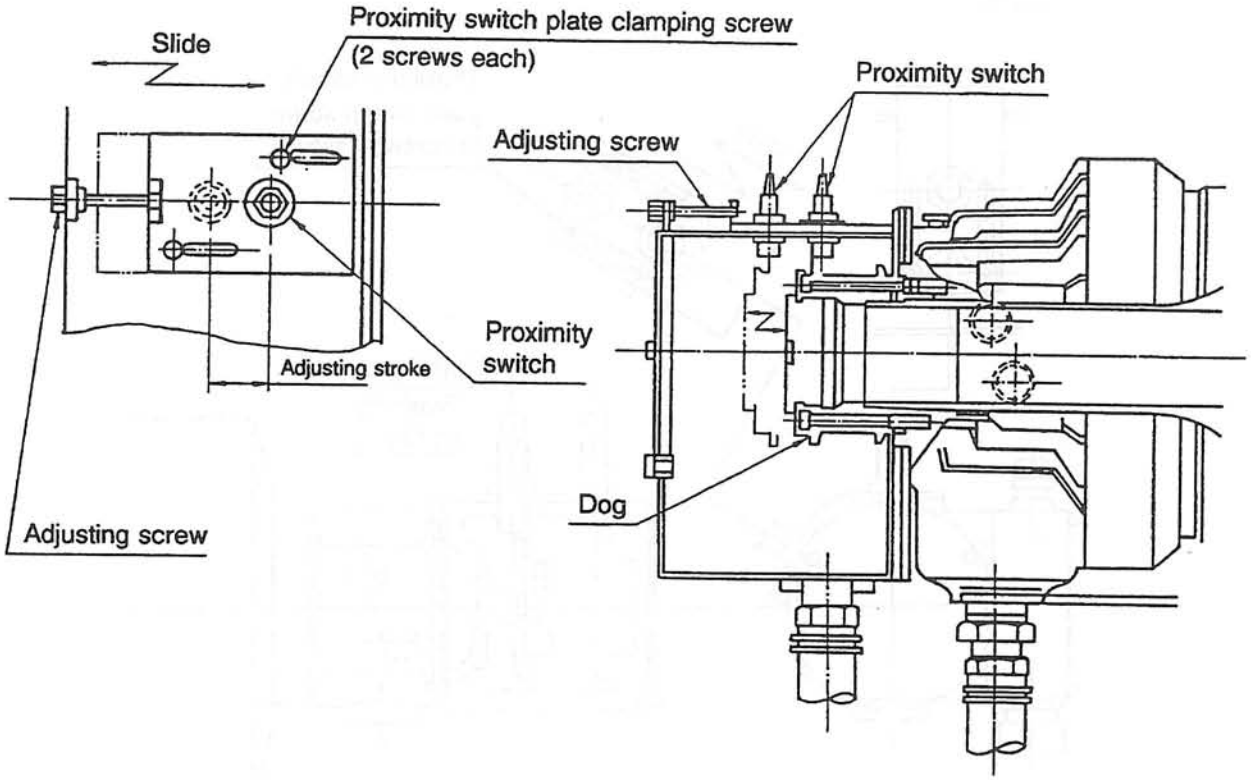
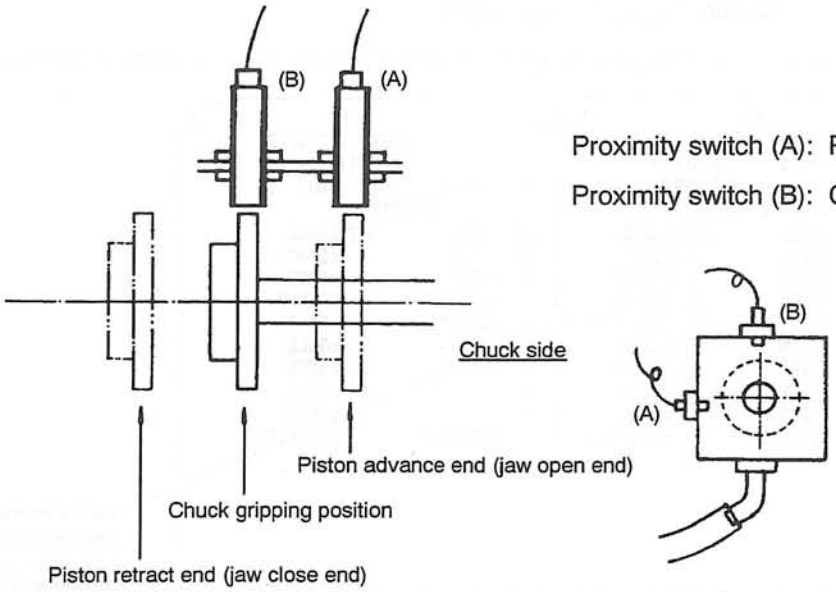


Fig. 3-10 Adjusting Proximity Switch Position (for Hollow Cylinder)

(8) Setting Proximity Switches

a) OD chucking

Set the proximity switches at the positions as indicated below:



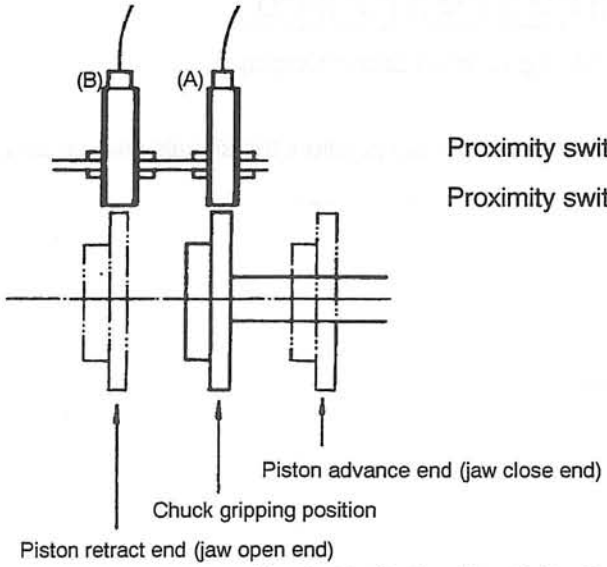
Proximity switch (A): Piston advance end

Proximity switch (B): Chuck gripping position

Fig. 3-11 Setting Proximity Switches (OD Chucking)

b) ID chucking

Set the proximity switches at the positions as indicated below:



Proximity switch (A): Chuck gripping position

Proximity switch (B): Piston retract end

Fig. 3-12 Setting Proximity Switches (ID Chucking)

Note: According to the OD/ID chucking, the proximity switch to be set at the chuck gripping position differs.

CAUTION : Always actually clamp the workpiece to set the proximity switch at the chuck gripping position.

(9) Confirmation Signals

a) Signal input status display

Whether or not the proximity switches are set correctly and corresponding signals are input can be checked by the check data display screen.

For the procedure to display the CHECK DATA screen, refer to OSP MAINTENANCE MANUAL.

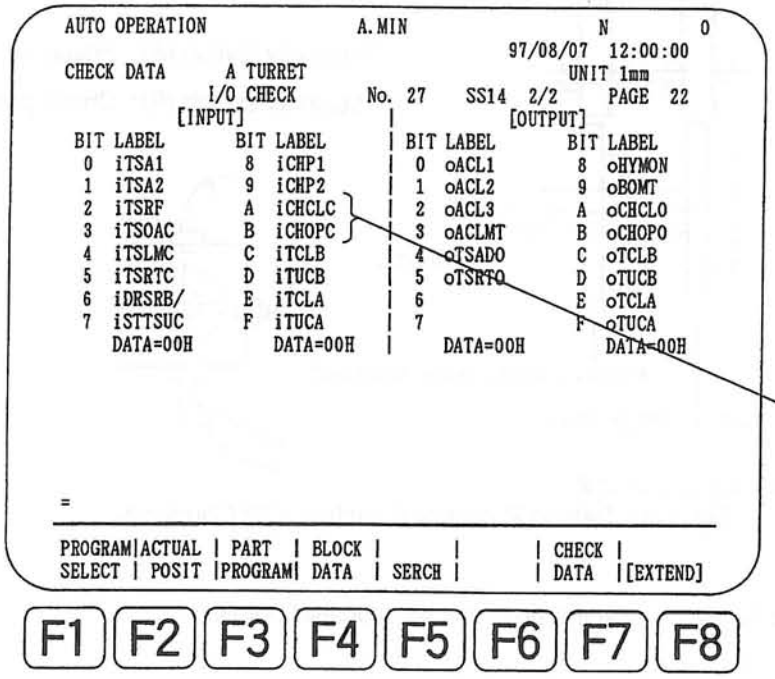


Fig. 3-13 Signal Input Status Display

b) Checking input signals

When the proximity switches are set in the correct position, the signals change as indicated below according to the chuck status.

OD chucking:

At chuck gripping position

iCHOPC 0
iCHCLC 1

At piston retract end position

iCHOPC 1
iCHCLC 0

ID chucking:

At chuck gripping position

iCHOPC 1
iCHCLC 0

At piston advance end position

iCHOPC 0
iCHCLC 1

c) Operation completion confirmation delay timer

There may be cases in which the chuck open/close is not completed even if the corresponding signal is input. For such cases, timer function can be used to delay the confirmation of the chuck operation after the input of the signal.

The timer is set using the following parameters.

MC USER PARAMETER (CHUCK)

Chuck clamp answer time

The timer to set the delay duration after the input of the signal from the chuck gripping position proximity switch to confirm the chuck close state.

MC USER PARAMETER (CHUCK)

Chuck unclamp answer time

The timer to set the delay duration after the input of the signal from proximity switch detecting the piston retract end (for OD chucking) or the piston advance end (for ID chucking) to confirm the chuck open state.

Setting is made in units of 0.01 sec. The default values for these parameters are indicated below.

Chuck clamp answer time: 100 (1 sec)

Chuck unclamp answer time: 0

For the procedure to set the data for MC USER PARAMETER, refer to OSP OPERATION MANUAL.

(10) Hydraulic Chuck Clamping Force Characteristics Diagram

a) For solid chuck

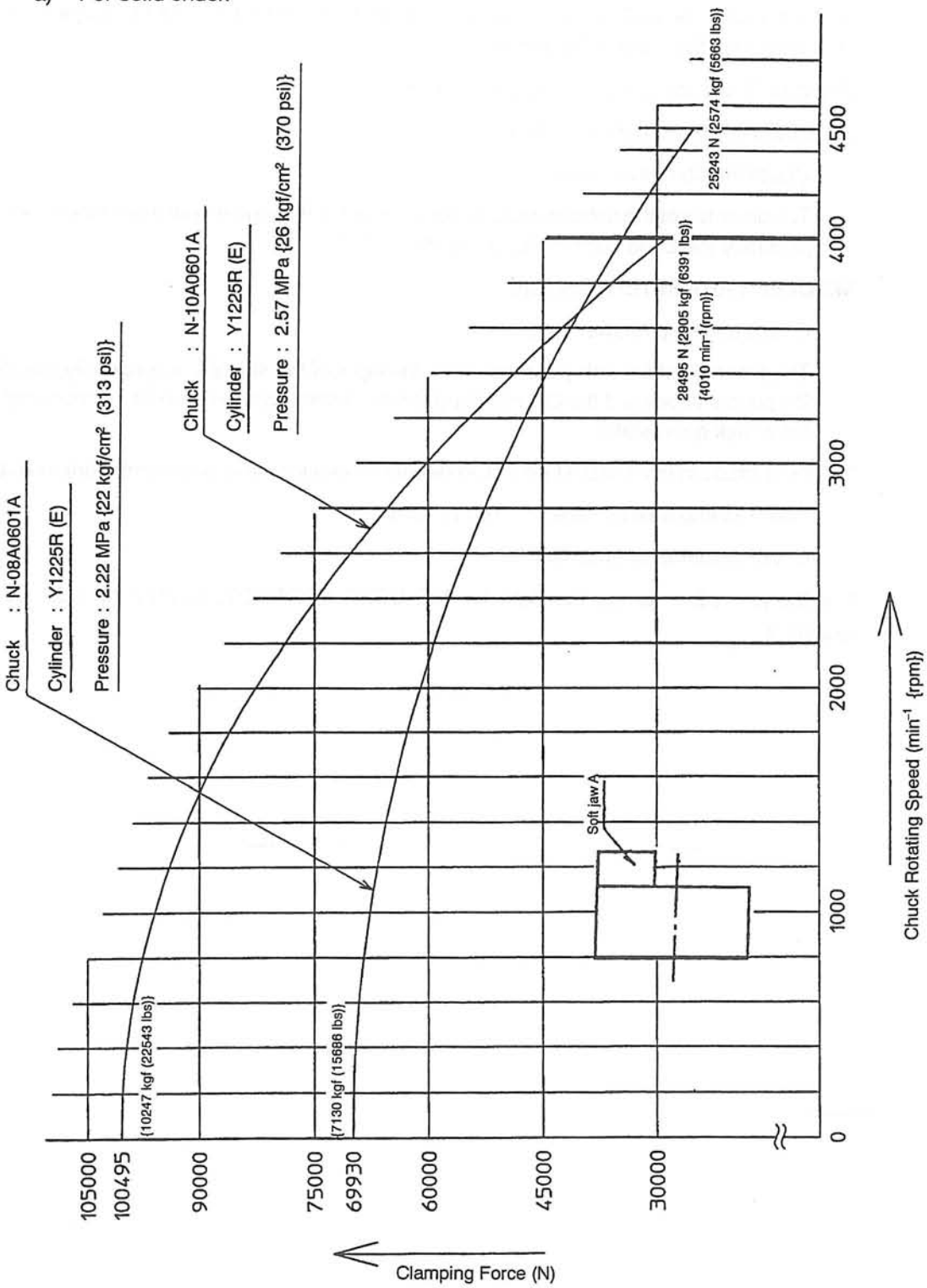


Fig. 3-14 Chuck Speed - Clamping Force Diagram (for Solid Chuck)

b) For hollow chuck

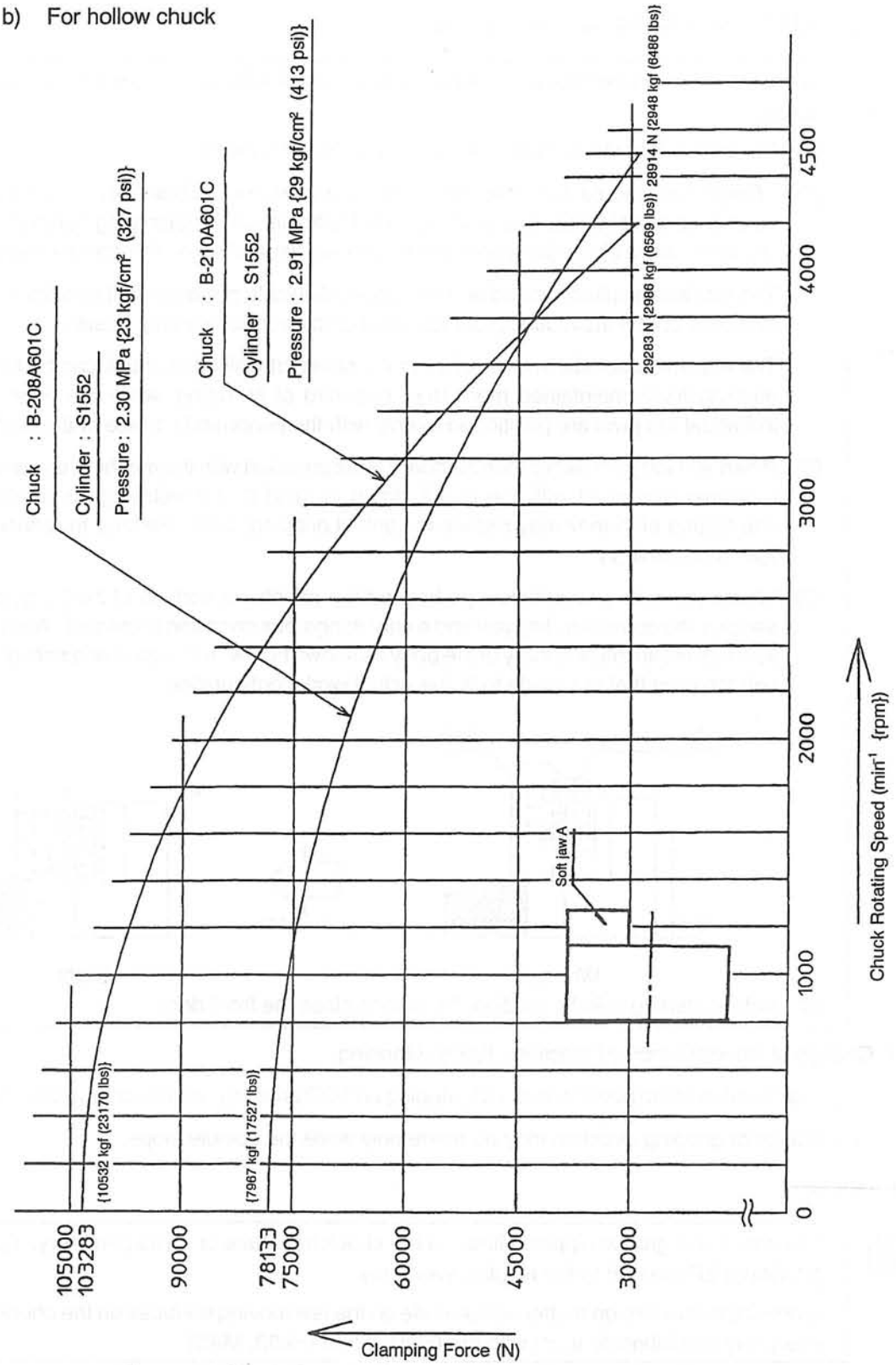


Fig. 3-15 Chuck Speed - Clamping Force Diagram (for Hollow Chuck)

(11) General Precaution for Using Power Chucks

⚠CAUTION : In order to insure maximum safety in operation, the following points call for your special notice:

(4) Select the right chuck that matches the machine's capacity.

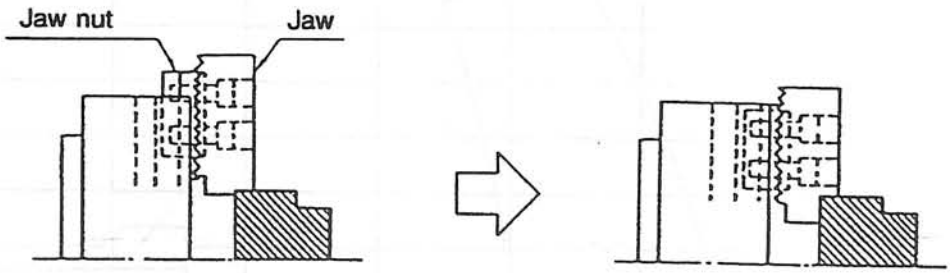
(5) Workpieces should be clamped in the chuck without imbalance. Selection of cutting conditions must be made referring to (10) "Hydraulic Chuck Clamping Force Characteristics Diagram" since chuck jaw gripping force varies depending on the spindle speed.

The maximum spindle speed and maximum allowable pressure limit (maximum setting) are indicated on the instruction plate attached to the front of the chip guard.

The maximum spindle speed refers to the speed at which the chuck can be turned, with its gripping force maintained more than one-third of its rating, while the outer ends of the individual top jaws are positioned evenly with the peripheral surface of the body.

(6) When soft top jaws larger than standard ones provided with the machine are prepared by the customer and used with the chuck, keep in mind that developing centrifugal force and decreasing efficiency may reduce the actual gripping force. Be sure to reduce the spindle speed accordingly.

(7) Where jaw nuts shown below go beyond the peripheral surface of the body, only one bolt secures the corresponding jaw and a very dangerous condition is created. Always locate the jaw nuts within the periphery of the body as shown below. It is a good and safe practice to use soft top jaws that are made to fit the actual work configuration.



Wrong Right

(8) Before starting spindle rotation, be sure to close the front door.

(12) Change of Chuck Gripping Direction - ID/OD Gripping

Gripping direction of the power chuck - ID gripping and OD gripping - can be changed by the parameter.

The change of gripping direction may be made only while the spindle stops.

(13) Greasing

⚠CAUTION : The chuck has grease nipples either on the chuck front face or on its periphery. Apply grease (Molykoat EP grease) to the nipples every day.

Since chips and foreign matter accumulate on the jaw moving surfaces on the chuck, clean them every day and lubricate them with the hydraulic oil (HL32, MAS).

2-4. Cutting Soft Top Jaws of Power Chuck

There are three different methods applied in cutting soft top jaws of chuck jaws for chucking a particular lot of parts.

- by pulse feed handwheel
- by tape
- by manual data input (MDI)

They are all basically the same operations, and it is advisable to use the tape or the manual data input when a good finish on the chucking surfaces of the jaws is essential.

Now let's explain the steps necessary to produce the top jaws for chucking the diameter of 70 mm (2.75 in.) with a depth of 15 mm (0.6 in.) by use of the manual data input.

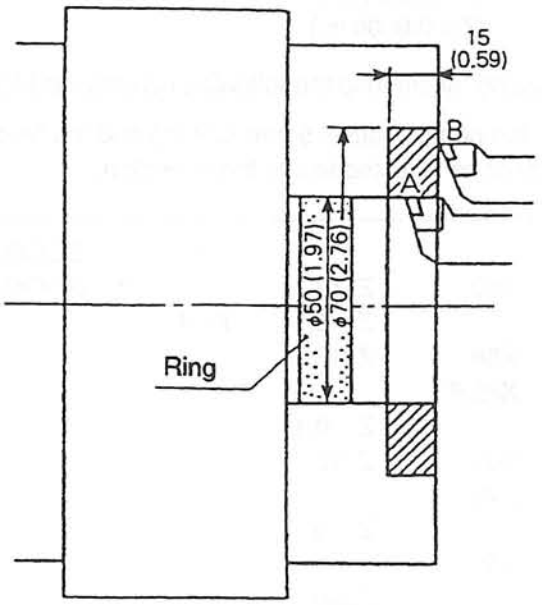


Fig. 3-16 Cutting Soft Top Jaws

(1) Procedure

a) Grip a ring of proper diameter in the chuck.

ϕ50 mm (2 in.) ring for instance

b) Locate the tool tip point at point A and set the zero offset value so that the actual position of X-axis is equivalent to the ring diameter; 50 mm (2 in.) in this case.

Actual position: X = 50.000 mm
(X = 2.0000 in.)

c) Locate the tool tip point at point B and set the zero offset value so that the actual position of Z-axis is equivalent to the required chucking depth of length; 15 mm (0.6 in.) in this case.

Actual position: Z = 15.000 mm
(Z = 0.6000 in.)

d) Proceed with cutting by entering the following commands block by block.

In the example, the depth of cut is 5 mm (0.2 in.) and the feedrate is 0.1 mm/rev (0.004 ipr). The spindle speed must be selected to suit the operation.

G50				SOOO		
G00	X60	Z 18		SOOO	M41	M03
G01		Z 0.1	F0.1			
G00	X58	Z 18				
	X69.6					
G01		Z 0.1				
G00	X67	Z 18				
	X70					
G01		Z 0				
	X48					
G00		Z500				M05

2-5. Hydraulic Tailstock Operation

(1) Tailstock Position Setting (when moved manually)

Move the turret to the X-axis plus limit position.

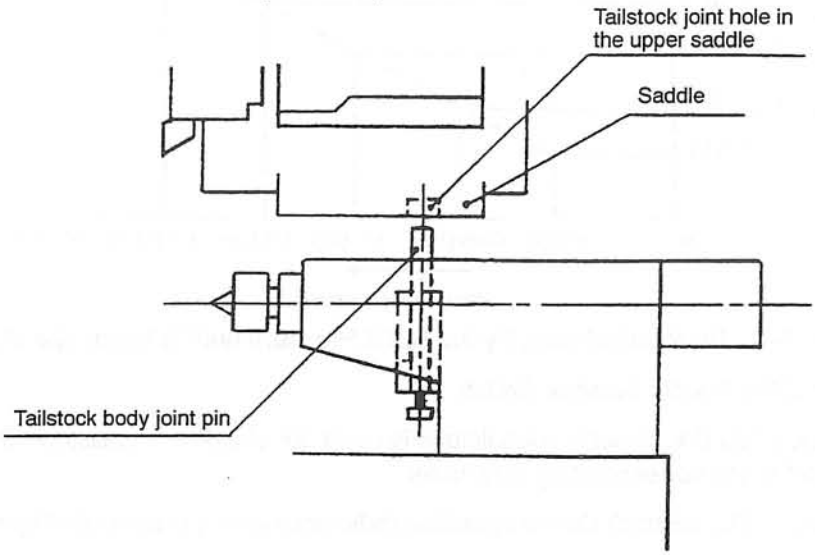


Fig. 3-17 Tailstock Position Setting

Move the saddle to align the center of the tailstock joint hole in the upper saddle and the center of the tailstock body joint pin. After loosening the four tailstock body clamp screws to unclamp the tailstock body, connect the tailstock body to the saddle.

Move the saddle using the pulse handle to bring the turret body to the required position. Release the joint pin of the turret body from the saddle and tighten the four clamp screws to fix the tailstock body to the bed.

NOTICE

: When extracting the joint pin after moving the saddle and tailstock using the pulse handle, feed the saddle about 0.5 mm (0.020 in.) in reverse direction using the handle. This is to prevent a side of the joint pin from interfering with the towing block when the pin is extracted.

(In MDI or automatic operation mode, the above reverse feed is automatically performed.)

Adjusting Tailstock Spindle Thrust

Tailstock spindle thrust can be adjusted by the pressure adjusting valve at the right side of the machine front. For details, refer to 2-1. (3). The maximum hydraulic pressure for tailstock thrust is 1.8 MPa {18.5 kgf/cm^2 (263.0 psi)} and the thrust with such pressure setting is 4900 N {500 kgf (1100 lbf)}.

Note that the tailstock spindle thrust largely affects the service life of the main spindle; do not set the thrust unnecessarily high.

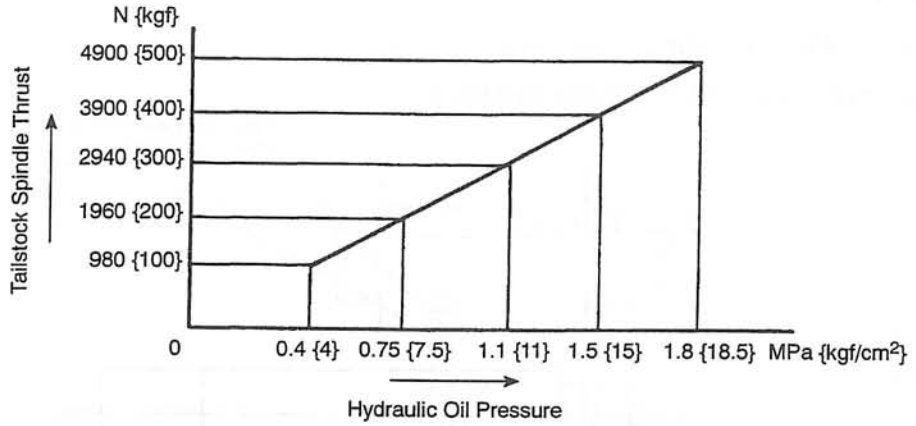


Fig. 3-18 Relation between Hydraulic Oil Pressure and Tailstock Spindle Thrust

(2) Center-work/Chuck-work Selector Switch

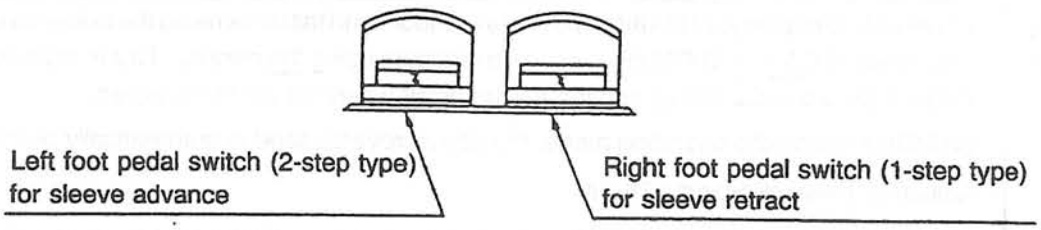
The tailstock setup (for center-work tailstock is used, for chuck-work tailstock is not used.) condition should be set to the corresponding parameter.

Center-work: The tailstock sleeve operation (advance/retract) is controlled by the foot pedal switch.
The spindle can rotate only when the left foot pedal switch is fully depressed.

Chuck-work: The tailstock sleeve operation (advance/retract) is not controllable.
The spindle can rotate only when the tailstock sleeve is located at the retract end.

(3) Advancing/Retracting Tailstock Sleeve

Advance and retraction of the tailstock sleeve can be performed by the foot-operated pedal switches located at the front of the machine.



a) Left pedal switch (2-step type) is used to advance the sleeve.

First slight-depress of pedal:

The sleeve advances while the pedal is depressed. (Spindle does not rotate.)

Second full-depress of pedal:

When depressed fully, the sleeve advances up to the stroke end. (Spindle rotates.)

b) Right pedal switch (1-step type) is used to retract the sleeve. When depressed, the sleeve retracts up to the stroke end.

(4) Allowable Load and Speed of the Revolving Center

The table given below indicates the allowable maximum load for MT No. 5 revolving center. Make sure to use the center within the limits indicated in the table.

Allowable Load (kN {kgf}) (life: 2000 hours)

Load Type / Speed min^{-1} {rpm}	Radial	Thrust
500	6.3 {640}	4.7 {480}
1000	5.9 {600}	3.7 {380}
1500	5.2 {530}	3.2 {330}
2000	4.8 {490}	2.9 {300}
2500	4.5 {460}	2.7 {280}
3000	4.2 {430}	2.5 {260}
3500	4.0 {410}	2.4 {250}

(5) If the machine is left stopped for a long time (for more than 30 minutes), remove a workpiece from the machine.

If the machine is left stopped for a long time with power switched off, tailstock sleeve thrust will be lowered gradually. This might cause a workpiece, held by the tailstock sleeve, to fall, damaging the machine.

2-6. Cautions on Operating the Turret

⚠CAUTION : When indexing the turret, retract it to a position where rotating of the turret does not cause interference between the tools in the turret and the workpiece or chuck.

For 0.5 seconds after the completion of turret indexing, the turret may not be clamped securely. Therefore, do not start machining within this period.

2-7. Interlock

NOTICE : The machine has the following interlock functions. Since these functions are very important for safe operation, read the explanation of them carefully to understand how the functions operate before operating the machine.

(1) Maximum Spindle Speed Interlock Function

The allowable maximum speed of the spindle is determined by the spindle speed set with the G50 command and the allowable speed of the chuck to be used. The spindle speed must be clamped at the lower value of these. It is not possible to start the spindle unless the allowable maximum spindle speed (clamp speed) is specified in a program. For details of the value to be set and how to specify it, refer to the OSP OPERATION MANUAL provided separately.

NOTICE

: (2) Door Interlock E Function

Since hazardous situation is constituted if the spindle and the turret are operated at high speeds while the door is open, this function sets the limits in machine operation performed with the door opened.

