

Vertical Machining Center

# **Operation Manual** (Mechanical part)

Serial No.:

**Applicable models of this document**

|         |         |                  |                         |
|---------|---------|------------------|-------------------------|
| V4      | VMC400E | VMC640           | VMC740                  |
| VMC855  | VMC855B | VMC850B          | V8                      |
| VMC966  | VMC1000 | VMC1100(box way) | VMC1100(li<br>near way) |
| VMC1160 | VMC1200 | VMC1300          | VMC1580                 |
| VMC1600 | VMC1800 | VDC1270          | VDC4050                 |
| VNM5710 |         |                  |                         |
|         |         |                  |                         |
|         |         |                  |                         |
|         |         |                  |                         |

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## 1. Foreword

Sincerely thank you for your trust in our company and our products!

This manual contains information such as machine safety precautions, machine performance, machine operation, adjustment and maintenance, etc. This information is very important to give full play to the performance of the machine tool and maintain the accuracy of the machine.

Before using this machine, please read this manual carefully and follow the instructions in this manual.

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### Important instruction

1. Be sure to observe the safety items in this manual and the contents of the safety nameplate attached to the machine. Failure to comply with these contents may cause serious personal accidents or property damage.
2. Do not make any modification that affects the safety of the machine without authorization. If you want to make a modification, please contact our company.
3. Due to the company's continuous improvement and upgrading of machines, the content of this manual may differ from the actual product. It should be noted that changes to product specifications will not be notified in advance. If the machine you purchased is different from the contents of this manual, please contact our company, we will provide the correct information.
4. Please keep this manual near the corresponding machine for easy reference.
5. This manual describes various safety rules and safety measures in detail. In order to avoid accidents caused by misoperation, please read and understand the contents before operating the machine. Although the manual discusses the content of safety in detail, due to the complexity of the machine and the unpredictability of the accident, it is impossible to predict it in 100% detail. Therefore, only professional technicians with professional

technical training can operate this machine.

6. Before the machine starts to operate, all safety devices should be in place and functioning. The manufacturer is responsible for the safety protection of the machine tools and auxiliary equipment supplied to the user. The user is responsible for the safety protection of the added fixtures, tooling and auxiliary equipment; responsible for the accidents caused by the machine tool work after changing the original tooling and auxiliary equipment. The user is responsible for accidents caused by not installing, operating and maintaining the machine in accordance with the instruction manual.

7. This manual only provides detailed instructions for general models. If customers have special configuration requirements, we can provide separate instructions.

8. The user should keep this instruction manual properly, if you have any questions, please contact our company.

## 2. Safety instructions

Before operating the machine and performing routine maintenance, the operator must carefully read this manual to understand the safety measures and requirements of the machine, and observe the relevant safety precautions.

### 2.1 Symbol requirements

The meanings of danger, warning and attention used in this manual are as follows:

**⚠ Danger: Failure to comply with this rule may result in death.**

**⚠ Warning: If this regulation is not followed, it is likely to cause serious personal injury or serious machine damage.**

**⚠ Note: If this regulation is not followed, it may cause personal injury or machine damage.**

### 2.2 Basic matters

| No. | content                                                                                                                                                                                                                                                                                                                                                                                                | Mark      |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1   | Only trained and qualified personnel can operate this machine .                                                                                                                                                                                                                                                                                                                                        | ⚠ Danger  |
| 2   | The inspection, wiring and maintenance of electrical parts must be performed by professionals to avoid accidents such as electric shock.                                                                                                                                                                                                                                                               |           |
| 3   | There are high-voltage parts (with ⚡ signs) in the electrical cabinet. Because the high voltage part will bring the risk of electric shock, do not touch the high voltage part. Before checking the operation, check the protective cover installed in the high-voltage part. When checking the high voltage part, be careful not to touch the terminals to prevent being knocked down by electricity. |           |
| 4   | When entering the dangerous area of the machine, the main power supply must be cut off.                                                                                                                                                                                                                                                                                                                |           |
| 5   | This machine is only suitable for the processing of ordinary metal materials, not for the processing of flammable metals or radioactive materials.                                                                                                                                                                                                                                                     | ⚠ Warning |
| 6   | When operating the machine, the operator should wear safety glasses, appropriate clothing, safety shoes, and helmet; loose clothing, gloves, and various accessories such as rings and watches are prohibited.                                                                                                                                                                                         |           |
| 7   | Do not operate electrical equipment with wet hands.                                                                                                                                                                                                                                                                                                                                                    |           |

|    |                                                                                                                                                                                                                                                                                                                                                                                  |       |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 8  | Regularly check the set parameters of the machine. It is forbidden to change the parameters of the control system set by the manufacturer at will, and it is not allowed to increase the pressure of the hydraulic system and replace the machine accessories at will.                                                                                                           |       |
| 9  | It is forbidden to disassemble or modify the safety protection devices and protective covers at will.                                                                                                                                                                                                                                                                            |       |
| 10 | Do not remove or move the zero return switch, travel switch, travel stopper and other safety protection devices on the machine.                                                                                                                                                                                                                                                  |       |
| 11 | Do not allow the machine to perform processing beyond its stroke limit and capacity range.                                                                                                                                                                                                                                                                                       |       |
| 12 | Two or more people are prohibited to operate the control panel at the same time.                                                                                                                                                                                                                                                                                                 |       |
| 13 | In order to use this machine tool correctly, operators, programming and maintenance personnel must carefully read this manual, as well as the functional part manual provided with the machine, fully familiar with the structure and working principle of the mechanical, electrical, and hydraulic systems, and understand the functions and operating methods of the machine. | ⚠Note |
| 14 | Before operating the machine, you should carefully read the machine tool instruction manual and system operation manual, fully understand the technical specifications and functions of the machine tool, and operate in the prescribed manner.                                                                                                                                  |       |
| 15 | Sufficient space should be reserved near the machine and the floor should be kept clean.                                                                                                                                                                                                                                                                                         |       |
| 16 | The ground around the machine should be dry and clean. There should be no water or oil stains to avoid slipping and injury.                                                                                                                                                                                                                                                      |       |
| 17 | The operator should be familiar with the positions, functions and operating methods of various switches and buttons on the machine.                                                                                                                                                                                                                                              |       |
| 18 | The operator must be familiar with the location and operation of the emergency stop switch.                                                                                                                                                                                                                                                                                      |       |
| 19 | Operators should close up and tie up long hair, button up the hem and sleeves of clothes.                                                                                                                                                                                                                                                                                        |       |
| 20 | When the spindle is rotating for manual operation, do not let any part of the body touch the moving parts.                                                                                                                                                                                                                                                                       |       |
| 21 | Refer to the inspection parts planned in this manual, and regularly                                                                                                                                                                                                                                                                                                              |       |

|    |                                                                                                                                                                                                  |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|    | inspect, adjust and maintain them.                                                                                                                                                               |  |
| 22 | When the hydraulic, pneumatic, lubrication, and refrigeration systems are abnormal, the power supply should be cut off immediately to terminate the work of the machine.                         |  |
| 23 | You should always pay attention to whether there is abnormal sound of the machine, whether there is an alarm on the warning light or the operation panel, and diagnose and eliminate it in time. |  |
| 24 | Work station appliances, measuring tools, blanks, finished products, etc. should be placed in an orderly manner to avoid stumbling and falling.                                                  |  |
| 25 | Do not wipe the machine with organic solvents.                                                                                                                                                   |  |
| 26 | Abandoned lubricating oil and coolant should be stored in a centralized manner at designated locations, and should not be dumped everywhere to avoid environmental pollution.                    |  |
| 27 | Before testing the workpiece, the correctness of the processing procedure should be carefully checked to avoid collision and damage to the machine, fixtures, tools and workpieces.              |  |
| 28 | During the operation, it is forbidden to hit the tool, spindle and other parts.                                                                                                                  |  |
| 29 | When the belt needs to be adjusted, it must be carried out when the motor is powered off to avoid accidents.                                                                                     |  |
| 30 | After the machine work is finished, it must be shut down in the prescribed order and the power supply must be cut off.                                                                           |  |

### 2.3 Machine installation and power supply

#### **⚠Danger**

- (1) The installation of the machine must ensure that the machine has a good grounding (grounding resistance is less than  $10\ \Omega$ ).
- (2) The machine should be far away from electromagnetic fields and equipment that easily cause large voltage fluctuations.
- (3) The machine should be far away from direct sunlight, vibration and heat sources, and high-frequency generators, electric welding machines, etc., and do not share a power

distribution box with equipment that can generate noise, such as electric welding machines and high-frequency hardening machines.

