

OPERATION

MANUAL



# Contents

1. Safety Instruction.....	2
2. Working Environment.....	7
3. Purpose and Structure of Machine.....	7
4. Transportation, Installation and Trial Run.....	9
5. Main Technical Parameter 6. Transmission System of Machine.....	14
6. Transmission System of Machine.....	15
7. Operation of Machine.....	21
8. Cooling and Lubrication of Machine.....	24
9. Adjustment and Maintenance of Machine.....	25
10. Troubleshooting.....	34
11. Electrical System of Machine.....	35
12. Accuracy Test List.....	44
13. Packing List.....	46



## 1. Safety Instruction

### 1.1 General safety rules

Operator must read the instruction carefully before operating the machine, and the manager of safety department should assure the operator knows the requirements well.

**WARNING:** Never contact the cutters and other driving parts by hands if they are still running.

1.1.1 The operation, maintenance and repair of the machine must be done by qualified person who has been trained to has the ability to forecast the potential risks. Only safety-conscious persons who are fully aware of the risks can operate the machine.

1.1.2 To those people who assemble, operate, or maintain the machine must be confirmed to have read and understood the operating instructions.

1.1.3 After stopping the machine, the tool will still run for a period of time due to inertia, do not open the tool guard and touch the tool by hands before it comes to a stop.

1.1.4 Do not detach or modify any part of the safety guard. The machine should be disconnected from the power supply during maintenance or repair.

1.1.5 Assign special persons to operate, maintain and adjust the machine.

1.1.6 Operate the machine in technically perfect condition. Only relative professional can completely repair the machine.

1.1.7 Stop the machine immediately if abnormal phenomena appears, check and repair the machine by professional in time.

1.1.8 Convey the machine with the hoisting equipment, which is of adequate load capacity, and lift the machine according to the hoisting figure.

1.1.9 Observe all safety instructions and warnings attached to the machine, make sure they are always complete and perfectly legible.

1.1.10 Do safety inspection before operating the machine. Ensure the travel limit switches, stop block and emergency stop button are safe and reliable.

1.1.11 Reinstall the removed guards and safety devices in place after maintaining the machine.

- 1.1.12 Do maintenance or adjustment only after shutting off power source.
- 1.1.13 Always keep children away from the machine. Operator must be at least 18 years old. Be away from turning spindle when spindle is turning, specially let others around the machine know fatallness.
- 1.1.14 Do not wear loose clothing, gloves, neckties or jewelry (rings, watches, etc). Keep the sleeves and the edges of the work uniform tight. Always be sure to wear safety goggles and wear safety shoes during operation.
- 1.1.15 Put the long hair into a safety cap during operation no matter the operator is a man or a woman.
- 1.1.16 It is recommended to wear suitable hearing protection equipment if necessary.
- 1.1.17 Provide adequate light around the machine, and keep the perimeter around the machine dry, clean and in good order. In addition, do not place anything near the machine; otherwise it becomes an obstacle during operation. The machine must not be damaged by fulsome dust, acid air, corrosive air and salinity air.
- 1.1.18 Do not remove the guards from their working place during operation.
- 1.1.19 Disconnect the power supply before leaving the machine.
- 1.1.20 Restart the machine only after the guards and safety devices are replaced in their position and in good condition.
- 1.1.21 Do not place tools, work pieces, or other items, which is not in use on the machine, especially on the moving parts.
- 1.1.22 Clamp workpiece completely and reliably and take off the wrench from table before starting the spindle running.
- 1.1.23 Stop the machine before adjusting the position of the coolant nozzles.
- 1.1.24 Do not use compressed air to remove dust and chips, deposit on the machine, switchboard, control unit etc.
- 1.1.25 Both operators and the maintenance men should read the descriptions carefully on the caution plate attached to the machine. They should observe the OPERATION MANUAL during their work. During operation and maintenance, care should be taken so that the caution plate is not dirtied or damaged.
- 1.1.26 Always bear in mind where the emergency stop button is so that you can operate it without delay in case of an emergency. Operator must know the operating method of emergency stop button.

1.1.27 Start the machine according to the starting procedures strictly.

1.1.28 Keep your hands away from the turning spindle of the machine during operation.

1.1.29 Do not remove the chips directly by hand, It is safer with proper tool to remove the chips. Be sure to stop the machine when removing chips from the machine.

1.1.30 Prior to starting test operation, read the manual carefully so as to be familiar with the machine.

1.1.31 Contact the manufacturer if for some reason the OPERATION MANUAL should become unreadable.

1.1.32 Must fill lubricant oil into each gearbox and oil pocket according to demand of operation manual before starting the machine for the first time!

## 1.2 Additional Safety Rules for Milling Machine

1.2.1 Read and understand the entire instruction manual before operating the machine.

1.2.2 Always wear approved safety glasses/suit while operating machine tool.

1.2.3 The machine must be grounded.

1.2.4 Before operating the machine, remove tie, rings, watches, other jewelry, Keep the sleeves and the edges of the work uniform tight. Always be sure to wear safety goggles and wear safety shoes during operation. Do not wear gloves while operating machine tool.

1.2.5 Keep the floor around the machine clean and away from scrap iron, oil and grease, etc.

1.2.6 Keep all guards of the machine securely in place at all times when working. For maintenance purpose, use extreme caution to replace the guards immediately after maintenance.

1.2.7 Make sure workpiece and cutter be fitted and clamped well, and make sure the cutter doesn't touch the workpiece before starting up the machine.

1.2.8 Must shut off power supply before adjusting or maintaining the machine.

1.2.9 The operator must keep clear-minded when operating the machine and pay attention to what he is doing. It is not allowed to operate the machine when the operator is tired, after drinking or taking medicines.

1.2.10 Use tools properly. Don't force a tool or an attachment to do work which was

not designed. Sharp tools should be used. Deformed or dull tools should not be used.

1.2.11 Make certain the main switch is in OFF position before connecting the machine with power supply.

1.2.12 Never attempt to operate or adjust the machine when the procedure is not understood.

1.2.13 Always stop the machine before adjusting the position of the coolant nozzle.

1.2.14 Operator should change machining position on the table frequently in order to prolong the life of the machine.

1.2.15 Lubricate the machine in time according to the lubricating demand.

1.2.16 Keep the electrical elements clean, do not clean the electrical elements with kerosene or gas.

1.2.17 Be sure the spindle rotation of the machine comes to rest before changing spindle speed.

1.2.18 It is forbidden to process flammable and explosive metal, for example: pure aluminum, magnesium and so on.

1.2.19 The machine should never be used in flammable, explosive or humid environment.

1.2.20 Make sure the operating site should keep well ventilated. It is recommended that ventilation equipment should be provided on the operating site. Only professional can install, maintain, repair the machine according to the steps in the instruction.

1.2.21 Check safety protection device and ambient working environment, and check whether all limit switches are in good condition, check whether the moving parts move smoothly in travel range, check whether there are some obstacles before starting the machine.

1.2.22 Must not touch or change rotating tool, or measure, adjust and clean the workpiece during machining. Clean the electrical box timely avoid foreclosing ventilation.

1.2.23 Every part of body must not approach rotary or moving part. Operator must not touch workpiece and tool, spindle during machining.

1.2.24 Must clamp workpiece and cutting tool, and must not overloadly work.

1.2.25 Because the machine has extensive use, manufacturer does not provide spindle and table guard devices, so user must make guard device himself according

to the workpiece. User must install guard devices first before processing the workpiece to prevent the damage of scrap iron.

1.2.26 The every part of the machine is in the clamping state when installing the machine, and lift the machine after adjusting the every part of the machine in place according to the hoisting figure.

1.2.27 Make sure the reliability of clampness or looseness of every part of the machine, make sure the reliability of every direction travel, grounding, emergency stop button, make sure the correctness of phase sequence before operating the machine.

1.2.28 Lock the other axes when one axis is feeding, otherwise it will result in the change of workpiece processing precision.

1.2.29 Please select reasonable rotary speed and feed quantity according to the correlative content in the manual when material of workpiece and specification of tool are different, otherwise it will result in damage of the machine.

1.2.30 Must not allow others to enter working area or remain.

1.2.31 Press E-STOP button first, then shut off main power when the machine malfunctions or is in closed state, switch on main power after the failure of the machine is obviated.

1.2.32 Electric professional must wear electric insulated shoes, and operate the machine according to operating regulations. Appoint a person to take charge main power switch or hang warning plate on the main power switch during repairing the machine. A responsible person is in charge of electrical box key.

1.2.33 **Warning:** There still is voltage in power cord of main switch and contact during checking electrical equipment.

1.2.34 There may not be opening door and power off function, suggest user that must shut off main power switch before opening door.

1.2.35 Suggest that user must add guard device according to size and shape of workpiece before operation in order to avoid splashing coolant and scrap iron

1.2.36 Operator pays attention to the upside when standing up round the machine in order to avoid bump.

1.2.37 Must not protrude spindle sleeve too long, otherwise it will result in damage of the machine.

1.2.38 Forbid unauthorized anybody to start, operate, repair, open electrical box door

and touch electrical component.

1.2.39 There must not be poisonous air around the machine, there must not be explosive material and electric dust around the machine, there must not be attack of rain and snow in workshop, and ground is smooth, there is not obstacle on the aisle in the workshop. The machine is away from libration source, heat source, heat flow.

**Warning: Failure to comply with above instruction may cause serious injury.**

## 2. Working Environment

2.1 The milling machine is designed for operating on the site:

The height above sea level doesn't exceed 1000m,

The ambient temperature range doesn't exceed  $-10^{\circ}\text{C} \sim 50^{\circ}\text{C}$ ,

The relative humidity  $30\% \sim 85\%$ , air pressure  $86 \sim 106\text{kpa}$ ,

Powder dust consistence does not exceed  $10\text{mg}/\text{m}^3$ ,

The light in the working environment should not be lower than 500 lux.

2.2 Do not use the machine in an environment of electric dirt, explosion, metal fretted, gas and steam which can destroy insulation.

2.3 Do not use the machine in an environment of impact and vibration.

## 3. Purpose and Structure of Machine

The universal swivel head milling machine is designed for milling on general metal workpiece.

**Warning: Do not process flammable and explosive metal, e.g. pure aluminum and magnesium, etc.**

The universal swivel head milling machine consists of universal swivel head, base, column, knee, table, upper transverse slide, nether transverse slide, main drive structure, ram, coolant, lubrication, electrical system and so on.

The structure of the machine: (Figure.1)

3.1 The column is fixed on the base with bolts.

3.2 Knee is in front of the column, and connects with the column through rectangular guideway, which can rise and lower along vertical guideway.

3.3 Nether transverse slide connects with knee through rectangular guideway. Table connects with upper transverse slide through dovetail guideway. Worktable and the upper transverse slide, nether transverse slide can be moved through lead screw and

nut. Table may be swiveled left or right.

3.4 Main transmission adopts gears drive structure.

3.5 Ram part consists of fixed base, ram, hanger and so on. Fixed base on the column connects with ram through dovetail guideway. Hanger locates in front of the column.

3.6 The coolant system consists of coolant pump, outlet conduit and return pipe and tank in the base and so on.

3.7 Lubricant system includes lubricant pump and hand lubricant pump, centralized lubrication and so on.

3.8 Electrical box is in the column, power supply switch is on the right of column, operation panel is on the left of the column, which enables convenient operation.

The worktable is moved by hands or power in longitudinal, transverse, vertical directions, the power of table is provided by only one servo motor. Main transmission adopts gears structure, high efficiency, big torque, wide speed change range; three-support structure is adopted on horizontal spindle, which can improve the rigidity of spindle, vertical milling head can be fixed in front of the column, so expand the processing range.