- Spindle speed: Lower than 50 min^{-1}
- Axis feed: 2 mm/min (0.079 ipm)
- Turret indexing: Step by step (only in manual mode; not allowed in other modes)

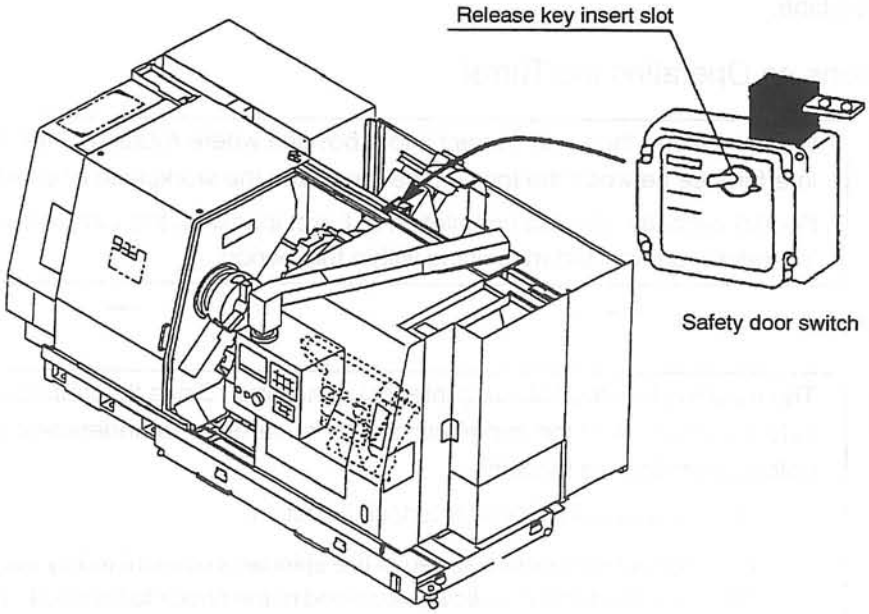
For more details, refer to the SAFE OPERATION FUNCTIONS provided separately.

(3) Safety Door Switch

The function prevents the front door from being opened by mistake. While the machine is operating, the safety door switch provided at the top of the front door locks it closed so that it will not be opened.

Before opening the front door, make sure to confirm that the machine has completely stopped. If the front door is forcibly opened while it is locked by the safety door switch, it could cause switch failure.

The door is in the locked state when the power is turned OFF. To open the door when the power is off, after power failure for example, release the lock by using a release key supplied with the machine.



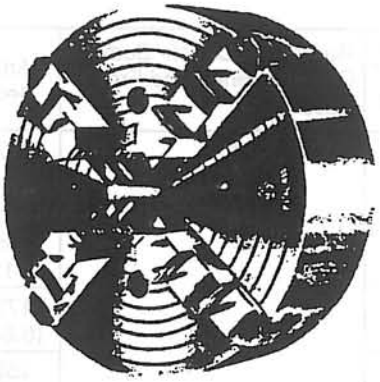
2-8. After Completion of A Day's Operation

(1) Press the CONTROL OFF button on the operation panel.

(2) Turn the main switch on the control box to OFF.

(3) Clean the machine and keep the surrounding area neat and in order.

2-9. Manually Operated Chuck



Four-jaw Independent Chuck (Kitagawa)

(1) Inspection

Check the model name indicated on the chuck body, possible damages during transportation, and accessories.

(2) Standards

The four-jaw independent chucks (Kitagawa) are manufactured in strict adherence to the standards stipulated in JIS B6154 (Independent chucks). The standards applied in manufacturing and inspection of the chucks are provided on the following pages.

IC Type

Unit: mm (in.)

Type		Maximum Chucking Diameter		Run-out of Chuck Body Circumference and Front Face	Adaptor Installation Section Dimensions		Bolts	
inch	mm	ID Chucking	OD Chucking				P.C.D.	No. of Bolts × Bolt Size
4	100	40 (1.57)	90 (3.54)	Within 0.030 (0.00118)	75 (2.95)	+0.030 (0.00118) 0	86 (3.39)	4-M8
6	150	60 (2.36)	140 (5.51)		130 (5.12)	+0.040 (0.00157) 0	115 (4.53)	4-M10
8	200	75 (2.95)	185 (7.28)		175 (6.88)		155 (6.10)	4-M12
10	250	95 (3.74)	220 (8.66)		150 (5.91)		125 (4.92)	4-M12
12	300	125 (4.92)	265 (10.43)		170 (6.69)		140 (5.51)	4-M12
14	350	155 (6.10)	310 (12.20)	Within 0.035 (0.00138)	190 (7.48)	+0.046 (0.00181) 0	160 (6.30)	4-M12
16	400	190 (7.48)	360 (14.17)		210 (8.27)		180 (7.09)	4-M16
18	450	220 (8.66)	405 (15.94)		230 (9.06)		200 (7.87)	4-M16
20	500	250 (9.84)	450 (17.72)	Within 0.040 (0.00157)	250 (9.84)		220 (8.66)	4-M16
22	550	290 (11.42)	500 (19.69)		275 (10.83)	+ 0.052 (0.00205) 0	240 (9.45)	4-M20
24	600	320 (12.60)	550 (21.65)		300 (11.81)		260 (10.24)	4-M20
26	660	370 (14.57)	610 (24.02)	Within 0.045 (0.00177)	325 (12.80)	+ 0.089 (0.00350) 0	275 (10.83)	8-M26
28	710	385 (15.16)	650 (25.59)		350 (13.78)		300 (11.81)	8-M20
30	762	435 (17.13)	700 (27.56)		375 (14.76)		325 (12.80)	8-M20
32	813	485 (19.09)	750 (29.53)	Within 0.050 (0.00197)	400 (15.75)		350 (13.78)	8-M20
36	915	555 (21.85)	850 (33.46)		450 (17.72)	+0.097 (0.00382) 0	400 (15.75)	8-M24
40	1000	630 (24.80)	940 (37.01)	Within 0.060 (0.00236)	500 (19.69)		450 (17.72)	8-M24

IA Type

Unit: mm (in.)

Spindle Nose	Type	Minimum Chucking Diameter		Run-out of Chuck Body Circumference and Front Face
		ID Chucking	OD Chucking	
A-5	IA5-200	75 (2.95)	185 (7.28)	Within 0.030 (0.00118)
	IA5-250	95 (3.74)	220 (8.66)	
	IA5-300	125 (4.92)	265 (10.43)	
A-6	IA6-205	75 (2.95)	185 (7.28)	
	IA6-250	95 (3.74)	220 (8.66)	
	IA6-300	125 (4.92)	265 (10.43)	
	IA6-350	155 (6.10)	310 (12.20)	Within 0.035 (0.00138)
	IA6-400	190 (7.48)	360 (14.17)	
	IA6-450	220 (8.66)	405 (15.94)	
	IA6-500	250 (9.84)	450 (17.72)	Within 0.040 (0.00157)
A-8	IA8-250	95 (3.74)	220 (8.66)	Within 0.030 (0.00118)
	IA8-300	125 (4.92)	265 (10.43)	
	IA8-350	155 (6.10)	310 (12.20)	Within 0.035 (0.00138)
	IA8-400	190 (7.48)	360 (14.17)	
	IA8-450	220 (8.66)	405 (15.94)	
	IA8-500	250 (9.84)	450 (17.72)	Within 0.040 (0.00157)
	IA8-550	290 (11.42)	500 (19.69)	
	IA8-610	320 (12.60)	550 (21.65)	
A-11	IA11-400	190 (7.48)	360 (14.17)	Within 0.035 (0.00138)
	IA11-450	220 (8.66)	405 (15.94)	
	IA11-500	250 (9.84)	450 (17.72)	Within 0.040 (0.00157)
	IA11-550	290 (11.42)	500 (19.69)	
	IA11-610	320 (12.60)	550 (21.65)	
	IA11-710	385 (15.16)	650 (25.59)	Within 0.045 (0.00177)
	IA11-750	435 (17.13)	700 (27.56)	
	IA11-800	485 (19.09)	750 (29.53)	Within 0.050 (0.00197)
	IA11-915	555 (21.85)	850 (33.46)	
	IA11-1000	630 (24.80)	940 (37.01)	Within 0.060 (0.00236)

(3) Installing Chuck

a) Accuracy of adaptor installation section has direct influence to the workpiece chucking accuracy. Therefore, machine the adaptor very carefully. Required accuracy is within 0.005 mm (0.00020 in.) for run-out on circumference, face run-out, and flatness.

b) Any damages such as score or foreign matter on fitting parts and installation surfaces will deteriorate chuck installation accuracy. Install the chuck only after cleaning both the chuck and the adaptor.

After the installation of the chuck, measure run-out of the chuck body circumference and face. Run-out must be within 0.020 mm (0.00079 in.).

c) Insert the chuck onto the spindle with the chuck drive pin hole aligned with the spindle pin. Tighten the chuck clamping bolts gradually and uniformly. After the installation, the chuck fits on the spindle end face in the following manner as illustrated below.

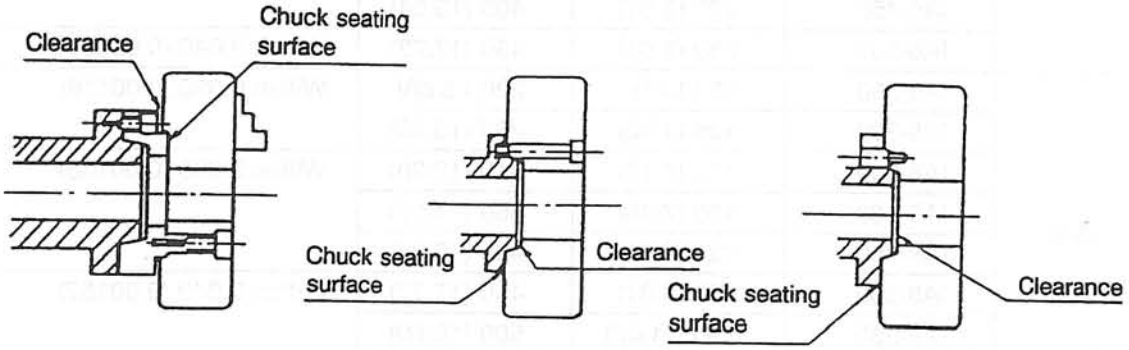


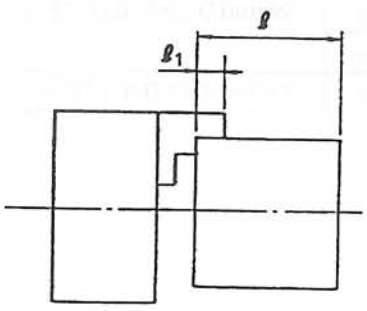
Fig. 3-19

d) To clamp a workpiece, use only the handle supplied with the chuck. If a workpiece is clamped forcibly by inserting a pipe into the handle hole, chucked part will be distorted causing shorter life and deteriorated accuracy.

If higher clamping force is required for your turning operation, use a larger chuck.

⚠CAUTION

: To hold a long workpiece, always use a tailstock or work rests to support the free end of the workpiece.



$\ell = \ell_1 + (\ell_1 \times 3.5)$

The workpiece whose length "ℓ" is longer than the value calculated using the formula above, it is recommended to use a tailstock.

e) Never tap a workpiece held in the chuck.

f) Select the chuck size meeting the intended machining operation.

(4) Lubrication and Cleaning

NOTICE : To ensure high accuracy for a long period, clean the fitting portions between the chuck body and the chuck jaws, and between the chuck jaw serration and a screw. For the cleaning, remove the jaws.

Supply oil once or twice a day.

(5) Maximum Speed

⚠CAUTION : Each chuck has its allowable maximum speed. If a chuck is rotated at a speed exceeding this limit, it will institute hazards to both operators and the machine.

Always tighten or clamp the workpiece at the torque specified in the table below and use the chuck at a speed lower than the indicated maximum speed.

Chuck Specifications – Flat Back Type Chuck

Type	Gripping Force		Maximum Gripping Force		Chuck		
	Handle Torque N·m {kgf·m (lbf·ft)}	Gripping Force/Jaw kN {kgf (lbf)}	ID Chucking mm (in.)	OD Chucking mm (in.)	Weight kg (lb)	Inertia (GD^2) $N \cdot m^2$ {$kgf.m^2$}	Allowable Max. Speed min^{-1} {rpm}
IC-4	34 {3.5 (25.3)}	4.9 {500 (1100)}	40 (1.57)	90 (3.54)	2.4 (5.3)	0.1 (0.01)	2000
IC-6	49 {5 (36)}	5.9 {600 (1320)}	60 (2.36)	140 (5.51)	6.1 (13.4)	0.8 (0.08)	1600
IC-8	83 {8.5 (61.5)}	9.8 {1000 (2200)}	75 (2.95)	185 (7.28)	14.8 (32.6)	2.9 (0.3)	1600
IC-10	118 {12 (87)}	13.7 {1400 (3080)}	95 (3.74)	220 (8.66)	21 (46)	5.9 (0.6)	1600
IC-12	147 {15 (108)}	15.7 {1600 (3520)}	125 (4.92)	265 (10.43)	29.5 (64.9)	13.7 (1.4)	1400
IC-14	157 {16 (116)}	16.7 {1700 (3740)}	155 (6.10)	310 (12.20)	40 (88)	28.4 (2.9)	1400
IC-16	215 {22 (159)}	19.6 {2000 (4400)}	190 (7.48)	360 (14.17)	56.5 (124.3)	44.1 (4.5)	1200
IC-18	215 {22 (159)}	19.6 {2000 (4400)}	220 (8.66)	405 (15.94)	70 (154)	68.6 (7.0)	1200
IC-20	245 {25 (181)}	21.6 {2200 (4840)}	250 (9.84)	450 (17.72)	90 (198)	116 (11.8)	900
IC-22	245 {25 (181)}	21.6 {2200 (4840)}	290 (11.42)	500 (19.69)	135 (297)	173 (17.6)	900
IC-24	275 {28 (203)}	22.5 {2300 (5060)}	320 (12.60)	550 (21.65)	150 (330)	248 (25.3)	900
IC-26	275 {28 (203)}	22.5 {2300 (5060)}	370 (14.57)	610 (24.02)	176 (387)	411 (42)	900
IC-28	294 {30 (217)}	23.0 {2350 (5170)}	385 (15.16)	650 (25.59)	247 (543)	569 (58)	900
IC-30	294 {30 (217)}	23.5 {2400 (5280)}	435 (17.13)	700 (27.56)	284 (625)	784 (80)	600
IC-32	294 {30 (217)}	23.5 {2400 (5280)}	485 (19.09)	750 (29.53)	357 (785)	1039 (106)	600
IC-36	353 {36 (260)}	23.5 {2400 (5280)}	555 (21.85)	850 (33.46)	413 (909)	1696 (173)	600
IC-40	510 {52 (376)}	29.4 {3000 (6600)}	630 (24.80)	940 (37.01)	600 (1320)	2971 (303)	600

Chuck Specifications – Type A Short Taper Chuck

Spindle Nose	Type	Gripping Force		Maximum Gripping Force		Chuck		
		Handle Torque N·m {kgf·m (lbf·ft)}	Gripping Force/Jaw kN {kgf (lbf)}	ID Chucking mm (in.)	OD Chucking mm (in.)	Weight kg (lb)	Inertia GD^2 $N·m^2$ {$kgf·m^2$}	Max. Allowable Speed min^{-1} {rpm}
A2-5	IA5-200	83 {8.5 (61.5)}	9.8 {1000 (2200)}	75 (2.95)	185 (7.28)	14.9 (32.8)	3.1 (0.32)	3600
A2-6	IA6-250	118 {12 (87)}	14.7 {1500 (3300)}	95 (3.74)	220 (8.66)	24.2 (53.4)	7.45 (0.75)	3000
	IA6-300	147 {15 (108)}	15.7 {1600 (3520)}	125 (4.92)	265 (10.43)	39.1 (86.0)	15.7 (1.6)	2000
	IA6-350	147 {15 (108)}	15.7 {1600 (3520)}	155 (6.10)	310 (12.20)	50.9 (112.0)	29.4 (3.0)	2000
	IA6-400	215 {22 (159)}	19.5 {2000 (400)}	190 (7.48)	360 (14.17)	69.8 (153.6)	46.1 (4.7)	1800
	IA6-450	245 {25 (181)}	22.5 {2300 (5060)}	220 (8.66)	405 (15.94)	97.2 (213.8)	69.6 (7.1)	1200
	IA6-500	245 {25 (181)}	22.5 {2300 (5060)}	250 (9.84)	450 (17.72)	103.5 (227.7)	132 (13.5)	1200
A2-8	IA8-350	215 {22 (159)}	19.5 {2000 (4400)}	155 (6.10)	310 (12.20)	56.2 (123.6)	30.4 (3.1)	2000
	IA8-400	245 {25 (181)}	22.5 {2300 (5060)}	190 (7.48)	360 (14.17)	73.8 (162.4)	49.0 (5.0)	1800
	IA8-450	245 {25 (181)}	22.5 {2300 (5060)}	220 (8.66)	405 (15.94)	102.5 (225.5)	71.6 (7.3)	1200
	IA8-500	245 {25 (181)}	22.5 {2300 (5060)}	250 (9.84)	450 (17.72)	108.4 (238.5)	139 (14.2)	1200
	IA8-550	245 {25 (181)}	22.5 {2300 (5060)}	290 (11.42)	500 (19.69)	123 (271)	158 (16.1)	1200
	IA8-610	275 {28 (203)}	22.5 {2300 (5060)}	320 (12.60)	550 (21.65)	136 (299)	226 (22.8)	1100
A2-11	IA11-500	245 {25 (181)}	22.5 {2300 (5060)}	250 (9.84)	450 (17.72)	130 (286)	166 (16.9)	1200
	IA11-550	245 {25 (181)}	22.5 {2300 (5060)}	290 (11.42)	500 (19.69)	145 (319)	185 (18.9)	1100
	IA11-610	275 {28 (203)}	22.5 {2300 (5060)}	320 (12.60)	550 (21.65)	204 (449)	338 (34.5)	900
	IA11-710	392 {40 (289)}	29.4 {3000 (6600)}	385 (15.16)	650 (25.59)	257 (565)	588 (60)	800
	IA11-750	451 {46 (333)}	29.4 {3000 (6600)}	435 (17.13)	700 (27.56)	300 (660)	840 (85.7)	800
	IA11-810	539 {55 (398)}	29.4 {3000 (6600)}	450 (17.72)	750 (29.53)	380 (836)	1300 (132.5)	600
	IA11-915	451 {46 (333)}	29.4 {3000 (6600)}	555 (21.85)	850 (33.46)	440 (968)	1809 (184.5)	600
	IA11-1000	657 {67 (485)}	36.3 {3700 (8140)}	630 (24.80)	940 (37.01)	570 (1254)	2824 (288.2)	600

(cont'd)

Spindle Nose	Type	Gripping Force		Maximum Gripping Force		Chuck		
		Handle Torque Nf·m {kgf·m (lbf·ft)}	Gripping Force/Jaw kN {kgf (lbf)}	ID Chucking mm (in.)	OD Chucking mm (in.)	Weight kg (lb)	Inertia GD^2 $N·m^2$ $\{kgf·m^2\}$	Max. Allowable Speed min^{-1} {rpm}
A2-15	IA15-610	441 {45 (325)}	26.5 {2700 (5940)}	280 (11.02)	520 (20.47)	215 (473)	394 (40.2)	900
	IA15-710	451 {46 (333)}	27.5 {2800 (6160)}	385 (15.16)	650 (25.59)	280 (836)	798 (81.5)	800
	IA15-750	451 {46 (333)}	27.5 {2800 (6160)}	420 (16.54)	690 (27.17)	230 (506)	933 (95.2)	600
	IA15-810	539 {55 (398)}	29.4 {3000 (6600)}	460 (18.11)	750 (29.53)	392 (616)	1339 (136.6)	600
	IA15-915	726 {74 (535)}	29.4 {3000 (6600)}	500 (19.69)	800 (31.50)	500 (1100)	2043 (208.5)	500
	IA15-1000	726 {74 (535)}	29.4 {3000 (6600)}	550 (21.65)	900 (35.43)	610 (1342)	2842 (290)	500

SECTION 4 INSPECTION AND MAINTENANCE OF MACHINE

Your CNC lathe is a highly efficient production machine calling for a much higher utilization rate than an engine lathe.

This section deals with the maintenance requirements which must be met by every user in order to insure excellent, trouble-free performance and prolonged life.

It also outlines some basic steps to pinpoint possible causes of trouble, together with troubleshooting hints, if your CNC lathe is found out of order in any way, or in need of readjustment or repair.

Generally, NC lathes are used at three to four times higher "utilization" rates than manually controlled engine lathes. To insure a maximum productive time with a minimum of downtime, the machine must be periodically inspected and carefully serviced.

A periodical inspection schedule is presented below. In addition to the regular maintenance items given here. There are some maintenance items which should be checked according to the actual condition of the machine, as described in this section.

Periodical Inspection Schedule

Frequency	Inspection Items
Daily	(1) Check oil level through the oil level gauges in the hydraulic power unit, slideway lubricating oil tank and spindle coolant unit. Check oil flow through the oil window. (2) Check source pressure of the hydraulic unit, chuck pressure and tailstock pressure. (3) Supply lubricating oil to the power chuck master jaw.
Monthly	(1) Check the bedways for level and straightness. (2) Flush out the hydraulic power unit and change the hydraulic fluid. (3) Change cooling oil in the spindle cooling unit. These three items must be carried out after the first month of operation following initial installation of the machine.
Every six months	(1) Change hydraulic oil in the hydraulic unit. (2) Supply lubricating oil to the chip conveyor. (3) Change cooling oil in the spindle cooling unit.

The following details the regular maintenance requirements for your CNC lathe.

1. LUBRICATION

NOTICE : The machine should be completely and correctly lubricated in strict adherence to the directions in the Lubrication Chart in the following page.

(1) Always use the specified lubricating oil.

a) If the oil other than specified is used, the lubrication unit might fail to operate normally.

b) Lubricating oil used in common with coolant or lubricating oil used in common with hydraulic oil might cause corrosion of lubrication unit or mixing of oils to result in lubrication failure, which, in turn, leads to damages on the slideway surfaces.

(2) For coolant, use the specified coolant.

a) Coolant usually contains chemical additives such as activator. If improper coolant is used, lubricating oil will be affected by chemicals and therefore, use the specified coolant so far as possible.

b) If coolant which is not our recommendation is to be used, check to be sure that it will not cause any following problems.

Mixing with lubricating oil, possible parting, peel of paint, rusting, and swelling of packings.

If a problem is found during the use of the coolant, avoid the use of such coolant.

(3) Amount of lubricating oil and its discharge condition must be checked everyday.

a) Whether or not lubricating oil is properly supplied can be checked by checking oil level in the tank. For normal oil consumption amount, refer to 1-2 in this section.

b) Prior to shipment of the machine from our plant, the oil and the coolant tanks are flushed out and must therefore be refilled during the initial installation of the machine.

Lubrication Chart

(1) Standard Spindle, Large Diameter Spindle

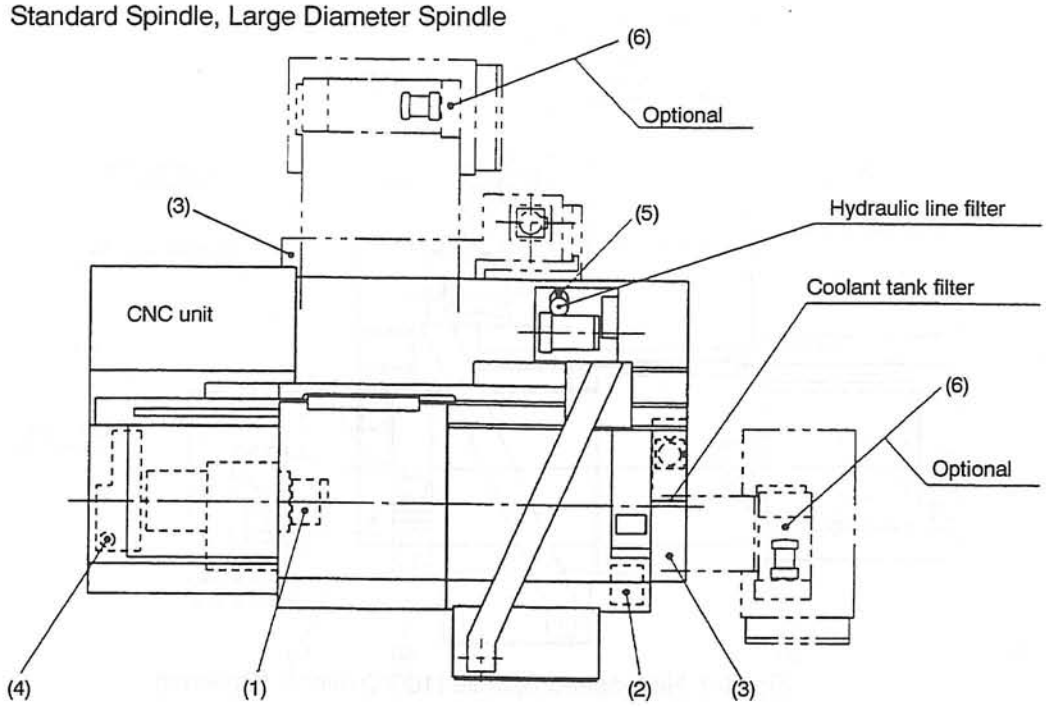


Fig. 4-1 Lubrication Chart

No.	Oiling Points		Quantity	Oil Used	(MAS)	Remarks
1	Chuck jaw		As needed	Molykoat EP grease (Dow Corning)	—	Everyday when cleaning chuck jaws
2	Centralized slideway lubrication tank		4.4 dm^3 (L) (1.16 gal)	Tonna Oil T68 (Shell)	G68	As needed
3	Coolant tank (side disposal type)	2SC × 600	135 dm^3 (L) (35.64 gal)	Hi-chip NC10 (Taiyu)*1	—	As needed
	Coolant tank (rear disposal type)	2ST × 350	350 dm^3 (L) (92.4 gal)			
	Coolant tank (side disposal type)	2SC × 1000	180 dm^3 (L) (47.52 gal)			
4	Headstock coolling unit		15 dm^3 (L) (3.96 gal)	Velocite No. 3 (Mobil)	FC2	In 1 month after initial installation Every 6 months after that
5	Hydraulic power unit		40 dm^3 (L) (10.6 gal)	DTE Oil Light (Mobil)	HL32	In 1 month after initial installation Every 6 months after that
6	Chip conveyor		As needed	Mobilux 2 (Mobil)	XM2	Replenish every 3 to 6 months.

*1 Use NC10 diluted by 20 to 30 times their volume with tap water or distilled water.

Refer to Table 4-1 on next page for similar oil of other makers.

Note: Chip conveyor is optional.

(2) High-speed Spindle (10000 min^{-1}) (Optional)

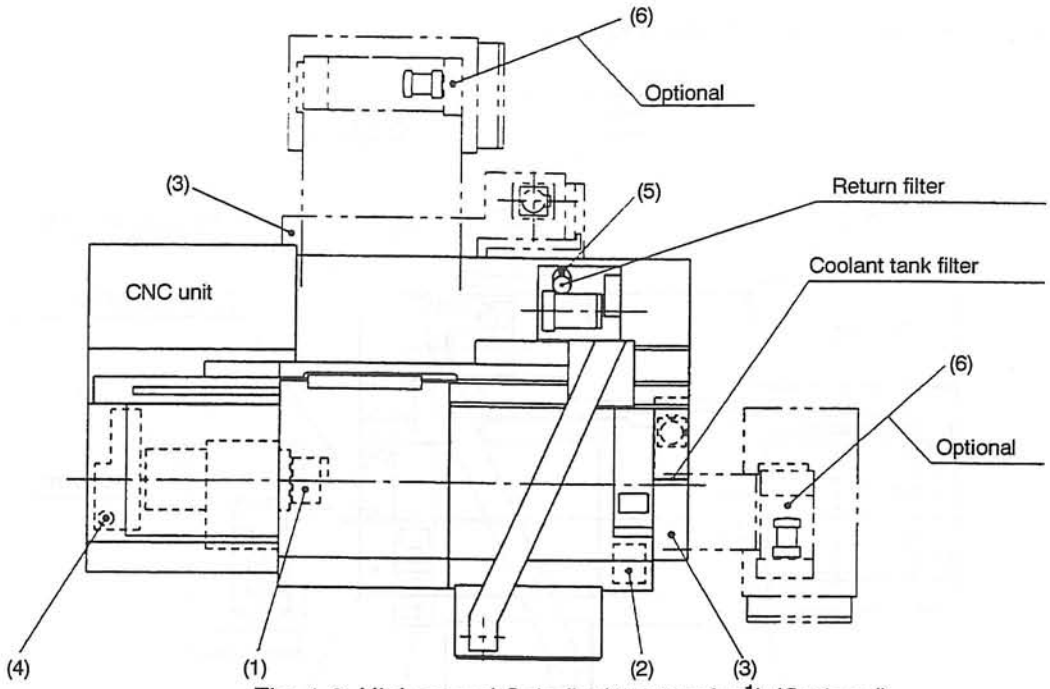


Fig. 4-2 High-speed Spindle (10000 min^{-1}) (Optional)

No.	Oiling Points		Quantity	Oil Used	(MAS)	Remarks
1	Oil-air lubrication unit		2.7 dm^3 (L) (0.71 gal)	DTE Oil Light (Mobil)	HL32	Replenish every 1000 hours.
2	Centralized slideway lubrication tank		6 dm^3 (L) (1.57 gal)	Tonna Oil T68 (Shell)	G68	As needed
3	Coolant tank (side disposal type)	2SC × 600 2ST × 350	135 dm^3 (L) (35.67 gal)	Hi-chip NC10 (Taiyu)*1	—	As needed
	Coolant tank (rear disposal type)		350 dm^3 (L) (92.47 gal)			
	Coolant tank (side disposal type)	2SC × 1000	180 dm^3 (L) (47.52 gal)			
4	Headstock cooling unit		75 dm^3 (L) (19.82 gal)	Velocite No. 3 (Mobil)	FC2	In 1 month after initial installation Every 6 months after that
5	Hydraulic power unit		40 dm^3 (L) (10.57 gal)	DTE Oil Light (Mobil)	HL32	In 1 month after initial installation Every 6 months after that
6	Chip conveyor		As needed	Mobilux 2 (Mobil)	XM2	Replenish every 3 to 6 months.

*1 Use NC10 diluted by 20 to 30 times their volume with tap water or distilled water.

Refer to Table 4-1 on next page for similar oil of other makers.

Table 4-1 Lubricating Oil Specification

Application	Code	Esso	Shell	Mobil
Headstock gearbox (Spindle gearbox with C-axis) Separately installed gearbox	CB32	Unipower 32	Tetra Oil 32	DTE Oil Light*
Cam type turret	CC320	Spartan EP320*	Omala Oil 320	Gear Oil 632
Spindle bearing lubrication unit	FC10	Spinesso 10*	Tetra Oil 10	Velocite No. 6*
Centralized slideway lubrication unit (M-turret, ball screw)	G68	Febis K68	Tonna Oil T68*	Vactra Oil No. 2 (SLC)
	G220	Febis K220	Tonna Oil T220*	Vactra Oil No. 4 (SLC)
Hydraulic power unit	HL32	Unipower 32	Tetra Oil 32	DTE Oil Light*
M-tool holders	(Grease)	—	—	Mobilux EP2*
Master jaw on chuck	(Grease)	Molykoat EP grease (Dow Corning) or Kitagawa chuck grease for Kitagawa power chuck. For special chucks, refer to the instruction manual supplied with the chuck.		
Headstock cooling unit	FC2	Unipower MP-2	Tetra Oil 2	Velocite No. 3* ISO viscosity grade = Equivalent to 2 cst (40°C)
Turret ball screw	XM2 (Grease)	Lithtan 2	Alvania Grease 2	Mobilux EP2*

Note 1: The above table is based on the MAS.

We do not have any experience in using the oils other than those indicated by an asterisk (*). Selection should thus be made from them. Because slide-way lubricating oil contains additives such as extreme-pressure additive, it could incur variety of troubles if reacting with other oils or coolant. Therefore, pay special attention to the use of slide way lubricating oil.

Note 2: As for service point or amount of lubricating oil of the machine, refer to the Instruction Manual of respective machine models.

Note 3: Lubricating oil used in common with coolant or lubricating oil used in common with hydraulic oil might cause corrosion of lubrication unit or turbidness of oils to result in lubrication failure, which, in turn, leads to damages on the slideway surface or ball screw. (We take no responsibility for the troubles caused by using the lubricating oil which is not our recommendation.)

