



Z30⁴⁰₅₀×¹²₁₆ (I)(II) RADIAL DRILLING MACHINE

OPERATION MANUAL

SHENYANG MACHINE TOOL CO.,LTD.
CHINA CZECHOSLOVAKIA BORING AND DRILLING
MACHINES WORKS
THE PEOPLE'S REPUBLIC OF CHINA

This file is made for Model Z30⁴⁰/₅₀ × ^{12(I)(II)}/_{16(I)(II)} Radial Drilling Machine

This machine was built according to the Standards; standards of
"accuracy Inspection for radial drilling machine" GB/T4017-1997.

PRECAUTIONS

Be sure to read this manual as detailed as possible and understand thoroughly all the contents in it before operating the machine.

Be sure to keep this manual properly for running maintenance and correct operation.



WARNING

You must read this "Operation Manual", the installation, operation and maintenance must follow its requirements to prevent from equipment damage and personnel injuries!

- ◆ The handling of the machine tool must be carried out following the "Machine Tool Handling Diagram" and using the equipment such as special hook, bolt, etc. provided along with the machine tool.
- ◆ Should the installation of the machine tool takes place in a different site, the handling is allowed only after all the places of the machine tool have been in a clamping status and adjusted to a specified position conformed to the "Machine Tool Handling Diagram".
- ◆ Before operation of the machine tool, the reliability of clamping and releasing of all positions of the machine tool and the reliability of all travels must be verified, the reliability of the grounding of power supply, the rightness of phase sequence and the reliability of emergency stop push-button must be checked.
- ◆ The working parts and cutters must be installed and clamped firmly and reliably, over cutting is forbidden.
- ◆ The column and spindle head must be clamped before cutting, otherwise personnel injury is easy to happen.
- ◆ According to the different machined material and drill diameter, the rotation speed and feed quantity shall be selected reasonably following the content listed in the table on the front panel, otherwise the machine tool is easy to be damaged.
- ◆ The spindle-moving handle turns during the motorized feed of the spindle, the operator shall take care to be away from it, otherwise injury is easy to happen.
- ◆ The spindle protection device must be used during cutting.
- ◆ Other persons are not allowed to stay in the working area when the machine tool is in operation, the passers-by are not allowed enter into the forbidden area.
- ◆ The operator shall carefully look about personnel and material to prevent from injury or damage when he (she) releases the column and is ready to turn the arm.
- ◆ The squeezing points are existed between the spindle head and the stop block as well as between the arm and outer column, the operator must pay attention to safety during operation.
- ◆ The general power switch must be disconnected before maintenance of the machine tool.
- ◆ When the machine tool is failure or in a dangerous state, first of all press the emergency stop push-button (Fig. 3.1, the front panel of the spindle head, item 1-1),

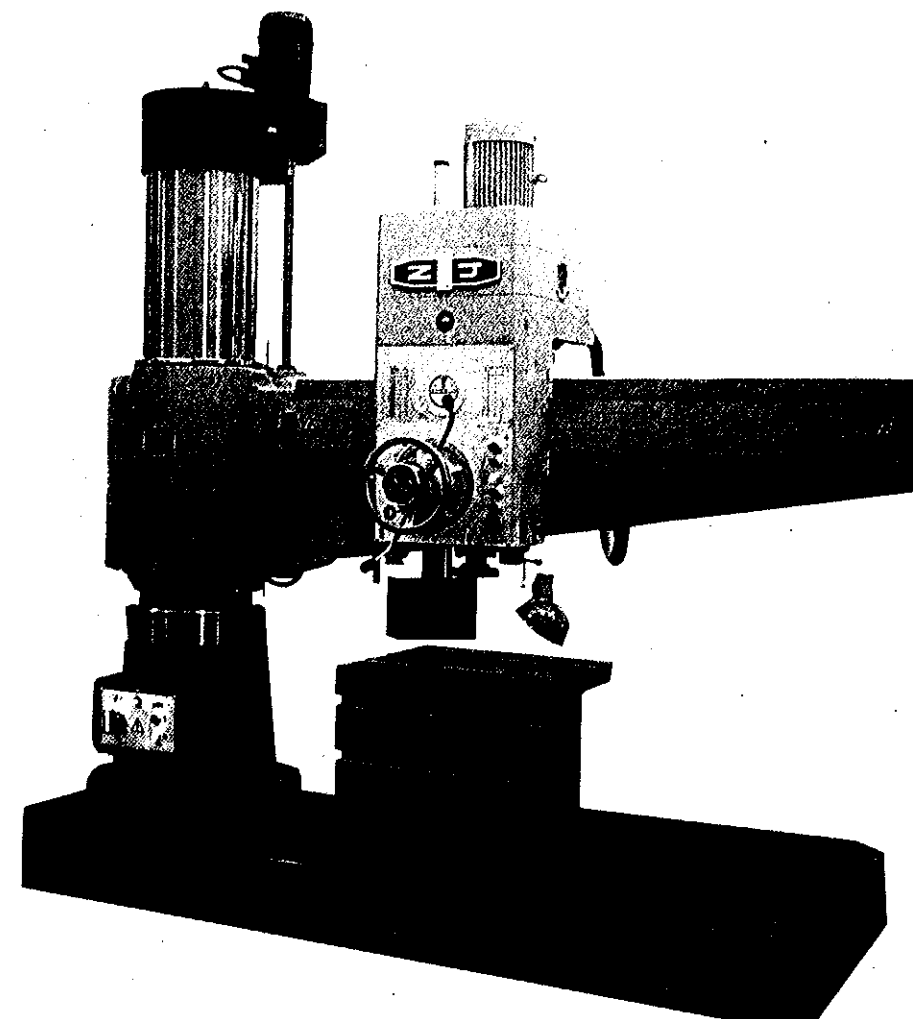
then press the general power switch (Fig. 4.4, column square door diagram, item 4-1); power on is not allowed before the fault has been removed.

- ◆ The operators of this machine tool must experience a skill training concerning the operation of this machine tool, possess with the ability of operating and using this machine tool, after that they are allowed to operate; maintenance personnel must possess with special maintenance ability; long-haired person must wear working cap.
- ◆ The operator of this machine tool must know well where is and how to operate the emergency stop push-button.
- ◆ The electrical maintenance personnel must work following electrician operating rules and regulations, and wear electrician-used insulated shoes. A special person must be set on guard at the general power switch or hang a warning board in the electrical maintenance period of the machine tool.
- ◆ The keys of the niche and general power switch must be kept by special person.
- ◆ Be careful that there is still voltage in the power line of the general power switch and the contactors during the inspection of electric equipment!
- ◆ In respect to the double-voltage machine tool, if the user intends to change the voltage from one to the another, the operation must be carried by a special person, the detail see electrical section.
- ◆ When machining the workpiece that avoid injury for spatter cooling water and chip. when the user require according as the machining workpiece shape and size that set up the guard plate before operating the machine.
- ◆ The machine should Turn off the main switch-QSI immediately When the door of electric Cabinet is openimy.
- ◆ When maintain the machine tool,if need dismantle the spindle banancing device,please pay attention to safety that avoid balance spring injury the worker.



PROHIBITION

- ◆ It is prohibited to loose the hanging rope without installing and tightening the anchor bolts during the installation of the machine tool!
- ◆ The abnormal operation such as changing cutter, checking parts, troubleshooting and cleaning cuttings, etc. is prohibited during the machine tool is in cutting operation!
- ◆ It is prohibited that the spindle impacts the upper and lower limit position of the spindle travel. When the spindle mechanical feeding approach to the limit position of the spindle travel must uncouple the spindle mechanical feeding change into manual operation that avoid damage the horizontal axis!
- ◆ It is prohibited to wear loose and comfortable outer clothing, ornaments which hinder the operation and gloves during the operation!
- ◆ It is prohibited to wipe the machine tool with kerosene, gasoline and other inflammable liquids; it is prohibited to clean the machine tool using the equipment of producing compressed air!
- ◆ It is prohibited for anyone to start, operate and repair the machine tool, turn on the switch and touch electrical appliance without authorization!
- ◆ It is prohibited to rotate the arm horizontally in excess of $\pm 180^\circ$!



Machine tool outside drawing

Machine tool outside drawing

CONTENTS

1	Introduction	7
2	Installation and Alignment	9
3	Technical Characteristics	28
4	Machine Tool Control	36
5	Common Faults and Troubleshooting	41
6	Safety Protection Device	43
7	Machine Tool Maintenance and Adjustment	44
8	Hydraulic System	48
9	Electric System	55

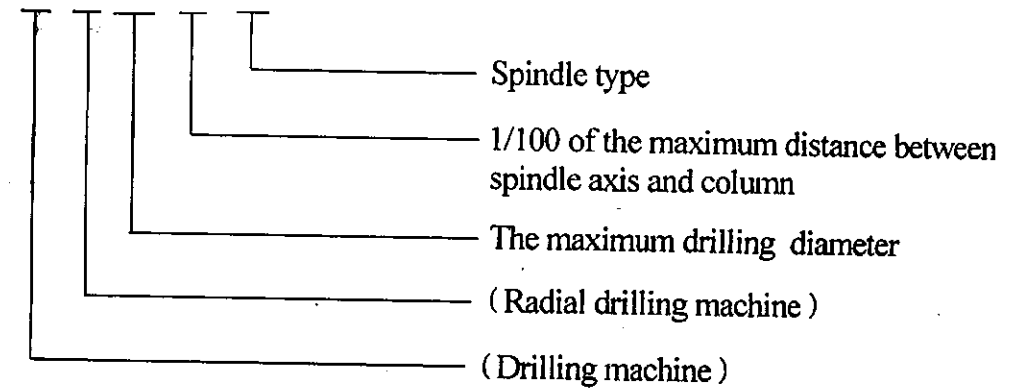
1 INTRODUCTION

1.1 The size and type and their meaning of the radial drilling machine

The machine tools described in this "Operation Manual" pertain to series of machine tools having the following sizes: Z3040×12(I), Z3040×12(II), Z3040×16(I), Z3040×16(II), Z3050×12(I), Z3050×12(II), Z3050×16(I), Z3050×16(II).

The type has the following meaning (e.g. Z3040×16(I)):

Z 3040X16 (I)



CE	
MODEL:	
WEIGHT:	kg
OVERALL DIMENTION:	
DATE:	
SERIAL NO.:	
ADDRESS:	25. ZHULIN ROAD. DADONG DISTRICT. SHENYANG CHINA
CHINA CZECH RADIAL DRILLING MACHINE WORKS	
(CHINA CZECHOSLOVAKIA FRIENDSHIP WORKS)	

F1.1 Machine tool nameplate

1.2 Main use and application range

Type Z3040×12(I), Z3040×12(II), Z3040×16(I), Z3040×16(II), Z3050×12(I), Z3050×12(II), Z3050×16(I), Z3050×16(II) radial drilling machines are mainly applied to the machine work such as drilling, reaming, fraising, reaming plane and tapping on large-and medium-size casting and steel workpieces.

The machining capability is listed in the following table:

Z3040 series	Casting	Steel	Z3050 series	Casting	Steel
Drilling	φ 40	φ 40	Drilling	φ 50	φ 50
Tapping	M20×2.5	M16×2	Tapping	M20×2.5	M16×2

1.3 Environmental requirement

The condition suitable for the machine tool: temperature 0°C~5°C, humidity 30%~85%, atmospheric pressure 86~106kpa, a better air cleanliness, dust concentration is not higher than 10 mg/m³, free from acidic, alkalinous and toxic gas; without explosive danger and conductive dust; no rain and snow attack in the factory building; the ground is good lighting condition) in the factory building; the machine tool shall be installed far from vibration, heat sources and heat stream.

1.4 The effect of the machine tool on the environment

This machine tool has no harmful effect on the environment, and no discharge of harmful gas or liquid.

The noise of the machine tool ≤85dB (A).

1.5 Energy resource

The energy resource the machine tool used is electric power.

2 INSTALLATION AND ALIGNMENT

Note: When leaving the factory, the spindle head, the arm and column are in a clamping state, after opening the packing head, please work following the sequence specified in the manual, connect the power supply, or release the clamping privately during handling or installation is absolutely not allowed, otherwise the machine tool damage due to topping over or personnel injury may happen.

2.1 The preparation of foundation

The foundation shall be completed before the installation of the machine tool, if you have selected type Z3040×12(I), Z3040×12(II), Z3050×12(I), Z3050×12(II) machine tool, the foundation will occupy an area of 2350×1300 mm, if you have selected type Z3040×16(I), Z3040×16(II), Z3050×16(I), Z3050×16(II) machine tool, it will occupy an area of 2600×1300 mm the depth of the foundation is decided according to the local soil condition, but not less than 500 mm. Since the arm may rotate horizontally, when you decide the location of the foundation, a minimum distance of 800 mm shall be kept from the existing adjacent equipment, fixed wall and safety pass, etc. to the horizontal movement limit position of the arm.

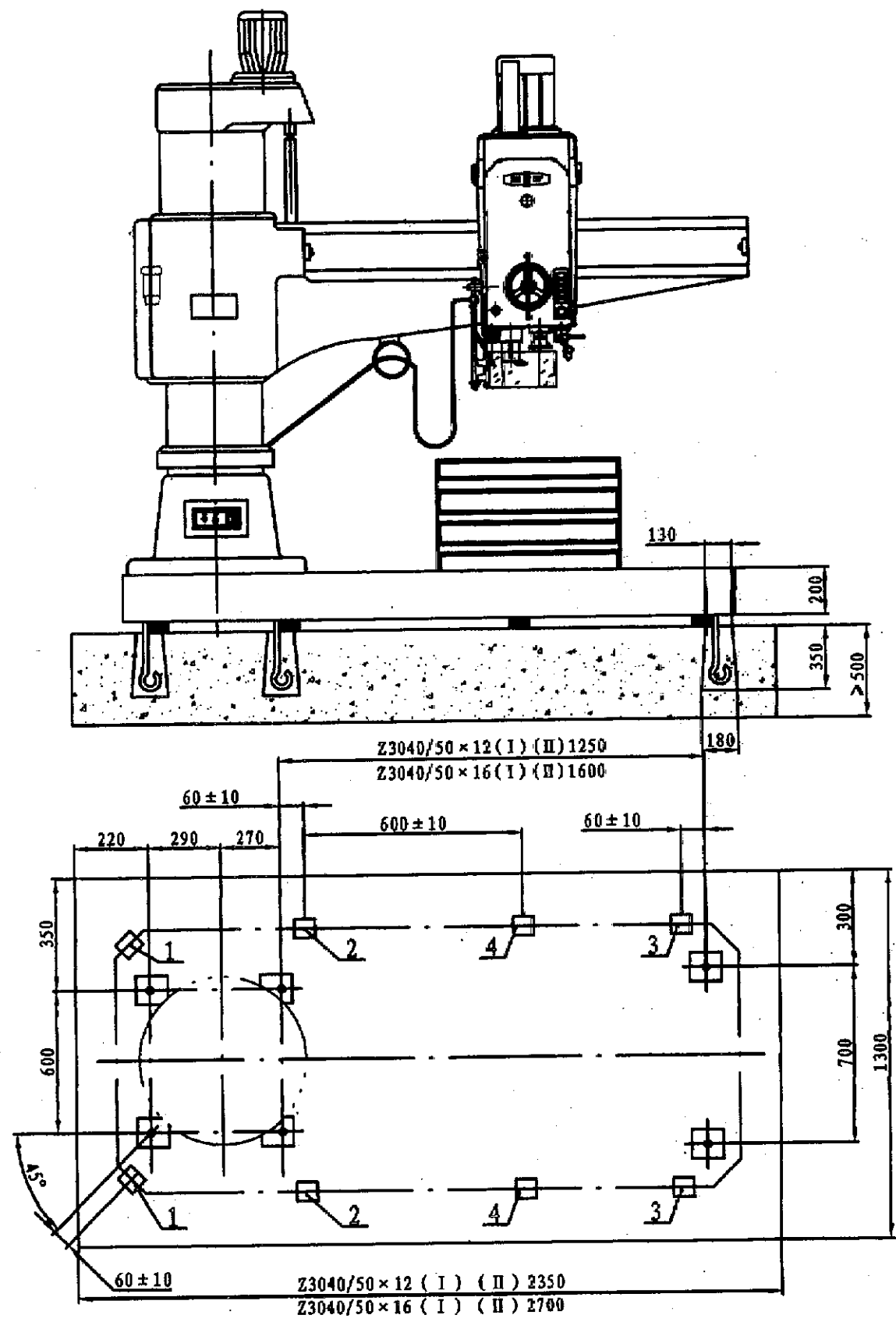


Fig. 2-1 Foundation Plan

2.2 Overall unit handling (Fig. 2.2)

If you purchased machine tool is packaged as an overall unit, after the packing head is opened, please first loose the screws used to fix the bench and the machine tool body, turn the bench 90° in a horizontal plane, then move the bench vertically to the center of gravity of the overall unit, fasten the bench to the machine tool body with screws, after that, rope the overall unit, and put soft material at the places where the rope contacts with the surface of the machine tool to prevent from bruising the surface of the machine tool, then the handling may start.

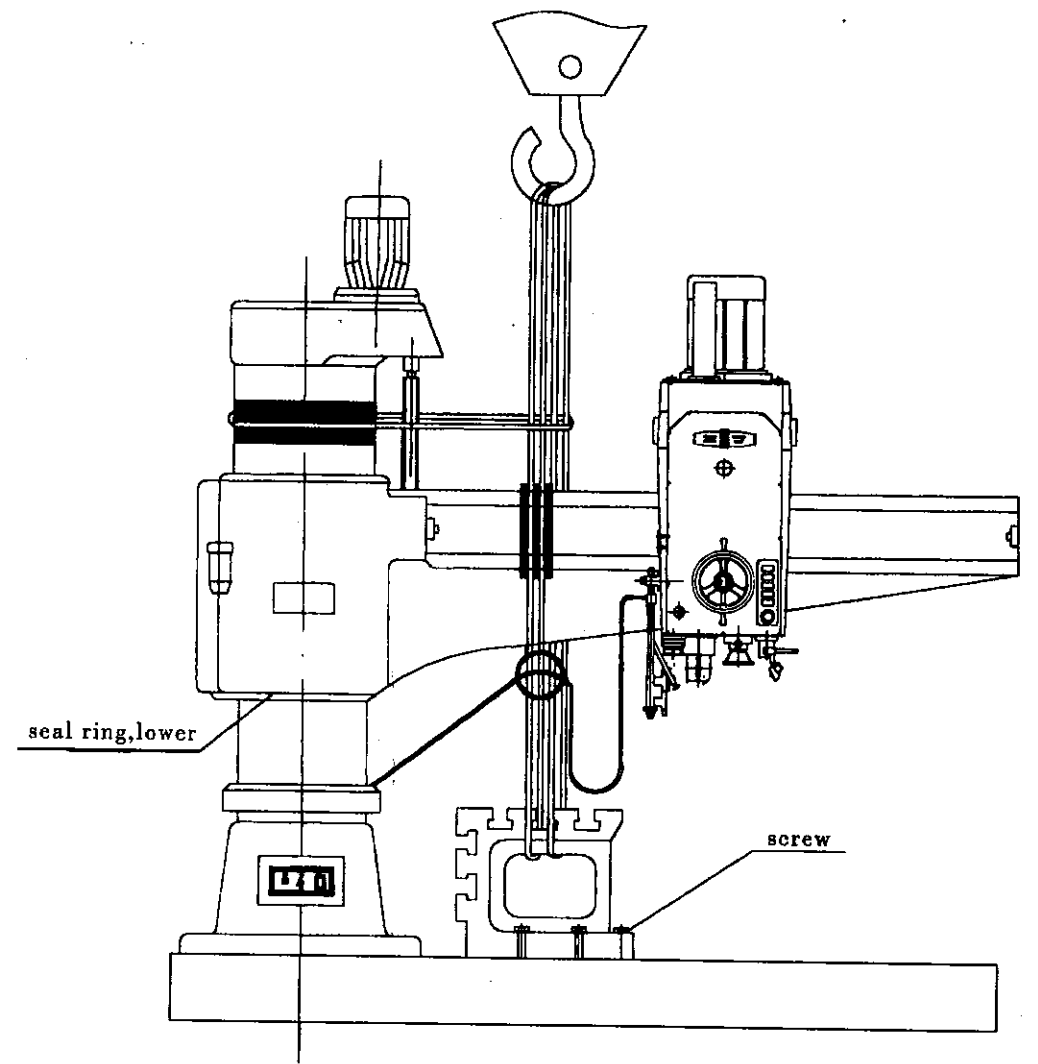


Fig 2.2 Overall Unit Handling diagram

2.3 Overall unit installation

2.3.1 When installation, let the anchor bolts pass through the holes on the machine tool baseplate, then place the machine tool on the foundation, and put the shims under the baseplate.

2.3.2 Wipe away the antirust oil on the bare surface of baseplate, the column, arm, and spindle, etc. with clean material.

2.3.3 Preliminary level: the leveling of the shims shall be performed following the sequence 1,2,3,4, showed in foundation diagram.

2.3.4 Remove the screw at 1 in Fig. 2,3, and connect the clamping oil pipe.

2.3.5 As showing in 2.4, remove the loose resistance plate at left clamping of the arm.

2.3.6 Electric installation.

2.3.6.1 The installation of rising-falling motor (Fig. 2.5): Install the motor properly, and tighten the bolts, open the cover of motor terminal head, connect the wires according to their line number, close and tighten motor terminal head cover.

2.3.6.2 Connect properly general power supply incoming line.

2.3.7 Check the correctness of phase sequence of power supply (Fig. 3.1): Press down press-button 1-18, check if the spindle head is released (or press down press-button 1-19, check if the spindle head is clamped); press down and hold the arm rising press-button 1-3, allow the arm to rise 10mm, check if it rises or not (or press down and hold the arm falling press-button 1-2, check if it falls or not).

2.3.8 Press down and hold the arm falling press-button 1-2 (Fig. 3.1), allow the arm to fall 10 mm, wipe out the antirust oil on the upper part of the outer column, allow the arm to rise 10 mm again, wipe out the antirust oil on the lower part of the outer column, repeat the above operation until the outer column is completely clean; press down spindle head releasing press-button to allow the spindle head to release, rotate the spindle head moving hand wheel 1-10, allow the spindle to move to left side, wipe out the antirust oil on the arm guide, then let the spindle head come back to its original position and clamp it.

2.3.9 Drop lube oil on the outer column, then allow the arm to fall about 50 mm, wipe the exposed part clean, and then lubricate it again, allow the arm to rise about 100 mm, wipe the exposed part clean again and lubricate sufficiently, at this time it is allowed the arm to rise and fall in a larger amplitude, **Note: Do not scratch the surface of the outer column;** Then fill oil according to the requirement of the lubrication diagram (Fig. 2.6) and the lubrication table, check the lubrication condition, fill cooling liquid which meets the requirement in the cooling water tank.

2.3.10 Allow the arm to rise to the top of the column, then fall to the bottom, check if the over travel-limit switch works or not.

2.3.11 Level carefully, the leveling of the shims shall be carried out following 1,2,3,4

shown in Fig. 2.1, the foundation diagram, the installation level data measured at machine tool base plate both in vertical and horizontal directions are less than or equal to 0.04/1000.

2.3.12 Adjust all the precision, and ensure that these values are not larger than the practically measured ones recorded in the "Certificate of Quality". After the machine tool has been adjusted properly, grout the anchor bolts with cement mortar, fasten the anchor bolts after the cement mortar has cured, then fix the base plate and the shims with cement. In order to prevent the level of the machine tool from changing, it is necessary to make a final correction with a level gauge.

2.3.13 The installation of spindle guard (Fig. 2.7): Unscrew part 1 under the electroplated pipe used to install cooling system, then put the guard on the spindle, and screw part 1.

Explanation:

1. In respect to this machine tool, floating place the lower seal ring of the arm sleeve, and installation the left end cover of the arm in an open state, these are not normal assembling position, please install them in the correct position during the installation of the machine tool (See Fig. 2.2).

2. Inspect oil leakage at all the oil pipe joints, oil window, oil leveler and associated parts of the machine tool, please disassembly and reassemble if necessary.