The working noise of the machine is not more than 85dB(A). the machine has no poisonous air or liquid to let out.

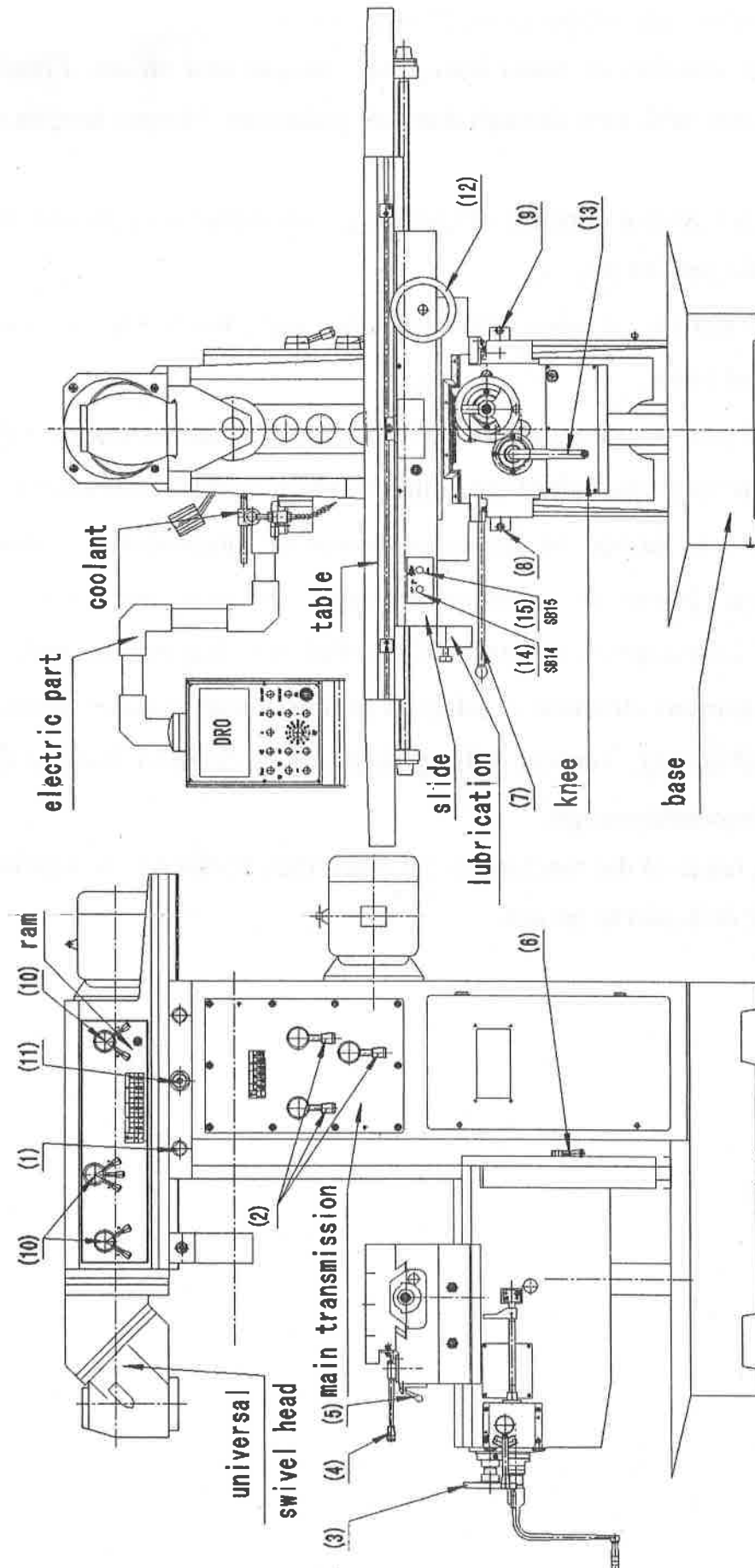
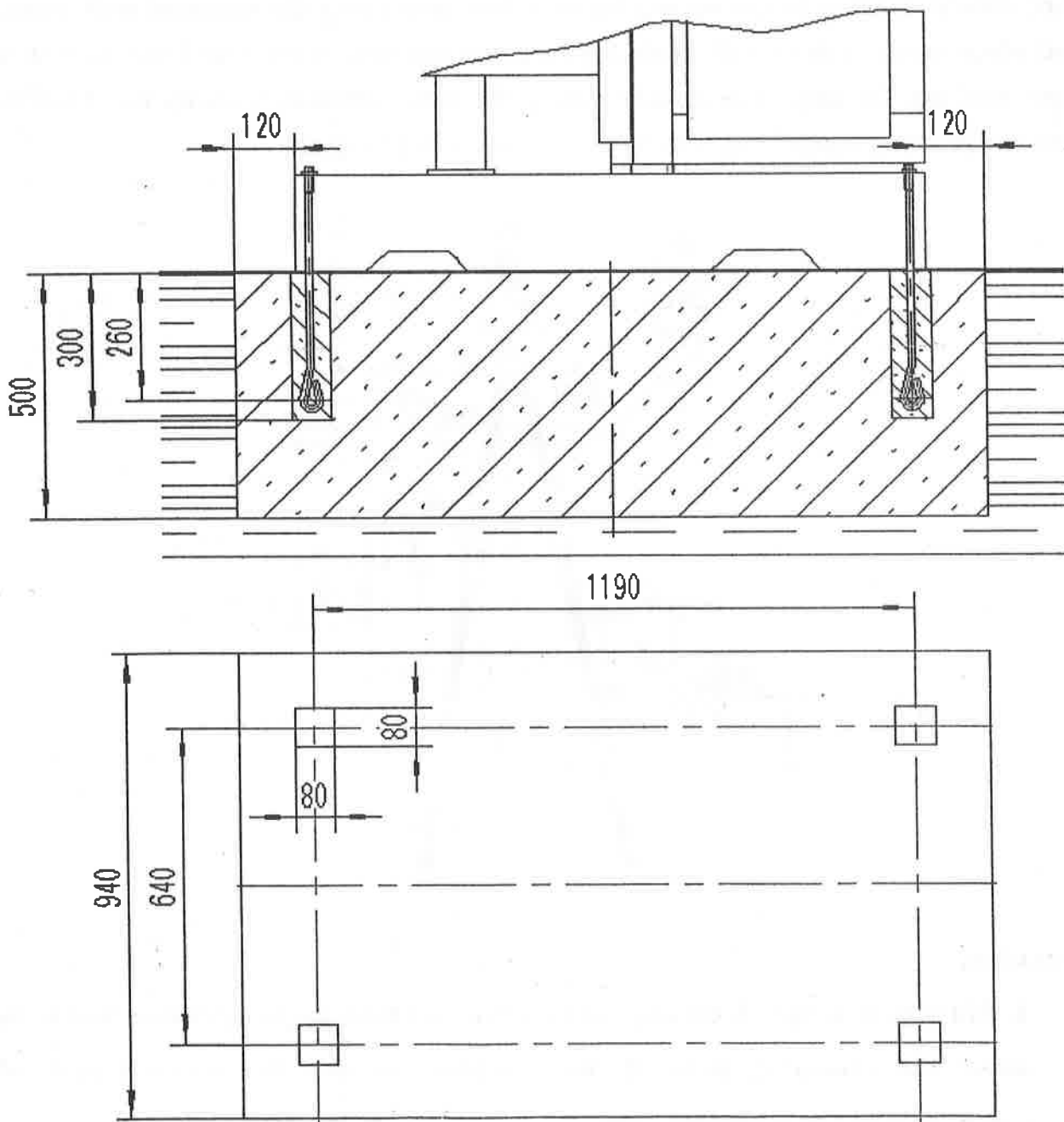


Figure.1

#### 4. Transportation, Installation and Trial Run

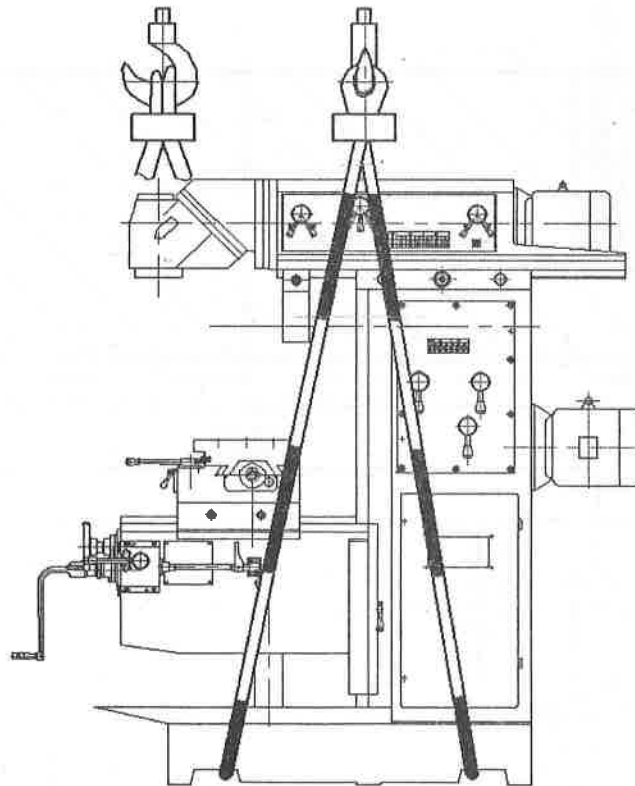
##### 4.1 Foundation

The foundation is ready well before installing the machine, the machine overall measurement is  $2550 \times 2161 \times 2102$  mm(L  $\times$  W  $\times$  H); must consider table longitudinal travel and actual use area, namely, actual use area is more than machine overall measurement. Minimal distance that is away from aisle and other equipment is 800mm, foundation depth is decided according to the condition of soil, and foundation depth is not less than 500mm.



#### 4.2 Machine hoisting

Machine is packed with wooden bar and wooden plate or steel pallet and veneer. Must load or unload machine according to outer sign on the packing box. Any impact or vibration is prohibited. Must open the box carefully, otherwise it will scratch the paint on the machine surface. After opening the box, first check all the machine integrity and accessories according to the packing list, check whether there is something wrong or damaged, please inform dealer or manufacturer in time in order to solve it well, then convey the machine with forklift. Please set a steel wire rope according to conveying figure when conveying the machine with crane, and place some pads or soft cloth between the machine surface and the steel wire rope, and ask for help if necessary during the transportation. Convey the machine with the hoisting equipment, which is of adequate load capacity.



#### **Warning:**

- 1. Must loosen the clamping part of the machine when operator wants to move the clamping part of the machine because the moving part of machine is in the clamping state.**

**2. Must clean the antirust oil on the exposed processing surface of machine before moving the removable part of the machine, and adjust the position of moving part of the machine to be in place before lifting the machine, then clamp the removable part of the machine.**

**3. The machine must not be away from ground too high, move the machine slowly.**

**4. The packing case is well sealed with to avoid doing harm to others and environment..**

#### 4.3 Installation of the machine

Place the machine in the position of foundation bolts and let them through the base of machine, then put the machine on the foundation. Place wedge block under the machine if there is no foundation bolt on the foundation.

Clean the antirust oil on the table, exposed surface of every guideway, inject gas to clean every oil cup with oil gun, fill lubricant according to the manual after gas volatilizes completely, coat a layer of machine oil on exposed metal surface on the table, exposed surface of every guideway.

Please fix handwheel and handle according to the manual if they are dismantled for transportation.

Primary level: Adjust the machine to level with adjusting sizing block or wedge iron.