Note 4: As for oil replenishment for the optional accessories such as special chucks or chip conveyor, refer to the Special Instruction Manual supplied with individual accessories.

Note 5: When slideway lubricating oil mixed with coolant and some trouble appears, contact your local Okuma representatives. They have optional accessories such as oil skimmer.

1-1. Spindle Lubrication System

All the spindle bearings are lubricated by packed high quality grease, requiring no further greasing.

1-2. Slideway Lubrication System

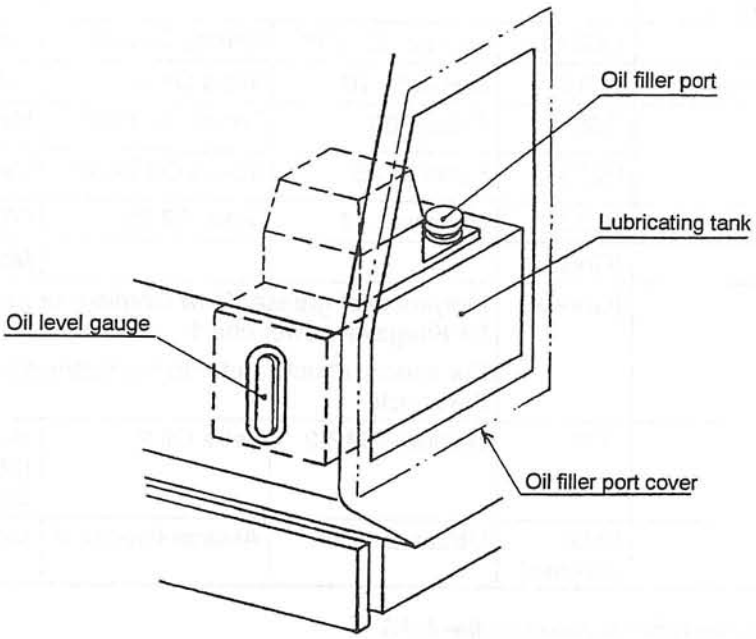


Fig. 4-3 Slideway Lubrication System

Oil Specification	G68 (MAS)
Amount	4.4 L (1.16 gal)
Oil Change Interval	Replenish as required. Low lubrication level alarm detected by the level switch occurs in approx. 70 hour operation. Check oil level every day and replenish lubricating oil before the alarm occurs.

⚠CAUTION

: Check oil level before starting day's operation.

To forcibly deliver lubricating oil, follow the steps below:

(1) Press the EMERGENCY STOP button.

(2) Press the RESET button.

This delivers lubricating oil.

Repeat the above indicated steps several times.

The centralized lubricating oil tank is accessible by opening the oil filter port cover. The lubricating oil is fed to the bed slideway, the cross-slide slideway, the X- and Z-axis drive ball screws and the tailstock sleeve.

2. ADJUSTING CENTRALIZED LUBRICATION UNIT

(1) Adjusting Pump Delivery

The delivery amount to each lubrication point is controlled by the metering type distribution valve, and no further adjustment is necessary.

A metering type distribution valve is provided at the machine rear (inside the cover) and at the right side of the tailstock. The delivery condition of lubricating oil can be checked visually. (Use sufficient care when checking the delivery condition.)

(2) Maintenance and Countermeasure

When no lubricating oil is delivered:

a) Oil level is low.

Replenish the lubricating oil of the same brand.

b) The pump is at a rest: The pump operates intermittently.

The pump operation interval is set at 3 minutes.

c) The suction filter is clogged.

Clean the suction filter at least every six months. (See Fig. 4-4.)

d) The motor does not rotate. Check wiring.

(3) Other Remarks

a) The lubricating oil to be replenished must be clean and it must be of the same brand as currently used.

b) When cleaning the tank and the filter, NEVER USE THINNER OR TRICHLEN (TRICHLOROETHYLENE) SHOWING HIGH VOLATILE CHARACTERISTICS.

c) Specified lubricating oil: G68 (MAS)

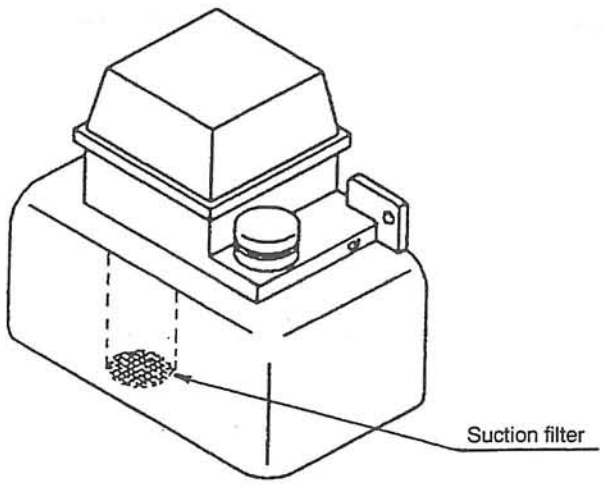


Fig. 4-4 Adjusting Centralized Lubrication Unit

d) Suction filter cleaning procedure:

1) Remove the pump. (two M5 screws)

2) Take out the pump and clean the suction filter provided at the end of the suction pipe.

3) Reinstall the pump.

3. CLEANING COOLANT TANK

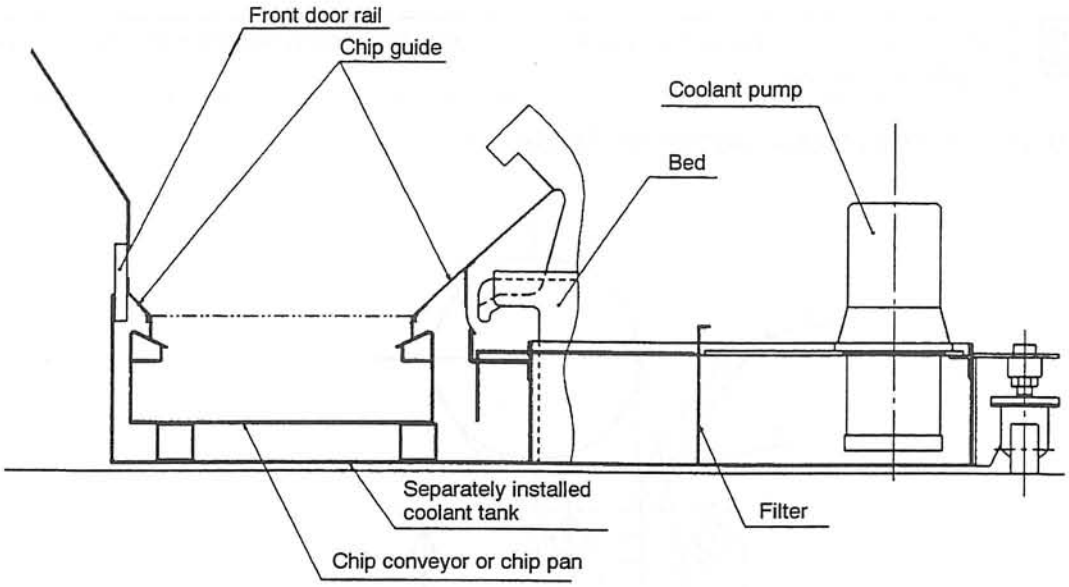


Fig. 4-5 Cleaning Coolant Tank

(1) Procedure to Clean the Separately Installed Coolant Tank

a) Remove the cover at the side of the coolant pump.

b) Draw the coolant out of the tank by the pump.

c) Pull out the coolant tank to the right until the pump protrudes from the side cover, and pull it out to the front.

d) Clean inside the coolant tank.

e) Clean the filter.

f) After cleaning the tank, reinstall the coolant tank.

The coolant tank must not protrude from the front rail. If the coolant tank is not installed correctly, coolant will leak.

4. TENSIONING BELTS

⚠WARNING : As a safety precaution, always turn OFF the machine when adjusting the belt tension or when replacing the belt.

4-1. Timing Belt for Lower X-axis Servo Motor

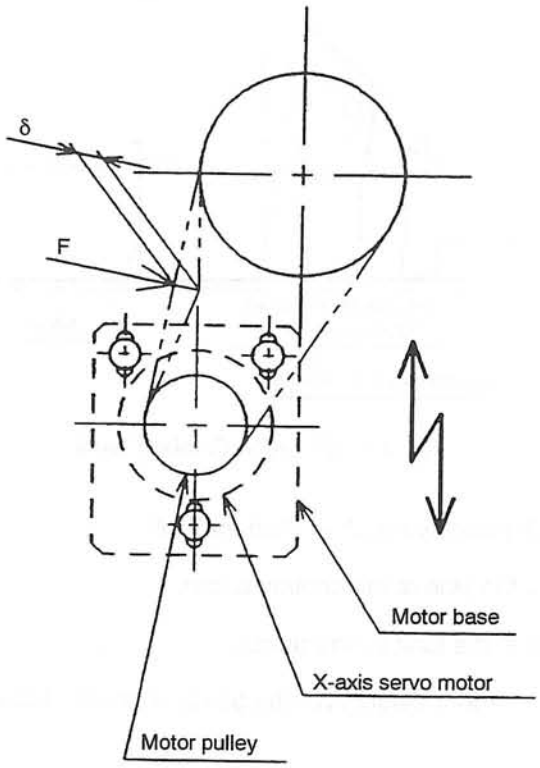


Fig. 4-6 Timing Belt for Lower X-axis Servo Motor

Adjust the belt tension by moving the servo motor.

Type of Belt	Type and Size	No. of Belt	Tension F N {kgf (lbf)}	δ mm (in.)
Timing belt Lower X-axis	STS 250S8M760 (M119-0009-07)	1	31 {3.2 (7.04)}	3.4 (0.13)

5. OTHER MAINTENANCE ITEMS

5-1. Alignment of Headstock

If taper is generated on the turned workpiece in the chuck work operation, proceed with the alignment of the headstock as follows:

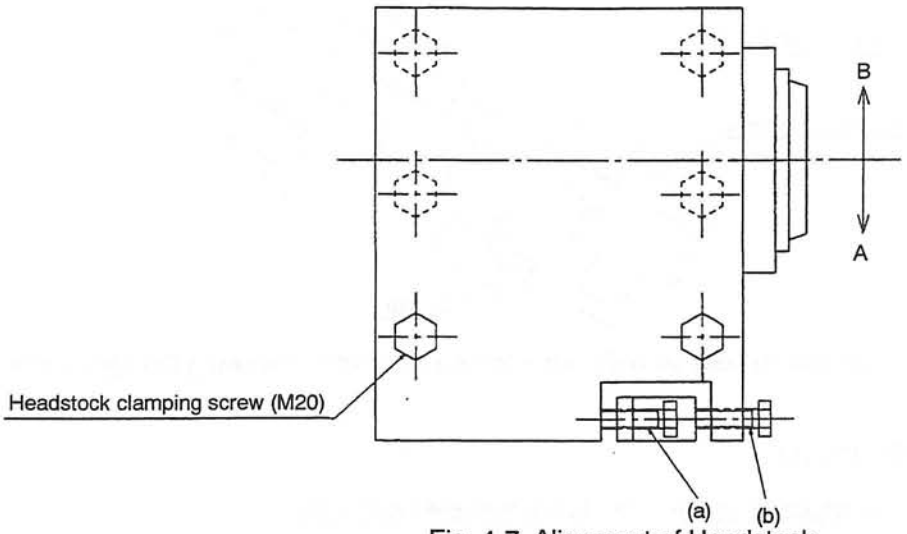


Fig. 4-7 Alignment of Headstock

Procedure:

(1) Loosen the headstock clamping screws (M20, 6 pcs.).

(2) Align the headstock.

a) In A direction

After loosening the adjusting screw (b), secure the adjusting screw (a). This shifts the headstock in the A direction.

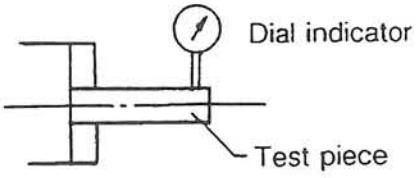
b) In B direction

After loosening the adjusting screw (a), secure the adjusting screw (b). This shifts the headstock in the B direction.

Carry out this adjustment while reading the dial indicator applied at the front end of the test piece.

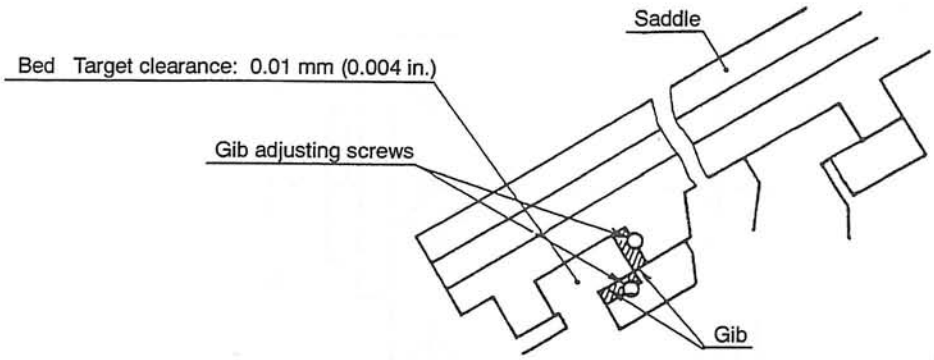
> For Your Information
>
> The Japanese Industrial Standard (JIS) specifies that the lathe should turn cylindrically to within 0.015 per 225 mm (0.0006 per 8.86 in.) of finishing length of work held in a chuck without the use of tailstock center to hold the work.

c) After the required accuracy is obtained, tighten the six headstock clamping screws. Note that reading of the dial indicator applied at the test piece top end must not change.



5-2. Adjustment of Tapered Gibs on Saddle Cross-slide

The machine is shipped after complete adjustment of tapered gibs. Readjustment will become necessary when the gibs are worn or loosened by use, resulting in noticeable irregular feed movement, which adversely affects the working accuracy.



Adjust the gib using the adjusting belts on both sides of the saddle after removing the right and left saddle covers.

(1) Gib Adjustment Procedure

a) Loosen the gib adjusting screw at the headstock side (left side).

b) Fully tighten and then return by a half turn the gib adjusting screw at the tailstock side (right side).

c) Tighten the gib adjusting screw at the headstock side (left side).

Clearance should be 0.01 mm (0.0004 in.).

(2) Adjust the gibs for the cross-slide in the same manner.

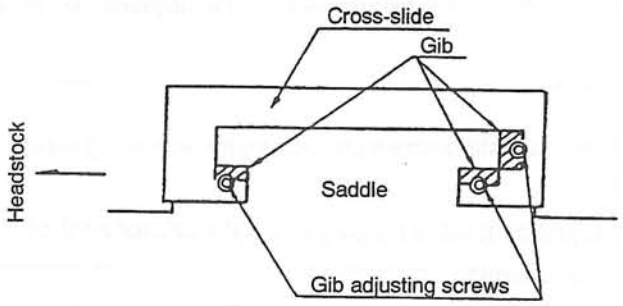


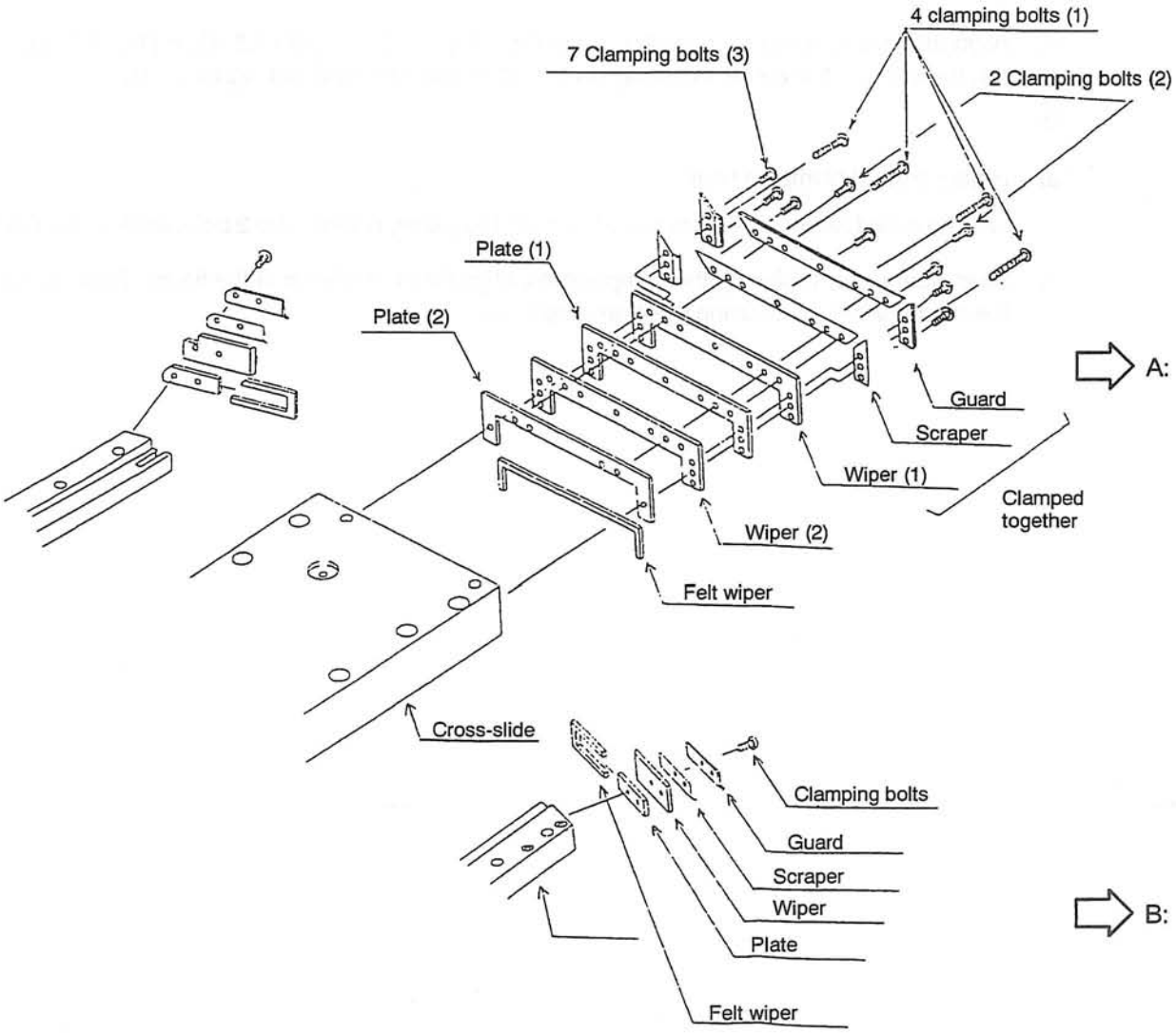
Fig. 4-8 The Gibs for the Cross-slide

5-3. Lower Cross-Slide and Saddle Wiper Inspection

When replacing consumable parts, these items have priority over those shown on the spare parts list.

(1) Lower Cross-Slide Wiper Inspection

Conduct the inspection as described below. (For details regarding the inspection items, refer to the following page.)



A:

a) Remove the four clamping bolts (1), then detach all wipers from the cross-slide.

b) Remove clamping bolts (2) and (3) to disassemble the components.

c) After cleaning or replacing the components, mount the guard, scraper, and wiper (1) on plate (1).

d) Align the guard, scraper, and wiper assembly (step c) above) with felt wiper plate (2) and wiper (2), then mount the entire assembly on the cross-slide using clamping bolts (1).

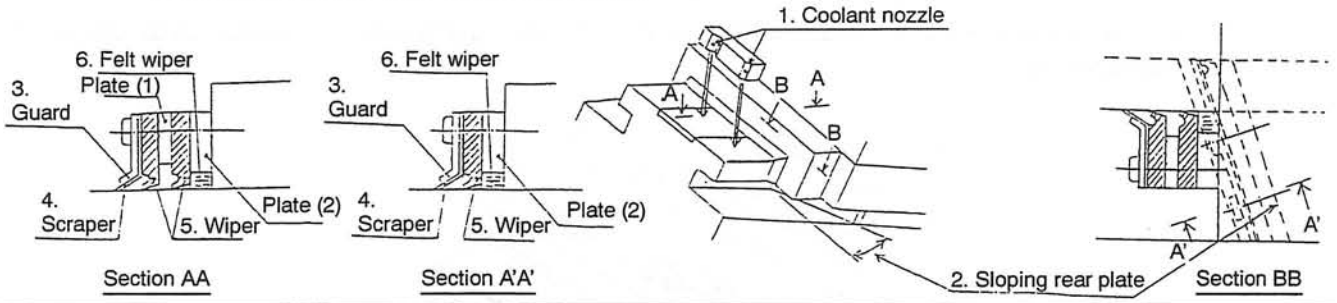
B:

a) Remove the 2 clamping bolts.

As the guard, wiper, and plate are all clamped together, remove the 2 bolts to disassemble them.

b) After cleaning or replacing the components, align them as shown in the figure, then mount them on the rear plate using the clamping bolts.

Lower Cross-Slide Wiper Inspection Items

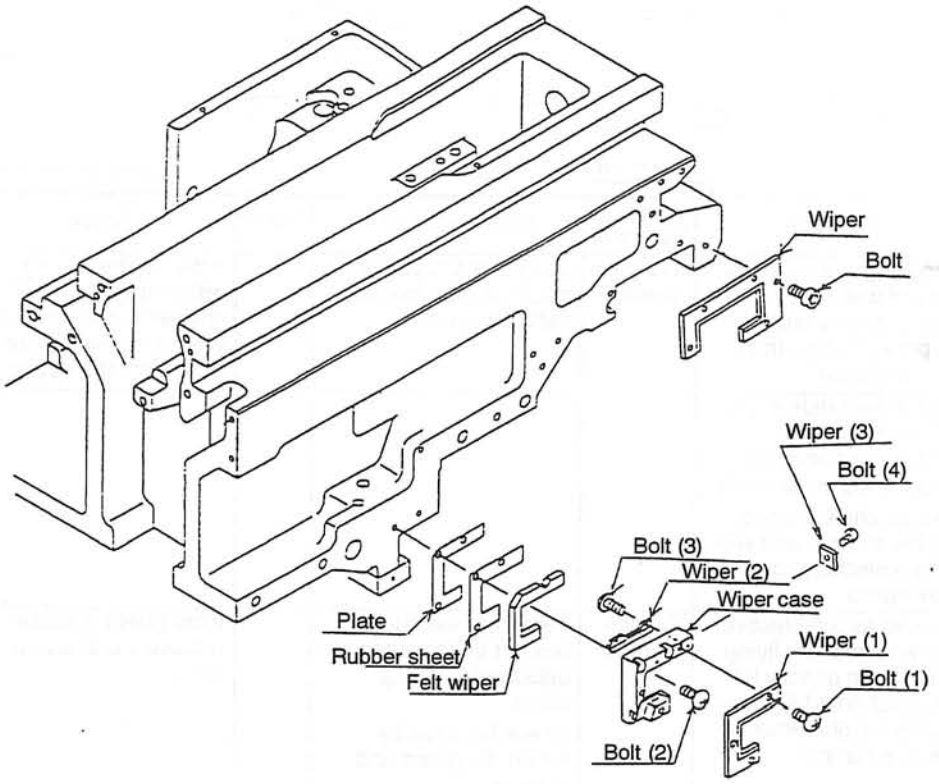


No.	Item	Function	Insp. Schedule	Insp. Description	Check	Action	Check	Remarks
1.	Coolant nozzle	Discharges a constant flow of water on the X-axis slideway surface to prevent chips from accumulating.	Every 6 months	Verify that the coolant nozzle is not clogged with chips, etc.		If the nozzle is clogged with chips, etc., use a slender rod-shaped device to remove the material from the nozzle.		
2.	Cross-slide sloping rear plate	The X-axis slideway's left and right rear plates are sloped to shed chips more easily. Minute chips missed by the scraper and wiper are discharged downward.						
3.	Guard	Serves as a protective cover to prevent flying chips from directly hitting and possibly damaging the phosphor bronze scraper.	Every 6 months	Verify that the guard has not be loosened or detached by flying chips. Check for chips between the guard and scraper.		If the guard is broken, replace it with a new one.		
4.	Scraper (phosphor bronze)	The scraper end makes contact with the slideway surface to prevent penetration by minute chips.	Every 6 months	Verify that the wiper is not broken, or its end bend or damaged, etc. Verify that the wiper end makes contact with the slideway in a uniform manner.		If the wiper is broken, replace it with a new one. After replacing the wiper, make sure that its end makes contact with the slideway in a uniform manner.		2 spare sets provided
5.	Wiper (nitrile rubber)	The ribbed nitrile rubber wiper acts to prevent minute chips missed by the scraper from penetrating to the slideway. (Double wiper format is used to enhance effectiveness)	Every 6 months	Verify that there is no penetration or gouging by minute chips. Check the rib wear condition.		If chip penetration has occurred, clean the wiper then re-mount it. If the ribs are worn, replace the wiper.		1 spare set provided
6.	Felt wiper	Acts to prevent ultra-minute chips missed by the scraper and double wiper arrangement from penetrating to the slideway surface.	Every 6 months	Verify that felt is free of chips. Check to see if the felt has hardened.		If chips are stuck to the felt, or if the felt has hardened, replace it with a new one.		1 spare set provided

Note: The inspection schedule shown above serves as a general guideline. The schedule may vary depending on the amount of chips generated and the working conditions, etc.

(2) Lower Saddle Wiper Inspection

Conduct the inspection as described below. (For details regarding the inspection items, refer to the following page.)



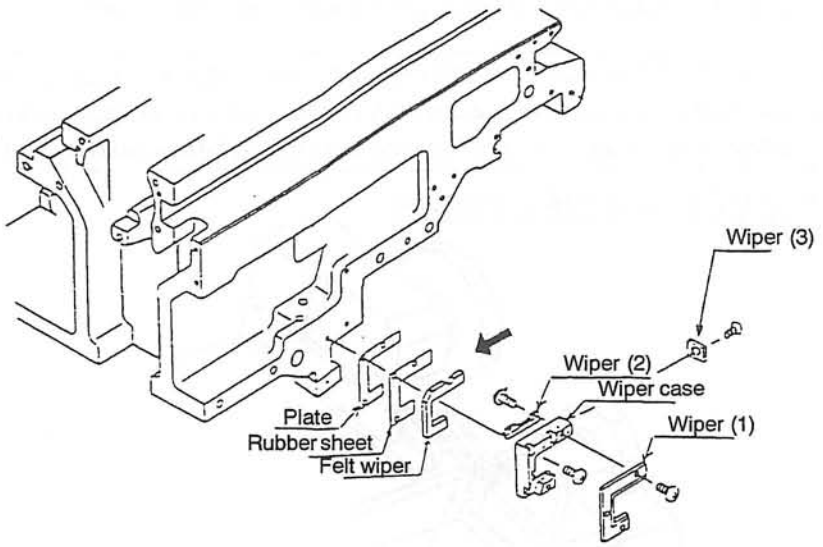
a) Remove the 3 bolts (1), then remove wiper (1) from the wiper case.

b) Remove the 3 bolts (2), then remove the plate, rubber sheet, felt wiper, and the wiper case.

c) Remove the 2 bolts (3), then remove wiper (2) from the wiper case.

d) Remove the bolt (4), then remove wiper (3) from the wiper case.

e) After inspecting, cleaning, or replacing the components, reassemble them in the reverse order from that shown above.



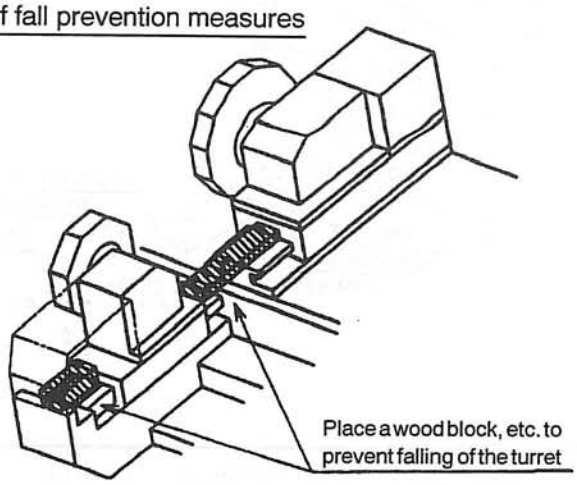
No.	Item	Function	Insp. Schedule	Insp. Description	Check	Action	Check	Re-marks
1.	Wipers (1), (2)	The ribs of the nitrile rubber wipers press against the slideway surface to prevent chip penetration.	Annually	Verify that there is no chip penetration. Check the rib wear condition.		If chip penetration has occurred, clean the wiper then re-mount it. If the ribs are worn, replace the wiper.		
2.	Wiper (3)	Prevents chips from entering the wiper area from direction "A".	Annually	Check for the presence of minute and embedded chips. Check for wear at the wiper contact area.		Replace the wiper if chips are embedded or if the wiper's contact area is worn.		
3.	Felt wiper	Prevents chips missed by wipers (1) and (2) from penetrating to the slideway.	Annually	Verify that felt is free of chips. Check to see if the felt has hardened.		If chips are stuck to the felt, or if the felt has hardened, replace it with a new one.		

Note: The inspection schedule shown above serves as a general guideline. The schedule may vary depending on the amount of chips generated and the working conditions, etc.

5-4. Cautions on Checking the X-axis Ball Screw and Related Parts

⚠WARNING : When removing the X-axis drive servomotor for the purpose of inspection or maintenance of the X-axis ball screw, servomotor, and the related parts, make sure to support the upper/lower turret with a wood block, etc., to prevent it from falling before starting your work.

An example of fall prevention measures



6. TROUBLESHOOTING FOR SIMPLE MECHANICAL TROUBLE

6-1. Trouble with Headstock

(1) No Spindle Rotation

Is the power chuck closed?

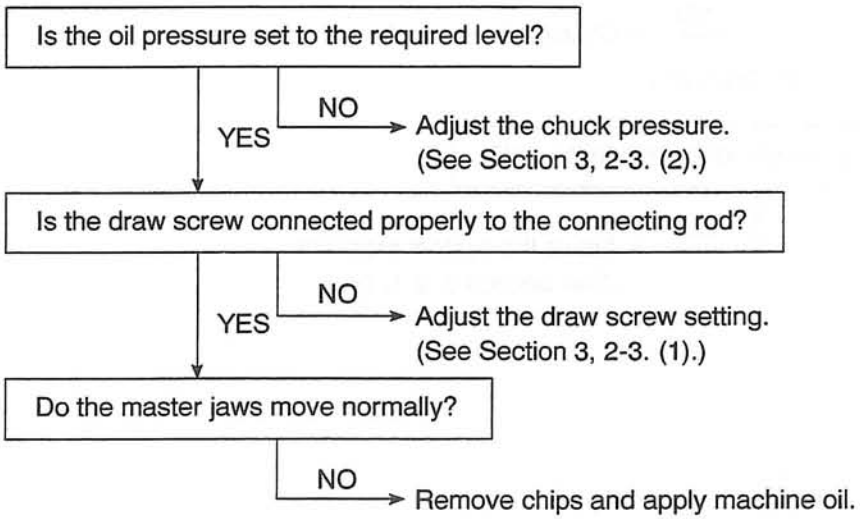
For model with tailstock:

CENTER WORK/CHUCK WORK selector setting:

CENTER WORK . . . Tailstock sleeve must be at the advance end.

