



CAK80 SERIES CNC LATHES

INSTRUCTION BOOK

(For Mechanical Unit)

**SHENYANG NO.1 LATHE WORKS
SHENYANG MACHINE TOOL CO., LTD
THE PEOPLE'S REPUBLIC OF CHINA**

IT IS NECESSARY FOR YOU TO READ THIS BOOK CAREFULLY AND THOROUGHLY BEFORE OPERATING THE MACHINE.

THE CHINESE VERSION OF THIS TECHNICAL DOCUMENT IN ENGLISH IS REGARDED AS FINAL.

MATTERS NEEDING ATTENTION TO OPERATION

It is necessary for you to read this Instruction Book carefully and thoroughly and be acquainted with all details of the Instruction Book before operating the machine, only for this doing you can make the machine completely run safely.

Although this Instruction Book has been checked carefully, if you find there are still a few questionable points, incorrect explanation or omission in it, please make contact with our factory.

For explaining concrete detail of the machine, some graphs in this Book were drawn without door, cover or safe guard, etc. therefore, before operating the machine, put on all these covers, safe guards or close the doors according to this Book, otherwise, some troubles may be occur, resulting in the machine's major assembly or other attachments damaged.

In order to transport the machine safely, some devices, like guarding door, etc. were fixed with fixtures as shown in Fig.2. User must dismount all these fixtures before operation of the machine to avoid damaging the machine.

MATTERS NEEDING ATTENTION TO INSTALLATION

In order to insure the machine running normally, care must be greatly taken to following items during the installation of the machine:

1 Wiring

1.1 The performance values of wires used for connecting the electrical parts should be equal to or more than the specified values in this Instruction Book.

1.2 Never connect the terminal block with the equipment with power cables, like welding machine or high frequency quencher, etc.

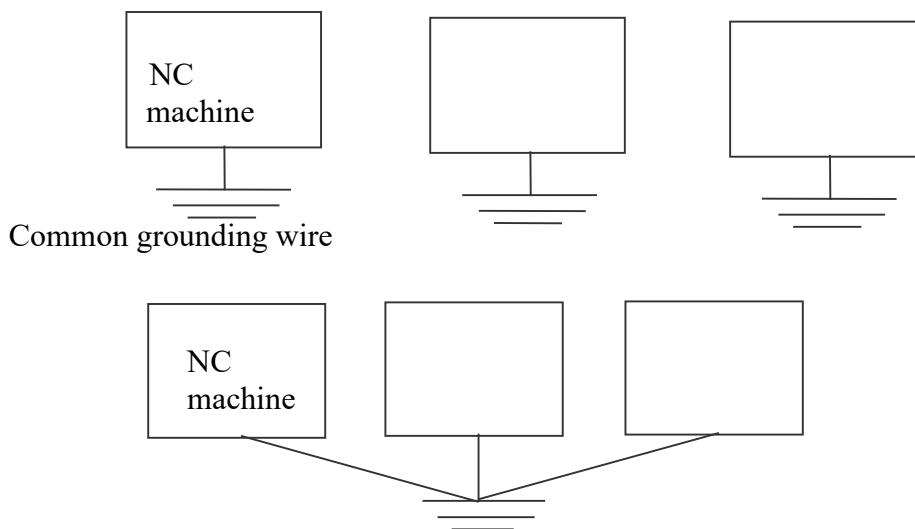
1.3 Power cable should be connected by skilled electrician.

2 Grounding

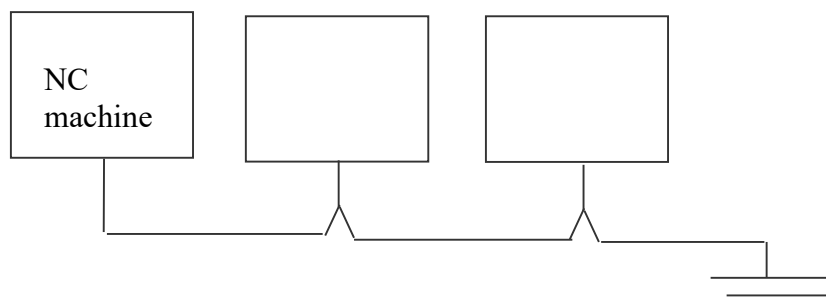
The cross section and the grounding resistor of grounding wires used as well as matters needing attention to grounding should be in accordance with the standard GB5226.1-2002.

The grounding wire shall be connected as the figures given below:

Separate grounding



Never connected to one grounding rod for some equipments like the figure given below:



NOTICE TO ENVIRONMENTAL PROTECTION

The following stipulations have to be followed when the machine is finally scrapped:

- It is necessary to deliver some harmful or non-degradable castoffs, including used batteries, electrical elements, rubber components, etc., which cannot be recovered or re-utilized and designated local recovering unit.
- The waste liquid leading to environment pollution, such as lubricating oil, coolant, etc., which cannot be recovered or re-utilized have to be drained off at designated local place.

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1 GENERAL DESCRIPTION

1.1 Application Scope and Purpose of the Instruction Book

The instruction is edited and prepared for the CNC lathes provided with FANUC 0i –mate, SMTCL-NC100, SIEMENS, FANUC 21i or FAGOR control systems.

The Chapter 2 of the Instruction Book-----“Matters Needing Attention to Safety Protection” can be taken as routine inspection items of operators.

The Chapter 3 of the Instruction Book-----Handling and Installation of the Machine, explains matters needing attention and the methods for installing the machine.

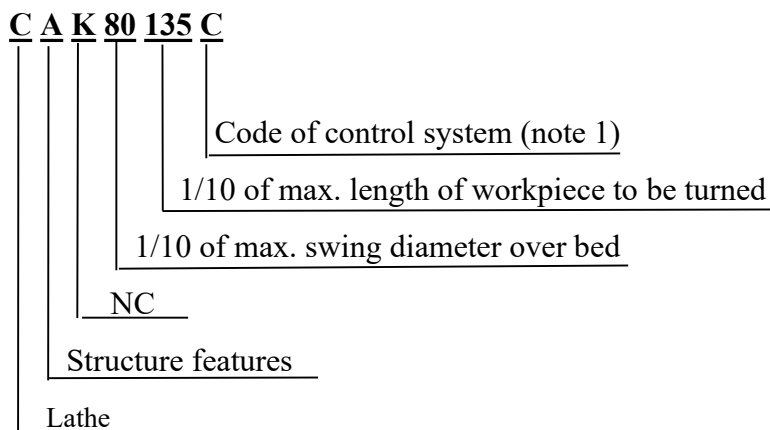
The Chapter 4 of the Instruction Book----- Specifications of the Machine”, and Chapter 5-----“Construction of the Machine”, describe the content needing pre-comprehension before operation.

The Chapter 6 of the Instruction Book-----Inspection and Maintenance, is the knowledge needed for operation and maintenance for operators.

The Chapter 7 of the Instruction Book-----“Tool Disposition” submits machining range of the machine, tool interference, etc.

If you find troubles that are not mentioned in the Instruction occur, please make contact with the Market Department of our factory.

1.2 Identification Marking of Model



- Note 1: The symbol should be d when FANUC 0i-mate system is disposed.
 The symbol should be b when SMTCL-NC100 system is disposed.
 The symbol should be c when SIEMENS system is disposed.
 The symbol should be d when FANUC 21i system is disposed.
 The symbol should be f when FAGOR system is disposed.

1.3 Major Applications of the Machine

The CNC lathes of CAK80 series are economic lathes for mechanical turning, and they can perform the finishing and the roughing of the parts. They are characterized by their reliable construction, convenient operation and economic and practical. Because the control systems possess complete functions, they can meet the needs of various fields. Especially, they are suitable for high-efficiency, large-batch and high-accuracy machining of gyro-rotor workpieces in the fields of automobile industry, tractor industry, war industry, mechanical industry, etc.

In addition, the CNC lathes of CAK6180 series are also available to perform the machining of internal/external faces of cylinder and cone faces, cutting threads, drilling holes, and reaming of shaft-type workpieces and disc workpieces, turning of gyrorotor, etc. in small-batch and middle-batch. The workpieces produced on the machine can achieve the working accuracy of Grade IT7, and the roughness of the face of the machined workpieces can be up to Ra1.6.

1.4 Accuracy of the Machine

Accuracy of the machine is in accordance with the Standard JB/T8324.1-1996 《Accuracy of Simple Horizontal CNC Lathes》.

1.5 Environmental Available for the Machine

The machine is to be used in following environment and operating conditions:

- Environmental temperature: 5° C ~ 40°C.
- Humidity: When under the max. temperature of 40°C, the relative humidity shall not be over the range of 50%, and the principle of humidity change is that no condensation results in.
- Height above sea level: Lower than 1000 m.
- Atmosphere: There is no excessive dust, acid gas, corrosive gas and salt component.
- Radiation: It is necessary to avoid temperature rising of environment due to direct lighting up of the sun for the machine or heat radiation.
- Location for installation of the machine should be far away from vibrating source, flammable and hazard articles.

1.6 Affection of the Machine to Environment

The sound-pressure grade of noise from the machine is $\leq 83\text{dB(A)}$. The machine is provided with full guard and does not drain harmful gas or liquid. Therefore, there is no bad affection from the machine to the environment.

2 MATTERS NEEDING ATTENTION TO SAFETY PROTECTION

The machine is provided with some safeguards to prevent operator from injury or machine from damage. So, before operation of the machine, it is necessary for operator to be acquainted with details on the all-safe labels and the following regulations.

2.1 Requirements for Operator and Maintainer

- The operator of the machine shall be the personnel who was trained and has skill certificate. Before operating the machine, it is necessary to read the Instruction Book carefully and comprehend the content in the Instruction Book thoroughly. It is only permissible to operate the machine after the operator possesses the required ability for operating the machine.
- To avoid accidents, personnel to do the maintenance for the machine shall be qualified or possess maintaining capability.

2.2 Basic Operation Requirement

Danger:

- Never touch some devices such as control board, transformer, terminal block and other places with high-voltage terminals; otherwise, it may cause shock.
- Never touch any switch with wet hand; otherwise, short circuit will result in personnel injury.

Warn:

- Be familiar with the position of emergency stop button so that it can be touched immediately whenever necessary.
- It is necessary to power off the machine before replacing fuse.
- Whenever troubles occur in power supply, it is necessary to switch off the switch of main circuit.
- If a job has to be completed by two persons or more, it is necessary to set the correspondence signal for each step, and the next step operation can't be done unless the signal specified is offered and received.

Notices:

- Recommended hydraulic oil, lubrication oil and grease or the oil having same functions as the recommend ones that are allowed should be used.
- The fuse, which has satisfied rated current value, should be used.
- It is necessary to prevent the NC devices, operator's panel and electric control board from being attacked, otherwise, troubles resulting in the abnormal work of the machine will occur.

- **Don't change parameters or other electric devices at will. If it must be changed, you should register the original value before change, so that it can recover to the original value when needed.**
- **Do not dirty nick or get down any caution label. If the words on it are not clear or lost, order a new one from our Works.**
- **Enough space for working should be provided to avoid accidents.**
- **Water or oil can make the floor slipping to cause hazard, and in order to avoid accidents, it is necessary to keep the working floor clean and dry.**
- **Confirm the switch to be used, never mistake it.**
- **Never touch any switch at will to avoid mis-action of the machine.**
- **The worktable near the machine shall be strong and stable to prevent accidents. In addition, it is necessary to avoid something sliding down from the worktable.**

2.3 Requirement prior to Switch-on the Power Supply

Danger:

All cables, wires or coils whose insulating covers are damaged will cause current leakage or shock, so it is necessary to check them carefully before use.

Warn:

- **It is necessary to understand all the details specified in the Instruction Book and Programming Manual, and make clear for every function and operation procedure.**
- **Wear the insulating shoes, overalls and other articles for safeguard.**
- **Close the doors and covers of NC unit, operator's panel and electric control panel.**

Notices:

- **The cables used from the electrifying switch to the switch for general power supply of the machine should have enough section to meet the requirements of electric power.**
- **The cables set on the floor must have the ability of chip proof to avoid short circuits.**
- **Before starting the machine for the first time after unpacking the wooden cases or start the machine after a long-time stop of the machine, it is necessary to oil the slip parts with new lubrication oil, the lubrication pump should continuously work until the oil seeps from chip scraper.**
- **The oil tank of the machine should be filled to the oil level, and check it, refill it if**

necessary.

- For lubricating point, the kind of oil and relative oil position, please refer to concerned label.
- Every switch and operating lever should be nimble, smooth and the actions should be checked.
- When you supply power to the machine, switch on the factory-electrifying switch, main circuit switch and power supply switch (make them at Positions “ON”) on the operator’s panel in turn.
- Check the amount of coolant; and add it when necessary.

2.4 Requirement after Switch-on the Power Supply

When the switch of power supply on the operator’s panel is set to ON (electrifying)(switch on the switch accordingly), check if the indicating lamp **READY** is light or not.

2.5 Normal Inspection

Matters needing attention:

Never insert your finger in-between the pulley and belts when you check the tension of the belts.

Notice:

- Check if the reading on the pressure meter is correct.
- Check if there is any abnormal noise comes from motor, gear box or other parts.
- Check the lubrication state of slide parts.
- Check if the safeguard device or protective cover is under good status.
- Check the tension of the belts. If they are too loose, replace them with new match-able ones.