Check the correctness of power phase sequence: Start the machine, turn on the switch of spindle CW or CCW, phase sequence is right if the rotary direction of the spindle accords with the visual symbol on the operation panel, otherwise must adjust the phase sequence of main power. Carefully adjust the machine to level, make sure the allowance of machine level is under 0.04/1000 mm in transverse and longitudinal directions after tightening the foundation bolts.

#### Warning:

1. Must loosen the correlative clamping handles before moving the every movement part of the machine.
2. Must not use metal tool and instruments that scratch the surface of the

machine to clean the antirust oil on the moving part of the machine.

3. Must ensure the level of the machine because it will influence the accuracy of the machine.

4. Must ensure earthing wire of the machine connects with the earth well.

#### 4.4 Trial run

Inject lubricant into the gear box and the other lubricating points right for the first time, then do an overall check.

Check whether all handwheels and handles of the machine are reliable and flexible.

Check whether every moving part is normal, for example: spindle CW or CCW, speed change of the spindle, restoration or protrusion of spindle sleeve, start or stop of spindle, manual feed in the longitudinal or transverse, vertical direction of the table, clamping device. The machine may run for half an hour if the above every condition is normal.

First start to run idle at the lowest speed for more than 30 minutes, then increase the speed step by step.

**Caution: Care must be taken when loading or unloading the machine during the transportation.**

## 5. Main Technical Parameter

No.	Specification	Parameter	
1	Table size	1650×360 mm	
2	Table travel (longitudinal/transverse/vertical )	1300/300/420 mm	
3	T-slot of table (number/width/distance)	3/14/95 mm	
4	Spindle taper hole (V/H)	7:24 ISO50	
5	Spindle speed range (50Hz)	58—1800 r.p.m. (12 steps) (horizontal)	
		60—1750 r.p.m. (12 steps) (vertical)	
6	Distance from horizontal spindle axis to the surface of table.	0-420 mm	
7	Distance from vertical spindle end face to table surface.	150—570 mm	
8	Distance from table center to the surface of column.	230--530 mm	
9	Max. swiveling angle of table	±35°	/
10	Table feed speed	longitudinal/transverse: 25~800 mm/min vertical: 8-267 mm/min	
11	Stroke of ram	500 mm	
12	Motor power	Horizontal spindle motor	5.5 kW, 1440 r/min
		Universal swiveling head main motor	4 kW
		Table feeding servo motor	2.36kW, 15N.M
13	Overall measurement	2550×2161×2102 mm	
14	Weight (approximate)	2850 kg	

The parameter is basic, actual parameter that merchants order machine may not accord with the above parameter list, so machine is subject to actual parameter, we do not inform all customer if we alter above parameter.

## 6. Transmission System of Machine

### 6.1 Horizontal spindle transmission system

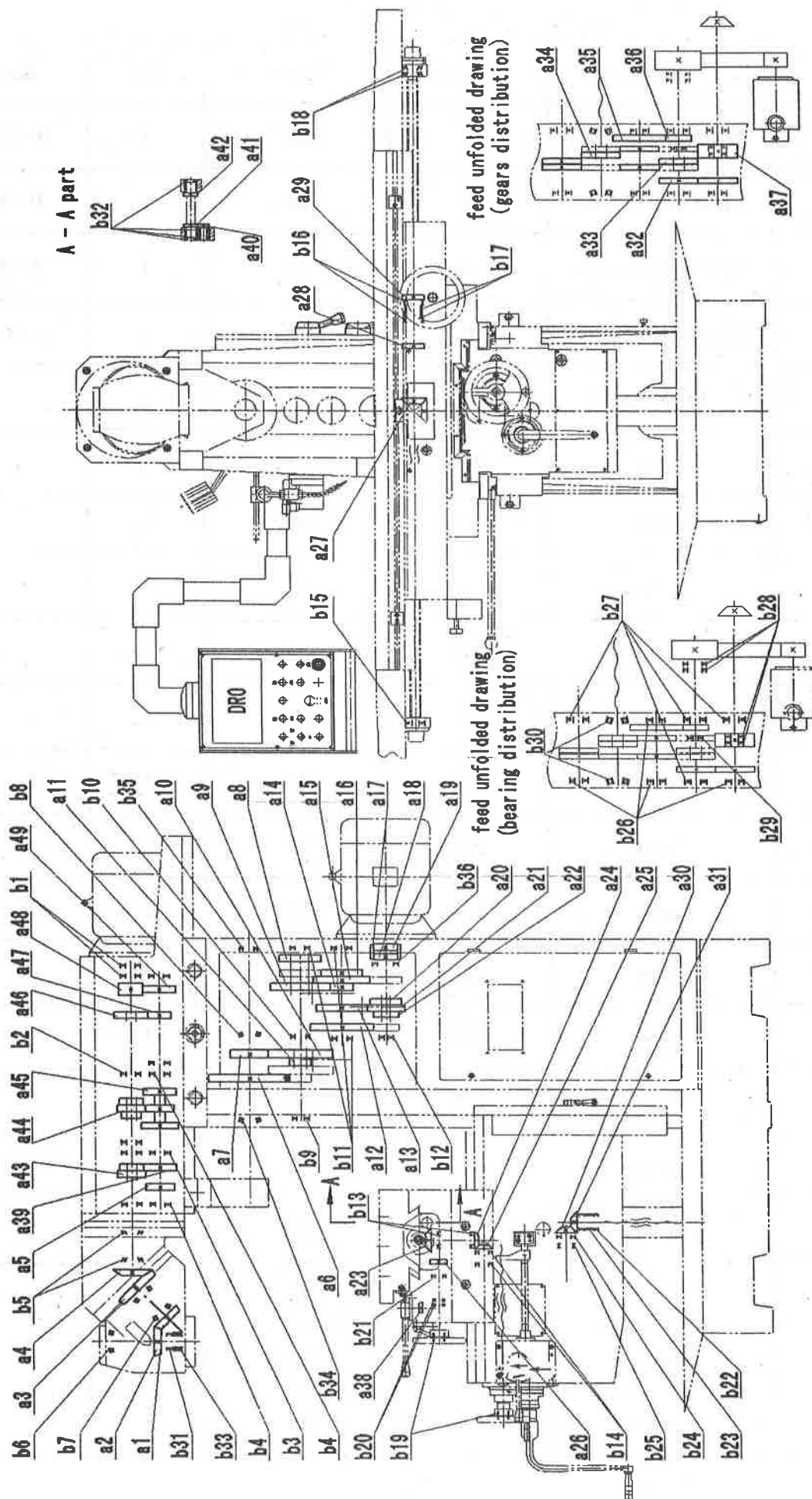
Horizontal spindle transmission system is installed in the column and driven by a 5.5kW motor, the power is passed through sliding gears in the column to horizontal spindle.

### 6.2 Vertical spindle transmission system

Vertical spindle transmission system is installed in the ram and driven by a 4kW motor at the back of the ram, the power is passed through sliding gears in the ram to vertical spindle.

### 6.3 Table feeding transmission

Power of table longitudinal/transverse/vertical movement is provided by handwheel or servo motor.



No.	Name	Module	Teeth	Qty	Remark
a1	Spiral bevel gear	4	30	1	$\beta = 35$ right
a2	Spiral bevel gear	4	30	1	$\beta = 35$ left
a3	Spiral bevel gear	4	35	1	$\beta = 35$ left
a4	Spiral bevel gear	4	30	1	$\beta = 35$ right
a5	Gear shaft	3		1	
a6	gear	3.5	71	1	
a7	gear	3	39	1	
a8	gear	2.5	51	1	
a9	gear	2.5	73	1	
a10	gear	3	66	1	
a11	gear	3.5	19	1	
a12	gear	2.5	77	1	
a13	gear	2.5	62	1	
a14	gear	2.5	29	1	
a15	gear	2.5	70	1	
a16	gear	2.5	51	1	
a17	gear	2	36	1	
a18	gear shaft	2	36	1	
a19	gear	2	36	1	
a20	gear	2.5	38	1	
a21	gear	2.5	46	1	

a22	gear	2.5	31	1	
a23	bevel gear	2	35	1	
a24	gear	2	25	1	
a25	gear	2	25	1	
a26	bevel wheel	2	14	1	
a27	bevel gear	2	33	1	
a28	gear	2	36	1	
a29	bevel wheel	2	28	1	
a30	bevel gear	2.5	18	1	
a31	bevel gear	2.5	54	1	
a32	gear	2.5	32	6	
a33	gear	2.5	32	1	
a34	gear	2.5	32	1	
a35	gear	2.5	43	1	
a36	gear	2.5	21	1	
a37	gear	2.5	21	1	
a38	gear shaft	1.5	19	1	
a39	gear	3	31	1	
a40	gear	2	17	1	
a41	gear	2	22	1	
a42	gear	2	24	1	
a43	gear	3	39	1	
	gear	3	26	1	

a44	gear	3	22	1	
	gear	3	31	1	
	gear	3	26	1	
a45	gear	3	35	1	
	gear	3	26	1	
	gear	3	31	1	
a46	gear	2.5	49	1	
a47	gear shaft	2.5	20	1	
a48	gear shaft	2.5	20	1	
a49	gear	2.5	49	1	

#### Bearing list

No.	Name	Model	Specifikaion	Qty	Remark
b1	Deep groove ball bearing	6010-2RS	50×80×16	4	
b2	Deep groove ball bearing	6008-2RS	40×68×15	1	
b3	Deep groove ball bearing	6007-2RS	35×62×14	1	
b4	Deep groove ball bearing	6206-2RS	30×62×16	5	
b5	angular contact bearing	7009AC	45×75×16	2	
b6	Taper roller bearing	30210	50×90×21.75	1	
b7	Taper roller bearing	32007	35×62×18	2	
b8	Taper roller bearing	30311	55×120×31.5	2	
b9	Deep groove ball bearing	6307	35×80×21	1	
b10	Deep groove ball bearing	6209	45×85×19	1	
b11	Deep groove ball bearing	6308	40×90×23	3	

b12	Deep groove ball bearing	6306	30×72×19	1	
b13	Deep groove ball bearing	6005-2RZ	25×47×12	2	
b14	Deep groove ball bearing	61908-2RZ	40×62×12	2	
b15	Deep groove ball bearing	6204-2RZ	20×47×14	1	
b16	Thrust ball bearing	51110	50×70×14	2	
b17	needle bearing	HK5020	50×58×20	2	
b18	angular contact bearing	7204C-Z	20×47×14	2	
b19	needle bearing	HK2216	22×28×16	4	
b20	Deep groove ball bearing	61905-2RZ	25×42×9	2	
b21	Deep groove ball bearing	6006-2RZ	30×55×13	1	
b22	Thrust ball bearing	51106	30×47×11	2	
b23	needle bearing	RNA6905	30×42×30	1	
b24	Deep groove ball bearing	6204	20×47×14	1	
b25	Thrust ball bearing	51104	20×35×10	1	
b26	Deep groove ball bearing	6005	25×47×12	4	
b27	Deep groove ball bearing	6006	30×55×13	4	
b28	Deep groove ball bearing	61906	30×47×9	4	
b29	Deep groove ball bearing	6004	20×42×12	1	
b30	Taper roller bearing	32006	30×55×17	2	
b31	Thrust ball bearing	51116	80×105×21.75	1	
b32	Deep groove ball bearing	61904-2RZ	20×37×9	4	
b33	Taper hole double columns cylinder roller bearing	NN3018K	90×140×37	1	
b34	Taper roller bearing	32217	85×150×38.5	1	

b35	Deep groove ball bearing	6309	45×100×25	1	
b36	Deep groove ball bearing	6212	60×110×22	1	

## 7. Operation of Machine

The operation of the machine must be done by qualified person who have been trained .

