Original Instructions

Universal Milling Machine

Model: UF200S

Operation & Maintenance Manual

(Mechanical & Electrical)

Serial number：

Delivery time：

INDEX

I. NOTICE

The manual is compatible for Universal Milling Machine model and its variants.
Machine with longer X axis travel

- Read this *Operation Manual* carefully and fully to learn parameters and functions of the machine before any operation. Follow its instruction strictly.
- Wear appropriate protection work suit.
- Check and clear obstacles inside or around the machine frequently.
- Do NOT touch electrics with wet hand.
- Check and adjust maintenance points listed in this *Operation Manual* periodically.
- Do NOT tear off or change safety apparatus, labels and protection devices.
- Do NOT shift gears when the machine is running.

(Machine Picture with Options, For Illustration Only)

II. SAFETY INSTRUCTIONS

Marks / Tokens:

★: "***RISKY***" for a potentially instant risky status to be avoided. Fatal death or severe injury may occur.

▲: "***WARNING***" for a potential risk. Injury to personnel or damage to machine may occur.
△: "***CAUTIONS***" for extra attention.

1. Installation

△***CAUTIONS***: Understand fully of the requirement and procedures of machine installation listed in the *Operation Manual.*

△***CAUTIONS***: Coordinate and cooperate with each other with clear communication.

▲***WARNING***: Check slings,tools and make sure they are qualified as per safety criterions.

2. Power

△***CAUTIONS***: Make sure the electric cabinet door is appropriately closed.

▲***WARNING****:* When machine stops suddenly due to cutoff of power, turn off the main power switch.

3. Idle Running

▲***WARNING***: Run the machine idly to warm it up before machining.

▲***WARNING***: During idle running, check for proper functioning of each component: Check whether all the handles run smoothly and all the clamping bolts and pads are released. Check for proper feeding direction, quiet machine sound and proper functioning of electrical parts. Open the electric cabinet door to check for loose components and wires and tighten them if so. Check for damaged components and change them. If everything is OK, close the electrical door and turn on the main power switch. Run the machine when obstacles around are cleared properly.

▲***WARNING***: Do NOT press buttons wrong. Check illustrative lamp on operation panel.

★***RISKY***: Stop the machine fully during loading and unloading.

4. Auxiliary Facilities

▲***WARNING***: Check the setup values and status of moving components.

★***RISKY***: Use the hoist equipment, cranes or help from others to move heavy articles.

▲***WARNING***: Do NOT touch the work lamp as it will be hot after being on for a long time.

▲***WARNING***: Be cautious for slippery floor with coolant that may fall when the table moves to its longitudinal limit.

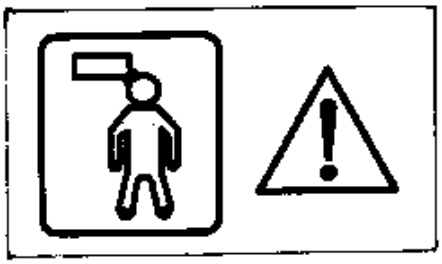
★***RISKY***: Do NOT touch rotating parts when the machine is running.

▲***WARNING***: Loose the clamping bolts gently to avoid damage of the threads.

▲***WARNING***: Clamp the workpiece and cutting tools firmly and securely.

▲***WARNING***: Do NOT put cutting tools or other articles on the operation panel or on the machine body.

▲***WARNING***: Be cautious of projecting ram, operation panel or other components when passing by.



5. Automatic Running
★***RISKY***: Do NOT lean against the machine when it is running.
▲***WARNING***: Do NOT press buttons wrong. Check illustrative lamp on operation panel.
★***RISKY***: Close all the safety doors before automatic running.
▲***WARNING***: Do NOT touch any rotating components during automatic running. Stop the machine fully if so required.
▲***WARNING***: Do NOT touch any switch during automatic running.

6. Machine Stop
★***RISKY***: Press the *Emergency Stop* button in emergency.
▲***WARNING***: Understand fully the machine status in difference stop conditions.
★***RISKY***: Make sure the machine stops completely.

7: Complete of Machining and Power-Off
▲***WARNING***: Clean inside of the machine.
▲***WARNING***: Keep machine bodies in specific position (like X, Y, Z, spindle, etc.).
▲***WARNING***: Turn off main power switch and get it interlocked when machining is completed. Remove secure key so that others will not start machine without attendance.

8. Check and Maintenance
▲***WARNING***: Identify the trouble as per description of the operator.
▲***WARNING***: Formulate work procedures and scopes for check and maintenance.
★***RISKY***: Place “Under Maintenance” signs around machine during maintenance.
★***RISKY***: Turn off the main power switch to avoid sudden power-on. Place “DO NOT TURN IT ON” signs on the main power switch.
★***RISKY***: Turn off the main power switch and place “DO NOT TURN IT ON” signs on the main power switch when working inside the machine.
★***RISKY***: Do NOT touch electric cables, electrics and switches with wet hand.
★***RISKY***: Use ladders or other safety apparatus when climbing high.
▲***WARNING***: With standard or specific tools only.
▲***WARNING***: Do NOT put cutting tools or clothes on the moving components.
★***RISKY***: Use properly checked and qualified slings, hooks and chain wheels for lifting.
▲: Use specified spares for changes ONLY.

Contact us promptly with reference of machine serial number and delivery date for appropriate support whenever it is needed.

III. INTRODUCTION

The UF200S series milling machines are universal machines that are capable of diverse machining, like drilling, reaming, milling and boring.

Flat, slant, vertical surfaces cutting and slotting can be done with formed cutter or face mill. With the spindle center line rotating at any angle in the first half hemisphere of the rotary head, it has a diverse cutting capacity.

The machines have a wide application for single-piece or small batch production in manufacturing, instruments, construction, maintenance and repair workshops and so like industries.

Featuring optimum structure, easy operation and less maintenance, the machine can also be equipped with DRO system for higher positioning and efficiency in batch production.

Features:

★ Fine elaborate workmanship and neat appearance with perfect paint finish.
★ **High Rigidity**: Robust & rugged machine body made of high grade casting assuring superb stability and long lasting life.
★ **Bigger Travels**: Ram stroke for extended cross feed length and wider cutting scope.
★ **High Versatility**: Universal milling head with 2 x 45° swivel shells that swivels 360° left to right and 0-90° up to down for high versatile vertical, horizontal and universal machining in a semi-sphere scope.
★ Universal milling head firmly fixed on ram for robust cutting performance.
★ Motor coupled directly into the gear transmission for extraordinary heavy cutting.
★ **Gear-driven horizontal spindle** is equipped for extraordinary heavy power cutting.
★ Horizontal milling spindle is supported with heavy loading taper roller bearing at optimized distance featuring robust cutting capacity.
★ Wide speed ranges of the milling spindles for enhanced cutting on different material.
★ **Patented-design with a Servo motor drive** mechanism with gear speed reduction for feeding transmission.
★ **Automatic feeding** on 3 axes, ie. X, Y, Z axes. Boring function can be done.
★ Feed selection among X / Y / Z axes **via one lever only**, easier operation, avoiding interference of axes.
★ Rapid traverse function on 3 axes for easier operation and high machining efficiency.
★ Compulsory lubrication on main transmission gears for efficient cooling.
★ A manual centralized lubricator unit equipped for lubrication on leadscrews and guide ways for smooth travel and longer machine life.
★ Modular design with wide options for diverse needs: 2-axis DRO unit, 3-axis DRO unit, table guards, universal dividing heads, various clamping kits, vices, tool holders, etc.

★ *Working Ranges:*

Swivel of universal milling head	360°

★ *Axis Movement:*

	Manual feed	Auto feed	Rapid traverse	Remarks
X axis	*Yes*	*Yes*	*Yes*	
Y axis	*Yes*	*Yes*	*Yes*	
Z axis	*Yes*	*Yes*	*Yes*	

Working Conditions:

a). Power supply: 380V ±10%, 50Hz ±1Hz, 3Ph

b). Ambient temperature: 0℃- 40℃

c). Relative humidity: 30% - 85% (at 20℃)

d). Atmospheric pressure: 86 – 106kPa

e). Dust density: ≤10mg/m3

f). Environment: clean from harmful / corrosive / explosive gas, acid, alkali, liquids, etc

g). Foundation: solid, flat, clean, well-lightened, clear from vibration, thermal sources

IV. STRUCTURE

The machine consists of main transmission mechanism, base, column, knee, table, ram, universal head as well as coolant system, lubrication system and electrical system.

The column is fixed on the base. The column is fixed on the base. The ram is placed on top of the column. Ram moves forward or backward on the column top. Main transmission mechanism is installed in the column and provides power via gears and shafts to the horizontal spindle. The horizontal spindle is with an ISO 50, 7:24 taper and is compatible for end-mill or horizontal mill arbor. The horizontal mill arbor is to be supported in a bracket at the other end that moves along the dovetail guide ways on ram.

Universal milling head is mounted on the front side of the ram. It has two shells with 45° angle on the coupling surfaces. Two pairs of helix bevel gears are integrated inside with one of 45° angle and the other 135° angle. The front shell swivels along the ring type T-slot on the rear shell. The rear shell swivels along the ring type T-slot on the flange that fixed on the ram. With the compound rotation of the front and rear shells, the universal head can swivel to different angle in a semi-sphere scope. Loose the locking pins, the head can swivel 360° left to right and 0-90° up to down. After rotate to the required angle, insert the pins to lock the universal head.

The knee with saddle and table on the top is mounted along guide ways of the column. Loose the locking bolt, rotate the hand to drive the knee up and down. The feeding mechanism is fitted inside the knee. A servo feeding motor is equipped for variable speed output to the horizontal, cross and vertical direction via gear transmission.

Compulsory lubrication of horizontal milling head is done with independent pump. Lubrication of feeding mechanism is through oil splashing bath lubrication. Lubrication of other locations is to be done with hand pump or oil gun.

Coolant pump is mounted on the machine base and provides coolant to the cutting tool and work-piece through a hose.

Electrics are inside a cabinet that is well sealed and easy for check and maintenance.