2.6 Temperature Raising

Notices:

- When you raise the temperature of the machine, especially for spindle and feed shaft, the machine should run at half or one-third at max. speed for 10-20 minutes under auto mode so that the stable temperature required for the machine can be reached.
- Under the automatic mode, every action of the part should be carried out according to the program. At the same time, the action status of each part shall be checked.
- If the machine has been stopped for a long time, you’d better not start the

machine with actual machining which damages the slide parts because of the lubrication is not sufficient. For this reason the machine parts may get heat expansion, to affect the machining accuracy. In order to avoid this situation the machine temperature should be raised.

2.7 Preparation before Operation of the Machine

Warn:

- Tooling should be in accordance with the technical parameters, size and type of the machine.
- Excessive wear or damage of tools will influence the working accuracy directly or damage the machine, so new ones should replace excessive worn tools should be replaced with new ones beforehand.
- In order to check safety job conveniently, the working area should have good illumination.
- Tools or other things around the machine or equipment should be arranged in perfect order and keep the environment tidy and the path unlocked.
- Tools and other things cannot be put on the headstock, turret, covers or other similar positions.
- If the center hole of a heavy cylindrical workpiece is too small, the workpiece may skip out of the center when it is loaded, so, pay attention to the size and angle of the center hole.

Notice:

- The length of workpiece should be limited within the specified range to avoid interference.
- After the tools were set, trail run should be performed first.

2.8 Matters Needing Attention during Operation

Danger :

- Long hair should be covered with cap when operating the machine.
- Workpiece must be chucked tightly.
- The adjustment of the nozzle of the coolant is only permissible when the machine is stopped.
- During machining, it is forbidden to touch workpiece or spindle by hand or under other modes.
- Do not open the door of machine during automatic machining.
- During heavy cutting, hot chips may cause fire, so preventing chips from congestion is necessary.

Warn:

- **When operating the machine, operate the switches without gloves to avoid mis-operation.**
- **Workpiece can be unloaded only when the tool and spindle are under stop status.**
- **Chip cleaning is forbidden during cutting.**
- **It is forbidden to open the safeguard door when the machine is running.**

Notices:

- **When moving heavy workpiece, more than two people must work together to ensure safety.**
- **The operators who use fork-type lifter, crane or other similar equipment must have been professionally trained and have been granted certificate.**
- **Whenever operating the fork type lifter, crane or other similar equipment, great attention should be paid to avoid collide with other devices around.**
- **The steel wire or hook being used for handling must have enough strength to satisfy the requirement of loading, and they must be limited within the safe rules.**
- **Do not clean chips on the cutter by bare hand, but use brush to clean it.**
- **Mounting and dismounting tools should be done only when the machine is under stop status.**
- **Operator should wear anti-gas mask when machining the workpieces made from magnesium alloy.**

2.9 Machining Interruption**Notices:**

After machining, before leaving from the machine, the operator have to turn off the switch of power supply on the operator's panel as well as the switch of main circuit.

2.10 After Turning**Notices:**

- **Cleaning is forbidden before stopping the machine.**
- **After stopping the machine, it is necessary to clean the chips, doors, covers and windows, etc.**
- **Back all parts of the machine to their original positions.**
- **Check the chip scraper to see if it is damaged, and replace it with a new one if it's damaged.**

- Check if the coolant, hydraulic oil and lubricating oil are dirty, and if the pollution is serious, change it with the new.
- Check the amount of coolant, hydraulic oil and lubricating oil, and add them when necessary.
- Clean the filter of the water tank.
- Before leaving from the machine, turn off the switch of power supply on operating pendant as well as the switch of main circuit and main switch of the machine.

2.11 Safeguard Devices

- Front and back protection devices and coolant protection device.
- Overtravel limitation switch.
- Protection device for chuck, tailstock and tool (NC software is set by user parameters).
- Store travel limit (NC software)
- Emergency stop button

2.12 Preparation before Maintenance

Warn:

- Any maintenance cannot be done without authorization.
- Replacement of parts, wearing parts (seal, oil seal, O-type ring, bearing, grease and oil) should be made according to preplan.
- Prepare record, preventive measures and correct maintenance method.

Notices:

- Carefully read and be acquainted with the safeguard measures specified in the INSTRUCTION BOOK.
- Read the INSTRUCTION BOOK carefully and thoroughly and be acquainted with the relative principle, structure and notices included in the Book.

2.13 Maintenance Operation

Danger:

- During the period of maintenance, anyone who has no relationship with the maintenance should not operate the main circuit switch or the power ON switch on the pendant, therefore a sign plate with “The machine is under maintaining, don’t touch the switch” or with words similar to the above meaning should be

hung on the switch or other suitable places. This plate should be easy to see and to pick off but uneasy to fall down.

- It's dangerous to maintain the machine with power on, principally the switch of main circuit should be turn off during maintenance.

Warn:

- A professional maintainer should carry out the electric maintenance and the maintainer should always be in contact with the chief, and never make any decision by himself.
- Travel limit device, approach switch or interlock devices cannot be dismantled or modified.
- In order to ensure the safety, the ladder or the lifter used for altitude work must be maintained and controlled every day.
- Fuses and cables used for the machine should be certificated products.

2.14 Handling after Maintenance

Warn:

- After maintenance is finished, the working place should be cleaned and re-arranged, and the oil, water on every part should be cleared away to get a good working ambience.
- Take the dismantled parts and dirty oil far away from the machine to keep safety.

Notice:

- Maintainer should check if the operation of the machine is safe.
- Register and keep all the data of maintenance and inspection for further reference.

2.15 Miscellaneous

- **Max. allowed loading of the machine:**

Power:	13 kW
Torque:	1557Nm
Cutting force:	16051N

When the chuck is running at high speed, the jaws must clamp a workpiece to avoid being thrown off from the chuck!

- When the 4-jaw chuck, faceplate, or 3-jaw chuck of $\phi 500$ is used, the max. speed of chuck shall not be higher than 255r/min.

3 HANDLING AND INSTALLATION

3.1 Preparation for Installation

The protection door and CRT should be first fixed before the machine is transported. On both sides under the protection door there are two screw holes of M6. Make the screws of M6×30 of the dog on the guideways be fixed with the protection door. And the pieces, on the upper edge of the protection door, used for transportation make the door be connected and fixed with the rear protection position.

Measures for corresponding anti-damp, anti-vibration and anti-impact had been taken during the packing of the machine, guaranteeing the machine can be transported and stored under the temperature of -25°C~+55°C, and the highest resistible temperature is up to 70°C during the short-period transportation and storage within 24h.

3.2 Handling of the Machine

Handling plan for the machine with max. length of 1500 of workpiece to be turned, please refer to Fig. 1-1.

Handling plan for the machine with max. length of 3000 of workpiece to be turned, please refer to Fig. 1-2.

Handling plan for the machine with max. length of 5000 of workpiece to be turned, please refer to Fig. 1-3.

Notices:

- It is necessary to pay attention while handling the machine to avoid the machine, NC system and high-voltage switches from being attacked.
- Before handling the machine, it is necessary to check if each part is firmly fixed, and to see if there is any article that shall not be put on the machine.

The handling of the machine shall be carried out according to the following requirements:

To lift the machine packed in wooden case by a crane, strong steel wire rope should be looped in the rope marks pointed lateral side of the case. When transporting and unloading the case, bumping and shocking should be avoided. Over inclination of packing case is prohibited, otherwise, the accuracy of the machine will be badly affected even damaged. If rolls are used for the transport of the case, it is important that the inclination of condition of the slips should not exceed 15° and the diameter of the rolling rod should not be more than 70 mm. Never place the case on a prismatic body or upside down to avoid accuracy of the machine to be effected.

When the machine is unpacked, first inspect its exterior condition and check attachments according to the “Packing List”.

When using a crane lifts the unpacked machine, make the two steel bars pass through the two handling holes at both ends of headstock as shown in Fig 1-1 (or Fig.1-2 and Fig. 1-3), and by the help of the carriage and the tailstock to balance the machine to be lifted.

Before the machine is lifted, wooden blocks should be padded between the strong steel wire rope and the machine or the steel wire ropes are slipped with rubber pipes to prevent the machine and the protection plate from scratching.

- The machine should be kept balance in both horizontal and vertical during handling, so, at the very beginning when the machine being handled up the machine should be kept balance.
- The angle of the handling rope is no more than 60°.
- Whenever more than one person carries out the handling work, signals should be used between each other for coordination.

3.3 Installation of the Machine

The performance of a machine is greatly influenced by the installation way. If the guideways of a machine are finishing machined, but the original accuracy cannot be reached due to the reason of bad installation of the machine. And most troubles of the machine were caused by this reason.

Read the installing procedure carefully, and install the machine according to the requirements specified, so that the machine can perform high-precision machining.

3.3.1 Preparation before the Installation of the Machine

3.3.1.1 Ambient Requirement (for Machine)

Machine shouldn't be installed in the positions listed below:

- The ambient temperature can obviously change. For example, the machine's installing position is closed to the heat resource or there is a heat resource near the machine.
- Over wet place.
- Too dust, too dirty place.
- Near the vibration resource.
- The floor for installing the machine is not strong enough or soft.

Notice:

- If the machine has to be installed near the position with vibration resource, dig a canal around the machine or make similar measures for anti-vibration.
- If the machine has to be installed on the soft soil, it is necessary to use the pile way or similar measures to increase the force of support of the soil, so that the machine will not sink or incline.

3.3.1.2 Ambient Requirement (for NC)

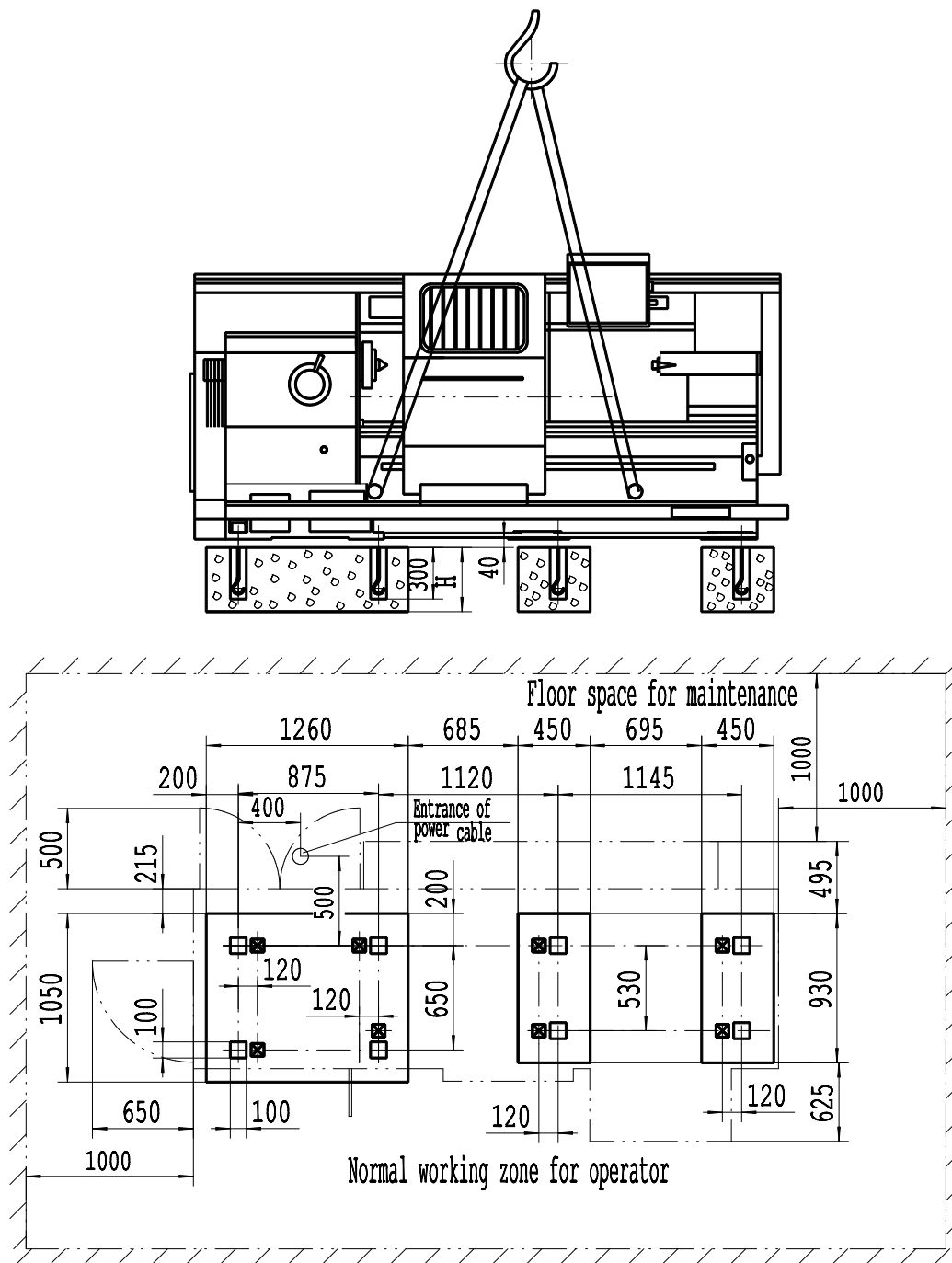
- Ambient temperature: 5 ~ 40°C (under working condition)
- Relative humidity in normal case: Lower than 75% (normal relative humidity)

3.3.1.3 Interface of Power

Terminal block is located inside the front leg of the machine.