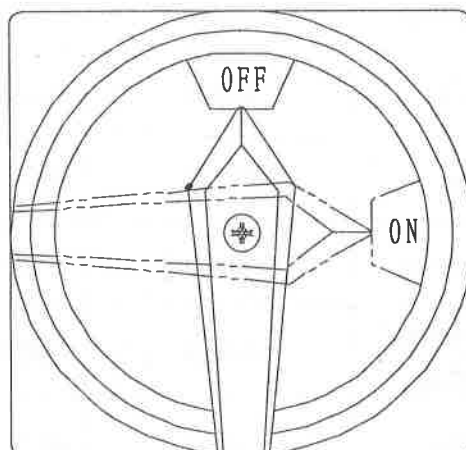
Carefully read the manual to be familiar with the structure, function of every handle, transmission system and lubricant system.

Check whether every clamping mechanism loosens before starting machine, Check whether vertical movement of spindle sleeve and electrical equipment are normal, Check whether earth wire ( yellow and green wire is earth wire) is reliable.

Check whether electric switches are flexible and reliable.

7.1 Integrated control mode (include spindle and table feed control part and so on) is adopted, operation box is on the left of the machine, which controls CW or CCW rotation, stop of spindle, longitudinal and transverse, vertical movement of table, switching on/off of coolant pump. Set power indicator light and E-STOP button on the operation panel. There are main power switch and spindle jogging button. Please carefully observe visual symbol, first jog, then confirm the button and operate the machine.

There is a main switch on the electrical box door, which is on one side of electrical box. Clockwise turn red knob 90°, point at “ON”, namely, switch on the switch of the machine. The switchboard is in the electrical box on the right of the column.



## 7.2 Table feed

Table of the machine is cross table structure, which can move in longitudinal /transverse/vertical direction. Face to the machine, left and right movement of table is longitudinal feed, fore-and-aft movement of table and slider is transverse feed, up and down movement of table is vertical movement. Power of the table is provided by hands or power.

### 7.2.1 Manual feed movement of table

7.2.1.1 Table longitudinal feed handwheel is in the front of table, so operation is very convenient. Loosen table longitudinal clamping handle (5), adjust handle (4) to be in manual position, push handle (12) to make the clutch mesh well, then turn handle (12) to realize table longitudinal feed, tighten the clamping handle (5), then start to work.

#### 7.2.1.2 Table transverse feed:

Loosen table transverse clamping handle (7), adjust handle (9) to be in manual position, push handle (3) to make the clutch mesh well, then turn handle (3) to realize table transverse feed, tighten the clamping handle (7), then start to work.

#### 7.2.1.3 Table vertical feed:

Loosen table vertical clamping handle (6), adjust handle (8) to be in manual position, push handle (13) to make the clutch mesh well, then turn crank handle (13) to realize table vertical feed, tighten the clamping handle (6), then start to work.

### 7.2.2 Automatic feed of table

Power of table automatic feed is provided by only one servo motor that is at the bottom of the knee, power is passed through gears to realize longitudinal /transverse/vertical direction feed.

a. First adjust longitudinal/transverse/vertical direction feed handle (4), (9), (8) in neutral position.

b. Start servo motor.

c. It will realize longitudinal/transverse/vertical direction automatic feed after completing above steps:

#### 7.2.2.1 Table longitudinal automatic feed

Loosen table longitudinal clamping handle (5), adjust handle (4) left or right to realize table longitudinal automatic feed, then start to work. The neutral position is

“STOP” position.

#### 7.2.2.2 Table transverse automatical feed

Loosen table transverse clamping handle (7), adjust handle (9) up or down to realize table transverse automatical feed, then start to work. Adjust handle (9) up, the table move to the column, vice versa.

#### 7.2.2.3 Table vertical automatical feed

Loosen table vertical clamping handle (6), must not push handle (13) to make the clutch mesh, adjust handle (8) up or down to realize table vertical automatic feed, then start to work.

#### 7.3 Rapid feed of table and inversing ready

There are rapid feed button (14) and transverse, vertical feed inversing ready button (15) at the front left side of slider. Press rapid feed button (14) to move table at the preset rapid feed speed, the table will feed at the normal feed speed when loosening the rapid feed button (14). Press vertical feed inversing ready button (15), servo motor turns at the preset speed, at this time, adjust handles (8, 9) to realize mesh of inversing gear well, loosen the button (15) when the gears mesh well, the table will move at normal speed.

#### **Warning:**

- 1. No matter manual feed or automatic feed, first must loosen handles (5),(7),(6).**
- 2. Must not make lifting crankhandle mesh when table vertically automatically feed.**
- 3. Only move table in one direction when the machine works, and clamp the other feed directions locking handles.**

#### 7.4 Movement of ram

Loosen two pieces of clamping handles (1) on the right of ram, turn the gear shaft (11) with crank handle to move ram in place, then unclamp the clamping handles (1).

#### **Warning:**

**Not to unclamp the clamping handle too much, only loosen about one circle.**

#### 7.5 Speed change of vertical spindle.

First stop the vertical spindle before changing speed, adjust positions of handles (10) on the right of ram according to the signs on the speed plate to gain target speed of

spindle.

#### 7.6 Speed change of horizontal spindle

First stop the horizontal spindle before changing speed, adjust positions of handles

(2) on the right of column according to the signs on the speed plate to gain target speed of spindle.

7.7 Make workpiece be away from tool after work, first stop feed of the machine, adjust feeding handles in neutral position, then switch off the coolant, spindle, working lamp, shut off the main power of the machine finally.

#### 7.8 Cleanness and maintenance of the machine

Clean dirt and scrap iron on the machine after turning off the machine according to above steps, and coat a thin layer of antirust oil on the uncoated paint surface.

#### **Warning and cue:**

- 1. Shut off power supply at once when the machine malfunctions or abnormal sound appear during work, then ask correlative professional to check and repair the machine.**
- 2. Should adopt correlative protecting measure to avoid scrap iron flying when drilling, milling on the workpiece.**
- 3. Must not place irrespective object on the table, clean dirt on the interface of workpiece and fixture; must not use compressed air to clean the guideway of the machine to avoid scrap iron entering interface of guideways or inner cavity of machine.**
- 4. Be careful of protection when clean the machine by hands to avoid the damage.**
- 5. Select cutting parameter according to workpeice material and speed of spindle, must select proper use cutting parameter to avoid damage.**

### 8. Cooling and Lubrication of Machine

#### 8. Cooling of Machine

Coolant pump is fixed on the base, and there is coolant in the cavity in the base, coolant is sent to nozzle through pipe. Adjust the valve of nozzle to spray coolant to cutting area exactly. Coolant returns to collected liquid box in base of the machine through return pipe.

#### 8. Lubrication of Machine

To a great extent, life of machine depends on scientific lubrication. Lubricant decides the effect of lubrication. User may select relevant lubricant according to the actual situation.

8.1 Centralized lubrication device with automatic forcible lubrication mechanism is adopted to lubricate the gears in the column and vertical milling head, automatic forcible lubrication mechanism consists of reversible cycloidal lubricant pump that is through spline shaft and motor shaft to connect, and oil pipe. Lubricant pump starts to work when main motor turns. Lubricating oil is sprayed to gears.

8.2 Table, transverse guideway and feed leadscrew, gears, vertical guideway and feed leadscrew are lubricated by the centralized hand lubricant pump that is fixed on the left of the transverse slider. Lubricate them 4~8 times per shift according to the working frequency.

8.3 Gears and bearings in feeding box in knee are lubricated by electromagnetic lubricant pump that is fixed in the feeding box in lifting slider, spray lubricant to gears through oil pipe. Operator should often check oil pointer, keep oil surface be in the middle of the oil pointer, change the lubricant every once six months.

#### **Warning :**

- 1. Please observe the advice of safety and health of lubricant.**
- 2. Suggest using 20# machine oil in winter and 32# machine oil in summer.**

## **9. Adjustment and Maintenance of Machine**

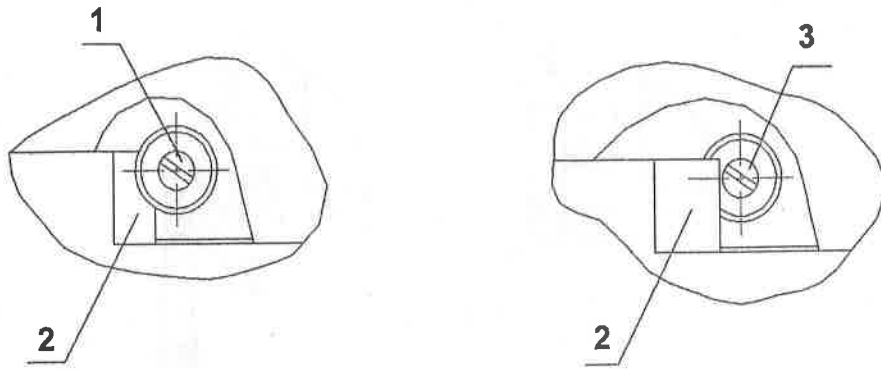
### **9.1 Adjustment of Machine**

#### **9.1.1 Clearance adjustment of table transverse guideway**

It will cause vibration of machine, and it will influence processing precision of machine if the clearance of transverse guideway of table is too much. There are adjusting screws at the two ends of transverse guideway gib, adjusting steps is as following:

First remove the wipers on the gib, then loosen the adjusting screw (1) at the small end of the gib, and tighten the adjusting screw (3) properly at the opposite end until a slight drag is felt while moving the table along the guideway, move table freely, feeler gauge (specification 0.04mm) is not inserted. Tighten the loose screw (1) properly, but tighten it too excessively avoid distortion, fix the the wipers on the

slider finally.

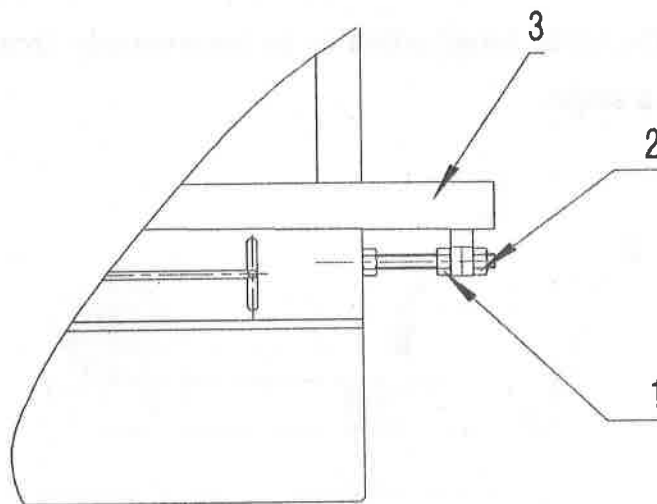


### 9.1.2 Clearance adjustment of table longitudinal guideway

It will cause vibration of machine, and it will influence processing precision of machine if the clearance of longitudinal guideway of table is too much. There are adjusting screws at the two ends of longitudinal guideway gib, adjusting steps as following: First loosen the adjusting screw (1), and tighten the other adjusting screw (2) properly until a slight drag is felt while moving the table along the guideways, move table freely, feeler gauge (specification 0.04mm) is not inserted.