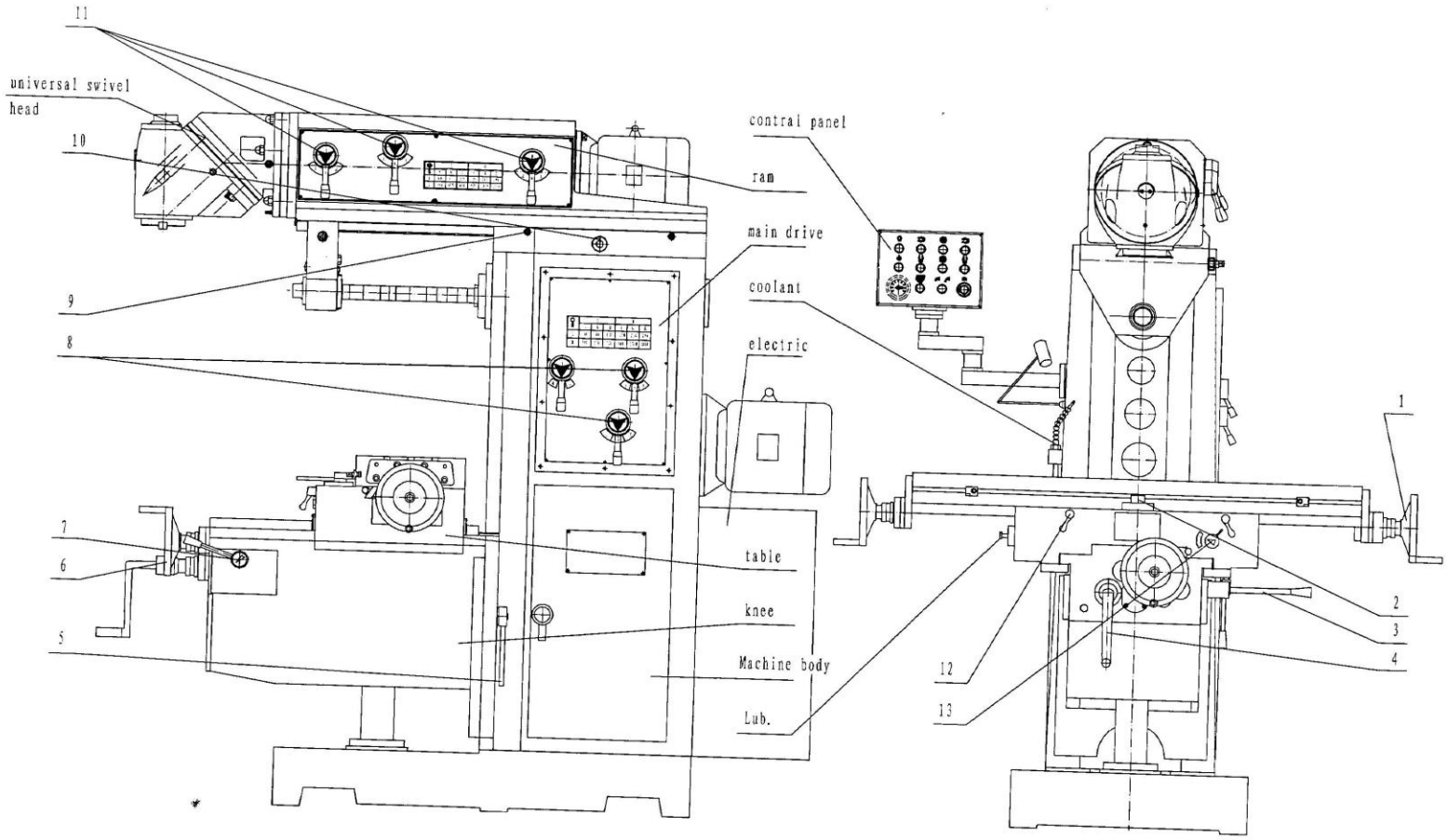


figure1-1 structure appearance figure(XL6432, XL6436)

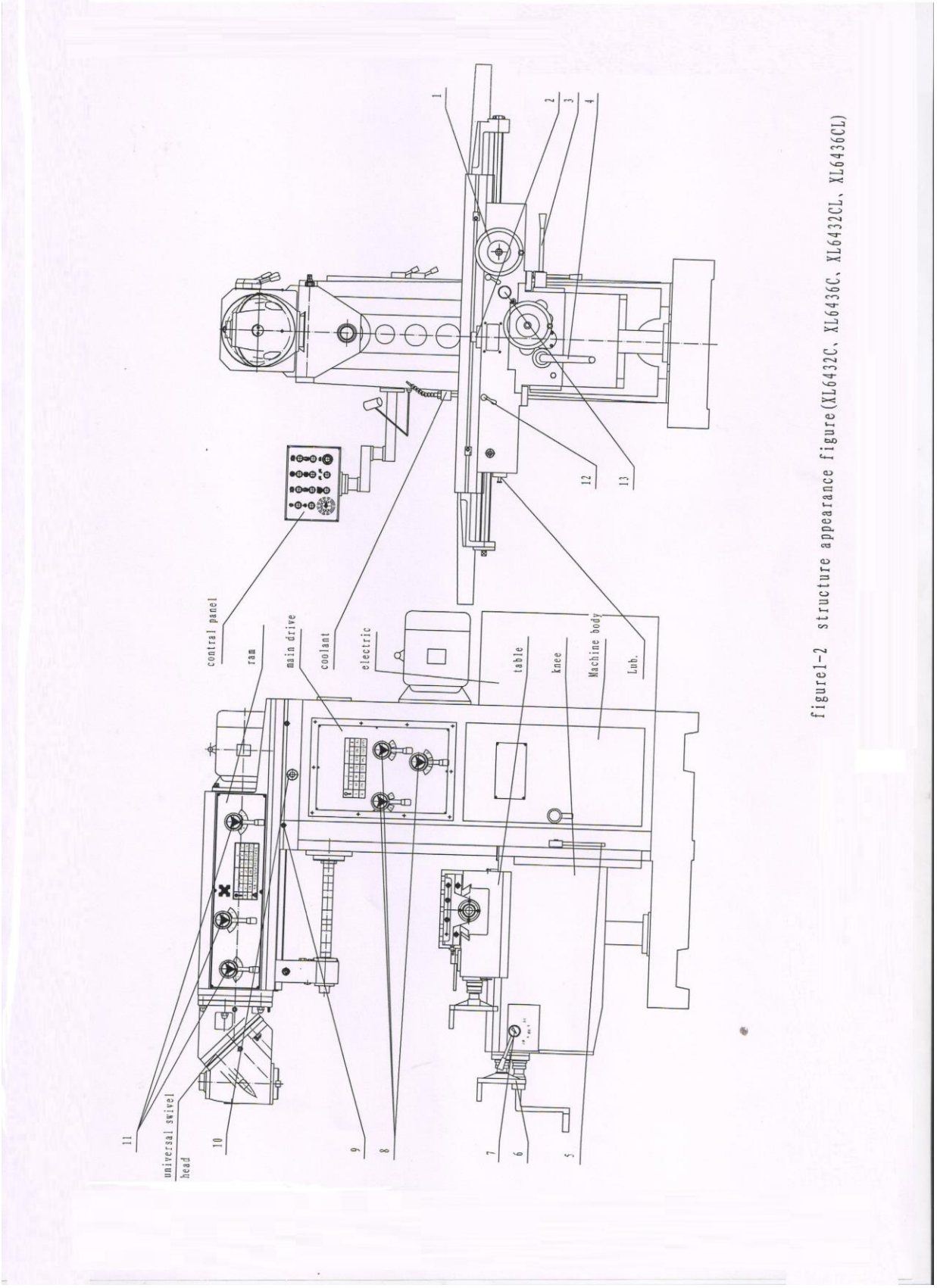


figure1-2 structure appearance figure(XL6432C、XL6436C、XL6432CL、XL6436CL)

<Diagram 1 – Outline View>

V. SPECIFICATIONS

No.	Items	UF200S
1	Table size	360 x 1600 mm
2	Max. table load capacity	500 kg
3	T-slots (number x width x pitch)	3 x 18 x 80 mm
4	X axis travel (longitudinal)	1300 mm
5	Y axis travel (cross)	320 mm
6	Z axis travel (vertical)	400 mm
7	Distance between horizontal spindle to table top	0 – 380 mm
8	Distance between vertical head end to table top	130 – 570 mm
9	Swivel of universal milling head	360°
10	Feed rate of X axis	20-500mm/min
11	Feed rate of Y axis	30 -750mm/min
12	Feed rate of Z axis	15-375mm/min
13	Universal milling head spindle taper	ISO 50, 7:24
14	Universal milling head spindle speed	(12 steps) 60 – 1750 rpm
15	Horizontal spindle taper	ISO 50, 7:24
16	Horizontal spindle speed	(12 steps) 60 – 1800 rpm
17	Stroke of ram	550 mm
18	Power of horizontal spindle motor	5.5 kW
19	universal milling head motor	4 Kw
20	PTorque of feed motorower of	15 Nm, servo motor
21	Machine dimension (approximate)	2520 x 2100 x 2250mm
22	Machine weight (approximate)	2850 kg

VI. UN-PACKING AND INSTALLATION

1. Transportation and Handling

Place the machine on flat surface and secure it firmly for transportation in a smooth and vibration-proof manner.

Lift the machine as per diagram shown. Use a sling of minimum **3 tons load capacity** to

lift the machine.

Cautions:

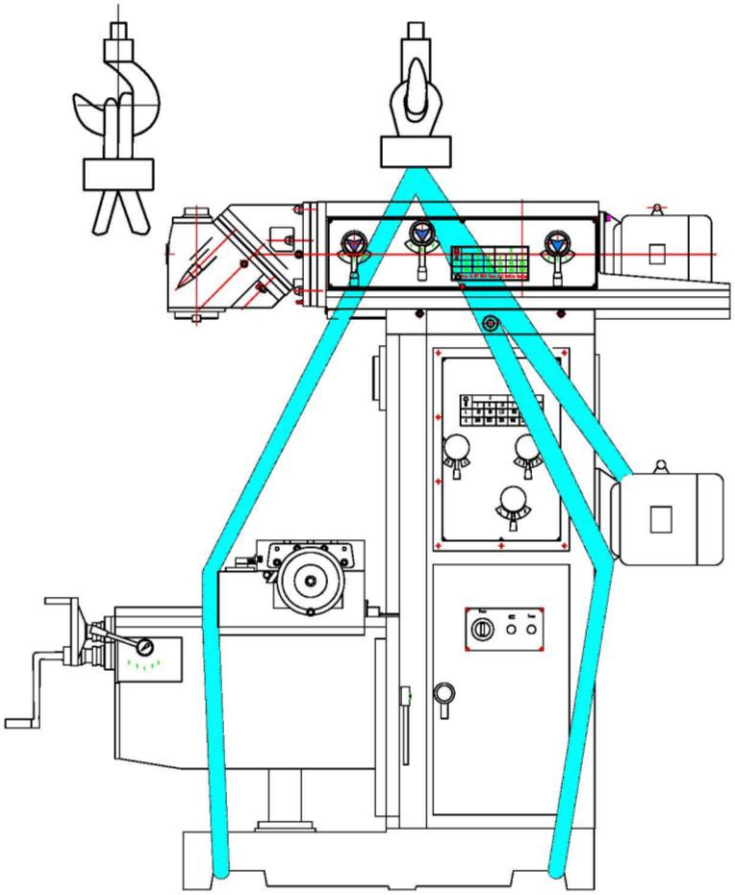
★ ***Lift the machine ONLY with qualified slings.***

★ ***Keep the slings away from machine surfaces, levers and handles.***

★ ***Put wooden block (100 x 100 x 200 mm) or soft mattress on the contacting surfaces to avoid damage to the painting.***

★ ***Move the ram backward and table in the middle to keep the machine in balance.***

★ ***Do not lift the machine too high and move it slowly to avoid any accident.***



<Diagram – Machine Lifting>

2. Un-packing

Un-pack the machine properly to avoid damages to the machine and its components. Contact the transportation company, the insurance company and us promptly if any damages occur.