3.3.1.4 General Power Supply

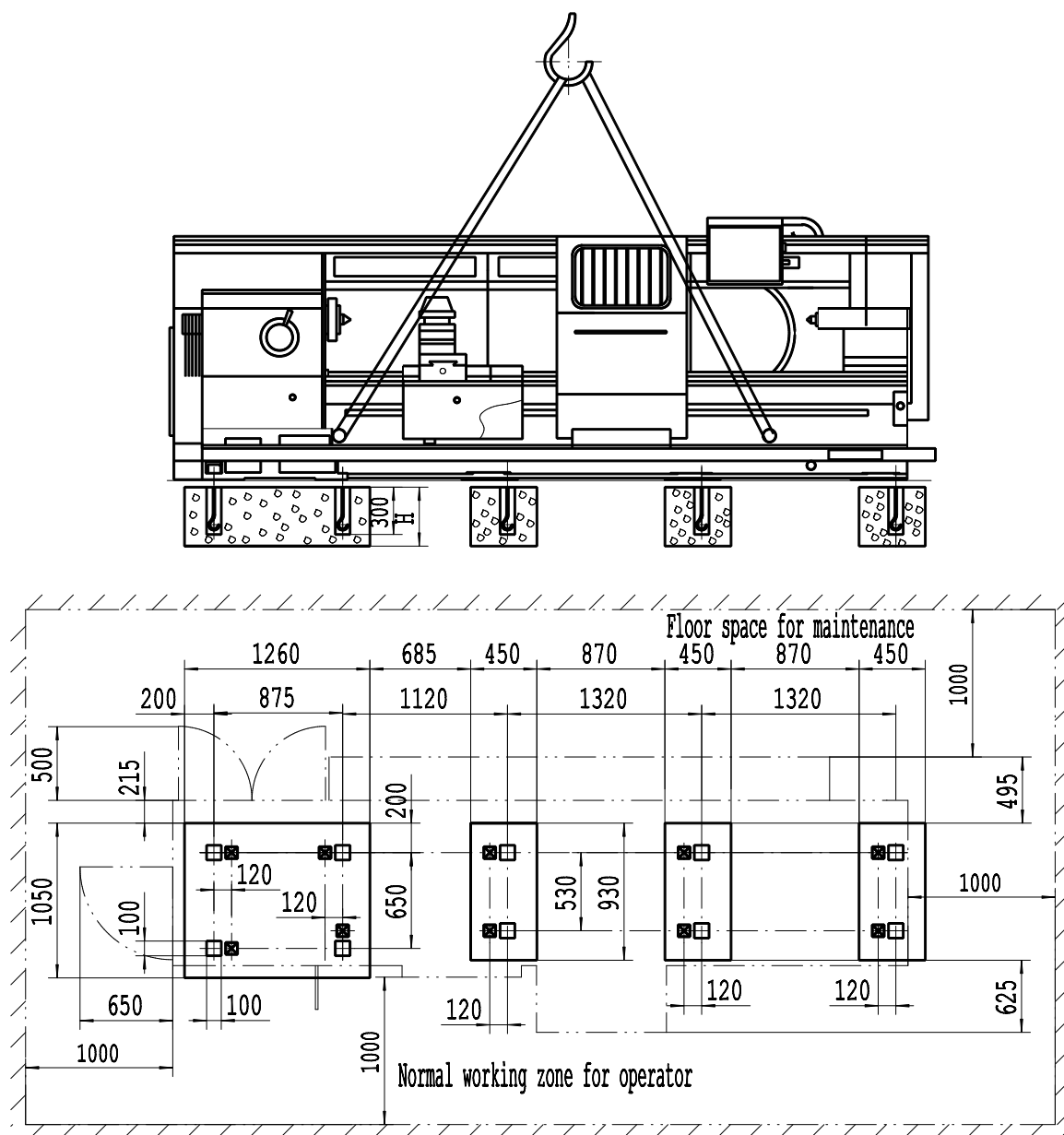
Prepare the power supply cable and grounding wire according to main power supply specified by the Parameter List. For the details, please refer to Instruction Book of Electric Unit.



Note: 1. H: Decided according to property of the local soil.

2. Mark  in the Fig. shows the position of wedge.

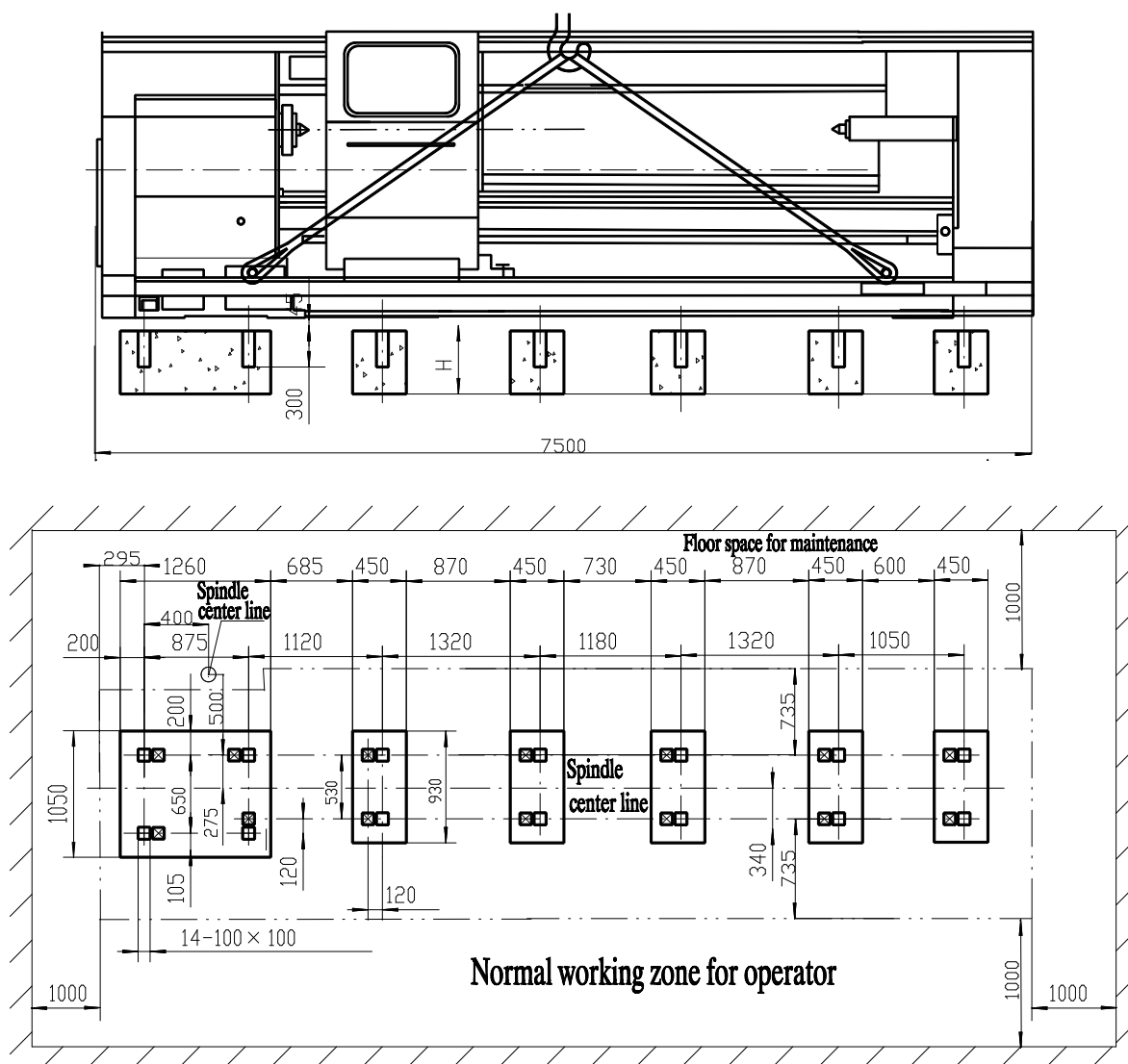
Fig. 1-1 Foundation plan and handling schematic plan for the machine of 1500



Note: 1. H: Decided according to property of the local soil.

2. Mark  in the Fig. shows the position of wedge.

Fig. 1-2 Foundation plan and handling schematic plan for the machine of 3000



Note: 1. H: Decided according to property of the local soil.

2. Mark \boxtimes in the Fig. shows the position of wedge.

Fig. 1-3 Foundation plan and handling schematic plan for the machine of 5000

3.3.2 How to Install the Machine

The performance of a machine is greatly influenced by the installation way. If the guideways of a machine are precisely machined, but the original accuracy cannot be reached due to the reason of bad installation of the machine. And most troubles of the machine were caused by this reason.

Read the installing procedure carefully, and install the machine according to the requirements specified, so that the machine can perform high-precision machining.

3.3.2.1 Foundation

For installing the machine, a plane installation place should be first found, then arrange the environment according to the specifications and determine the installation space according to the foundation plan.

The floor space of machine includes the machine itself and maintenance space, which has been specified in Foundation Plan.

3.3.2.2 Temporary Leveling

- Lift up the machine and set the foundation bolts into the boltholes for leveling. And the pad irons shall be put at the corresponding positions specified in the Foundation Plan.
- Put down the machine slowly to make the foundation bolts come into the foundation holes according to the stipulations given by the Foundation plan.
- Insert the wedges into the bottom of the bed for temporary leveling to obtain rough adjustment.
- Fix the foundation bolts with cement after rough adjustment.
- After the adjustment, it is necessary to fix the foundation by cement.
- If the anti-vibration wedges are used, they can be directly put on the plane cement floor.

3.4 Inspection of Inner Devices Connection

After the leveling, before switch on the machine, the following preparation work should be done:

- Be sure that grounding wire is connected correctly (installation resistor shall be lower than 10Ω).
- Tighten the screws on terminals.
- Re-check whether couplings are connected tightly.

- Make sure the printed-circuit boards inside NC devices are not moveable.
- Check and make sure that input power supply is in correct phase, and if the phase order is wrong, NC device or AC converting control board may have troubles.

3.5 Inspection before Operation

After connection of the inside devices, check the mechanical system and electrical system of the machine according to the following rules.

- Cleaning

Sliding surfaces and metal parts surfaces of the machine have been covered with a film of antirust for rust proof. Some dust, sand or other dirty things may come into the anti-rust coating during transportation, so, it is necessary to clean out the anti-rust coating before starting the machine.

Clean out this rust preventive with cloth dipped with cleaning oil. After cleaning, cover them with a film of lubrication oil.

- Inspection of machine:
 - ◆ Check if any part of the machine has been damaged.
 - ◆ Check if any part or attachment has been lost.
 - ◆ Check if every part has been lubricated well.
 - ◆ Check if all the hydraulic pipes have been connected well.
- Check electrical system before / after switch on power supply (Refer to Instruction Book of Electrical Unit).
- Matters needing attention when the machine is under the condition of stopped for a long term:

When the machines is started first time after installation or after a long-term stop, start it with lubrication to make the slide surfaces have enough lubrication oil.

3.6 Final Adjustment of Bed Level

When the cement in the foundation holes is solidified, adjust the level by leveling bolt and arrange the leveler according to the rule of “temporary level adjustment”. For the steps and tolerances of leveling, refer to the “Test Certificate” attached with the machine.

Note: After leveling, leveling nuts and foundation bolts should be tightened firmly to ensure the level accuracy unchanged. The minimum scale of the leveler being used is 0.02 mm.

3.7 Maintenance and Inspection of Inner Devices Connection after Installation

3.7.1 Maintenance of Primary Period after Installation

For the primary period after the installation of machine, the level of the machine bed will change obviously for reasons of unstable solidifying of the surface and the solidification of foundation are not steady, so that the accuracy of the machine will be greatly affected. On the other hand, because of the primary wear, the machine is very easy to be polluted, which will result in machine trouble easily.

Measures that should be taken for maintenance during the primary period of installation are as follows:

- Trial-run

For first time trial-run, it should be carried out with great care, the time of trial-run is about 1 hour, and heavy load cannot be used during trial-run.

- Check the bed level of the primary period

Check the bed level after the machine has been installed for six months; check the situation of foundation once a month at least. If any un-normal phenomenon is found, correct it to reach the specified requirement so that the accuracy of the bed level can be ensured.

- After six months, the checking period can be extended according to the situation of practical change. When it reaches a certain steady extent, the checking period can be set for once or twice a year periodically.

3.7.2 Check the Connection of Inner Devices

Check NC device, main machine, hydraulic device, control panel and other devices to make sure that the electric connection is correct.

- Check if connectors are connected tightly.

Check if the electric connection of devices is right. Inspect if the electric connectors between devices are tight, and tighten them when necessary.

- Check if the screws of terminals are connected well

Check if interface of the machine and the screws on terminals of electric equipment on control panel are loose, and if any of them is loose, tighten them according to the requirements.

- Check if the screws on terminals and installing screws of micro-switch are loose, tight them when needed.

3.7.3 Check Electric Control Panel

Before checking the electric control panel, switch off the power supply of the machine is necessary.

- Terminal screws and weld elements
Check every terminal screw on electric equipment, tighten them when they are loose, and softly pull the weld element on relay board to make sure they are welded well.
- Plug fuse
Check if the fuse is loose, and if there is, it is necessary to tighten it.
- Arc-quencher
Check every arc-quencher, and replace them if their colors change.
- Cleaning
When some dust, chip or other dirty things were inside the electric control panel, clean them out carefully; otherwise, they may cause troubles.
- When the air filter become black that means it was polluted, dismount it and clean softly with water.