3. The oil quantity must be kept at the red mark of the oil window, above the red mark is not allowed.

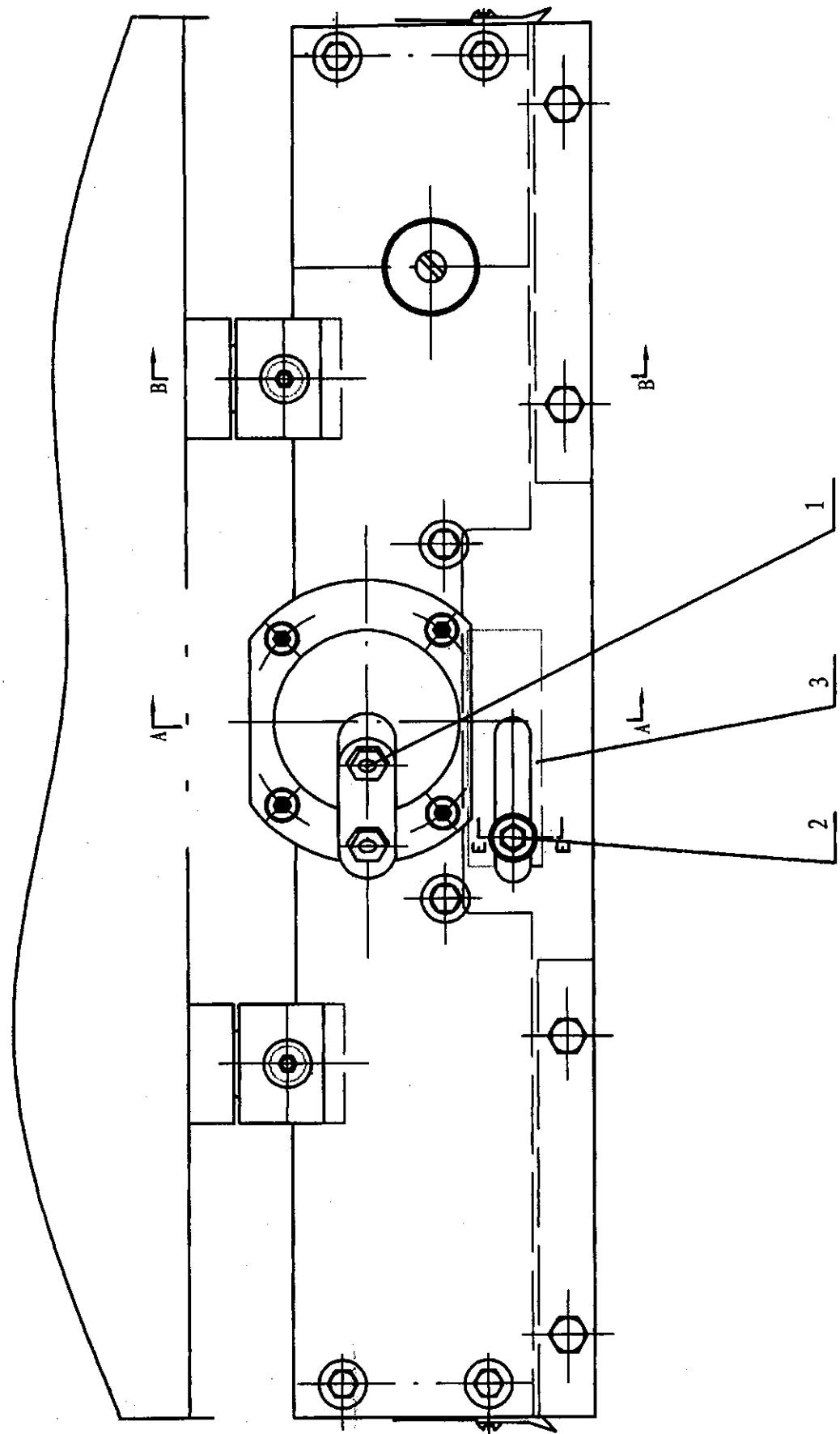


Fig 2.3 Spindle head clamping mechanism

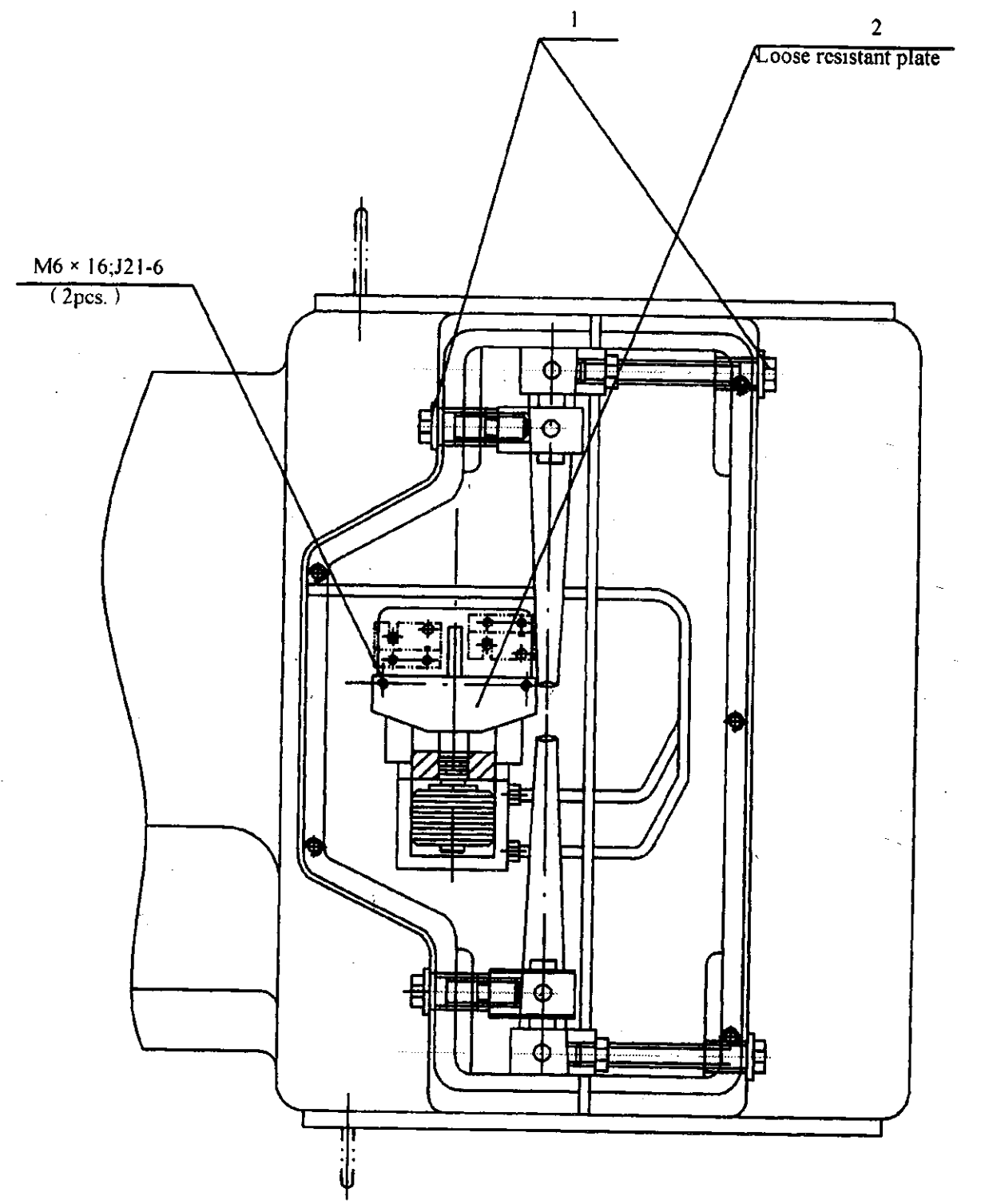


Fig 2.4 Arm clamping

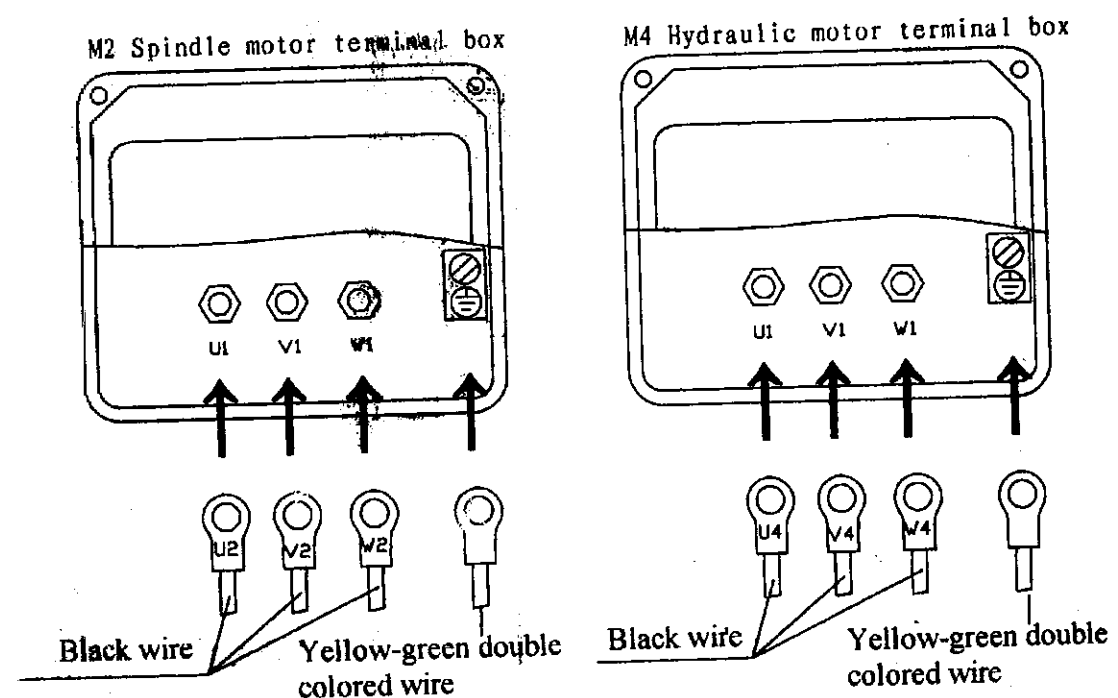
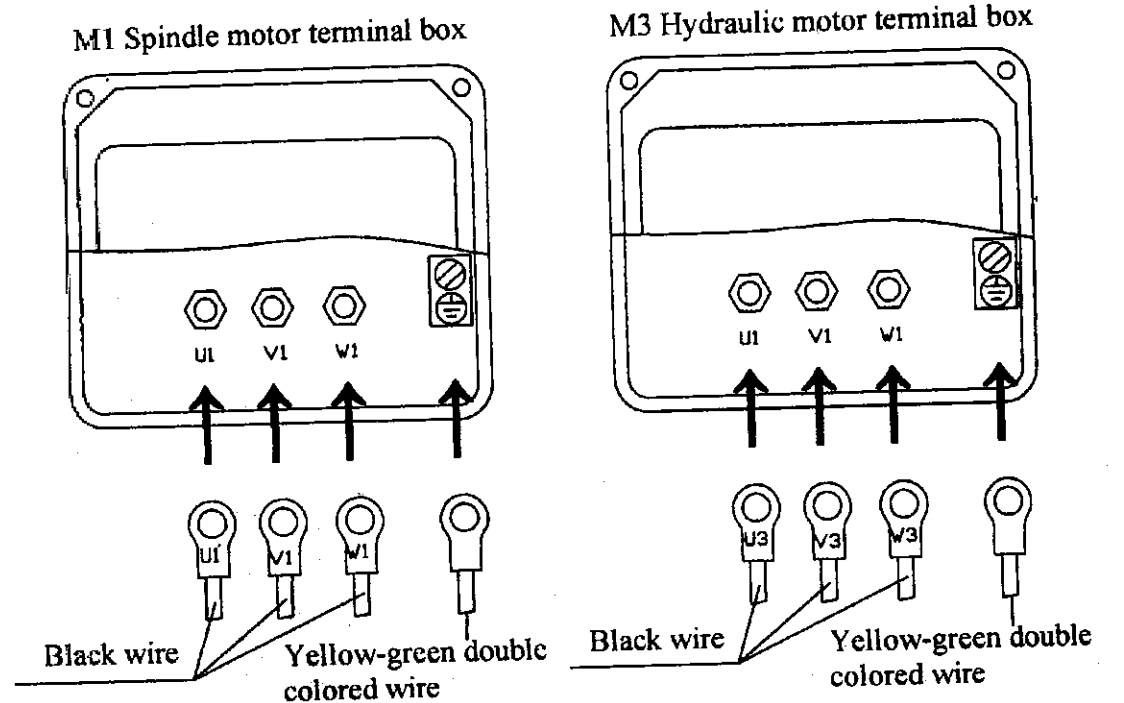


Fig. 2.5 Motor wiring layout

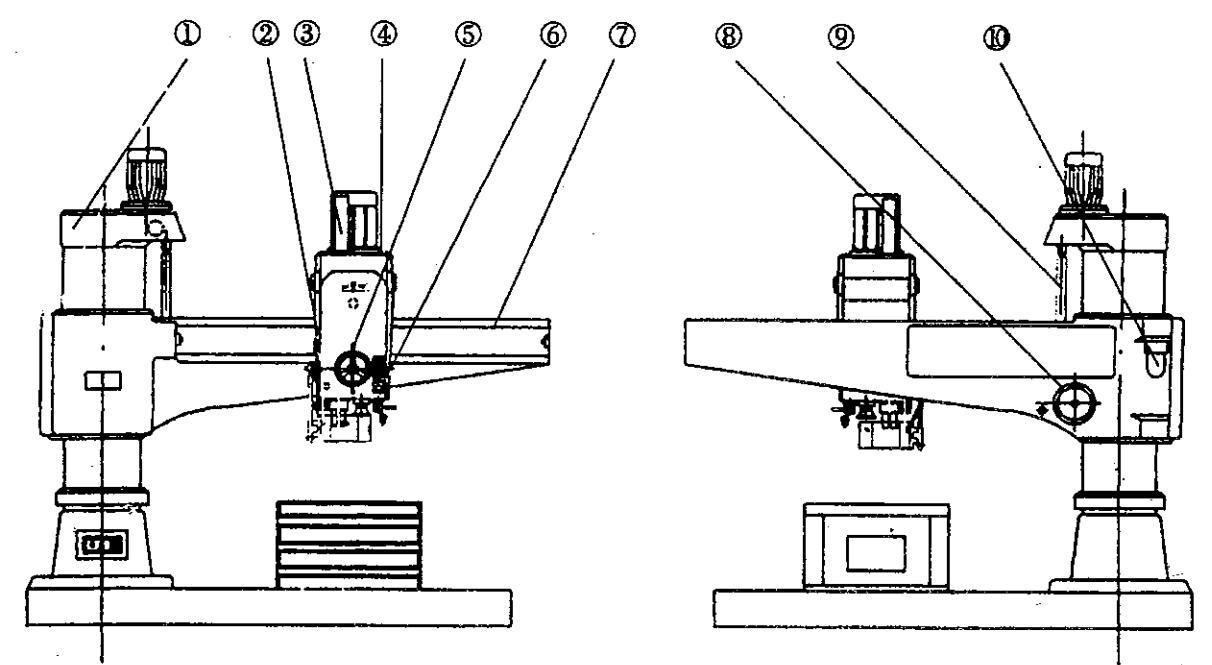


Fig. 2.6 Lubrication of machine tool

Lubrication Table

Item No.	Lubrication Point	Lubricant trademark number	Lubrication Circle	Remark
1	arm rising - falling mechanism	L - AN32	Change oil once per 3 months	Unscrew the threaded plug when fill oil (about 1000ml)
2	Gear head lower oil pool	L - AN32	Change oil once per 3 months	Open label on gear head for filling oil (about 1600ml)
3	Spindle spline	L - AN32	Fill oil once per week	Do not overfill
4	Gear head upper oil pool	L - AN32	Change oil once per 3 months	
5	Fine adjustment worm	L - AN32	Fill oil once per month	Do not overfill
6	Spindle upper & lower bearings	Animal & plant oil calcium soap 12 - 17% mineral oil 83 - 87%	Fill oil once per month	Open label on gear head for filling oil
7	Rock arm guide	L - AN68	Always keep oily	
8	Clamping pump oil pool	L - AN32	Change oil once per 3 months	Open the cover of door of electric appliance cabinet for filling oil
9	arm rising falling guide screw	L - AN68	Fill oil once per week	Do not overfill
10	Column lube oil pump oil pool	L - AN32	Always keep oil	

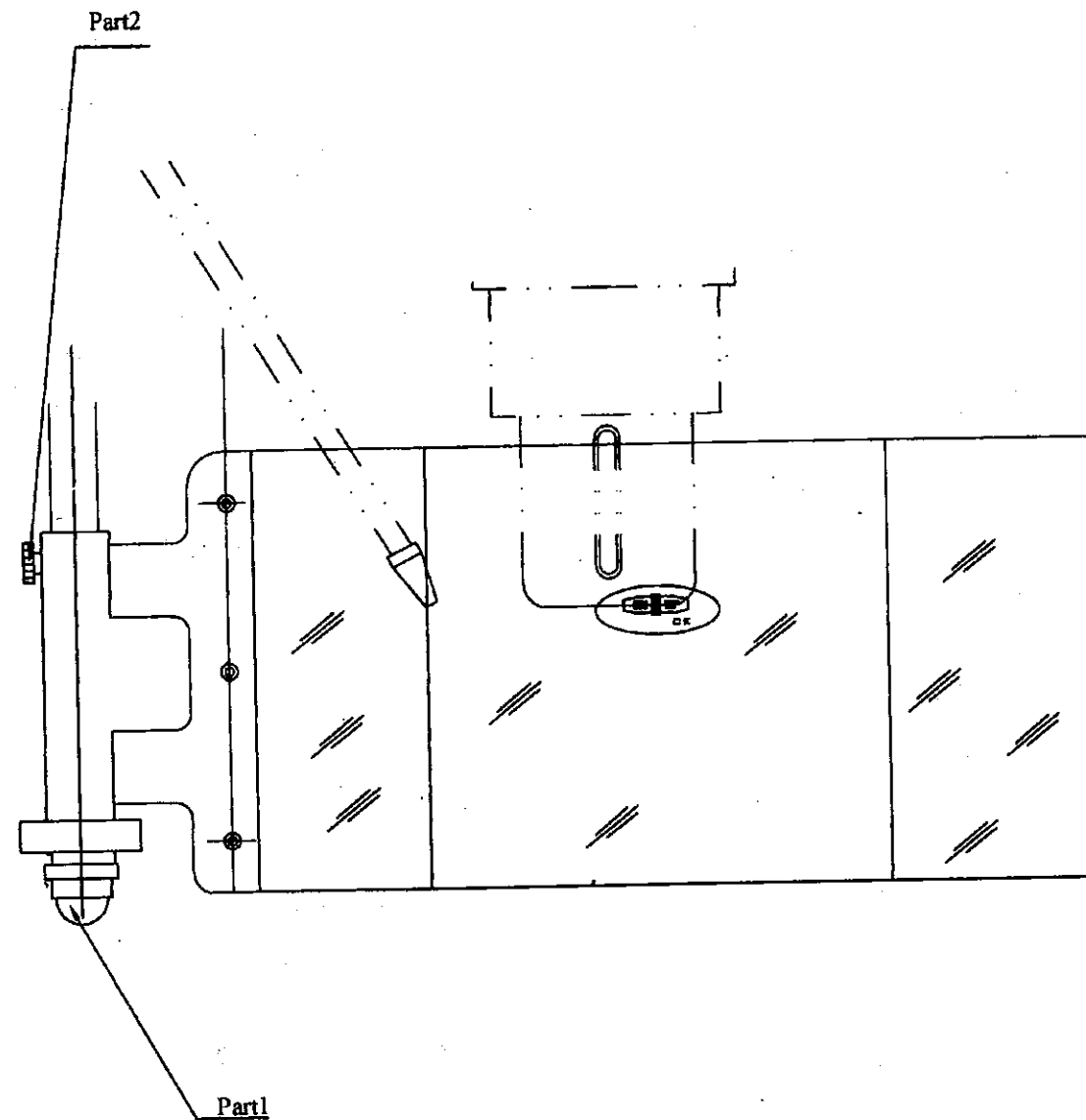


Fig 2.7 Spindle guard

2.4 Disassembled machine tool installation:

If you selected is a machine tool packaged in disassembling, please carefully the installation instruction after opening the packing head, assemble the machine tool strictly follow the required sequenc:

2.4.1 Wipe away dust and antirust oil from various component of the machine tool.

2.4.2 Handling the baseplate as shown in Fig. 2.8, place properly the baseplate and two groups of shim (1-4) as shown in Fig. 2.1, screw the nust of the anchor bolts to prevent the machine tool from tipping over after putting the arm on the column.

2.4.3 Hóist the column as shown in Fig. 2.9 and Fig. 2.10, wipe the combined surface clean, then remove the hoisting rope from the column, mount the column on the baseplate, and fasten the screws.

2.4.4 Mount the arm on the column, at first, rope the arm properly as shown in Fig. 2.11, the arm must be in a balanced state when hoisting. Before putting the arm on the outer column, carefully inspect and remove the dirt in the big hole of the arm, wipe the outer surface of the column clean and apply lube oil on it. Before the arm is sheathed on the column, be careful to align a key on the arm with a keyway on the column, then the sheathing is carried out slowly. After the arm is sheathed on the column, place a shim with a height of 50~100 mm between the arm and the nosing of the lower part of the outer column. Finally remove the hoisting ring on the arm, then screw the removed hoisting ring threaded hole plug. Note: At this time the arm is not in a clamping state, you must prevent the arm from rotate, pay attention to safety!

2.4.5 Install the top parts of the column as shown in Fig. 2.12: First remove the cover 4 on the body case, mount the body case on the column, tighten the screw 10; then manually rotate the guide screw into the body case, sheathe on the gear 11, and allow it to connect properly with the gear of the motor shaft, screw the nut 12, loosen the screw 2 which is on the clamping level and used to fix the rhombic block, then connect the clamping oil pipe.

2.4.6 Remove the locking screw at position 1 in the diagram shown in Fig. 2.3, then connect the clamping oil pipe.

2.4.7 Electric mounting

2.4.7.1 Pass the power line through the column top as shown in Fig. 2.13: wiring with rock arm rising-falling motor (see 2,3,6,1.).

2.4.7.2 The installation of hydraulic motor (Fig. 2.5): Correctly install the motor and fasten the bolts, open the cover of motor terminal head and connect the wires according to their wire number, close and fasten the cover of the terminal head.

2.4.7.3 Mount the master motor (Fig. 2.5): Correctly install the motor and fasten the bolts, open the cover of motor terminal head and connect the wires according to their wire

number, close and fasten the cover of the terminal head.

2.4.7.4 Install the cooling pump motor (Fig. 2.5); Correctly install the motor and fasten the bolts, open the cover of motor terminal head and connect the wires according to their wire number, close and fasten the cover of the terminal head.

2.4.7.5 Connect properly general power supply incoming line.

2.4.8 Inspect the correctness of phase sequence of the power supply (Fig. 3.1): Press down press-button 1-19 to check if the spindle head is clamped or not, (or press down press-button 1-18 to check if the spindle is released or not); Press down and hold the arm rising press-button 1-3, allow the arm to rise 10 mm, check if the arm rises or not (or press down and hold the arm falling press-button 1-2 to check if the arm falls or not).

2.4.9 Press down and hold arm falling press-button 1-2 (Fig. 3.1), allow the arm to fall 10 mm, wipe away the antirust oil on the upper part of the outer column, then allow it to rise 10 mm again, wipe away the antirust oil on the lower part of the outer column, repeat the above operation until the outer column is wiped clean; Press down spindle head releasing press-button to release the spindle head, rotate spindle head moving handwheel 1-10, move the spindle head to the left side, wipe away the antirust oil on the arm guide, then move the spindle head to the original position and clamp it.