3. Cleaning

Clean the machine thoroughly and remove the anti-rust oil and grease with proper solvent. Do NOT run the table, saddle and knee without proper clean and lubrication. Contacting surfaces under the table, saddle and knee should also be cleaned and lubricated properly. Loose locking bolts on the machine, move it forward or backward to clean and lubricate the contacting surfaces. *Note: Do NOT use petrol or other flammable solvent for cleaning.*

4. Installation

Keep the floor flat with fine concrete. Steel plates can be used to keep rough floor flat if the machine is to be placed on the floor. (However, it is recommended to grout the machine to avoid movement or inclination of the machine due to un-even load.) Make sure machine base contacts the floor firmly before tightening the foundation bolts to avoid inclination or deformation of the machine. Level the machine in both horizontal and cross directions. The tolerance is 0.04/1000mm. After leveling, grout the anchor bolts into pits with fine concrete. When the concrete becomes solid, tighten the anchor bolts and level the machine again for check. Some handles are to be removed for easier transportation. Fit them back when the machine is installed.

Cautions:

★ ***Prepare the foundation with a depth of minimum 500 mm.***

★ ***Concrete should be grade No.150 or above.***

★ ***Grout the anchor bolts and tighten them ONLY after the concrete becomes solid.***

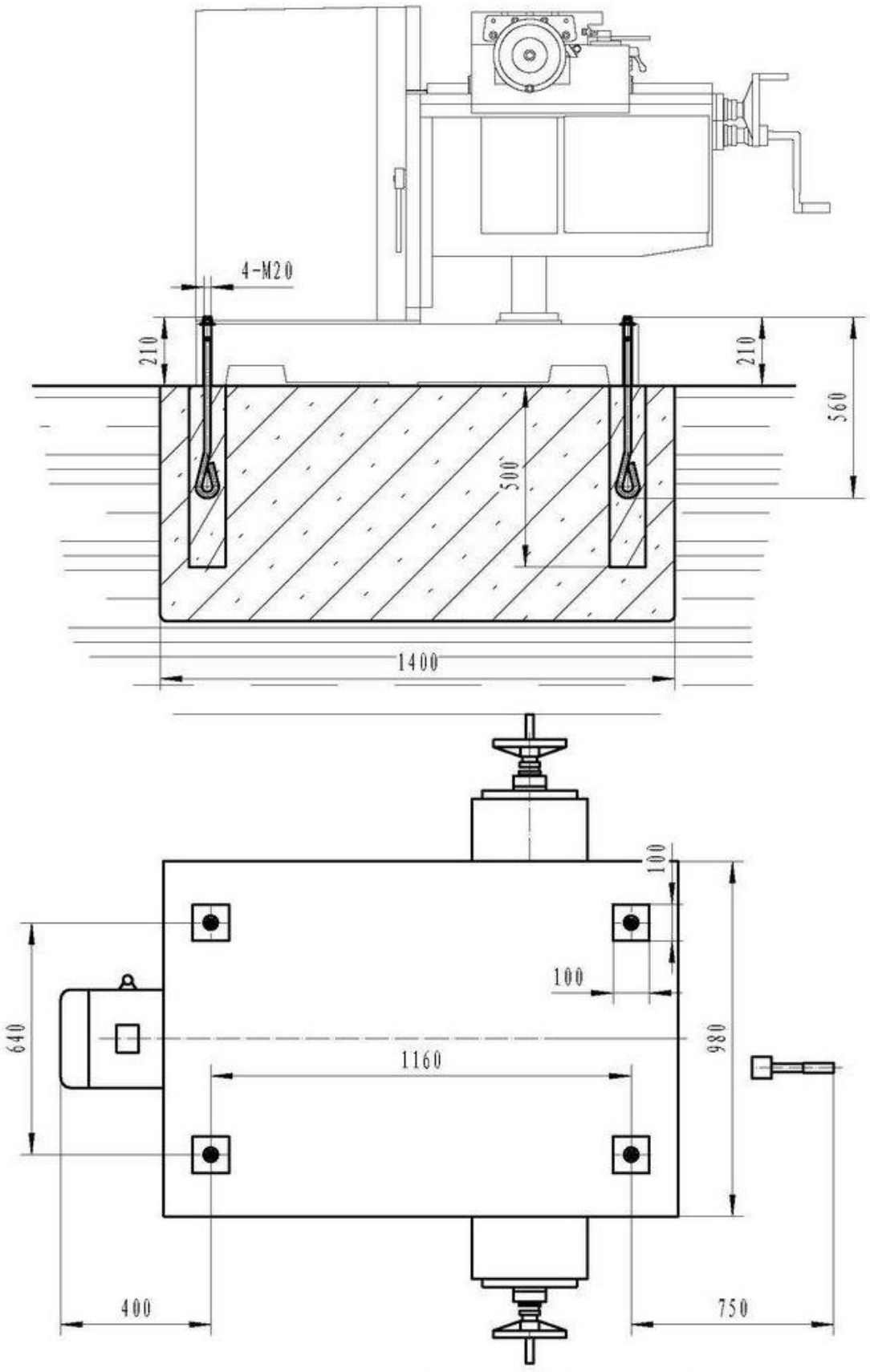


Figure 3 Foundation plans

<Diagram – Foundation Drawing>

5. Alignment of Machine

Align the machine with a precision leveling gauge longitudinally and cross on the table. The allowance is 0.04 / 1000mm. After the alignment, move down the saddle and knee.

6. Wiring of Power

Wire the power by a qualified electrician as per procedures below:

(1) Make sure the power input is proper for the machine.

(2) Wire the power cable as per local safety rules and regulations.

(3) Make sure the spindle rotates in the correct direction. Viewing from the top, the spindle should rotate clock wisely at high speed.

VII. TRANSMISSION SYSTEM

1. Transmission System of Horizontal Spindle

The transmission system is installed inside the column. It is driven by a 5.5 kW motor via gears and shafts. Horizontal spindle speed can be changed with the three handles on the column for 12 different speeds of 60-1800rpm.

2. Feed Mechanism

The transmission system is installed in the knee. It is driven by an AC servo motor via gears that provides variable speeds. It features compact structure and big torque output. This system has two operation modes, ie. manual or automatic. In automatic mode, select among X / Y / Z axes via a handle on the right side of the knee and then select the feed rate on the operation panel. In manual mode, shift the X / Y / Z axes selection handle to neutral and operate the machine via hand-wheels.

3. Table

Table is placed on top of the saddle and the knee. Alignment of the table can be adjusted by the gib strips in between the table and the saddle. Manual or automatic feed can be carried in horizontal, cross or vertical directions of the table.

4. Knee

The knee is fitted on the column. Alignment can be adjusted by the gib strip between the knee and the column. Movement of the knee can be either in manual or in automatic mode. Automatic movement of the knee is driven by the servo motor inside the knee.

5. Ram

The ram is mounted on top of the column. Alignment can be adjusted by the gib strip between the ram and the column. Movement of the ram is through pinion and rack. Horizontal milling arbor can be fitted with a support bracket mounted in the front of the ram. The support bracket is equipped with a copper sleeve as a bearing of the horizontal milling arbor. Oil reservoir is provided inside the support bracket to supply lubrication oil to the copper bearing.

6. Universal Milling Head

Universal milling head is fitted in front of the ram. Spindle inside the head is driven by two bevel gears and a spline shaft that is coupled with a spline sleeve inside the ram. It can rotated via pinion, rack, worm gear and worm shaft for specific angle as per needs.

