



OPERATION MANUAL

Model BT24L

Vertical machine center

MECHANICAL PART

TABLE SIZE (L X W): 31 57/64" × 9 29/64"

SERIAL NO.: _____

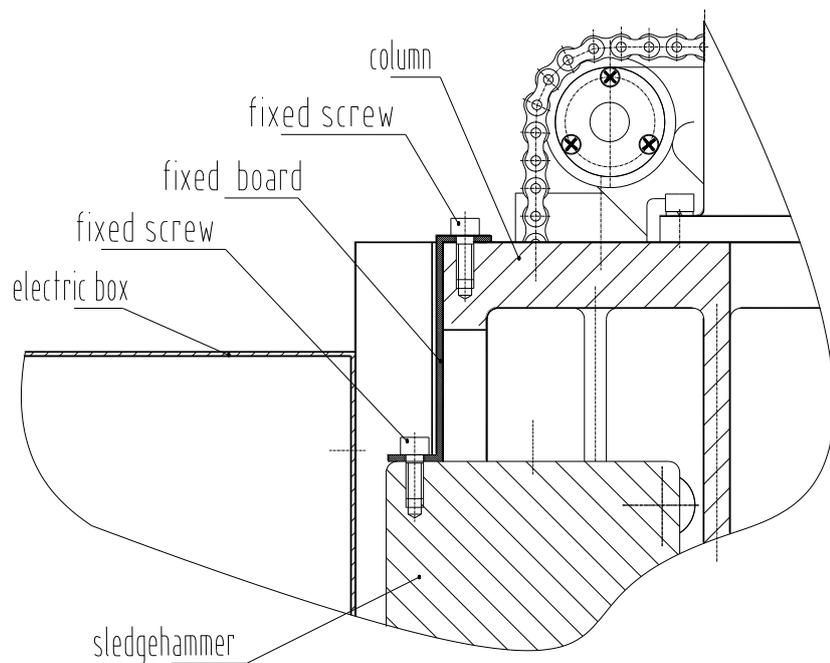
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1 WARNING

- 1.1 Do not attempt to operate the machine until you have read this manual and related technical document.
- 1.2 Environment condition for Installation

Altitude of installing site can not be over 2500 meters; relative air humidity around can not be over 90%; no obvious attack or vibration around and without interference power.
- 1.3 The best temperature of using this machine is 20°C.
- 1.4 The power supply is 380V/50HZ/3PH with AC 4 wires. Power capacity requires 8KVA.
- 1.5 Operators must prepare his own compressed air supply at 0.5-0.7Mpa
- 1.6 Keep this machine electrified monthly when it is standing idle temporarily and make the operating time not less than 4 hours.
- 1.7 Before dismantle the wooden case , please be sure to remove the fixed screw and fixed board on the sledgehammer. The dismantle part, see diagram. And also remove the fixed angle steel and screw on the worktable, carriage slide and bed.



Attached diagram.1

2.MAINFEATURES, PRUPOSE AND APPLICATION SCOPE

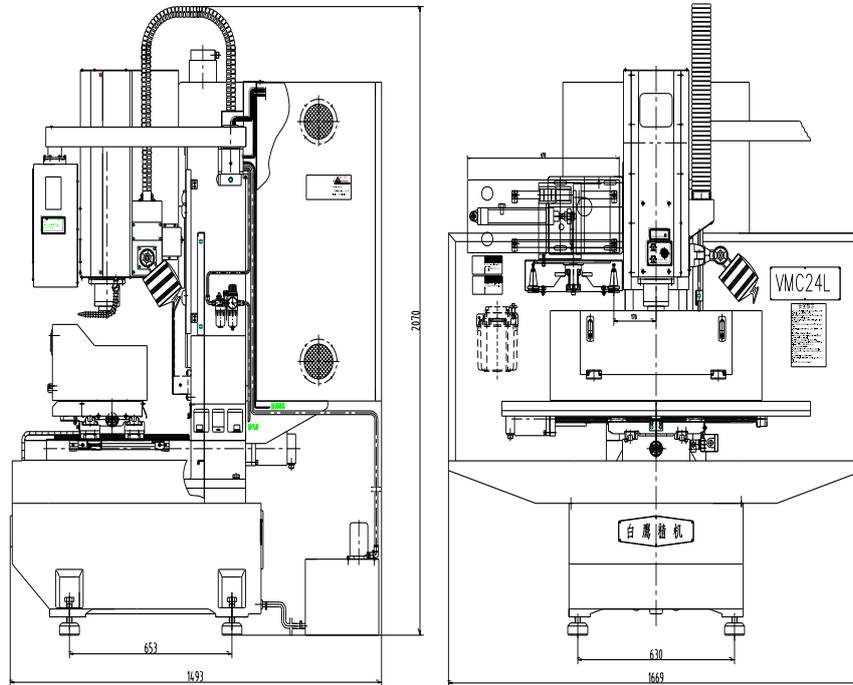


Diagram 1 of machine outline

VMC24L is a smaller CNC machine center with automatic tool change and work in high speed and high efficiency. The machine outline and installation size as Diagram 1. The standard ATC is BT30 cloak's type with capacity (10pcs), which can realize the tool-change automatically without mechanical hand. This machine is a combined CNC machines concentrated with various functions of milling machine, drilling machine and boring

For the work piece fixed on this machine, it can process milling, drilling, boring, reaming, screwing and can milling on the side edge. It is the best choice on machining the frame of smaller mould and precisely milling. Its working efficiency normally is 3-4 times than common machines, such as common milling machine, common boring machine and common drilling machine. Its machining precision is far higher than common machine's. For example, the machining distance at 12" between two holes will be less than ± 0.015 .

This machine is a vertical machine. The spindle is in vertical direction toward the worktable with spindle in vertical direction (as Z axis), worktable in longitudinal direction (as X axis) and slide saddle in cross travel (as Y axis). This machine is especially suitable for machining spare parts such as plates, shells, boxes and others. And this machine is very popular used for production in small-middle manufacturing in lot with many varieties.