2.4.10 Drop lube oil on the outer column, then allow the arm to fall about 50mm, wipe the exposed part clean, and then lubricate it again, allow the arm to rise about 100 mm, wipe the exposed part clean again and lubricate sufficiently, at this time it is allowed the arm to rise and fall in a larger amplitude, **Note: Do not scratch the surface of the outer column;** Then fill oil according to the requirement of the lubrication diagram (Fig. 2.6) and the lubrication table, check the lubrication condition, fill cooling liquid which meets the requirement in the cooling water tank.

2.4.11 Allow the arm to rise to the top of the column, then fall the bottom, check if the over travel-limit switch work or not.

2.4.12 Level carefully, the leveling of the shims shall be carried out following 1, 2, 3, 4 shown in Fig. 2.1, the foundation diagram, the installation level data measured at the machine tool base plate both in vertical and horizontal directions are less than or equal to 0.04/1000.

2.4.13 Turn on power supply, adjust the clamping force for column and arm, when the arm is clamped, the inspection is carried out with a plug gauge of 0.04 mm, and the plug gauge is not allowed to insert into the clearance between the large hole of the arm and the column.

2.4.14 Adjust all the precision, and ensure that these values are not larger than the practically measured ones recorded in the "Certificate of Quality". After the machine tool

has been adjusted properly, grout the anchor bolts with cement mortar, fasten the anchor bolts after the cement mortar has cured, then fix the base plate and the shims with cement. In order to prevent the level of the machine tool from changing, it is necessary to make a final correction with a level gauge.

2.4.15 Install the parts of the arm such as antidusting ring, etc., which were disassembled due to packing.

2.4.16 The installation of spindle guard: Unscrew part 1 under the electroplated pipe used to install cooling system, then put the guard on the spindle, and screw 1. (See Fig. 2.7).

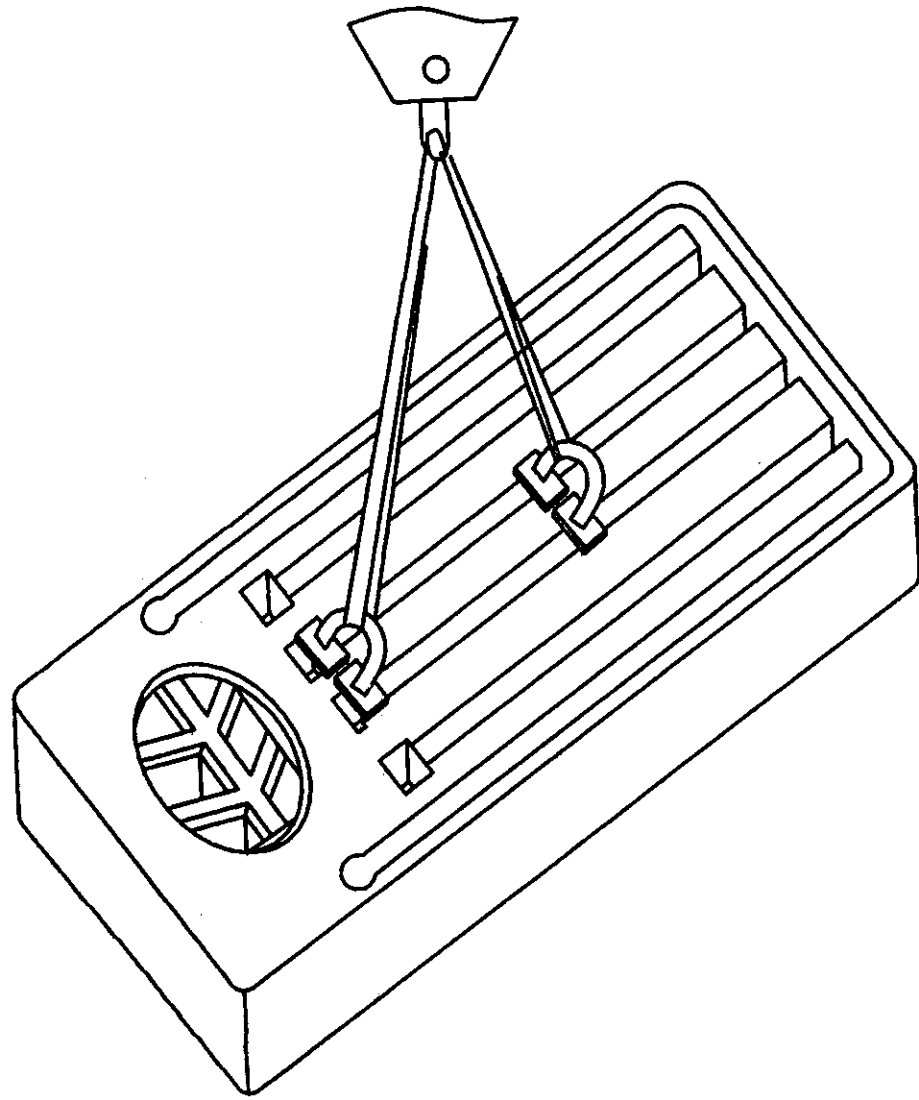


Fig. 2.8 Baseplate Handling Diagram

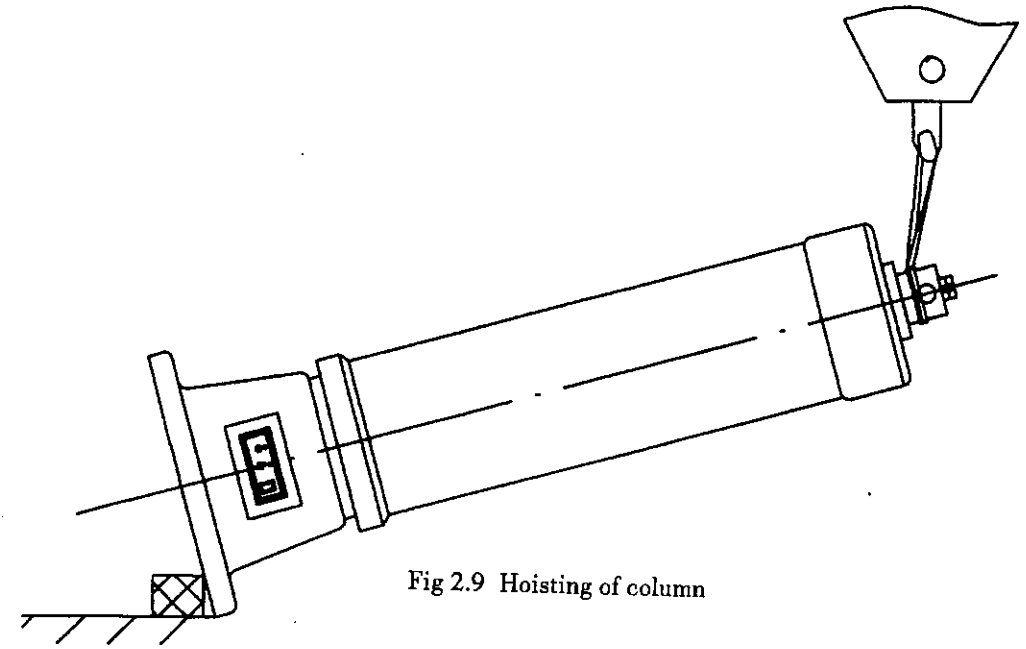


Fig 2.9 Hoisting of column

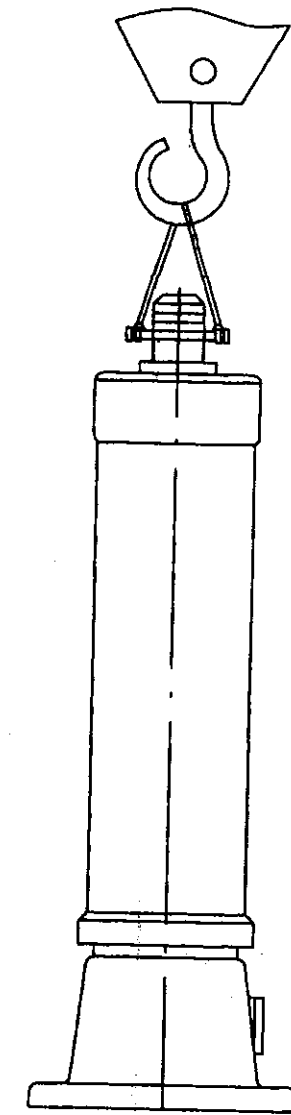


Fig 2.10 Column hading diagram

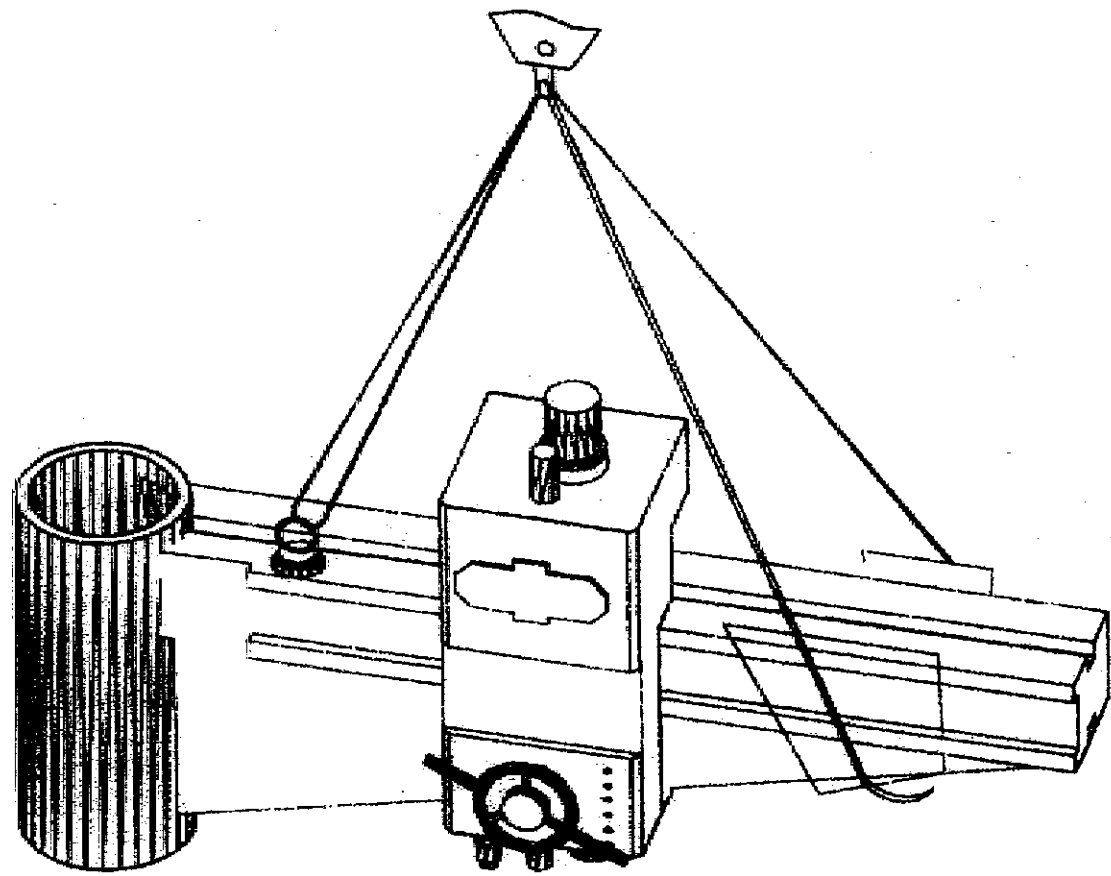


Fig. 2.11 Handling of the Arm

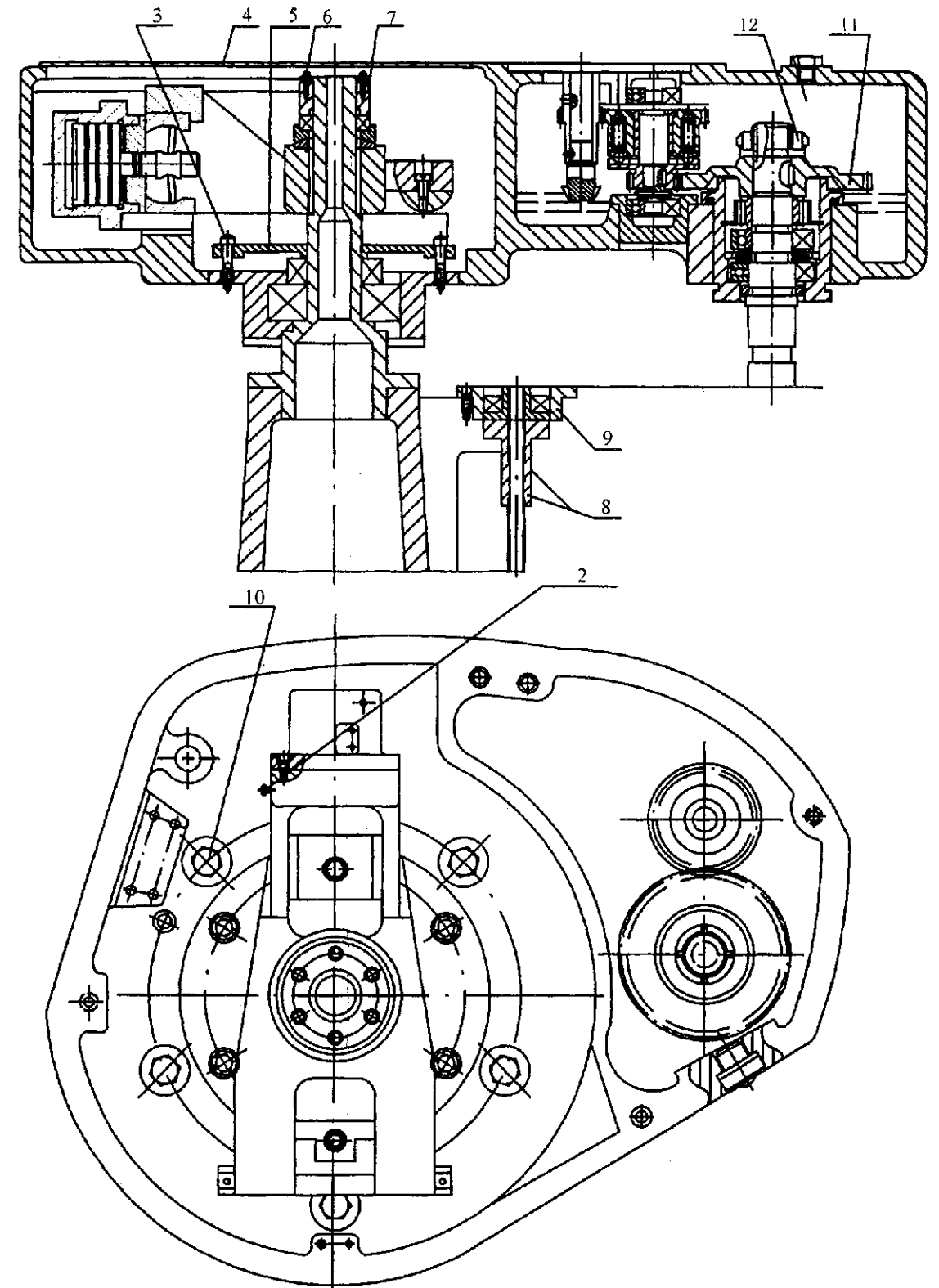


Fig. 2.12 View of column top

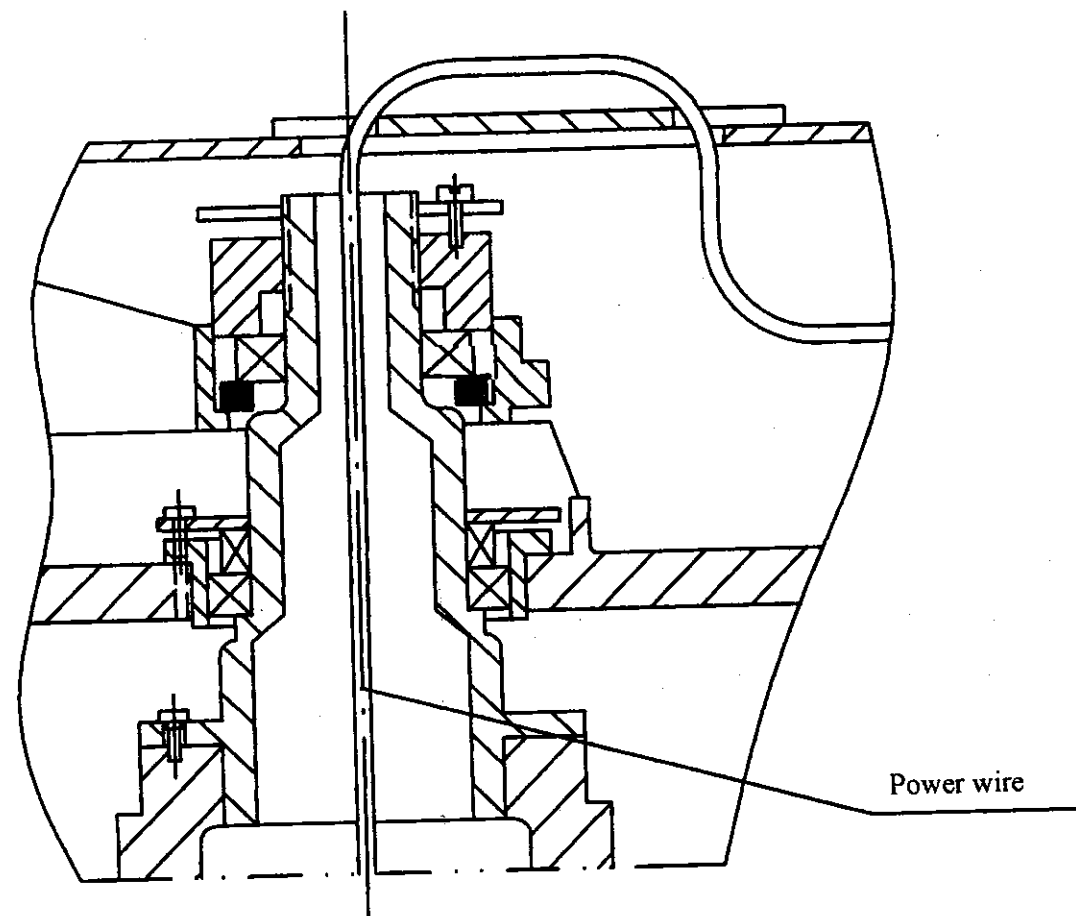


Fig. 2.13 Wiring Laying of Column Top

2.5 Commissioning

2.5.1 After the machine tool has been installed properly, check the phase sequence, the key point is the general power supply switch.

2.5.2 Start the machine tool (see the instruction in control section), meantime check if all the moving component of the machine tool are in normal conditions or not, for example. Spindle corotation and counter revolution, speed change and neutral position, various class of spindle rotation speed, various class of spindle feed quantity, spindle start up and stop, arm rising and falling, column and spindle clamping and releasing, spindle head limit travel, arm limit travel, spindle manual and motorized feed.

2.5.3 If all the conditions mention above are normal, let the machine tool run 30 minutes without load, if all conditions are normal, the machine tool can be put into operation.

3 TECHNICAL CHARACTERISTICS

3.1 Major Function

This machine tool is applied to drill, ream, fraise, ream plane and tap on large-and medium-size metal parts, the operation components such as handle, press-button, etc., by virtue of which the major function and actions are realized, are concentrated on the spindle head.

3.1.1 The outer column drives the arm to rotate $\pm 180^\circ$ around the inner column;

3.1.2 The arm rises and falls along the outer column;

3.1.3 The spindle head moves toward left and right along a guide of the arm;

3.1.4 Spindle head: it realizes the various class of rotation speed and feed and operation (see spindle head view drawing 3.1). Spindle rotation speed range is 25~2000 RPM, and divided into 16 classes, this can be accomplished by turning the concentrated operation hand wheel 1-12; spindle feed quantity range is 0.04~3.2 mm/r and divided into 16 classes, this can be accomplished by turning the concentrated operation hand wheel 1-11.

Function	Operation handle or press-button
Spindle corotation, counter revolution & neutral position	1—13
Spindle manual/motorized feed	1—15
Spindle head horizontal movement	1—10
Spindle movement	1—9
Spindle set depth cutting	1—7
Spindle microfeed	1—17

3.1.5 The arm rising-falling and clamping: the arm rising-falling is driven by the motor at the top of the column and transmitted by a guide screw nut, in this way the arm rising-falling is accomplished (see fig 3.1, spindle head front panel). There is a shear nut mounted on the rising-falling nut to ensure the arm from sudden falling down; the arm clamping is accomplished by way of driving the rhombic block with hydraulic press, the rhombic block is self-locked after clamping; when the arm rising-falling and clamping actions have ended, the arm is clamped automatically, this is controlled by a electric switch on the hydro-cylinder seat.

3.1.6 the clamping of spindle head and column: the clamping of spindle head and the column is accomplished by the rhombic block driven by hydraulic pressure. The two actions can be carried out simultaneously or separately. the selection switch is knob 1—6 on the spindle head front panel, of which the center position is clamping, the left position

is column releasing individually, the right position is the spindle releasing individually, the actions are accomplished by press-button 1—18, 1—19 (Fig. 3.1).