<Diagram – Transmission System>

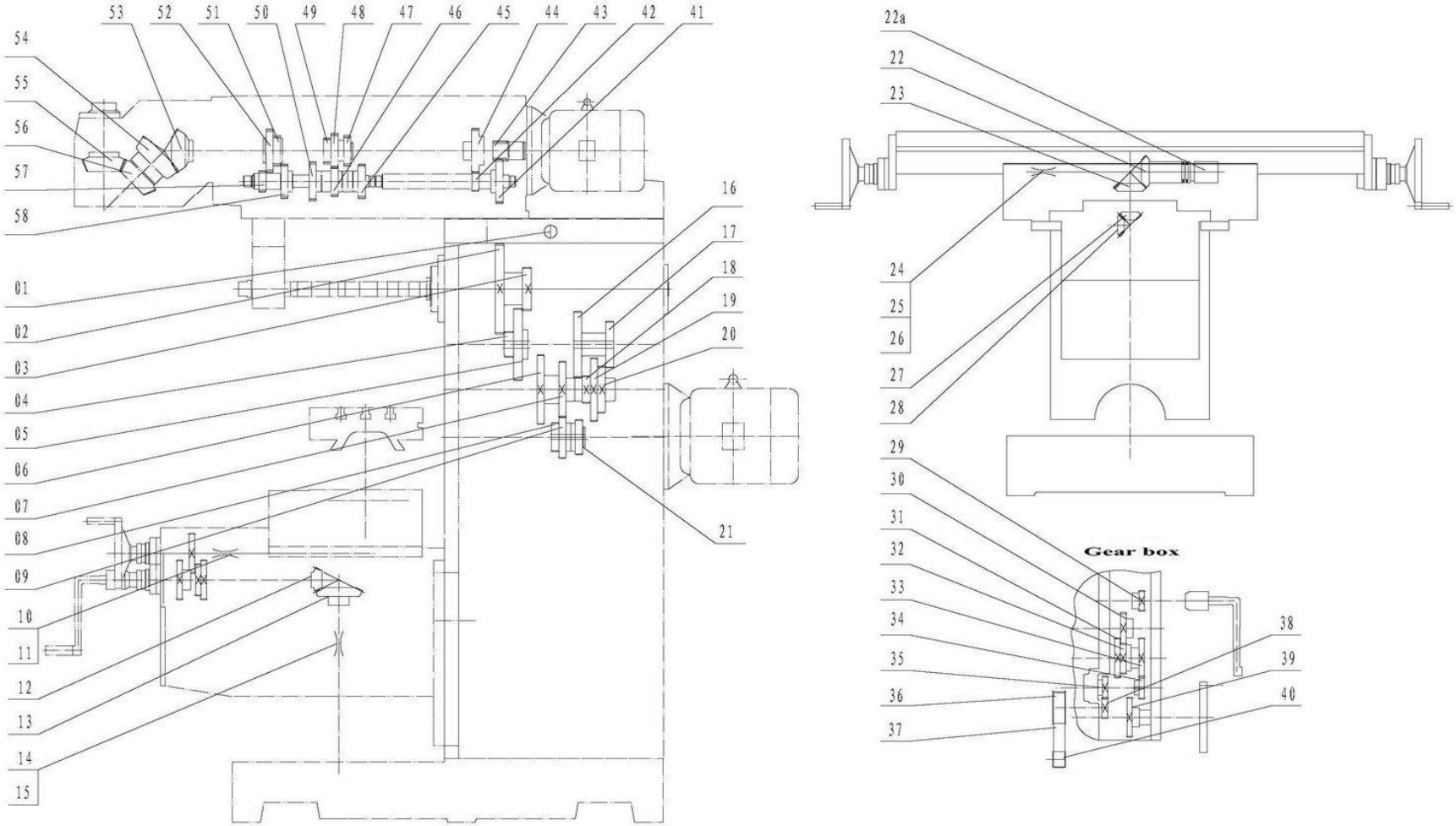


Figure 4 Transmission system

Part List in the Transmission System:

No.	Part No.	Item	No.	Part No.	Item
1	05206	Pinion shaft	33	02218	Gear
2	06204	Gear	34	Sliding gear	02216
3	06205	Gear	35	Gear	02215
4	06202	Sliding gear	36	Pulley	02235
5	06201	Sliding gear	37	Timing belt	
6	06217	Gear	38	Pulley	02239
7	06218	Gear	39	Gear	02232
8	06224	Sliding gear	40	Gear	02238
9	06223	Sliding gear	41	Gear	03213
10	02231	Cross leadscrew	42	Gear	03206
11	52K713	Cross leadscrew nut	43	Gear	03208
12	02210	Bevel gear	44	Gear	03207
13	02207	Bevel gear	45	Gear	03209
14	02226	Vertical leadscrew	46	Gear	03205
15	02304	Vertical leadscrew nut	47	Bevel gear	X52K62-740
16	06207	Sliding gear	48	Gear	X5005215
17	06208	Sliding gear	49	Pinion shaft	X5005203
18	06221	Gear	50	Pinion shaft	X5005216
19	06219	Gear	51	Gear	X5005214
20	06220	Gear	52	Gear	X5005212
21	06222	Sliding gear	53	Gear	X5005210
22	03204	Bevel gear	54	Gear	X5005211
22a	03233A	Clutch	55	Gear	X5005209
23	03201	Bevel gear	56	Gear	X5005208
24	03205	Hori. leadscrew	57	Gear	X5005207
25	03301	Hori. leadscrew nut	58	Gear	X5005202
26	03302	Hori. leadscrew nut	59	Gear	X5005201
27	03222	Bevel gear	60	Spiral gear	X643606204
28	03223	Bevel gear	61	Spiral gear	X643606205
29	02224	Gear	62	Spiral gear	X643606209
30	02246	Gear	63	Spiral gear	X643606208
31	02213	Gear	64	Pinion gear	X5005206
32	02214	Gear	65	Gear	X5005205

<Diagram – Bearing>

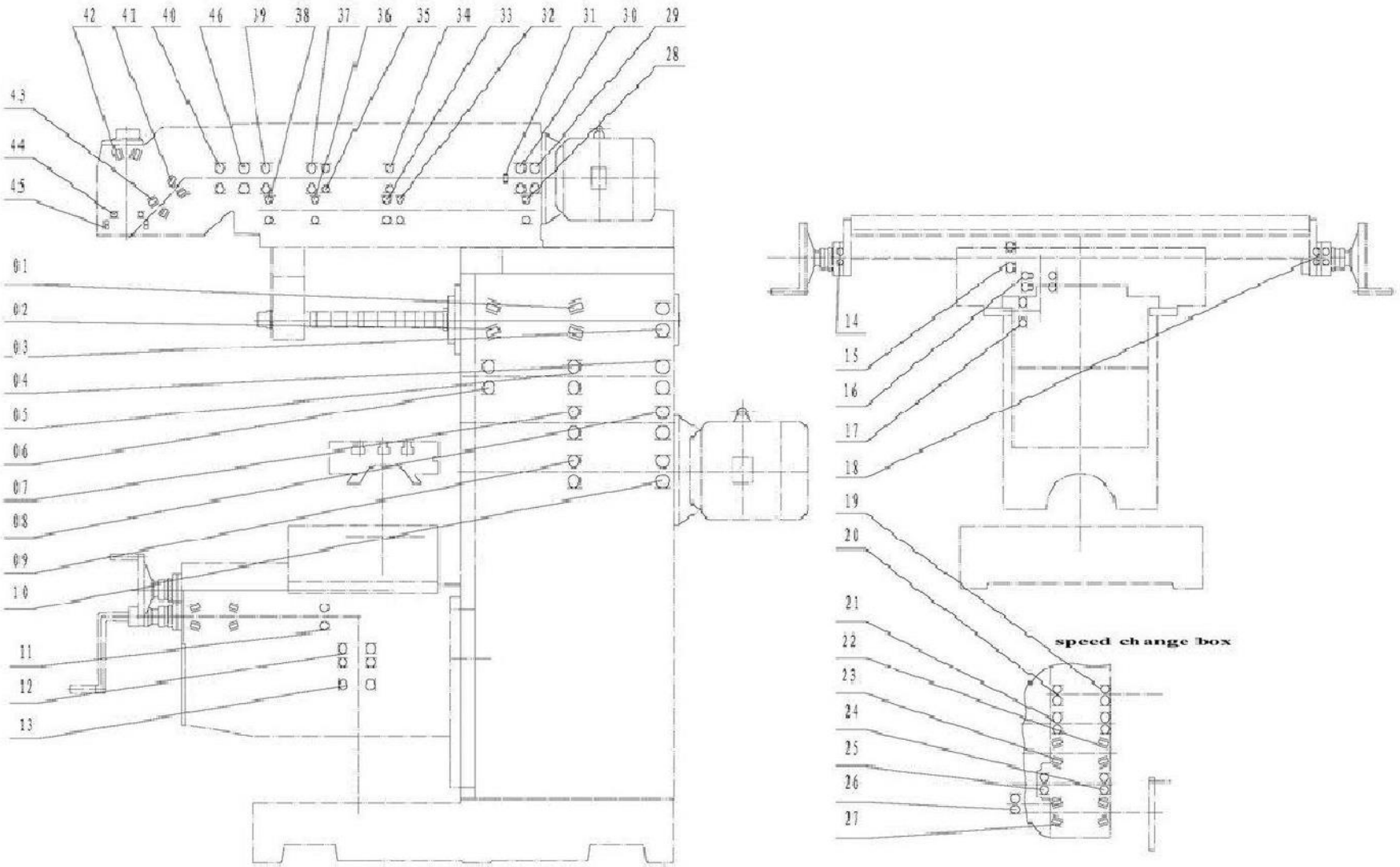


Figure 5 Rolling bearing location map

List of Bearings:

No.	Item	Model	Specifications	Qty.
1	Taper roller bearing	30311, P5	55 × 120 × 31.5	1
2	Taper roller bearing	32217, P5	85 × 150 × 38.5	1
3	Deep groove ball bearing	6309	45 × 100 × 25	1
4	Deep groove ball bearing	6308	40 × 90 × 23	1
5	Deep groove ball bearing	6209	45 × 85 × 19	1
6	Deep groove ball bearing	6307	35 × 80 × 21	1
7	Deep groove ball bearing	6308	40 × 90 × 23	1
8	Deep groove ball bearing	6308	40 × 90 × 23	1
9	Deep groove ball bearing	6306	30 × 72 × 19	1
10	Deep groove ball bearing	6211-2RS	55 × 100 × 21	1
11	Deep groove ball bearing	6005	25 × 47 × 12	1
12	Thrust ball bearing	51207	40 × 68 × 19	2
13	Deep groove ball bearing	6207	35 × 72 × 17	1
14	Deep groove ball bearing	6006	30 × 55 × 13	1
15	Thrust ball bearing	51112	60 × 85 × 17	1
16	Deep groove ball bearing	6006	30 × 55 × 13	2
17	Thrust ball bearing	51112	60 × 85 × 17	1
18	Angular contact ball bearing	7006AC	30 x 55 x 13	2
19	Deep groove ball bearing	6205	25 x 52 x 15	1
20	Deep groove ball bearing	6204	20 x 47 x 14	1
21	Deep groove ball bearing	6206	30 x 62 x 16	2
22	Taper roller bearing	30206	30 x 62 x 17.25	1
23	Taper roller bearing	30206	30 x 62 x 17.25	1
24	Deep groove ball bearing	6005	25 x 47 x 12	1
25	Deep groove ball bearing	6005	25 x 47 x 12	1
26	Deep groove ball bearing	6205	25 x 52 x 15	1
27	Taper roller bearing	30206	30 x 62 x 17.25	2
28	Deep groove ball bearing	6004	20 x 42 x 12	1
29	Deep groove ball bearing	6004	20 x 42 x 12	1
30	Thrust ball bearing	51104	20 × 35 × 10	1
31	Deep groove ball bearing	6005	25 × 47 × 12	1
32	Thrust ball bearing	51105	25 × 42 × 11	1
33	Deep groove ball bearing	6005	25 × 47 × 12	1
34	Deep groove ball bearing	6206/2RS	30 × 62 × 16	1
35	Deep groove ball bearing	6010	80 × 50 × 16	1
36	Deep groove ball bearing	6010	80 × 50 × 16	1
37	Needle bearing	NA4903	17 × 30 × 13	1
38	Deep groove ball bearing	6206/2RS	30 × 62 × 16	1
39	Deep groove ball bearing	6206/2RS	30 × 62 × 16	1
40	Deep groove ball bearing	6208/2RS	40 × 68 × 15	1

No.	Item	Model	Specifications	Qty.
41	Deep groove ball bearing	6206/2RS	30 × 62 × 16	1
42	Deep groove ball bearing	6207/2RS	35 × 62 × 14	1
43	Deep groove ball bearing	6010	80 x 50 x 16	1
44	Deep groove ball bearing	6206/2RS	30 × 62 × 16	1
45	Deep groove ball bearing	6010	80 x 50 x 16	1
46	Angular contact ball bearing	7009/AC	45 × 75 × 16	1
47	Angular contact ball bearing	7009/AC	45 x 75 x 16	1
48	Taper roller bearing	32007	35 × 62 × 18	1
49	Taper roller bearing	30201, P5	50 x 90 x 21.75	1
50	Taper roller bearing	30207	35 × 72 × 18.25	1
51	Thrust ball bearing	51116, P5	80 x 105 x 19	1
52	Double-row cylindrical roller bearing	NN3018K, P5	90 x 140 x 37	1

XIII. LUBRICATION SYSTEM

Timely proper lubrication will maintain a long machine life.