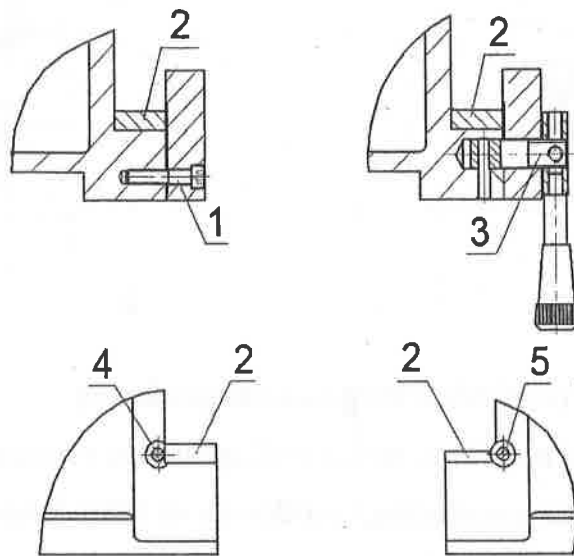
Counter-clockwise turn screw (1), and tighten the loose screw (1) properly.

Note: Longitudinal left and right two pieces of gibs of table are adjusted at the same time.



### 9.1.3 Adjust the clearance between the knee and vertical guideway of column.

First loosen the clamping handle (3), but loosen it too much, generally not more than one circle, loosen screw (5) at small end of gib, then adjust the screw (4) on the big end of gib in proper position until a slight drag is felt while moving the knee, check the knee is lifted freely, otherwise adjust it again and again.

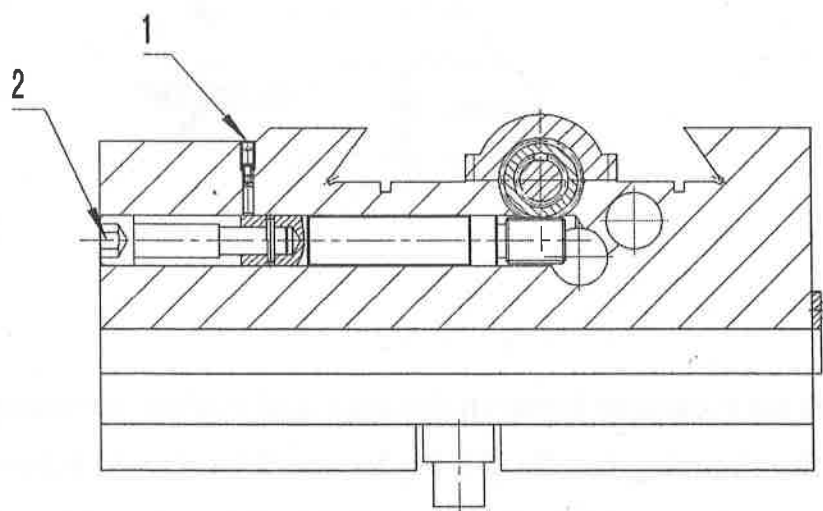


#### 9.1.4 Adjustment of the clearance between the longitudinal and transverse lead screws and nuts.

Too much clearance between the lead screws and nuts will influence machining accuracy.

Adjustment of longitudinal lead screw and nut is as follows:

Loosen lock screw (1) first, deasil turn nut (2) to be in proper position, tighten lock screw (1), move the table longitudinally or transversely freely, and backlash is not more than 1/20 of a scale.

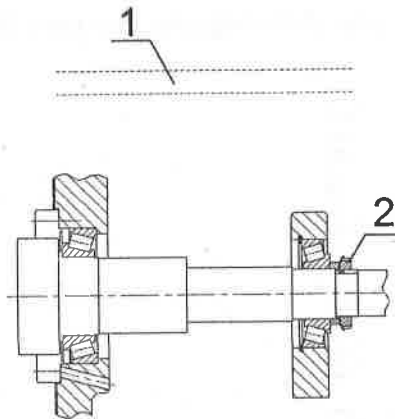


#### 9.1.5 Adjustment of the horizontal spindle bearing clearance.

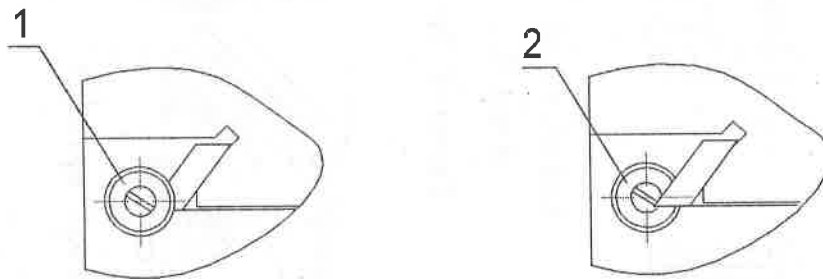
Clearance of s horizontal spindle bearings has been adjusted well before the machine left the factory. Long time use of machine causes natural wear of spindle bearings

and clearance will increase. Please ask professional to adjust it.

Remove the cover (1) on the left of column first, adjust locking nut (2) to make clearance of spindle proper, then fix the cover (1) .



#### 9.1.6 Adjustment of the ram guideway clearance



Ram will vibration, and it will influence processing precision of machine if the clearance of ram guideway clearance is too much, adjusting steps is as following:

First loosen adjusting screw (1) on small end of gib, and tighten the adjusting screw (2) properly at the opposite end until a slight drag is felt while moving the ram along the guideway, move ram freely, feeler gauge (specification 0.04mm) is not inserted. Tighten the loose screw (1) properly.

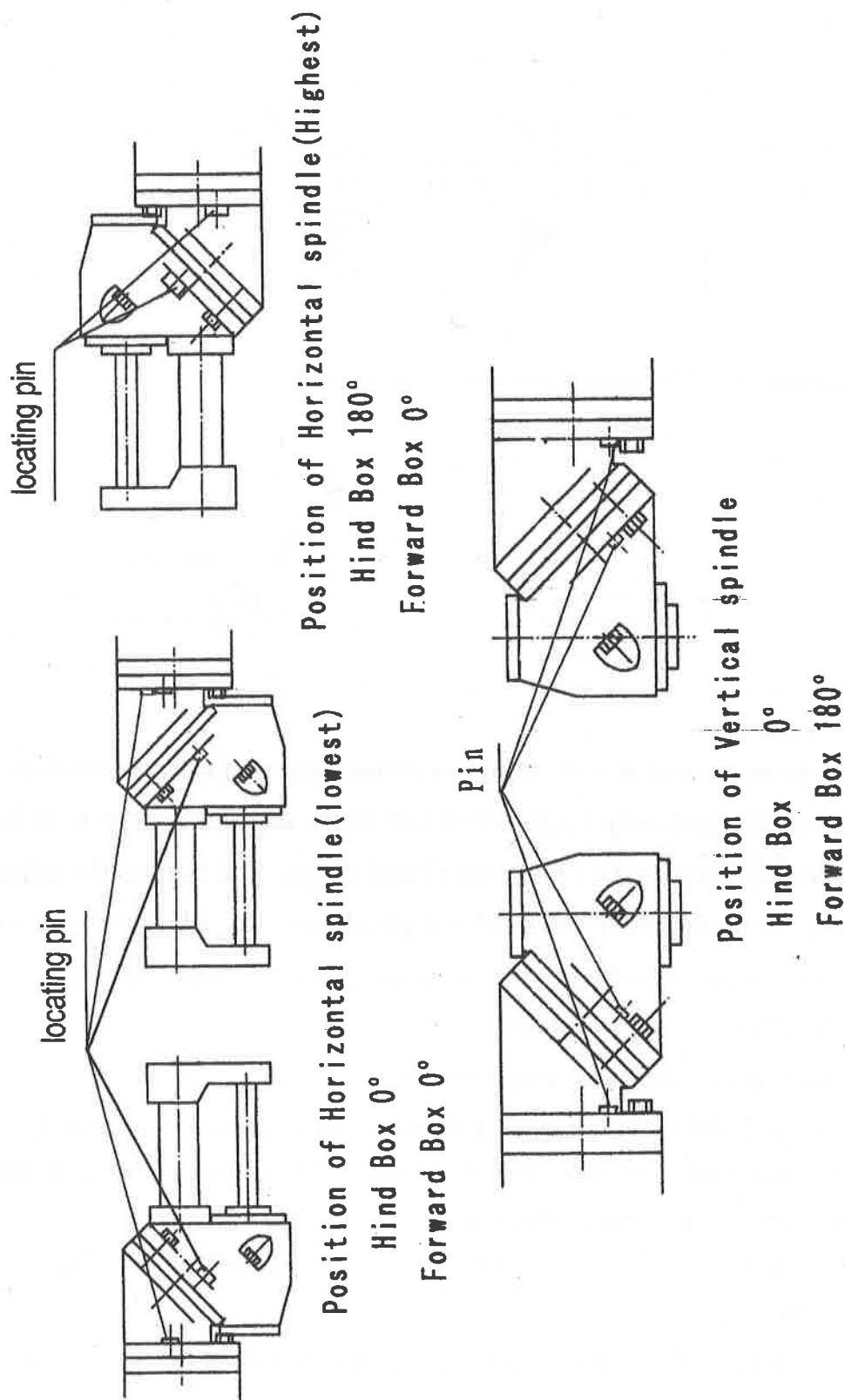
#### 9.1.7 Adjustment of universal swivel head.

9.1.7.1 Forward and hind boxes of the swivel head are all at an angle  $0^\circ$ , the spindle is in the horizontal position. Try to install milling tools towards the rootage of milling bar when horizontally milling.

9.1.7.2 The spindle will be in the vertical position when forward box is revolved to the angle  $180^\circ$ .

9.1.7.3 To expands the machining range, operator will raise the spindle that is in the horizontal position from normal position through revolving hind box an angle  $180^\circ$ .

Forward and hind boxes must be positioned precisely with taper pin while the swivel head is in the horizontal or vertical position, which is in order to ensure the vertical and horizontal level precision between the spindle and the table. The taper pin does match special location hole only, don't force the locating pin into the special location hole while it isn't in its position to avoid damaging the junction plate.

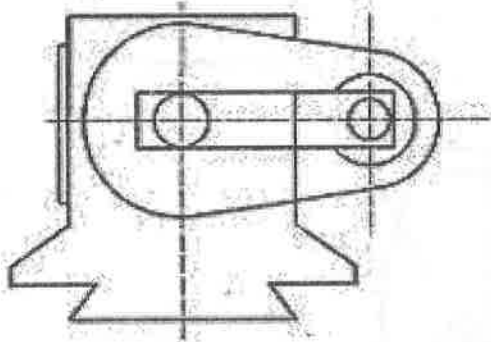


### 9.1.8 Right and left tilt of the spindle

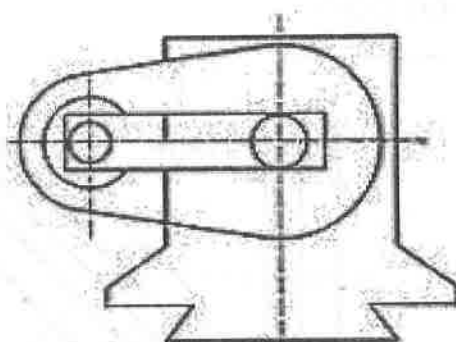
Pull out the positioning pin before rotating the rotation head, then loosen locknut 1-2 pitches, rotate the rotation head in target position, push and insert positioning pin strongly, and clamp the head locknut, so operator can position the head promptly and precisely.

**Caution: Don't unclamp the nut completely, or rotation head will drop from the machine. It is dangerous to rotate them when unclamping the locknuts of upside head and downside head simultaneously.**

Turn hind box of the swivel head an angle 90° clockwise or counter-clockwise, which make the spindle work in different position, so the machine will expand the longitudinal processing range.



left tilt of horizontal spindle  
hind box 90° (dextrorotation)  
forward box 0°



right tilt of horizontal spindle  
hind box 90° (levorotation)  
forward box 0°

**Notice: Do not loosen clamping nut too much before turning universal milling head, universal milling head will drop to injure machine and operator.**

### 9.1.9 Turning adjustment of the spindle in horizontal plane.

The spindle with the tool support may be turned in horizontal plane in order to improve the rigidity of the milling arbor (it is used in left or right spiral milling condition). Must turn forward box and hind box in the different direction when adjusting them. The angle of the spindle is decided by adjustment of forward box and hind Box. The adjustable angle is calculated or checked by the following table.