3. MAIN DATA (see TABLE 1)

TABLE 1 MAIN TECHNICAL DATA

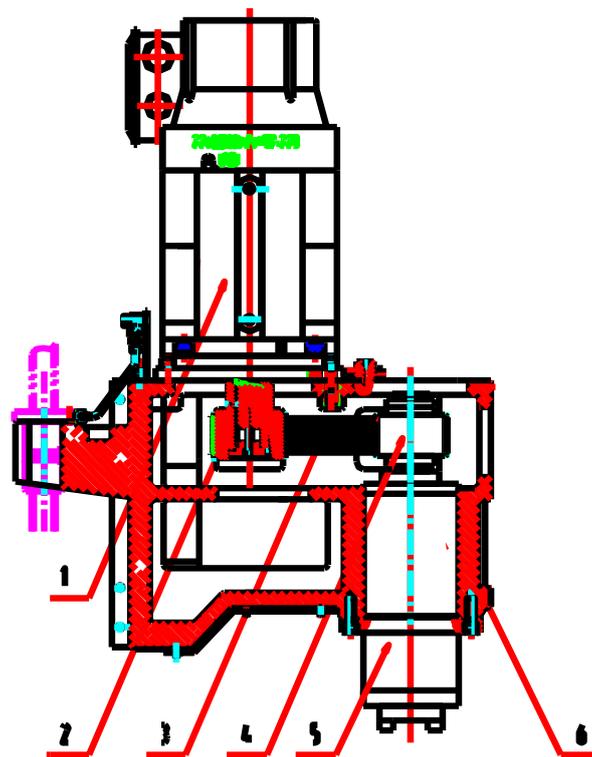
| NO | ITEM | Unit | Parameter |
|----|--|---|----------------------|
| 1 | Size of worktable(L X W) | inch | 31 57/64" × 9 29/64" |
| 2 | T slot (width x qty x space between) | inch×pc×inch | 41/64" × 3 × 2 3/8" |
| 3 | Max loading weight on worktable | Kg | 4.00 |
| 4 | X-Axis travel | inch | 14 31/32" |
| 5 | Y-Axis travel | inch | 9 29/64" |
| 6 | Z-Axis travel | inch | 14 37/64" |
| 7 | Distance between spindle nose and table | inch | 3 5/32"- 17 23/32" |
| 8 | Distance between spindle center and column | inch | 12 11/64". |
| 9 | Spindle taper | BT: | BT30 |
| 10 | Max. spindle speed | r/min | 5000 |
| 11 | Spindle motor power | KW | 2.2 |
| 12 | Feeding Motor power: X Axis | KW | 1 |
| | Y Axis | KW | 1 |
| | Z Axis | KW | 1.5 |
| 13 | Rapid feeding speed: X,Y,Z axis | inch/min | 70 7/8" |
| 14 | Feeding speed | inch/min | 0-157 31/64" |
| 15 | Min. set unit | mm | 0.001 |
| 16 | Max. tool size | inch | 2 3/8"-6 57/64" |
| 17 | Loosing and clamping way for tool | Clamp by disc spring oose pneumatically | |
| 18 | Max. loading weight of Tool | LBS | 7.7 |
| 19 | N.W (include machine stand) | LB | 2200 |
| 20 | Packing size (L×W×H) | inch | 58.78"×65.71"×81.5" |

4. DRIVE SYSTEM INTRODUCTION

4.1.1 Drive system introduction

AC spindle motor can make the spindle range speed to 50-5000r/min through a couple of pulley and one cog belt to run the spindle.

See diagram 2.



1.AC spindle servo motor 2 Pulley I 3.Pulley cog belt

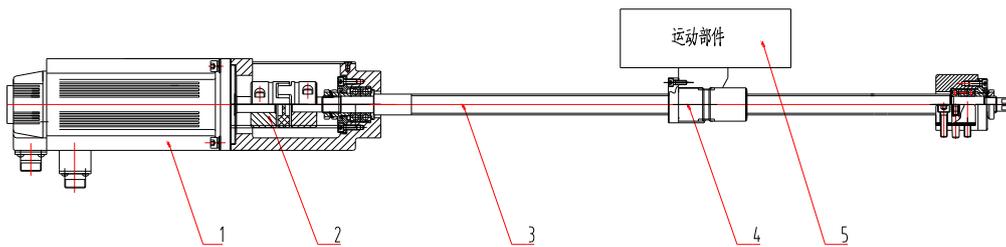
4. Pulley II 5.Spindle unit 6.Headstock

Diagram 2 Spindle Drive

4.2 Feeding drive system

The feeding movement of X, Y, Z axis is driven by 3 stepper (or server) motors directly transferring the movement to ball lead-screw through the elastic coupling and then changing the rotating movement to be linear movement through ball lead-screw.

The drive structure for each axis, see diagram 3.



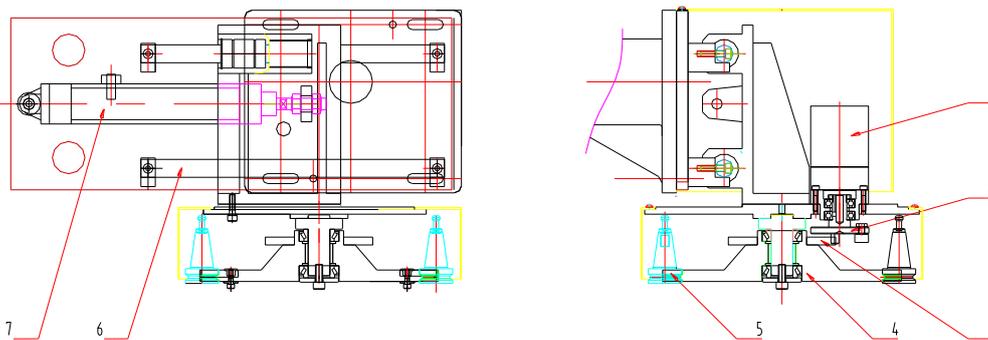
1. AC servo feeding motor 2. flexible connecting device 3. Ball screw
4. Leadscrew nut 5. Moving parts

Diagram 3 of X/Y/Z Feeding Drive Structure

4. 3 ATC drive system(Dia.4)

This machine is supplied with tool magazine without arm-type as standard equipment, which is driven by AC reducer motor to drive the tool plate and to make index movement by times, and to make air cylinder piston rod to move in straight line, which can realize the work of tool clamping and work of moving back for tool plate.