**⚠Warning**

- (1) Do not manually transport and unload heavy workpieces, but use cranes and other equipment.
- (2) Enough space should be left near the machine and the floor should be kept clean.
- (3) Carefully check the programming, parameter setting, action sequence, tool interference, workpiece clamping, switch protection and other links are completely correct, so as to avoid accidents during cycle processing and damage to tools and related parts.
- (4) Adequate lighting in the work area.

## 2.4 Machine start

**⚠Danger**

- (1) Before starting the machine, you must open each protective door, and carefully check that there are no people or other foreign objects inside before starting the machine .
- (2) When checking the tension of the belt, do not put your hand between the belt and the pulley.

**⚠Warning**

- (1) The specified lubricant must be used.
- (2) Check whether the liquid level of the lubricating oil tank and the coolant tank is above the specified level line.
- (3) Instantaneous power failure caused by power failure or lightning may cause accidents. Therefore, when abnormal voltage fluctuations occur, the main power supply of the machine should be cut off immediately.

**⚠Note**

- (1) When using the machine for the first time after unpacking or after long-term idle, you must first use the manual button of the lubrication pump to press the lubricating oil onto the guide rail surface, and then start the machine to move the coordinate axes.

(2) Check whether the electrical cabinet door is closed properly.

(3) Start the workshop power switch, the main switch of the machine and the on-off switch on the operation panel in sequence before starting the machine.

(4) Work procedures should be prepared before starting work, and the processing scope should be clarified.

(5) Because the temperature difference of various parts of the machine will cause the accuracy of the processed parts to be unstable, preheating can solve this problem. The machine should be warmed up before work every day. The warm-up time ranges from 10 minutes to 30 minutes. The spindle speed can take 4 to 5 speeds from low to high, and each axis moves in full stroke. These steps can be compiled into a small program for use. In the preheating process, pay attention to check whether there are any abnormalities in each part, and be especially careful when preheating the spindle speed to the highest speed.

(6) Misoperation will cause damage to the machine. Be sure to carefully confirm the switches on the operation panel before operation.

**Special note: The company is not responsible for the warranty for machine damage caused by misoperation! Repairs require additional fees!**

## 2.5 Machine warm-up

### 1. Warm-up purpose

After a long period of standing or maintenance, before re-operating the machine, it needs to be preheated to ensure the stability of lubrication, liquid temperature and accuracy and prolong the service life of the machine. When starting the machine in the morning, the operator should also warm up the machine. When preheating, it is best to perform automatic operation through the program instead of manual operation.

### 2. Preheating method

(1) Warm-up time: no-load operation for more than 15 minutes (longer in winter).

(2) Spindle speed: about 500r/min.

- (3) Movement: Correctly execute cutting speed and rapid movement in sequence.
- (4) Use the program to check various actions of the tool magazine.
- (5) Check the conditions of lubrication, hydraulics and coolant during warm-up.

## 2.6 Machine running

### **⚠Danger**

- (1) When changing any tool in the tool magazine, stop the movement of the spindle and coordinate axis, and do not reach into the range of the ATC tool change mechanism.
- (2) When adjusting the flow of the cooling nozzle or the direction of the illuminating lamp holder, the machine must be stopped.
- (3) It is forbidden for two or more people to operate the control panel at the same time.
- (4) Do not wear gloves to operate buttons or switches to prevent malfunction.
- (5) During the normal operation of the machine, the doors of all parts cannot be opened.
- (6) When leaving the machine temporarily, turn off the switch of the operation box and the main power switch.
- (7) When abnormal phenomena or malfunctions occur during work, stop the machine immediately for troubleshooting, or notify maintenance personnel for repair.

### **⚠Warning**

- (1) Do not use severely worn or damaged tools. All these tools should be replaced with new ones.
- (2) Make sure that the connection of pull studs, tool holders, auxiliary tools and cutting tools are tight and reliable. Use the standard specifications of the pull studs specified by this machine. Users should not make their own pull studs to avoid accidents due to insufficient precision or strength.
- (3) Before processing the workpiece, a processing simulation or trial run must be carried out to check whether the program is correct. Strictly check and adjust the processing origin, tool parameters, processing parameters and motion trajectory, and clean the workpiece, pay special attention to whether the workpiece is fixed firmly and whether the adjustment tool

has been removed.

(4) Do not place any cutting tools or tools on the machine operation panel or any parts of the machine.

#### Warning

- (1) The tool must conform to the diameter, length and weight specified by the machine.
- (2) Do not clean the cutting chips on the tool by hand, you should use a brush to clean it.
- (3) If the tool is placed on the spindle for a long time, it may cause the tool holder to rust due to thermal expansion, cold shrinkage and cutting fluid corrosion, so that the tool cannot be hit down.
- (4) Lifting equipment should be used to load and unload workpieces weighing more than 20kg. For large workpieces, two or more people should load and unload at the same time.
- (5) During operation, it is forbidden to hit the center, cutter, spindle and other parts.
- (6) During the machining process of the machine, do not clean the chips. After the spindle and coordinate axis stop moving, use a brush or cleaning fluid to rinse.
- (7) After the work is completed, the machine should be cleaned in time, the chips should be cleaned and the protective cover glass should be wiped clean, and the machine should be restored to its original state, all switches and handles should be placed in non-working positions, the power supply should be cut off, and the shift system should be carefully implemented.
- (8) Use moderate force when pressing the keys, and do not tap the keyboard, keys, and display screen too hard.
- (9) The work light will become very hot after long time use, please do not touch it.

## 2.7 Machine inspection and maintenance

- (1) Without permission and guidance, do not perform any maintenance operations.
- (2) Must be trained personnel to complete the specified maintenance work.
- (3) Electrical maintenance must be carried out by professionals, and the relevant procedures of the machine should be fully grasped.

- (4) When the machine is being maintained, a sign indicating that “the machine is under maintenance” should be hung around.
- (5) Before replacing any electrical components, the power switch must be turned off.
- (6) In order to prevent accidental danger, when cutting off the power supply for maintenance, the main power supply insurance should be removed or a warning sign such as "checking, no power transmission" should be hung.
- (7) Escalators or related safety equipment should be used when climbing.
- (8) When using lifting equipment, special cables and spreaders should be used.
- (9) The position of the overtravel striker and other switches are not allowed to change.
- (10) When replacing parts, make sure to use the specified parts.
- (11) If you encounter problems that are difficult to judge and solve, you should immediately contact the manufacturer for help.
- (12) During maintenance, air guns should not be used to clean the guide rail and lead screw to prevent small chips from entering the guide rail and lead screw nut.

## 2.8 Precautions for fire protection

### 1. Coolant

Emulsified oil is generally used as the coolant. Be sure to ensure that the coolant has sufficient concentration. This is very important, otherwise it will cause corrosion of machine parts and damage the machine. In addition, do not use coolant to wash hands, laundry, etc., coolant is not allowed to be mixed with gasoline, kerosene, etc., if there are special needs, you must explain to the manufacturer in advance. Users in various places should select the correct coolant according to the local actual situation and the characteristics of the coolant and replace the coolant regularly.

After the coolant and chips flow to the drain pan, they flow to the chip collecting box through the channel first, and then flow back to the cooling box through the filter screen, where the chips are accumulated in the chip collecting box. The operator should clean these chips frequently to prevent clogging.

Under this configuration condition, the operator needs to manually clean the residual chips

everywhere, and the chips in the large cover need to be swept to the chip collecting box through the gap on the drain pan or directly cleared out.

**Precautions:**

- (1) Frequent use of cooling, the chips in the chip tray should be cleaned in time to avoid clogging of the filter.
- (2) The cooling pump should not run dry, and the water level of the collecting tank should be checked regularly. When the water level is too low, add coolant in time.
- (3) Before turning on the power of the cooling pump, be sure to turn on the adjustment switch in front of the nozzle; ensure that the pipeline is smooth.
- (4) When the temperature is high in summer, always check the coolant texture to prevent water quality changes from corroding the water tank and causing pollution.
- (5) The cooling water tank shall not be moved for long distances when it is full of water to avoid damage to the universal wheels of the water tank.
- (6) Please take measures to properly dispose or recycle the exhaust gas coolant, pay attention to environmental protection; do not cause harm to the environment and people.

**2. Processing flammable metal materials**

Before processing any combustible metal materials such as magnesium, magnesium alloy and other materials, carefully study and understand the nature of the material, follow the above precautions, and take all possible measures to prevent fire.

**3. Dry processing**

During dry machining, there is a fire hazard due to the fact that the workpiece, tools or chips are not cooled. Therefore, do not stack combustible materials near the machine tool and allow chips to accumulate.