3.8 Occupied Floor Space and Foundation Plan

For the occupied floor space and foundation plan for the machine of max. length of 1500 of the workpiece to be turned, refer to Fig. 1-1.

For the occupied floor space and foundation plan for the machine of max. length of 3000 of the workpiece to be turned, refer to Fig. 1-2.

For the occupied floor space and foundation plan for the machine of max. length of 5000 of the workpiece to be turned, refer to Fig. 1-3.

4 SPECIFICATIONS OF THE MACHINE

4.1 Explanation to the Specification

This machine has some different sizes and types. Before read the manual, make sure which type is your machine.

4.2 Specifications

Table of Specifications Table 1

Item	Unit	CAK80b	CAK80c	CAK80d	CAK80d	CAK80f	
CNC system		SMTCL-NC100	SIEMENS 802D	FANUC 0i-mate	FANUC 21i	FAGOR	
Max. length of workpiece to be turned	mm	1500 3000	1500 3000 5000	1500 3000 5000	3000	3000	
Max. turning length	mm	1350 2850	1350 2850 4850	1350 2850 4850	2850	2850	
Max. swing dia over bed	mm	φ800					
Max. turning dia. over slide	mm	φ480					
Type and code of spindle nose	mm	D11					
Front taper hole of spindle	mm	Metric 120					
Diameter of spindle bore	mm	φ104					
Range of spindle speed	r/m in	17-100; 38-222; 76-445; 180-1000					
Steps of spindle speed		4 steps, stepless					
Output power of main motor	kW	15					
Center height	From bed	mm	400				
	From floor	mm	1130				
Rapid speed of X-axis	m/m in	4					
Rapid speed of Z-axis	m/m in	8					
Travel of X-axis	mm	420					
Travel of Z-axis	mm	1350; 2850;4850					
Min. setting unit for X-axis	m m	0.0005					
Min. setting unit for Z-axis	m m	0.001					
Motor for X-axis	Type		HC152	1FK7083	β12/2000i	α12/3000i	FXM53.20F
	Speed	r/min	2000	2000	2000	3000	2000
	Torque	N.m	9.7	16	11	12	11.9

Item		Unit	CAK80b	CAK80c	CAK80d	CAK80d	CAK80f
Motor for Z-axis	Type		HC352	1FK7101	β22/2000i	α22/3000i	FXM73.20F
	Speed	r/m in	2000	2000	2000	3000	2000
	Torque	N. m	17	27	21	22	20.8
Diameter of tailstock sleeve		m m	100				
Travel of tailstock sleeve		m m	250 mm				
Taper hole of tailstock sleeve			Morse No. 5				
Turret form			Vertical 4-station or 6-station				
Indexing time of turret		s	3.75			5.4	
Size of tool shank	Outer dia.	m m	32×32				
	Inner dia.	m m	32, 40				

Table of other specifications Table 2

Size of the machine (mm)		1500	3000	5000
Weight of the machine (kg)		5500	6500	8000
Bearing weight of the machine (t)		2	3	3
Overall dimensions of machine (L. ×W. ×H.)		Full-protection	Full-enclosure protection	Full-protection
		3650×2050×1850	3950×1980×1835	5285×2050×1850 7500×1997×1860

5 CONSTRUCTION OF THE MACHINE

5.1 Layout of the Machine

Refer to Fig. 2 and Fig. 3.

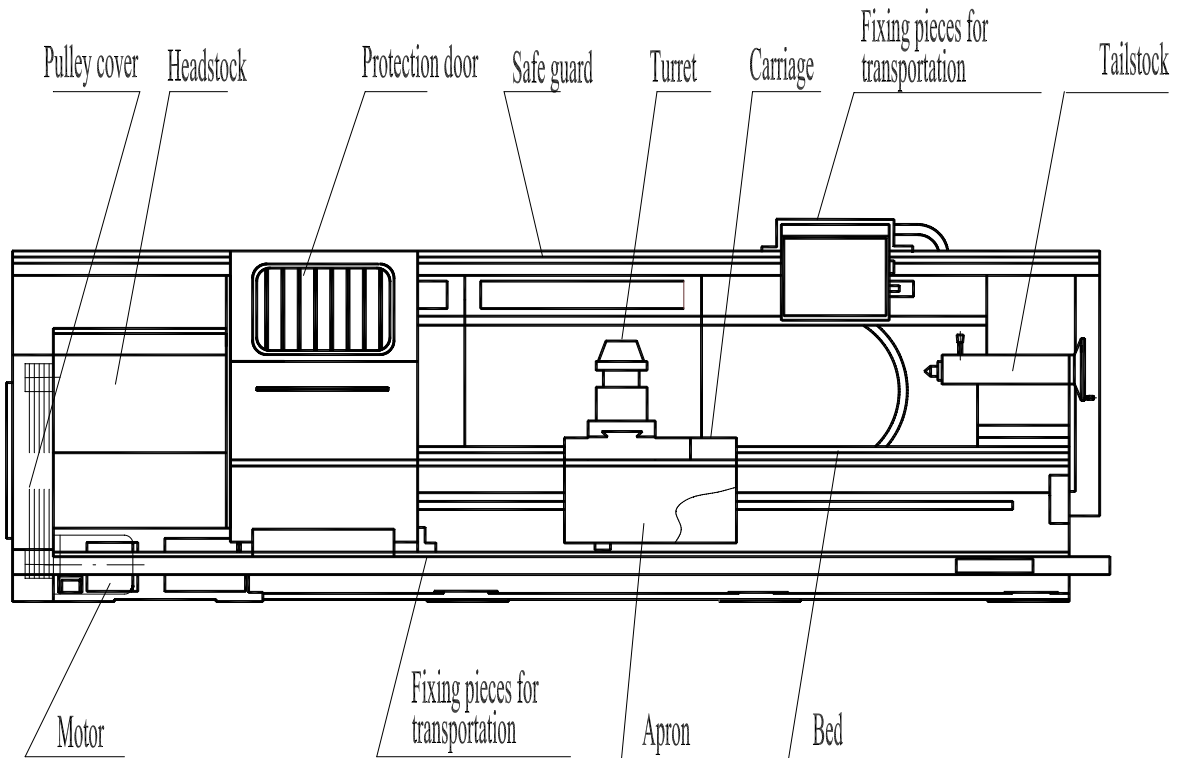


Fig. 2 Appearance view for the machine with full-protection

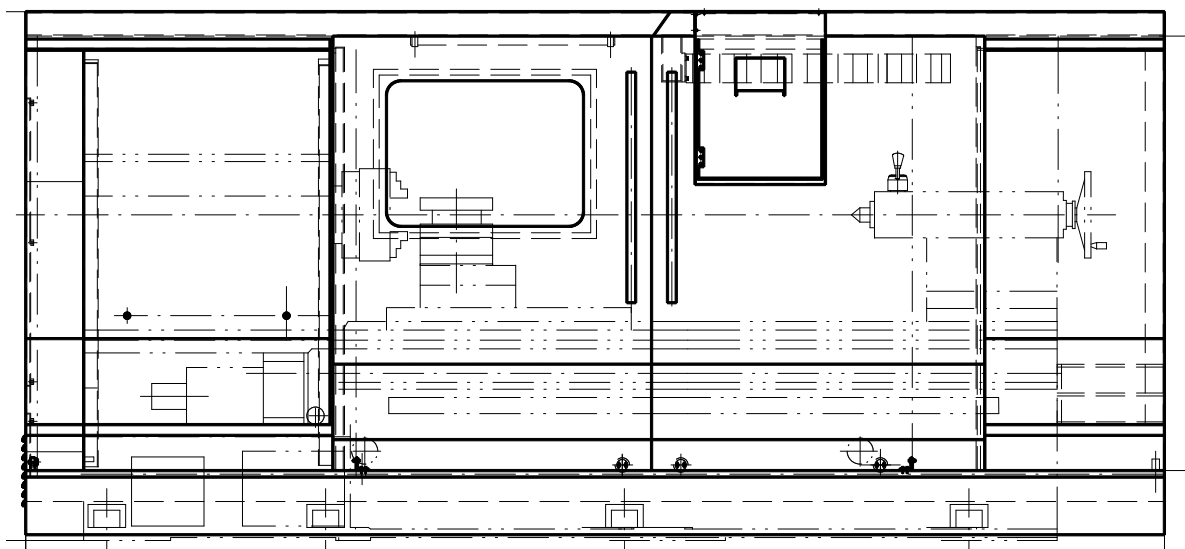


Fig. 3 Appearance view for the machine with full-enclosure protection (1500 mm)

5.2 Brief Instruction to Parts of Machine

5.2.1 Headstock

For the drawing of main driving system of machine, refer to Fig. 4, please.

The main driving is transmitted from the gear 1 on shaft I to the gear 3 on shaft II, then, to the gear 7 on shaft III through the gear 5 and to the gear 10 on shaft IV through the gear 9. This driving chain is middle speed;

The main driving is transmitted from the gear 1 on shaft I to the gear 3 on shaft II, then, to the gear 8 on shaft III through the gear 6 and to the gear 10 on shaft IV through the gear 9. This driving chain is high speed;

The main driving is transmitted from the gear 2 on shaft I to the gear 4 on shaft II, then, to the gear 7 on shaft III through the gear 5 and to the gear 10 on shaft IV through the gear 9. This driving chain is low speed;

The main driving is transmitted from the gear 2 on shaft I to the gear 4 on shaft II, then, to the gear 8 on shaft III through the gear 6 and to the gear 10 on shaft IV through the gear 9. This driving chain is middle speed;

The machine is of 4-step stepless changing speed. The driving calculations of various revolution speeds of each step are calculated as follows:

$$a: 3600(615) \times 138/238 \times 41/55 \times 18/61 \times 34/66 = 222(38) \text{ r/min}$$

$$b: 3610(650) \times 138/238 \times 41/55 \times 51/41 \times 34/66 = 1000(180) \text{ r/min}$$

$$c: 3600(615) \times 138/238 \times 24/72 \times 18/61 \times 34/66 = 100(17) \text{ r/min}$$

$$d: 3600(615) \times 138/238 \times 24/72 \times 51/41 \times 34/66 = 445(76) \text{ r/min}$$

From the above, we can obtain:

Speed range of high speed step: 180 – 1000 r/min

Speed range of low speed step: 17 – 100 r/min

Speed range of middle speed step: 38-222 r/min; 76 – 445 r/min

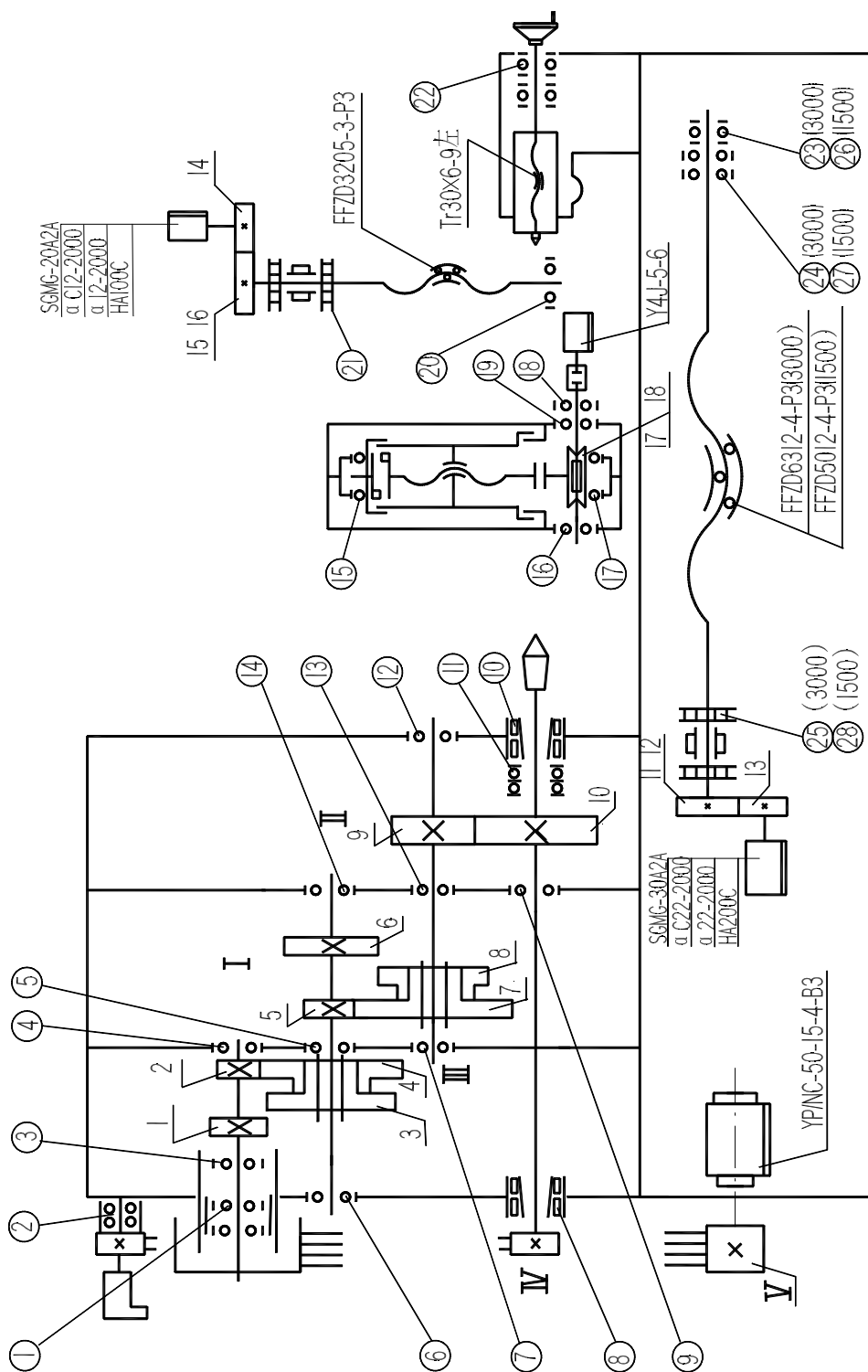


Fig. 4 Drawing of main driving system of machine

Table of Gears Table 2

No.	Teeth	Module	Correction Coefficient	Part Number
1	41	2.5		A63-02154L
2	24	2.5		A63-02155L
3	55	2.5		A63-02168L
4	72	2.5		A63-02169L
5	18	3.5	-0.07	A63-02170L2
6	51	3		A63-02171L
7	61	3.5		A63-02172L2
8	41	3		A63-02173L
9	34	4.5	0.57	A18-02207L
10	66	4.5	0.315	A18-02208L
11	42	2.5		A63-01004L
12	42	2.5		A63-01005L
13	21	2.5		A63-01002L
14	28	2		A63-05005L
15	35	2		A63-05028L
16	35	2		A63-05029L