The drive of tool magazine as diagram 4.



1. AC reducer motor 2. drive plate 3. slot plate
4. tool plate 5. arbor 6. guide way 7. cylinder

Diagram.4 ATC drive system.

4. 4 List for Ball-screws from the machine

Sheet 2

BALL SCREW LIST

| Item No. | Part No. | Name from Blueprint | Specification | Remark |
|----------|---------------|---------------------|-----------------------------|--------|
| 1 | VMC24L-71-201 | X Ball screw(set) | 25-6-3-FDIC-594-804.5-0.008 | |
| 2 | VMC24L-11-201 | Y Ball screw (set) | 25-6-3-FDIC-469-717-0.008 | |
| 3 | XK7125-01-025 | Z Ball screw (set) | 25-6-3-FDIC-579.5-715-0.008 | |

4.5 List for Bearings from machine

Sheet 3

BEARING SHEET LIST

| Item No. | Description | Model | Specification | Qty | Remark |
|----------|------------------------------|-------------|---------------------------------------|------|------------------------------|
| 1 | angular contact ball bearing | 7203C/DB/P5 | 1 $23/40 \times 2/3 \times 43/91$ " | 1set | From bed assembly. |
| 2 | Deep groove ball bearing | 6203-2Z | 1 $23/40 \times 2/3 \times 43/91$ " | 1 | From bed assembly |
| 3 | Deep groove ball bearing | 6003-2Z | 1 $17/45 \times 2/3 \times 37/94$ " | 4 | From column and bed assembly |
| 4 | angular contact ball bearing | 7204C/DB/P5 | 1 $17/20 \times 37/47 \times 43/78$ " | 1set | From column assembly |
| 5 | angular contact ball bearing | 7003C/DB/P5 | 1 $17/45 \times 2/3 \times 37/94$ " | 1set | From table |

5. Main structure and characters

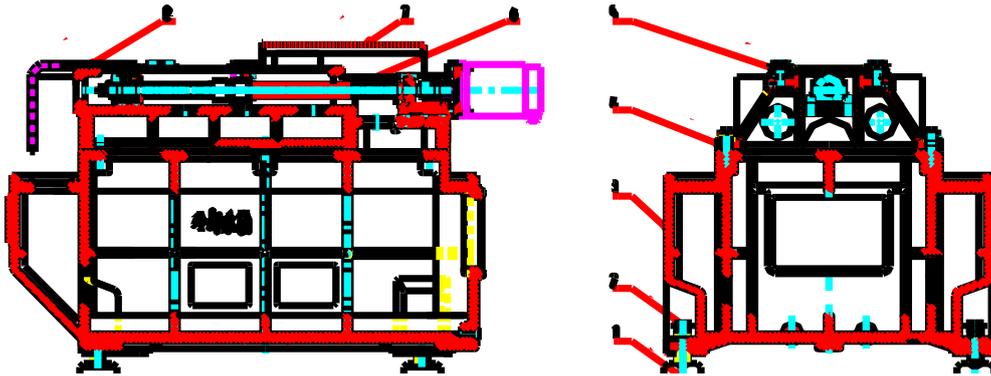
This CNC milling machine consists of main machine and controller system (electrical). The main machine is the main part of the CNC machine and the controller system is the brain of the CNC machine.

The main machine have 4 basic parts of machine base, bed, column , worktable, headstock, tool memory auto-change system, lubricating system, cooling system, and pneumatic system, etc. attached function parts

5.1 Machine bed and base

Machine bed and base are one of very important and essential parts, which is the supporting and guiding parts for slide carriage and worktable, and also the essential parts for column support. It has to undertake the effect of bending moment, torque vibrating and temperature changing from working table, sliding saddle and column from all the directions. It requires enough statistic and dynamic rigidity and high precision in favor of scrap irons removing and heat emitting. The bed

and base are made of high rigidity casting materials, and adopted heat symmetry casting structure; The guide way of the bed is high speed and high precision and high loading balls-crew linear. Between the two guide ways, there are high precision flanged ball-screw with double nuts to get higher positioning precision, repeating position precision and stability of transmission. Detailed information from Figure 5#