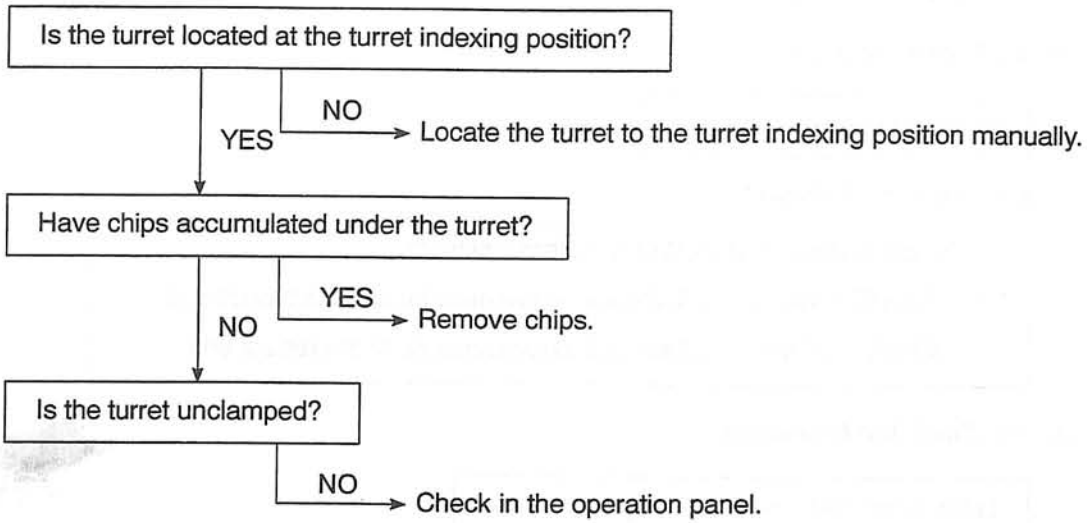
CHUCK WORK . . . . Tailstock sleeve must be at the retract end.

(2) No Chuck Jaw Movement

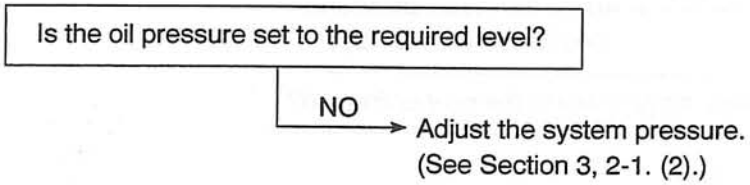


6-2. Trouble with Turret

(1) No Turret Indexing



(2) Weak Turret Clamping Pressure



(3) After Collision of Turret

a) Checking after turret collision

Misalignment of the turret or the headstock might be caused when the turret is struck against the workpiece or the chuck in rapid feed due to operation error or programming error, or when an abnormally heavy load is imposed on the turret due to axis feed with damaged inserts. The procedure to check the alignment of the turret and the headstock is explained below.

1) Checking turret alignment

Checking turret inclination

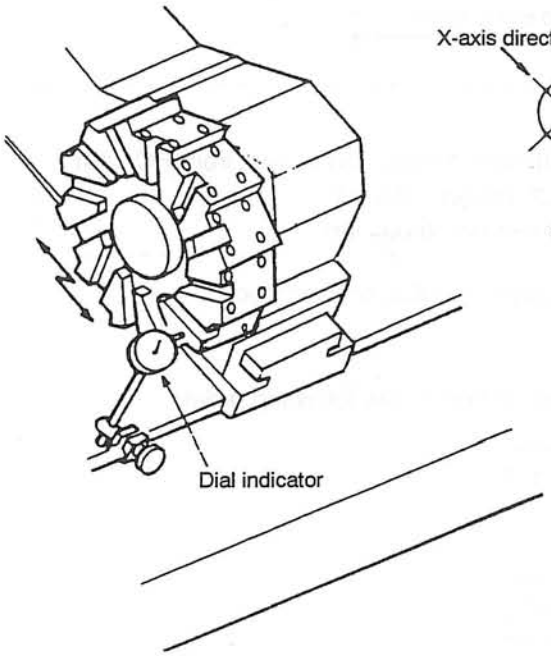


Fig. 4-9

Set the dial indicator as illustrated in Fig. 4-9 and feed the X-axis with the pulse handle to check the inclination of the toolholder mounting surface on the turret. If the inclination is larger than 0.02 mm (0.0008 in.) it must be corrected. The procedure to make corrections is explained in Item b).

Checking turret offset

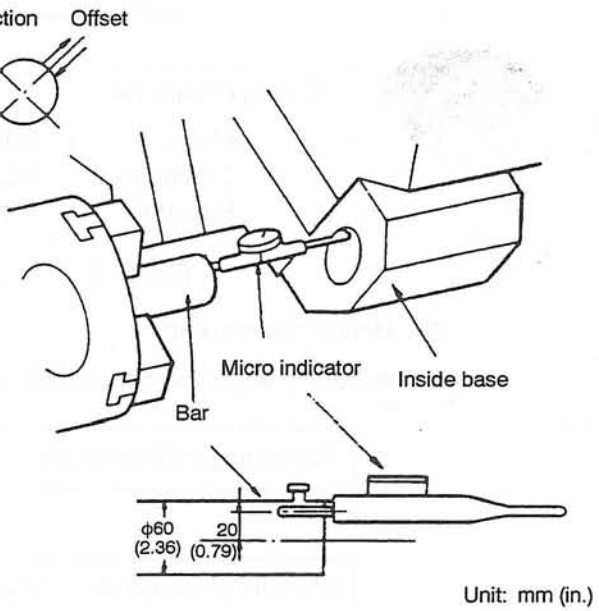
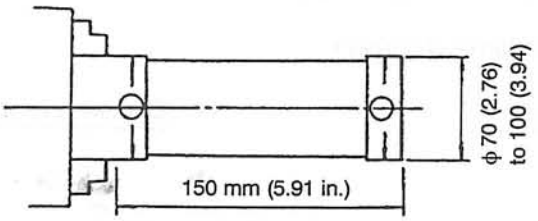


Fig. 4-10

Mount the inside base holder on the turret as illustrated in Fig. 4-10. Check the center position of the hole on the inside base holder using the micro indicator set in the chuck to check the offset or misalignment of the hole on the inside base holder from the spindle center. Alignment of the spindle center and the inside base holder hole center in the X-axis direction must be adjusted first. The offset amount is one half the error read by the micro indicator. If offset amount is larger than 0.05 mm (0.002 in.), make corrections as explained in Item c).

2) Accuracy inspection of headstock

Finish a test piece indicated in Fig. 4-11 below in the MDI mode operation to check the cylindricity. If the measured cylindricity is larger than 0.018 mm/225 mm (0.0007 in./8.86 in.), adjustment of the headstock is necessary. For the procedure to adjust the headstock, refer to 4-1. in this section. This adjustment should be carried out in combination with the adjustment for offset in Fig. 4-10.



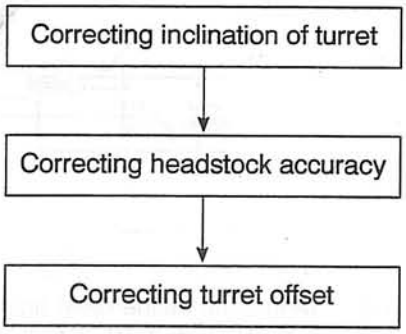
Cutting conditions

Material	:	Mild steel (S45C, JIS) or cast iron (FC, JIS)
Depth of cut	:	ϕ0.2 mm (ϕ0.008 in.)
Feedrate	:	0.1 mm/rev (0.004 ipr)

Fig. 4-11 Accuracy inspection of headstock

3) Headstock accuracy

Accuracy adjustment should be carried out in the following order:



b) Correcting turret inclination

If the turret inclination amount measured as per Fig. 4-9 is larger than 0.02 mm (0.0008 in.), adjustment should be made in the manner indicated below (Refer to Fig. 4-12, 4-13.):

1) Remove covers (1), (2) and (7).

2) Loosen the turret clamping screws (3). Note that turret clamping screws (4) and (5) should not be loosened.

3) After loosening the turret clamping screws (4) and (5) satisfactorily, check turret inclination as in Fig. 4-9 while tapping the turret with a soft head hammer.

4) When the inclination of the turret is adjusted within the allowable range, secure the turret clamping screws (3), (4) and (5).

5) Install the covers (1) (2) and (7). Apply the sealant to the cover mounting surfaces.

This completes the adjustments.

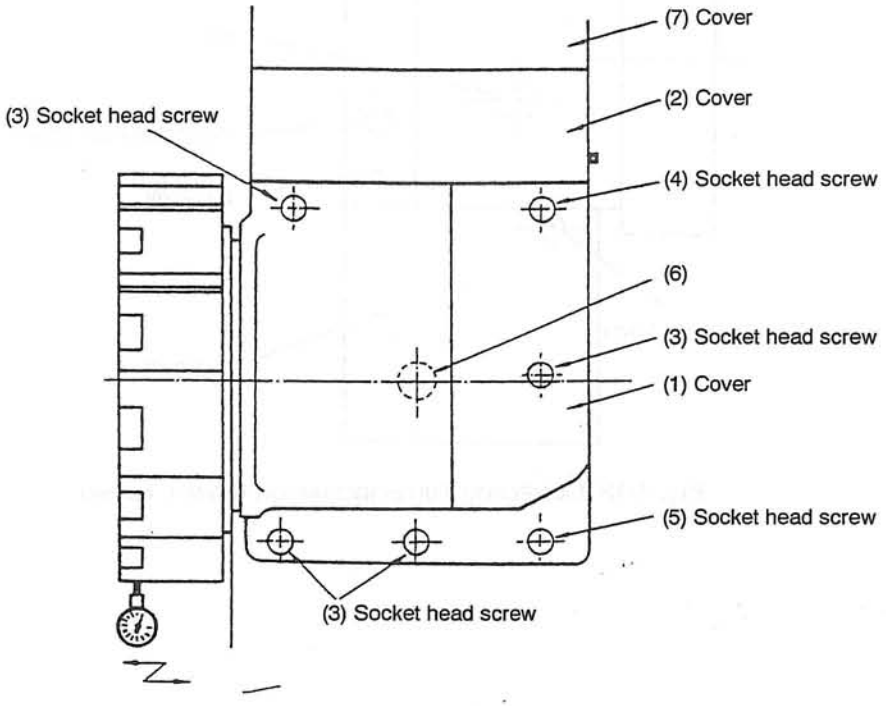


Fig. 4-12 Correcting Turret Inclination (Upper Turret)

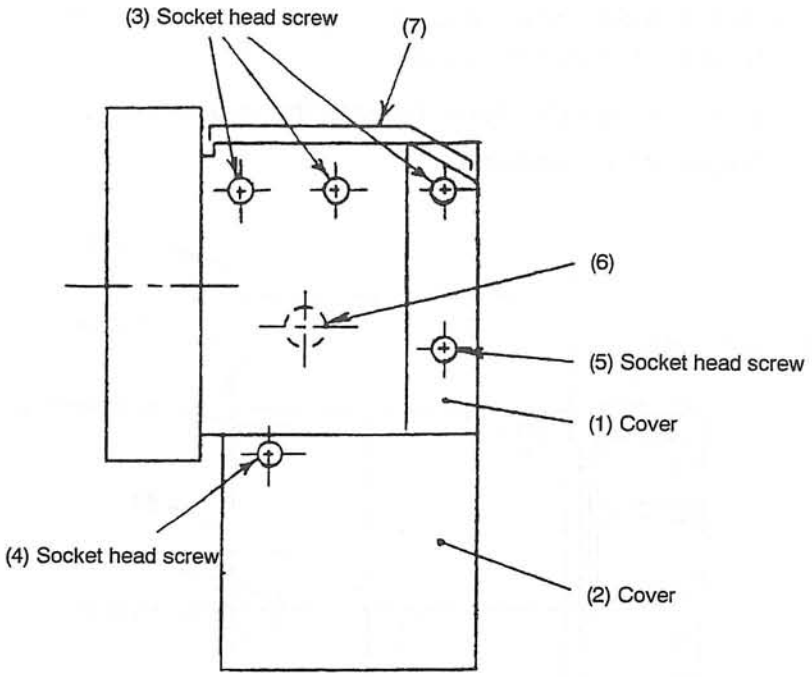


Fig. 4-13 Correcting Turret Inclination (Lower Turret)

c) Correcting turret offset

If the offset amount measured as per Fig. 4-10 is larger than 0.05 mm (0.002 in.), make corrections following the steps below:

Upper turret (Refer to Fig. 4-14.)

1) Press the CONTROL OFF button to turn off the power supply to the NC and then, turn off the main switch.
2) After removing the plug (1), loosen the bolt (2).
3) Prepare two taper pins with female thread (3), $\phi 10 \times 63$ mm ($\phi 0.39 \times 2.48$ in.), and drive fit them while tapping the turret with a softhead hammer. It is recommended to screw the bolt into the female thread of the taper pin in advance.
4) After the two taper pins have been driven into the turret head, secure the turret head clamping screws tight.
5) Turn on the power.
6) Measure the offset amount in the manner as illustrated in Fig. 4-10.
7) If steps 1) through 6) cannot eliminate offset, proceed to the steps below.
8) Set "1" for MC USER PARAMETER, No. 4, TURRET/DOOR, "3. NC turret pulse handle A-side". Then, select the "manual" mode and press the TOOL INDEX switch, and the turret will be unclamped.
9) Press the CONTROL OFF button to turn off the power supply to the NC and then, turn off the main switch. Keep the power off until the turret head is reassembled.
10) After removing the six screw (4), remove the tool number plate (5). Before removing the tool number plate, mark match marks so that it can be replaced easily.
11) Remove screws (6) and detach cap (7).
12) Remove the bolt (8).
13) Remove the center shaft (10) and the cover (11) using a tap (9).
14) Lift up the turret with a jib crane and remove bolt (12).
15) Detach the turret head. (Leave marking for matching.)
16) Remove the bolt (13) and then remove the clutch (14). (Leave marking for matching.)
17) Loosen the bolt (15) and then remove the taper pin (16).
18) Prepare two taper pins with female thread, $\phi 6 \times 36$ mm ($\phi 0.24 \times 1.42$ in.) and drive fit them into taper pin holes (17).
19) Tighten clutch securing screw (15).

20) Finish two taper pin holes (18) with a taper reamer and drive the taper pin $\phi 8 \times 50$ mm (0.31 × 1.97 in.) into the taper pin hole. If the taper pin removed in step 16) is stepped or bent, replace it with a new one. If the taper pin is inserted too deeply, use a little longer taper pin.

21) Remove taper pins (3) and (17).

22) Reassemble the turret head in reverse order of steps 10) to 16).

    Be sure that all O-rings have been placed in position.

    Apply grease to the clutch teeth slightly.

23) Turn on power.

24) Set "0" for MC USER PARAMETER, No. 4, TURRET/DOOR, "3. NC turret pulse handle A-side". Then, select the "manual" mode and press the TOOL INDEX switch, and the turret will be clamped.

25) Measure the offset amount again as illustrated in Fig. 4-10.

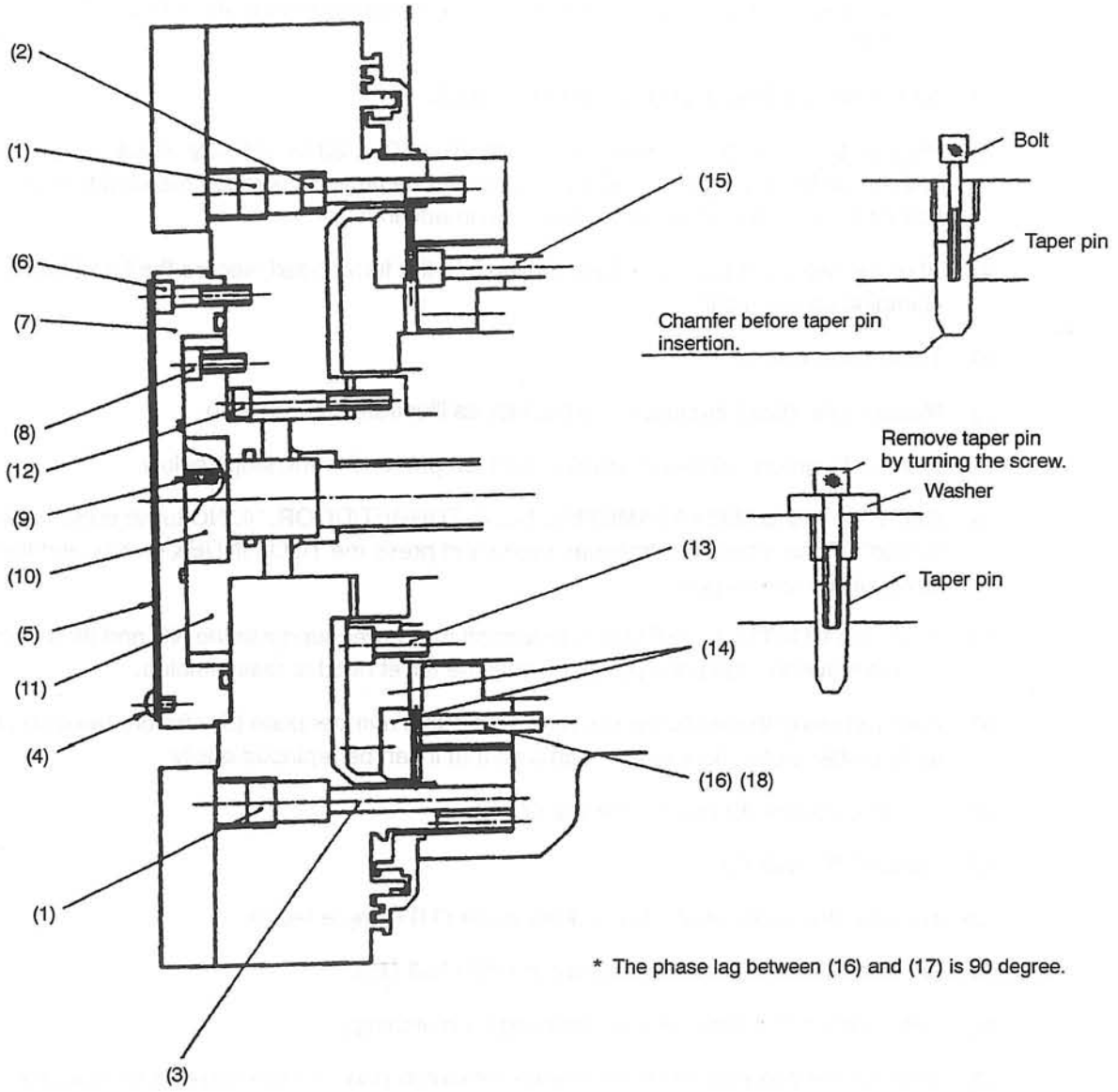


Fig. 4-14 Correcting Turret Offset (Upper Turret)

Lower turret (Refer to Fig. 4-15.)

1) Press the CONTROL OFF button to turn off the power supply to the NC and then, turn off the main switch.

2) After removing the plug (1), loosen the bolt (2).

3) Prepare two taper pins with female thread (3), ϕ10 × 63 mm (ϕ0.39 × 2.48 in.), and drive fit them while tapping the turret with a softhead hammer. It is recommended to screw the bolt into the female thread of the taper pin in advance.

4) After the two taper pins have been driven into the turret head, secure the turret head clamping screws tight.

5) Turn on the power.

6) Measure the offset amount in the manner as illustrated in Fig. 4-10.

7) If steps 1) through 6) cannot eliminate offset, proceed to the steps below.

8) Set "1" for MC USER PARAMETER, No. 4, TURRET/DOOR, "4. NC turret pulse handle B-side". Then, select the "manual" mode and press the TOOL INDEX switch, and the turret will be unclamped.

9) Press the CONTROL OFF button to turn off the power supply to the NC and then, turn off the main switch. Keep the power off until the turret head is reassembled.

10) After removing the six screw (4), remove the tool number plate (5). Before removing the tool number plate, mark match marks so that it can be replaced easily.

11) Remove screws (6) and detach cap (7).

12) Remove the bolt (8).

13) Remove the center shaft (10) and the cover (11) using a tap (9).

14) Lift up the turret with a jib crane and remove bolt (12).

15) Detach the turret head. (Leave marking for matching.)

16) Remove the bolt (13) and then remove the clutch (14). (Leave marking for matching.)

17) Loosen the bolt (15) and then remove the taper pin (16).

18) Prepare two taper pins with female thread, ϕ6 × 36 mm (ϕ0.24 × 1.42 in.) and drive fit them into taper pin holes (17).

19) Tighten clutch securing screw (15).

20) Finish two taper pin holes (18) with a taper reamer and drive the taper pin ϕ8 × 50 mm (0.31 × 1.97 in.) into the taper pin hole. If the taper pin removed in step 17) is stepped or bent, replace it with a new one. If the taper pin is inserted too deeply, use a little longer taper pin.

21) Remove taper pins (3) and (17).

22) Reassemble the turret head in reverse order of steps 10) to 16).

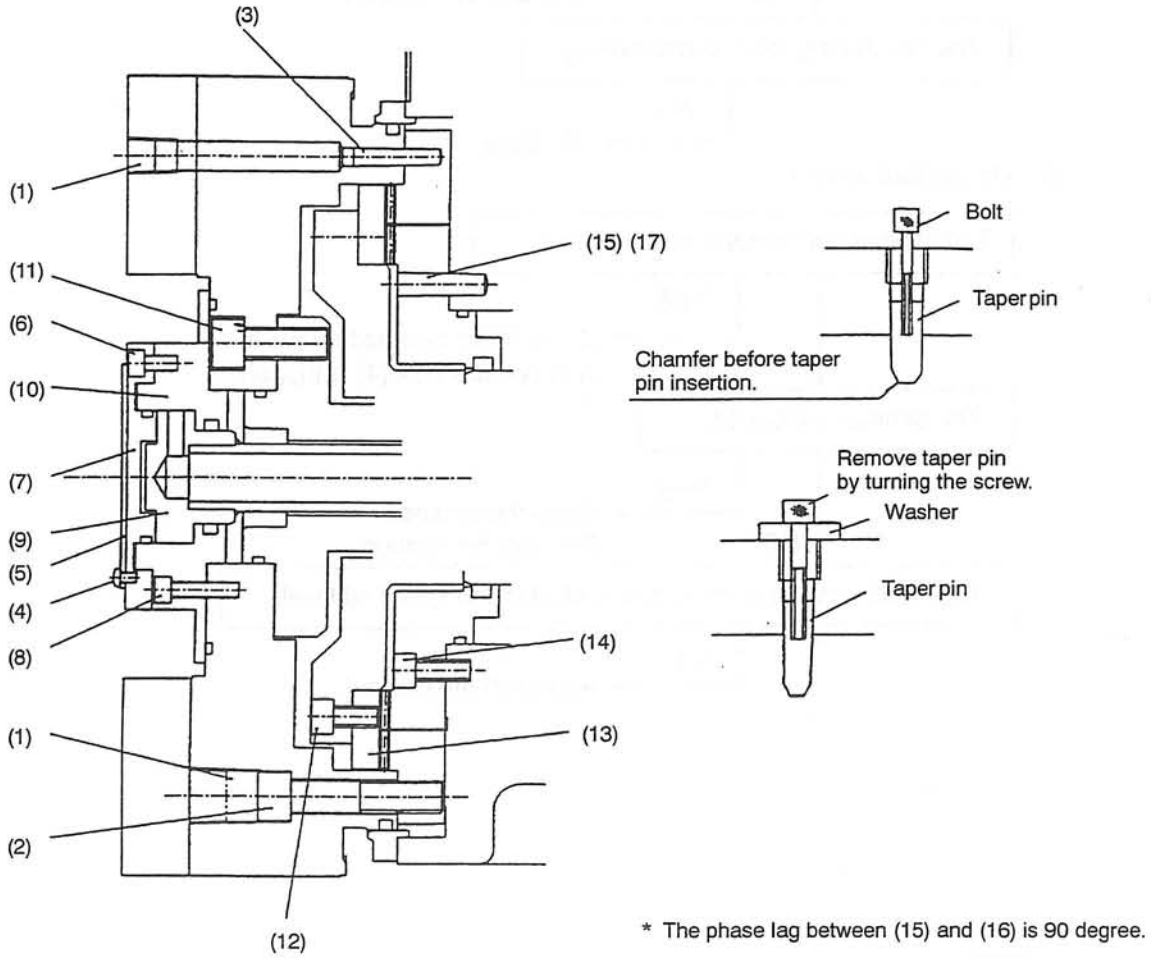
Be sure that all O-rings have been placed in position.

Apply grease to the clutch teeth slightly.

23) Turn on power.

24) Set "0" for MC USER PARAMETER, No. 4, TURRET/DOOR, "4. NC turret pulse handle B-side". Then, select the "manual" mode and press the TOOL INDEX switch, and the turret will be clamped.

25) Measure the offset amount again as illustrated in Fig. 4-10.

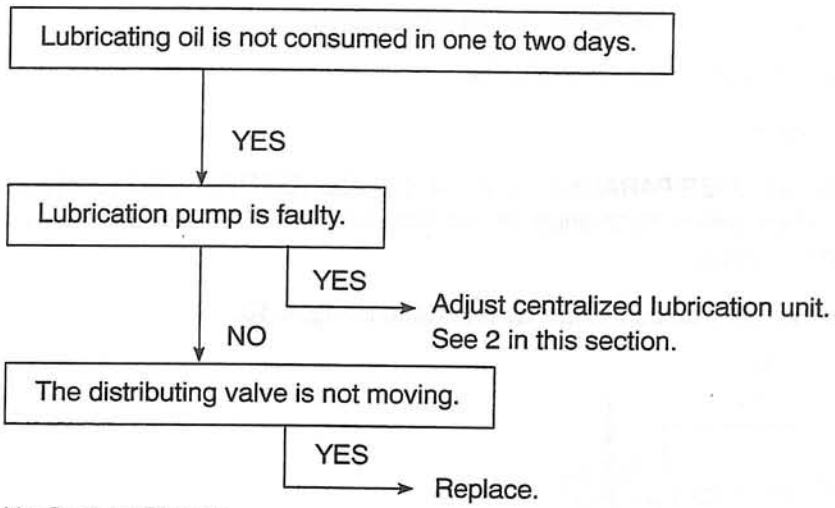


* The phase lag between (15) and (16) is 90 degree.

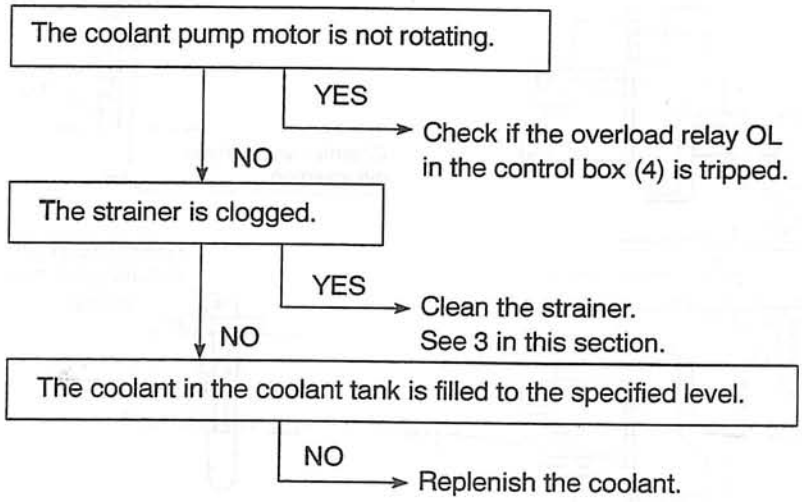
Fig. 4-15 Correcting Turret Offset (Lower Turret)

6-3. Others

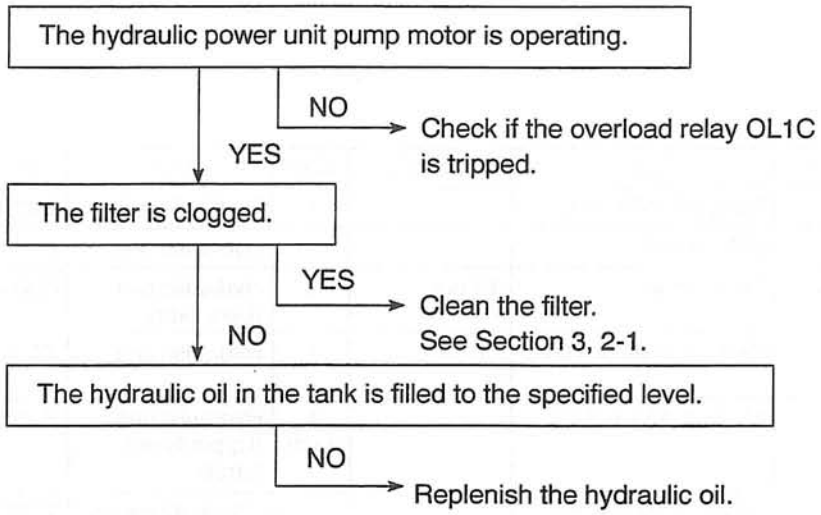
(1) No Lubricating Oil Flow to X-/Z-axis Slideways



(2) No Coolant Supply



(3) No Pressure Building-up of Hydraulic Power Unit



SECTION 5 SPARE PARTS LIST

1. HYDRAULICS

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
1	Strainer	Daiei	SS60607 150 mesh		1	Hydraulic unit	H0032-0010-01
2	Line filter	Masuda	UPM04-10P		1	Hydraulic unit	H0032-0009-17
3	Line filter element	Masuda	U038-010P	10 μm	1	Hydraulic unit (Line filter)	H0032-0010-03
4	Pressure gauge	Nagano Keiki	GV50-173-60 × 100 K		1	Hydraulic unit	T019-400-005-23
5	Solenoid valve	Nachi	SL-G01-A3X-GR-D2		1 each	Hydraulic unit (Upper/lower turret)	F0001-431-000-83
6	Solenoid valve	Nachi	S-G01-B3X-GRZ-D2-32		1	Chuck manifold block	F0000-431-000-19
7	Reducing valve	Nachi	OG-G01-PC-K-20-5645C		1	Chuck manifold block	F0011-730-000-06
8	Pressure gauge	Yodagawa Keiki	ADGU-60 × 70 K × 1000 PSI		1	Chuck manifold block	T019-400-004-01
9	Solenoid valve	Nachi	S-G01-C5-GRZ-D2-30		1	Tailstock manifold block	F0000-442-000-05
10	Reducing valve	Nachi	OG-G01-AC-K-12		1	Tailstock manifold block	F0011-621-000-01
11	Pressure gauge	ASK	OPG-DF-U PF1/4 60 × 70 K		1	Tailstock manifold block	T019-400-003-24
12	Oil leveling gauge	Kamui	6 × 120		1	Spindle cooling unit	H0039-0004-77
13	Dester block	Showa	DSA2	0.2 × 2	1	Upper turret	H0019-0001-44
14	Dester block	Showa	DS8Z	0.08 × 5 0.03 × 3	1	Upper closs-slide	H0019-0002-09
15	Dester block	Showa	DS8Z	0.08 × 7 0.05 × 1	1	Upper saddle	H0019-0002-08
16	Dester block	Showa	DS2Z	0.08 × 2	1	Upper saddle	H0019-0002-07
17	Dester plunger	Showa	DPB12	0.16 × 1 0.06 × 1	1	Lower turret	H0019-0002-92
18	Dester block	Showa	DS8	0.1 × 1 0.03 × 7	1	Lower closs-slide	H0012-0007-03
19	Dester block	Showa	DS5Z	0.1 × 1 0.03 × 4	1	Lower saddle	H0019-0002-89
20	Dester block	Showa	DS5Z	0.1 × 3 0.03 × 2	1	Lower saddle	H0019-0002-90
21	Dester block	Showa	DSB3	0.2 × 2 0.1 × 1	1	Lower saddle	H0019-0002-91
22	Dester plunger	Showa	DPB16	0.03 × 6	1	Tailstock	H0012-0007-05
23	Dester plunger	Showa	DPB11	0.1 × 1	1	Tailstock	H0012-0007-06