Position	Name of operation handle	Position	Name of operation handle
1—1	Emergency stop press-button	1—11	Spindle feed quantity preselecting knob
1—2	arm falling press-button	1—12	Spindle rotation speed preselecting knob
1—3	arm rising press-button	1—13	Spindle corotation/counter revolution & neutral position preselecting knob
1—4	Master motor stop press-button		
1—5	Master motor start press-button	1—15	Manual/motorized feed switchover handle
1—6	Spindle head, column clamping state selection knob	1—16	Lighting lamp switch
1—7	Set depth cutting travel-limit handle	1—17	Micro-feed hand wheel
1—8	Dial fine tuning handle	1—18	Spindle head, column releasing press-button
1—9	Spindle movement hand wheel	1—19	Spindle head, column clamping press-button
1—10	Spindle head movement hand wheel	1—20	Cooling liquid flow adjustment knob

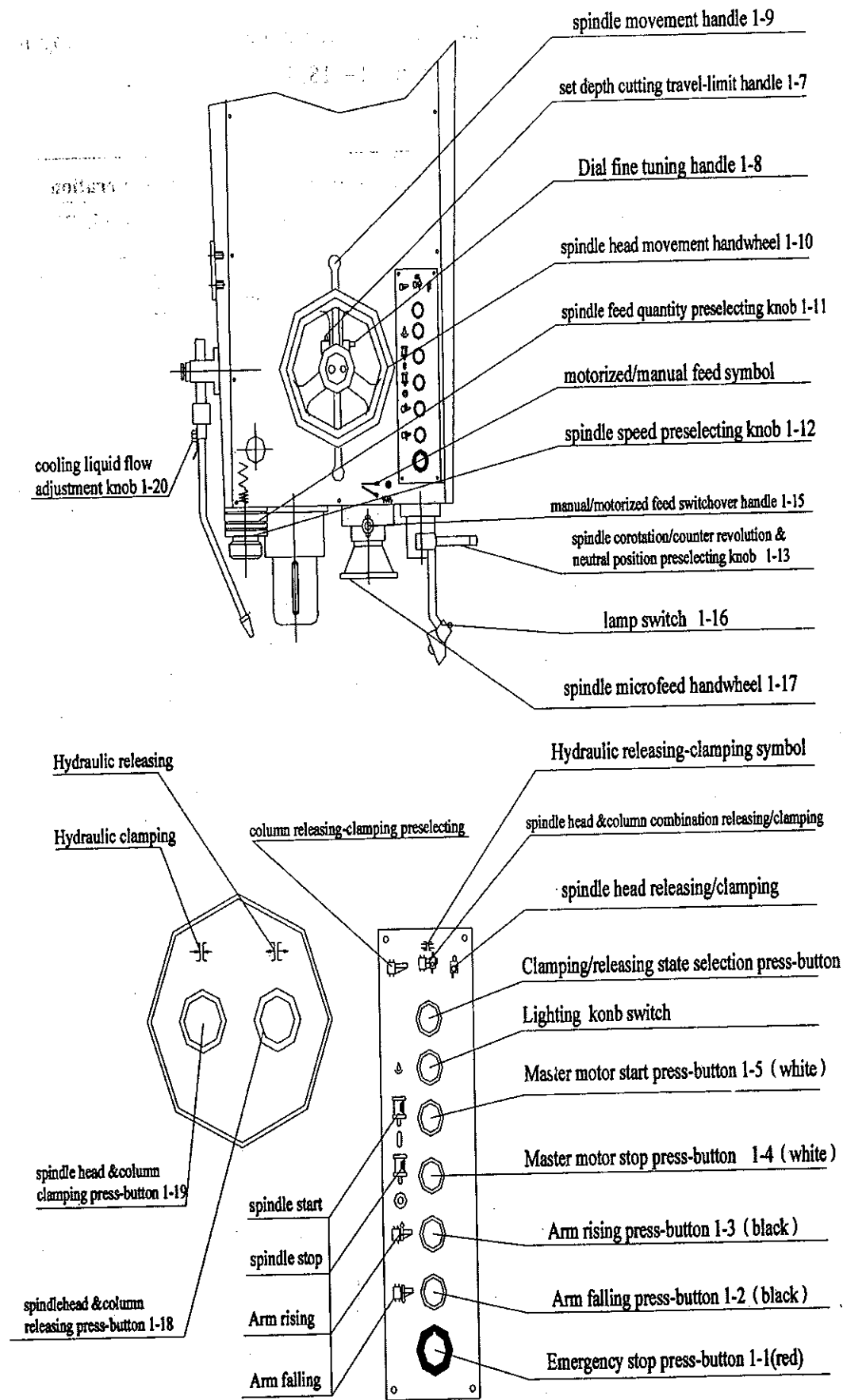
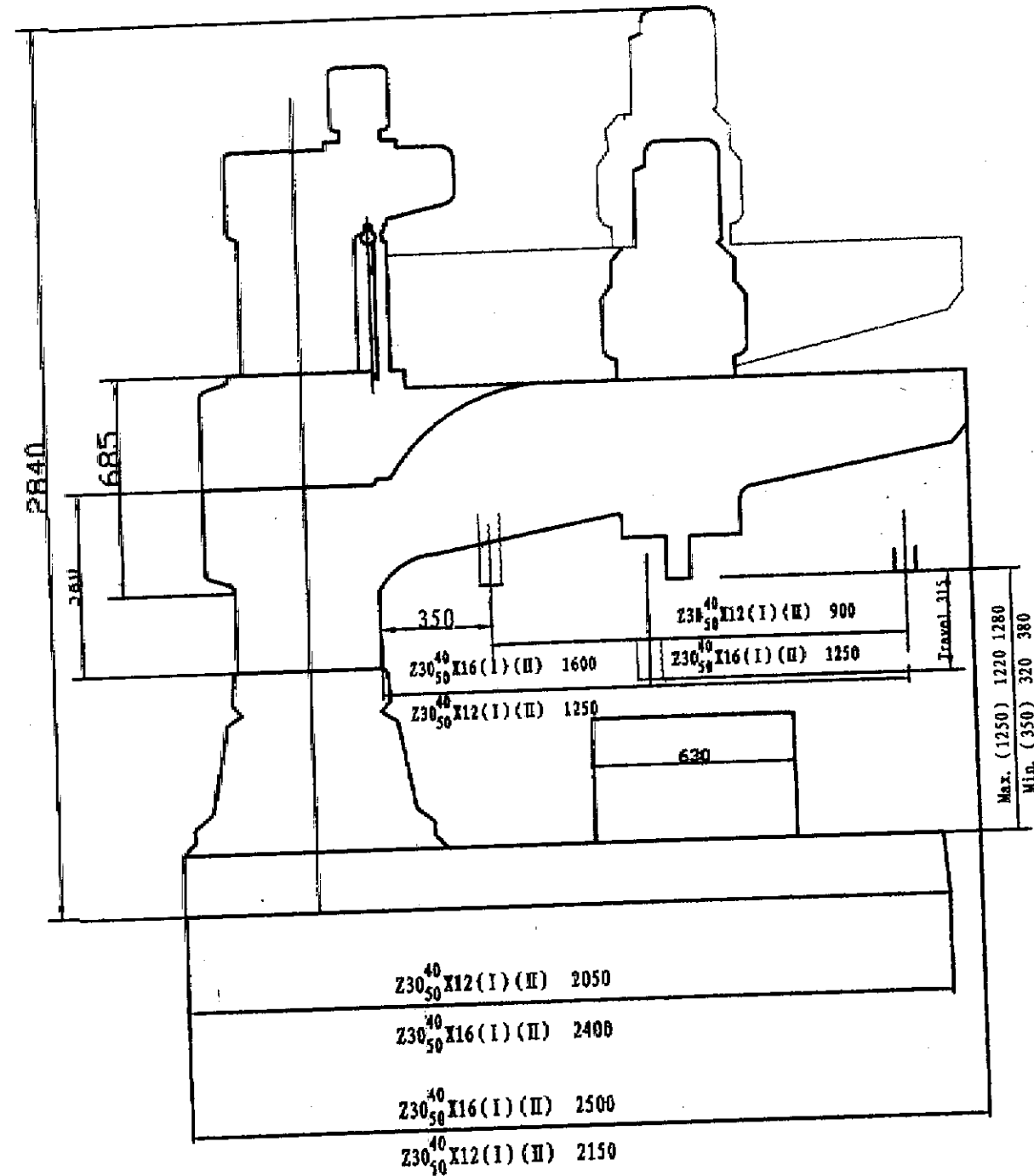


Fig 3.1 Spindle Head Front Panel

Main Parameter Table

Main size & parameter	Z3040 × 16 (I) (II)	Z3050 × 12 (I) (II)	Z3040 × 16 (I) (II)	Z3050 × 16 (I) (II)
Distance from center line of spindle to the bus of the column	Max.	40 mm	40 mm	50 mm
	Min.	1200 mm	1600 mm	1200 mm
Spindle head horizontal movement distance	Max.	350 mm	350 mm	350 mm
	Min.	900 mm	1250 mm	900 mm
Distance from spindle end to baseplate working surface	Max.	Z3040 × 12 (I): 1250mm	Z3040 × 16 (I): 1250mm	Z3050 × 12 (I): 1220mm
	Min.	Z3040 × 12 (II): 1280mm	Z3040 × 16 (II): 1280mm	Z3050 × 12 (II): 1250mm
arm rising-falling distance		Z3040 × 12 (I): 350mm	Z3040 × 16 (I): 350mm	Z3050 × 12 (I): 320mm
		Z3040 × 12 (II): 380mm	Z3040 × 16 (II): 380mm	Z3050 × 12 (II): 350mm
arm rising falling speed		580mm	580mm	580mm
arm rotation angle		0.02m/s	0.02m/s	0.02m/s
Spindle conical bore		±180°	±180°	±180°
Spindle rotation speed range		Morse No.4	Morse No.4	Morse No.5
Spindle rotation-speed-class		25-2000r/min	25-2000r/min	25-2000r/min
Spindle feed quantity range		16 classes	16 classes	16 classes
Spindle feed quantity class		0.04-3.2mm/r	0.04-3.2mm/r	0.04-3.2mm/r
Spindle travel		16 classes	16 classes	16 classes
Drilling depth per each rotation of dial		315mm	315mm	315mm
Allowed spindle max. torque		122mm	122mm	122mm
Allowed spindle max. feed resistance force		400N.m	400N.m	500N.m
Power of master motor		16000N	16000N	18000N
Power of arm rising-falling motor		3Kw	3Kw	4Kw
Power of hydraulic clamping motor		1.5Kw	1.5Kw	1.5Kw
Power of cooling pump motor		0.75Kw	0.75Kw	0.75Kw
Weight of machine tool (approximate)		0.09Kw	0.09Kw	0.09Kw
Dimensions of machine tool (length × width × height)		3000Kg	3000Kg	3000Kg
		2150×1070× 2840mm	2500×1070× 2840mm	2150×1070× 2840mm
				2500×1070× 2840mm



Note: Size in the parentheses is for type Z3040X12(I), Z3050X12(II), Z3040X16(I), Z3050X16(II) machine tool, Z3050X12(I), Z3050X12(II), Z3040X16(I), Z3040X16(II), Machine tool

Fig. 3.2 Machine Main Data Diagram

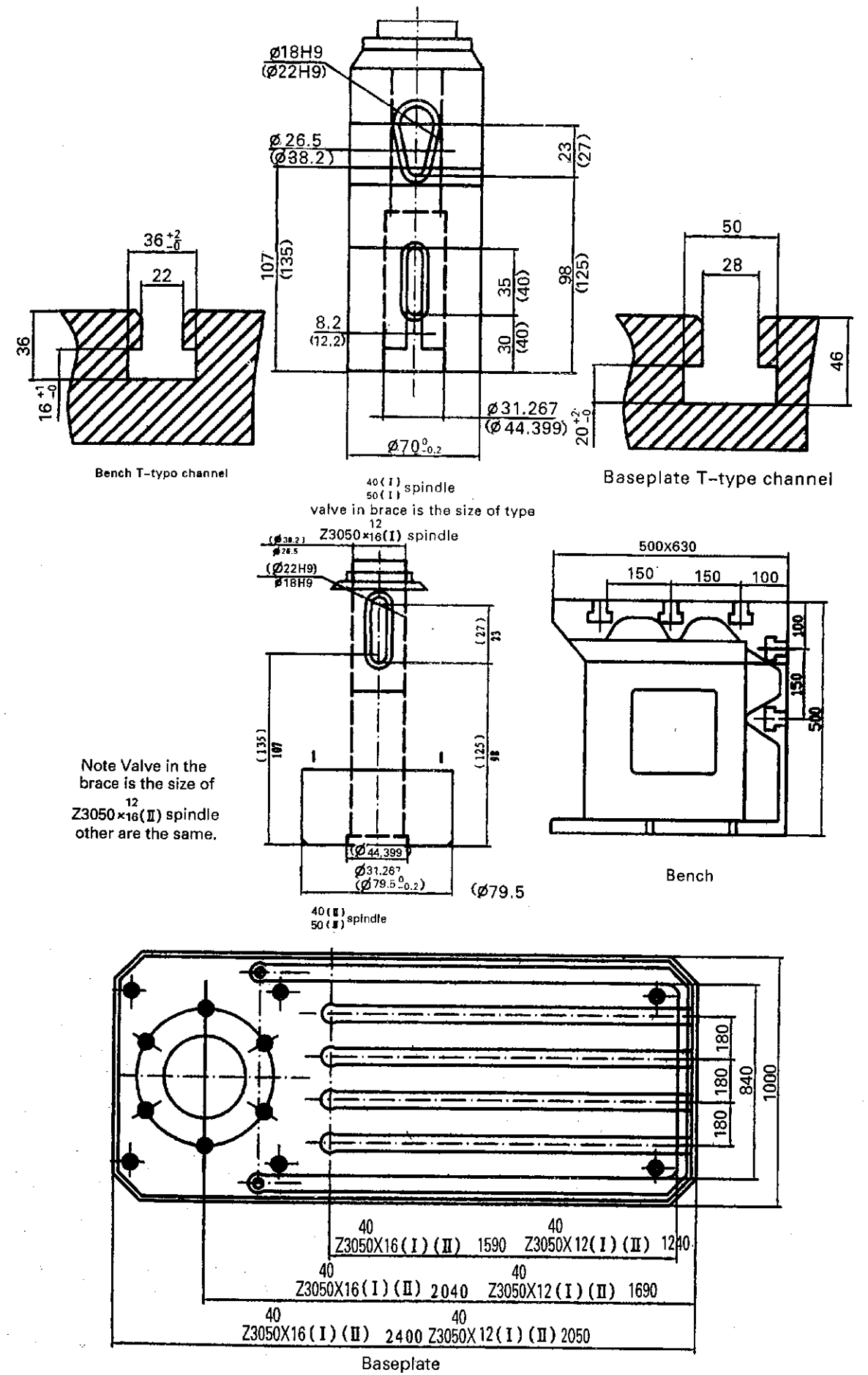


Fig. 3.3 Major Parameter Diagram for Spindle, Bench, Baseplate, etc.

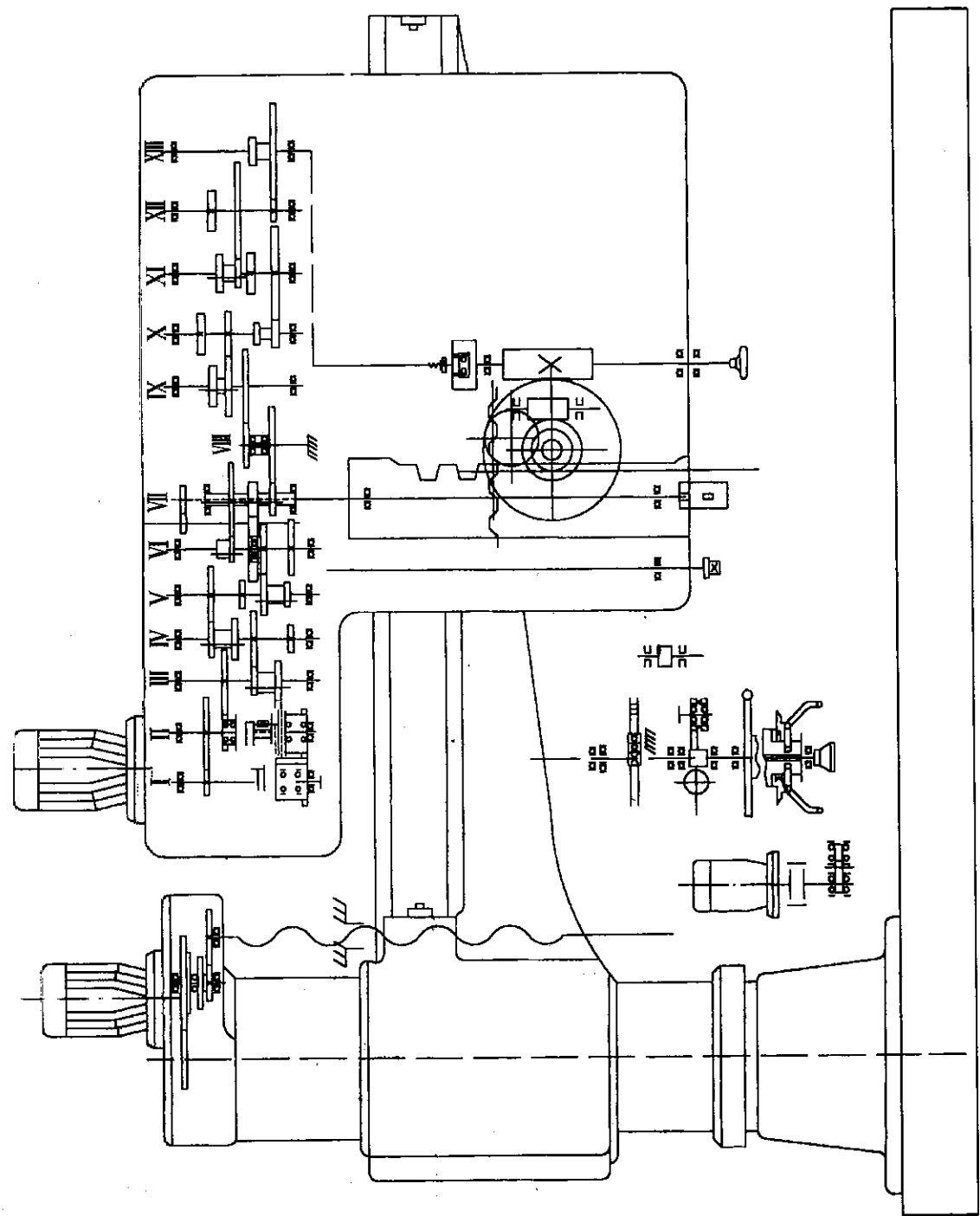


Fig 3.4 Transmission System Diagram

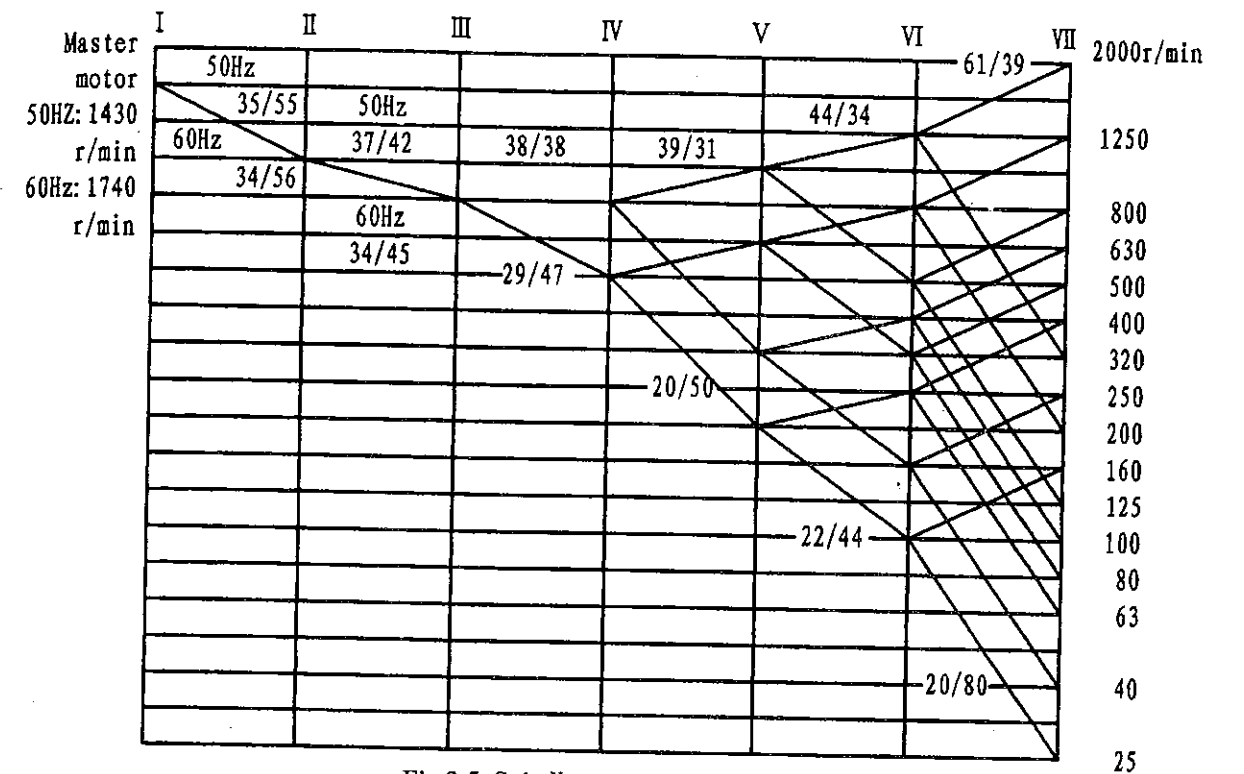


Fig 3.5 Spindle rotation speed diagram

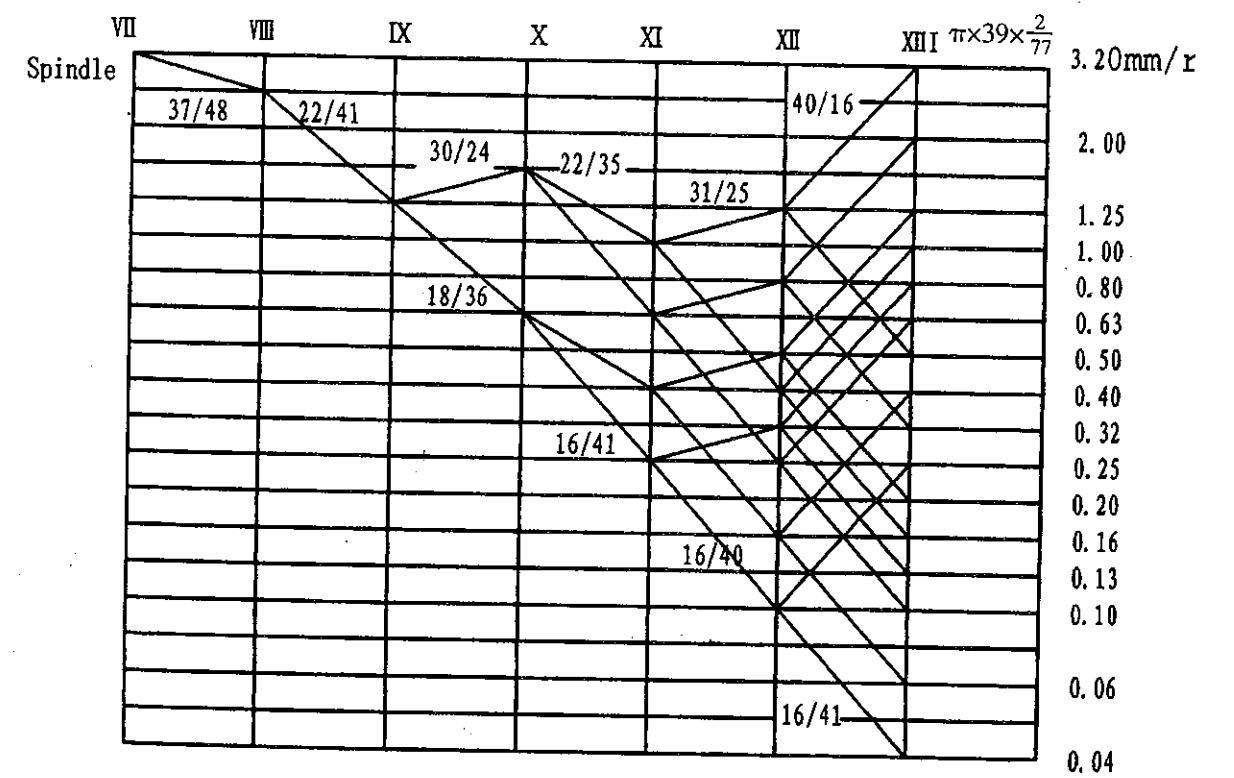


Fig 3.5 Spindle feed quantity rotation speed diagram

4 MACHINE TOOL CONTROL

The machine tool can be officially put into operation after the completion of the commissioning.