The formula for calculating is:

$$\cos \beta = 2\cos \theta - 1 \quad \text{tg } \alpha = \sqrt{2}/2 \text{ tg } \frac{\beta}{2}$$

$\theta$  — Angle included between the axis of spindle and transverse movement of table.

$\beta$  — Forward Box Angle.

$\alpha$  — Hind Box Angle.

For example:

1.cut-45° dextrorotation

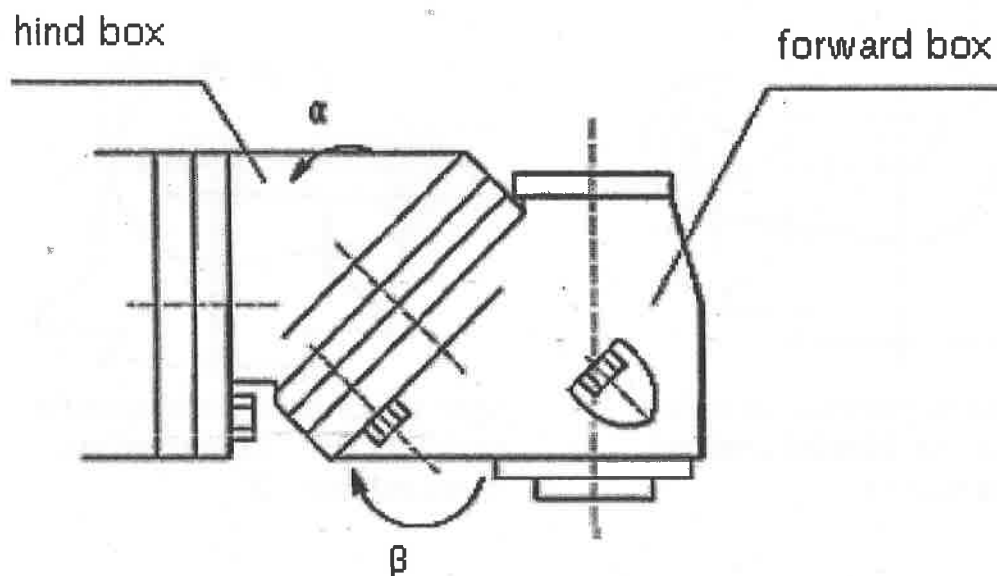
Hind Box  $\alpha$  24° 28' 11" (counterclockwise)

Forward Box  $\beta$  65° 31' 49" (clockwise)

2.cut-30° levorotation

Hind Box  $\alpha$  15° 32' 32" (clockwise)

Forward Box  $\beta$  42° 56' 29" (counterclockwise)



Refer to table of turning angles

Spindle angle $\theta$	Forward Box angle $\beta$	Hind Box angle $\alpha$	Spindle angle $\theta$	Forward Box angle $\beta$	Hind Box angle $\alpha$
1°	1°24'51"	0°30'00"	24°	34°11'56"	12°18'20"
2°	2°49'43"	1 00°00"	25°	35°38'52"	12°48'31"
3°	4°14'35"	1°30'02"	26°	37°05'58"	13°20'53"
4°	5°39'29"	2°00'05"	27°	38°33'17"	13°53'28"
5°	7°04'24"	2°30'09"	28°	40°00'48"	14°26'15"
6°	8°29'21"	3°00'15"	29°	41°28'32"	14°59'17"
7°	9°54'20"	3°30'24"	30°	42°56'29"	15°32'32"
8°	11°19'22"	4°00'35"	31°	44°24'41"	16°06'02"
9°	12°44'28"	4°30'50"	32°	45°53'07"	16°39'48"
10°	14°09'37"	5°01'09"	33°	47°21'50"	17°13'49"
11°	15°35'50"	5°31'32"	34°	48°50'48"	17°48'08"
12°	17°00'08"	6°01'59"	35°	50°20'04"	18°22'44"
13°	18°25'28"	6°32'32"	36°	51°49'38"	18°57'38"
14°	19°50'56"	7°03'10"	37°	53°19'31"	19°32'52"
15°	21°16'29"	7°33'54"	38°	54°49'44"	20°08'27"
16°	22°42'08"	8°04'45"	39°	56°20'17"	20°44'22"
17°	24°07'54"	8°35'42"	40°	57°51'12"	21°20'39"
18°	25°33'46"	9°06'47"	41°	59°22'30"	21°57'20"
19°	26°59'46"	9°38'00"	42°	60°54'10"	22°34'23"
20°	28°25'54"	10°09'21"	43°	62°54'10"	23°11'52"
21°	29°52'11"	10°40'51"	44°	63°58'50"	23°49'48"
22°	31°18'36"	11°12'31"	45°	65°31'49"	24°28'11"
23°	32°45'12"	11°44'20"	46°	67°05'17"	25°07'03"

Spindle angle $\theta$	Forward Box angle $\beta$	Hind Box angle $\alpha$	Spindle angle $\theta$	Forward Box angle $\beta$	Hind Box angle $\alpha$
47°	68°39'15"	25°46'24"	69°	106°27'18"	43°24'55"
48°	70°13'44"	26°26'17"	70°	108°25'08"	44°26'37"
49°	71°48'47"	27°06'42"	71°	110°25'04"	45°30'13"
50°	73°24'24"	27°47'42"	72°	112°27'20"	46°35'50"
51°	75°00'38"	28°28'17"	73°	114°32'08"	47°43'41"
52°	76°37'30"	29°11'30"	74°	116°39'43"	48°53'57"
53°	78°15'02"	29°54'22"	75°	118°30'23"	50°05'52"
54°	79°53'17"	30°37'56"	76°	121°04'29"	51°22'41"
55°	81°32'17"	31°22'13"	77°	123°22'25"	52°41'47"
56°	83°12'04"	32°07'16"	78°	125°44'42"	54°04'30"
57°	84°52'40"	32°53'06"	79°	128°44'53"	55°31'17"
58°	86°34'10"	33°39'47"	80°	130°44'45"	57°02'43"
59°	88°16'35"	34°27'22"	81°	133°24'12"	58°39'30"
60°	90°	35°15'51.8"	82°	136°11'28"	60°22'33"
61°	91°44'28"	36°05'21"	83°	139°08'09"	62°13'04"
62°	93°30'02"	36°55'54"	84°	142°16'26"	64°12'40"
63°	95°17'47"	37°47'33"	85°	145°39'30"	66°23'44"
64°	97°04'48"	38°40'21"	86°	149°22'17"	68°49'50"
65°	98°54'11"	39°34'25"	87°	153°33'02"	71°36'58"
66°	100°45'01"	40°29'49"	88°	158°27'58"	74°56'51"
67°	102°07'23"	41°26'38"	89°	164°49'02"	79°49'34"
68°	104°31'26"	42°24'57"	90°	180°	90°

## 9.2 Maintenance of Machine

Routine maintenance of machine is very important for accuracy and function of machine.

9.2.1 Add lubricating oil to oil tank and lubricating site regularly daily; check the oil quantity of gear box daily, add lubricant if necessary in time.

9.2.2 Often check the lubricant quantity, please add lubricant in time if the lubricant is inadequate.

9.2.3 Clean the surface of table, all guideways, all screw rods and nuts after operation, and coat a thin layer of machine oil.

9.2.4 Check all adjusting gibs monthly, and adjust it properly;.

9.2.5 Please often change fixing position of workpiece on the table for prolong the working life of the table.

9.2.6 Check and clean electrical box once six months, and check connection of every wire.

9.2.7 Check longitudinal and transverse backlash of screw rods and nuts periodically, adjust them if necessary.

9.2.8 Workpiece and cutter must be tightened before working.

## 10. Troubleshooting

**WARNING: Do not make any adjustment until the machine is unplugged and all moving parts have come to a complete stop.**

10.1 Check whether motor seat, lock nuts and bolts are loose when the machine vibrates, tighten all clamping position hard.

10.2 Move knee vertically unsmoothly, and there is noise; move table unsmoothly, check whether gibs are loose, and lubricant lacks, please add lubricant in time, and adjust the gibs properly.

10.3 Motor does not turn, please check whether the switch of motor is in "ON" position, and check whether the wiring is correct.

10.4 Radial runout of spindle is too much, and abnormal sound and heating

phenomenon appear, check whether the spindle is loose, adjust the lock nut on the spindle assembly properly.

10.5 Abnormal sound appears when the table is feeding, should stop the machine, and check whether speed change shifting fork is in place in feeding box, lubricant lacks, please adjust the shifting fork in place, and add lubricant in time.

**Caution :**

1. **Shut off power supply before adjusting and repairing the machine.**
2. **The machine should be repaired by professional only.**

## 11. Electrical System of Machine

Refer to wiring diagram and electrical parts list.

Power supply: AC 380V 50Hz, 3PH. Connect electrical system of the machine and power supply through the power supply switch that is fixed on door of the electrical box on the right of the machine.

Must confirm the external power supply accords with the power supply of the machine, and make sure it is right; earthing conductor is connected with earth well.

11.1 The machine has many protection functions, such as short circuit, overload, emergency stop, power off opening door and so on.

11.2 Set automatic brake function on the horizontal spindle, which enable horizontal spindle to stop rapidly after stopping the machine.

11.3 Servo motor is adopted on the machine, so torque is big, which realizes stepless speed change.

11.4 Operation panel:

SB1: emergency stop button; press it to stop the machine immediately, turn it CCW to relieve it.

SB2: control circuit starting button

SB3: horizontal spindle stop      SB5: horizontal spindle CW

SB6: horizontal spindle CCW

HL1: servo ready, servo is ready when lamp lights; servo alarms when lamp goes out.

SB7: feed stop      SB8: feed start;

SB10: coolant "ON"      SB9: coolant "OFF"