1. Lubricate the machine as per instruction with clean and clear N46 machine oil.

2. Horizontal milling spindle is compulsorily lubricated with an individual pump. When the horizontal spindle motor is turned on, the pump will start pumping lubrication oil to the horizontal milling spindle, gears and shafts.

3. Feed mechanism adopts splashing bath lubrication. Fill lubrication oil inside the knee oil reservoir.

4. Surfaces, column, saddle, table and lead screws should be properly lubricated with hand piston pump or oil gun. Lubricate minimum four times per shift. A centralized automatic oil lubricator is available as an option. When an automatic oil lubricator is equipped, oil volume of each shot is rated and lub. interval time can be set. When an alarm for low oil level is given, add oil to the lubricator tank promptly.

5. Supporting sleeve bearing for the horizontal milling arbor should also be lubricated properly in a timely manner.

6. Lubrication of gears inside the universal milling head is with lithium grease. Add new grease inside the head every 3 months.

7. Lubrication oil should be sufficient for gears in the ram and horizontal spindle. Oil level can be observed on the level scale.

8. All the oil reservoirs should be cleaned in a timely manner. Clean them and change with new oil once in the first three months and then clean them once every six months.

IX. COOLANT SYSTEM

General emulsified coolant mixture can be used for cooling of the cutting tools. Different coolant can be used for different material. The coolant pump is installed and is compatible with different coolant for different cutting tools. Coolant is stored in the machine base reservoir and pumped to the nozzle via hose. The nozzle can be adjusted to different angle as per needs. Coolant flows back to the reservoir through T slots on the table, hose and filter net.

A switch is installed on the left electric cabinet door. Turn it on and the pump will work. To change the coolant, pull the plug from the right and drain the coolant. Inject new coolant through the filter net.

X. ELECTRIC SYSTEM

1. The machine is suitable for 400V（or 380V）, 3Ph, 50Hz power supply. Power supply for feed is AC 220V, 1Ph, 50Hz. Make sure motor rotates as per the direction sign on it. Electric components are clearly marked. Refer to the *Electric Schematic Diagram* and *List of Electric Components* for repair.

2. The machine should be properly earthed for safety.

3. Before start of the machine, make sure the electric cabinet door is securely closed. Release the Emergency Stop button and turn on the main power switch. Shift the direction switch for horizontal or vertical spindle to CW or CCW direction, press the START button (green), the horizontal or vertical spindle will run accordingly. Press the STOP button (red), the motor will stop.

4. Keep clean of the electrics. Clean them periodically.

5. Pressing the red Emergency Stop button in emergency will cut off the machine. Release the button to re-start the machine.

<Diagram - Electric Schematic Diagram>

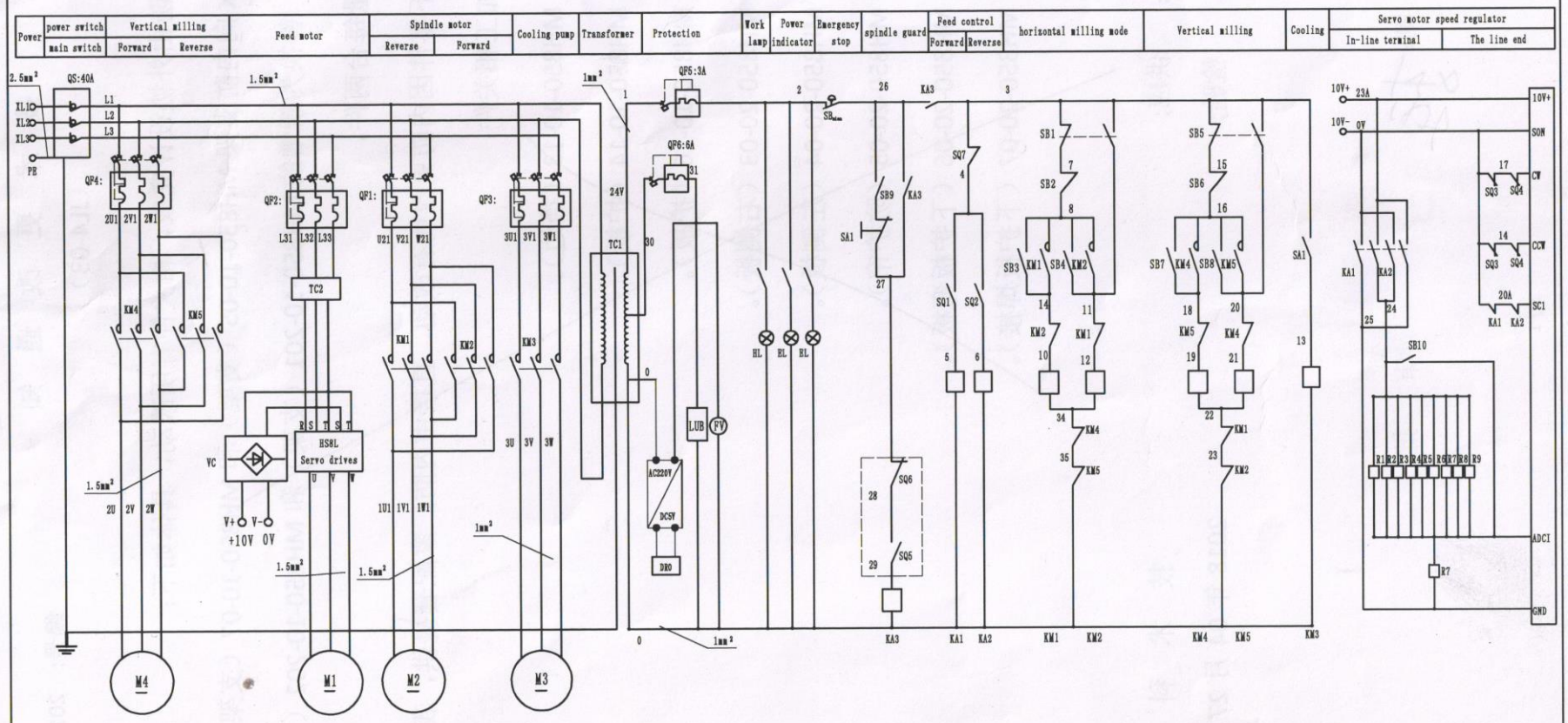


Fig.9 Electrical schematic diagram

XI. OPERATION

1). Read the *Operation Manual* carefully before starting the machine. The operator should be familiar with the machine structure, functions of handles, knobs, coolant system, lubrication system, electric systems, switches, etc.

2). Before starting the machine, make sure the locking mechanism locks firmly and wire connection and earthing are proper.

3). After powering on the machine, check functioning of the switches and buttons. Make sure they work properly. The power switch (#17) powers on or cuts off the machine. When it powers on, the lamp (#19) will illuminate as a signal. The button (#18) is for spindle JOG. Press the button, the spindle will rotate. Release the button, the spindle will stop. The button is useful for gear change. Rotary switch (#8) is for feed rate regulation. Rotating the switch will generate different feed rates. Switch (#2) is for clock-wise and counter-clock-wise rotation of universal milling head spindle, and switch (#3) is for clock-wise and counter-clock-wise rotation of horizontal spindle. Lever (#10) is for positive or negative feeding of table. Button (#6) is for coolant on or off. Button (#7) is for table JOG. Button (#5) is the emergency stop button. The machine will fully stop when the button is pressed. The button is useful in emergency.

4). To change the horizontal spindle speed, it has to stop the spindle firstly. Different spindle speed can be get by shifting the 3 levers (#28) between A, B, I, II, III, M and L on the plate.

5). To change the universal milling head spindle speed, it has to stop the spindle firstly. Different spindle speed can be get by shifting the 3 levers (#20) between A, B, C, I, II, III, M and L on the plate.

6). To move the table up and down, loose the locking lever (#13) firstly. In manual mode, rotate the handwheel (#12). In automatic mode, take off the handwheel (#12), shift lever (#15) to “Z”, and then press JOG button (#7) to move the table to specific position. For precision fine positioning, use the handwheel (#12). After movement, use the lever (#13) to lock it firmly before cutting.

Cautions: Take off the handwheel (#12) to avoid injury due to sudden rotation in automatic mode. Power will ONLY provide to the lifting motor when switch (#13) is on after taking off the handwheel (#12).

Warning: When DRO units are installed, care should be taken to avoid damage of the DRO rulers when the table moves to the spindle end, or the limit blocks fitted on the column.

7). To move the table in cross direction, loose lever (#11) firstly. In manual mode, shift

lever (#15) to neutral “0” position and rotate handwheel (#14) for movement. In automatic mode, shift lever (#15) to cross “Y” position and rotate the switch (#8) to get specific feed rate.

8). To move the table in horizontal direction, loose lever (#16) firstly. In manual mode, shift lever (#27) to “Manual” position and rotate handwheel (#9) for movement. In automatic mode, shift lever (#15) to horizontal “X” position, shift lever (#27) to “AUTO” position and rotate the switch (#8) to get specific feed rate.

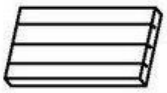
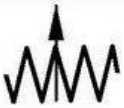
Cautions: Loose the locking levers before any movement. After movement, lock the levers again to boost rigidity of the machine.

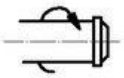
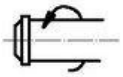
9). To move the ram backward and forward, loose the two screws (#21) firstly and then rotate the pinion shaft (#22) for specific position and then tighten the two screws (#21).