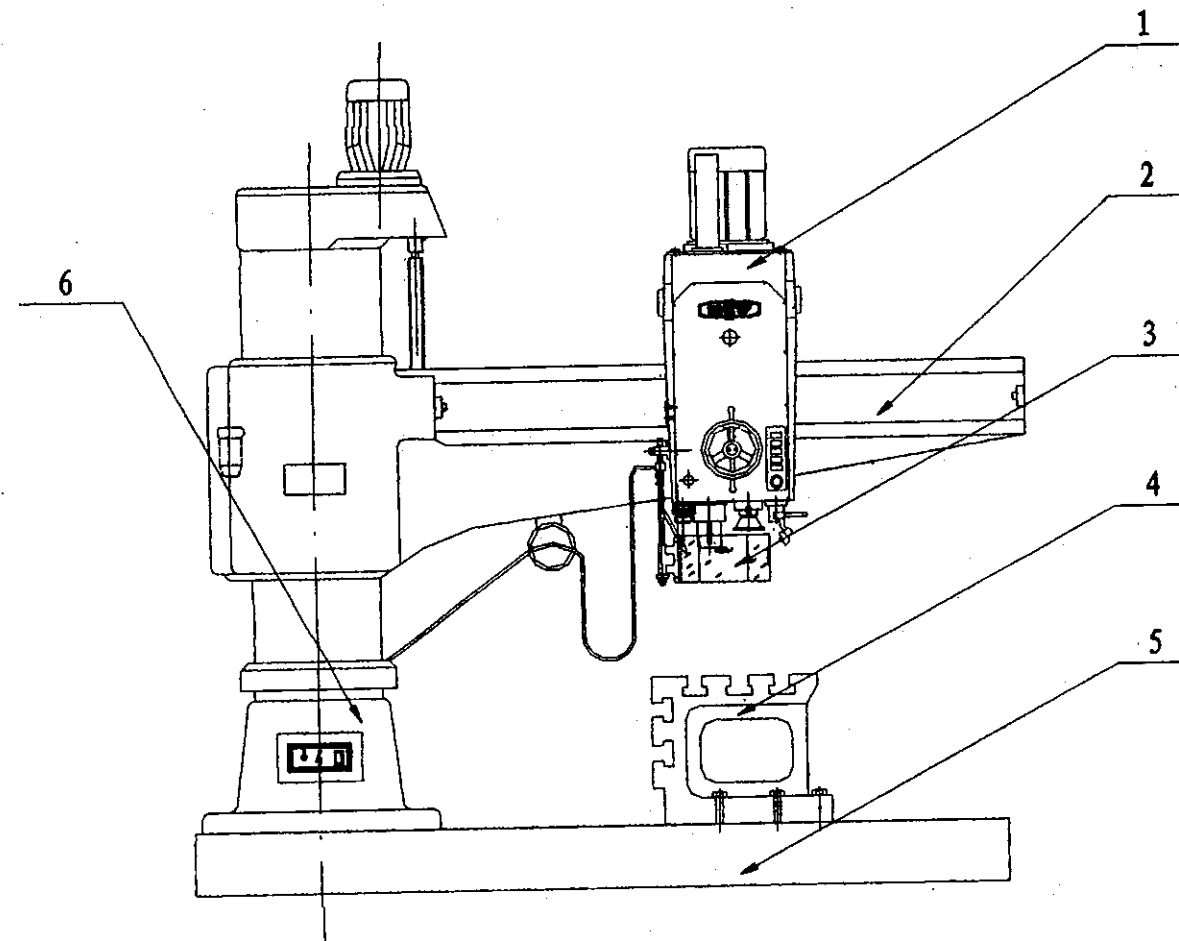


Fig. 4.1 Machine Tool Component Allocation Diagram

Machine Tool Component Table

Location	1	2	3	4	5	6
Designation	Spindle head	arm	Spindle guard	Bench	Machine tool body	Column

Prompt: 1. Check if the loose resistant plate shown in Fig. 2.4 has been removed or not;
2. Check if the stop screw connector at position 1 shown in Fig. 2.3 has been removed and the oil pipe has been connected or not.

4.1 The Preparation Steps:

- 4.1.1 Turn on the general power supply switch 4-1 at column square door, press down cooling pump start press-button 4-3 (See Fig. 4.4), turn on the lighting lamp switch 1-16 (See Fig. 3.1).
- 4.1.2 Clamp the workpiece on the bench;
- 4.1.3 Adjust the arm to a suitable position according to the height of the workpiece through press-button 1-2, 1-3 (See Fig. 3.1, the same up to item 4.8 hereunder);
- 4.1.4 Rotate knob 1-6, select spindle head and column clamping mode (hereunder take combination clamping as an example);
- 4.1.5 Press down press-button 1-8, release the clamping of spindle head and column;
- 4.1.6 Rotate handwheel 1-10, adjust the spindle head along the arm guide direction to a suitable position;
- 4.1.7 Pull handwheel 1-10, rotate horizontally the arm to a suitable position;
- 4.1.8 Press down press-button 1-19, clamp the spindle head and the column simultaneously.

4.2 Drilling by motorized feed.

- 4.2.1 Press down master motor start press-button 1—5;
- 4.2.2 Rotate spindle rotation speed preselecting knob 1—12, select a suitable rotation speed;
- 4.2.3 Rotate spindle feed preselecting knob 1—12, select a suitable feed quantity;
- 4.2.4 Use set depth cutting travel limit handle (detail see spindle feed hereunder);
- 4.2.5 Press down the motorized feed handle 1—15, allow it to connect to motorized feed.
- 4.2.6 Pull out handle 1—9, connect motorized feed;
- 4.2.7 Spindle speed change: Press downwards the corotation/counter revolution handle 1—13 to the speed change position about 3 seconds, accomplish the preselected rotation speed and feed quantity; then raise this handle to a horizontal position, move the handle toward left to the spindle corotation position, the motorized feed drilling can be started.

4.3 Manual feed is divided into two conditions:

4.3.1 Change from motorized feed to manual feed: in the process of motorized feed described above, if you want to change it to manual feed, what is required is only push inwards handle 1—9 to disconnect motorized feed, then the handle can be controlled by hand.

4.3.2 Complete manual feed: At the beginning, if the motorized feed handle 1—15 is not press downward, motorized feed can not be carried out; Rotate counterclockwise the handwheel 1—9, manual feed drilling can be started.

4.4 Tapping:

4.4.1 Press down master motor start press-button 1—5;

4.4.2 Rotate spindle rotation speed preselecting knob 1—12 and feed quantity knob 1—11, select spindle rotation speed and feed quantity.

4.4.3 Press spindle corotation/counter revolution handle 1—13 downward to a speed change position for three seconds, then raise this handle to a corotation position, at this time tapping can be started, when the depth is reached, move the handle 1—13 to a counter revolution position, withdraw the cutter.

4.5 The instruction of spindle neutral position/speed change

As shown in Fig. 4.2, raise upward the handle 1—13, turn the spindle lightly by hand. If you want to start the spindle, first press 1—13 downward to a speed change position until the spindle rotates, then move 1—13 to a corotation position (reverse turn).

4.6 The instruction of spindle corotation/counter revolution

As shown in Fig. 4.2, after the machine tool master motor starts, turn the handle to corotation or counter revolution position, the spindle will rotate clockwise or counterclockwise.

4.7 The instruction of spindle feed

4.7.1 Motorized feed: Press down handle 1—15, pull out handle 1—9, motorize feed is connected.

4.7.2 Manual feed: Push in handle 1—9, turn handle 1—9, the spindle is driven to feed upward or downward.

4.7.3 Micro feed: Set the handle 1—15 in a horizontal position, then pull out handle 1—9, turn handwheel 1—17.

4.7.4 Set depth cutting: As shown in Fig. 4.3, pull out handle 1—7, and turn 1—8 to a position shown in the figure, turn the dial to a required cutting depth, and allow the scale mark of this depth to align with "O" scale mark of the auxiliary rule on the spindle head body, then turn the handle 1—8 again to a position shown in Fig. 4.3, and make a fine tuning until the

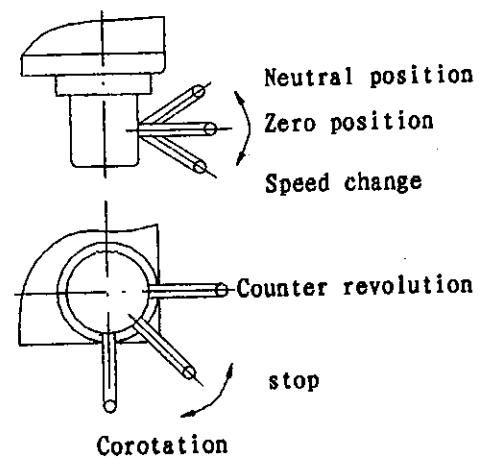


Fig. 4.2

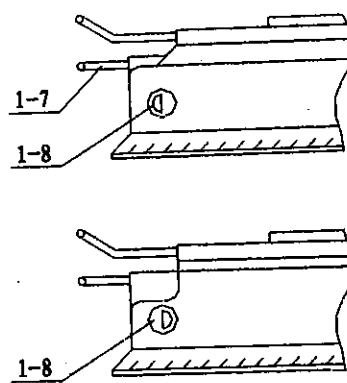


Fig. 4.3

alignment with "O" scale mark is reached, and hold handle 1—8 tightly using a locking

Fig. 4.3

knob at the opposite side, push in handle 1—7, connect feed, when the cutting depth reaches the set depth value, the handle 1—15 rises automatically, the set depth cutting is completed.

4.8 Shut down operation procedure

4.8.1 Raise motorized feed handle 1—15, disconnect motorized feed.

4.8.2 Press down spindle movement handle 1—9, disconnect motorized feed.

4.8.3 Clamp spindle head and column.

4.8.4 Press down master motor stop press-button, stop the master motor.

4.8.5 Close cooling liquid.

4.8.6 Turn off general power supply switch.

Note:

1. If you drill a through-hole, the feed quantity shall be decreased as the hole is nearly drilled through, in order to prevent the cutter from damage or avoid to produce waste.
2. When malfunction occurs, the red emergency stop press-button (1—1) on the spindle head front panel shall be immediately pressed down.

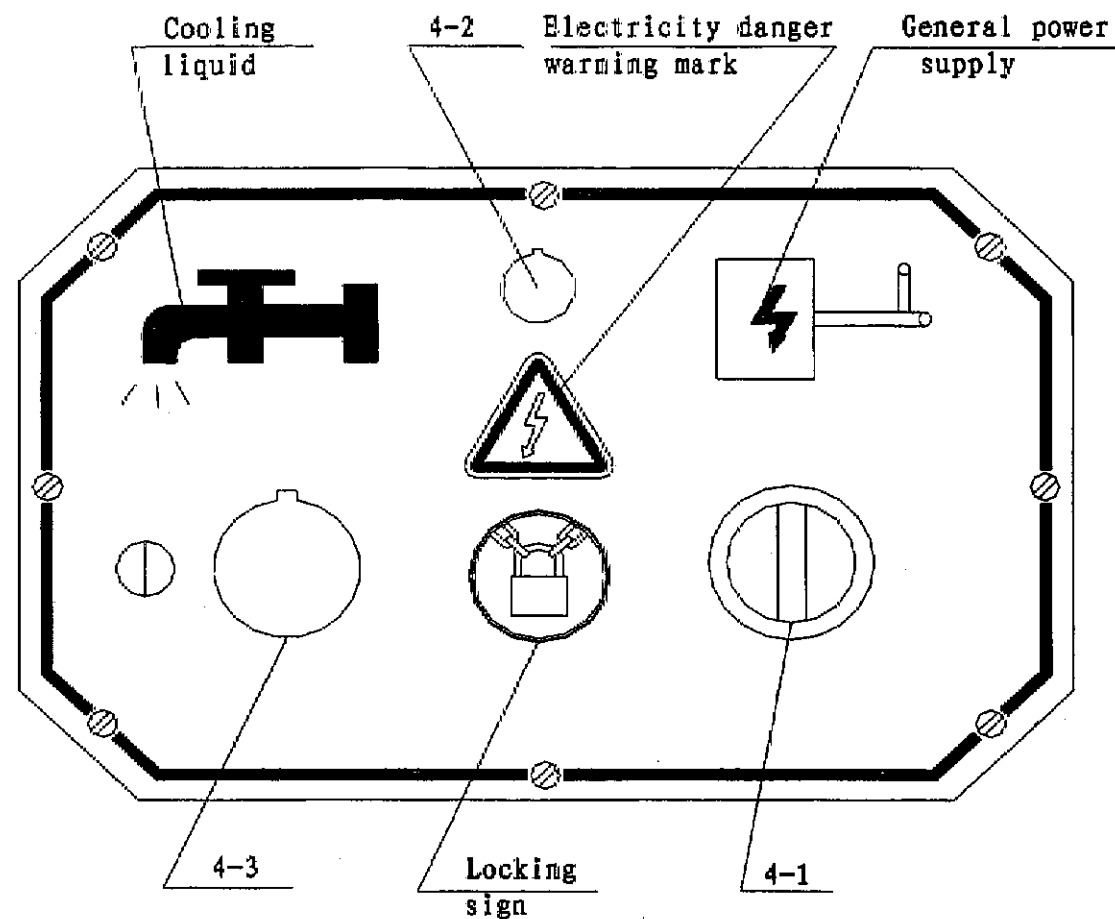


Fig. 4.4 Column Square Door Diagram

Press-Button Designation Table

Number	Press-button designation
4-1	General power supply switch (red)
4-2	Power supply indicating lamp
4-3	Cooling pump indicating Press-Button

5 COMMON FAULTS AND TROUBLESHOOTING

Fault	The reason caused	Troubleshooting	Remark
Master motor does not run when start press-button is pressed down.	The general power supply switch has not been turned on; the start press-button has a poor contact, the contactor does not close, a poor contact of wiring at master motor terminal head or in the electric panel, or a connector drops off.	Turn on the general power supply switch; check connector of start press-button; check all the connecting points of the contactor in the electric panel; check the joint points related to the master motor.	
Handling handle to change speed, spindle does not back turn	Variable speed oil pump is an unidirectional oil pump, if the rotation direction is wrong, the pump does suck oil, the shifting fork can not be driven to press upward or downward the friction plate	Shift any two wires of the master motor power line.	
Oil leaks at spindle and outer surface	Excessive oil filled in the oil tank, oil leaks from the upper part of the bearing housing.	When fill oil, do not fill oil beyond the mark of oil leveler center.	
Oil leaks at guide screw of the case body	Too much oil in the oil pool, the excess oil leaks from the bearing on the guide screw.	Fill oil according to the marked quantity shown on the oil leveler, the oil quantity shall not be in excess of the center mark of the oil leveler.	
The spindle head can not be clamped tightly	The fit clearance of 55° guide surface that combines the spindle head and the arm is larger; the position of clamping block 2 of the spindle head is wrong; oil leaks at the location where the clamping oil cylinder and the brake rack combine together, or oil pipe 1 leaks oil. The shrink range of the rhombic block is not enough, this does not enable the rhombic block stand up to complete self-lock.	Adjust screw 5 to make this fit clearance not larger than 0.04 mm (check with a 0.04 mm plug gauge); In the releasing state, loosen screw 3, adjust clamping block 2 to a suitable position, then fasten screw 3.	see Fig. 7.1
After pressing spindle head releasing press-button, when move spindle head, it moves heavily, or it can not move.	1. Screw 3 is loose, when move spindle head, clamping block 2 follows to move, thus, the clearance between clamping block and guide surface decreases, this has a effect on spindle head movement. 2. When move the spindle head, if there is a feeling of heavy, you may check if the rolling bearing of pressure plate is damaged or not.	Check if the screw 3 on the clamping block is loose or not, change the rolling bearing on the pressure plate (25×62×10; 305).	See Fig. 7.1

Fault	The reason caused	Troubleshooting	Remark
The upright column can not be clamped tightly	Over regulation of a screw on spring plate 3, this causes the column to be raised too much, the rhombic block clamping mechanism can not tightly press the conical surface where outer and inner column combine together; Improper regulation of nut 6 causes a clearance between lever 13 and case body; Oil pressure in hydraulic system is too low, it can not push the piston in the hydro-cylinder to move, this causes the rhombic block can not be in clamping position.	Readjust the screw on the spring plate, but the acting force used to release arm must be ensured, the adjust a nut on column top, let the clamping force reach 1568N (the thrusting force at the end of the arm), the lock the nut tightly with screw; If feel lighter when release the column, nut 6 shall be adjusted to decrease the clearance between the lever and the case body, fasten 4 screws of nuts 7; Adjust oil pressure in hydraulic system to ensure oil pressure at $245-291 \times 10^4$ Pa, or change oil in the oil pool.	See Fig. 7.2
The arm can not be clamped tightly	The adjustment of screw 1 is not proper, there is a clearance at the fit position where the arm fits with outer column when the arm is in clamping state; The travel-limit switch is installed closer to the piston rod, the piston rod contacts with the switch before it reaches the clamping position, this causes the hydraulic pump motor stop supplying oil.	Remove side cover, loosen locking nut, or readjust screw 1, this ensures not only a 0.04mm plug gauge can not be inserted into the fit clearance when the arm is in clamping state, but also the rhombic block can stand up and self-lock; In the clamping condition, adjust the position of the travel-limit switch, allow the normally-closed contract to open and the rhombic block to be in clamping position, in respect to the rhombic block please refer to spindle head clamping mechanism.	

Note:

If there are serious faults which, for example, need to open the spindle head, the repair must be carried out by special repair persons, the others are not allowed to open privately the spindle head to repair.

1. If there are faults concerning safety characteristics, a test run must be done again after the faults have been removed.

6 SAFETY PROTECTION DEVICE

6.1 Safety Protection Device (Fig. 2.7)

This machine tool pertains to general purpose one. During operation the spindle components and cutting tools can move upward and downward and rotate, the spindle protection device must be used during the operator machines a workpiece, in order to prevent from contacting cutter to cause danger. The protection device is mounted on a cooling fulcrum bar, this causes two actions:

- 2) Rotate around the fulcrum bar;
- 3) Move upward and downward along the fulcrum bar, and the protection device is locked in position by turning knob 2. Before running of the spindle, rotate the protection device to the front of the spindle components, allow it to enter into working position, then start the master motor, allow the spindle components and cutting tools to turn. During the machining, do not allow to open the protection device; Do not allow to touch cutters, workingpieces and cuttings by fair means or foul. After the machine tool stops completely, rotate the protection device to the left side, after opening the protection device, it is allowed to install and clamp cutter, change workpiece, clean cuttings, etc.

6.2 Handling of emergency faults

Should the accidents such as winding up, impacting, pressing and squeezing, scratching happen, the first is to press down the red emergency stop press-button 1—1 on the front panel of the spindle head, then remove the fault. Only when the fault have been removed completely, the general power supply switch 4—1 can be turned on the machine tool enters into working condition again.

7 MACHINE TOOL MAINTENANCE AND ADJUSTMENT

7.1 Main tenance

7.1.1 During the operation , the machine tool shall be lubricated according to all the regulations specified in the manual , the filtering net shall be regular cleaned , keep oil clean.

7.1.2 The guide of the arm and column shall be often keep clean ,fill oil frequently,'keep oily to prevent from damage caused by grinding.

7.1.3 Keep the bench, baseplate clean, clean the cuttings in time. Do not take cuttings directly by hands during cleaning to prevent from injury of hands.

7.1.4 Change cooling liquid once per month, keep it clean, the foreign matters such as cuttings, etc. deposited at the entrance of the cooling head it the cooling liquid must be cleaned everyday.

7.1.5 The conical hole of the spindle shall be wiped clean before install cutter.

7.1.6 The maintenance of electrical appliance

The electrical appliance must be kept clean, for this purpose, the dust, dirt and greasy dirt must be regular cleaned up. Dust can be cleaned up by blowing of compressed air. The coils is prohibited to wash with kerosene or gasoline, etc. The bearing of the motor shall be inspected and cleaned per annual service, the inspection and changing oil must be carried out at least once a year. The grease the motors used contains animal and plant oil calcium soap and mineral oil. All the contacts shall be carefully cleaned to remove dirt on them, the worn contacts must be replaced by new ones, oily, burned or oxidic contacts are not allowed, they can be recovered by light filing with fine file.

7.2 The adjustment of the machine tool

7.2.1 The adjustment of spindle clamping force (Fig. 7.1)

Loosen screw 2 to move part 3; the clamping force can be adjusted. The clamping force shall be adjusted to such an extent that apply a circumferential force of 392N to the edge of the spindle head movement handwheel, the spindle head must not be released. Screw 5 and 6 are used to adjust the fit clearance of the guide combination surface where the arm and the spindle head combine together, use a plug gauge of 0.04mm to check this clearance, the insertion depth must not be larger than 20mm, and the spindle head can move when the circumferential force applied to the edge of the spindle head movement handwheel is reached. After the adjustment, the setscrew must be fastened.

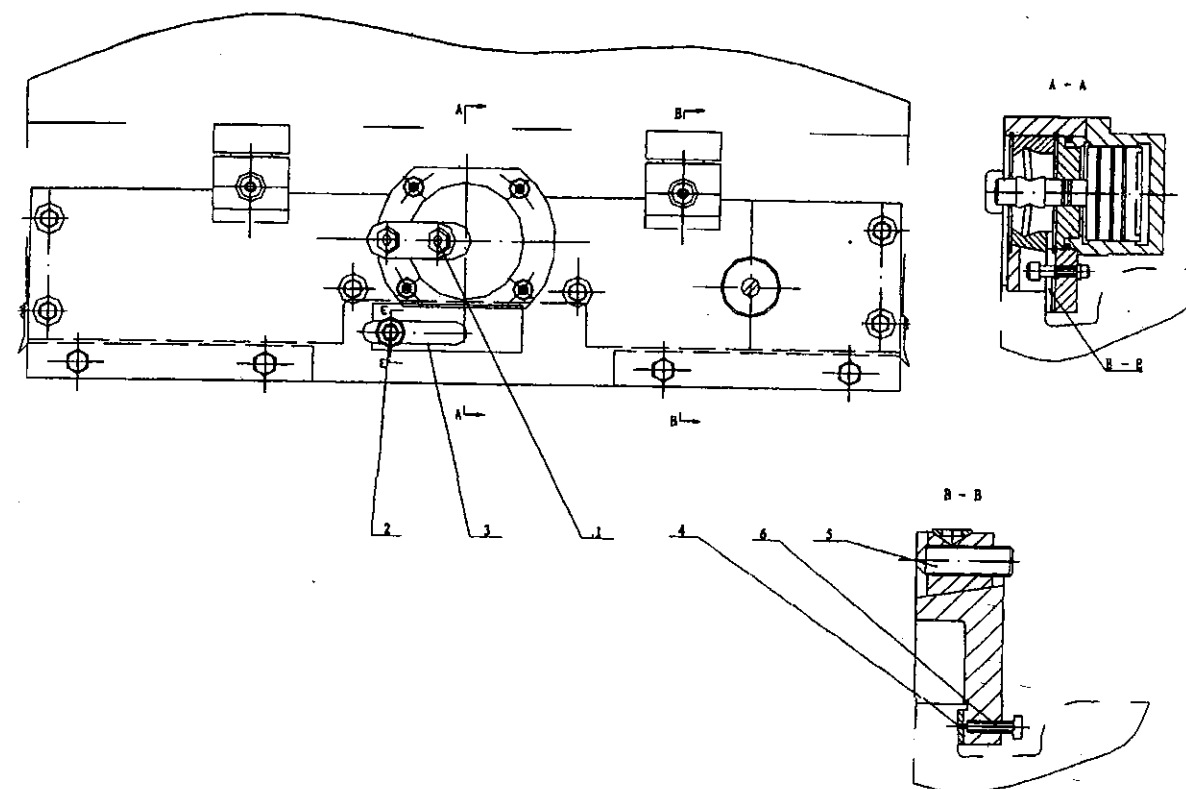


Fig. 7. 1 Spindle head Clamping

7.2.2 The adjustment of column clamping force (Fig. 7.2)

Screw 3 is used to adjust the clearance between the conical surface of inner and outer column, when adjust, the force must evenly apply to the screw, the column clamping force is adjusted by nut 7. When the requirement that apply a horizontal force of 1568N at the end of the arm the column does not rotate, and after releasing, apply a horizontal force of 29N, the column can rotate is met, tighten screw 6, clamp the nut 7 tightly.