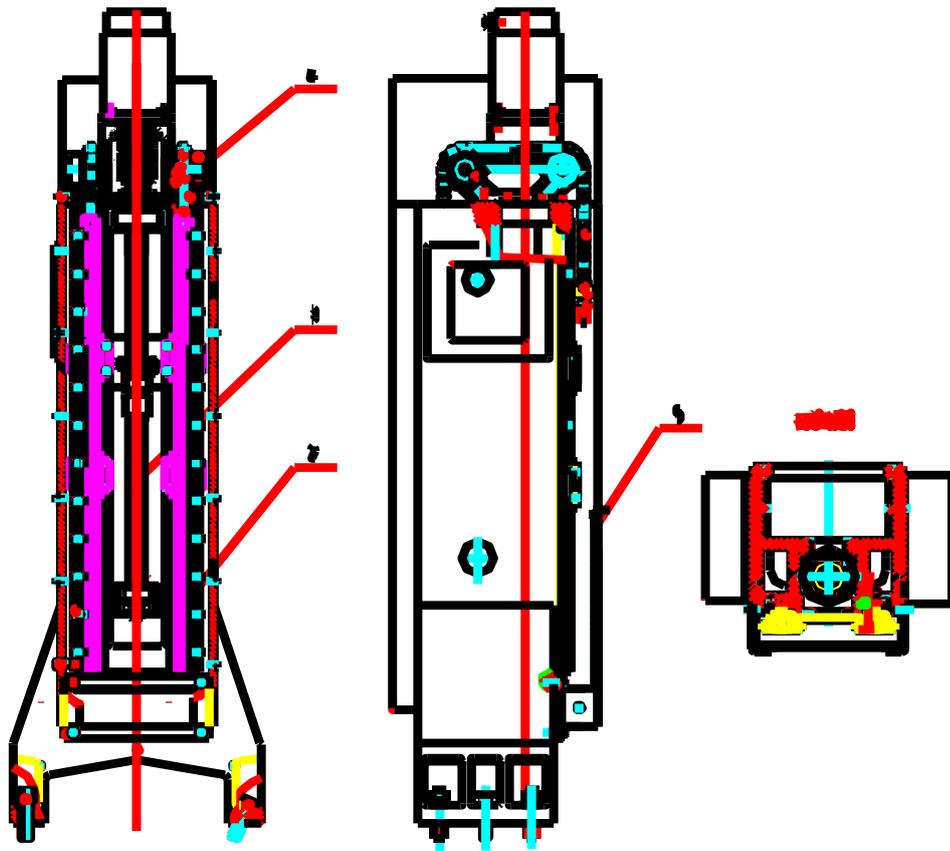
1. Iran pad
2. adjusting screws
3. bed based
4. Bed
5. Linear ball-screw guide-way of bed
6. Ball-screw of Y axis
7. Back protection of guide-ways
8. Front protection of guide ways

Diagram 5: Assembly of Bed Base

5.2 Column and Column assembly

Column and column parts are the major basic kits of this machine centre. It is the main body for supporting and orienting of the headstock.. It should undertake those bending moment, torque moment, vibration from the headstock in two directions and undertake the effect from temperature changing

The machine is vertical machining centre. Its column's cross section is a rectangle, see diagram 6#. Similar like a square with bigger size to make the column has higher rigidity and bending resistance, torsion resistance and absorbing the vibrating.



1.column 2. linear ball screw guide way of bed 3. Ball screw Z axis 4.Balancing bracket 5.

Guide way protector

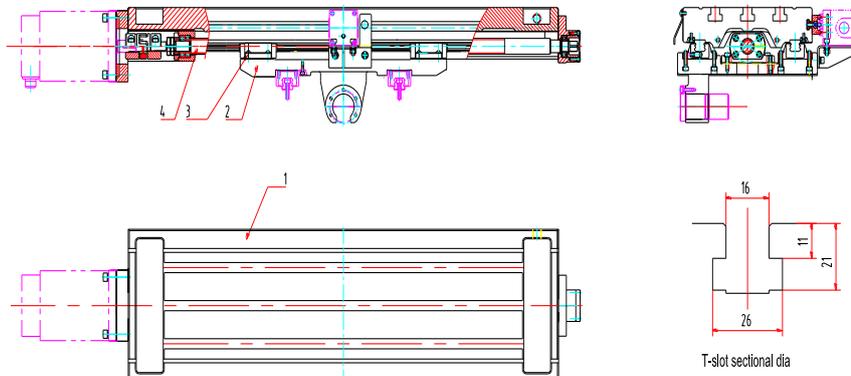
Diagram 6# Column assembly

5.3 Table and table assembly

Table assembly is the most important part for machining centre to finish its movement in X and Y directions. It is the basic rule for installing of work-pieces and clamping kits. Its precision and rigidity will directly affect the quality of work-pieces after machined. It should support the clamping force from work-piece, and also those cutting force and bending moment and torsion moment brought during the processing. So the worktable and work-table assembly should have higher precision and rigidity.

Table assembly consist table, sliding saddle, table linear ball-screw and X axis ball-screw and other components. Details from Diagram 6#

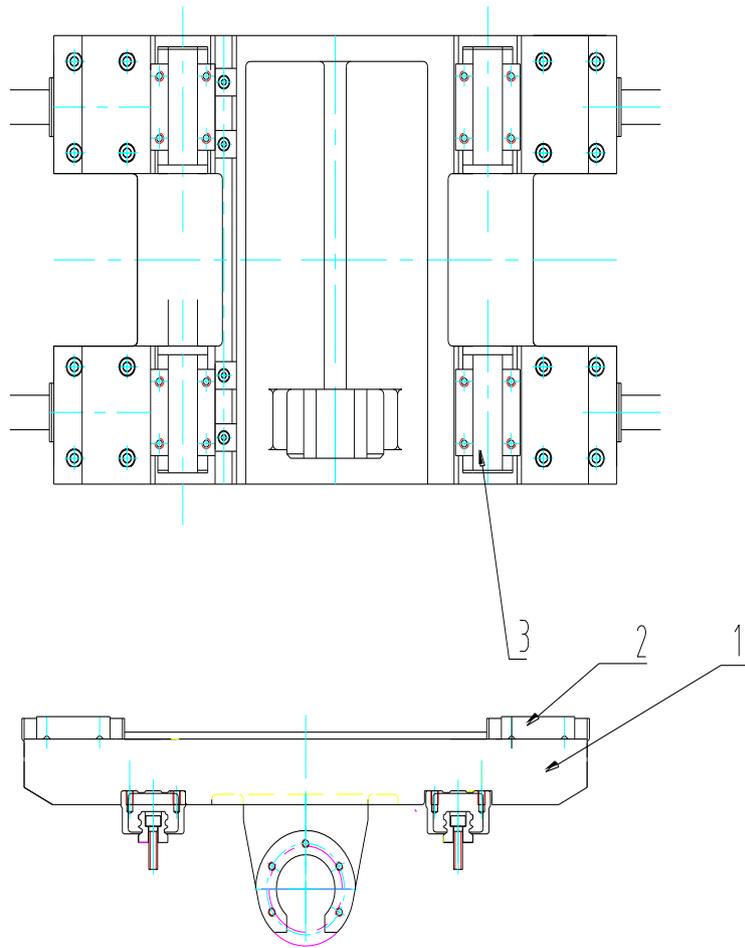
Table is used HT250 high rigidity grey casting materials, and aging treated twice . The section of table is shell shape; 3 T-slots are 17/27" width, Space between every slot is 25/69" Sizes for T-slot from Diagram 7#