## **2.9 Safety and warning signs**

**1. Joint warning sign**

The joint warning sign puts forward the key content in the manual, and requires the operator to be familiar with and implement it; it reminds the operator of some details that must be paid attention to

during the operation of the machining center to prevent accidents.

**Warning**

|  |                                                                                                               |  |                                                                                                        |
|--|---------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------|
|  | <p>Do not clean the spindle with air directly.</p>                                                            |  | <p>Please always clean up iron filings inside the chassis.</p>                                         |
|  | <p>When machine starts and moves automatically, keep hands, clothing and body away from rotating spindle.</p> |  | <p>Don't assemble or disassemble tools in the spindle. It can cause serious injury to the spindle.</p> |
|  | <p>Opening the protective door is prohibited when machine is working.</p>                                     |  | <p>Interior space is small. No entry, unless turn off the main power.</p>                              |

**Danger**

Devices using high-pressure, non-professionals are prohibited to do the installation and maintenance.

### Warming-up Instruction

To ensure the normal lubrication at different parts and the quality of subsequent machining, the standard mode of warming-up refers to three-axis whole-travel displacement and main shaft running, namely the rotation by the slow displacement in the beginning and then gradually accelerate the speed and rotation.

| Rotation Mode                            |                                                                              | Status                     | Warming-up time |
|------------------------------------------|------------------------------------------------------------------------------|----------------------------|-----------------|
| Main Shaft Rotation (r.p.m.)             | Three-axis Rapid Feed (mm/min)                                               |                            |                 |
| Max rotation of main shaft $\times 75\%$ | 1. Warming-up speed: Initial speed of three axis $\times 75\%$               | Daily operation            | About 30min     |
|                                          | 2. Warming-up range: Warming-up for 2/3 range of the entire limit of travel. | Over 48 hours of shut-down | About 60 min    |
|                                          |                                                                              | Over 1 week of shut-down   | About 120 min   |

### Safety Instruction

1. Only the personnel who have skilled experience or receive the proper training and can safety do the operation take charge of the operation of this machine.
2. Carefully read, understand and follow the description and warning signs of operation and instruction manual before the operation.
3. The machine should not be operated unless all shields, interlock device and other safety devices are properly placed.
4. When operating the machine, the operator should wear the safety glasses, safety shoes and hearing protector. No wearing of loose clothes that is easy to be rolled up.
5. Service or installation of this machine must be performed by qualified personnel only, following procedures described in the instruction manual. Turn off and lock out power at main electrical panel before servicing.

| Regular maintenance inspection list |                                                 |     |      |       |      |      |                                |
|-------------------------------------|-------------------------------------------------|-----|------|-------|------|------|--------------------------------|
| NO.                                 | ITEM                                            | DAY | WEEK | MONTH | WEEK | YEAR | MARK                           |
| 1                                   | Tool changing and auto head movement            | ○   |      |       |      |      | Function inspection            |
| 2                                   | Table surface                                   | △   |      |       |      |      | Foreign material clearance     |
| 3                                   | Positioning accuracy                            |     |      |       |      | ○ ☆  | Inspection and adjustment      |
| 4                                   | Feeding accuracy                                |     |      |       |      | ○ ☆  | Inspection and adjustment      |
| 5                                   | Main motor, servo motor input voltage           |     |      |       | ○    |      | ± 10%                          |
| 6                                   | The axis movement                               | ○   |      |       |      |      | Function inspection            |
| 7                                   | The slide surface lubrication                   |     |      |       | ☆    |      | Add lubricant grease           |
| 8                                   | The spindle inner hole (cone)                   | △   |      |       |      |      | Abnormal wear inspection       |
| 9                                   | Spindle belt inspection                         |     |      |       |      |      | Tension force inspection       |
| 10                                  | Tool holding, loosen                            | ○   |      |       |      |      | Function inspection            |
| 11                                  | The circuit of pipes                            | ○   |      |       |      |      | Air leakage                    |
| 12                                  | The lubricating oil level                       | ○ ● |      |       |      |      | Oil level scale                |
| 13                                  | Panel light inspection                          |     | ◇    |       |      |      | Function inspection            |
| 14                                  | Protective cover                                | ○   |      |       |      |      | Check the leakage, open, close |
| 15                                  | Cooling tank and filter screen                  |     |      | △     |      |      | Inspection, cleaning           |
| 16                                  | Emergency stop switch and operator status light | ○   |      |       |      |      | Open, close inspection         |
| 17                                  | The machine internal chip removal               | △   |      |       |      |      | Foreign material clearance     |
| 18                                  | F.R.L Unit                                      | ○ △ |      |       |      |      | Water proofing                 |
| 19                                  | Interior of the guide protective cover          |     |      |       | △    |      | Foreign material clearance     |

○ Inspection      ● Refueling      ● Check and replace if necessary  
 ☆ Adjust it if necessary      ◇ Function test      △ Clean

## 2. Nameplate

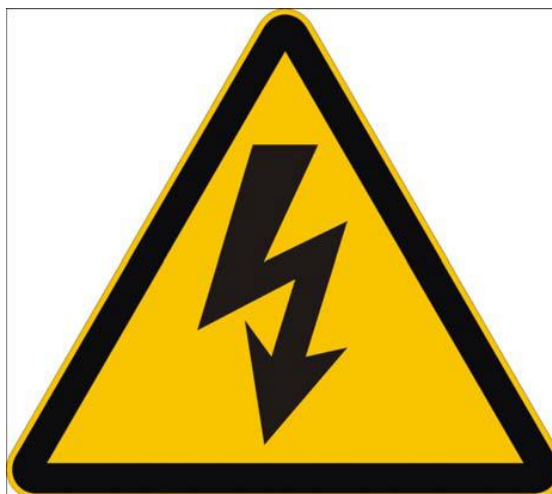
### VERTICAL MACHINING CENTER

MODEL:

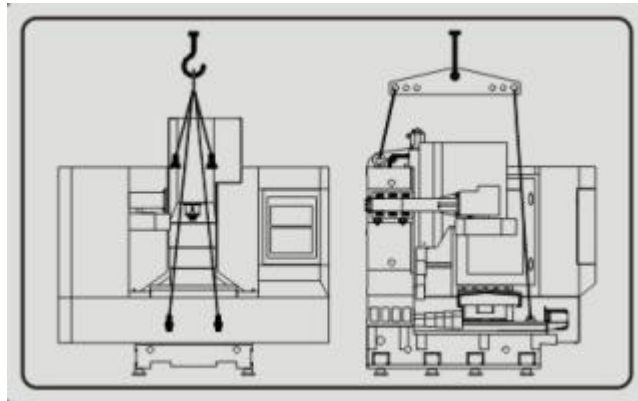
NO.:

DATE:

## 3. Lightning warning sign



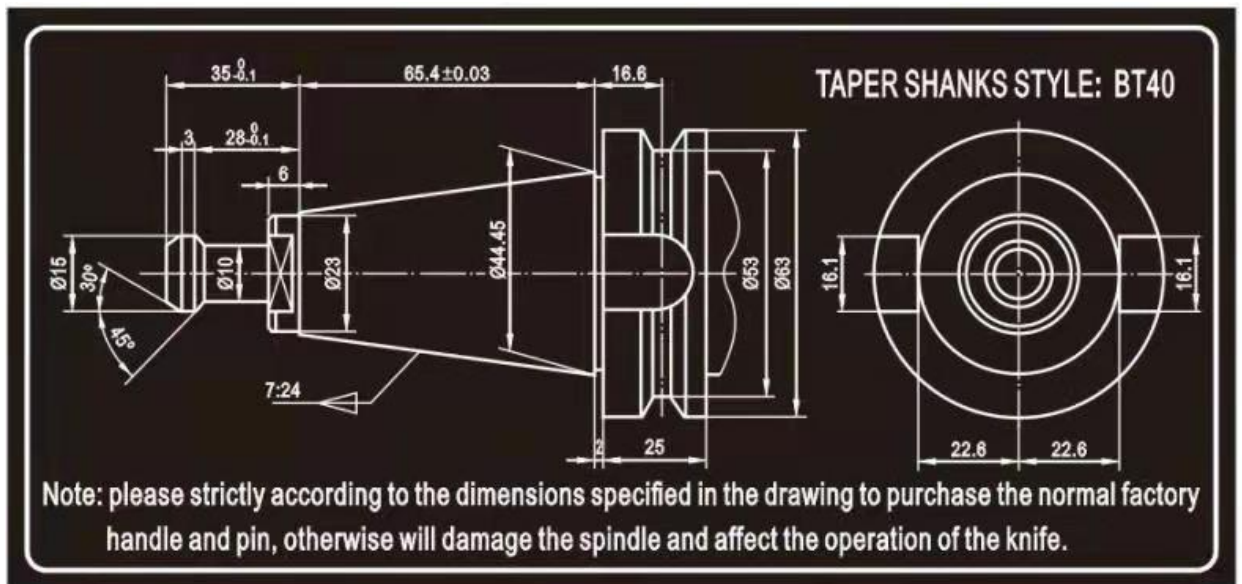
#### 4. Other signs



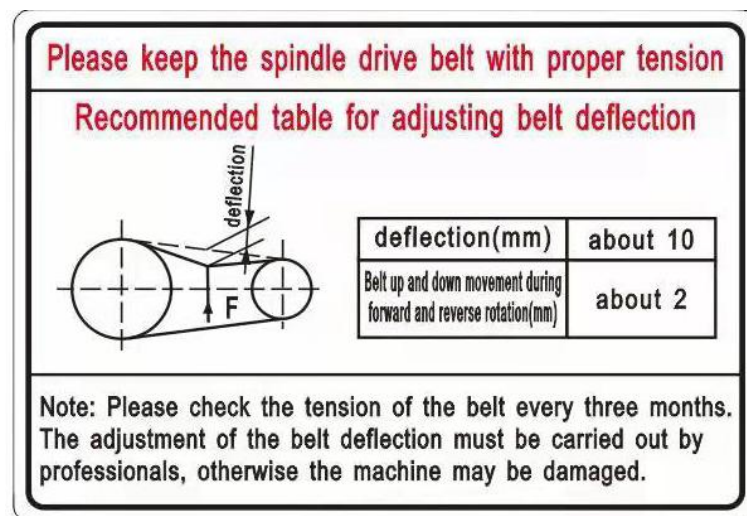
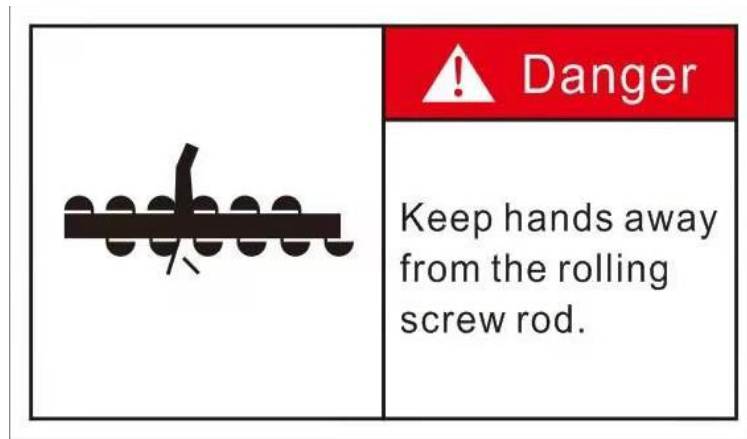
Lifting signs

| Recommendations for the use of the oils |                |           |                        |                             |
|-----------------------------------------|----------------|-----------|------------------------|-----------------------------|
| Item \ Brand                            | MOBIL          | SHELL     | ESSO                   | CASTROL                     |
| Air pressure lubrication system         | DTE LIGHT      | TURBO T32 | TERESSO 32<br>NUTO H32 | HYSPIN VG32<br>PERFECTO T32 |
| Automatic lubricating system            | VACTRA 2       | TCNNA T68 | FEBIS K68              | MAGNA BD68                  |
| Spindle oil temperature                 | DTE LIGHT      | TURBO T32 | TERESSO 32<br>NUTO H32 | HYSPIN VG32<br>PERFECTO T32 |
| Oil pressure system                     | DTE24          | TELLUS 37 | UNIVIS N32<br>NUTO H32 | HYSPIN<br>AWS32             |
| Gear box transmission unit              | MOBIL GARD 629 | OMALA 150 | SPARTAN EP150          | ALPHA SP150                 |

Oil use recommendation table nameplate



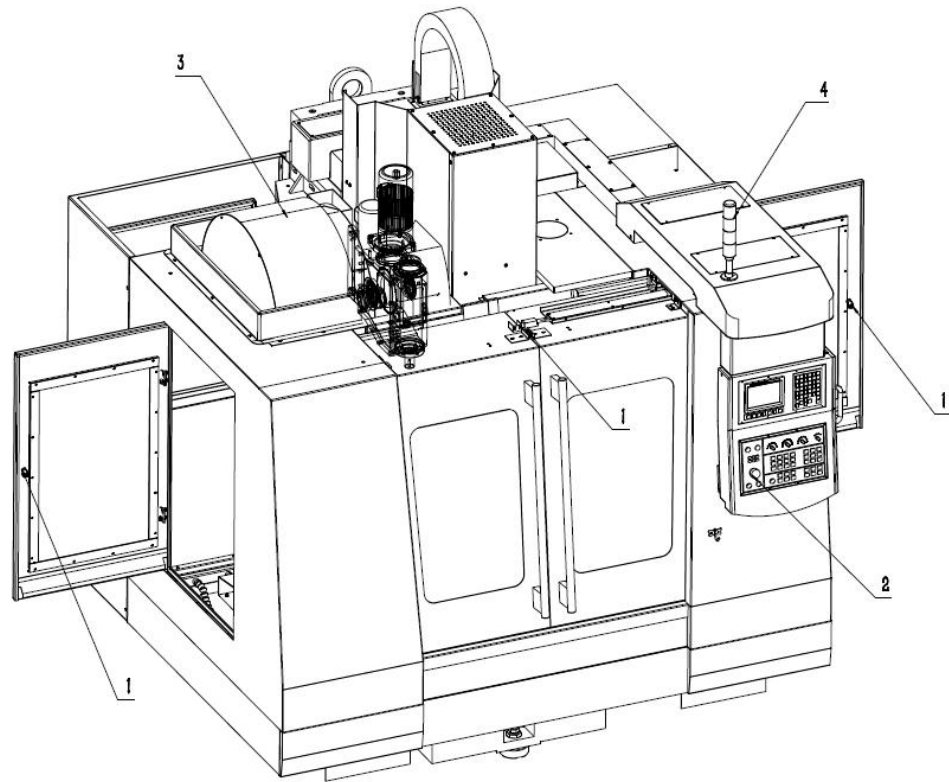
Tool handle warning sign



## 2.10 Main safety devices of machine

### 1. Safety device function and location

| No. | Name                               | Functions                                                                                                                                                |
|-----|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Operation door lock (3 locations)  | Do not open the operation door during automatic cycle.                                                                                                   |
| 2   | Emergency stop button (1 location) | 1. Each manual operation panel is equipped with an emergency stop button.<br>2. When you press this button, whether it is automatic or manual operation, |
| 3   | Tool magazine protective cover     | Prevent iron filings and cutting fluid from entering the tool magazine                                                                                   |
| 4   | Warning Light                      | The machine operation indicator can correctly indicate the operating status of the machine .                                                             |



## 2. Notes on the observation window

The normal service life of the observation window glass is 2 years, and it needs to be replaced with a new one after the expiration date to prevent the glass from aging and reducing the safety level. The glass should be replaced with new glass immediately if the following conditions occur to avoid accidents.

- (1) Due to impact deformation (protrusion, depression), cracks, etc.
- (2) Damage to the sealing edge, penetration of coolant (aging).
- (3) Staining, fading or grinding of the observation window.
- (4) Other damage to the protective layer.

Note for cleaning the observation window:

- (1) Use a soft cloth for cleaning, not a scrubber or hard cloth.
- (2) When removing dirt, use cold or warm water. If it is difficult to remove, rinse with diluted neutral detergent.

(3) Do not use organic solvents such as thinners, propanol or strong alkaline detergents.

(4) If the surface is contaminated by chemical solvents, it must be cleaned with a soft cloth and alcohol within a short time, otherwise the board will crack or break.

3. It is necessary to read the machine manual carefully, master the operation and maintenance skills , and be familiar with the structure and performance of each part to prepare for the formal operation.

## 2.11 Others

### **⚠Danger**

When disassembling the servo motor in the vertical direction (Z axis), the spindle box must be placed on the workbench with a square wood pad before disassembly, so as to prevent the weight of the spindle box from causing the lead screw to rotate freely and slide down. An accident may cause damage to related parts or cause personal injury. Security incident.

### **⚠Warning**

Configure a suitable and stable power grid according to the relevant data in the manual. If the grid voltage fluctuates beyond the specified value, a corresponding voltage stabilizing device must be added to ensure the normal operation of the electrical components of the machine and avoid component damage and malfunction.