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
24	Air filter	MAC	440 × 450 (15.75 × 17.72)		1	Cooling unit for high-speed spindle	
25	Air filter	MAC	440 × 310 (15.75 × 12.20)		1	Cooling unit for high-speed spindle	
26	Micro separator	Sanesu	MSB-110		1	Cooling unit for high-speed spindle	
27	Oil level gauge	Ukai	H-LW-D5-1-80		1	Cooling unit for high-speed spindle	
28	Oil filter port	Kamui	CAB-30B		1	Cooling unit for high-speed spindle	
29	Suction filter	Masuda	W-MSN-10		1	Cooling unit for high-speed spindle	

2. ELECTRICALS (ON MACHINE)

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
1	AC motor	Sanyo	22/15 kW (30/20 hp) built-in motor	Rotor stator	1 each	Main motor	E1006-288-025 E1006-288-024-1
2	Uni-pump	Nachi	UVN-1A-1A3-2.2-4-10		1	Hydraulic unit	F0100-73-000-16
3	Lubrication pump		MLB01W2B	17 W	1	Slideway lubrication	
4	Coolant pump	Fuji Electric	VKP081Z	250 W	1	Coolant	F0130-03-000-58
5	Limit switch	Yamatake	1LS1-J		1 each	Upper X-/Z-axis limit	E3012-891-001
6	Limit switch	Yamatake	1LW1		1	Lower Z-axis limit	E3012-891-056
7	Limit switch	Yamatake	SL1-A		1	Lower X-axis limit	E3019-891-017
8	Proximity switch	OMRON	TL-T2E1		2 each	Upper/lower turret	E3020-397-101
9	Limit switch	Yamatake	SL1-A		1	Tailstock	E3019-891-017
10	Proximity switch	Yamatake	FL7M-2J6HD		1	Tailstock	E3020-891-053
11	Brushless servomotor	Okuma	BL-MC200E-20SNA	4 kW	1 each	Upper/lower Z-axis	
12	Brushless servomotor	Okuma	BL-MC200E-12SB	2.4 kW	1	Upper X-axis	
13	Brushless servomotor	Okuma	BL-MC75E-20TB	1.5 kW	1	Lower X-axis	
14	Brushless servomotor	Okuma	BL-MC140E-30T	4.3 kW	1	Upper turret	
15	Brushless servomotor	Okuma	BL-MC50E-20T	1 kW	1	Lower turret	
16	Footswitch	Osaka Jido Denki	OFL-1-SM2C		1	Chuck operating pedal	E2860-119-001
17	Footswitch	Osaka Jido Denki	OFL-TWY-SM2C		1	Tailstock operating pedal	E2860-119-006
18	Fluorescent lamp	Matushita		U-shaped pipe 100 V 18 W	1	Work lamp	E3532-801-016
19	Limit switch	Yamatake	1LS1-J		1	Door interlock (door automatic open/close)	E3012-891-001
20	Door lock switch	OMRON	D4BL-2CRA		1	Door interlock	E3049-397-015
21	Spindle cooling unit pump motor	Tokyo SHOKE-TSU	TS-S200TMT-22	200 W	1	Spindle cooling unit	H0120-0006-18
22	Fan motor	Ikura	6008BXLTP-5	26.5/28 W	1	Spindle cooling unit	H0110-0004-53
23	AC motor	Sanyo	22/18.5 kW (30/24.67 hp) built-in motor	Rotor stator	1 each	High-speed spindle Main motor	E1006-288-022 E1006-288-023

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
24	Refrigerator	Toshiba	TH-207JA	1.5 kW (2 hp)	1	Cooling unit for high-speed spindle	
25	Circulating pump	Kuze	KSP-MIIC50-DB-22F E6P	2.2 kW (2.93 hp)	1	Cooling unit for high-speed spindle	
26	Fan motor	Shimomura Electric	FSE-120W	120 W	1	Cooling unit for high-speed spindle	
27	High/low pressure protection switch	Saginomiya	DNS-D306M High-pressure side manual reset type		1	Cooling unit for high-speed spindle	
28	Condenser	Sunrise	U-2 Forced ventilating cross-fin		1	Cooling unit for high-speed spindle	
29	Lamp	Sasaki Electric	STFP 110V15W T20/E12		3	3-tier signal tower (option)	E3580-284-002

3. CONSUMABLE ITEMS

(Exchange interval: Approx. 8000 hours or 3 years)

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
1	Oil seal	NTN	G35 × 42 × 4		1 each	Upper/lower X-axis	F1113-035-04204
2	Oil seal	NOK	SB32458		1	Upper X-axis	F1100-032-04508
					2	Lower X-axis	
3	Wiper	Bando	Wiper edge		1	Upper closs-slide (front)	H1023-0016-14
4	Wiper	Bando	Wiper edge		1	Upper closs-slide (right rear)	H1023-0016-15
5	Wiper	Bando	Wiper edge		1	Upper closs-slide (left rear)	H1023-0016-16
6	Wiper	Bando	Wiper edge		1	Upper saddle (left front)	H1023-0016-18-1
7	Wiper	Bando	Wiper edge		1	Upper saddle (left rear)	H1023-0016-19-1
8	Wiper	Bando	Wiper edge		1	Upper saddle (right front)	H1023-0016-20-1
9	Wiper	Bando	Wiper edge		1	Upper saddle (right rear)	H1023-0016-21
10	Timing belt	Bando	STS 250S8M760		1	Lower X-axis	M119-0009-07
11	Wiper	Bando	Wiper edge		2	Lower closs-slide (upper rear)	H1023-0022-33
12	Wiper	Bando	Wiper edge		1	Lower closs-slide (right front)	H1023-0022-34-1
13	Wiper	Bando	Wiper edge		1	Lower closs-slide (left front)	H1023-0022-35-1
14	Wiper	Bando	Wiper edge		1	Lower closs-slide (lower right rear)	H1023-0022-36
15	Wiper	Bando	Wiper edge		1	Lower closs-slide (lower left rear)	H1023-0022-37-1
16	Packing	Tsunekawa Felt	Felt		1	Lower closs-slide (upper rear)	H1032-1007-27
17	Packing	Tsunekawa Felt	Felt		1	Lower closs-slide (lower left rear)	H1032-1007-28-1
18	Packing	Tsunekawa Felt	Felt		1	Lower closs-slide (lower right rear)	H1032-1007-29-1

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
19	Wiper	Okuma			1	Lower closs-slide (upper rear)	505-0211-15
20	Wiper	Okuma			1	Lower closs-slide (upper left rear)	505-0211-16
21	Wiper	Okuma			1	Lower closs-slide (upper right rear)	505-0211-17
22	Wiper	Okuma			1	Lower closs-slide (lower left rear)	505-0211-18
23	Wiper	Okuma			1	Lower closs-slide (lower right rear)	505-0211-19
24	Wiper	Bando	Wiper edge		1	Lower saddle (upper right)	H1023-0022-10-1
25	Wiper	Bando	Wiper edge		1	Lower saddle (lower right)	H1023-0022-11-1
26	Wiper	Bando	Wiper edge		1	Lower saddle (upper left)	H1023-0022-12-1
27	Wiper	Bando	Wiper edge		1	Lower saddle (lower left)	H1023-0022-13-1
28	Wiper	Bando	Wiper edge		1	Lower saddle (lower left)	H1023-0022-14
29	Wiper	Bando	Wiper edge		1	Lower saddle (lower right)	H1023-0022-15-2
30	Packing	Tsunekawa Felt	Felt		1	Lower saddle (lower left)	H1032-1007-26
31	Packing	Tsunekawa Felt	Felt		1	Lower saddle (lower right)	H1032-1007-70
32	Z ring	NOK	AZ1833E0		1 each	Upper/lower Z-axis	H0031-0016-25
33	X ring	Nippon Valqua	R-35		1 each	Upper/lower turret	H0031-0002-93
34	X ring	Nippon Valqua	R-40		1	Upper turret	H0031-0005-01
35	Packing	NOK	USHCU1024K0		1	Lower turret	H0031-0016-52
36	Packing	NOK	USHCU0939K0		1	Lower turret	H0031-0008-89
37	Piston seal	NOK	SPGR260		1	Lower turret	H0031-0018-17
38	STS belt	Bando	250S8M632		1	Lower turret	M119-0007-66
39	Cap seal	Mitsubishi Densen	CAP-1BE-55		1	Tailstock	H0031-0008-83
40	Packing	NOK	USHCU0320K0		1	Tailstock	H0031-0008-85
41	Packing	NOK	USHCU0497K0		1	Tailstock	H0031-0008-86
42	Dust seal	NOK	DKIFD3913A0		1	Tailstock	H0031-0009-35
43	Wiper	Bando	Wiper edge		1	Tailstock (upper left)	H1023-0022-38-1

No.	Part Name	Maker	Type	Dimension	Q'ty	Use	Okuma Part No.
44	Wiper	Bando	Wiper edge		1	Tailstock (upper right)	H1023-0022-39-1
45	Wiper	Bando	Wiper edge		1	Tailstock (lower left)	H1023-0022-40-1
46	Wiper	Bando	Wiper edge		1	Tailstock (lower right)	H1023-0022-41-1

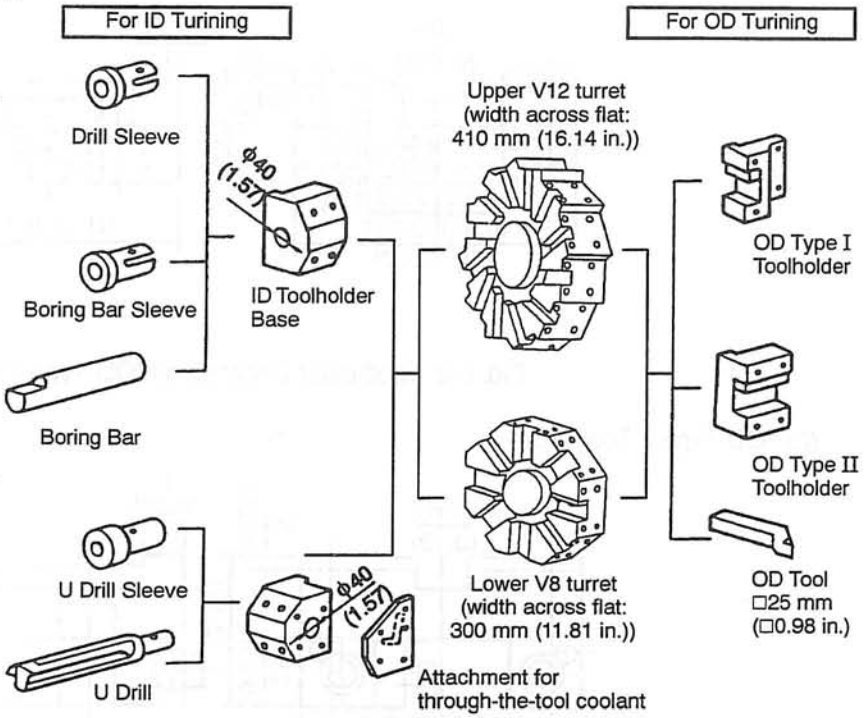
SECTION 6 TECHNICAL DATA

1. TOOLING SYSTEM

MT No. 1-H40
MT No. 2-H40
MT No. 3-H40
MT No. 4-H40

ϕ10-H40
ϕ12-H40
ϕ16-H40
ϕ20-H40
ϕ25-H40
ϕ32-H40

ϕ16-H40U
ϕ20-H40U
ϕ25-H40U
ϕ32-H40U

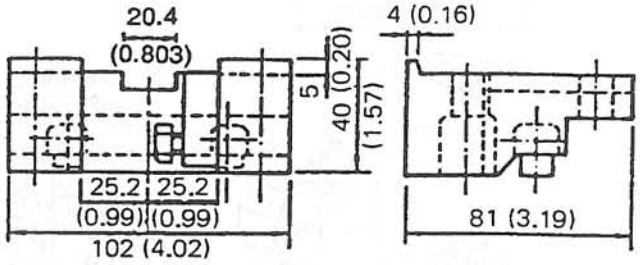


ID Toolholder Base for Through-the-Tool Coolant Tool (optional)
(used for through-the-tool coolant drill, boring bars, etc.)

Fig. 6-1 Tooling System

2. TOOLHOLDER DIMENSIONS

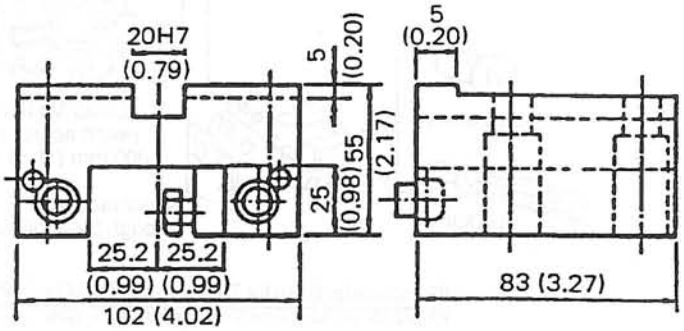
(1) OD Type I Toolholder



Unit: mm (in.)

Fig. 6-2 Toolholder Dimensions (OD Type I Toolholder)

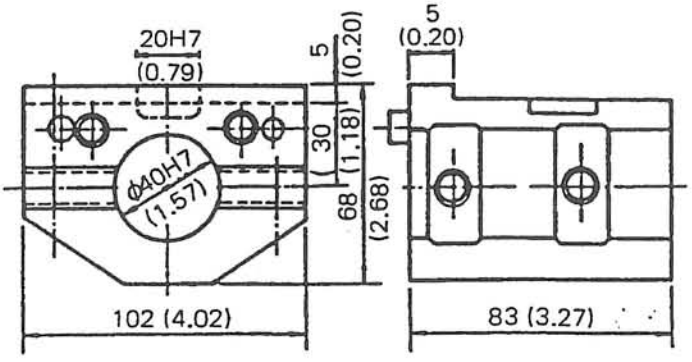
(2) OD Type II Toolholder



Unit: mm (in.)

Fig. 6-3 Toolholder Dimensions (OD Type II Toolholder)

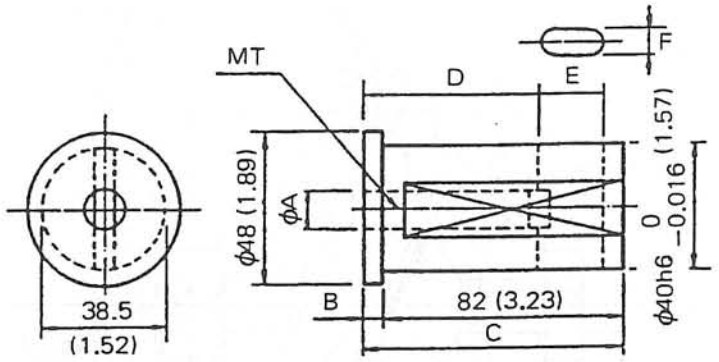
(3) ID Toolholder Base



Unit: mm (in.)

Fig. 6-4 Toolholder Dimensions (ID Toolholder Base)

(4) Drill Sleeve

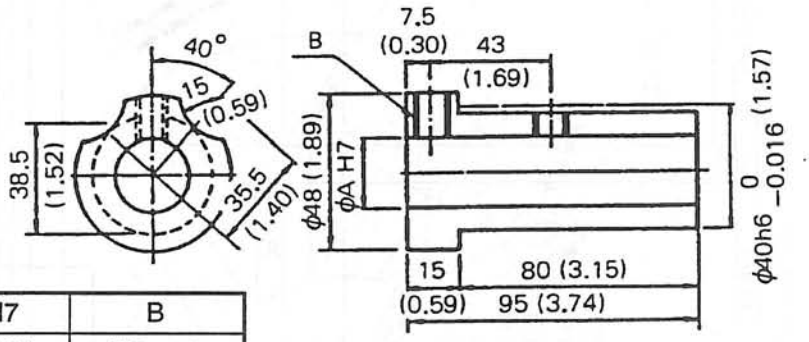


Unit: mm (in.)

	φA	B	C	D	E	F
MT No. 1-H40	12.065 (0.475)	5 (0.20)	87 (3.42)	52 (2.05)	19 (0.75)	5.4 (0.21)
MT No. 2-H40	17.780 (0.70)	10 (0.39)	92 (3.62)	63 (2.48)	22 (0.87)	6.6 (0.26)
MT No. 3-H40	23.825 (0.94)	30 (1.18)	112 (4.41)	78 (3.08)	27 (1.06)	8.2 (0.32)
MT No. 4-H40	31.267 (1.23)	55 (2.17)	137 (5.39)	98 (3.86)	32 (1.26)	12.2 (0.48)

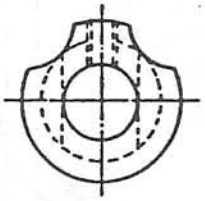
Fig. 6-5 Toolholder Dimensions (Drill Sleeve)

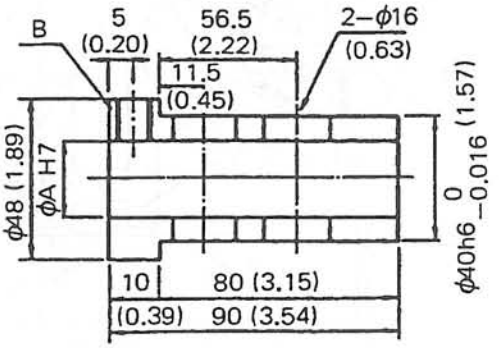
(5) Boring Bar Sleeve



Unit: mm (in.)

	φA H7	B
φ10-H40	10 (0.39)	M8 × 2
φ12-H40	12 (0.47)	M10 × 2
φ16-H40	16 (0.63)	M10 × 2
φ20-H40	20 (0.79)	M10, M8





φ25-H40	25 (0.98)	M6
φ32-H40	32 (1.26)	M6

Unit: mm (in.)

Fig. 6-6 Toolholder Dimensions (Boring Bar Sleeve)

3. TOOL INTERFERENCE DIAGRAM

(1) Standard Turret

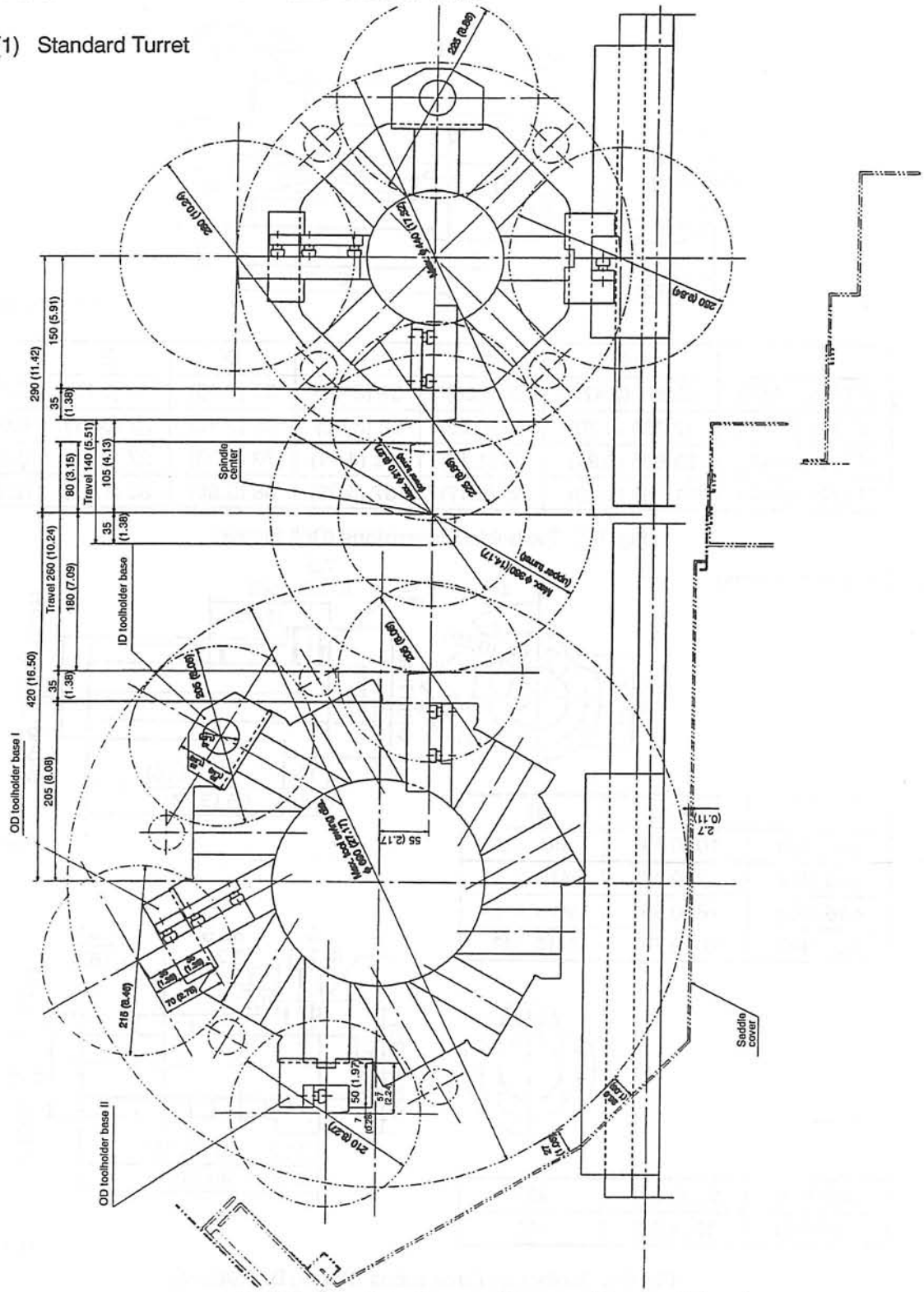


Fig. 6-7 Tool Interference Diagram (Standard Turret)

(2) VDI Turret (Optional)

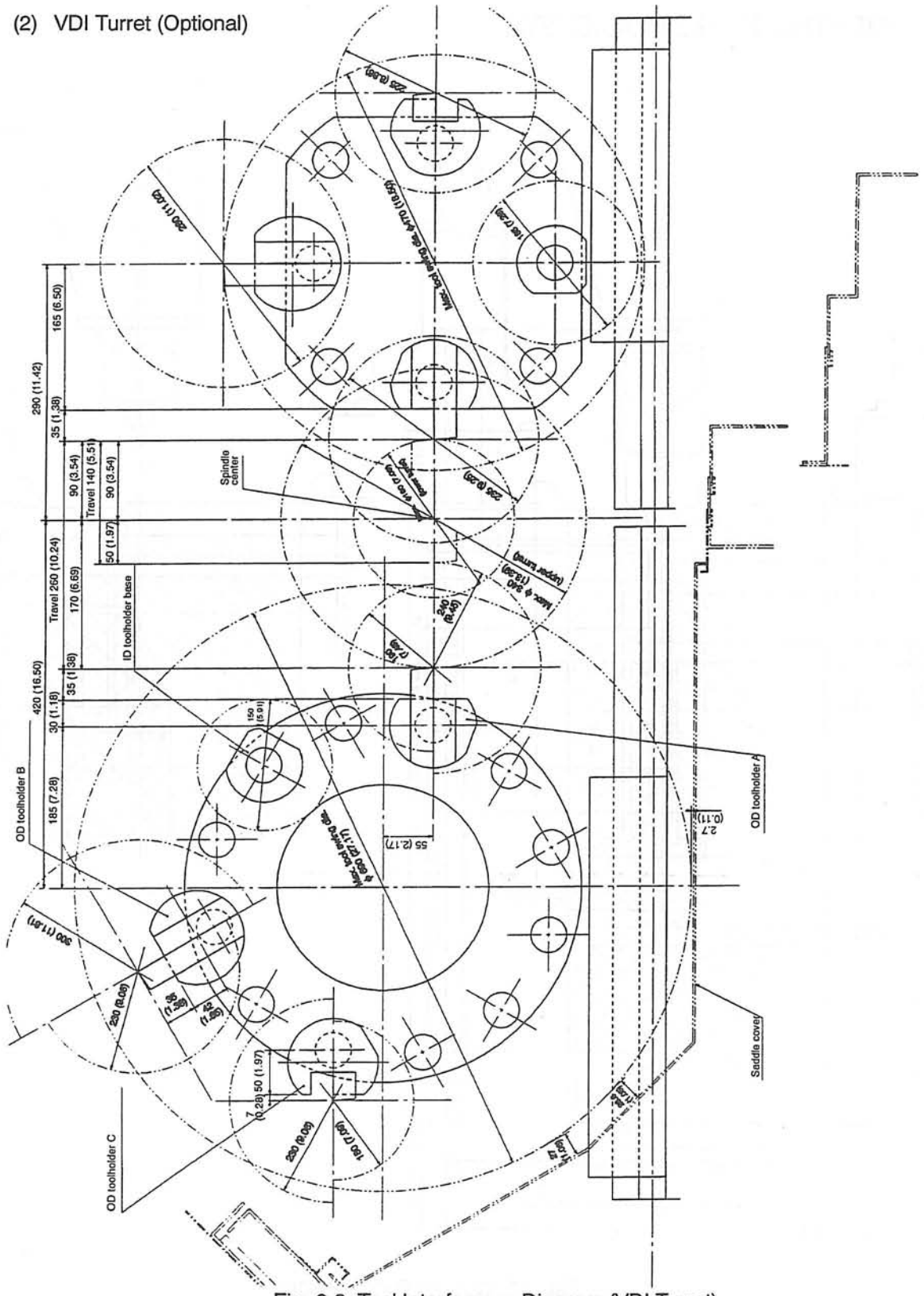


Fig. 6-8 Tool Interference Diagram (VDI Turret)

4. WORKING RANGE DIAGRAM

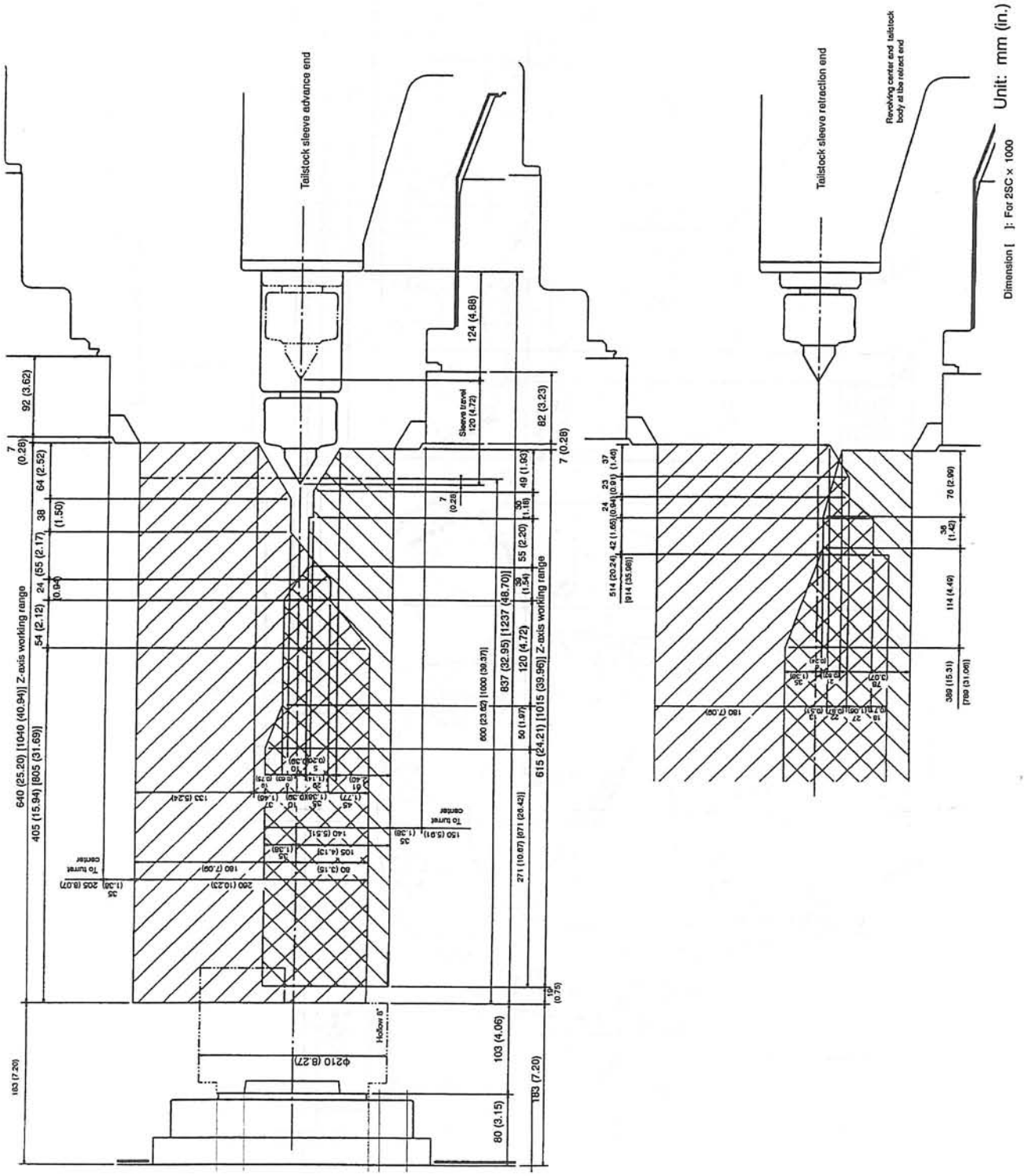


Fig. 6-9 Working Range Diagram

(1) OD Type I Toolholder

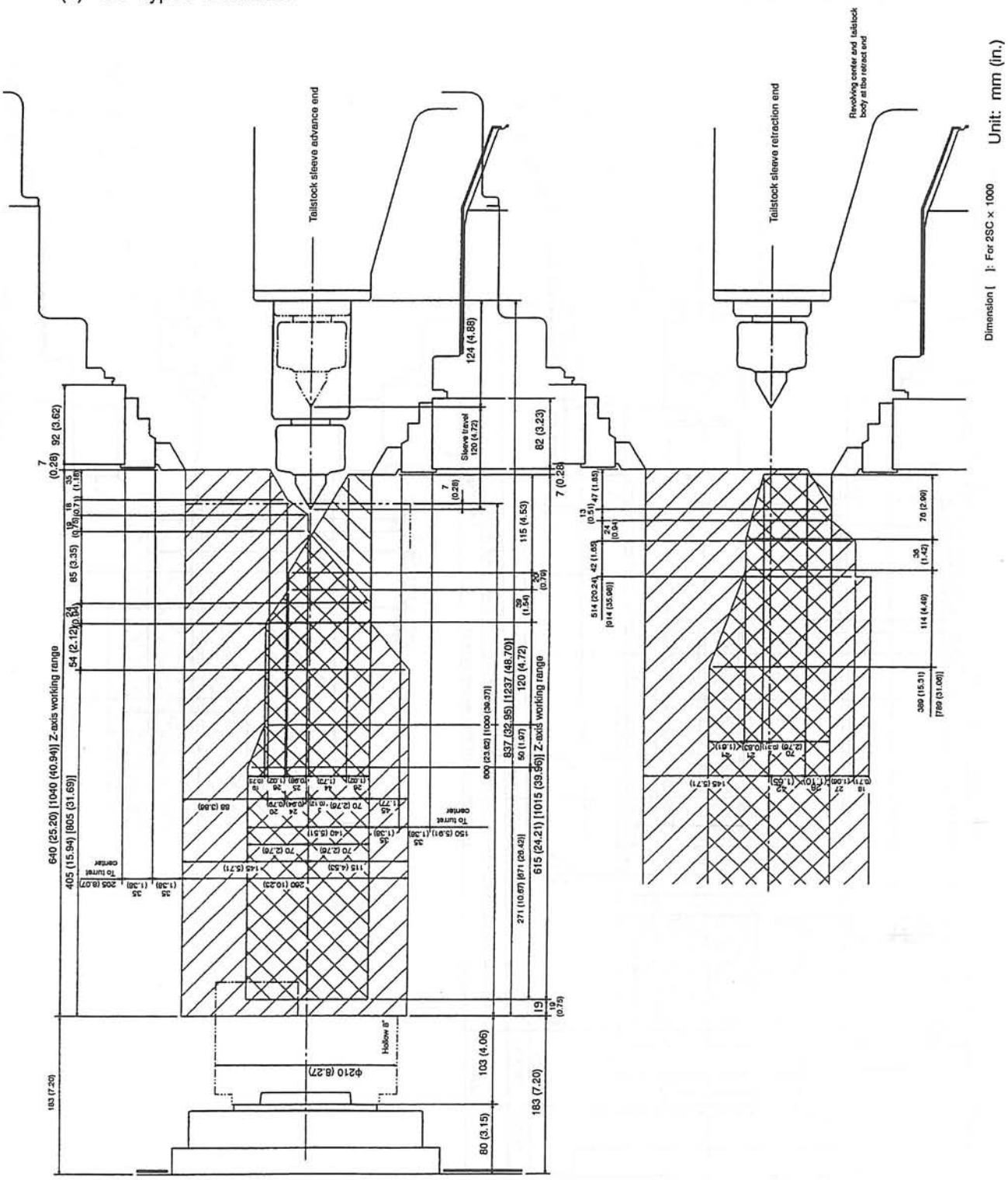


Fig. 6-10 Working Range Diagram (OD Type I Toolholder)