1. table 2.sliding saddle 3. linear ball screw guide way of table 4. Ball screw X axis

Figure 7# Table outline and section

Sliding saddle is the carrier for installing those guide-way sliding blocks of X and Y axis. Sliding saddle should support the cutting component forces from two directions and bending moment, torsion moment and vibrating. Sliding saddle is used HT250 high rigidity grey casting materials, and aging treated twice after ruff machining.



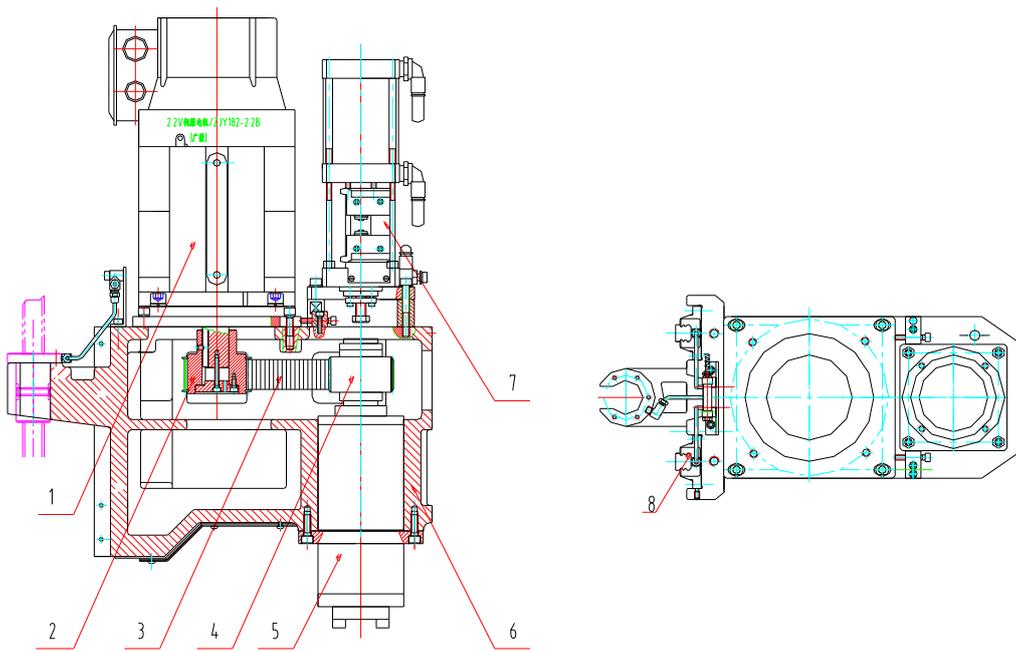
1. Sliding saddle 2. Guide way's sliding block in X axis 3. Guide way's sliding block in Y axis

Figure 8# Sliding saddle structure

5.4 Headstock structure

The headstock is formed with Head-stock body, BT30 spindle unit, Spindle motor, Timely pulley, timely belts, cylinder, pneumatic parts and cooling pipes. One Sliding Base with linear sliding rail was installed onto the headstock.

See Figure 9#



- 1.AC SERVO MOTOR OF SPINDLE 2. TIMELY PULLEY 1# 3. TIMELY GEARED BELT
 4. TIMELY PULLEY 2# 5. SPINDLE UNIT 6. HEADSTOCK BODY 7. CYLINDER 8 LINEAR GUIDE-WAY SLIDING BASE

Figure 9# HEADSTOCK STRUCTURE

Main drive of the machine is realized by making spindle motor drive the spindle module through gear-type pulley, and belt. The main belt driving model is 565-5M, the belt pulley flexibility d is $2/17'' \sim 13/66''$, when adjusting the belt elastic, pls note that the elastic value, Not too tight. See diagram10.

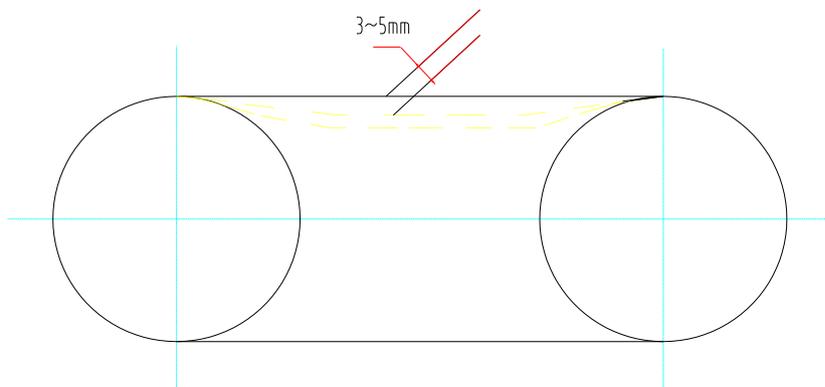


Diagram 10 Gear belt elastic

5. 5 Tool magazine structure and tools exchange process

Tool magazine install on the left of column ,parallel with the headstock, see diagram 11 tool magazine installation. Before transmission as shown diagram 4.The cylinder push disk left and right movable. The deceleration motor drives Ma Shi structure and let dish revolvable. The tools changer process as diagram 12.