### **⚠Note**

If you find difficult problems during the specific operation of the machine, please do not dispose of them at will. Please contact the manufacturer in time to find out the problem before proceeding. In short, be careful when operating the machine, and try to avoid unexpected accidents.

### **3. Machine outline**

#### **3.1 Breif introduction**

This series of machine is a fixed-column vertical machining center with a mechatronics design, beautiful in appearance, and capable of precise cutting. After the workpiece is clamped once, the machine can automatically and continuously complete the processing of various processes such as milling, drilling, boring, expansion, reaming, countersinking, and tapping. The machine is suitable for medium and small boxes, plates, plates, and shells. The multi-variety processing of complex parts such as the same can efficiently manufacture high-quality machine parts for your factory.

This series of machine tools has good rigidity and high precision, and can be applied to the following industries: auto parts industry, mold industry, valve industry, construction machinery industry, IT equipment industry, optical equipment industry, medical equipment industry, etc.

After the CNC rotary table (optional configuration) is added to this series of machine, the processing range is expanded, and it can perform 4-axis and 5-axis processing of complex parts. The mechanical part of the machine is mainly composed of the host, the cooling chip removal system, the operation box, the electric cabinet, and the pneumatic pipeline. The machine has the capability of rigid tapping.

#### **3.2 Machine specifications and configuration parameters**

This is the standard configuration parameters of this series of machines. If there is any special configuration change, the actual configuration shall prevail. If you have any questions, please contact our technical staff.

| Name                    |                                             | unit                                 | V4          | VMC400E           |
|-------------------------|---------------------------------------------|--------------------------------------|-------------|-------------------|
| Working table           | Table size                                  | mm                                   | 600×350     | 600×350           |
|                         | Max.table load                              | kg                                   | 100         | 100               |
| travel                  | X/Y/Z axis travel                           | mm                                   | 600/350/400 | 600/350/400       |
|                         | Distance from spindle nose to table surface | mm                                   | 120~520     | 120~520           |
|                         | Distance from spindle axis to column        | mm                                   | 420         | 420               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   | m/min                                | 48/48/48    | 30/30/24          |
| Spindle                 | Main motor power                            | Kw                                   | 3.7/5.5     | 5.5/7.5           |
|                         | Max.spindle speed                           | rpm                                  | 10000       | 6000              |
|                         | Spindle taper                               |                                      | BT40        | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity               | pcs         | 16                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          | φ 78/ φ 120       |
|                         |                                             | Max. Length of tool                  | mm          | 300               |
|                         |                                             | Max. weight of tool                  | kg          | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           | 1.36/4.5          |
|                         | Umbrella type tool magazine                 | Tool magazine capacity               | pcs         | 16                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          | φ 78/ φ 120       |
|                         |                                             | Max. Length of tool                  | mm          | 300               |
|                         |                                             | Max. weight of tool                  | kg          | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           | 3/7               |
| Machine accuracy        | Positioning accuracy (X/Y/Z)                |                                      | mm          | 0.022/0.022/0.022 |
|                         | Repeat positioning accuracy (X/Y/Z)         |                                      | mm          | 0.012/0.012/0.012 |
| Automatic chip conveyor |                                             |                                      | optional    | optional          |
| Machine weight          |                                             | kg                                   | 2000        | 2000              |

| Name                    |                                             | unit                                 | VMC640      | VMC740            |
|-------------------------|---------------------------------------------|--------------------------------------|-------------|-------------------|
| Working table           | Table size                                  | mm                                   | 920×400     | 920×400           |
|                         | Max.table load                              | kg                                   | 300         | 300               |
| travel                  | X/Y/Z axis travel                           | mm                                   | 650/400/500 | 700/400/500       |
|                         | Distance from spindle nose to table surface | mm                                   | 120~620     | 100-600           |
|                         | Distance from spindle axis to column        | mm                                   | 475         | 475               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   | m/min                                | 30/30/18    | 30/30/24          |
| Spindle                 | Main motor power                            | Kw                                   | 5.5/7.5     | 5.5/7.5           |
|                         | Max.spindle speed                           | rpm                                  | 6000        | 6000              |
|                         | Spindle taper                               |                                      | BT40        | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity               | pcs         | 16                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          | Φ 78/ Φ 120       |
|                         |                                             | Max. Length of tool                  | mm          | 300               |
|                         |                                             | Max. weight of tool                  | kg          | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity               | pcs         | 16                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          | Φ 80/ Φ 120       |
|                         |                                             | Max. Length of tool                  | mm          | 300               |
|                         |                                             | Max. weight of tool                  | kg          | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           | 3/7               |
| Machine accuracy        | Positioning accuracy (X/Y/Z)                |                                      | mm          | 0.025/0.022/0.022 |
|                         | Repeat positioning accuracy (X/Y/Z)         |                                      | mm          | 0.015/0.012/0.012 |
| Automatic chip conveyor |                                             |                                      | optional    | optional          |
| Machine weight          |                                             | kg                                   | 3500        | 3500              |

| Name                    |                                             | unit                                 | VMC855      | VMC855B           |
|-------------------------|---------------------------------------------|--------------------------------------|-------------|-------------------|
| Working table           | Table size                                  | mm                                   | 1000×550    | 1000×550          |
|                         | Max.table load                              | kg                                   | 500         | 500               |
| travel                  | X/Y/Z axis travel                           | mm                                   | 800/500/550 | 800/550/550       |
|                         | Distance from spindle nose to table surface | mm                                   | 150-700     | 150~700           |
|                         | Distance from spindle axis to column        | mm                                   | 610         | 590               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   | m/min                                | 30/30/24    | 30/30/18          |
| Spindle                 | Main motor power                            | Kw                                   | 11/15       | 11/15             |
|                         | Max.spindle speed                           | rpm                                  | 6000        | 6000              |
|                         | Spindle taper                               |                                      | BT40        | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity               | pcs         | 24                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          | φ 78/ φ 120       |
|                         |                                             | Max. Length of tool                  | mm          | 300               |
|                         |                                             | Max. weight of tool                  | kg          | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity               | pcs         | NO                |
|                         |                                             | Max.tool diameter (full/empty)       | mm          |                   |
|                         |                                             | Max. Length of tool                  | mm          |                   |
|                         |                                             | Max. weight of tool                  | kg          |                   |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s           |                   |
| Machine accuracy        | Positioning accuracy (X/Y/Z)                |                                      | mm          | 0.025/0.022/0.025 |
|                         | Repeat positioning accuracy (X/Y/Z)         |                                      | mm          | 0.015/0.012/0.015 |
| Automatic chip conveyor |                                             |                                      | optional    | optional          |
| Machine weight          |                                             | kg                                   | 5000        | 5000              |

| Name                    |                                             |                                         | unit  | VMC850B           | VMC966            |
|-------------------------|---------------------------------------------|-----------------------------------------|-------|-------------------|-------------------|
| Working table           | Table size                                  |                                         | mm    | 1100×500          | 1000×550          |
|                         | Max.table load                              |                                         | kg    | 500               | 500               |
| travel                  | X/Y/Z axis travel                           |                                         | mm    | 800/500/500       | 900/600/600       |
|                         | Distance from spindle nose to table surface |                                         | mm    | 150~650           | 100~700           |
|                         | Distance from spindle axis to column        |                                         | mm    | 560               | 630               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   |                                         | m/min | 24/24/18          | 30/30/24          |
| Spindle                 | Main motor power                            |                                         | Kw    | 11/15             | 11/15             |
|                         | Max.spindle speed                           |                                         | rpm   | 6000              | 6000              |
|                         | Spindle taper                               |                                         |       | BT40              | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity                  | pcs   | 24                | 24                |
|                         |                                             | Max.tool diameter （full/empty）          | mm    | Φ 78/ Φ 120       | Φ 78/ Φ 120       |
|                         |                                             | Max. Length of tool                     | mm    | 300               | 300               |
|                         |                                             | Max. weight of tool                     | kg    | 8                 | 8                 |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     | 1.75/5            | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity                  | pcs   | NO                | NO                |
|                         |                                             | Max.tool diameter （full/empty）          | mm    |                   |                   |
|                         |                                             | Max. Length of tool                     | mm    |                   |                   |
|                         |                                             | Max. weight of tool                     | kg    |                   |                   |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     |                   |                   |
| Machine accuracy        | Positioning accuracy （X/Y/Z）                |                                         | mm    | 0.032/0.025/0.025 | 0.032/0.025/0.025 |
|                         | Repeat positioning accuracy （X/Y/Z）         |                                         | mm    | 0.018/0.015/0.015 | 0.018/0.015/0.015 |
| Automatic chip conveyor |                                             |                                         |       | optional          | optional          |
| Machine weight          |                                             |                                         | kg    | 5300              | 5500              |