(2) OD Type II Toolholder

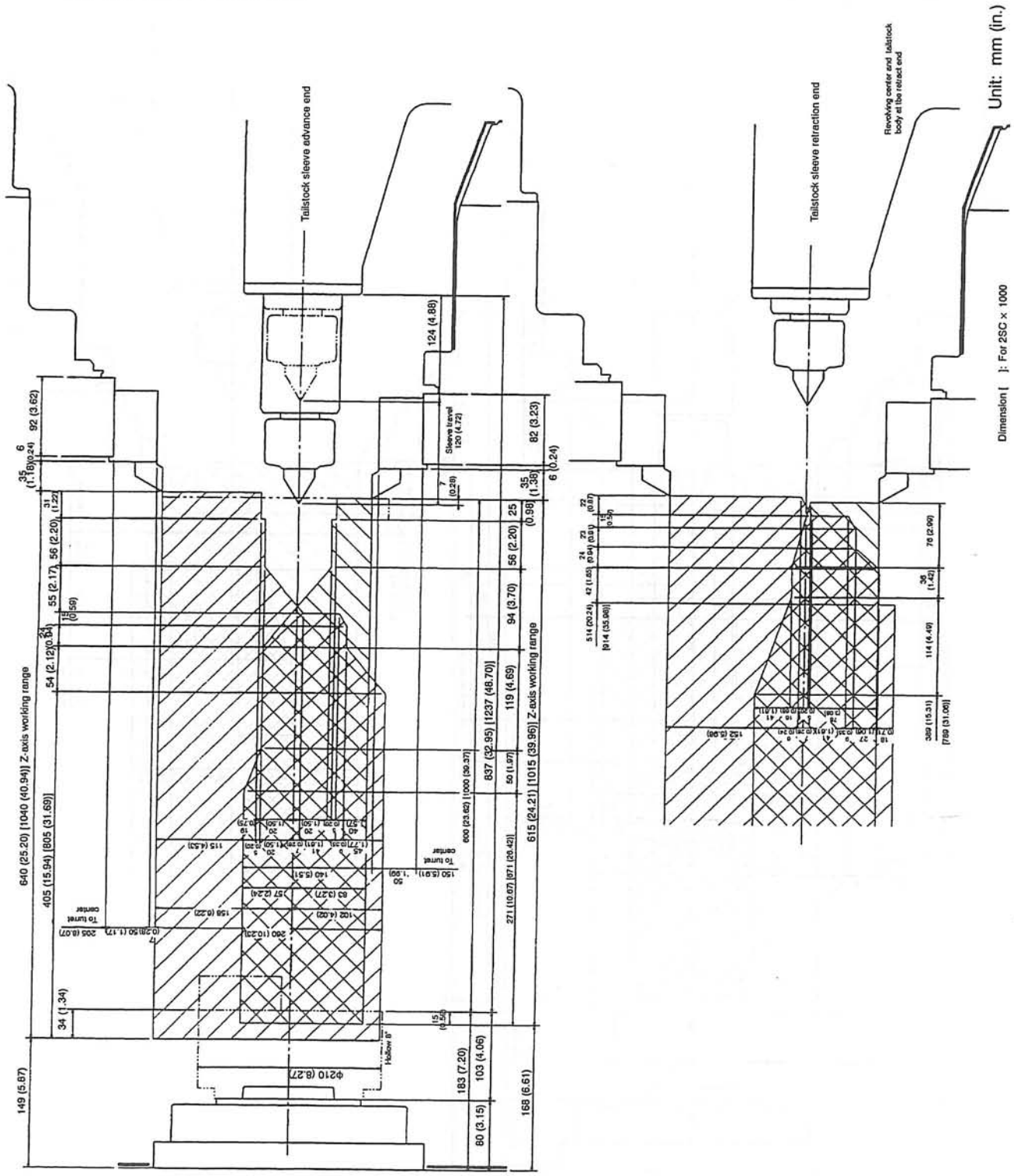


Fig. 6-11 Working Range Diagram (OD Type II Toolholder)

(3) ID Toolholder Base

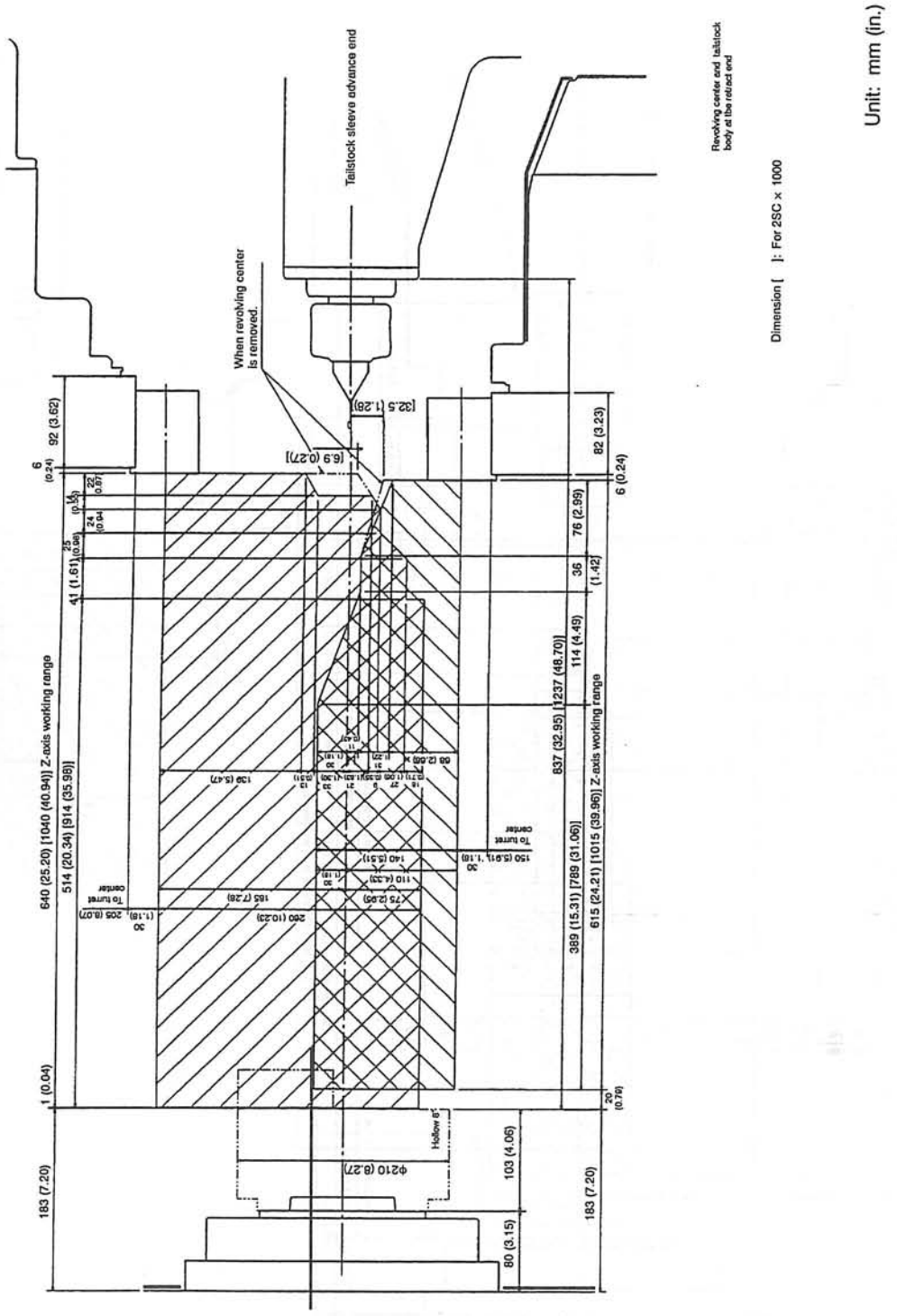


Fig. 6-12 Working Range Diagram (ID Toolholder Base)

(4) VDI OD Toolholder Type A

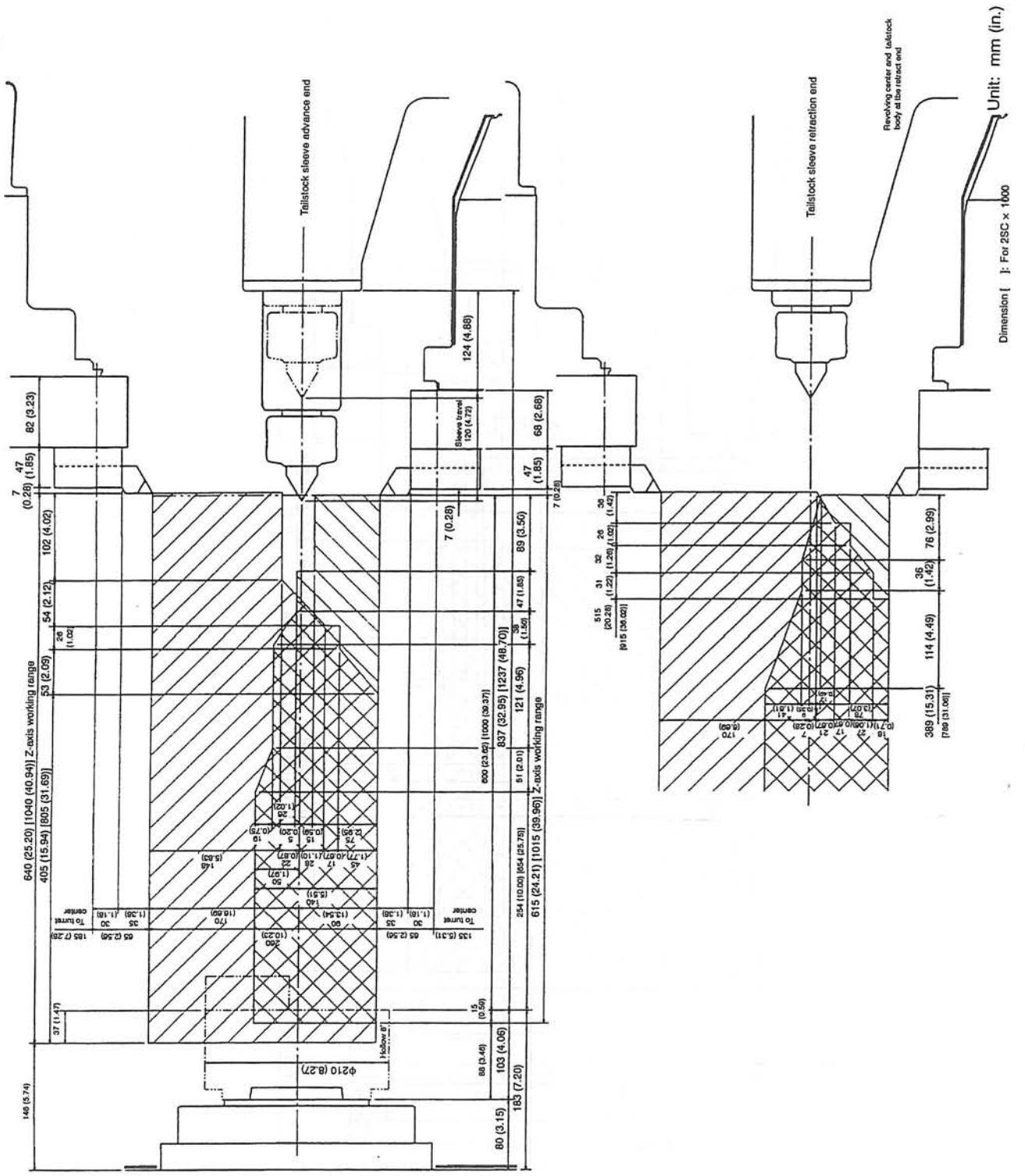


Fig. 6-13 Working Range Diagram (VDI OD Toolholder Type A)

(5) VDI OD Toolholder Type B

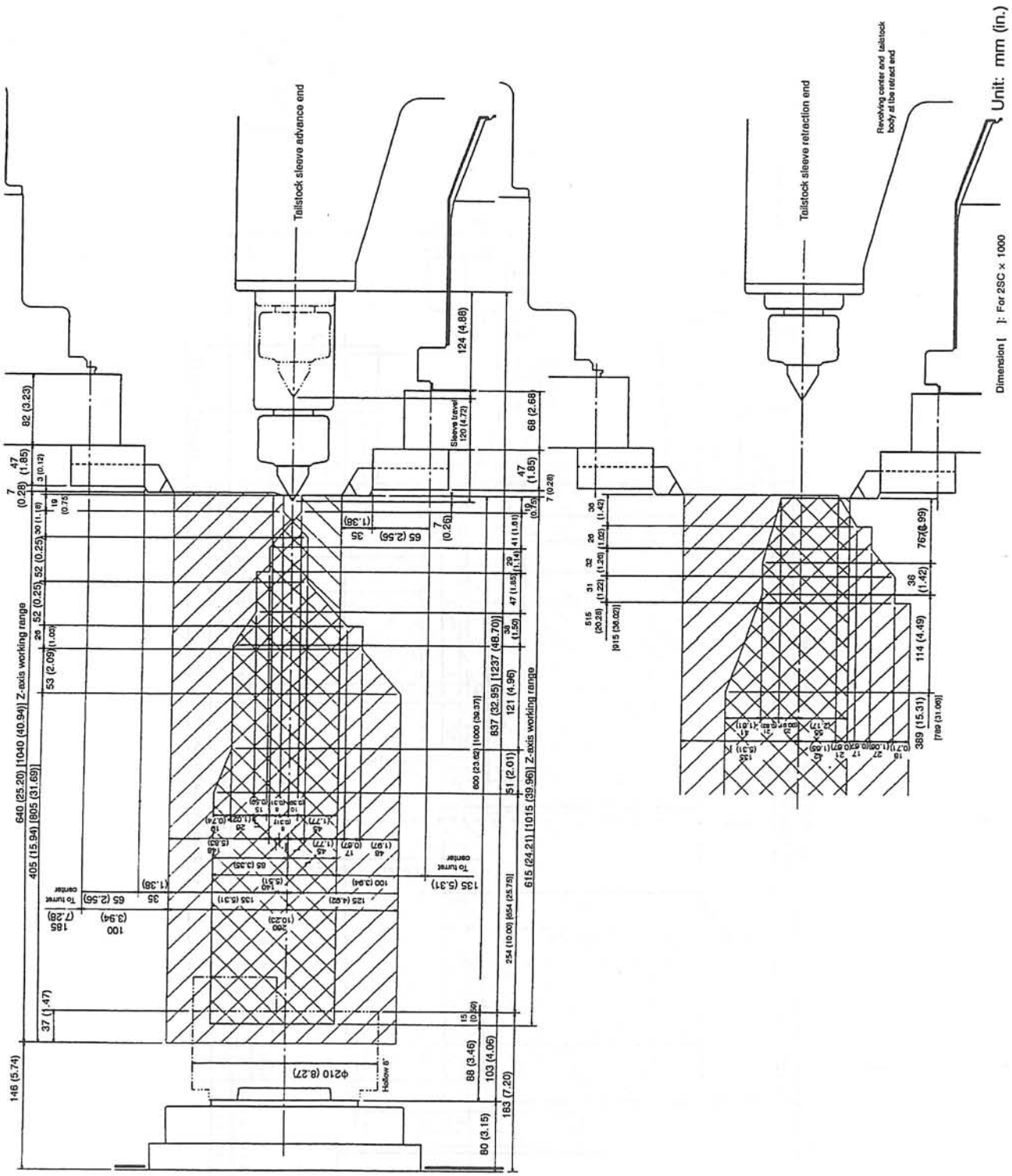


Fig. 6-14 Working Range Diagram (VDI OD Toolholder Type B)

(6) VDI ID Toolholder Base

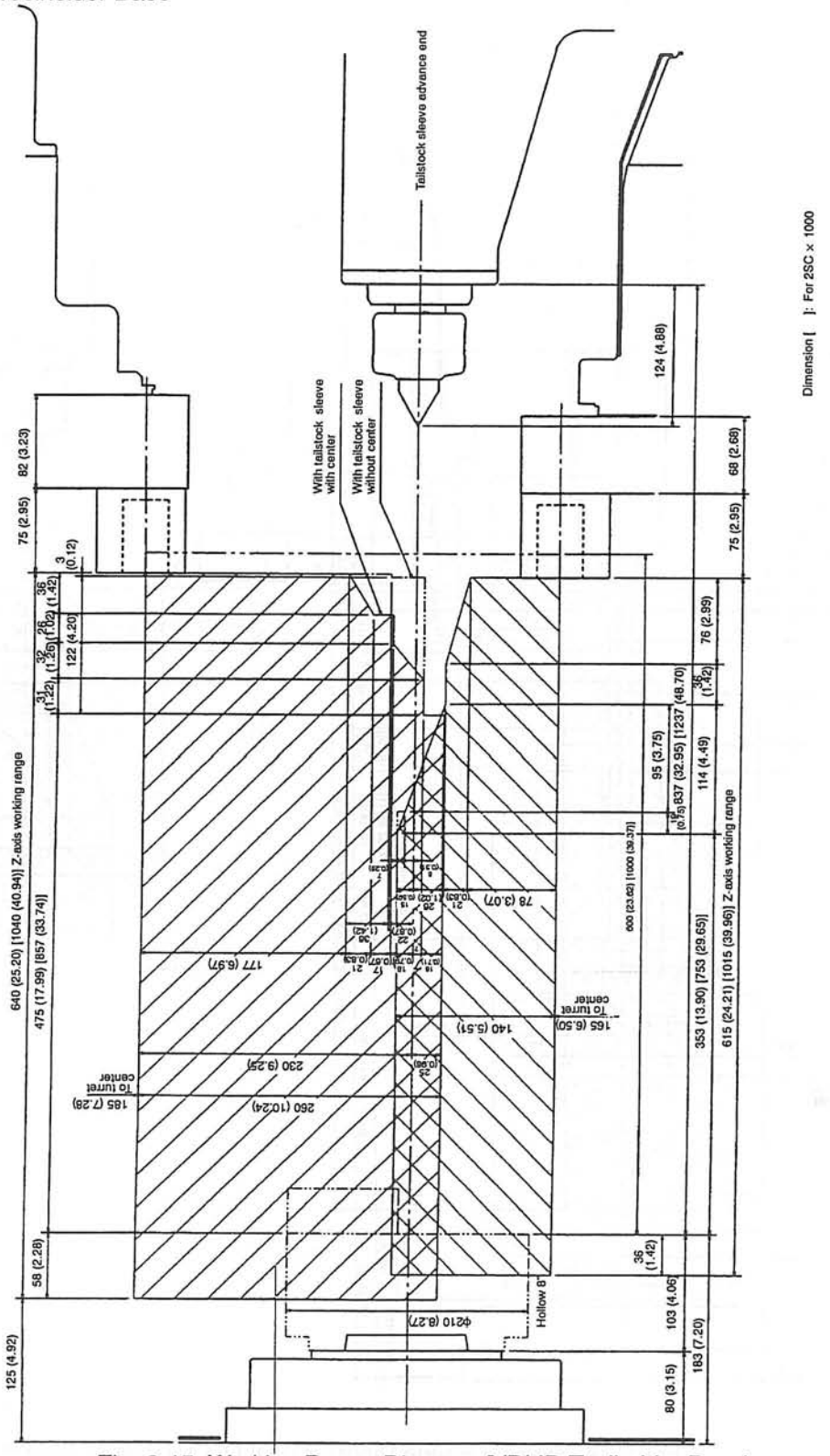


Fig. 6-15 Working Range Diagram (VDI ID Toolholder Base)

5. DIMENSION OF SPINDLE NOSE

(1) Standard Spindle (JIS-A2-6)

Unit: mm (in.)

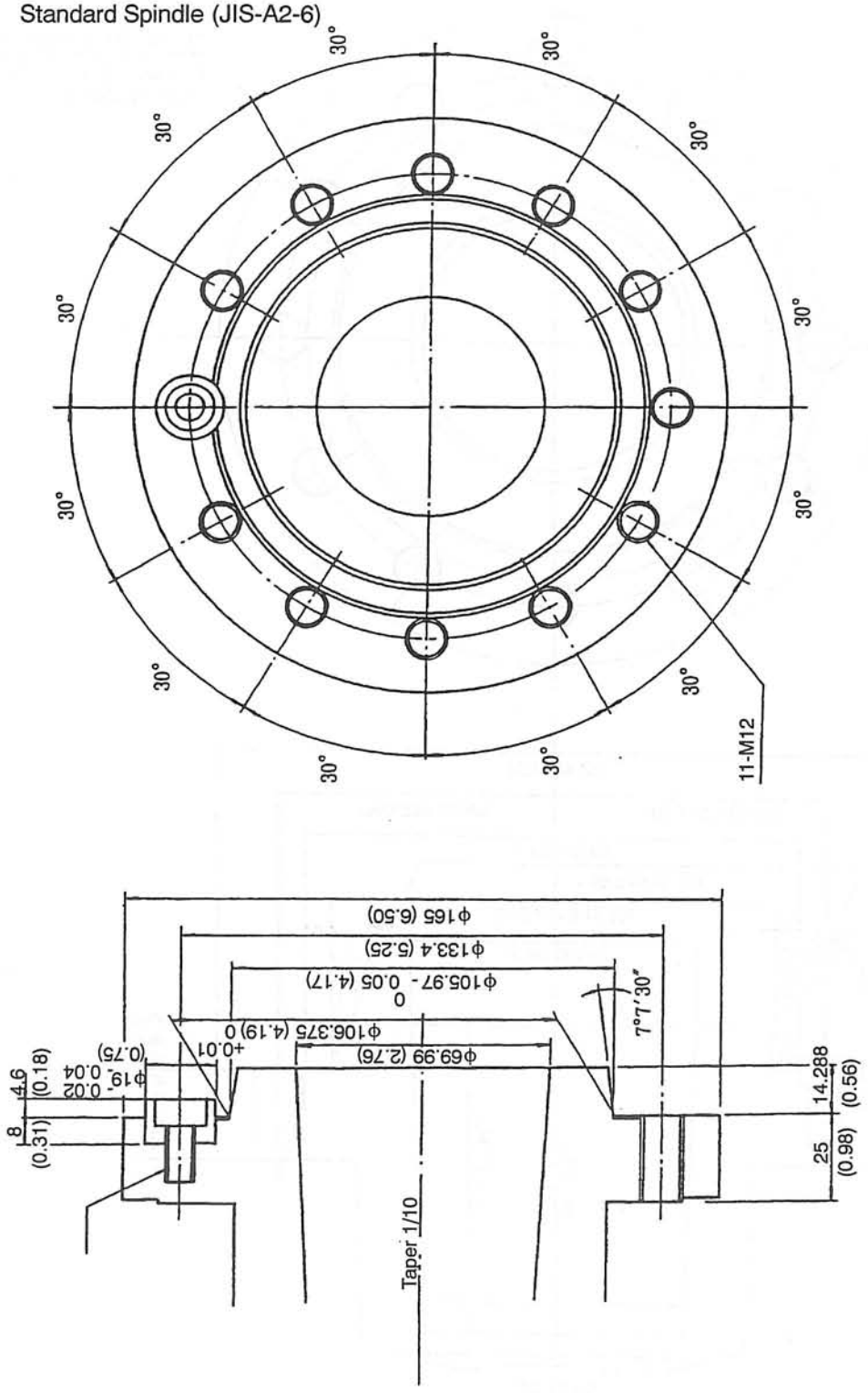


Fig. 6-16 Dimension of Spindle Nose (JIS-A2-6)

(2) Large-diameter Spindle (JIS-A2-8)

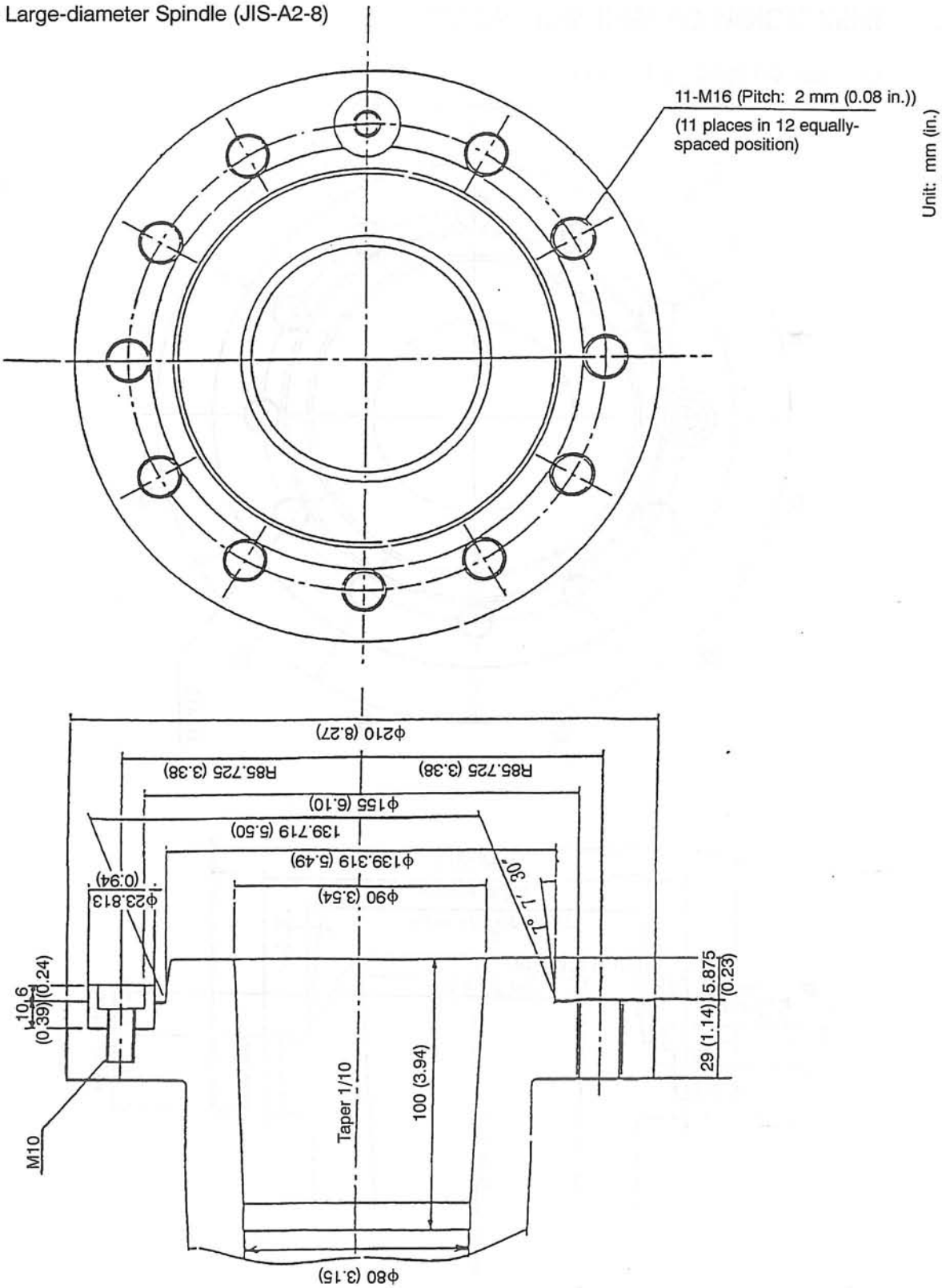
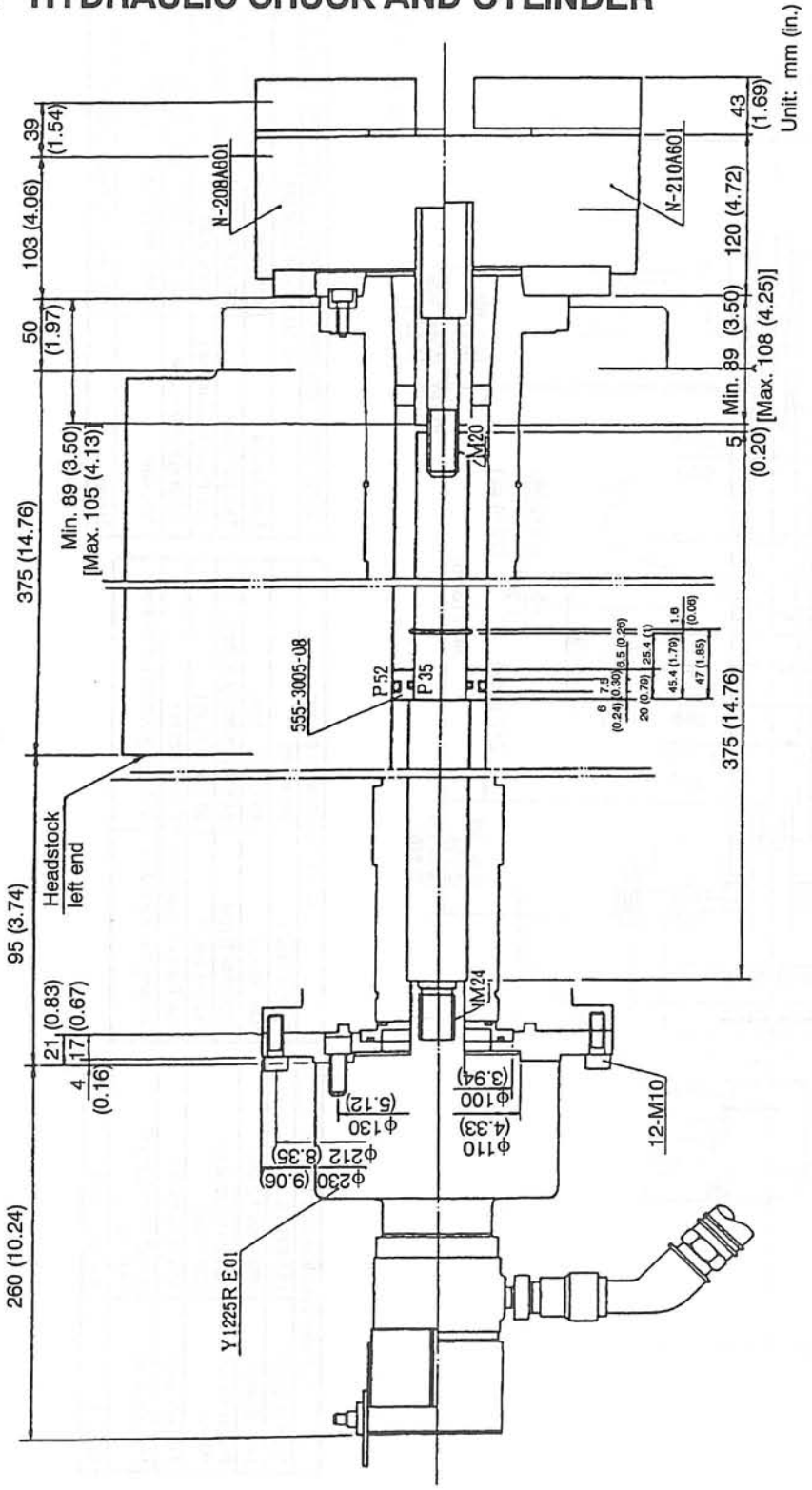