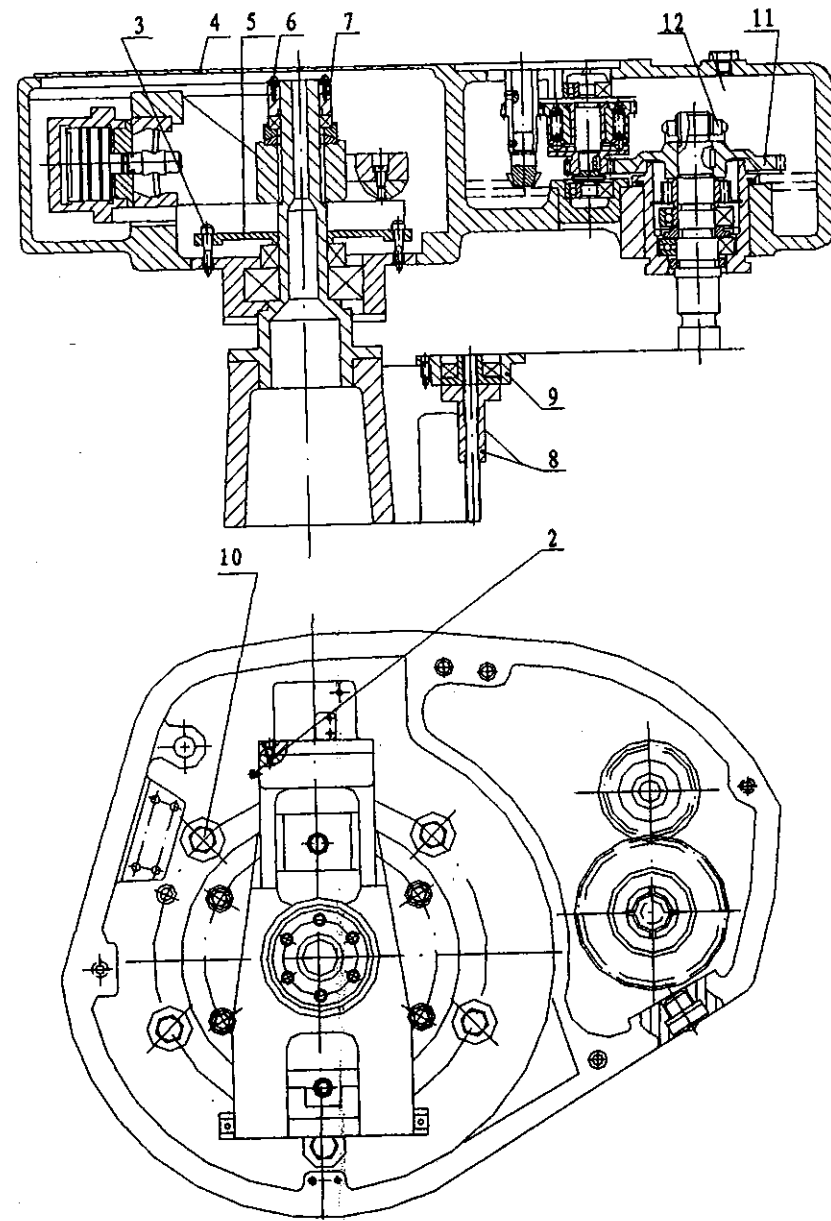


Fig. 7.2 Upright Clamping

7.2.3 The adjustment of arm clamping force (see Fig. 7.3)

When adjust, the general power supply can be disconnected during the arm rising-falling, allow the arm to be in a releasing condition, adjust screw 1, 2, 3 and 4 properly the adjustment is completed when the arm is in a clamping condition a 0.04 mm plug gauge can not be inserted into the clearance of the combination surface.

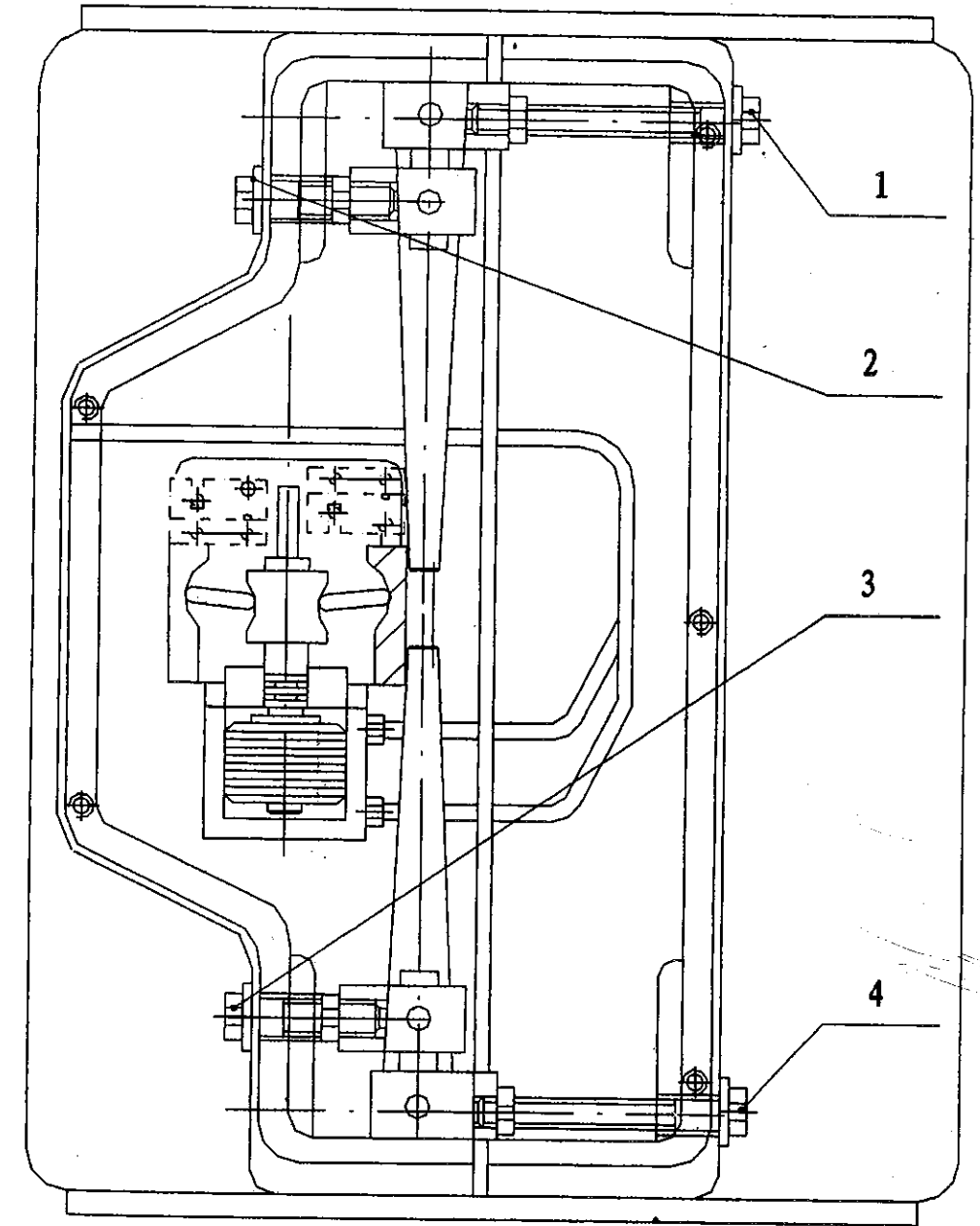


Fig. 7.3 The Arm Clamping

8 HYDRAULIC SYSTEM

The hydraulic system of the machine tool is comprised of two parts: control mechanism hydraulic system and clamping mechanism hydraulic system.

8.1 Control Mechanism Hydraulic System (Fig. 8.2)

The control valve and preselecting valve are mounted on the top of the spindle head. The spindle rotation speed preselecting valve and the feed quantity preselecting valve are 16-position 6-way rotary valve with each controls 4 differential hydro-cylinder, realize a 16-class speed transformation. The control valve is 5-position 6-way rotary valve, controls corotation hydro-cylinder, counter revolution hydro-cylinder, speed change hydro-cylinder, neutral position hydro-cylinder and brake hydro-cylinder.

The oil path state for each position of the control valve is as follows:

Oil path number \ Spindle action	1	2	3	4	5	6
Corotation	+	-	-	-	+	-
Counter revolution	-	+	-	-	+	-
Speed change	+	+	+	-	+	-
Neutral position	-	-	-	+	+	-
Stop	-	-	-	-	-	-

Note: "+" is high oil pressure, "-" is low oil pressure

The connecting position of the oil paths:

1. Contraction hydro-cylinder
2. Counter revolution hydro-cylinder
3. preselecting vave
4. neutral position hydro-cylinder
5. outlet of oil pump
6. inlet of return oil

During the speed change, high pressure oil enters into preselecting valve, pushes various peed change hydro-cylinder, the sliding gear is driven to change speed, meantime high pressure oil flows into the corotation hydro-cylinder respectively through small holes, since the area of corotation hydro-cylinder is different from that of the counter revolution hydro-cylinder (the area of corotation hydro-cylinder is larger than that of the counter revolution hydro-cylinder), this causes the shifting fork which presses the friction plate tight has a smaller force to press the corotation friction plate tight, therefore it enables the

transmission chain to be started.

When the control valve is in stop position, the oil coming from the pump ⑤ directly flows into return oil path ⑥, the whole system is in a low pressure condition, at this time, the spring which brake the hydro-cylinder is released due to pressure loss of oil path ⑤, consequently it presses the friction plate tight, and brakes the transmission chain, the spindle stops back turn.

The oil pipe must be installed according to the pipe number shown in Fig. 8.3, when insert oil pipe 1 and wash the filtering net, the end of oil pipe 1 must be inserted into the net, otherwise the fault may be caused in the hydraulic system, and a long time normal service can not be ensured.

The pressure of the hydraulic system is controlled by spring 3 in a relief valve mounted on the oil pump (Fig. 8.3), the working pressure is $156.8 \times 10^4 \sim 196 \times 10^4$ Pa.

8.2 The Clamping Mechanism hydraulic System (Fig. 8.1)

The clamping and releasing of spindle head, column and the arm are realized via the rhombic block which acts after the piston being pushed by pressure oil, where in the clamping and releasing of the arm are controlled individually through a solenoid valve. The clamping and releasing of the spindle head and the column can be carried out both simultaneously and individually, "simultaneous" and "individual" operation are controlled by a knob 1—6 mounted on the spindle head.

When clamp (or release) the spindle head or the column, first turn the knob 1—6 to a special position (the center position is for combined releasing/clamping, the right, spindle head individual releasing/clamping and the left, the column individual releasing/ clamping), then start the clamping motor by press the press-button 1—19 (or 1—18) shown in Fig. 3.1, after the oil pump supplying oil, the oil will flow into clamping hydro-cylinder through the disbution valve, and push piston and in turn the rhombic block to realize clamping (or releasing).

The clamping mechanism hydraulic system of this machine tool is in a closed circulation mode, its working pressure is $250 \times 10^4 \sim 280 \times 10^4$ Pa. Since the area of the piston of the clamping hydro-cylinder is different, when oil flows into a large oil chamber, part of oil is needed to replenish through oil-sucking pipe; when oil flows into a small oil chamber, the surplus oil in the oil path will leak from the pump, and flows back to the oil pool via oil return hole. Since the volumetric efficiency of the pump is low, the volumetric difference is small, therefore back pressure and over pressure can not be produced in the system.

8.3 Cooling Liquid

Cooling liquid must be used when machining steel, fraising and tapping.

When use cooling liquid, press down the switch 4—3 (see Fig. 4.4), start the cooling

pump, the flow can be regulated by knob 1—20 (see Fig. 3.1). During operation, attention shall be paid to adjust the cooling pipe, align the nozzle to the machined position, do not let cooling liquid splash, the flow is adjusted depending upon the requirement. Do not use inflammable and harmful cooling liquid.

The type of the cooling pump is: AOB—25,
 Power: 0.09 KW,
 Flow: 25 L/min,
 Head: 4m.

Cooling Liquid Table

Use	Contents	Characteristic	Remark
Drilling steel	Emulsified gypsum 3—5%, Anhydrous sodium carbonate 0.2~0.35%, Sodium nitrite 0.25~5%, The rest: water	Flame retardant antirust	
Fraising	Emulsified gypsum 3—5% Anhydrous sodium carbonate 0.2—0.35%, Sodium nitrite 0.25—5% The rest: water	Flame retardant antirust	
Tapping	Chlorowax 40% Kerosene 30% Transformer oil 30%		Apply to the cutter before tapping

8.4 The cleaning of cooling liquid

The cooling liquid tank is located at the rear part of the machine tool baseplate, the cooling liquid is used in circulation, please change it in time when you find it is unclean. The change method: Prepare an empty container, put the nozzle of cooling liquid in the empty container, start the cooling pump, let the cooling liquid flow into the container, if there is residue, wipe it away with a cloth, then fill clean cooling liquid in the cooling liquid tank.

The foreign matter such as cuttings etc. deposited at the entrance of the cooling liquid tank in the cooling liquid shall be also cleaned in time.

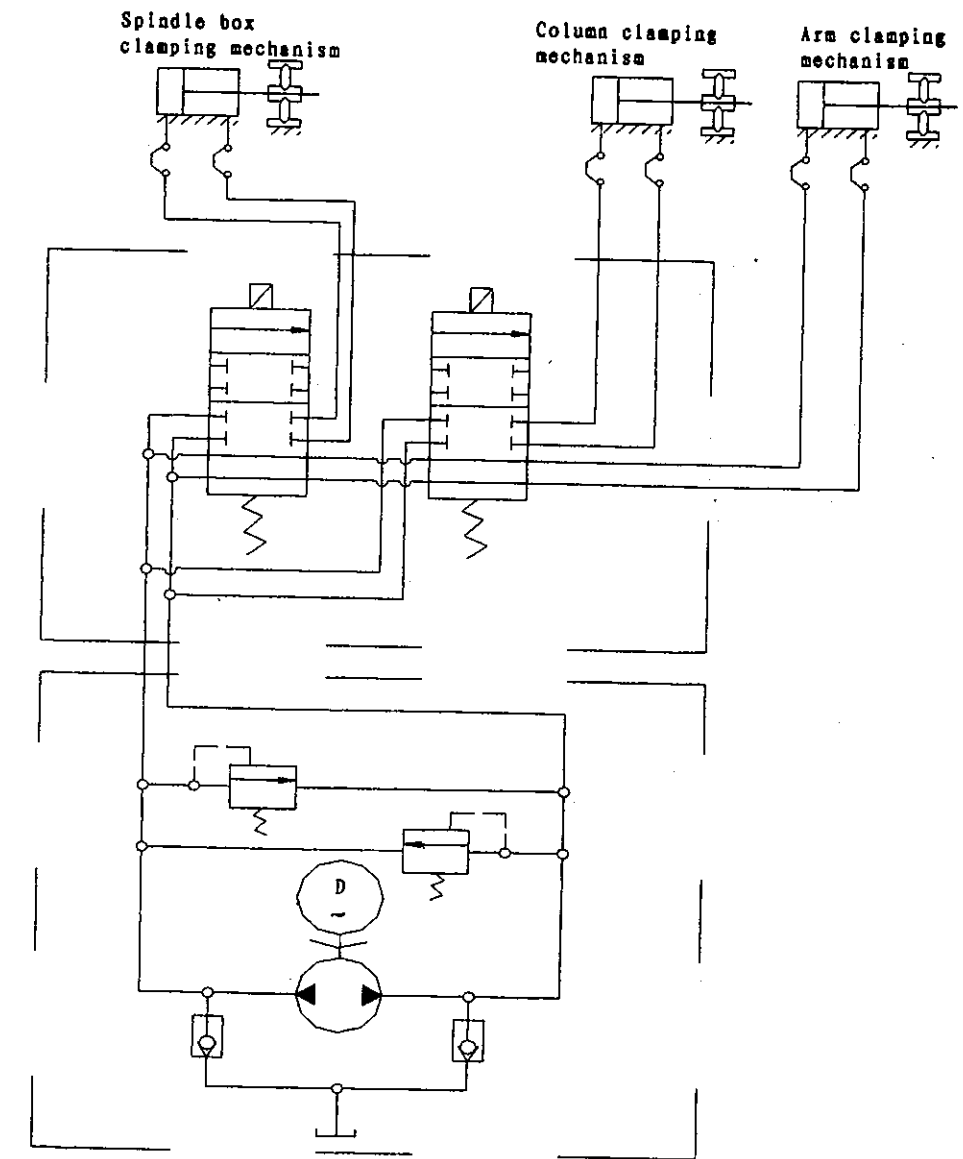


Fig. 8.1 Clamping Mechanism Hydraulic Schematic Diagram

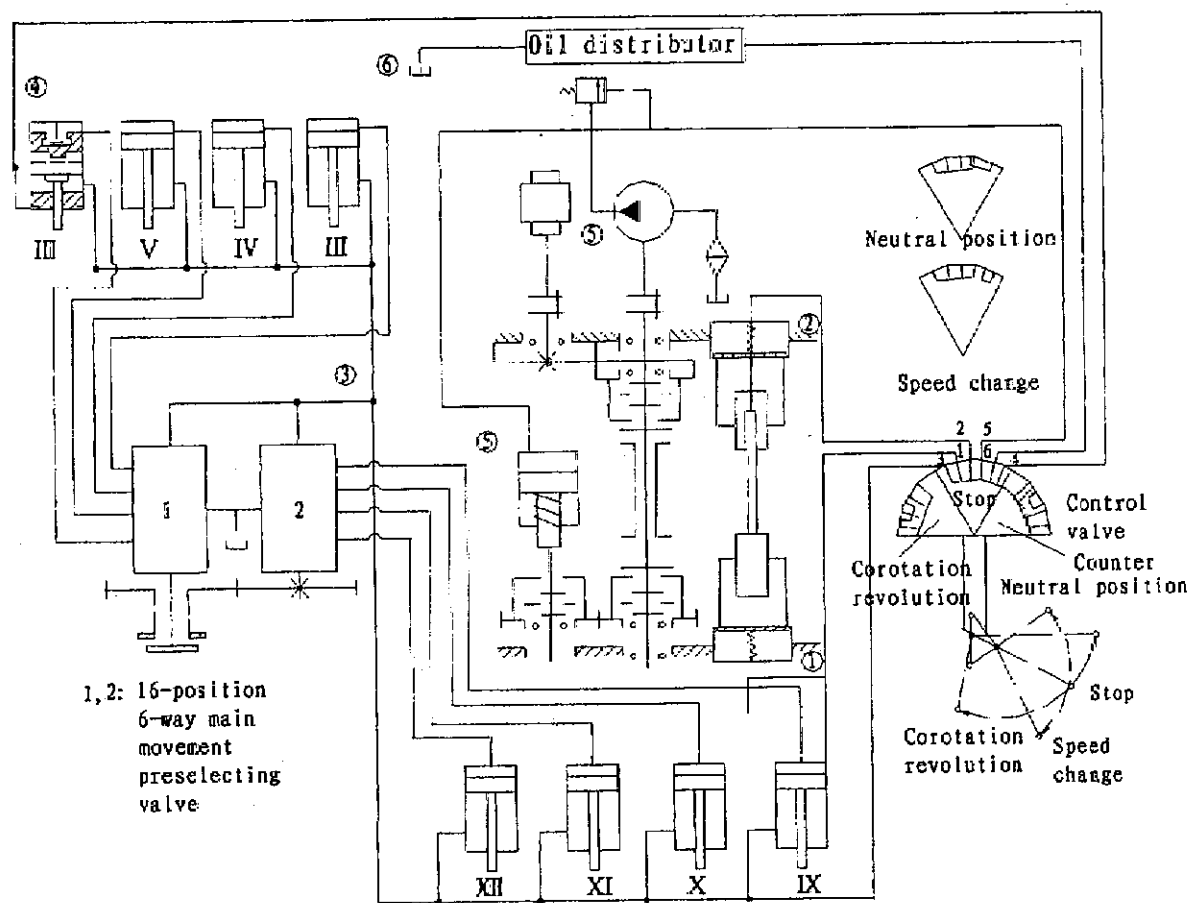


Fig. 8.2 Control Mechanism Hydraulic Schematic Diagram

Oil Paths Transformation Table of Speed Chang Hydro-Cylinder

Hydro-Cylinder No.	III	IV	V	VI	Hydro-Cylinder No.	IX	X	XI	XII
2000	+	+	-	+	3.20	+	+	-	-
1250	-	+	-	+	2.00	+	-	-	-
800	+	+	+	+	1.25	-	+	-	-
630	+	-	-	+	1.00	+	+	+	-
500	-	+	+	+	0.80	-	-	-	-
400	-	-	-	+	0.63	+	-	+	-
320	+	+	-	-	0.50	+	+	-	+
250	+	-	+	+	0.40	-	+	+	-
200	-	+	-	-	0.32	+	-	-	+
160	-	-	+	+	0.25	-	-	+	-
125	+	+	+	-	0.20	-	+	-	+
100	+	-	-	-	0.16	+	+	+	+
80	-	+	+	-	0.13	-	-	-	+
63	-	-	-	-	0.10	+	-	+	+
40	+	-	+	-	0.06	-	+	+	+
25	-	-	+	-	0.04	-	-	+	+

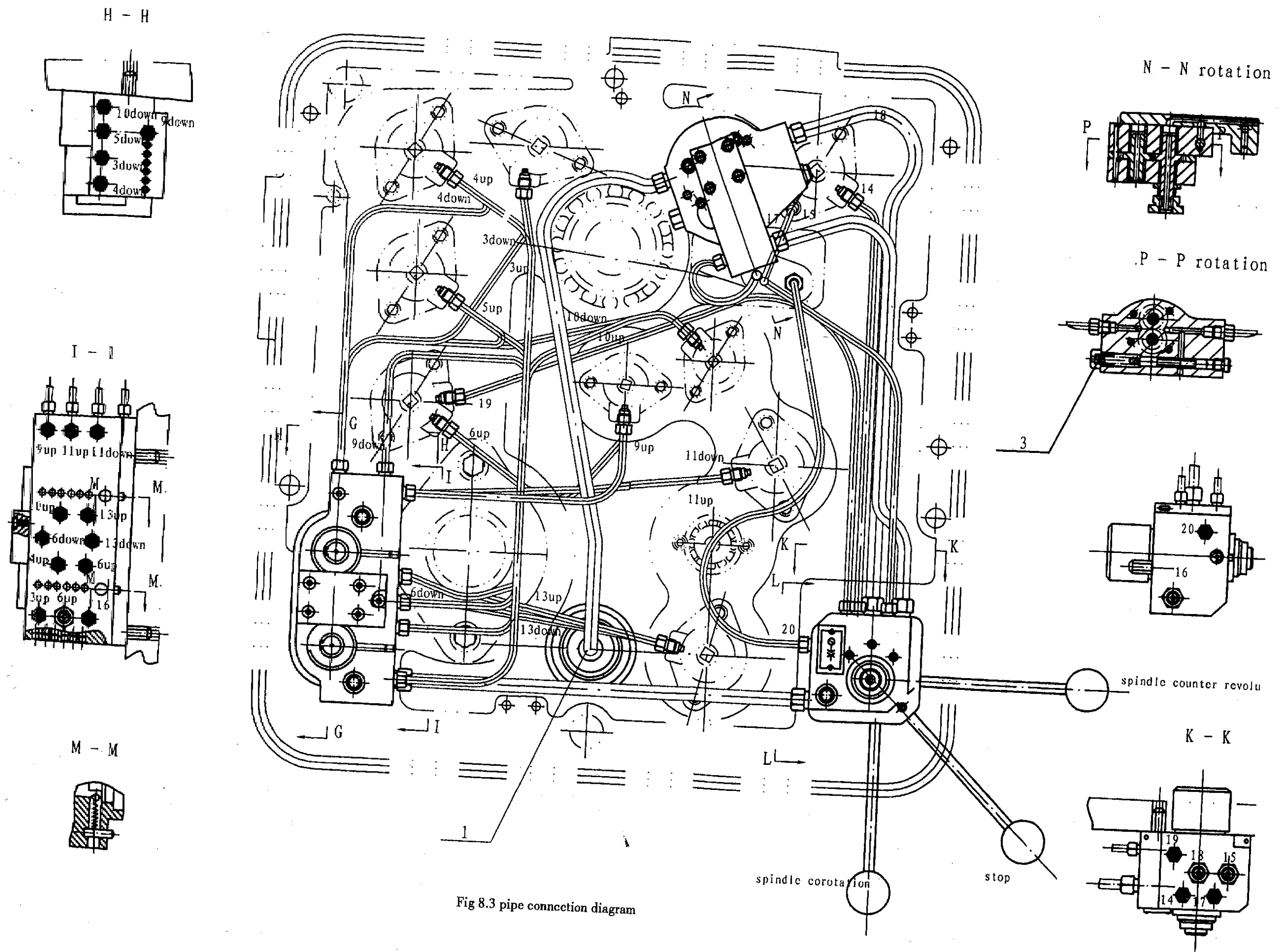


Fig 8.3 pipe connection diagram

9 ELECTRIC SYSTE

9.1 Introduction

9.1.1 Voltage: 3/ PE/~380V.

(Machine tool, with different class of voltage such as ~220V, ~420V and ~440V, etc. can be supplied on request).

9.1.2 Allowed voltage fluctuation range: Stable voltage value is 0.9~1.1 times of rated voltage.

9.1.3 Frequency: 50 Hz

(Machine tool with a frequency of 60 Hz can be supplied on request).