Table of Bearings Table 3

No.	Size and Type		Qty.	No.	Size and Type		Qty.
1	55×90×18	E111	2	15	40×60×13	8108	1
2	30×55×13	106	2	16	25×47×12	46105	1
3	40×90×23	E308	1	17	45×65×14	8109	1
4	30×72×19	E306	1	18	25×47×12	105	1
5	40×80×18	E208	1	19	25×47×12	46105	1
6	35×80×21	E307	1	20	25×52×15	205	1
7	45×100×25	E46309	1	21	25×57×50	ZARN2557TN	1
8	130×200×52	D3182126	1	22	30×52×16	8206K	2
9	140×210×33	E128	1	23	35×62×18	D8207	1
10	160×240×60	C3182132	1	24	40×68×15	D108	2
11	170×215×34	D8134	2	25	40×75×54	ZARN4075TN	1
12	45×100×25	E46309	1	26	30×52×16	D8206	1
13	55×100×21	E46211	1	27	35×62×14	D107	2
14	30×72×19	E306	1	28	35×70×54	ZARN3570TN	1

5.2.2 Chuck

Standard chuck of this CNC machine is manual chuck, and we can offer hydraulic chuck and electric chuck according to the requirements of the user.

Hydraulic chuck is connected with rotary oil-cylinder by link rod, the piston inside hydraulic cylinder moves to the direction of chuck and to make the jaws of the chuck release through the wedge type structure, and the jaws will close when the piston returns back. The rotary oil-cylinder consists of cylinder body, single-way valve and rotary conjunction. The single-way valve will keep the constant pressure inside the cylinder when the oil pressure goes down unusually because of the trouble of pressure resource. The structure of the jaws must suit the shape of the workpiece to be chucked. Some limitations and matters needing attention were specified for ensuring the safety, high accuracy and serving life of the chuck, therefore, it is necessary to operate according to

the specifications in “Operation Manual of Chuck”.

For working principle and matters needing attention to power chuck, please refer to Operation Manual for power chuck.

Note: Any chuck cannot run without clamping a workpiece, otherwise the jaws may be thrown out, which may result in personnel injury.

5.2.3 X-axis and Z-axis

The carriage is driven to move along the bed in the Z direction by Z-axis motor through ball screw rod, the slide on the carriage is driven to move along the carriage in the X direction by X-axis motor through ball screw rod.

Principle of zero-point reset:

Within the moving area of carriage, there is a reference position (generally called reference point) called zero point of the machine. The coordinate system of the machine set by NC device takes this zero point as a reference point to realize the control of carriage motion. The two axes of the machine have adopted the absolute encoders which possess memory function for the servo system, and before the delivery of the machine, reference-point return has been carried out and the mechanical coordinate system has been established, therefore, when power off, the set coordinate system will be kept and memorized by the encoder. Hereby, it is not necessary for the user to do reference-point return every time after power on while operating the machine. Even if the system doesn't alarm while the reference-point is lost due to the energy loss of the battery or the reference-point position of the machine has been changed due to the relative-position change of servo-motor axis (X-axis and Z-axis) to the leadscrew (X-axis and Z-axis) while maintaining, it is still necessary to reset the reference point. For the specific method of reference-point setting, please refer to 《Instruction Book of Electric Unit》 .

5.2.4 Turret

The turret of the machine is series SLD170 series vertical turret which is designed by our factory. It doesn't need to be lifted for indexing. The characteristics of the turret lie in the short time for indexing and accurate accuracy in positioning. And it adopts inner-type cooling.

And the turret is available with both 4 stations and 6 stations. For details of operation and maintenance, please refer to INSTRUCTION BOOK for SLD170—⁰⁴ .

⁰⁶
According to the user's requirement, horizontal 8-station turret can be provided also.

5.2.5 Tailstock

The machine's standard disposition is manual tailstock, and hydraulic tailstock is optional.

The manual tailstock is the same as the one used for the universal lathes, it is locked to the bed by the principle of eccentricity, and by help of turning handwheel to make the

leadscrew drive the tailstock can obtain tailstock spindle advancing and retreating.

Advancing and retreating of the hydraulic tailstock and pneumatic tailstock are realized according to the hydraulic principle and pneumatic principle. The limit switch used by the tailstock body can prevent the carriage from bump with the tailstock.

5.2.6 Hydraulic System

- The hydraulic system of the machine consists of oil tank, oil pump, operating plate and hydraulic valves, etc. The system is used to control changing speed of oil cylinder of the machine and lubricate the gears and the bearings in the headstock.
- Major specifications of hydraulic system
 - Hydraulic motor: Y802—4 (B3) 0.75 kW 1390 r/min
 - Hydraulic pump: CB-B6 (Reverse running only)
 - Rated pressure: 2.5 Mpa
 - Delivery capacity: 6 ml/r
 - Volume of oil tank: 32 L
 - Pressure of hydraulic system: 1 MPa
 - Overall dimension of oil tank: 920 mm × 290 mm × 230 mm
- Pressure adjustment of the machine

The hydraulic system of the machine uses CB-B6 gear pump (Only reverse running is allowed), and the outlet pressure of the pump is adjusted by MRF-02P-1-20 spill valve. In general case, its pressure is adjusted to about 1 Mpa and the pressure value can be read from the pressure gauge.
- The oil tank is placed within the front bed leg, it can be seen when the protecting cover on the rear of the machine is opened. There is an oil level indicator and filling oil hole on the top of the oil tank and the drain hole at the bottom of the tank. The oil tank uses net YA-N46 hydraulic oil; the oil filled should be up-to the highest oil level of the tank when filling oil. The oil level in the tank should regularly be checked to prevent the machine from un-function due to too little oil. For the first time, after the machine has been worked for 3 months, renewing oil and cleaning the oil tank and the filter should be done, later, do it once every year.
- Oil resource:

The oil supply is pumped to the hydraulic control plate placed inside the protection door on the left of headstock by means of the small flowing gear pump CB-B6 (Only reverse running is allowed.) driven by the motor Y802-4. Normal working pressure is 0.8-1.5Mpa. The plate is provided with two reversing slide valves, two single-way throttle valve, one spill valve, pressure meter, etc. and by help of the pressure meter,

you can observe the adjusted pressure of the spill valve.

- Pressure oil controlled by the valves flows into the oil cylinder in headstock through oil pipes, which can generate three kinds of action, that is, change speed I, II and III (Headstock with conversion has five kinds of actions). The MRF-02P-1-20 spill valve supplies lubricating oil for headstock. Returning oil returns into the oil tank through the two nylon pipes at the lower part in the front of headstock.
- For the principle, the component and the acting order of the whole hydraulic system, refer to the Principle Diagram for hydraulic system (Fig.5).
- It should be remedied on time when trouble occurs in the system. For example, if the pressure is too low or no pressure, check whether the adjustment of the spill valve is proper, the inlet of the oil pump is blocked or air is sucked in as well as the motor is running in correct direction. If the oil cylinder does not work or its speed is too low the oil flowing must be not fluent or not enough, so it is necessary to check if there is leakage or blocking. If automatic cycle cannot be realized in working, check if control signal is correctly sent out or performed, and the electromagnet and pressure relay is abnormal, and do check for other electrical reasons, and also check if the electromagnet core is blocked by dirt.

Table of Hydraulic Component (Oil tank, pipe line and Control plate) Table 4

Name	Type	Specification	Qty.	Remarks
Oil filter	WU-63×100-J		1	
Pressure filter	XU-40×200	Pipe type	1	
Gear pump	CB-B6	Reverse	1	
Motor	Y802-4 (B3)	0.75kW	1	
Anit-vibration pressure gauge	Y-60-Z-IV	6MPa	1	
Spill valve	MRF-02P-1-20		1	
Solenoid valve	SWH-G02-C2-D24-20		1	
Solenoid valve	SWH-G02-C7-D24-20		1	
Throttle	TVCM-G02-Y		2	

- Hydraulic chuck and Hydraulic tailstock (Optional part)

The optional parts for the machine include hydraulic chuck and hydraulic tailstock. According to the requirements of the users, the hydraulic chuck and hydraulic tailstock can be disposed.

Independent hydraulic oil tank takes the charge of supplying oil for hydraulic chuck and hydraulic tailstock. The hydraulic control valves are mounted on the cover of the oil tank in overlaid way, compact in structure and convenient in installation.

◆ Major specifications of hydraulic system

Hydraulic motor: Y90L-4 (B5) 1.5kW 1500 r/min

Hydraulic pump: VPVC-F20-A2-02

Delivery capacity: 11ml/r

Range of pressure adjustment: 1.4~3.5MPa

Volume of oil tank: 90L

Pressure of hydraulic system: 2.5MPa

Overall dimension of oil tank: 600 mm × 460 mm × 800 mm

◆ Hydraulic transmission principle

For hydraulic transmission principle, refer to the Fig.6: Principle diagram. For hydraulic chuck, refer to Fig.7, and for hydraulic tailstock, refer to Fig.8.

◆ Oil resource

The hydraulic system adopts VPVC variable vane pump made by Taiwan Northman Company. This kind of pumps is characterized by low noise and stable performance. Practical flow rate of the pump can be adjusted according to speed of the chuck. The rated pressure of the pump is 3.5 Mpa and the working pressure is 2.0-3.0 Mpa. The pump uses HL 46 hydraulic oil.

◆ Return of the chuck

The return of the chuck consists of check valve, relief valve, solenoid valve and pressure relay.

The check valve MC-02P-05-20 prevents the clamping return from being interfered with other returns.

The relief valve MPR-02P-K-O-20 is used for adjusting the clamping pressure according to requirements of work. The normal adjusting range is of 1.2-2.5Mpa.

When the electromagnet YV1 is electrifying, the chuck is clamping and YV2 electrifying, the chuck is releasing.

After workpiece is clamped, the pressure relay will send out signal. Refer to the action table of the principle diagram. During turning, if the pressure goes down due to troubles of the system, the pressure relay will send an alarm signal, making the machine stop working.

◆ Return of the tailstock

The return of the tailstock consists of relief valve, double-side single-way throttle, electromagnetic reversing valve and pressure relay. The relief valve is used to adjust the pressure of tailstock and its range for adjusting pressure is of 1.0~2.0Mpa according to the sizes of the workpieces to be turned. The tightening speed is adjusted

by the throttle MT—02W-K-30, when the electromagnet is electrifying, the tailstock is tightening, then, the pressure relay sends out a signal of the tailstock tightening. When YV4 electrifying, the tailstock is withdrawing. Refer to the Table of action of the principle diagram. During turning, if the pressure goes down due to troubles of the system, the pressure relay will send out an alarm signal, making the machine stop working.

- Maintenance of the hydraulic system
 - ◆ The hydraulic system uses HL 46 hydraulic oil, and the oil should be periodically changed according to the use of the oil.
 - ◆ Check often the oil inside the oil tank, and add it when its level lower than the lowest oil level.
 - ◆ When adding the oil into the oil tank, the oil must go through the air filter.
 - ◆ Check and change the oil suck filter periodically inside the oil tank.
 - ◆ If abnormal noise or vibration occurs from the hydraulic system, inspection and maintenance must be done at once.