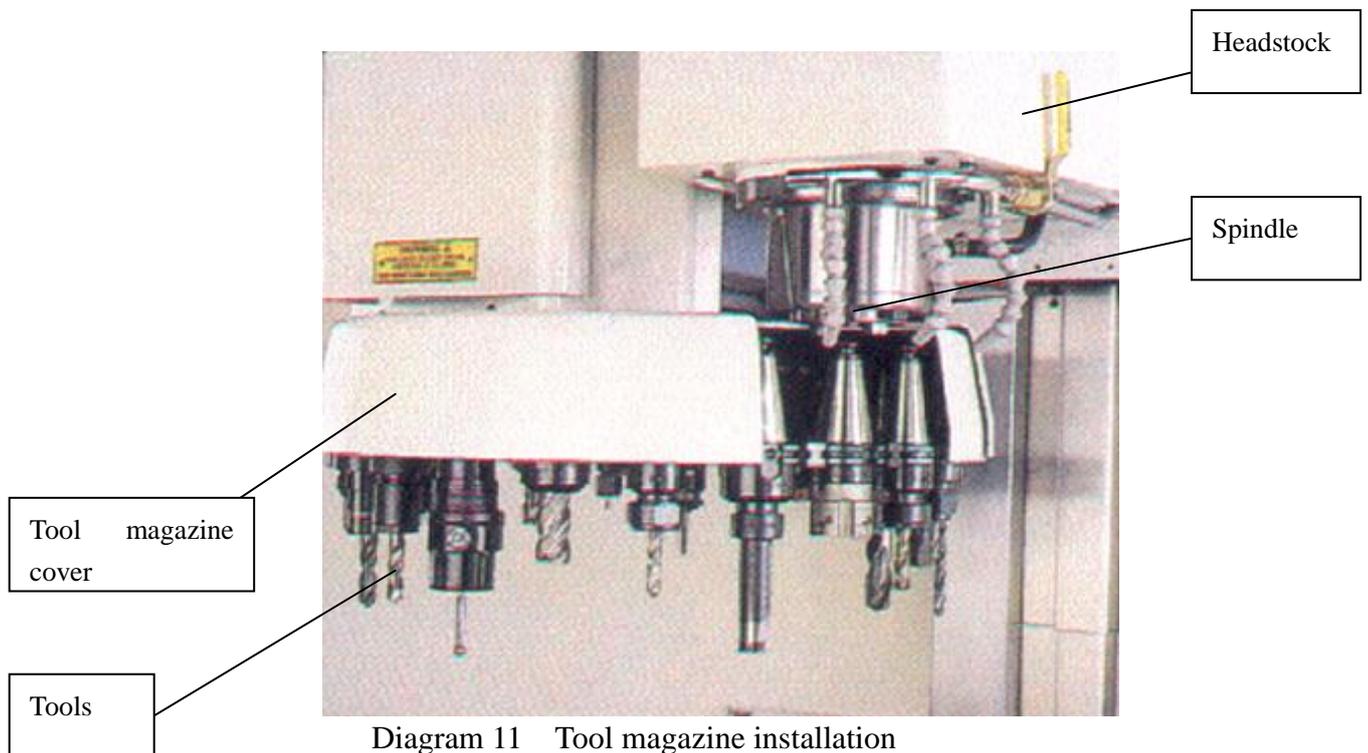


Diagram 11 Tool magazine installation

The spindle tools and tool magazine changer process:

- a. The headstock up to the tool exchange position while the spindle rising process to be finished and stop;
- b Tool magazine move to right and let correct jaws grasp the spindle tools ,and fulfill loosen tools;
- c. Make sure when tools are loosen ,the headstock up to the highest point;

d. Make sure after the headstock up to the highest point , the disk with the Ma Shi structure rotary and finished choose the tools;

e The headstock move down to tool changer position and let new tools insert spindle hole. The spindle drawbar tighten the tools;

f Tool magazine move left to normal position, tool exchange process finish.