Fig. 6-17 Dimension of Spindle Nose (JIS-A2-8)

6. HYDRAULIC CHUCK AND CYLINDER



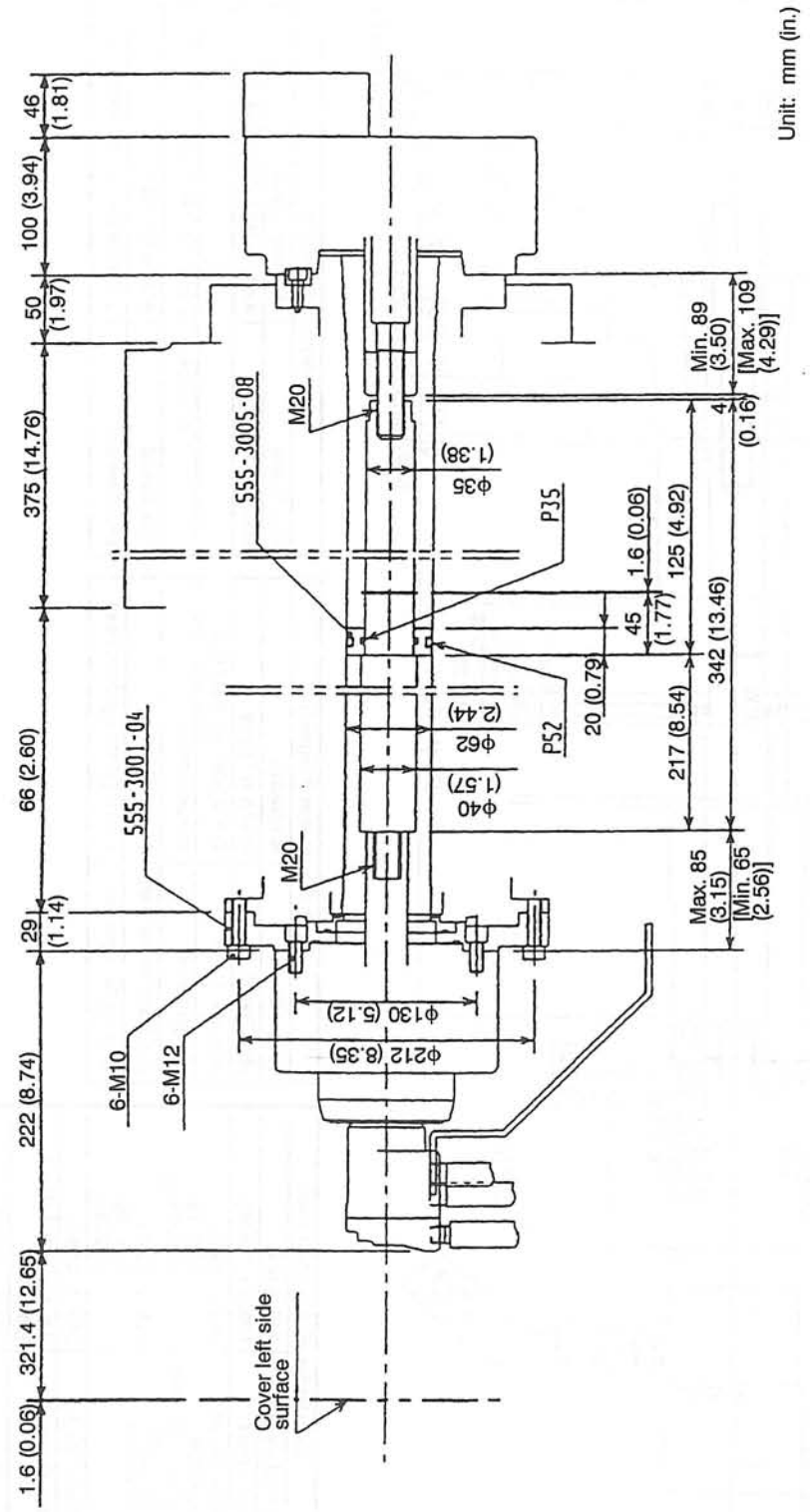
Machine Specification	
Max. Speed	4500 min^{-1} {rpm}
Max. Pressure	4.4 MPa {45 kgf/cm^2 (639.9 lbs)}

Allowable Max. Speed and Pressure	
Max. Speed	4010 min^{-1} {rpm}
Max. Pressure	2.57 MPa {26 kgf/cm^2 (370.0 lbs)}

Chuck Specification (Kitagawa)	
Type of Chuck	N-10A601A
Max. Speed	4010 min^{-1} {rpm}
Allowable Thrust	43 KN {4385 kgf (9647 lbs)}
Plunger Travel	19 mm (0.75 in.)
Jaw Travel (in diameter)	8.8 mm (0.35 in.)
Gripping Force per Jaw	111 KN {10800 kgf (23760 lbs)}

Cylinder Specification (Kitagawa)	
Type of Cylinder	Y1225RE01
Max. Speed	6000 min^{-1} {rpm}
Piston Thrust (Hyudraulic pressure: 4.0 MPa {40.8 kgf/cm^2 (580.2 psi)})	Push: 45 KN {4589 kgf (10086 lbs)} Pull : 42 KN {4283 kgf (9423 lbs)}
Piston Travel	25 mm (0.98 in.)
Max. Pressure	4.0 MPa {40.8 kgf/cm^2 (580.2 psi)}
Weight	10.5 kg (23.1 lb)

Fig. 6-18 Hydraulic Chuck and Cylinder (1)

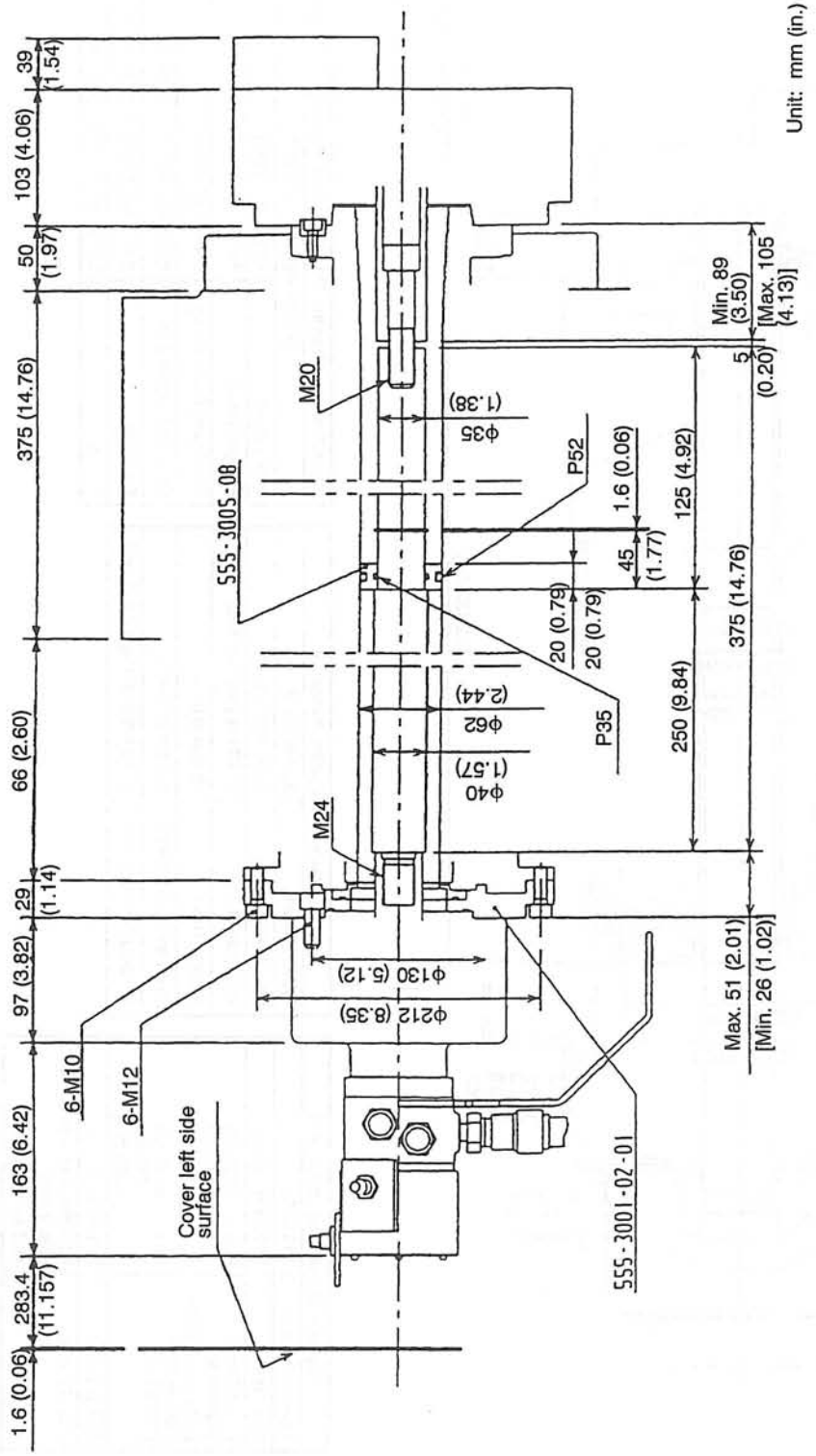


Specifications When the Chuck and the Cylinder are Combined	
H01MA8S + HH4CB125	
Max. Speed	4500 min^{-1} {rpm}
Plunger Travel	20 mm (0.79 in.)
Jaw Travel (in diameter)	7 mm (0.28 in.)
Gripping Force of Jaw	202.9 KN {20700 kgf (45540 lbs)}
Pressure	2.05 MPa {21 kgf/cm^2 (298.8 psi)}
Thrust	24.5 KN {2500 kgf (5500 lbs)}

Chuck Specification (Howa)	
Type of Chuck	H01MA8S
Max. Speed	4500 min^{-1} {rpm}
Allowable Thrust	24.5 KN {2500 kgf (5500 lbs)}
Plunger Travel	20 mm (0.79 in.)
Jaw Travel (in diameter)	7 mm (0.28 in.)
Gripping Force per Jaw	67.62 KN {6900 kgf (15180 lbs)}

Cylinder Specification (Howa)	
Type of Cylinder	HH4CB125
Max. Speed	4500 min^{-1} {rpm}
Piston Thrust (Max.)	38.22 KN {3900 kgf (8580 lbs)}
Piston Travel	20 mm (0.79 in.)
Max. Pressure	3.4 MPa {35 kgf/cm^2 (497.7 psi)}
Weight	8.4 kg (18.5 lb)

Fig. 6-19 Hydraulic Chuck and Cylinder (2)

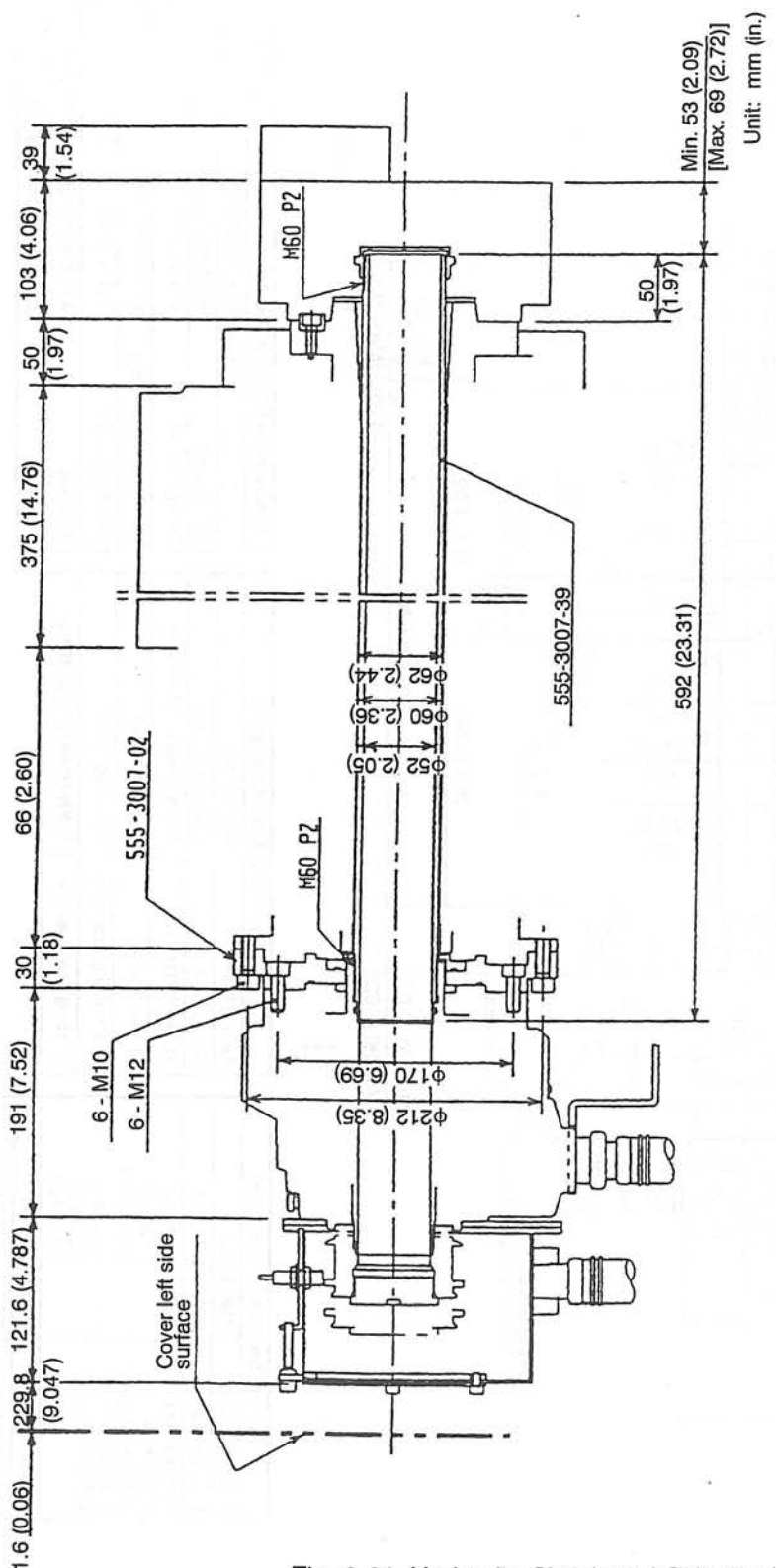


Cylinder Specification (Kitagawa)	
Type of Cylinder	Y1225RE01
Max. Speed	6000 min^{-1} {rpm}
Piston Thrust (Hyudraulic pressure: 4.0 MPa {40.8 kgf/cm^2 (580.2 psi)})	Push: 44.97 KN {4589 kgf (10096 lbs)} Pull : 41.97 KN {4283 kgf (9423 lbs)}
Piston Travel	25 mm (0.98 in.)
Max. Pressure	4.0 MPa {40.8 kgf/cm^2 (580.2 psi)}
Weight	10.5 kg {23.1 lb}

Chuck Specification (Kitagawa)	
Type of Chuck	N-08A601A
Max. Speed	4760 min^{-1} {rpm}
Allowable Thrust	25 KN {2549 kgf (5608 lbs)}
Plunger Travel	21 mm (0.83 in.)
Jaw Travel (in diameter)	8.8 mm (0.35 in.)
Gripping Force per Jaw	75 KN {7648 kgf (16826 lbs)}

Specifications When the Chuck and the Cylinder are Combined	
N-08A601A + Y1225RE01	
Max. Speed	4500 min^{-1} {rpm}
Plunger Travel	21 mm (0.83 in.)
Jaw Travel (in diameter)	8.8 mm (0.35 in.)
Gripping Force of Jaw	75 KN {7648 kgf (16826 lbs)}
Pressure	2.2 MPa {22 kgf/cm^2 (313.1 psi)}
Thrust	25 KN {2549 kgf (5608 lbs)}

Fig. 6-20 Hydraulic Chuck and Cylinder (3)



Specifications When the Chuck and the Cylinder are Combined	
B208A0601B + Y1552-01A	
Max. Speed	4500 min^{-1} {rpm}
Plunger Travel	16 mm (0.63 in.)
Jaw Travel (in diameter)	7.4 mm (0.29 in.)
Gripping Force of Jaw	83.93 KN {8565 kgf (18843 lbs)}
Pressure	2.6 MPa {25 kgf/cm^2 (355.5 psi)}
Thrust	33.97 KN {3467 kgf (7627 lbs)}

Chuck Specification (Kitagawa)	
Type of Chuck	B208A0601B
Max. Speed	4500 min^{-1} {rpm}
Allowable Thrust	33.97 KN {3467 kgf (7627 lbs)}
Plunger Travel	16 mm (0.63 in.)
Jaw Travel (in diameter)	7.4 mm (0.29 in.)
Gripping Force per Jaw	83.93 KN {8565 kgf (18843 lbs)}

Cylinder Specification (Kitagawa)	
Type of Cylinder	S1552-01A
Max. Speed	6200 min^{-1} {rpm}
Piston Thrust (Hyudraulic pressure: 4.0 MPa {40.8 kgf/cm^2 (580.2 psi)})	Push : 57.95 KN {5914 kgf (13011 lbs)} Pull : 41.97 KN {4283 kgf (9423 lbs)}
Piston Travel	22 mm (0.87 in.)
Max. Pressure	4.0 MPa {40.8 kgf/cm^2 (580.2 psi)}
Weight	15.7 kg (34.5 lb)

Fig. 6-21 Hydraulic Chuck and Cylinder (4)

7. HYDRAULIC CIRCUIT DIAGRAM

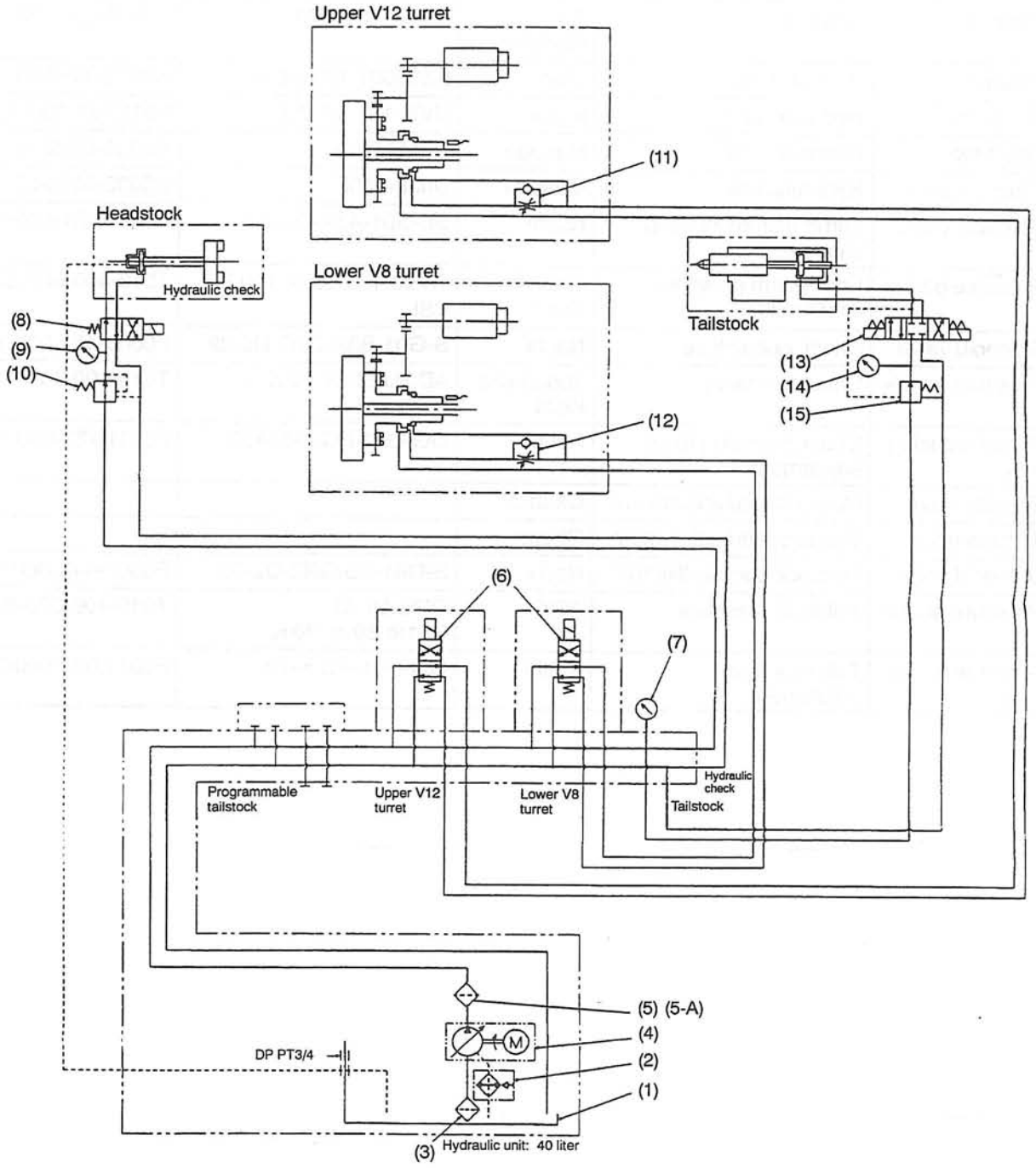
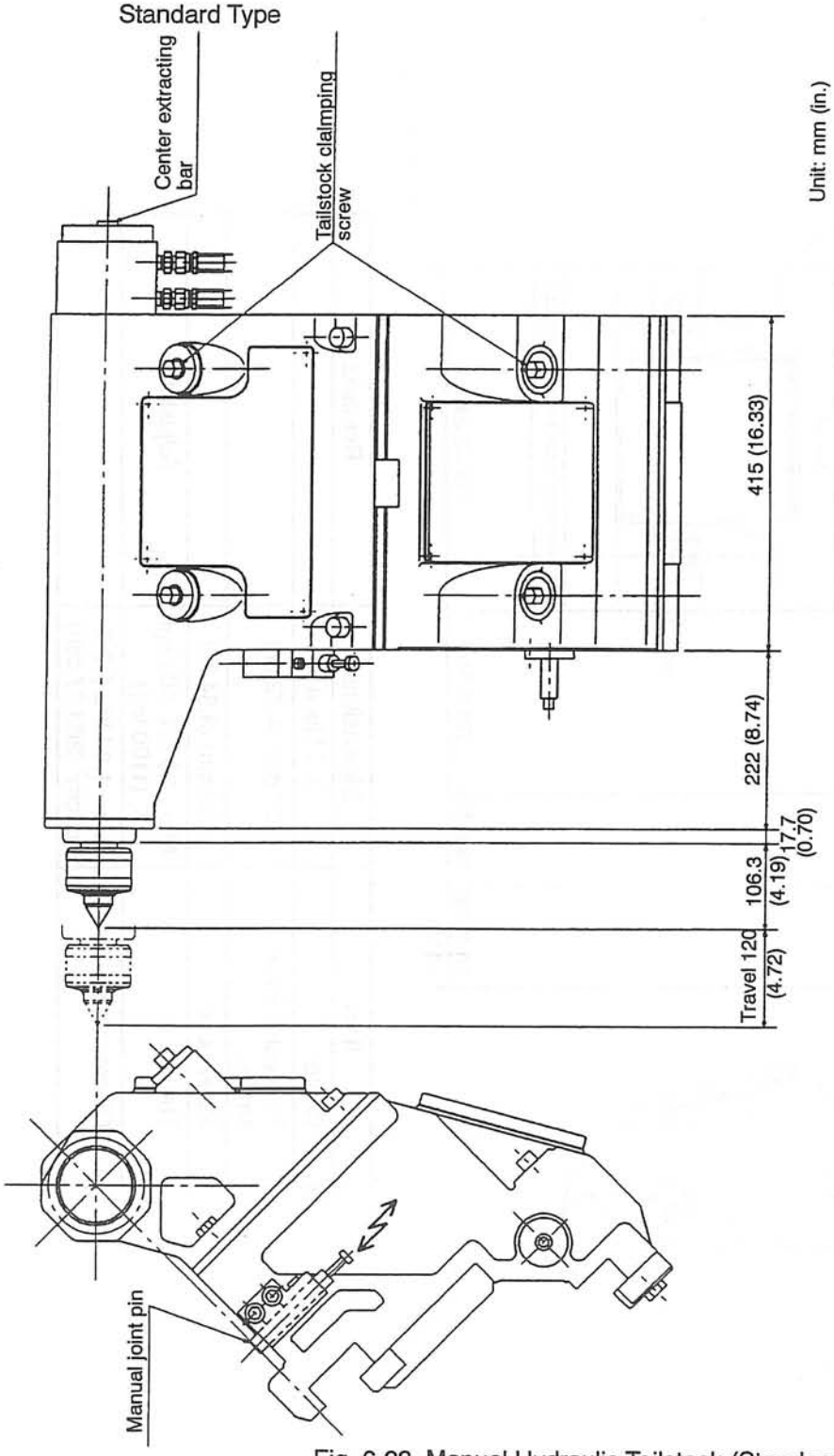


Fig. 6-22 Hydraulic Circuit Diagram

No.	Part Name	Use	Maker	Type	Okuma Parts No.
1	Oil tank	Hydraulic unit	Nachi	TNK-40L-H-10	
2	Radiator	Hydraulic unit	Toyo Radiator	3A92-001-1050	H0110-0004-75
3	Strainer	Hydraulic unit	Daiei	SS60607 150 mesh	H0032-0010-01
4	Uni-pump	Hydraulic unit	Nachi	UVN-1A-1A3-2.2-4-10	F0100-73-000-16
5	Line filter	Hydraulic unit	Masuda	UPM04-10P	H0032-0009-17
5-A	Filter element	Hydraulic unit	Masuda	U038-010P	H0032-0010-03
6	Solenoid valve	Turret clamp/unclamp change	Nachi	SL-G01-A3X-GR-D2	F0001-431-000-83
7	Pressure gauge	For system pressure confirmation	Nagano Keiki	GV50-173-60 × 100 K PSI	T019-400-005-23
8	Solenoid valve	Chuck open/close	Nachi	S-G01-B3X-GRZ-D2-32	F0000-431-000-19
9	Pressure gauge	Chuck pressure	Yodogawa Keiki	ADGU-60 × 70 K × 1000 PSI	T019-400-004-01
10	P-port reducing valve	Chuck clamping force adjustment	Nachi	OG-G01-PC-K-5645C	F0011-730-000-06
11	Throttle valve	Clamp speed adjustment	Okuma		
12	Throttle valve	Clamp speed adjustment	Okuma		
13	Solenoid valve	Tailstock spindle IN/OUT	Nachi	S-G01-C5-GRZ-D2-30	F0000-442-000-05
14	Pressure gauge	Tailstock pressure	ASK	OPG-DF-U PF1/4-60 × 70 K	T019-400-003-24
15	A-port reducing valve	Tailstock thrust adjustment	Nachi	OG-G01-AC-K-12	F0011-621-000-01

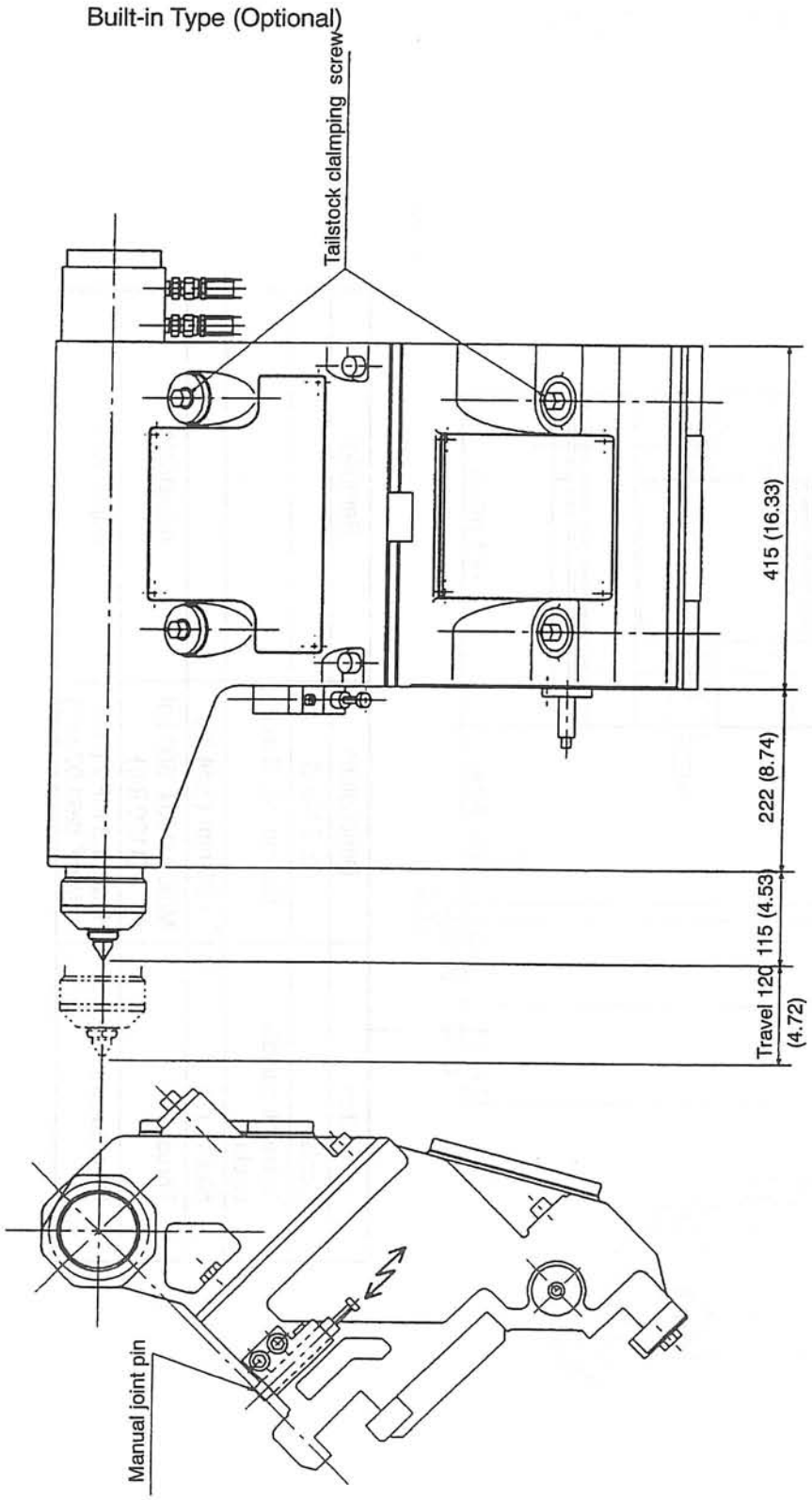
8. MANUAL HYDRAULIC TAILSTOCK



Unit: mm (in.)

Item	Dimensions	Remarks
Center	MT No. 5	
Tailstock spindle stroke	120 mm (4.72 in.)	
Sleeve dia.	ϕ90 mm (3.54 in.)	
Thrust	Max. 4.9 KN {500 kgf (1100 lbf)}	Adjustable
Oil pressure	Max. 1.8 MPa {18.5 kgf/cm^2 (263.07 psi)}	Adjustable

Fig. 6-23 Manual Hydraulic Tailstock (Standard Type)



Item	Dimensions	Remarks
Center	MT No. 4	
Tailstock spindle stroke	120 mm (4.72 in.)	
Sleeve dia.	φ90 mm (3.54 in.)	
Thrust	Max. 4.9 KN {500 kgf (1100 lbf)}	Adjustable
Oil pressure	Max. 1.8 MPa {18.5 kgf/cm^2 (263.07 psi)}	

Fig. 6-24 Manual Hydraulic Tailstock (Built-IN Type)

(1) Tailstock Spindle Advance/Retraction Position Confirmation Device (Optional)

Adjusting procedure:

a) Move the dog rightward.