| Name                    |                                             |                                     | unit  | V8                | VMC1000           |
|-------------------------|---------------------------------------------|-------------------------------------|-------|-------------------|-------------------|
| Working table           | Table size                                  |                                     | mm    | 1000×500          | 1200×550          |
|                         | Max.table load                              |                                     | kg    | 500               | 500               |
| travel                  | X/Y/Z axis travel                           |                                     | mm    | 850/550/600       | 1000/550/600      |
|                         | Distance from spindle nose to table surface |                                     | mm    | 100~700           | 100~700           |
|                         | Distance from spindle axis to column        |                                     | mm    | 612               | 612               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   |                                     | m/min | 48/48/48          | 36/36/32          |
| Spindle                 | Main motor power                            |                                     | Kw    | 7.5/11 or 11/15   | 7.5/11 or 11/15   |
|                         | Max.spindle speed                           |                                     | rpm   | 12000             | 6000              |
|                         | Spindle taper                               |                                     |       | BT40              | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity              | pcs   | 24                | 24                |
|                         |                                             | Max.tool diameter（full/empty）       | mm    | Φ 78/ Φ 120       | Φ 78/ Φ 120       |
|                         |                                             | Max. Length of tool                 | mm    | 300               | 300               |
|                         |                                             | Max. weight of tool                 | kg    | 8                 | 8                 |
|                         |                                             | Tool change time（tool-tool/cut-cut） | s     | 1.75/5            | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity              | pcs   | NO                | NO                |
|                         |                                             | Max.tool diameter（full/empty）       | mm    |                   |                   |
|                         |                                             | Max. Length of tool                 | mm    |                   |                   |
|                         |                                             | Max. weight of tool                 | kg    |                   |                   |
|                         |                                             | Tool change time（tool-tool/cut-cut） | s     |                   |                   |
| Machine accuracy        | Positioning accuracy（X/Y/Z）                 |                                     | mm    | 0.032/0.025/0.025 | 0.032/0.025/0.025 |
|                         | Repeat positioning accuracy（X/Y/Z）          |                                     | mm    | 0.018/0.015/0.015 | 0.018/0.015/0.015 |
| Automatic chip conveyor |                                             |                                     |       | optional          | optional          |
| Machine weight          |                                             |                                     | kg    | 5500              | 5800              |

| Name                    |                                      |                                         | unit  | VMC1100(box way)  | VMC1100（linear way） |
|-------------------------|--------------------------------------|-----------------------------------------|-------|-------------------|---------------------|
| Working table           | Table size                           |                                         | mm    | 1100×600          | 1300×600            |
|                         | Max.table load                       |                                         | kg    | 800               | 1000                |
| travel                  | X/Y/Z axis travel                    |                                         | mm    | 1100/600/600      | 1100/600/600        |
|                         | Distance from spindle nose to table  |                                         | mm    | 125-725           | 150-750             |
|                         | Distance from spindle axis to column |                                         | mm    | 630               | 630                 |
| Rapid feed              | Rapid feed speed on X/Y/Z            |                                         | m/min | 24/24/18          | 36/36/30            |
| Spindle                 | Main motor power                     |                                         | Kw    | 11/15             | 11/15               |
|                         | Max.spindle speed                    |                                         | rpm   | 6000              | 6000                |
|                         | Spindle taper                        |                                         |       | BT40              | BT40                |
| Tool magazine           | Arm type tool magazine               | Tool magazine capacity                  | pcs   | 24                | 24                  |
|                         |                                      | Max.tool diameter（full/empty）           | mm    | Φ 78/Φ 120        | Φ 78/Φ 120          |
|                         |                                      | Max. Length of tool                     | mm    | 300               | 300                 |
|                         |                                      | Max. weight of tool                     | kg    | 8                 | 8                   |
|                         |                                      | Tool change time<br>（tool-tool/cut-cut） | s     | 1.75/5            | 1.75/5              |
|                         | Umbrella type tool magazine          | Tool magazine capacity                  | pcs   | NO                | NO                  |
|                         |                                      | Max.tool diameter（full/empty）           | mm    |                   |                     |
|                         |                                      | Max. Length of tool                     | mm    |                   |                     |
|                         |                                      | Max. weight of tool                     | kg    |                   |                     |
|                         |                                      | Tool change time<br>（tool-tool/cut-cut） | s     |                   |                     |
| Machine accuracy        | Positioning accuracy（X/Y/Z）          |                                         | mm    | 0.032/0.025/0.025 | 0.032/0.025/0.025   |
|                         | Repeat positioning accuracy（X/Y/Z）   |                                         | mm    | 0.018/0.015/0.015 | 0.018/0.015/0.015   |
| Automatic chip conveyor |                                      |                                         |       | optional          | optional            |
| Machine weight          |                                      |                                         | kg    | 6500              | 6700                |

| Name                    |                                             | unit                                 | VMC1160      | VMC1200           |
|-------------------------|---------------------------------------------|--------------------------------------|--------------|-------------------|
| Working table           | Table size                                  | mm                                   | 1200×600     | 1220×620          |
|                         | Max.table load                              | kg                                   | 600          | 1000              |
| travel                  | X/Y/Z axis travel                           | mm                                   | 1100/600/600 | 1200/600/600      |
|                         | Distance from spindle nose to table surface | mm                                   | 120-720      | 150-750           |
|                         | Distance from spindle axis to column        | mm                                   | 672          | 660               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   | m/min                                | 30/30/24     | 24/24/18          |
| Spindle                 | Main motor power                            | Kw                                   | 11/15        | 11/15             |
|                         | Max.spindle speed                           | rpm                                  | 6000         | 6000              |
|                         | Spindle taper                               |                                      | BT40         | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity               | pcs          | 24                |
|                         |                                             | Max.tool diameter (full/empty)       | mm           | Φ 78/ Φ 120       |
|                         |                                             | Max. Length of tool                  | mm           | 300               |
|                         |                                             | Max. weight of tool                  | kg           | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s            | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity               | pcs          | NO                |
|                         |                                             | Max.tool diameter (full/empty)       | mm           |                   |
|                         |                                             | Max. Length of tool                  | mm           |                   |
|                         |                                             | Max. weight of tool                  | kg           |                   |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s            |                   |
| Machine accuracy        | Positioning accuracy (X/Y/Z)                |                                      | mm           | 0.032/0.025/0.025 |
|                         | Repeat positioning accuracy (X/Y/Z)         |                                      | mm           | 0.018/0.015/0.015 |
| Automatic chip conveyor |                                             |                                      | optional     | optional          |
| Machine weight          |                                             | kg                                   | 6000         | 8200              |

| Name                    |                                      |                                         | unit  | VMC1300           | VMC1580           |
|-------------------------|--------------------------------------|-----------------------------------------|-------|-------------------|-------------------|
| Working table           | Table size                           |                                         | mm    | 1500×700          | 1700×800          |
|                         | Max.table load                       |                                         | kg    | 1000              | 1500              |
| travel                  | X/Y/Z axis travel                    |                                         | mm    | 1300/700/700      | 1500/800/700      |
|                         | Distance from spindle nose to table  |                                         | mm    | 160-860           | 160-860           |
|                         | Distance from spindle axis to column |                                         | mm    | 760               | 810               |
| Rapid                   | Rapid feed speed on X/Y/Z            |                                         | m/min | 24/24/18          | 18/18/15          |
| Spindle                 | Main motor power                     |                                         | Kw    | 11/15             | 15/18.5           |
|                         | Max.spindle speed                    |                                         | rpm   | 6000              | 4000              |
|                         | Spindle taper                        |                                         |       | BT50              | BT50              |
| Tool magazine           | Arm type tool magazine               | Tool magazine capacity                  | pcs   | 24                | 24                |
|                         |                                      | Max.tool diameter                       | mm    | Φ 110/ Φ 200      | Φ 110/ Φ 200      |
|                         |                                      | Max. Length of tool                     | mm    | 350               | 350               |
|                         |                                      | Max. weight of tool                     | kg    | 18                | 18                |
|                         |                                      | Tool change time<br>(tool-tool/cut-cut) | s     | 3/7               | 3/7               |
|                         | Umbrella type tool magazine          | Tool magazine capacity                  | pcs   | NO                | NO                |
|                         |                                      | Max.tool diameter                       | mm    |                   |                   |
|                         |                                      | Max. Length of tool                     | mm    |                   |                   |
|                         |                                      | Max. weight of tool                     | kg    |                   |                   |
|                         |                                      | Tool change time<br>(tool-tool/cut-cut) | s     |                   |                   |
| Machine accuracy        | Positioning accuracy (X/Y/Z)         |                                         | mm    | 0.042/0.025/0.025 | 0.042/0.025/0.025 |
|                         | Repeat positioning accuracy (X/Y/Z)  |                                         | mm    | 0.020/0.015/0.015 | 0.020/0.015/0.015 |
| Automatic chip conveyor |                                      |                                         |       | optional          | optional          |
| Machine weight          |                                      |                                         | kg    | 10000             | 13000             |