Cautions: When using the feed override switch for movement of the table in X / Y / Z axes, start it from low speed gradually to higher speed. Do NOT turn it to a sharp high speed to avoid damages or injuries.

10). To use the universal milling head for horizontal milling, remove the locking pin and loose the locking nut half or one circle (Caution: Do NOT loosen it fully to avoid falling down of the universal head), then rotate the head 180° and fit the locking pin and tighten the locking nuts. Guiding rod is fitted for easier mounting and align it with the signs and then tighten the bolts. Fit the auxiliary supporting bracket and the guiding sleeve on the machine. Align the guiding rod and then tighten bolts on the auxiliary supporting bracket.

Cautions:
a). When using the universal head for horizontal milling, move the table to the column and move the ram backwards for more rigidity.
b). Mount the milling tool in the inner side of the arbor.
c). Shorten the distance of the auxiliary supporting bracket to increase the rigidity.

operation symbol meaning detail			
No.	symbol	symbol meaning	
1		vertical spindle forward	
2		vertical spindle reverse	
3		fast moving	
4		worktable	
5		coolant pump	
6		emergency	
7		stop	
8		electric，danger！	
9		ground	
10		vertical feeding	
11		cross feeding	
12		longitudinal feeding	

no.	symbol	symbol meaning	
13		horizontal spindle forward	
14		horizontal spindle reverse	
15		do not change speed when machine running	

<Operation Signs>

XII. MAINTENANCE

1. Instructions:

1). The operator should NOT start the machine before he fully understands the machine structures and instructions in this Operation Manual.

2). Do NOT put tools and other articles on the spindle. Workpiece should be firmly clamped before start of the machine.

3). Add auxiliary guards if the machine is to run at high speed.

4). Do NOT carry out repair or maintenance of the electrics before turning off the power.

5). Loose the locking bolts before movement.

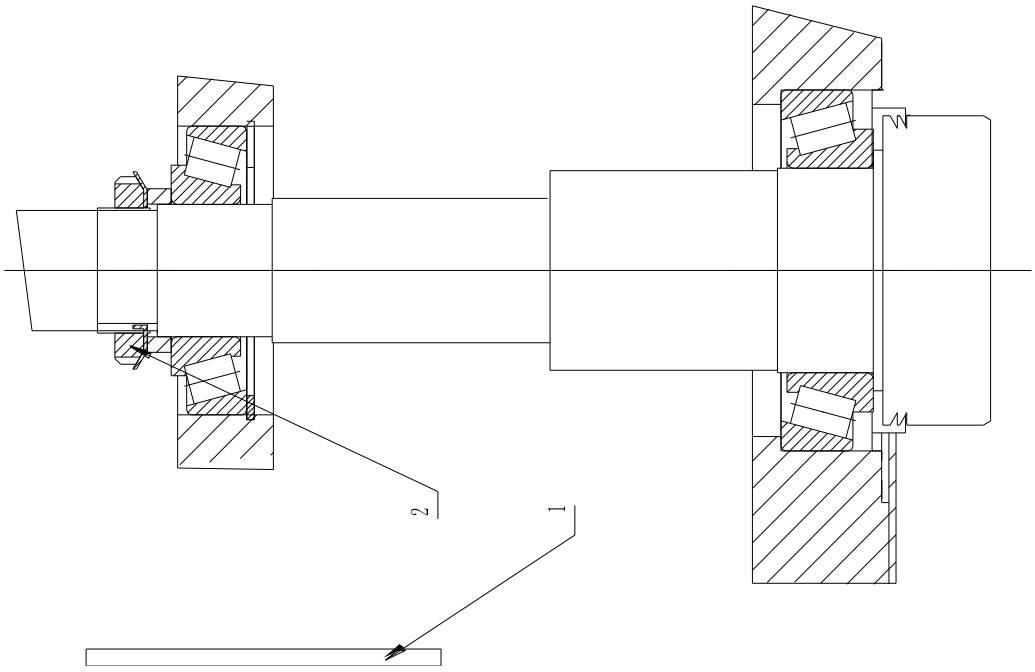
6). If the machine is to be stored in a long time, anti-rust oil / grease should be pasted on all the machined surfaces. If it is stored more than one year and a half, the anti-rust oil / grease should be removed and pasted with new ones.

2. Adjustment:

To keep the machine running with high accuracy in a long term, periodical maintenance and proper adjustment are required.

1). Adjustment of Horizontal Spindle Bearing

The spindle bearing space has been adjusted to a proper position. If the bearing space get larger because of worn, it should be done by professional person. Firstly, take off the right side cover (#1), rotate the round nut (#2) for proper clearance. After the adjustment, fit the cover back on the machine.



2). Adjustment of Gib Strip between X / Y / Z and Ram Guide Ways:

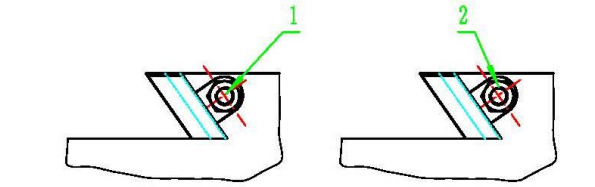
Big clearance will have a negative effect on machining accuracy. The gib strips should be adjusted properly and timely for maintaining the accuracy.

Longitudinal gib strip:
Firstly, loose the bolt (#1) at the small end of the gib strip, adjust big end bolt (#2) to suitable position, and then lock the bolt (#1).

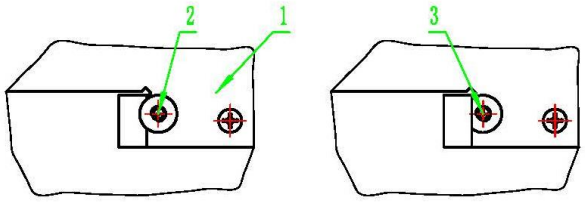
Cross gib strip:
Firstly, remove the guideway wipers (#1), loose the bolt (#2) at the small end of the gib strip, adjust big end bolt (#3) to suitable position, and then lock the bolt (#2). Fit the wipers back after the adjustment.

Vertical gib strip:
Firstly, remove the guideway wipers (#1), loose the bolt (#2) at the small end of the gib strip, adjust big end bolt (#3) to suitable position, and then lock the bolt (#2). Fit the wipers back after the adjustment.

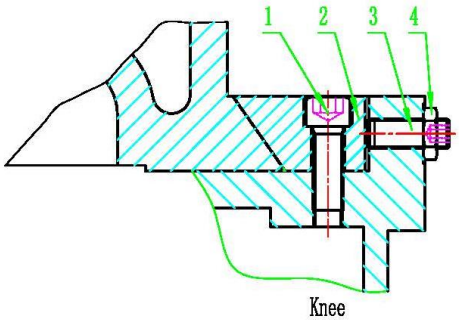
Ram gib strip:
Adjust bolt (#1) to reduce the clearance.



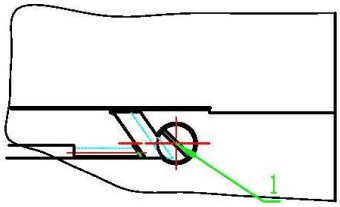
Table



Saddle



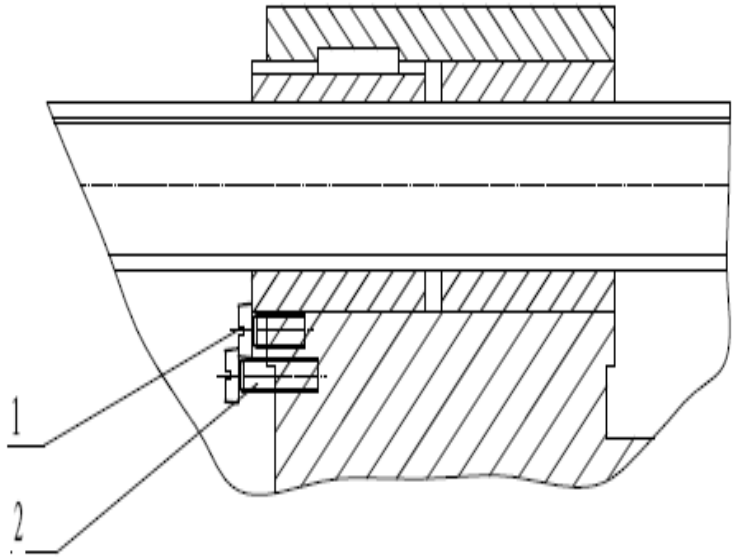
Knee



Ram

3). Adjustment of Leadscrew and Nut Clearance

Big clearance between the leadscrew and nut has a negative effect on machining accuracy and surface roughness. An adjusting bolt is fitted on the longitudinal leadscrew. To adjust, loose bolt (#1) firstly, and then adjust bolt (#2) to suitable position. After adjustment, tighten the bolt (#1) to lock bolt (#2).



4). Alignment of Universal Milling Head

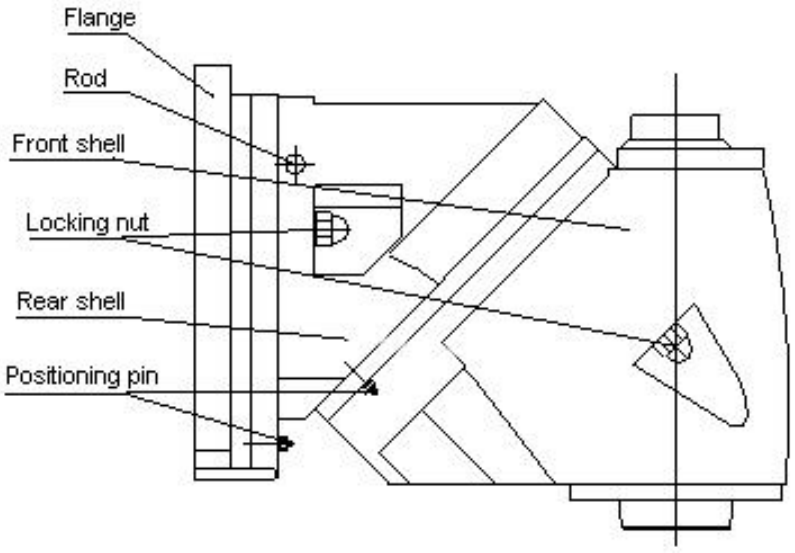
a). Horizontal and Vertical Positions of the Universal Milling Head Spindle

① When the front and rear shells are at 0° position, the spindle is in horizontal position.