Adjusting value of hydraulic system parameter (Chuck, Tailstock) Table 5

Name	Adjusted Element	Adjusted Value
System pressure	Pump VPVC—F20—A2—02	2.0 MPa (2.0~2.5MPa)
Clamping pressure of chuck	Relief valve MPR—02P—K—1—20	1.5 MPa (1.2~2.5MPa)
Clamping signal	Pressure relay MPS—02P—1—10 (SP1)	Same as the pressure of relief valve of the chuck
Tightening pressure of the tailstock	Relief valve MPR—02P—K—0—20	1.0 MPa-2.5 MPa
Tightening signal	Pressure relay PS—70 (SP3)	Same as the relief valve of the tailstock
Chuck speed	Max. flow quantity of the pump	Depending on need
Tailstock speed	Restrictor MT—02W—K—30	Depending on need

List of hydraulic elements (Chuck, Tailstock)

Table 6

Name	Type	Remarks	Manufacturer
Pump	VPVC-F20-A2-02		Taiwan Northman Company
Check valve	CI-PT-03-05-10		
Check valve	MC-02P-05-0-20		
Relief valve	MPR-02P-K-O-20		
Throttle	MT-02W-K-30		
Solenoid valve	SWH-G02-D2-D24-20		
Pressure relay	PS-70		
Air filter	AB-1163		
Pressure gauge	Y-60-Z (III) 6 MPa		