| Name                    |                                             |                                         | unit  | VMC1600           | VMC1800           |
|-------------------------|---------------------------------------------|-----------------------------------------|-------|-------------------|-------------------|
| Working table           | Table size                                  |                                         | mm    | 1800×800          | 2000×900          |
|                         | Max.table load                              |                                         | kg    | 2000              | 2000              |
| travel                  | X/Y/Z axis travel                           |                                         | mm    | 1600/850/700      | 1800/900/700      |
|                         | Distance from spindle nose to table surface |                                         | mm    | 200-900           | 200-900           |
|                         | Distance from spindle axis to column        |                                         | mm    | 930               | 960               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   |                                         | m/min | 15/15/12          | 15/15/12          |
| Spindle                 | Main motor power                            |                                         | Kw    | 15/18.5           | 15/18.5           |
|                         | Max.spindle speed                           |                                         | rpm   | 4000              | 4000              |
|                         | Spindle taper                               |                                         |       | BT50              | BT50              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity                  | pcs   | 24                | 24                |
|                         |                                             | Max.tool diameter（full/empty）           | mm    | Φ 110/ Φ 200      | Φ 110/ Φ 200      |
|                         |                                             | Max. Length of tool                     | mm    | 350               | 350               |
|                         |                                             | Max. weight of tool                     | kg    | 18                | 18                |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     | 3/7               | 3/7               |
|                         | Umbrella type tool magazine                 | Tool magazine capacity                  | pcs   | NO                | NO                |
|                         |                                             | Max.tool diameter（full/empty）           | mm    |                   |                   |
|                         |                                             | Max. Length of tool                     | mm    |                   |                   |
|                         |                                             | Max. weight of tool                     | kg    |                   |                   |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     |                   |                   |
| Machine accuracy        | Positioning accuracy（X/Y/Z）                 |                                         | mm    | 0.042/0.032/0.025 | 0.042/0.032/0.025 |
|                         | Repeat positioning accuracy（X/Y/Z）          |                                         | mm    | 0.020/0.018/0.015 | 0.020/0.018/0.01  |
| Automatic chip conveyor |                                             |                                         |       | optional          | optional          |
| Machine weight          |                                             |                                         | kg    | 18500             | 19000             |

| Name                    |                                             | unit                                 | VDC1270      | VDC4050           |
|-------------------------|---------------------------------------------|--------------------------------------|--------------|-------------------|
| Working table           | Table size                                  | mm                                   | 1400×700     | 1100×500          |
|                         | Max.table load                              | kg                                   | 1000         | 500               |
| travel                  | X/Y/Z axis travel                           | mm                                   | 1300/700/700 | 800/500/700       |
|                         | Distance from spindle nose to table surface | mm                                   | 200~900      | 200~900           |
|                         | Distance from spindle axis to column        | mm                                   | 780          | 560               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   | m/min                                | 24/24/18     | 24/24/18          |
| Spindle                 | Main motor power                            | Kw                                   | 15           | 11/15             |
|                         | Max.spindle speed                           | rpm                                  | 4000         | 6000              |
|                         | Spindle taper                               |                                      | BT40         | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity               | pcs          | 24                |
|                         |                                             | Max.tool diameter (full/empty)       | mm           | Φ 78/ Φ 120       |
|                         |                                             | Max. Length of tool                  | mm           | 300               |
|                         |                                             | Max. weight of tool                  | kg           | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) | s            | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity               | NO           | 16                |
|                         |                                             | Max.tool diameter (full/empty)       |              | Φ 80/ Φ 120       |
|                         |                                             | Max. Length of tool                  |              | 300               |
|                         |                                             | Max. weight of tool                  |              | 8                 |
|                         |                                             | Tool change time (tool-tool/cut-cut) |              | 3/7               |
| Machine accuracy        | Positioning accuracy (X/Y/Z)                |                                      | mm           | 0.025/0.022/0.025 |
|                         | Repeat positioning accuracy (X/Y/Z)         |                                      | mm           | 0.015/0.012/0.015 |
| Automatic chip conveyor |                                             |                                      | optional     | optional          |
| Machine weight          |                                             | kg                                   | 8500         | 5500              |

| Name                    |                                             |                                         | unit  | VNM5710           |
|-------------------------|---------------------------------------------|-----------------------------------------|-------|-------------------|
| Working table           | Table size                                  |                                         | mm    | 1300×570          |
|                         | Max.table load                              |                                         | kg    | 1000              |
| travel                  | X/Y/Z axis travel                           |                                         | mm    | 1050/570/600      |
|                         | Distance from spindle nose to table surface |                                         | mm    | 150-750           |
|                         | Distance from spindle axis to column        |                                         | mm    | 590               |
| Rapid feed              | Rapid feed speed on X/Y/Z                   |                                         | m/min | 36/36/30          |
| Spindle                 | Main motor power                            |                                         | Kw    | 11/18.5           |
|                         | Max.spindle speed                           |                                         | rpm   | 10000             |
|                         | Spindle taper                               |                                         |       | BT40              |
| Tool magazine           | Arm type tool magazine                      | Tool magazine capacity                  | pcs   | 24                |
|                         |                                             | Max.tool diameter （full/empty）          | mm    | Φ 78/ φ 120       |
|                         |                                             | Max. Length of tool                     | mm    | 300               |
|                         |                                             | Max. weight of tool                     | kg    | 8                 |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     | 1.75/5            |
|                         | Umbrella type tool magazine                 | Tool magazine capacity                  | pcs   | NO                |
|                         |                                             | Max.tool diameter （full/empty）          | mm    |                   |
|                         |                                             | Max. Length of tool                     | mm    |                   |
|                         |                                             | Max. weight of tool                     | kg    |                   |
|                         |                                             | Tool change time<br>（tool-tool/cut-cut） | s     |                   |
| Machine accuracy        | Positioning accuracy （X/Y/Z）                |                                         | mm    | 0.032/0.025/0.025 |
|                         | Repeat positioning accuracy （X/Y/Z）         |                                         | mm    | 0.018/0.015/0.015 |
| Automatic chip conveyor |                                             |                                         |       | optional          |
| Machine weight          |                                             |                                         | kg    | 6700              |

### 3.3 Machine working environment requirements

1. Maintaining a constant level of ambient temperature is an essential factor for precision machining. The ambient temperature requires  $10^{\circ}\text{C} \sim 40^{\circ}\text{C}$ , when the ambient temperature is  $20^{\circ}\text{C}$ , the humidity should be  $40 \sim 75\%$ . In order to keep the static accuracy of the machine within the specified range, the best ambient temperature requires  $15^{\circ}\text{C} \sim 25^{\circ}\text{C}$ , and the temperature difference should not exceed  $\pm 2^{\circ}\text{C}/24\text{h}$ .
2. Power supply voltage: 3-phase, 380V, within  $\pm 10\%$  of voltage fluctuation, power supply frequency:  $50 \pm 0.5\text{HZ}$ .
3. If the voltage in the application area is unstable, the machine should be equipped with a regulated power supply to ensure the normal operation of the machine .
4. The machine tool should have a reliable grounding: the grounding wire is a copper wire and should be connected to a separate ground rod, the wire diameter should not be less than  $10\text{mm}^2$ , and the grounding resistance should be less than  $10\Omega$  .
5. In order to ensure the normal working performance of the equipment, if the compressed air of the air source does not meet the air source requirements, a set of air source purification devices (dehumidification, oil removal, filtration) should be added before the air intake.
6. The machine should be kept away from direct sunlight, vibration sources and heat sources, and away from high-frequency generators, electric welding machines, etc., to avoid the production failure or loss of machine accuracy.
7. Prevent the machine from abnormal vibration from outside.

## 4. Machine transportation, installation and debugging

### 4.1 Lifting of the machines

When hoisting the machines, take special care to prevent the NC system and high-voltage switch board from being impacted. Before lifting the machine, check whether all parts are firm and immobile, and whether there are any items that should not be placed on the machine.

#### 4.1.1. Precautions

(1) The protective door is in an open state and the angle iron is used to connect and fix the door with the outer protective door.