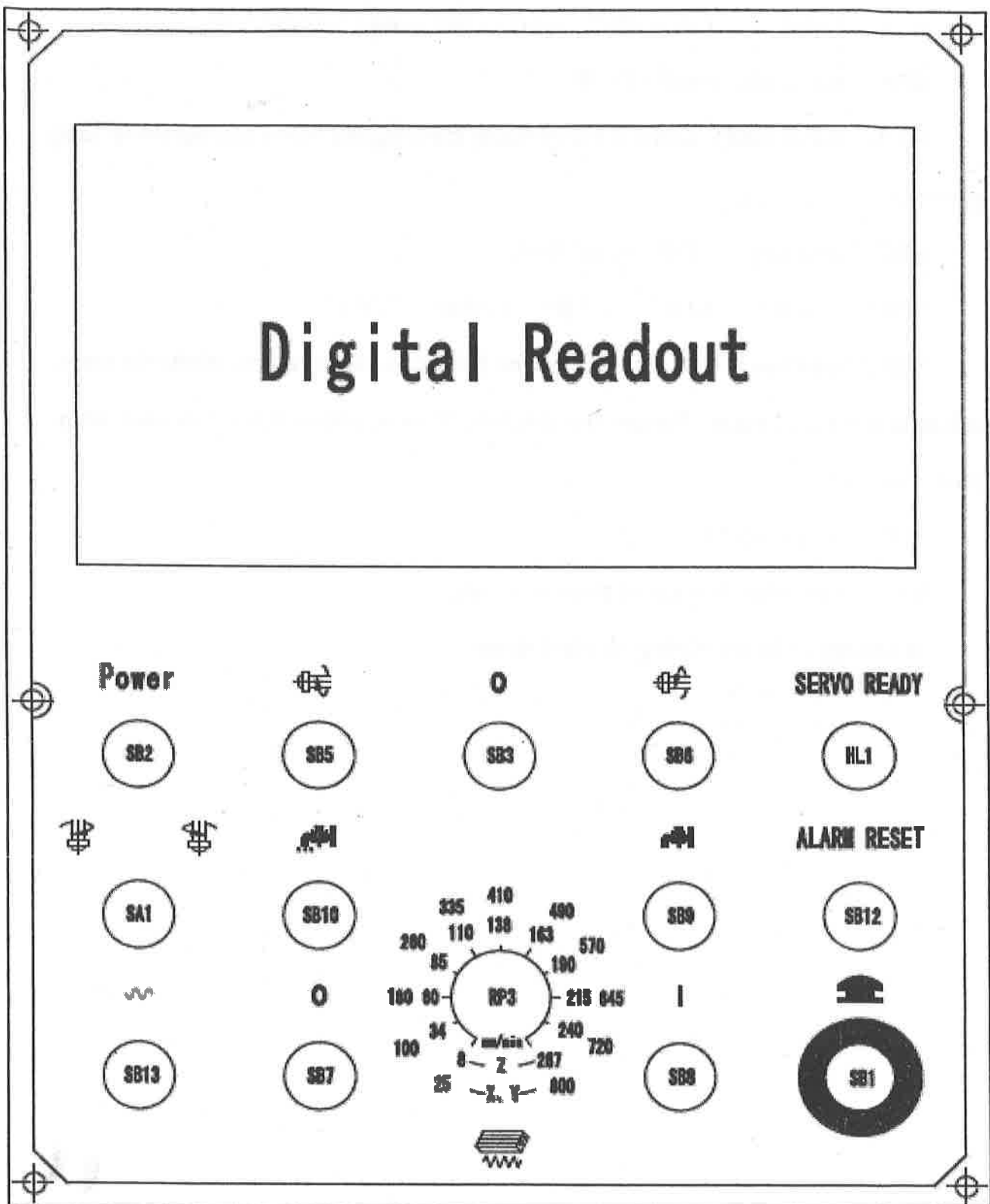
SB12: reset the servo alarm. Press the button to cancel alarm when the servo driver is giving an alarm. Restart the machine if servo alarm is not canceled when press the button.

SB13: feed rapidly

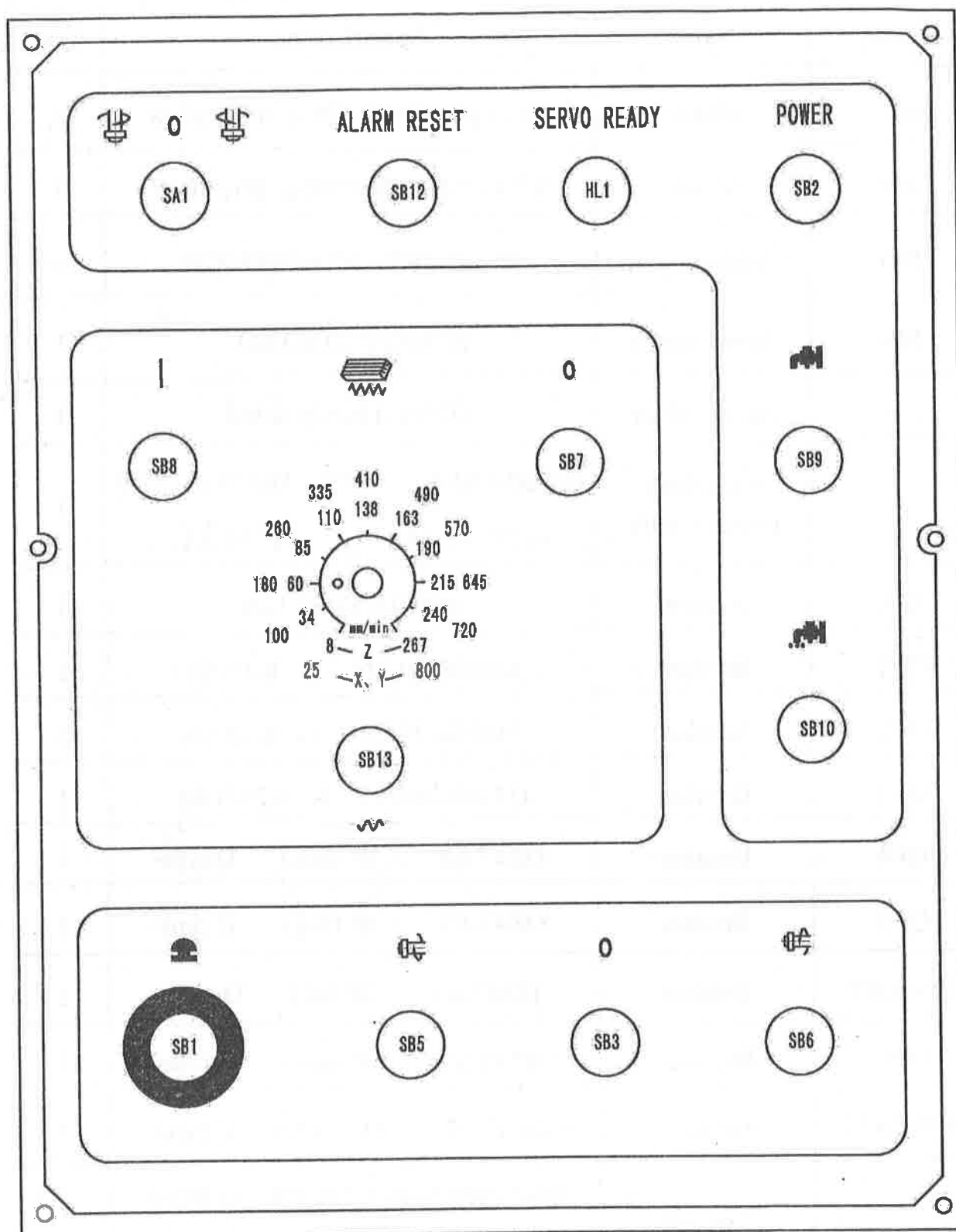
RP3: feed adjusting speed potentiometer.