② When the front shell rotate 180°, the spindle is in vertical position.

③ When the spindle is in horizontal position, rotating the rear shell 180° will move the spindle to a upper position for enlarged machining scope.

Cautions: To maintain a proper parallelism and perpendicularity of the spindle against the table, taper pins are provided for precision positioning of the front and rear shells. The taper pin is specific for particular holes. Do NOT mismatch or knock the taper pin into the holes by force.



b). Left and Right Set-off of the Universal Milling Head Spindle
Rotating the rear shell 90° clock-wise or counter-clock-wise will set off the spindle to the left or right side to increase the cut scope horizontally.

Cautions: Do NOT loose all the tightening bolts while rotating the universal milling head to avoid sudden falling down of the head due to gravity that may damage the table or the work-pieces.

c). Rotating Adjustment of the Universal Milling Head Spindle in Horizontal Plane
When the arbor supporting bracket is mounted, the spindle can be adjusted in horizontal plane to increase the rigidity (especially for left / right spiral milling). Rotating the front and rear shells in different directions will get the spindle in specific angles.

A chart is listed below for easy check.

The formula is:

$$\cos\beta = 2\cos\theta - 1$$

$$\mathrm{tg}\alpha = \sqrt{2}/2\ \mathrm{tg}(\beta/2)$$

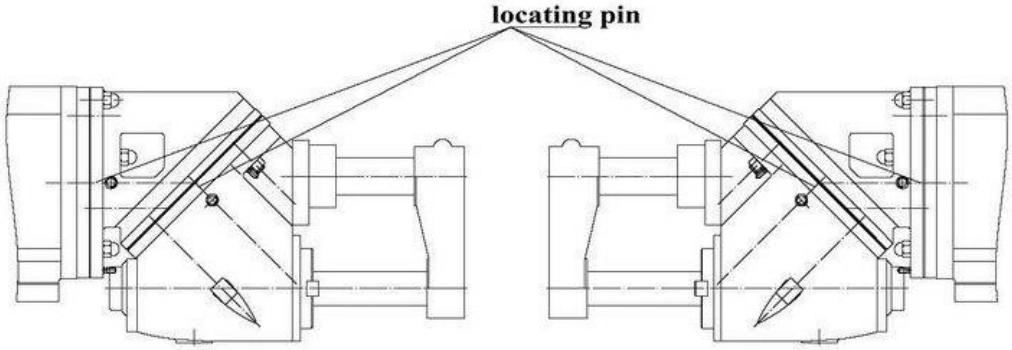
θ – angle between spindle center line and table cross movement
β – angle of front shell
α – angle of rear shell

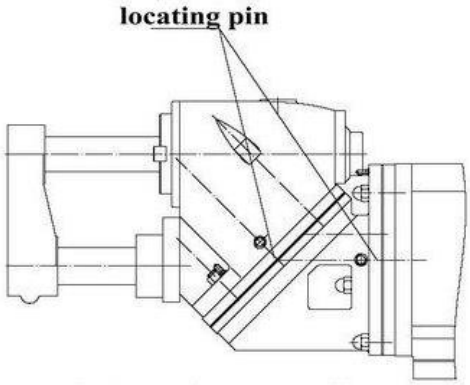
For example,
① For 45° left spiral milling
Rear shell: 24° 28’11” (counter-clock-wise)
Front shell: 65° 31’49” (clock-wise)
② For 30° left spiral milling
Rear shell: 15° 32’32” (clock-wise)
Front shell: 42° 56’29” (counter-clock-wise)

<u>Angle Chart</u>

Spindle Angle θ	Front Shell Angle β	Rear Shell Angle α	Spindle Angle θ	Front Shell Angle β	Rear Shell Angle α
1°	1° 24’51”	0° 30’00”	9°	12° 44’28”	4° 30’50”
2°	2° 49’43”	1° 00’00”	10°	14° 09’37”	5° 01’09”
3°	4° 14’35”	1° 30’02”	11°	15° 35’50”	5° 31’32”
4°	5° 39’29”	2° 00’05”	12°	17° 00’08”	6° 01’59”
5°	7° 04’24”	2° 30’09”	13°	18° 25’28”	6° 32’32”
6°	8° 29’21”	3° 00’15”	14°	19° 50’56”	7° 03’10”
7°	9° 54’20”	3° 30’24”	15°	21° 16’29”	7° 33’54”
8°	11° 19’22”	4° 00’35”	16°	22° 42’08”	8° 04’45”

Spindle Angle θ	Front Shell Angle β	Rear Shell Angle α	Spindle Angle θ	Front Shell Angle β	Rear Shell Angle α
17°	24° 07’54”	8° 35’42”	47°	68° 39’15”	25° 46’24”
18°	25° 33’46”	9° 06’47”	48°	70° 13’44”	26° 26’17”
19°	26° 59’46”	9° 38’00”	49°	71° 48’47”	27° 06’42”
20°	28° 25’54”	10° 09’21”	50°	73° 24’24”	27° 47’42”
21°	29° 52’11”	10° 40’51”	51°	75° 00’38”	28° 28’17”
22°	31° 18’36”	11° 12’31”	52°	76° 37’30”	29° 11’30”
23°	32° 45’12”	11° 44’20”	53°	78° 15’02”	29° 54’22”
24°	34° 11’56”	12° 18’20”	54°	79° 53’17”	30° 37’56”
25°	35° 38’52”	12° 48’31”	55°	81° 32’17”	31° 22’13”
26°	37° 05’58”	13° 20’53”	56°	83° 12’04”	32° 07’16”
27°	38° 33’17”	13° 53’28”	57°	84° 52’40”	32° 53’06”
28°	40° 00’48”	14° 26’15”	58°	86° 34’10”	33° 39’47”
29°	41° 28’32”	14° 59’17”	59°	88° 16’35”	34° 27’22”
30°	42° 56’29”	15° 32’32”	60°	90°	35° 15’51.8”
31°	44° 24’41”	16° 06’02”	61°	91° 44’28”	36° 05’21”
32°	45° 53’07”	16° 39’48”	62°	93° 30’02”	36° 55’54”
33°	47° 21’50”	17° 13’49”	63°	95° 17’47”	37° 47’33”
34°	48° 50’48”	17° 48’08”	64°	97° 04’48”	38° 40’21”
35°	50° 20’04”	18° 22’44”	65°	98° 54’11”	39° 34’25”
36°	51° 49’38”	18° 57’38”	66°	100° 45’01”	40° 29’49”
37°	53° 19’31”	19° 32’52”	67°	102° 07’23”	41° 26’38”
38°	54° 49’44”	20° 08’27”	68°	104° 31’26”	42° 24’57”
39°	56° 20’17”	20° 44’22”	69°	106° 27’18”	43° 24’55”
40°	57° 51’12”	21° 20’39”	70°	108° 25’08”	44° 26’37”
41°	59° 22’30”	21° 57’20”	71°	110° 25’04”	45° 30’13”
42°	60° 54’10”	22° 34’23”	72°	112° 27’20”	46° 35’50”
43°	62° 54’10”	23° 11’52”	73°	114° 32’08”	47° 43’41”
44°	63° 58’50”	23° 49’48”	74°	116° 39’43”	48° 53’57”
45°	65° 31’49”	24° 28’11”	75°	118° 30’23”	50° 05’52”
46°	67° 05’17”	25° 07’03”	76°	121° 04’29”	51° 22’41”





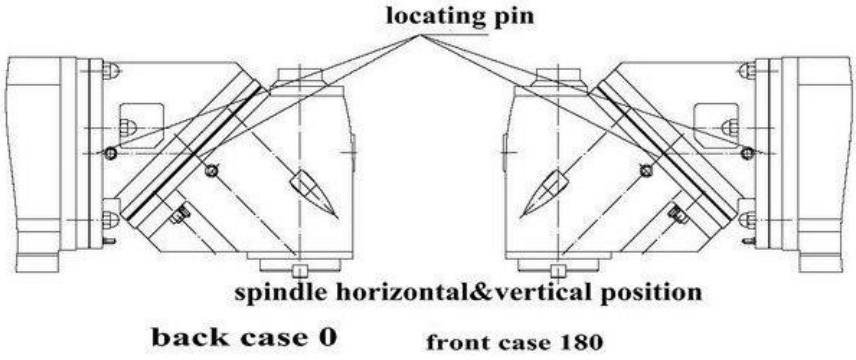
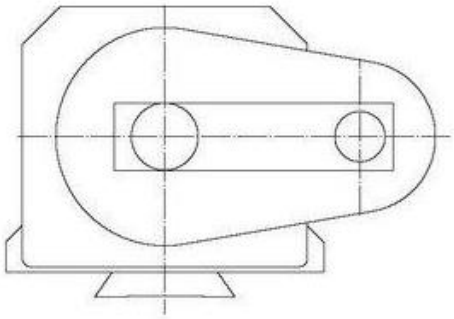


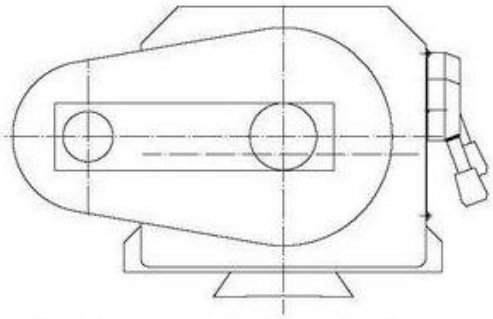
Figure10、 universal swiveling head horizontal&vertical position



horizontal spindle right offset

back case 90° (anticlockwise

front case (0°)



horizontal spindle left offset

back case 90° (clockwise

front case (0°)

11、

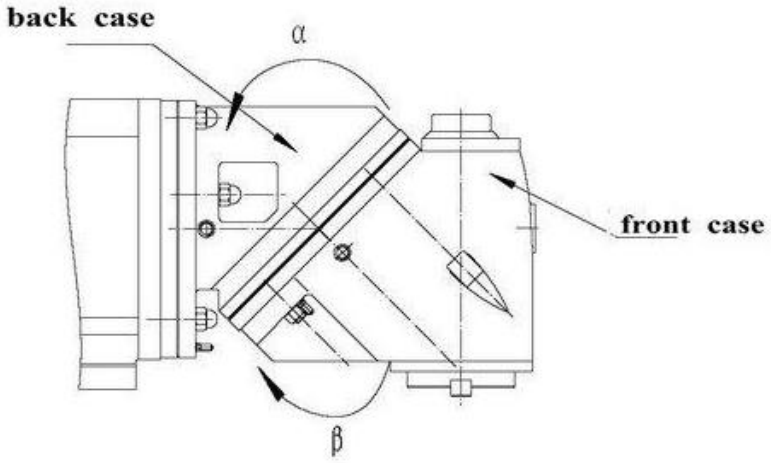


Figure12、 front case&back case clockwise& anticlockwise angle

<Diagram – Universal Milling Head>

5). Trial run

a). Before the trial run, loose the locking bolts on all three directions.

b). Remove antirust oil all parts of the machine. Do NOT use harsh tools which may scratch the surfaces. After cleaning the surface, paste it with a thin layer of lubricant oil.

c). Add oil into the tank as per instructions. Lubricate every point and check.

d). Check every manual operating hand wheel whether they are smooth and reliable.

e). After connecting to the power, check the spindle rotate direction, work table feed and knee lifting direction and find out whether the directions are the same with signs marked.

f). To run the machine, use JOG firstly to check for proper functioning of limit switches of the longitudinal, cross and vertical axes. Check every speeds by shifting gears and trial run the machine for at least 30 minutes at lowest speed and then increase the speed gradually to for test. Make sure that the gear shifting functions properly and reliably.