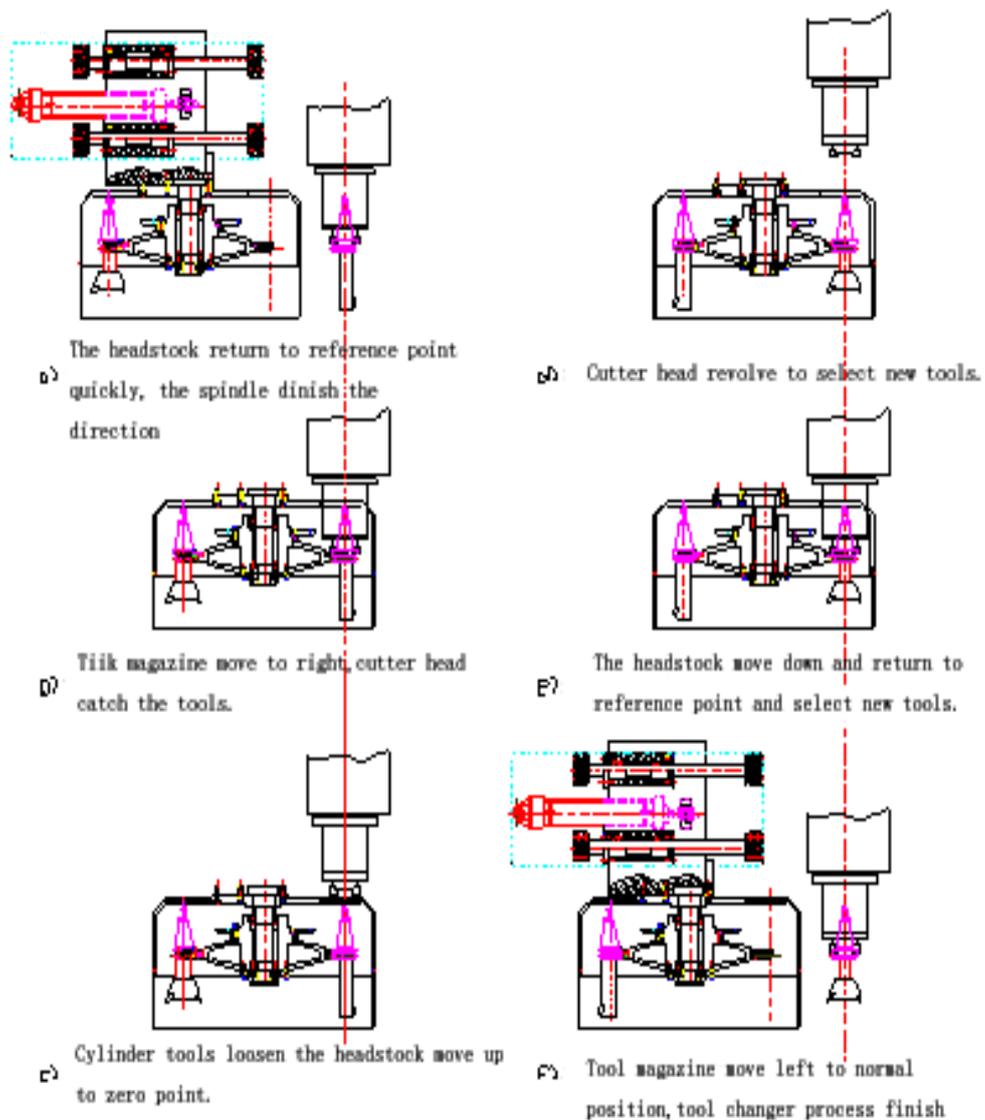
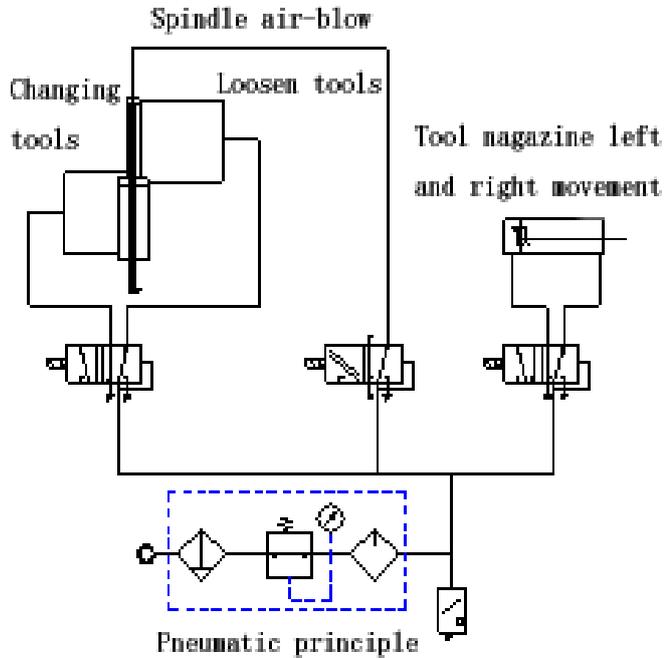


Diagram 12 Automatic tool changer

5.6 Machine Pneumatic system

The pneumatic system of this machine is to realize loosening and tightening tools for spindle, tools holding and loosening of the ATC and air-blowing of spindle and auxiliary action. The action achieving, see diagram 13, pneumatic principle system diagram.



Dia.13 Pneumatic principle

5.7 Lubricating system

Its lubricating system uses a small centralized automatic time lubricating device. The device will automatically deliver the lubricating micro-oil in definite time and definite quantity to each lubricating place and the oil will not be recycled.

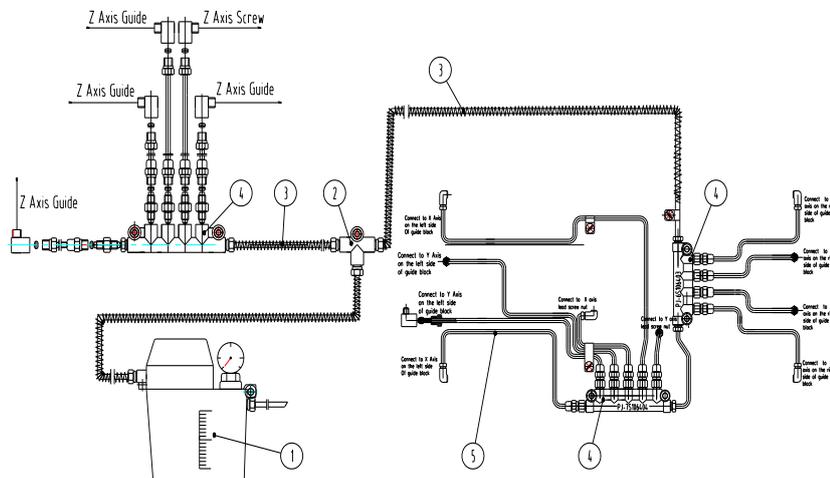


Diagram 14, auto-lubricating setting diagram.

①—Electric Lubricating pump ②—≡ Connector ③—Main line ④—Single way Connector ⑤—Branch pipeline

Auto-lubricating setting output Pressure oil through ≡ connector ,main line, one way connector ,branch pipeline and so on send to each Lubrication point, See diagram 14, auto-lubricating setting diagram.

5.8 Cooling system of tool

The cooling device of tools is the important peripheral installment of the machine. It consists of coolant box, filter, cooling pump, single-direction valve, throttle, piping, muzzle and so on.