9.1.4 Allowed frequency fluctuation range:

0.99~1.01 rated frequency (continuous service)

0.98~1.02 rated frequency (short time service)

9.1.5 Harmonic: The totality of 2~5 power distortion harmonic does not exceed 10% of mean square root of line voltage; With respect to the totality of 6~30 power distortion harmonic, an additional maximum 2% of mean square root of line voltage is allowed.

9.1.6 Imbalanced voltage: The contents of negative sequence and zero sequence of 3-phase mains voltage are not in excess of 2% of that of positive sequence.

9.1.7 Voltage interruption: At any time of power supply Cycle, the duration of power supply interruption or zero voltage is not in excess of 3 ms, the time interval shall be more than 1 s.

9.1.8 Voltage drop: The voltage drop shall be not in excess of 20% of the peak value voltage in one cycle, the time interval of voltage drop shall be more than 1 s.

	Z3040×16/1.2, Z3040×12/1.2	Z3050×16/1.2, Z3050×12/1.2
220V	91.76	117A
380V	53.62A	67.62A
420V	48.5A	64A
440V	46A	58.5A

9.1.9 The maximum start current of this machine tool is listed in the following table:

9.1.10 Control loop voltage: ~110V ~24V

9.1.11 In order to realize transmission of various mechanism, the following motors are mounted on the machine tool:

M1—spindle motor

M2—horizontal arm rising-falling motor

M3—hydraulic pump motor

M4—cooling pump motor

Note: Since there is no collector ring at the column top of this machine tool, do not rotate the arm

continuously along one direction during operation, in order to prevent the machine tool from short circuit due to twist breaking of the power line passed through the column and eventually prevent personnel from injury.

9.2 Installation (see Electrical Appliance Index):

9.2.1 The incoming power line shall adopt 4 mm² BVR wire, it shall be sheathed by $\phi 20$ wire tube and laid under ground, the incoming line terminal of the machine tool see "Electric Appliance Index".

9.2.2 It is recommended that the over current protection device at the power supply side shall adopt the circuit breaker with a rated current of 20A, its set value shall be 20A, its breaking current capability shall be larger than 10KA.

9.2.3 Phase sequence inspection of the machine tool:

After the machine tool has been installed completely, turn on the power, press down spindle head releasing press-button SB6, if the spindle head is released, that means the phase sequence of the power supply is correct, otherwise it is necessary to interchange position of any two wires in the power line.

After ensuring the correction of the phase sequence of the power supply, then inspect and adjust, if necessary, the phase sequence of rising-falling motor M2.

9.2.4 The distance from the space required for electrical appliance repair to the machine tool: 800 mm.

9.2.5 The lowest luminance in the workshop shall meet the luminance requirement of 500 lux.

9.3 Instruction of circuit (Refer to Electric Schematic Diagram):

In order to work out the output of the contactor and the electromagnet all of the input signals, such as electric control button station and travel limit switch, are operated by PLC.

9.3.1 Preparation before operation:

Open the electrical appliance head on the horizontal arm, turn on motor starter QF2, QF3, QF4, QF5 and air-break QF6, QF7, QF8, then close electrical appliance head.

9.3.2 Start the motor: Turn on the general power supply switch QF1 under the column, at this time the power supply indicating lamp HL1 indicates that the equipment is power on.

9.3.3 The rotation of the spindle motor.

Press down press-button SB3, the AC contactor KM1 is energized to actuate and self-lock, the spindle motor M1 turns; Press push-button SB2, the AC contactor KM1 is de-energized to release, the spindle motor M1 stops to turn.

In order to prevent the spindle motor in overload operation for a long time, the motor starter QF2 is set in the circuit, its set value shall be adjusted according to a rated current shown in a nameplate of the spindle motor M1.

9.3.4 arm rising/falling

Note: The control of arm rising (falling) adopts touch-to-move mode, press down the push-button, the arm rising/falling, when the hand leaves the push-button, the arm stops to rise and falls.

Press arm rising (or falling) push-button SB4 (or SB5), the hydraulic pump motor M3 rotates in positive direction, pressure oil flows through a distribution valve into a releasing oil chamber of the

arm releasing-falling hydro-cylinder, pushes the piston and the rhombic block, the arm is released, in the same time the piston rod presses a travel-limit switch SQ2 via a plate spring, this causes a AC contactor KM4 to be de-energized to release, a AC contactor KM2 (or KM3) is energized to actuate, the hydraulic pump motor M3 stops to turn, the arm rising-falling motor M2 rotates to drive the arm to rise (or fall).

If the arm is not released, the normal open contact of travel-limit switch SQ2 can not close; AC contactor KM2 (or KM3) can not be energized to actuate, the arm cannot rise/fall.

When the arm rises or falls to a required position, release the push-button SB4 (or SB5), AC contactor KM2 (or KM3) is de-energized to release, rising-falling motor M2 stops to turn, the arm stops to rise (or fall).

After a delay of 1—3 seconds, its normal close contact which is delay closed closes, a AC contactor KM5 is energized to actuate, the hydraulic pump motor M3 rotate in negative direction to supply pressure oil. The pressure oil flows through the distribution valve into a clamping oil chamber of the arm releasing-clamping hydro-cylinder, causes the arm to be clamped; Meanwhile the piston rod presses a travel-limit switch SQ3 via the plate spring, causes a AC contactor KM5 to be de-energized to release, the hydraulic pump motor M3 stops to rotate.

The travel-limit switch SQ1 (SQ1a, SQ1b) is used to restrict the arm rising-falling travel, when the arm rises/falls to a limit position, SQ1 (SQ1a, SQ1b) actuates, the AC contactor KM2 (or KM3) is de-energized, rising-falling motor M2 stops to rotate, the arm stops to rise/fall.

The arm automatic clamping is controlled by travel-limit switch SQ3, if there is a fault occurred in the hydraulic clamping system, the arm can not be clamped automatically, or the arm is clamped but the normal close contact can not open due to the improper adjustment of SQ3, both can cause the hydraulic pump motor to operate in an overload condition for a long time; In order to prevent the hydraulic pump motor from damage resulted from overload operation, a motor starter QF4 is used in the circuit, its set value shall be adjusted according to a rated current of the hydraulic pump motor.

The overload protection of the rising-falling motor is accomplished by a motor starter QF3, its set value shall be adjusted according to a rated current of the rising-falling motor M2.

9.3.5 The releasing or clamping of the column and the spindle head can be carried out both individually and simultaneously.

9.3.5.1 The releasing and clamping of the spindle head and the column can be carried out simultaneously.

First of all, move the commutator SA to the center position, press down the clamping (or releasing) push-button SB6 (or SB7), the electromagnet YA1 and YA 2 are energized to actuate, after 1—3 seconds, contactor KM4 (or KM5) is energized to actuate, the hydraulic pump motor M3 rotate in positive (or negative) direction to provide releasing (or clamping) oil chamber of the hydro-cylinder with pressure oil, and push piston and rhombic block, this causes the column and spindle head to be

released (or clamped).

9.3.5.2 Individually release and clamp the spindle head and column

Move the commutator SA to the left (or right), press releasing (or clamping) push-button SB6 (or SB7), follow the same principle of "release and clamp simultaneously", YA1 or YA2 is energized to actuate individually, then the column and the spindle head can be released (or clamped) individually.

9.3.6 The start and stop of the cooling pump

Press down cooling pump start push-button SB8, contactor KM6 is energized to actuate, the cooling pump motor M4 rotates. Press down cooling pump stop push-button SB8, contactor KM6 is de-energized, the cooling pump motor M4 stops to turn.

The overload protection of the cooling pump motor is accomplished by a motor starter QF5, its set value shall be adjusted according to a rated current of cooling pump motor M4.

9.3.7 Emergency stop and relief:

Press down an emergency stop push-button SB1 which has a self-lock function, all the motors stop to run, the machine tool is in an emergency shutdown condition. Turn the emergency stop push-button SB1 in the arrowhead direction, the emergency stop push-button will reset, the emergency stop state is relieved.

N.B. Certain electrical appliance in the machine tool is still with voltage after pressing down the emergency stop push-button, only when the general power supply switch QF1 is disconnected, there is no voltage in the machine tool except primary side of the general power supply.

9.3.8 Shutdown

If the machine tool is stop to use, the general power supply switch QF1 must be disconnected for the sake of personnel and equipment safety.

9.3.9 The protection of control loop and control transformer TC.

The protection of primary side of the control transformer is accomplished by air-break QF6.

The protection of the control loop is accomplished by air-break QF7.

9.3.10 Method for changing working voltage preset in the works when the machine tool is double voltage type, i.e., 220V/440V or 220V/380V, 3-phase, AC.

When the machine tool is designed to use double voltage, i.e. 220V/440V or 220V/380V, 3-phase, AC, the voltage leaving the works is written in a label which is stuck on the cover of the arm electric switch, if the user needs to use the another voltage which is not in conformity to the voltage leaving the works, please remember to change the wiring on the wiring terminals of 4 sets of motors and the control transformer respectively according to wiring diagram on the label of the motor and the wiring diagram on the control transformer, and change the motor starters and air-break supplied along with the machine tool according to the content specified in the "Packing List".

9.4 Inspection maintenance and adjustment of electrical appliance.

N.B.: When inspect the electrical appliance under voltage, all the general power supply switch, the

power line of the contactors and associated elements have voltage, please pay attention to safety!

9.4.1 Adjustment

9.4.1.1 The angle of contact in the rising-falling travel-limit switch SQ1 can be adjusted, normally this has been properly adjusted before leaving the works, but if this switch is failure during rising-falling, or the arm does not rise or fall when press down the rising-falling push-button, if confirm this is caused by the failure of SQ1, the cover of rising-falling travel-limit switch SQ1 head can be opened, loosen the locking screw at the side, then adjust the angle of the contact, fasten the screw and close the cover of the switch head when the proper angle is gained.

9.4.1.2 The adjustment of micros switch SQ2, SQ3.

The upper and lower position of the micros switch SQ2, SQ3 can be fine adjusted, when rising-falling is failure, and find the horizontal arm is not released, or it is released but the clamping does not reset automatically, a covering plate at left end of the horizontal arm can be opened, if find the position of the micros switch SQ2, SQ3 is not proper, move an adjusting plate fixing the micros switch SQ2, SQ3, after the adjusting plate has been adjusted to a suitable position, fasten it, install the covering plate.

9.4.1.3 The adjustment of motor starter current.

The current of the motor starter QF2, QF3, QF4, QF5 of this machine tool has been adjusted proper before leaving the works, if the voltage the user used is not in conformity to that of this machine tool, the corresponding adjustment must be performed, refer to the "Electrical Appliance List" for their data.

9.4.2 Preventive inspection:

In order to ensure safety of personnel and equipment, the electric part of this machine tool shall be inspected once per year, detecting and measuring records shall be made properly, if find problems, proper measure shall be adopted immediately.

9.4.2.1 The measurement of insulation resistance:

The major loop and control loop shall be measured with a 500V megohm, the insulation resistance shall be larger than 1 mega-ohm.

9.4.2.2 The inspection of grounding protection

The grounding protection is adopted for all the motors, spindle head, outer and inner column, body case, horizontion arm, power supply square door, push-button station, the hose in front and rear of the labels, etc. of this machine tool, during inspection, the continuity of the grounding wire shall be inspected, and the fastening of the grounding screw shall be inspected as well.

9.4.3 The maintenance for common faults

The electric schematic diagram, electrical appliance index and circuit instruction shall be referred during searching of faults.

Fault	Reason	Correction	Remark
Spindle does not turn	1. Wrong phase sequence; 2. Trip of motor starter QF2; 3. Motor M1 phase missing; 4. Fault in control loop; 5. Fault in machinery or oil path.	1. Shift phase sequence; 2. Reset motor starter QF2; 3. Recovery missing phase; 4. Refer to schematic diagram to search fault; 5. See Table 5 in Section 8.	
Horizontal arm falling failure	1. Trip of motor starter QF3; 2. Motor M2 phase missing; 3. Fault in control loop, e.g. improper position of micro-switch SQ2, SQ3, improper angle of contact of SQ1. 4. Fault in machinery or oil path.	1. Reset motor starter QF3; 2. Recovery missing phase; 3. Refer to schematic diagram to search fault; 4. See Table 5 in Section 8.	
Hydraulic clamping-leasing failure	1. Trip of motor starter QF4; 2. Motor M3 phase missing; 3. Fault in control loop; 4. Fault in machinery or oil path.	1. Reset motor starter QF4; 2. Recovery missing phase; 3. Refer to schematic diagram to search fault; 4. See Table 5 in Section 8.	
Cooling system trouble	1. Trip of motor starter QF5; 2. Motor M4 phase missing; 3. Fault in control loop.	1. Reset motor starter QF5; 2. Recovery missing phase; 3. Refer to schematic diagram to search fault.	

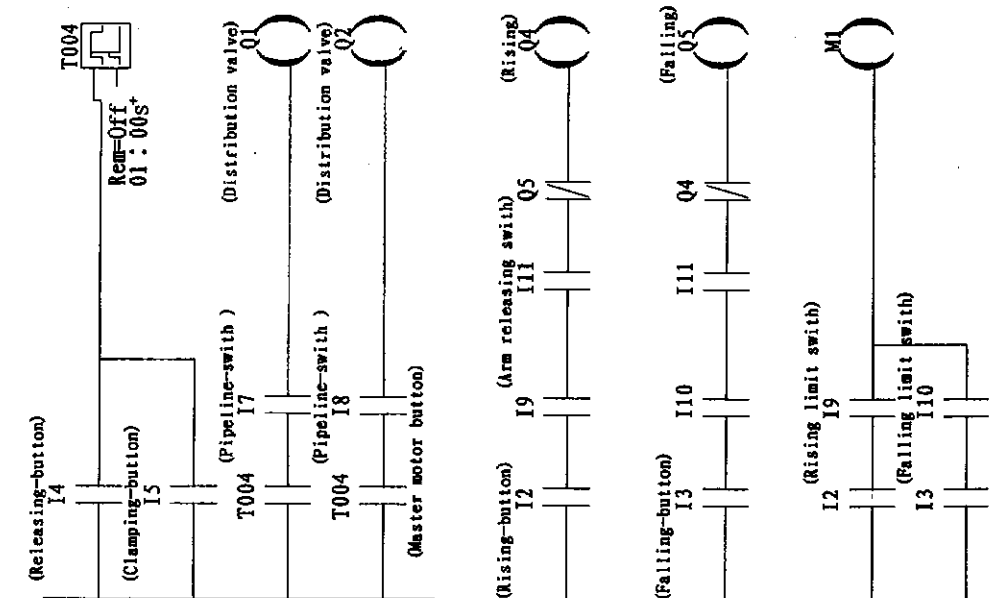
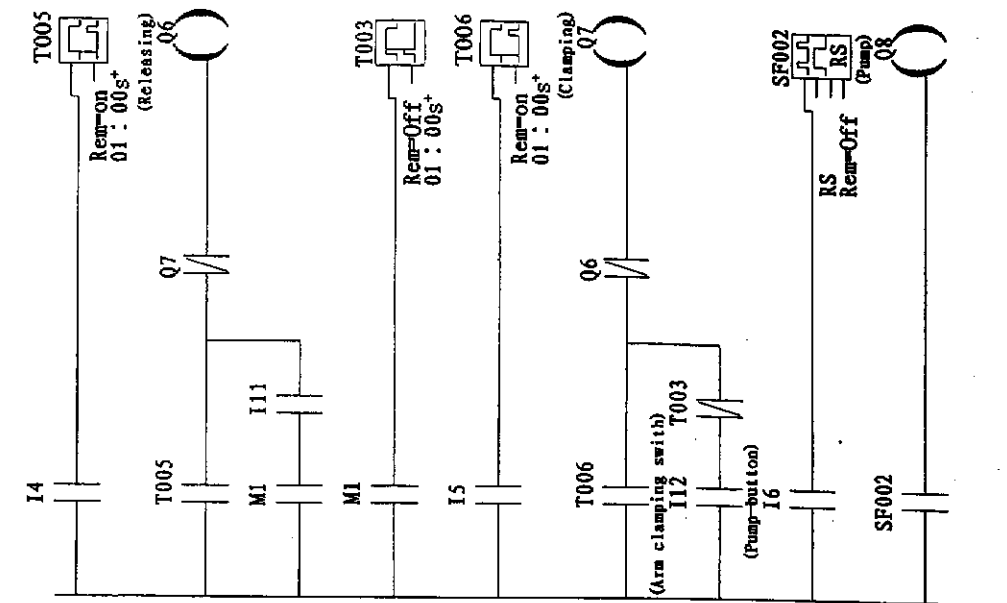


Fig9.1 Programme

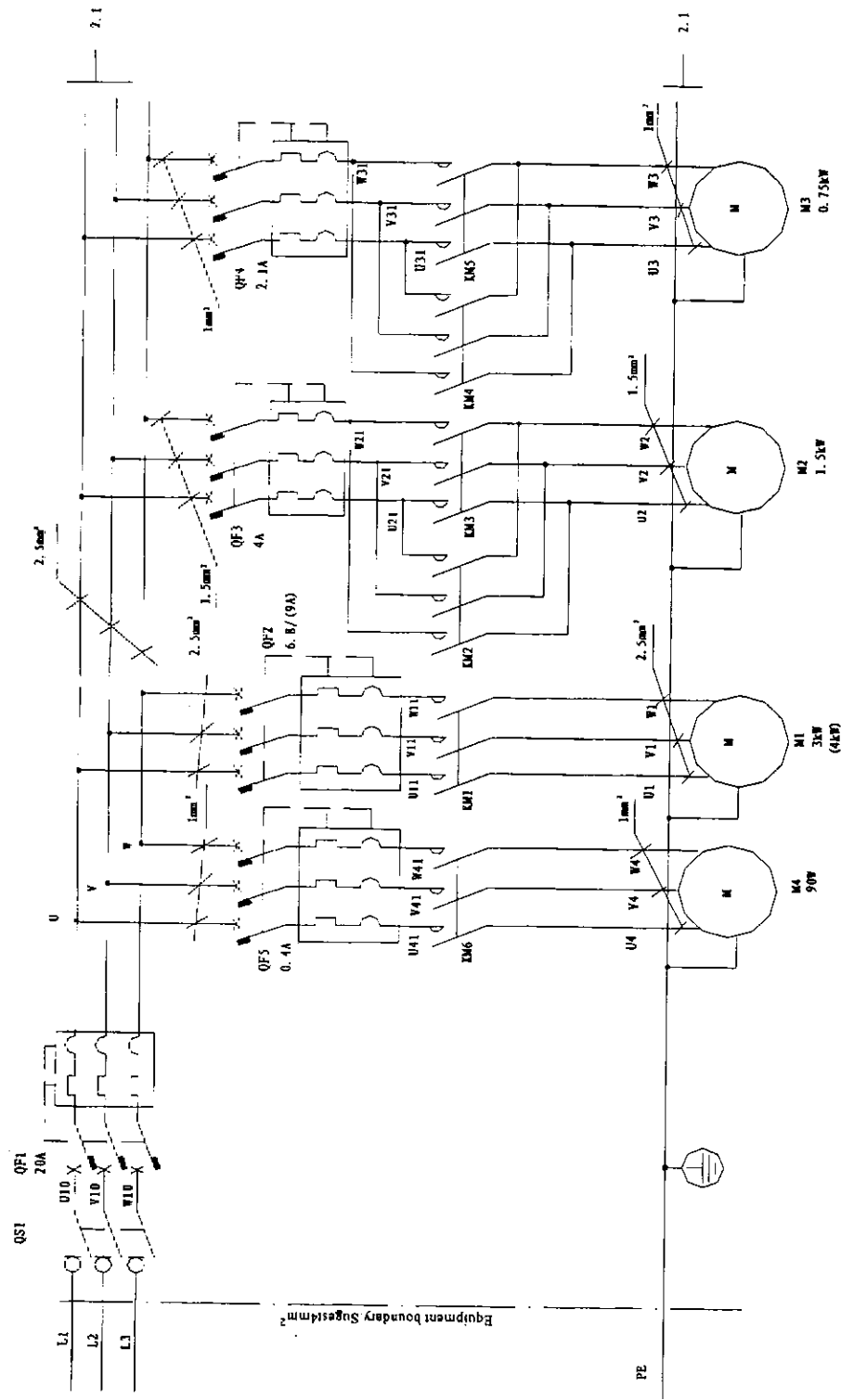
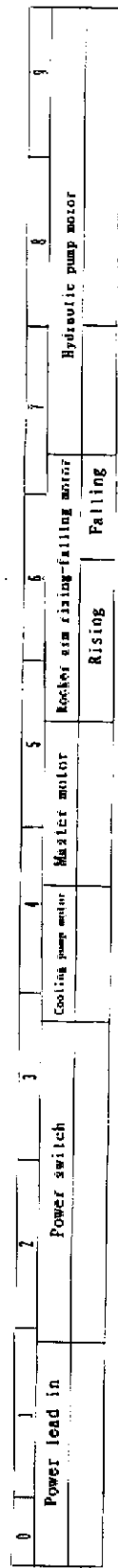


Fig9.2 Electric Schematic Diagram

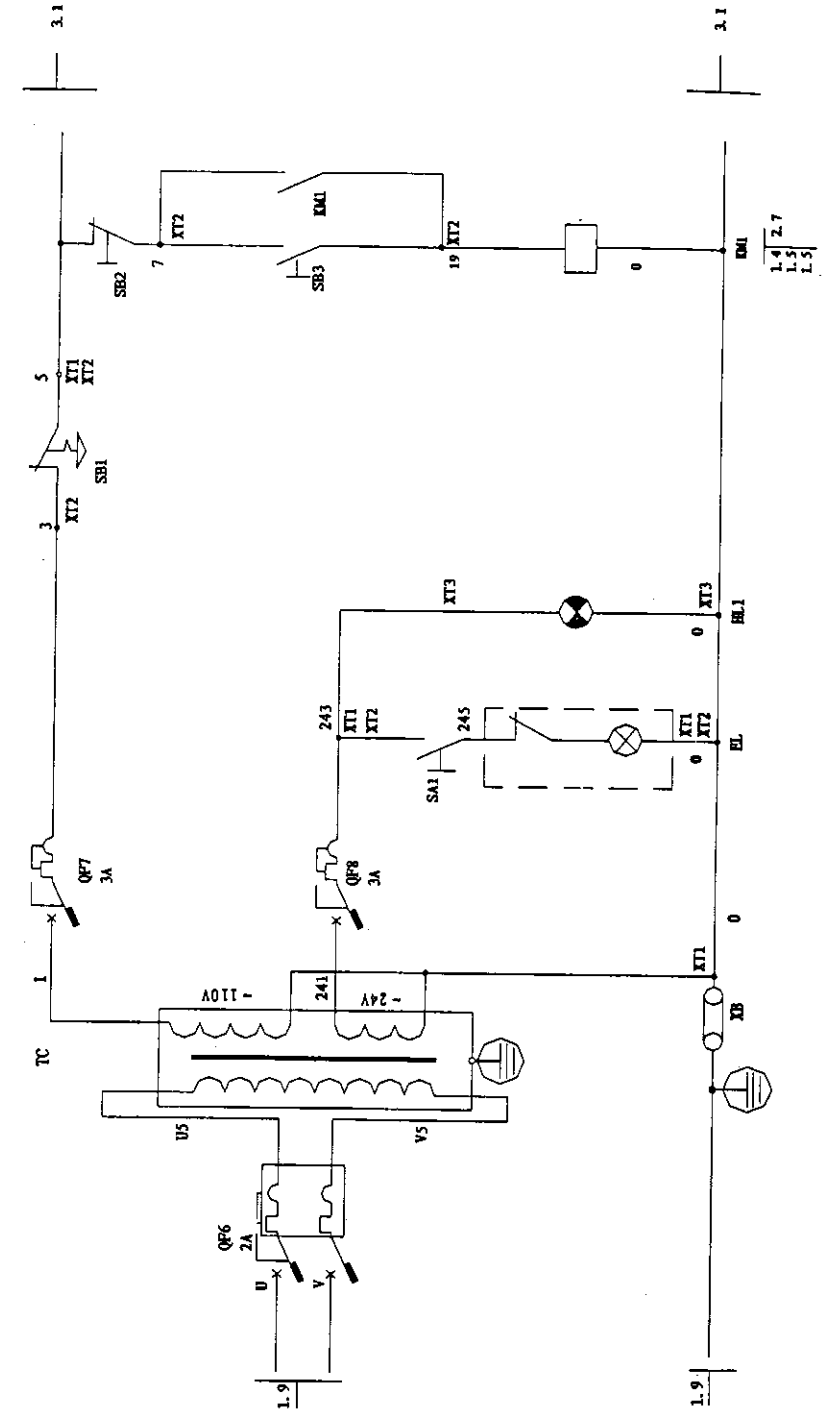
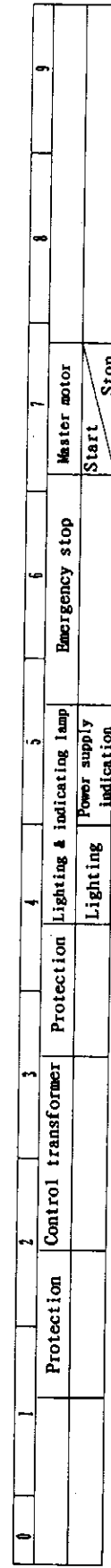