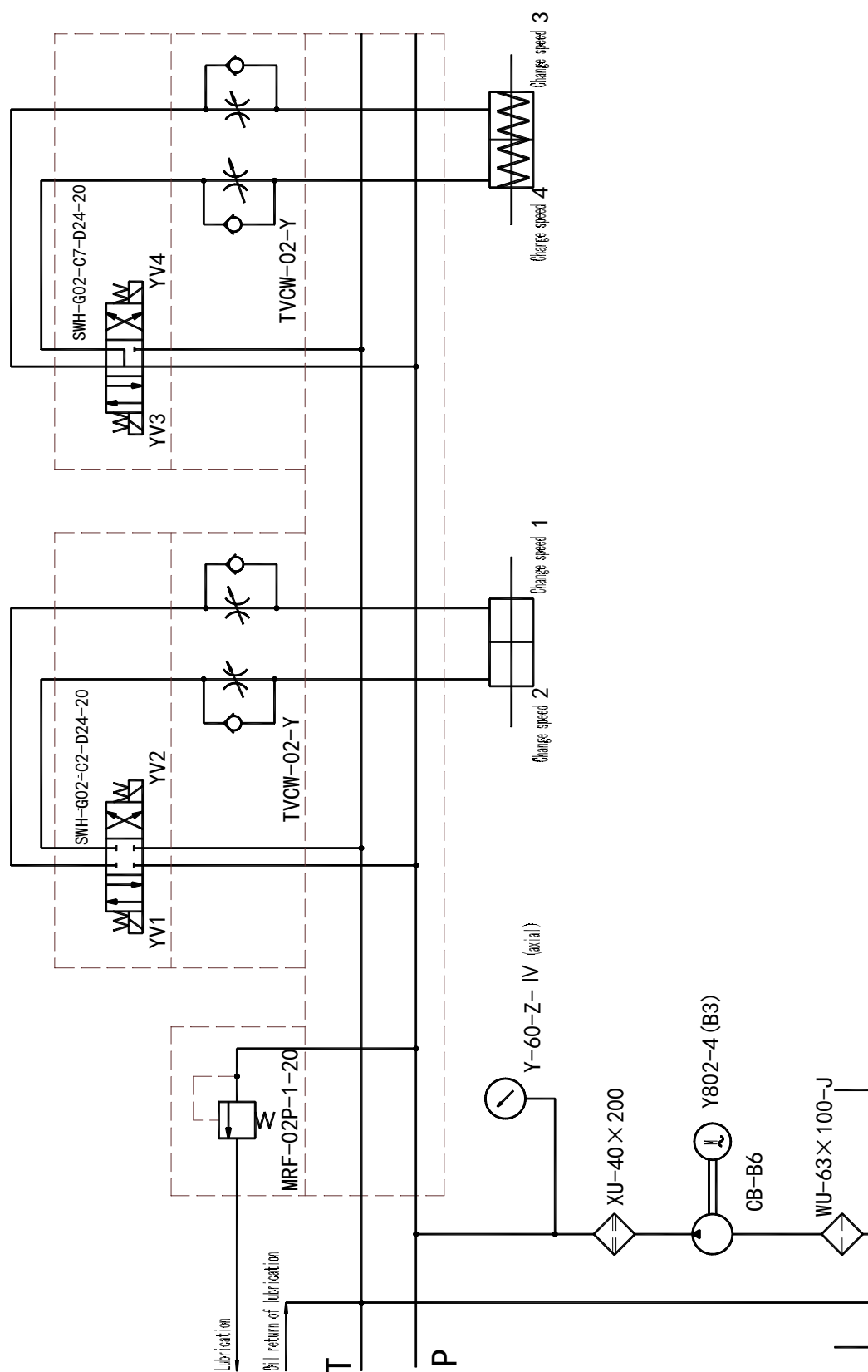


Fig.5 Diagram of change speed of spindle and lubricating principle

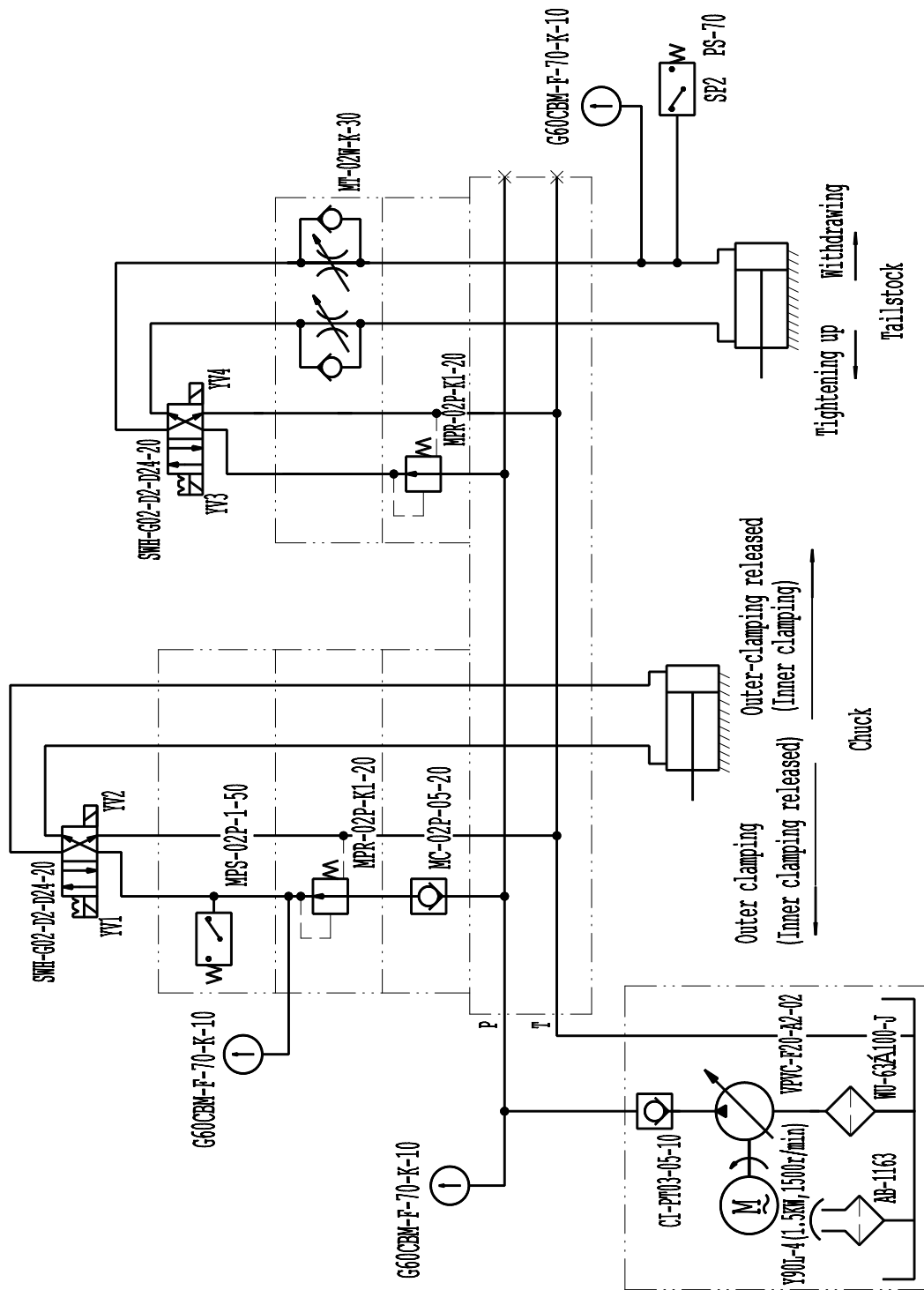


Fig. 6 Principle diagram of hydraulic chuck and tailstock

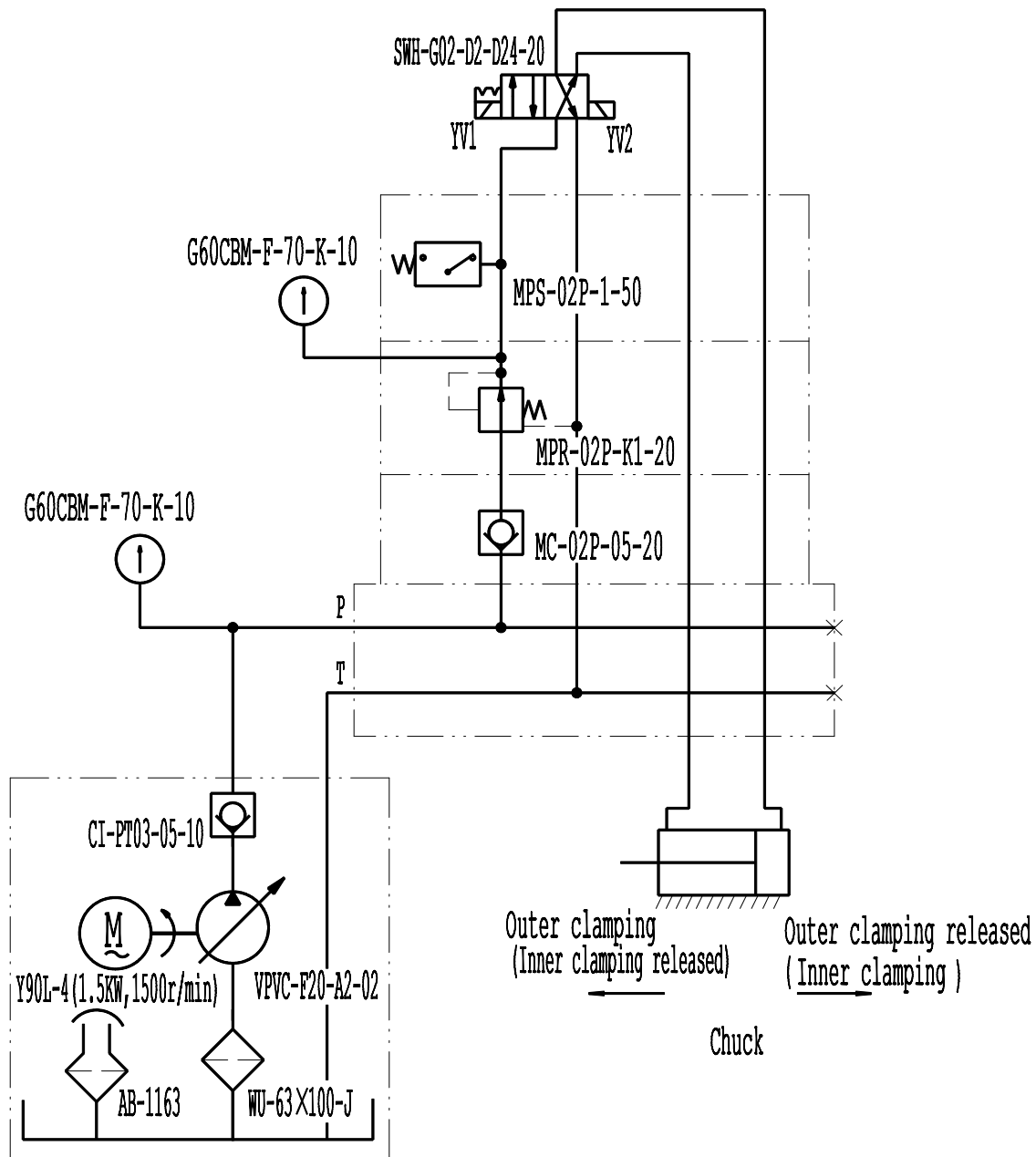


Fig. 7 Principle diagram of hydraulic chuck

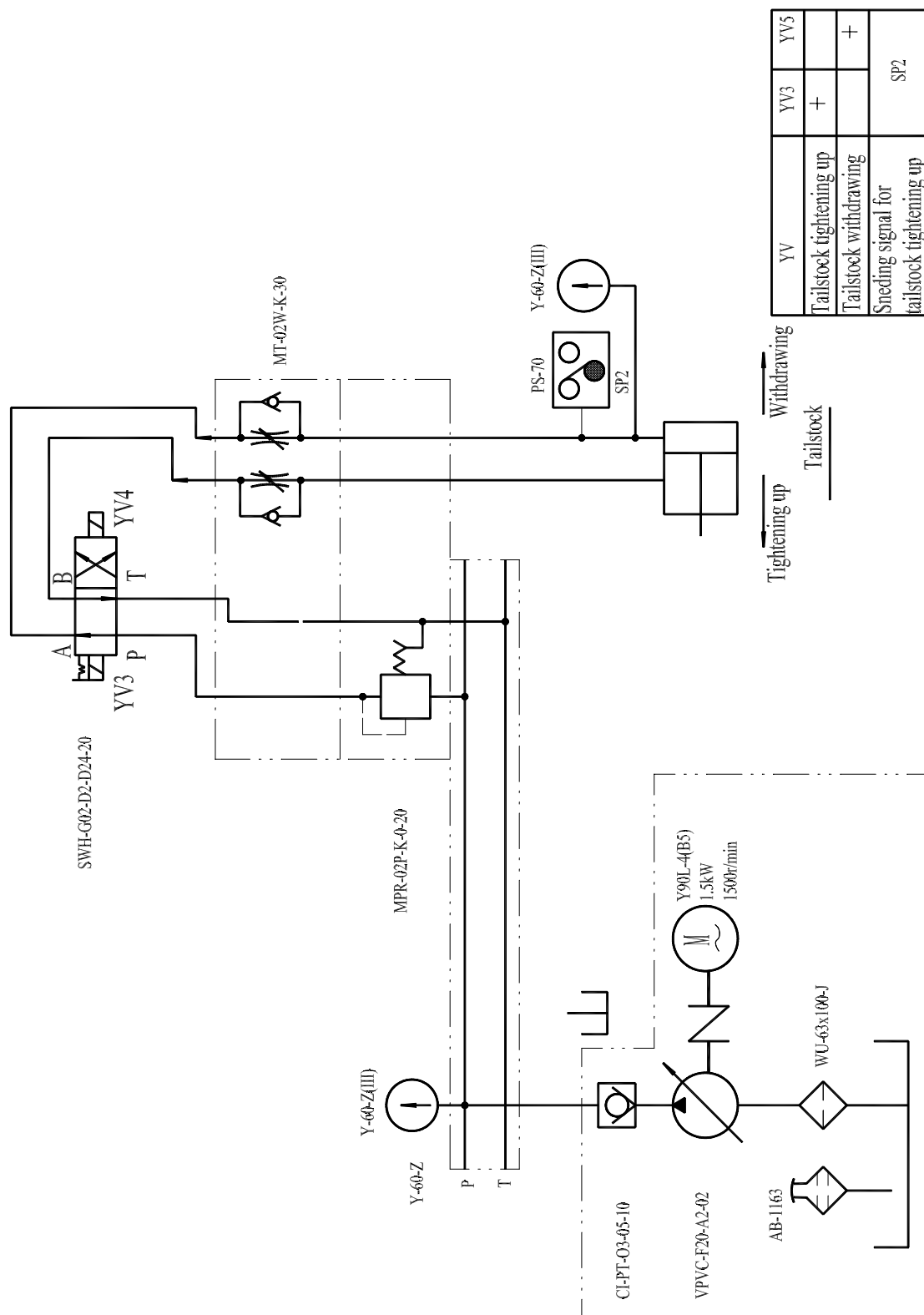


Fig.8 Principle diagram of hydraulic tailstock

This machine has two kinds of hydraulic systems for user's selection: One is with hydraulic chuck and hydraulic tailstock, but the other one only has hydraulic chuck. For the machine without hydraulic tailstock, only the overlaid circuit of tailstock is removed, all other parts are remained as the same.

This section only explains the circuit and principle of the hydraulic chuck; all the other parts are the same as the description above.

- Return of the chuck

The return of the chuck consists of check valve, relief valve, magnetic reversing valve and pressure relay. The check valve MC—02P-05-20 prevents clamping return from being interfered with other returns. The relief valve MPR—02A-K-O-20 is used to adjust clamping pressure of the chuck and the adjusting range of the clamping force are 1.2~2.5 Mpa according to the sizes of the workpieces to be cut. When electromagnet YV1 is electrifying, the chuck will be clamping, and the electromagnet YV2 electrifying, the chuck is releasing.

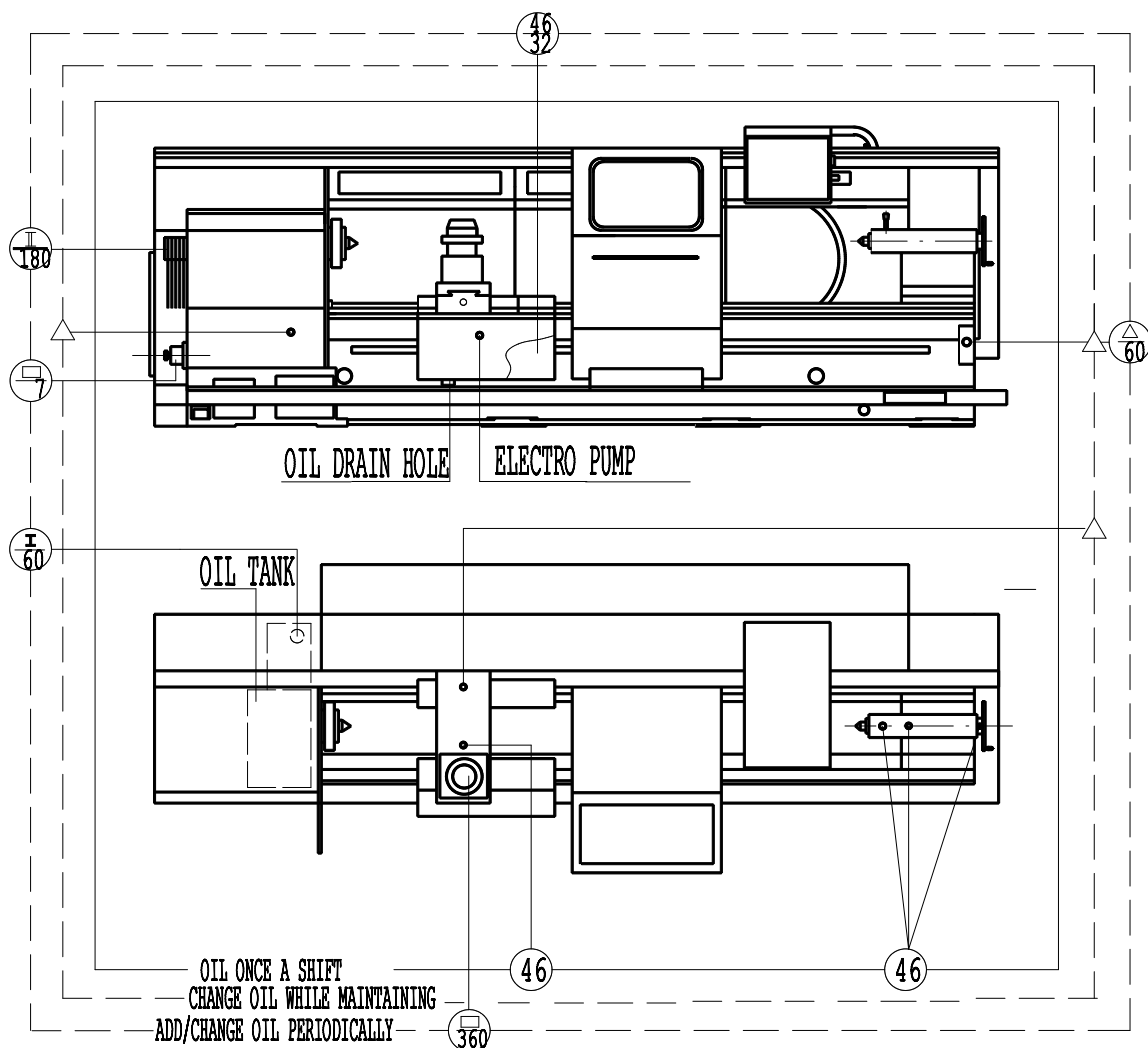
After the workpiece is clamped, the pressure relay PS—70 (SP1) sends out a ready signal, during machining if the pressure goes down due to troubles of the system, SP1 would send out a alarm signal, making the machine stop working.

- Hydraulic return of frequency-conversion headstock

The frequency-conversion headstock has four kinds of changing speed. Pressure of CB-B6 gear pump is adjusted by the spill valve MRF-02P-1-20, and its adjusting range is of 0.8-1.0 Mpa.

5.2.7 Lubricating System

Refer to Fig. 9.



④6	HL46 HYDRAULIC OIL	Ⓡ	HL46 HYDRAULIC OIL
⊖	OIL KINDS/CHANGING-OIL INTERVAL(DAYS) FOR TWO SHIFTS A DAY		
Ⓡ	4# MOLYBDENUM DISULFIDE	□	NO. 2 CA-BASED GREASE
		△	NO. 3 COMMON LI-BASED GREASE

Fig. 9 Lubrication chart

6 INSPECTION AND MAINTENANCE

6.1 Routine Inspection

Routine Inspection			
No.	Checked Position	Checked Object	Remarks
1	Oil gauge for lubricating position	<ul style="list-style-type: none"> ● Check if it has enough oil. ● Check if the oil is polluted obviously. 	Add oil when it is not enough.
2	Level of coolant	<ul style="list-style-type: none"> ● Check if level of the coolant is proper. ● Check if the coolant is polluted obviously. ● Check if the filter of the oil pan is blocked. 	Add it when necessary. Change it when necessary. Clean it when necessary.
3	Guideways	<ul style="list-style-type: none"> ● Check if the lubricant is enough. ● Check if the scraper is damaged. 	
4	Pressure gauge	<ul style="list-style-type: none"> ● Check if the pressure is enough. 	See 5.2.6 Hydraulic system
5	V-belt	<ul style="list-style-type: none"> ● Check if the tension is suitable. ● Check if the surface of the v-belt has any break or scratch. 	
6	Pipe, appearance of the machine	<ul style="list-style-type: none"> ● Check if there is any oil leakage. ● Check if there is any coolant leakage. 	
7	Movable parts	<ul style="list-style-type: none"> ● Check if there is any noise or vibration. ● Check if it moves smoothly and normally. 	
8	Operating panel	<ul style="list-style-type: none"> ● Check if the functions of the lever and switch is normal. ● Check if it shows alarm. 	
9	Safe devices	<ul style="list-style-type: none"> ● Check if it works normally. 	
10	Cooling fan	<ul style="list-style-type: none"> ● Check if the fans on the cabinet and operating panel work normally. 	
11	Outside wires and cables	<ul style="list-style-type: none"> ● Check if there is any wire broken ● Check if any bushing had damaged. 	
12	Motor, gear box and other rotating parts	<ul style="list-style-type: none"> ● Check if there is any noise or vibration ● Check if there is any abnormal heat created. 	
13	Cleaning	<ul style="list-style-type: none"> ● Clean the surface of chuck, cover of turret guideway and chip apron. 	Clean them at the end of work
14	Lubrication of the chuck	<ul style="list-style-type: none"> ● Lubricate around the jaws. 	Once a week
15	Machining of the machine	<ul style="list-style-type: none"> ● Check if the machining accuracy is kept within the requirements of the specifications. 	

6.2 Periodic Inspection

No.	Checked position		Maintained Object	Period
1	Hydraulic system	Hydraulic unit	● Change hydraulic oil and clean the filter	6 months
		Pipe joint	● Leakage inspection	6 months
2	Lubrication system	Lubrication unit	● Clean oil filter	1 year
		Pipe line	● Check if there is any leakage, blockage or breakage	6 months
3	Cooling devices	Chip Filter	● Clean the chip pan ● Change coolant, clean the filter and water tank	At proper time
4	Air	Air filter	● Clean or change the filter	1 year
5	V-belt	Belt	● Appearance inspection, check the tension of belt	6 months
		Pulley	Clean the pulley	
6	Spindle motor	Noise, vibration temperature, insulance	● Check the abnormal noise of the bearings and other places Clean the pulley	6 months
7	Servo motors of X、Z-axes	Noise, temperature	● Check the abnormal noise and temperature raise of the bearings and other places	1 month
8	Chuck	Chuck	● Remove it and clean out the chip inside it	1 year
		Cylinder swing	● Turn the cylinder to check leakage	3 months
9	Operating panel	Electric unit and wiring screw	● Check if there is any abnormal smell or colour, if the contact surfaces had worn or the screw has been loosen	6 months
			● Clean out dirty things	1 month
10	Connection of inside units	Cabinet, electric connections between the units of the machine	● Check and tighten the wiring screws ● Check and tighten the screws of terminals	6 months
11	Electric unit	Limit switch Sensors Solenoid valve	● Check and tighten the installing screws and wiring screws	6 months
			● Check their functions and actions by proper operation	1 month
12	X, Z axes	Clearance	● Measure the clearance with micrometer	6 months
13	Base	Bed level	● Check the level of the bed with level, and adjust it when necessary	1 year

6.3 Lubrication and Cooling

6.3.1 Hydraulic Device

Major items of maintenance of hydraulic device are to change / renew and supply hydraulic oil, inspect and clean oil filter.

- Changing of hydraulic oil

Although change/ renewal of hydraulic oil is depending on using frequency of the machine, basically, hydraulic oil should be changed when the machine has worked for three months, and whole hydraulic oil should be completely changed, after this, changing oil once for every six months is OK!

- Cleaning of oil filter

It is necessary to inspect and clean the oil filter when changing the oil. First, dismount sucking oil pipe, further, take the oil filter out from oil tank. In general, the oil filter should be changed every year.

6.3.2 Lubricating Device

Major items of inspection and repair of lubricating device are as follows:

6.3.2.1 Filling oil

Filling oil should be done according to related regulations.

6.3.2.2 Cleaning or Changing of oil filter

- Cleaning or changing of oil filter

Cleaning or changing the oil filter in apron should be done once a year. The oil filter can be seen after the oil pump is taken out from apron. Don't forget to clean the inside of apron after taking the oil pump out.