Diagram 15 is the return circuit diagram of cutting liquid device. Using coolant fluid in the machining not only could take out much cutting heat to decrease the cutting temperature but also could decrease friction to cause the cutting force and cutting temperature decreased because of the effect by the coolant lubricating. Correctly selecting cutting liquid could effectively improve the quality on machined surface, guarantee the machining accuracy, reducing power consumption, and increase the durability and working efficiency of cutting tools. Try to use the oil coolant liquid to prevent worktable, guide-way and other metal parts from rusty

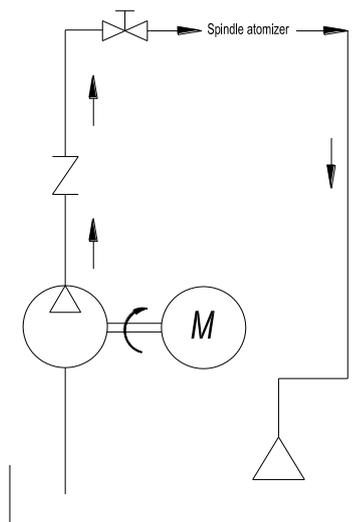


Diagram 15 centrifugal cooling pump

As the advantage of the pump, there is a little big gap between the rotor and

outside-cover., which could protect the pump body from damaged even if there a little iron chips into the coolant fluid.

6 Installment of machine

6.1.1 Working condition

This machine is a high-level CNC machine tool, so it could not be put in the place with high temperature, sun shined directly, deep humidity, unstable voltage, big vibration, high frequency equipment (Gantry planning machine, middle and high-frequency heat-treatment equipment) or too dust around and bad working condition. Usually the room temperature should be between 0-40°C, relevant humidity is not over 85% and the voltage fluctuation is within +10%-15%.

6.1.2 Installment base

This machine is a small-size machine center. It is easier for installing this machine. If the thickness of cement ground base is not lower than 11.81 inch, it is unnecessary to rebuild new ground base and cache the foot-bolts underground.. And the machine could be placed directly on the iron pads of standard accessories and use the support bolts to adjust the machine leveling. If the thickness of the cement ground is lower than 11 64/79 inch , new ground should be built and use ground bolts to fix the machine. Fixing the ground bolts, see diagram 16.

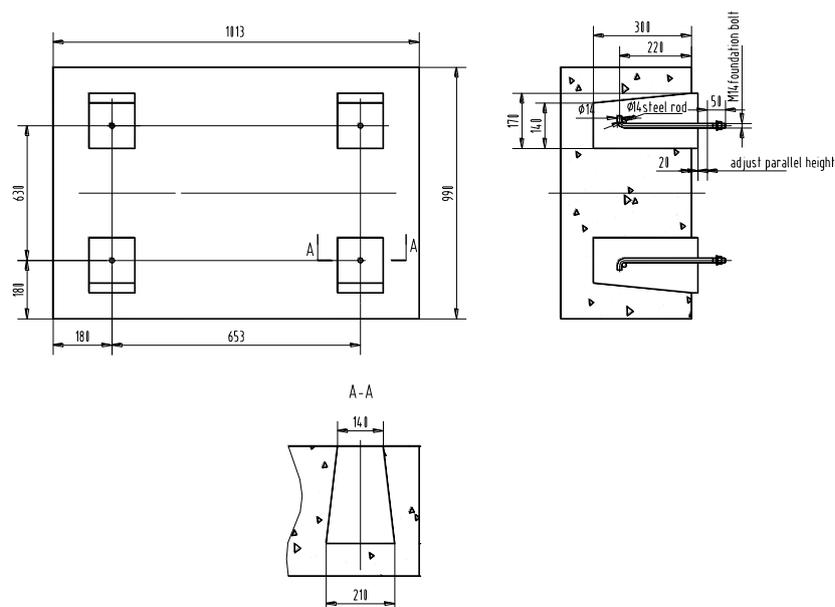


Diagram 16:Foundation diagram of machine installment

7 Maintenance

7.1 Daily maintenance

- 1). Check oil level of the auto-lubricating oil box and pay attention to inject.
- 2). Check the pressure gauge of the pneumatic system to make sure the pressure is within the range of 0.5-0.7Mp.
- 3) .Check the tri-connector of air resource about the oil level of lubricating cup, water level of water cup and pay attention to inject lubricating oil and water in time.
- 4) Please don't make the zero-return operation of 3 axis direction at once after power on, but should make the three axis move by 2 or 3 times within max. travel range at low speed manually and then begin the zero-return operation.
- 5) After operation to close the machine everyday, please first cut off power in turn, first for NC power, and then the whole power. After machine is closed, please clean out the cutting chips and coolant liquid splashed everywhere. If necessary, should paint some anti-rusty on the bare-metal working surface.
- 6) In order to keep the electrical device clean, all the doors or covers of electrical control cabinet should be closed during operation. Try not to use compressed air to clean the cutting chips or dust. Prohibit to use compressed air to clean the interior of the electrical control box.

7.2 Monthly maintenance

- 1) Make sure no dust or splashed coolant in the electrical box and try to clean it when necessary.
- 2) Clean the filter net of the air resource tri-connecting parts (use the inorganic cleaning agent and water to clean) to make sure working air tidy.
- 3) Check the rotation precision of spindle and if necessary spindle nut should be adjusted.
- 4) Check the level of the machine and if necessary, please adjust the ground bolts.
- 5) Check the gap between gipes of each axis and if the location of zero-return strike

block, position restricting block (including the combination switch) is right or not.

6) Put lubricating oil or lubricating grease to balanced beating chain, chain wheel and support base and so on.

7.3 Half-yearly maintenance

1) Clean the machine and interior of the electrical box thoroughly.

2) Check the connection of each axis between server motor and ball screw is right or not. Check the gap of opposite direction and should compensate when necessary.

3) Clean the dirt in the lubricating pipeline to make sure the oil-supplying system expedite.

4) Check all cable outside the electrical box and the joining position are in good condition or not and clean them in time.

8. Accessories

8.1 standard accessories

| Item | model | Name | Remarks |
|------|-------|----------------|---------|
| 1 | | Block iron | |
| 2 | | Adjusted bolts | |

8.2 Special accessories

Customers can order them from the professional manufacturer or entrust machine suppliers to provide them.

| Item | model | Name | Remarks |
|------|-------|-------------|---------|
| 1 | LD-30 | Pull bolt | |
| 2 | BT30 | Taper shank | |