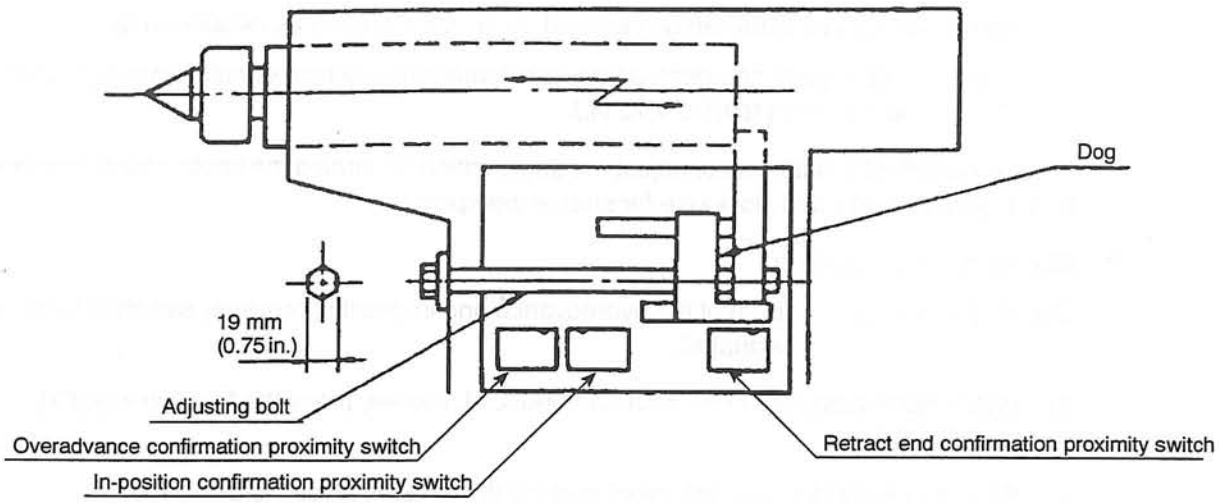


Fig. 6-25 Moving Dog Rightward

1) Turn the adjusting screw counterclockwise.

2) The dog then moves rightward.

b) Advance the tailstock spindle as desired and reposition the tailstock body so that the workpiece is hold by the tailstock spindle. Step the tailstock spindle advance pedal to the 2nd position. Under such setup turn the adjusting screw until both the overadvance detection proximity switch and the in-position detection proximity switch are actuated.

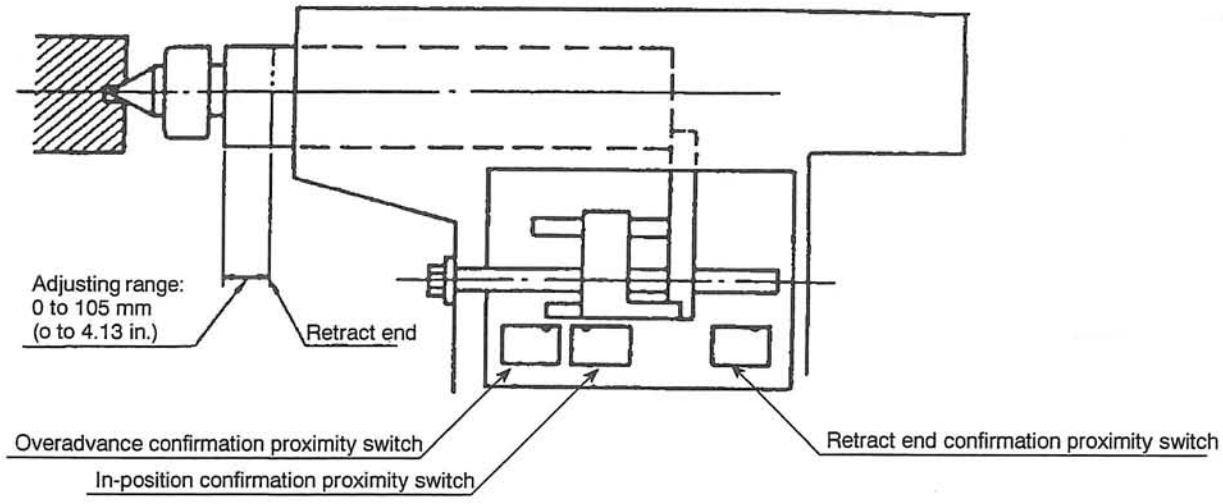


Fig. 6-26 Adjusting Dog Position

1) Turn the adjusting screw clockwise with the workpiece pressed by the tailstock spindle.

2) The dog moves leftward. First locate the dog at the position where both of the overadvance and the in-position signals are output from the corresponding proximity switches. Further turn the adjusting screw two turns from that point.

3) The signal output status can be checked on the CRT display as detailed in d) below.

Note: The in-position signal can be output within the tailstock spindle extending range of 30 to 120 mm (1018 to 4.72 in.).

c) In case workpiece length varies, adjust the dog position by turning the knob: counterclockwise for longer workpiece and clockwise for shorter workpiece.

d) Checking correct position

Correct position ..... Both of the overadvance and in-position proximity switches have been actuated.

1) After selecting any of AUTO, MDI and MANUAL modes, press the function key [F7] (CHECK DATA).

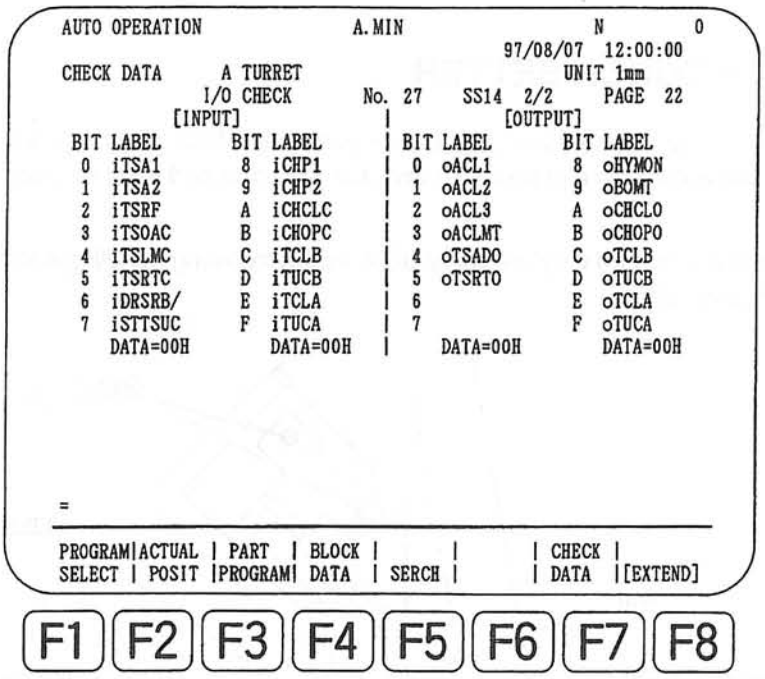
2) Press the PAGE key several times, and the I/O CHECK screen is displayed.

3) Refer to the table on the next page.

Bit 4 of INPUT is the tailstock spindle in-position confirmation (tailstock work pos) input signal and bit 3 the tailstock spindle over advance (tailstock over advance) input signal. The signal is ON when the label is highlighted.

4) When both bit 4 and bit 3 are highlighted, it indicates that both of the in-position and the overadvance confirmation proximity switches are actuated and the tailstock spindle is located in position.

I/O CHECK No. 27 < Slave station 14 SS14 2/2 >



	[INPUT]			[OUTPUT]		
Bit	Label	Address		Label	Address	
Bit 0	iTSA1	0270	Tailstock advance pedal 1	oACL1	0270	Coolant 1
Bit 1	iTSA2	0271	Tailstock advance pedal 2	oACL2	0271	Coolant 2
Bit 2	iTSRF	0272	Tailstock retract pedal	oACL3	0272	Coolant 3
Bit 3	iTSOAC	0273	Tailstock over advance	oACLMT	0273	Coolant motor
Bit 4	iTSLMC	0274	Tailstock work pos	oTSADO	0274	Tailstock advance
Bit 5	iTSRTC	0275	Tailstock retract	oTSRTO	0275	Tailstock retract
Bit 6	iDRSRB/	0276	Auto door safety rubber sawitch		0276	
Bit 7	iSTTSUC	0277	Simplified tow-along tailstock joint OFF		0277	
Bit 8	iCHP1	0278	Chuck pedal 1	oHYMON	0278	Hydraulic motor ON
Bit 9	iCHP2	0279	Chuck pedal 2	oBOMT	0279	Guide way lubrication oil motor
Bit A	iCHCLC	027A	Chuck close	oCHCLO	027A	Chuck close
Bit B	iCHOPC	027B	Chuck open	oCHOPO	027B	Chuck open
Bit C	iTCLB	027C	B Turret clamp	oTCLB	027C	B turret clamp
Bit D	iTUCB	027D	B Turret unclamp	oTUCB	027D	B turret unclamp
Bit E	iTCLA	027E	A Turret clamp	oTCLA	027E	A Turret clamp
Bit F	iTUCA	027F	A Turret unclamp	oTUCA	027F	A turret unclamp

SECTION 7 TOUCH SETTER M (OPTIONAL)

1. OVERVIEW OF TOUCH SETTER

The touch setter M is the manual swing type tool presetter which is mounted at the front side of the headstock. This semi-automatic tool presetter ensures accurate and easy gauging and setting of the tool offset data.

Since the touch setter is adjusted very precisely, observe the following handling instructions so that gauging accuracy can be maintained.

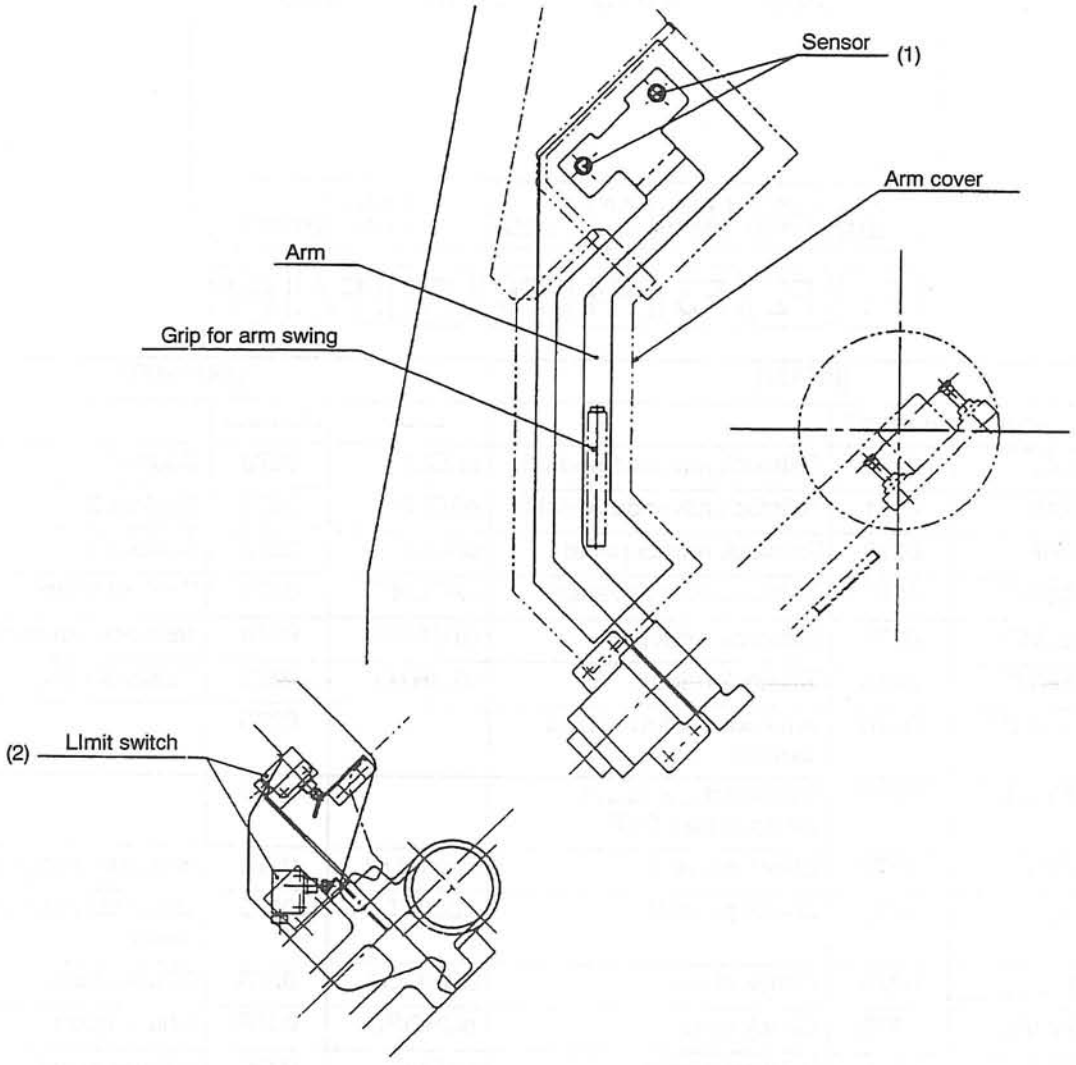
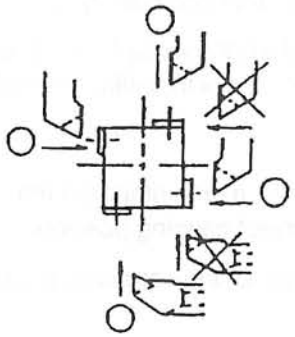


Fig. 7-1 Overview of Touch Setter

2. CAUTIONS ON HANDLING THE TOUCH SETTER

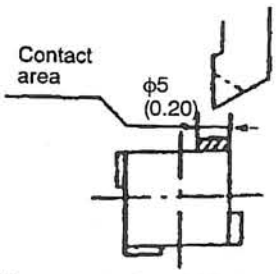
(1) Gauging Direction



a) The sensors allow gauging in four directions. Each of the sensors operate only in one direction and the tool nose must be brought into contact with the proper sensor which operates in the required gauging direction.

b) If the tool nose is brought into contact with the sensor in wrong direction, the sensor is damaged.

(2) Contact Area

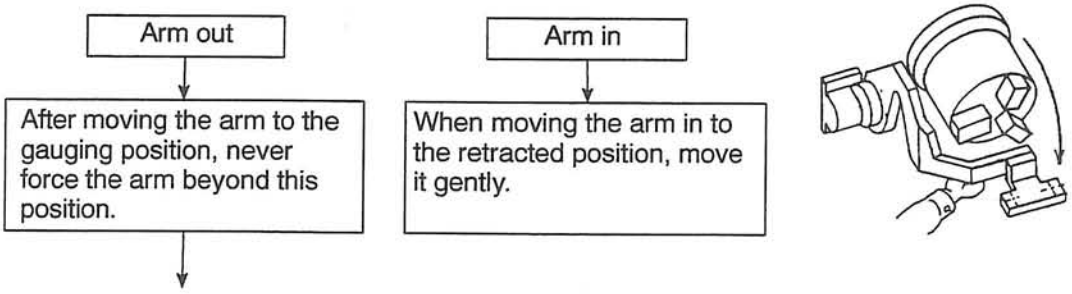


The ϕ5 mm (0.20 in.) tip made of cemented carbide is the contact area of the sensor.

Bring the tool nose at the center of the contact tip.

(3) Arm Motion

a) The touch setter is precision device used for gauging. Therefore, the touch setter arm must not be subject to shock. In addition, the arm must be moved gently.



b) If shock is applied to the arm while moving it out or in, check the sensor position using the reference tool.

(4) Resetting the Sensor Position

If cutting conditions (feedrate, tool nose R, etc.) are changed, surface roughness in finishing is changed and the finishing dimensions change accordingly. Due to this, error is generated in gauging.

To eliminate gauging error, machine the workpiece at the same cutting conditions. Then, set the sensor position again using the reference tool for which the tool offset data is known accurately.

(5) Interlock

The touch setter has the interlock as the standard feature. Gauging is not allowed unless the arm is completely pulled out to the correct gauging position.

When restoring the touch setter to the retracted position, place the arm correctly at the retracted position.

Interlock conditions: Chuck open and arm out

(6) Interference

The standard chucks which can be used with the touch setter without interference are indicated below:

Solid chuck : 8" H01MA8S
8" N-08A601A
10" N-10A601A (to soft-jaw A)

Hollow chuck: 8" B-208A601C
10" B-210A601C (to soft-jaw A)

If a special chuck or special soft jaws are used, there may be cases that the touch setter cannot be used with the special chuck.

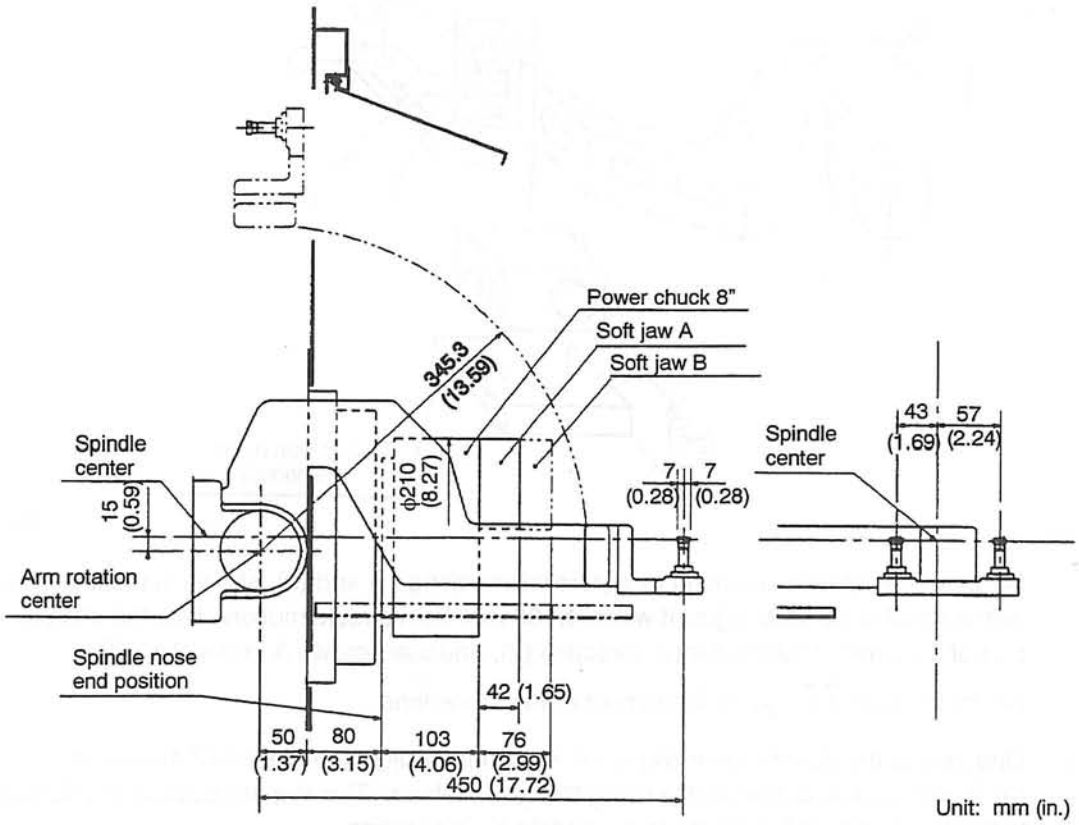
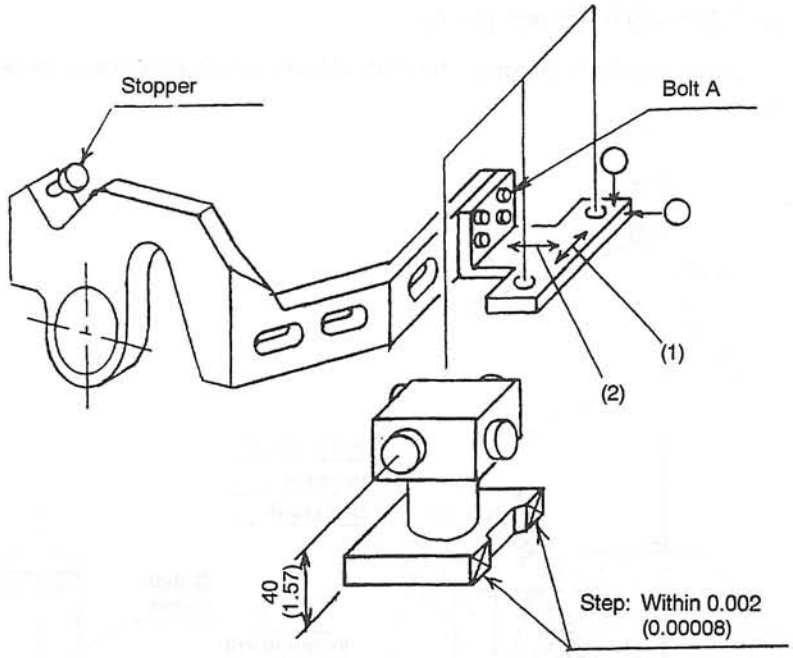


Fig. 7-2 Interference Diagram

3. RE-ADJUSTING THE SENSOR

Since the sensor is accurately adjusted before shipping, it is not necessary to adjust the sensor after installing the machine.

However, re-adjustment becomes necessary if the sensor position is offset due to mechanical shock or other reasons. Follow the procedure indicated below to re-adjust the sensor:



Unit: mm (in.)

(1) Measure the sensor mounting face parallelism along (1) and (2), shown in the illustrated to the left, with a small tester and adjust it within 1/100 mm from saddle motion. Use the stopper at the lower part of the arm for adjustment in direction (2), and use screws A in direction (1).

Adjust the center height of the sensor at the same time.

(2) One side of the sensor mounting block is ground. Adjust parallelism of the sensor in reference to the X-axis motion of the saddle using this ground face. The step measured on this face must be within 0.002 mm (0.00008 in.) to the saddle X-axis motion.

NOTICE

: (1) Sensor adjustment requires skill of an operator. Therefore, before attempting sensor adjustment, contact your local service center of Okuma.

(2) If the sensor position is adjusted, it is necessary to set the sensor position data. For details of sensor position data setting, refer to the Instruction Manual for Touch Setter M, published separately.

4. SPARE PARTS

Electrical Spare Parts

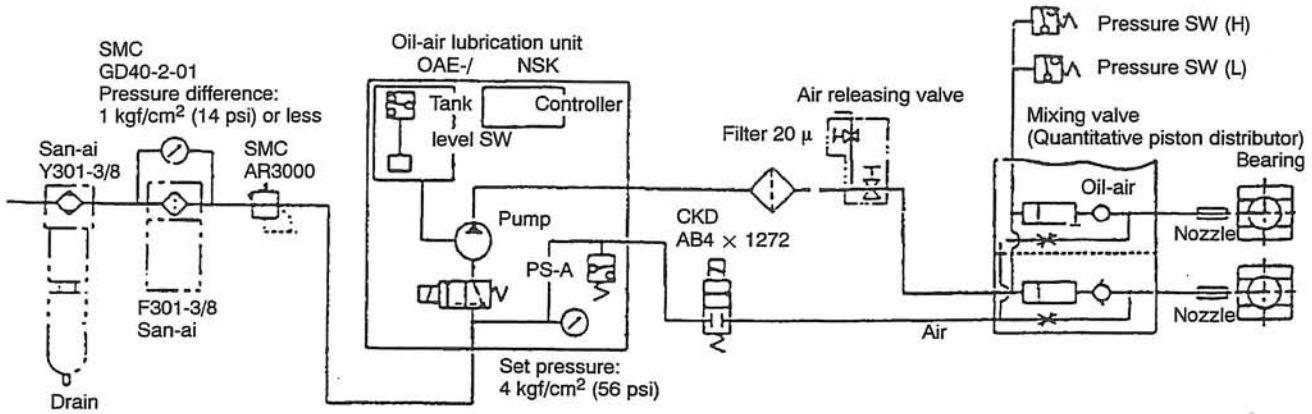
No.	Part Name	Maker	Type	Q'ty	Okuma Part No.
1	Machine switch	Metrol	H-4D-05-04S	2	E3045-857-023
2	Limit switch	Yamatake	SL1-A	2	E3019-891-017

SECTION 8 10000 MIN^{-1} {RPM} SPINDLE (OPTIONAL)

1. LUBRICATION (OIL-AIR)

The bearings of the 10000 min^{-1} {rpm} spindle are lubricated using an oil-air lubrication method instead of grease.

The configuration of the oil-air lubrication system is as shown below:



(1) Description

a) A very small amount of lubricating oil is intermittently discharged by the metering piston distributor at intervals of eight minutes, and then fed to the bearings for lubrication by compressed air.

The metering piston distributor is located at the upper portion of the spindlehead. The oil-air lubrication pump unit is located at the left front of the machine.

b) To prevent the bearings from damages, an interlock is provided: The oil level of the lubricating oil tank, the oil pressure, and the air pressure are monitored, and if the oil level has dropped or the oil or air pressure has dropped, and alarm occurs and the spindle stops rotation.

(2) Advantages

The oil-air lubrication method has the following advantages:

a) The bearings are always well-lubricated.

b) Temperature rise at the bearings is minimum, since the air which carries the oil lubrication also functions as a coolant.

c) The operating environment is kept cleaner, since only a small amount of lubrication is used, as opposed to the oil-mist lubrication method.

d) The method is highly reliable, requiring no periodical checking or replacement, as opposed to the grease lubrication method.

2. PRECAUTIONS

(1) Always use dry and clean compressed air.

(2) Keep air pressure between 5 kgf/cm^2 (71 psi).

Air consumption must be 940 NL/min (248.3 gpm).

(3) Clean and check the air filter and the Microalescer, located at the air inlet port, periodically.

(4) Use the recommended lubricating oil:

Mobil DTE Oil Light

(5) Always supply clean oil. Never allow intrusion of foreign matter into the lubricating oil.

(6) Never disconnect the piping between the pump unit and the distributors. The distributors will malfunction if air is entrapped in the piping.

(7) Do not change the lubrication timer setting (8 minutes).

(8) At the end of the day's operation, turn off the power supply and the air circuit.

3. ALARM

The spindle lubrication alarm activates alarm messages which are displayed on the CRT screen.

To reset an alarm, first eliminate the cause of the alarm. Then, hold down the lubrication switch, located on the inside of the unit, for more than one second.

For more information, refer to the Instruction Manual prepared by NSK.

An alarm occurs under the following conditions:

(1) Faulty Pressure Rise

The pump output pressure does not reach the required pressure [12 kgf/cm^2 (171 psi)] at the pressure switch 60 seconds after the start of the pump.

(2) No Decrease in Oil Pressure

Oil pressure does not decrease during the pump-off interval of 8 minutes.

(3) Low Oil Level

A float switch is activated due to the drop of oil level in the tank.

(4) Low Air Pressure

The air pressure decreases below the set pressure [2 kgf/cm^2 (28 psi)] at the air pressure switch and the circuit is opened.

4. SPINDLE WARM-UP

Check the oil level and air pressure.

Do not run 8000 min^{-1} {rpm} or higher spindle speeds from the start of an operation. Warm up the machine at 3000 min^{-1} {rpm} for 10 minutes before cutting at the high speeds. During cold weather, warm up the machine.

5. SPINDLE LIFE

Spindle life depends on bearing life, since lubricating oil is always supplied to the spindle.

Although not enough data is available to accurately determine spindle life, the spindle is expected to operate for 5 to 10 years without problems.

6. SPINDLE REPLACEMENT

Abnormal heat generation, vibration, and non-rotation may be signs that the spindle bearings are damaged. Contact your local Okuma representative.

Disassembly and reassembly of the spindle should not be performed by the customer.

⚠CAUTION	: Customer/user is not allowed to disassemble/assemble the spindle unit.

7. SPINDLE VIBRATION

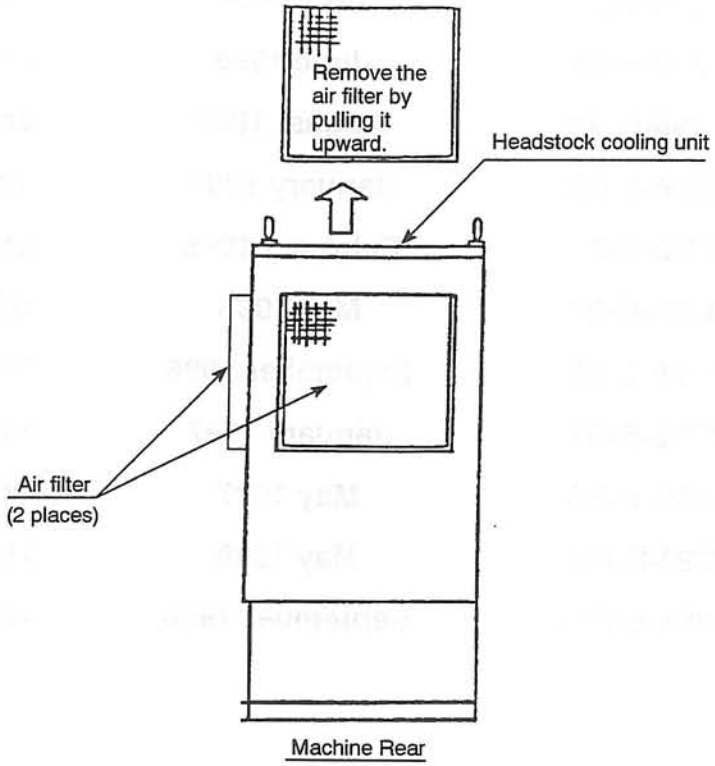
Abnormal vibration will occur within the spindle drive system if imbalanced cutting tools are operated at speeds higher than 3000 min^{-1} {rpm}. Vibration will damage bearings. Imbalanced cutting tools are therefore hazardous to the operators and the machine. Care should be taken to only use properly balanced tools.

Extra care must be exercised when using a large-diameter tool or boring bar.

⚠WARNING	: During high-speed cutting, chips and broken tools might fly off the machine. Safety measures such as not standing in front of a rotating body, etc., should be observed.

8. CLEANING OF AIR FILTER FOR COOLER (HEADSTOCK COOLING SYSTEM)

Clean the air filter for cooler of the spindlehead cooling system (combination unit) at the rear of the machine as follows:



(1) Two air filters are provided at the side of the spindlehead cooling system and it can be removed when pulled upward.

(2) Be sure to clean the air filter about twice a month.

(3) Clean the air filter with water or by using an air gun.

⚠CAUTION : (1) If you neglect the cleaning of the air filter, the thermal relay of the refrigerator motor may be tripped, and a significant drop of the cooling capacity may occur.

(2) If the thermal relay for the refrigerator is tripped, check the cause of the overload such as the clogging of the air filter, ambient temperature (should be less than 45°C), etc.

(3) Do not change the setting of the thermal relay.

LIST OF PUBLICATIONS

Publication No.	Date	Edition	
3798-E	April 1994	1st	
3798-E-R1	June 1995	2nd	A (PL)
3798-E-R2	August 1995	3rd	B
3798-E-R3	January 1996	4th	C
3798-E-R4	February 1996	5th	B
3798-E-R5	May 1996	6th	C
3798-E-R6	September 1996	7th	C
3798-E-R7	January 1997	8th	B
3798-E-R8	May 1997	9th	B
3798-E-R10	May 1998	11th	A (U100L)
3798-E-R11	September 1998	12th	B

This manual may be at variance with the actual product due to specification or design changes.
Please also note that specifications are subject to change without notice.
If you require clarification or further explanation of any point in this manual, please contact your OKUMA representative.