Fig9.3 Electric Schematic Diagram

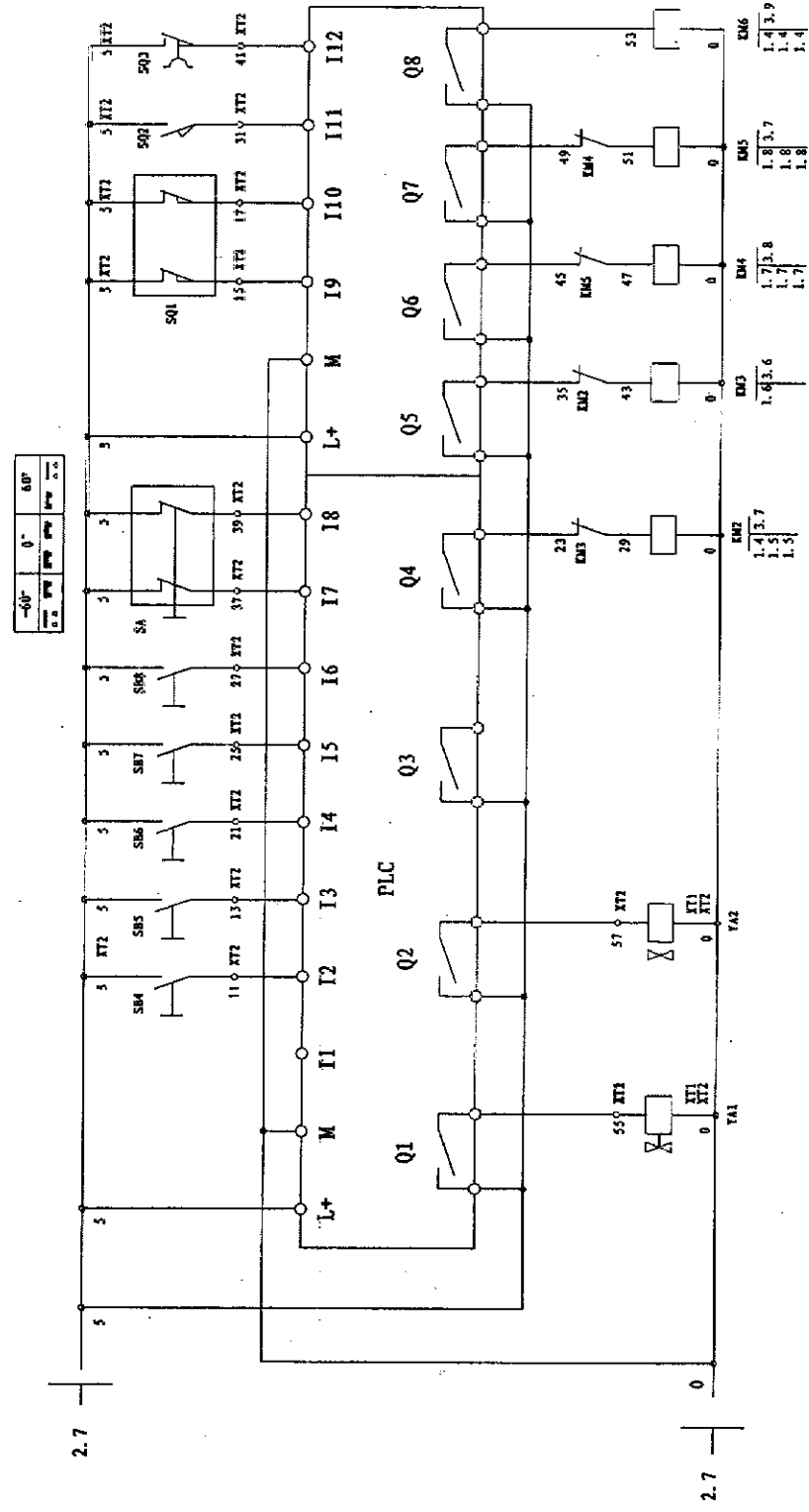


Fig9.4 Electric Schematic Diagram

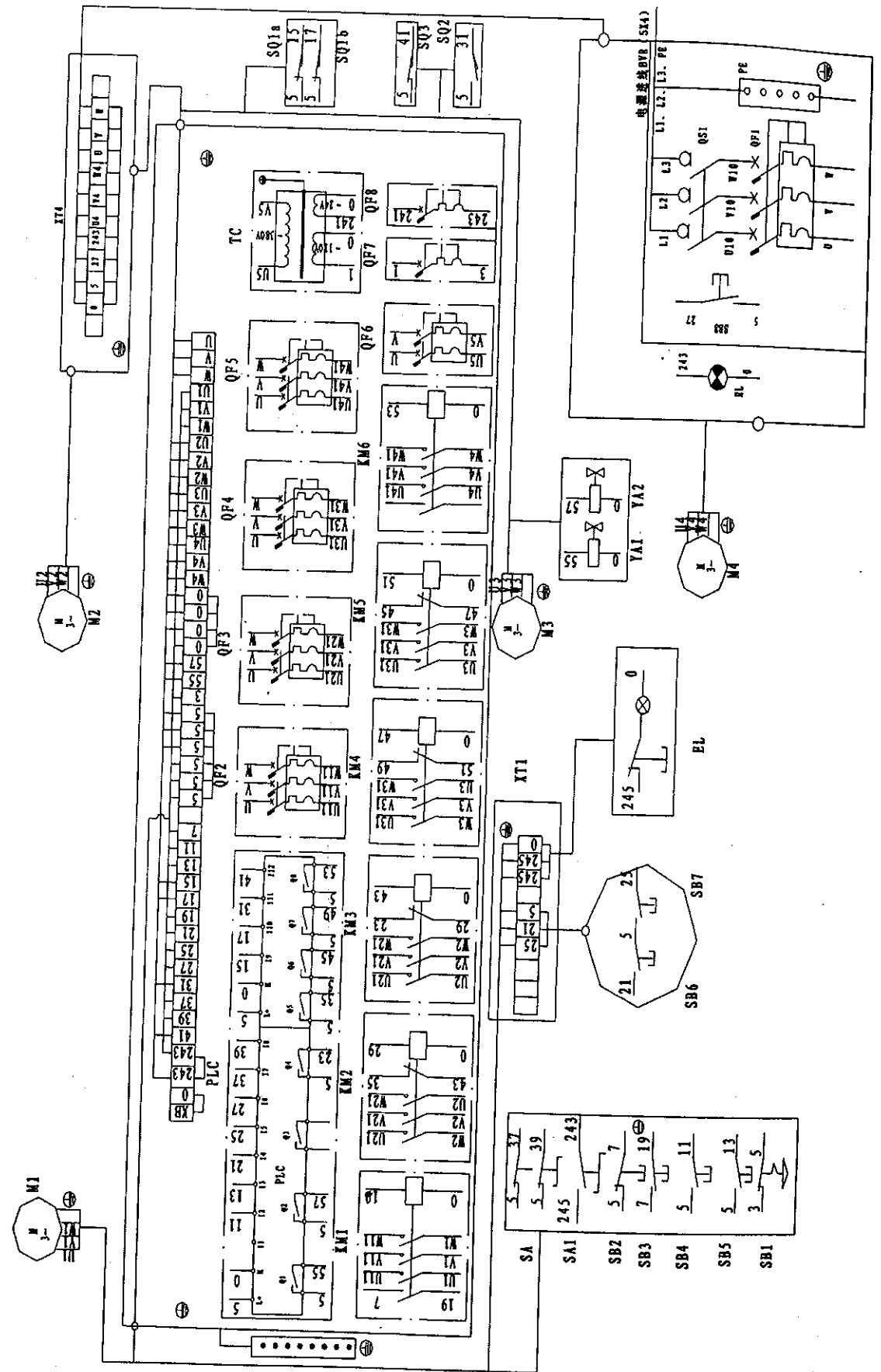


Fig9.5 Machine tool wiring diagram

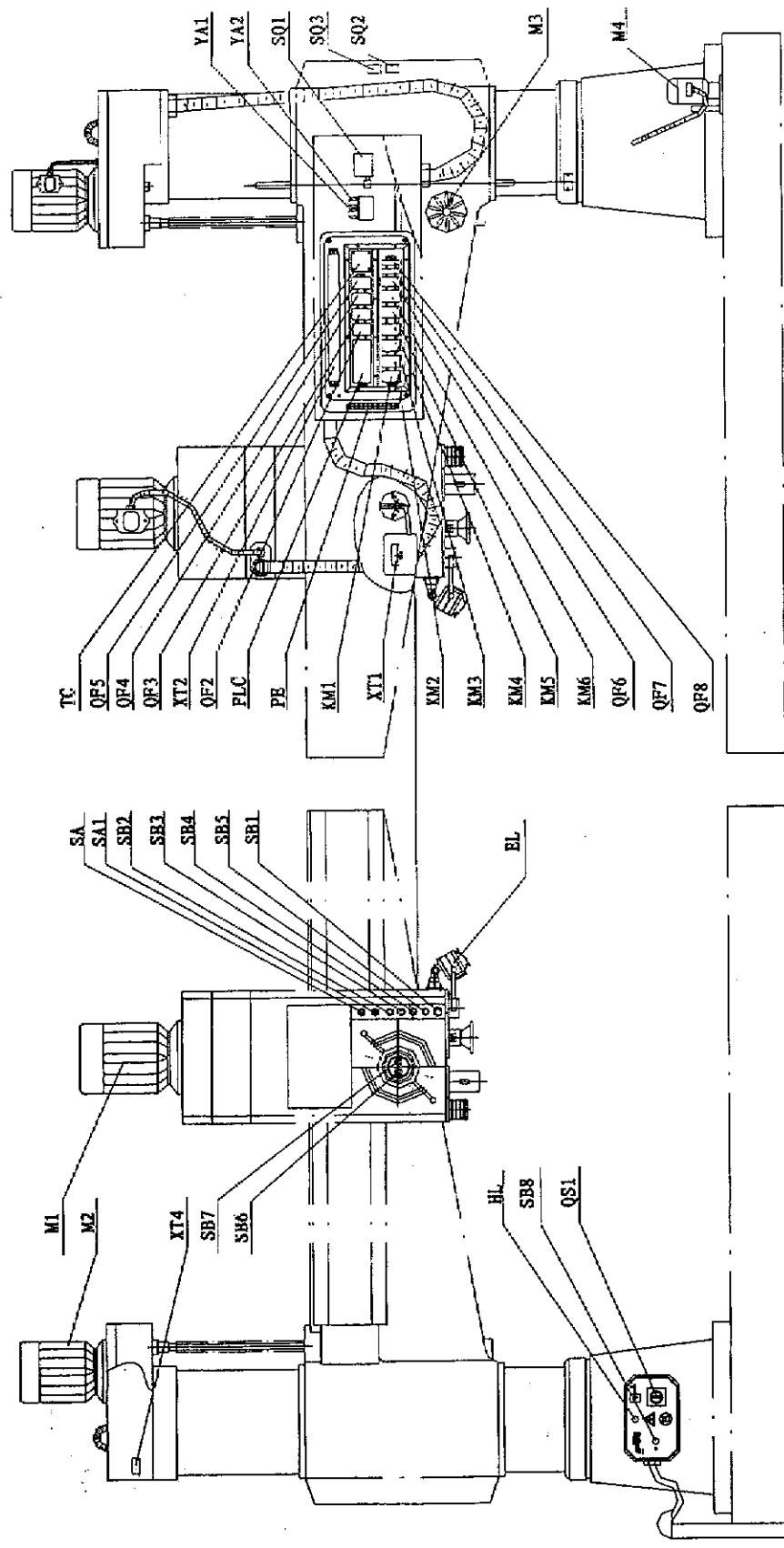


Fig9.6 Electrical appliance installation position index

Power supply incoming line. (Supplied by the user.)

BYR (4x4) short circuit.

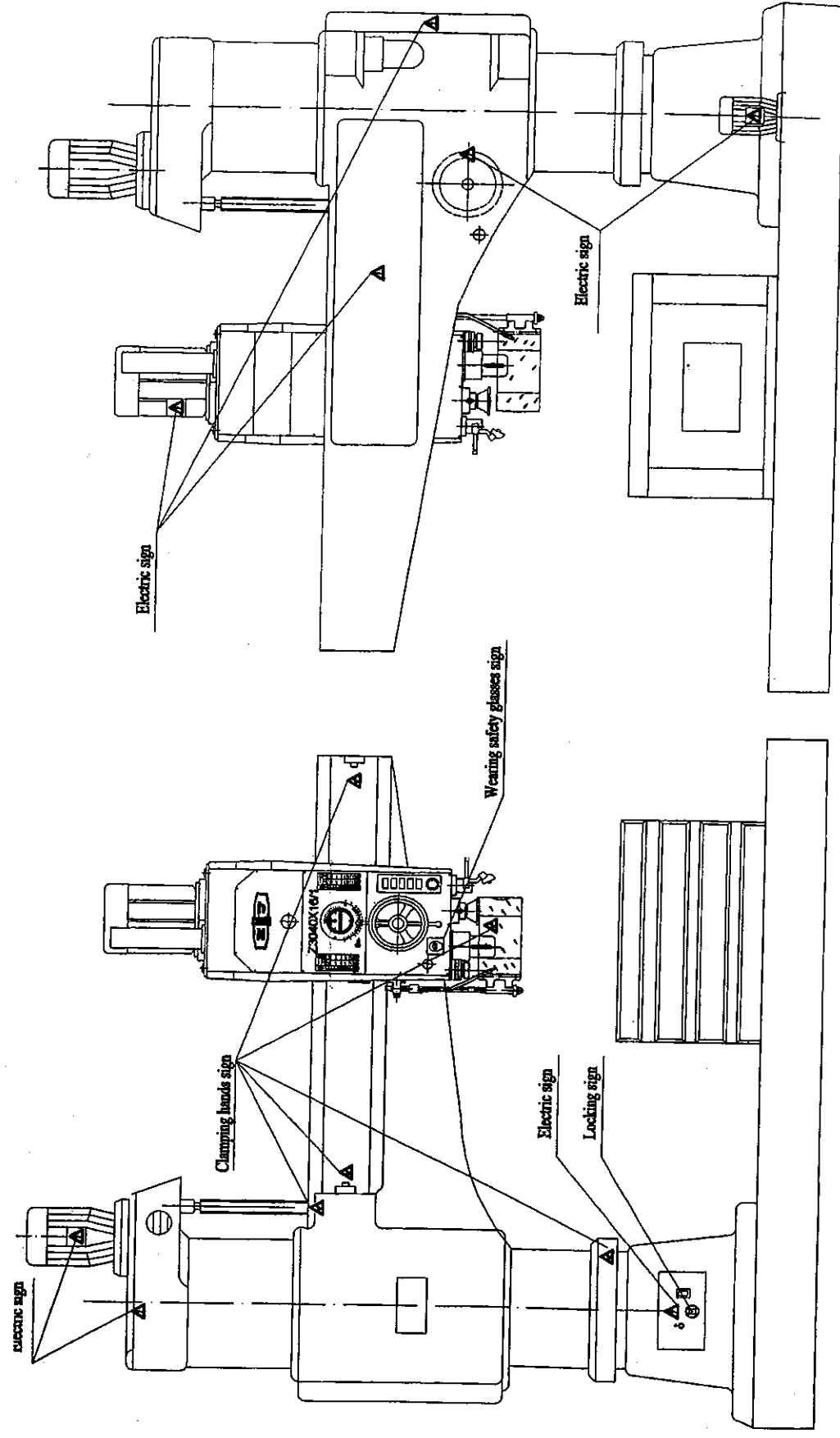
Protection 20A is recommended.

Short circuit protection device: 10KA

Note: Item of electrical, please look mai electrical appliances list

		Z3050X16/1. 2 Z3050X12/1								Z3040X16/1. 2 Z3040X12/1								Designation		
		220/440				220/380				220/440				220/380				Main electrical appliance list		
Type	Size	600V		420V		415V		400V		420V		415V		400V		Type	Size	Code	Manufacturer	Certifi- cation
Y100L2-4-V1	()/3KW/TH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Y100L2-4-V1	3/PH motor	M1	Dalian motor works	CE
Y112M-4-V1	()/4KW/TH.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Y112M-4-V1	3/PH motor	M1	Dalian motor works	CE
Y90L-4-V1	()/1.5KW/TH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Y90L-4-V1	3/PH motor	M2	Dalian motor works	CE
Y802-4-V1	()/0.75KW/TH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Y802-4-V1	3/PH motor	M3	Dandong motor works	CE
A0B-25	()/90W/TH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	A0B-25	3/PH pump	M4	Dandong water pump works	CE
JBE5-160	()/110V, 24V/TH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	JBE5-160	Control transformer	TC	Jiuchuan	CE
160VA=110AV+50VA		1	1	1	1	1	1	1	1	1	1	1	1	1	1	160VA=110AV+50VA				
3VU13400ML00	6~10A (6A)															3VU13400ML00	Circuit-breakers	QF2	Siemens	CE
3VU13400ML00	6~10A (6.5A)															3VU13400ML00	Circuit-breakers	QF2	Siemens	CE
3VU13400ML00	6~10A (6.5A)															3VU13400ML00	Circuit-breakers	QF2	Siemens	CE
3VU13400NL00	8~13A (11A)															3VU13400NL00	Circuit-breakers	QF2	Siemens	CE
3VU13400ML00	6~10A (7.5A)															3VU13400ML00	Circuit-breakers	QF2	Siemens	CE
3VU13400NL00	8~13A (8.5A)															3VU13400NL00	Circuit-breakers	QF2	Siemens	CE
3VU13400MR00	14~20A (15A)															3VU13400MR00	Circuit-breakers	QF2	Siemens	CE
3VU13400MH00	1.6~2.4A (1.6A)															3VU13400MH00	Circuit-breakers	QF4	Siemens	CE
3VU13400NH00	2~3.2A (2.1A)															3VU13400NH00	Circuit-breakers	QF4	Siemens	CE
3VU13400NJ00	3.2~5A (3.3)															3VU13400NJ00	Circuit-breakers	QF4	Siemens	CE
3VU13400NJO0	3.2~5A (3.2)															3VU13400NJO0	Circuit-breakers	QF3	Siemens	CE
3VU13400NJ00	3.2~5A (3.7)															3VU13400NJ00	Circuit-breakers	QF3	Siemens	CE
3VU13400ML00	6~10A (6.3A)															3VU13400ML00	Circuit-breakers	QF3	Siemens	CE
3VU13400MD00	0.24~0.4A															3VU13400MD00	Circuit-breakers	QF5	Siemens	CE
3VU13400ME00	0.4~0.6A															3VU13400ME00	Circuit-breakers	QF5	Siemens	CE
3TF33110XG2	110V, 50/60Hz															3TF33110XG2	AC contactor	KM1	Siemens	CE
3TF31100XG2	110V, 50/60Hz															3TF31100XG2	AC contactor	KM1	Siemens	CE

Z3050X16/1, 2 Z3050X12/1		Z3040X16/1, 2 Z3040X12/1				Main electrical appliance list		Type	Size	Designation	Code	Remark
600V	220/440	4	4	4	4	4	4	3TF30010XG2	110V, 50/60Hz	AC contactor	KM2-KM5	Siemens
440V	420V	1	1	1	1	1	1	3TF30000XG2	110V, 50/60Hz	AC contactor	KMG	Siemens
415V	415V	1	1	1	1	1	1	LOGO; 230RC0	6ED10522FB000BA5	Logic controller	PLC	Siemens
400V	440V	1	1	1	1	1	1	LOGO; DM8, 230R	6ED10551FP000BA1	I/O modules		Siemens
380V	220/380	1	1	1	1	1	1	JFD11-25/31	yellow handle red laser	Circuit breaker	QS1	
220	220/440	1	1	1	1	1	1	SSJ63207CC20S	3P 20A	Air circuit breaker	QF1	Siemens
220	220	1	1	1	1	1	1	SSJ62027CC20S	2P 2A	Air circuit breaker	QF6	Siemens
220	220	2	2	2	2	2	2	SSJ61037CC20S	1P 3A	Air circuit breaker	QF7 QF8	Siemens
220	220	2	2	2	2	2	2	MFJ1-3	110V/TH	electromagnetic irons	YA1 YA2	Shenyangji -chuaogdianli
220/380	380V	1	1	1	1	1	1	CE3T-10R-01	Red	Emergency-button	SBI	ABB
220/380	400V	2	2	2	2	2	2	CPI-10W-11	White	Press-button	SR2, SR3	ABB
400V	420V	2	2	2	2	2	2	CPI-10B-11	Black	Press-button	SB4-SB5	ABB
440V	440V	2	2	2	2	2	2	ZB2-BA2C+BZ101C	Black	Press-button	SB6-SB7	Schneider
220/380	380V	1	1	1	1	1	1	ZB2-BA1C+BZ101C	White	Press-button	SB8	Schneider
220/380	400V	1	1	1	1	1	1	C3SS1-10B-02	Black	Knob switch	SA	ABB
220/380	420V	1	1	1	1	1	1	C2SS2-10B-10	Black	Knob switch	SA1	ABB
220/380	440V	1	1	1	1	1	1	HZ4-22 TH		Travel-limit switch	SQ1	Jiuchuan
220	220	2	2	2	2	2	2	Z-150D		Micros switch	SQ2, SQ3	
220	220	1	1	1	1	1	1	LAY7-XD1/25	24V/white	Indicating lamp	HL	Taikeni
220	220	1	1	1	1	1	1	JC38A50W, 24V		Machine tool lamp	EL	
220	220	1	1	1	1	1	1	RCT6/46		Terminal board	XT2	



1. Be careful any part of body not close to spindle when it is rotating to avoid injury. The machine and ground should be cleaned timely to prevent injury caused by slippery.
2. Workpiece handling process should be paid high attention to avoid scratching or collision damages. Lifting equipment must be employed to handle large size work-piece.
3. If pedal adopted is 500mm above ground, a fence should be installed to prevent personnel falling. A warning sign should be displayed instead if a fence is not convenient to be installed.
4. Workpiece and cutting tool must be clamped solidly and reliably. Excessive cutting is prohibited. During loading and unloading process, the tool should be prevented to fall down and hit foot suddenly.
5. Safety belt should be worn during arm lifting motor maintenance and high-altitude operation to avoid falling down.
6. It is prohibited to wear a loose coat and accessories impeding operation during the operation process. Long hair should be rolled up. Wearing gloves is prohibited.
- 7.

Warning Signs Positions Diagram

Clamping hands sign	Sticking at sides of two limit blocks, side of arm lifting screw, above the spindle.	4 pieces/set
Wearing safety glasses sign	Sticking above spindle on the headstock	1 pieces/set
Electric sign	Sticking on the door of electric box Every motor	
Locking sign	Sticking on main switch sign	