3. Maintenance

1). Instructions:

Clean lubrication oil should be provided through the lubrication points.

Lack of lubrication oil may cause vibration or extra heat. Prompt feed of clean lubrication oil is needed. Stop the machine and remove the plug to feed oil.

Lubrication oil should be drained out and changed with new one periodically. Gears should be cleaned at the meantime.

Do NOT change speeds or rotation direction of the spindle unless the machine is stopped.

Check wiring of the electric system and bearing of the motor every 6 months. Grease of the bearing should be replaced at the meantime. Power the machine off before checking the wiring. Clean the dust or dirt from the wires with dry cloth and hand fan. Do NOT clean them with petrol or diesel in case of damage to the sealing and further accident.

Charts for periodical check should be formulated and followed.

Daily Check Chart:

No.	Location	Items	Remarks
1	Lubrication oil	● Check for sufficient oil ● Check for clean oil	Feed or change
2	Coolant	● Check for sufficient coolant ● Check for clean coolant	Feed or change
3	Guide ways	● Check for proper lubrication ● No damage on wipers	
4	Pipes	● No oil leakage ● No coolant leakage	
5	Motor, gears and other rotary parts	● No abnormal noise or vibration ● No abnormal heat	

6	Movable parts	● No abnormal noise or vibration ● Check for smooth running	
7	Operation panel	● Check for proper functioning ● No alarm	
8	Safety device	● Check for proper functioning	
9	Coolant unit	● Check for proper functioning	
10	Cables, wires	● No breakage ● No damage on sheath	
11	Table and base	● Cleanness	Remove chips

Periodical Check Chart:

No.	Location	Items	Remarks
1	Lubrication system	Oil	Change periodically
2	Oil reservoir in machine base	Oil	Change periodically
3	Lubrication oil in ram	Oil	Change in first 3 months and every 6 months afterwards
4	Centralized oil lubricator (opt.)	Oil	Feed oil when an alarm is given
5	Coolant system	Coolant and filter	Clean filter

2). Trouble shooting:

Refer to the following procedures for general troubles:

Observation	Possible Reasons	Solution
Abnormal of spindle brake	Worn-out of braking disc	Replace the disc
Abnormal rotation of the spindle	1. Switch is broken 2. Loose V-belt 3. Motor is broken	1. Check the switch 2. Adjust or replace 3. Repair or replace
Wrong rotation direction	Wrong lever position	Put the lever in the correct position
Big run-out of horizontal spindle	Worn-out of bearing or loose locking nut	Tighten the nut, and adjust the clearance of the bearing
Abnormal feed of three axes	1. Gib strip is too tight 2. Clearance in the bolt and nut is not proper 3. Lack of lubrication oil	1. Replace the gib strip 2. Adjust the clearance 3. Add more oil
Vibration of the machine	1. Foundation is not solid enough 2. Abnormal cutting conditions	1. Tighten the grouting bolts 2. Use proper setting of cutting rates, material and cutting tools.
Motor not running after power on	1. Incorrect power source 2. Incorrect connection Wire	1.Input correct power 2.Check correct connection

	3. Terminal block loose	3.Tighten the terminal block
Failure of spindle running	1. Main transmission speed change gear grade shift not in the position 2. Cutting overload 3. Motor broken 4. Spindle mechanical part damage	1. Check main transmission speed change box 2. Use the machine according to the cutting rule 3. Check the motor 4. Check the mechanical part manual
High temperature of spindle	1. Bearing damage 2. Lock nut too tight	1. Change bearing 2. Adjust lock nut
Spindle accuracy not good	1. bearing damage or adjusting not so well 2. spindle inner hole wear 3. spindle temperature too high cause heat deformation 4. lock nut get loose	1. change bearing or adjusting 2. change spindle 3. adjusting bearing 4. tighten lock nut
No gear change for spindle speed change	Spindle motor impulse line contact failure	Check electrical wire, adjusting impulse shaft tail end bolts, reach the impulse contact.
Feed box high noise	1. Transmission gear not in the position or loose 2. Motor noise	1. Check every transmission gear 2. Check motor
Feed box no feed movement	1. Feed motor not connecting with power or damage 2. Feed electrical clutch does not function	Check electrical part wire connection and electrical unit failure and exclude
Abnormal movement part sound	1. Articles fall inside 2. Screw and nut connecting part loose	1. Clean the foreign matter 2. Tighten the bolts
Axial movement of moving parts	1. Screw and nut connection loose 2. Screw bearing bracket loose. 3. Screw and nut space too large.	1. Tighten the loosen bolts 2. Tighten bearing bracket 3. Adjusting the screw and nut space.
Crawl movement of moving parts	1. Guideway not be fully lubricated 2. No lubrication	1. Check the pipe jam or not, oil distributer damage, lubrication system abnormal 2. Lubricate the machine as operation manual.
Motor broken	1. Water or oil into the electrical wire, circuit gets short-circuit.	1. Contact with manufacture. 2. Eliminate the problem and change the motor.

	2. Wire damage cause short circuit.	
Abnormal noise	1. Transmission gear loose 2. Foreign matter fall into the machine	1. Retighten the loosen gear 2. Clean foreign matter
Quick consumption of lubrication oil	1. Oil pipe damage 2. Oil distributor damage	1. Change oil pipe 2. Change oil distributor
Insufficient lubrication or no lubrication of guide ways and leadscrews	1. Oil distributor damage or oil is not enough, 2. Lubrication break off or pipe block 3. No lubrication 4. Machine oil outlet block up	1. Change the lubrication pipe joint. 2. Change oil pipe. 3. Fill up the lubrication oil. 4. Repair the ou-let hole.
No coolant supply	1.Coolant liquid is too dirty coolant filter filter mesh block, 2. Coolant pipe leak or fold 3. Nozzle get block	1.Clean filter mesh and change clean coolant liquid 2. Change pipe 3. Clean nozzle.
Coolant pump fault	1. Longtime work, voltage too high 2. Coolant pump block up, motor too hot. 3. Coolant pump damage. 4. Thermal relay burn out 5. Wrong motor rotation direction. 6. No coolant liquid	1. Pull on thermal relay 2. Clean coolant pump, pull on thermal relay. 3. Change coolant pump motor. 4. Change thermal relay. 5. reconnection 6. Fill up the coolant liquid
Vibration when cutting	1. Cutting parameter is unreasonable 2. Spindle bearing loose. 3. Worn of gibs and big guide ways clearance 4. Workpiece is not be clamped tighten or unreasonable clamping method	1. Adjusting the cutting parameter 2. Repair the spindle box 3. Repair the gibs 4. Tighten the workpiece
Poor cutting finish	1. Workpiece is not be tighten clamped. 2. Transmission part have space or preload is insufficient 3. Cutting feed is not correct.	1. Tighten the workpiece 2. Adjust the guideway space 3. Change the cutting parameter.

XIII. EASY-WORN PARTS (available at extra charge)

	Drawing No.	Item	Qty.
1	X603202304	Knee lifting leadscrew nut	1
2	X603203301	Longitudinal leadscrew nut	1
3	X603203302	Longitudinal leadscrew nut	1
4	X6005301	Sleeve	1
5	X52K713	Cross leadscrew nut	1

INSPECTING

No.	Inspecting items		Tolerance	Actually
1	Straightness of knee vertical movement	At the cross vertical surface At the longitudinal vertical surface	A ： 0.04/200 B ： 0.04/200	
2	Verticality of the table surface to knee guide	A :At the cross vertical surface B :At the longitudinal vertical surface	A ： 0.04/200 a ≤90° B ： 0.04/200	
3	Flatness of the table surface		0.06/500	
4	Table surface to the table movement	A : cross B :longitudinal	A ； 0.04/200 B ： 0.04/200 Max0.06	
5	Spindle axial movement		0.035	
6	Spindle taper hole runout	A : near spindle end face B :200mm to end surface	A ： 0.02 B ： 0.05	
7	The parallelism Spindle spin axis to table		0.04/200 (only down)	
8	The parallelism Spindle spin axis to table cross moving	A At the vertical surface	0.04/200 (only down)	
		B At the horizontal surface	0.04/200	
9	Straightness of Table cross movement to longitudinal		0.04/200	
10	The parallelism of beam guide to Spindle spin axis	A At the vertical surface	0.04/200 (only down)	
		B At the horizontal surface	0.04/200	
11	The parallelism of beam guide to Spindle spin axis	A At the vertical surface	0.03 (only down)	
		B At the horizontal surface	0.03	

12	The Verticality of Spindle spin axis to table (vertical)	A At the cross vertical surface	a 0.03/200 a〈90°	
		B At the longitudinal vertical surface	b 0.03/200	
13	Spindle axis diameter runout(vertical)		0.025	
14	The spindle shaft shoulder bearing surface runout(vertical)		0.04	
15	Spindle taper hole runout(vertical)	A near spindle end face	0.015	
		B 200mm to end surface	0.05	

PACKING LIST

No.	Name	Detail	Qty.
1	Milling machine		1
2	7：24 middle cover	7：24 ISO50/MS4	1
3	Draw bar	M24(vertical, horizontal)	1
4	Washer	24	1
5	Double-ended wrench	22*24	1
6	milling cutter arbor	Φ27	1
7	milling cutter arbor	Φ32	1
8	ISO50 sets milling chuck	4、5、6、8、10、12、14、16	1
9	Certification		1
10	Packing list		1
11	Operation manual		1