- Cleaning or changing the oil filter in headstock

Cleaning or changing the oil filter in headstock should be done once every six months. When doing cleaning or changing job, first, take the oil filter and copper net out from upper part of the left endface of headstock, then, do cleaning job. Change it if necessary.

- Inspection of lubricating condition of lubricating parts

In order to make sure that every lubricating element can be lubricated, it is necessary to check every lubricating point of every element. If an element is not lubricated, the reason may be that there is leaking oil in the lubricating oil pipes or some pipe joint is blocked. Blocked pipe joint is not allowed to use again, it is necessary to change it with a new one.

6.3.3 Cooling Device

Items of inspection and repair of cooling device are as follows.

- Check if the cooling pump is normal.
- Change coolant.

You should check coolant level in the coolant tank (chip plate) as soon as coolant being jetted from the coolant jet decreases. If coolant is not enough, add it and make its level be over the sucking mouth of the cooling pump. If coolant is too dirty, change the coolant in the coolant tank completely. At the same time, clean the inside of the chip plate.

- Cleaning of coolant filter

Take the coolant filter out to wash it or change it.

6.4 Adjustment and Maintenance of the Machine

6.4.1 Adjustment of V- belts

The V-belts and bearings may reduce their service life if tension of V-belts is more than allowable value. Conversely, if the tension is too small, the V-belts will have not enough force to transfer rated power.

By help of moving the motor base up or down, the tension of the V-belts can be adjusted. Proper tension of the V-belts should be determined by help of flexibility resulting from loading of the V-belts.

Adjusting tension of the V-belts according to steps given below.

The first adjusting time should be after the V-belts are used for 3 months, later on, adjust them once every six months

Adjusting steps:

- Pull the belt up at the direction vertical to the belt by hand. Applied force must be at middle of the two pulleys.
- Screw up the four installing bolts on the motor base.
- Screw the adjusting bolts to move the motor base to make the belts having proper tension.
- Cleaning grooves of the pulleys

If there is oil, dirty matters, dust or similar foreign matters in the grooves of the pulleys, the belts may slip to reduce serving life of the belts.

6.4.2 Adjustment of Spindle

The spindle of the machine employs rolling bearings (see Fig.10). The nut 1 is used to adjust rolling clearance of two axial positioning bearings. The match of the nut 2 and the

nut 3 is used to adjust diametrical rolling clearance of two double row ball bearings, and rolling clearance of the double row ball bearings on the rear supporting point of spindle is adjusted by the nut 4.

Too large or too small clearance of spindle bearings can directly affect machining accuracy and normal use of the machine.

If the radial run-out or the axial slip of the spindle is found not to meet the requirements of the Test Certificate, do adjustment according to the description mentioned above. If the requirement is still not obtained, check if the bearings and concerned components have been damaged.

After adjustment is finished, the machine should be tested by dry-run, and running time at the speed of 1000 r/min should not be less than one hour. Temperature rising of the spindle during running should not exceed 40 °C and it is necessary to observe the changing of temperature rising. If there is abnormality, stop the machine at once and then the machine must be checked and adjusted by special personnel.

Tightening screw 5 is used to fix the gear 6. This gear can send signal to the spindle encode. Pay attention to check whether the tightening screw is loose if turned threads is not exact.

The front bearing and the rear bearing of the spindle all employ 3# high speed spindle grease for lubrication.

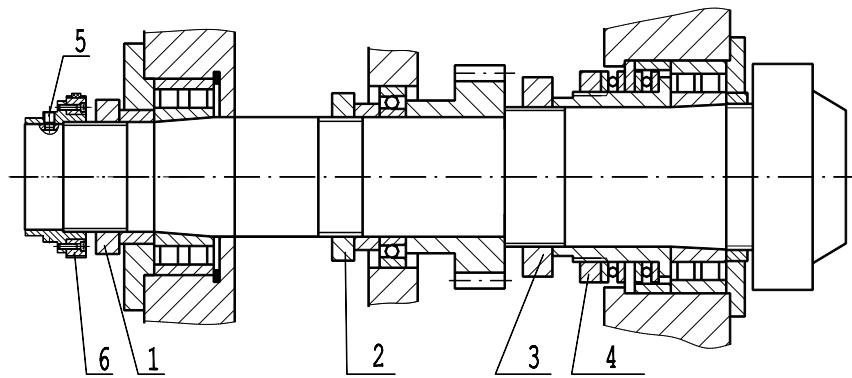


Fig.10 Spindle structure

6.4.3 Chuck

If hydraulic chuck has been used for a long time, there may be accumulated fine chips inside the chuck, which can result in troubles, so the chuck should be dismantled and cleaned once every six months.

6.4.4 Clearance

The longitudinal and traverse feed motion of the machine are obtained by servo motor

through retarding from the first class gears to drive ball screw rod, the ball screw rod and the nuts on it will transfer rotation to straight movement for realizing longitudinal and traverse movement.

In order to eliminate clearance generated by two gears during feed, driven gears employ the elimination clearance structure shown by Fig.11. If you want to reduce the clearance, you may loosen the locking nuts 1 at first, then, two locking screws 2, in this case, the two gears can rotate in different directions under the actuation of the spring 3 to make the clearance be reduced, then, retighten the screws and the nuts.

The expansion sleeve 4 is used to fix the gears and the motor shaft. When dismantling or locking them, you may loosen and screw down the screws uniformly.

If feed is found not exact, check if every screw and nut mentioned above is loose, if the clearance of bearings is too large and if the expansion sleeve is slip.

The nut body of the ball screw rod is not allowed willingly to be dismantled, if there is any trouble, please make contact with the manufacturer.

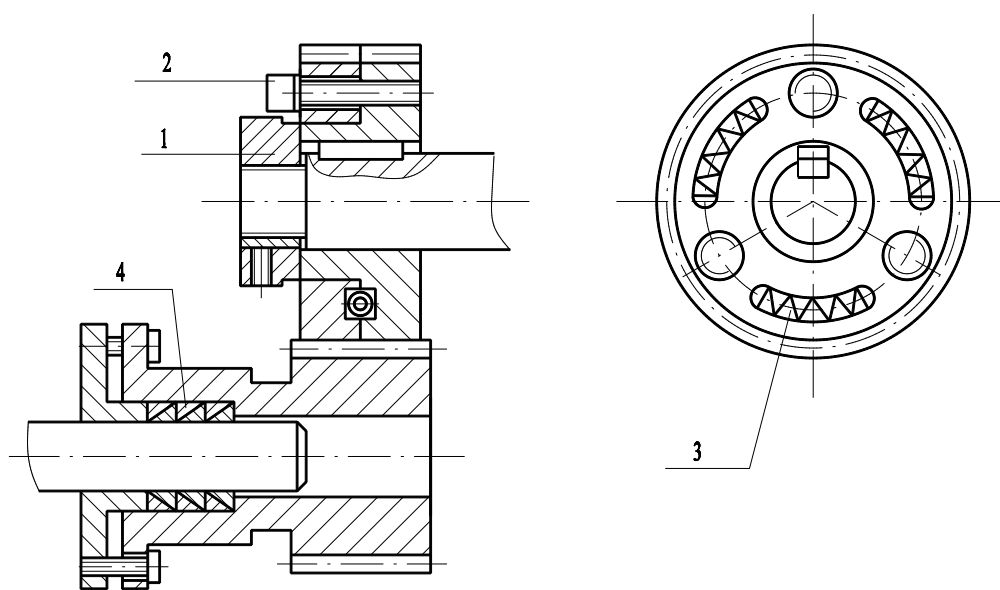


Fig.11 Adjustment of clearance

7 TOOL DISPOSITION

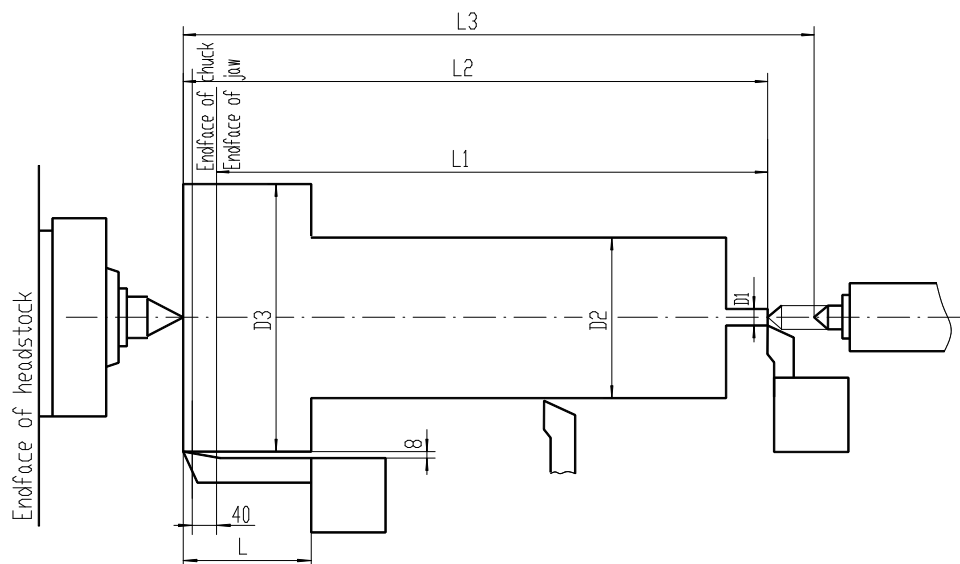


Fig.12 Turning limitation size drawing of 4-station turret

Mark	Description	Size mm	Remarks
D1	Min. turned dia. when normal extension of tool	$\phi 40$	
D2	Max. swing dia. of workpiece over carriage	$\phi 480$	
D3	Max. swing dia. of workpiece over bed	$\phi 800$	
L	Max. turning length in the case of D3.	Overhang length of tool rod	Pay attention to station -change of tools

Size of the Machine	1500	3000	5000
L1	1350	2800	4800
L2	1500	2850	4850
L3	1500	3000	5000

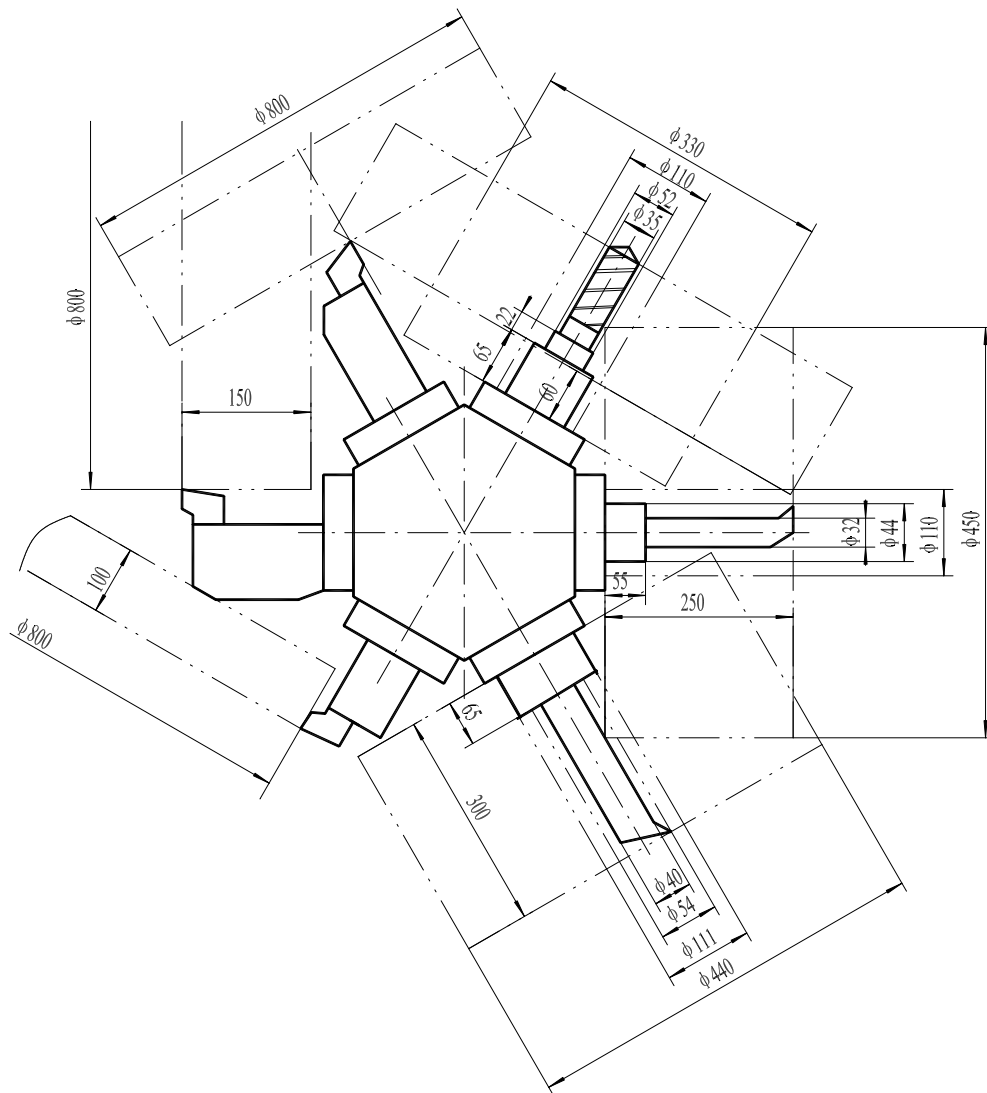


Fig.13 Turning limited-area drawing of standard tools for vertical 6-station turret

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