**Warning : No repairing on electricity.**

# Digital Readout



a. Install digital readout

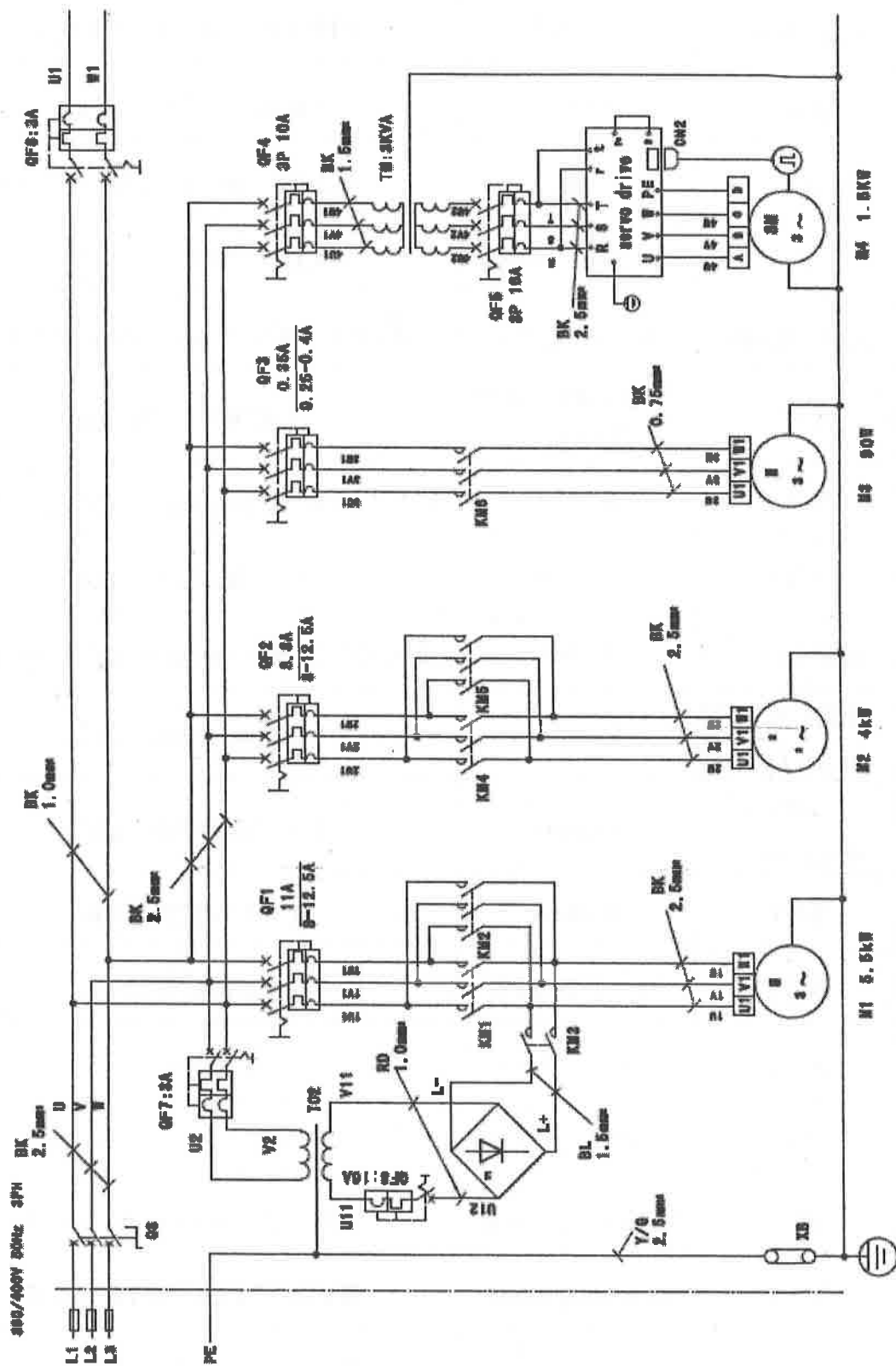


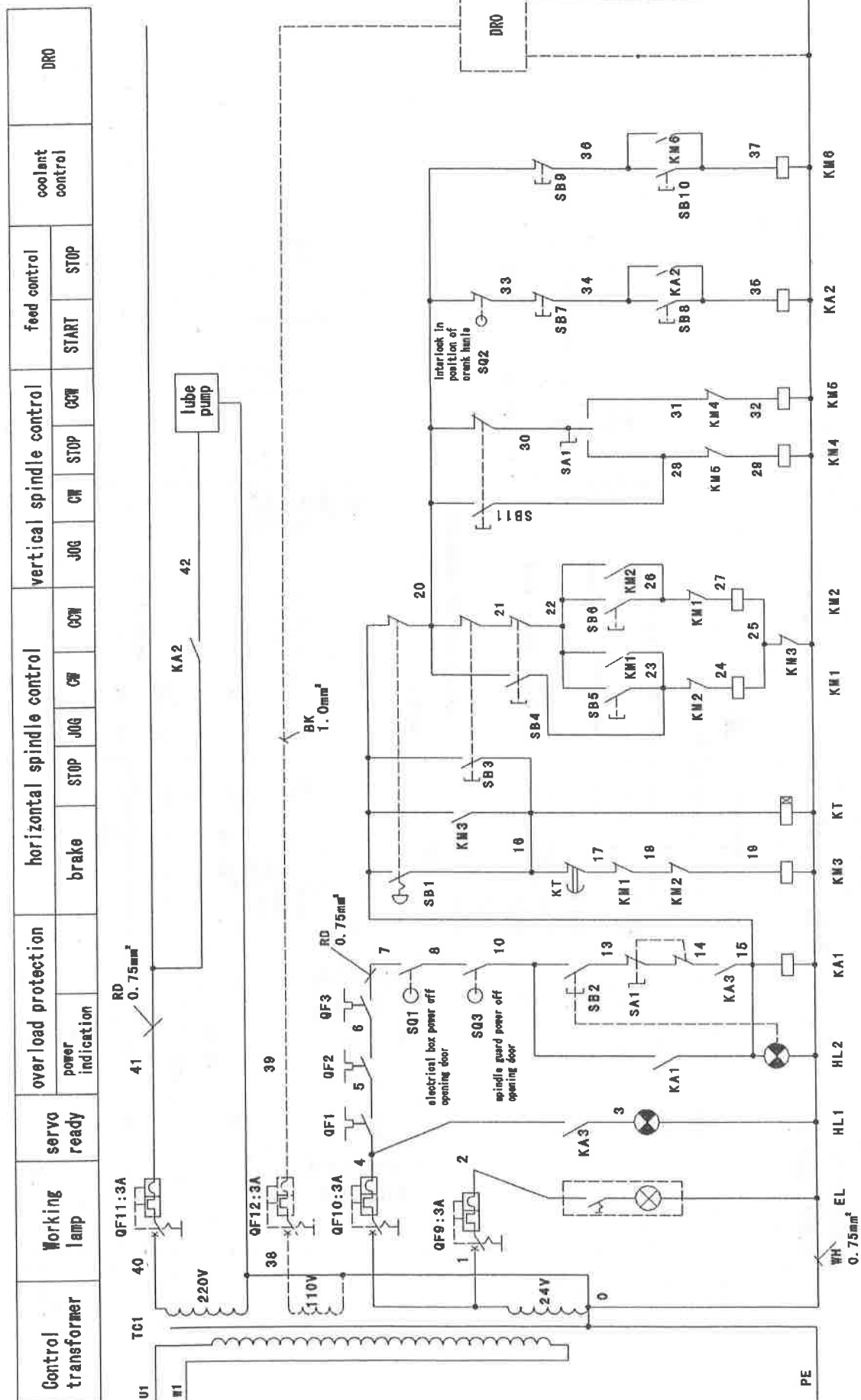
b. No digital readout

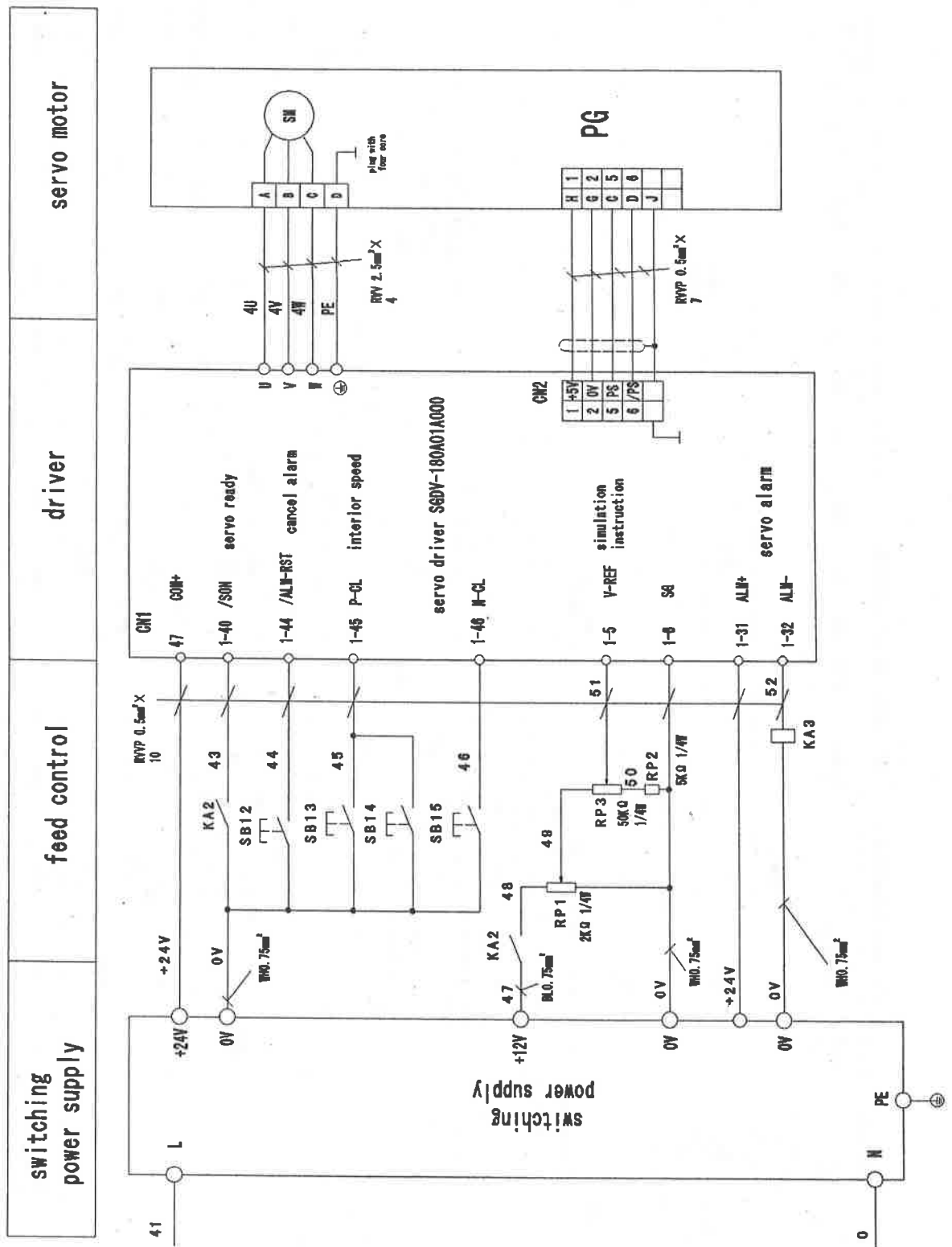
Code	Name	Specification	Qty
M1	Motor	Y2 132S-4 380V 50Hz 3PH5.5KW	1
M2	Motor	Y2 112M-4 380V50Hz 3PH 4KW	1
M3	Coolant pump	AB-25 380V 50Hz 3PH 90W	1
M4	Servo motor	SGMGV-20ADA61	1
	Servo driver	SGDV-180A01A000	1
	Switching power supllly	QW60-3AFAC: 220V Dc+24V (2A) +12V (0.5A) , -12V (0.5A)	1
QS	Switch	JCH-13 32/31 32A	1
QF1	Breaker	DZ108-20/211 I: 8-12.5A	1
QF2	Breaker	DZ108-20/211 I: 8-12.5A	1
QF3	Breaker	DZ108-20/211 I: 0.25-0.4A	1
QF4	Breaker	DZ47-63 (3P 10A) D type	1
QF5	Breaker	DZ47-63 (3P 16A) D type	1
QF6 QF7	Breaker	DZ47-63 (2P 3A) D type	2
QF8	Breaker	DZ47-63 (1P 16A) C type	1
QF9-QF12	Breaker	DZ47-63 (1P 3A) C type	4
TC1	Control transformer	JBK5-300 300VA I:0-380V O:0-24V (150VA)、0-220V(100VA)、 0-110V (50VA)	1
TC2	Control transformer	JBK5-300 300VA I:0-380V O:0-24V	1

TM	Servo transformer	BS--300 3KVA I:0-380V O:0-220V	1
KA1 KA2	relay	HH54P (AC24V 50HZ)	2
KA3	relay	HH54P (DC24V)	1
KT	relay	JS14A 0-5S (AC 24V)	1
V1	Rectifier bridge	KBPC2005 IE:20A	1
KM1-KM6	AC contactor	CJX1-12/22 (AC: 24V 50Hz)	6
SB1	Emergency stop button	LA103-11ZS/red	1
SB2	Button	LA103-10DS/ green (AC 24V)	1
SB3	Button	LA103-11BN/red	1
SB4 SB11	Button	LA103-11BN/ white with "T" symbol	2
SB5 SB8 SB10	Button	LA103-10BN/ green	3
SB6 SB12-SB15	Button	LA103-10BN/ white	5
SA1	Button	LAY7-22X/3106	1
SQ1	Micro switch	LXW6-11D/L	1
SQ2	Limit switch	JLXK1-311	1
EL	Working lamp	JC50L AC24V 90W	1
HL1	Indication lamp	AD17-22/ white (AC24V)	1
RP1	Potentiometer	RV24YN-202 1/4W 2K $\Omega$	1
RP2	Potentiometer	RV24YN-502 1/4W 5K $\Omega$	1
RP3	Potentiometer	RV24YN-103 1/4W 10K $\Omega$	1

Main power supply switch	Horizontal spindle			Vertical spindle		Coolant	Servo drive
	Brake	CW	CCW	CW	CCW		







## 12. Accuracy Test List

No.	Test item	Tolerance	Measurement
1	Levelling of the machine	A: longitudinal 0.04/1000	✓
		B: transverse 0.04/1000	✓
2	Linearity of the vertical movement of knee	A: longitudinal 0.05/300 $\alpha \leq 90^\circ$	0.02
		B: transverse 0.05/300	0.03
3	Perpendicularity between vertical guideway of column and table surface.	A: in transverse vertical plane 0.05/300	0.02
		B: in longitudinal vertical plane 0.05/300	0.04
4	Flatness of table	0.04/500	0.03
5	Parallelism between table movement and table surface.	A: longitudinal 0.05/300	0.02
		B: transverse 0.05/300	0.03
6	Spindle axial runout	0.02	0.01
7	Parallelism between spindle rotary axis and table surface	0.05/300 (only down )	0.03
8	Spindle taper hole runout	A: at end of spindle. 0.01	0.01 0.01
		B: 300mm to spindle end 0.03	0.02 0.03
9	Perpendicularity between spindle rotary axis and table surface.	A: in transverse vertical plane $\alpha \leq 90^\circ$ 0.05/300	0.04
		B: in longitudinal vertical plane 0.03/300	0.02
10	Parallelism between spindle rotary axis and table transverse movement.	A: in vertical plane 0.05/300 (only down)	0.02
		B: in horizontal plane 0.05/300	0.03
11	Linearity of datum T-slot.	0.03/500 Max.: 0.06	0.02

12	Parallelism between movement of table and datum T-slot..	0.03/300    Max.: 0.06	0.03
13	Perpendicularity between transverse and longitudinal movement of table.	0.04/300	0.02
14	Parallelism between spindle rotary axis and the guideway of ram.	A: in vertical plane 0.05/300 (only down)	✓
		B: in horizontal plane 0.05/300	
15	Coaxialism between the center hole of hanger and spindle axis.	A:in vertical plane 0.05 (only down)	✓
		B: in horizontal plane 0.05	
Checker :			

### 13. Packing List

No.	Name	Model	Qty
1	Machine		1
2	Milling chuck	7:24 ISO50 (8 pieces)	1 set
3	Inner hexagon spanner	5, 6, 8, 10, 12, 14	each 1
4	Wrench	S21~24、 S27~30	each 1
5	Middle-sleeve	7:24 ISO50/MS4	each 1
6	Draw bar	M24 (vertical/horizontal)	each 1
7	Nut	M16	1
8	Milling arbor	ISO50-φ27 ISO50-φ32	each 1 set
9	Washer	Φ16	2
10	Shell end milling arbor	7:24 ISO50-Φ32	1
11	Operation manual		1
12	Accuracy test list		1
13	Packing list		1