(2) The headstock is moved to the lowest position and fixed with a transportation fixture.

(3) When lifting machines with packaging boxes by crane, they should be lifted with steel wire ropes in accordance with the lifting signs on the packaging boxes to minimize various shocks and vibrations on the packaging boxes.

(4) The packing box is not allowed to incline excessively under no circumstances. When using the roller to move the packaging box on a slope, the inclination should not be greater than  $15^{\circ}$ , and the diameter of the roller should not exceed 70mm. The packaging box is not allowed to be placed on an angular object or placed upside down, so as not to affect the accuracy of the machine.

(5) There should be no strong impact or vibration during hoisting and transportation, and it is strictly forbidden to invert or tilt the packaging box.

(6) Do not allow steel cables to squeeze oil pipes, air pipes, cables, NC devices, electrical cabinets, hydraulic components, etc. during lifting.

(7) Before unpacking, the lifting should be carried out in accordance with the signs on the surface of the packaging (lifting point, lifting direction, center of gravity, upwards, etc.), the height of the hanging point from the bottom of the box should not be less than 5 meters,

and the lifting wire rope angle should not be greater than  $60^{\circ}$  .

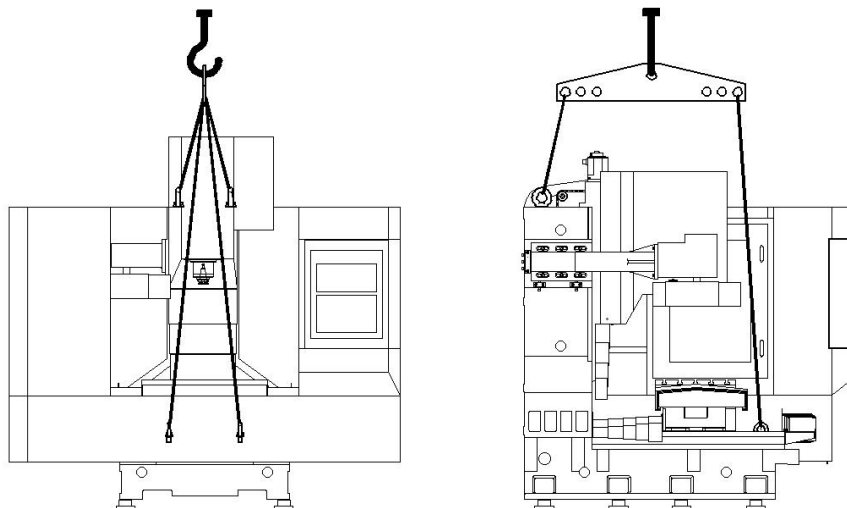
( 8 ) When unpacking, first check the external condition of the machine, and check whether the accessories and tools are complete according to the "packing list".

#### 4.1.2. Machine lifting

The machine base is equipped with eyebolts (or the casting hole is used to pass the suspension bar), and the machine tool column is equipped with a lifting plate. When hoisting the machine, use the wire rope to hoist the machine through these three lifting points. The load-bearing capacity of the wire rope must meet certain requirements; the hoisting capacity of the crane must also meet the corresponding requirements. Remove the coolant tank before hoisting; in order to prevent the wire rope from damaging the machine , electrical cabinet and machine protective cover during hoisting, the wire rope should be spread at the upper end, and wood blocks or other soft materials should be placed at the contact between the machine and the wire rope to protect the paint.

See the figure below for the lifting diagram.

Before the machine is hoisted and transported, in order to prevent vibration from damaging the machine, supports and fasteners must be used to support and fasten the moving parts. When the machine is installed at the work site, all supporting fasteners must be removed before starting the machine.



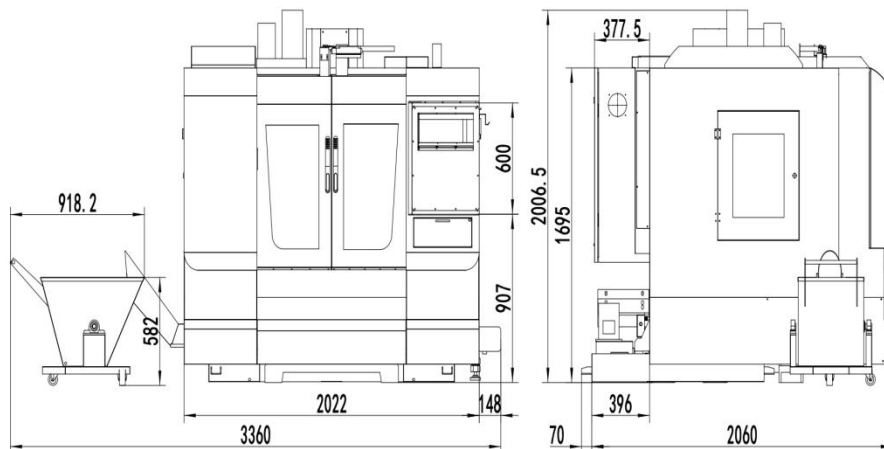
## 4.2 Machine installation

For the machine, the installation method has a great influence on the function of the machine tool. If the guide rail of a machine is precisely machined, and the machine is not installed properly, it will not reach the initial machining accuracy. In this way, it is difficult to obtain the required machining accuracy. Most failures are caused by improper installation. Therefore, the installation steps must be carefully read and installed in accordance with the specified installation requirements, so that the machine can achieve high-precision processing.

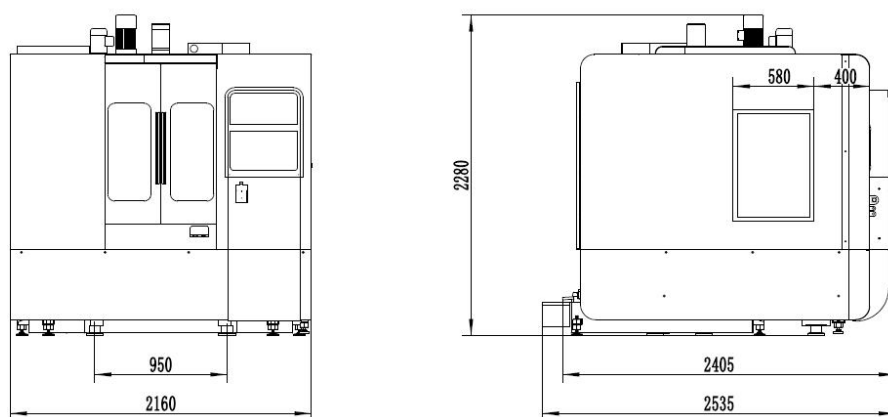
### 4.2.1. General requirements for equipment

Too high temperature will reduce the service life of electrical components. Too much humidity may cause the CNC system to malfunction. Too low temperature will increase the viscosity of the oil and cause deterioration of the working conditions of the oil pump. In addition, the influence of electromagnetic pulses generated by wire cutting and electric welding on the CNC system should also be avoided. Therefore, this machine tool should be installed in a workshop with better conditions, and certain measures should be taken to control temperature, humidity, vibration, and dust. In addition, in order to facilitate maintenance and inspection operations in the future, please reserve an appropriate space beside the machine installation location.

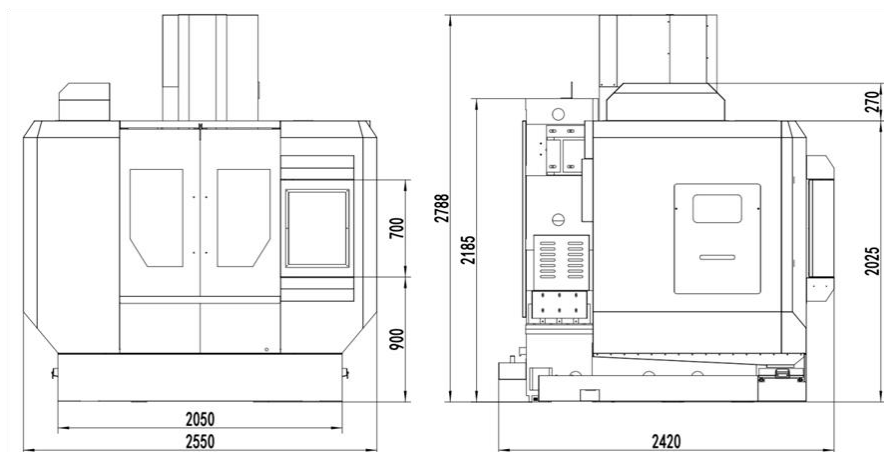
#### 4.2.2. Machine outline drawing



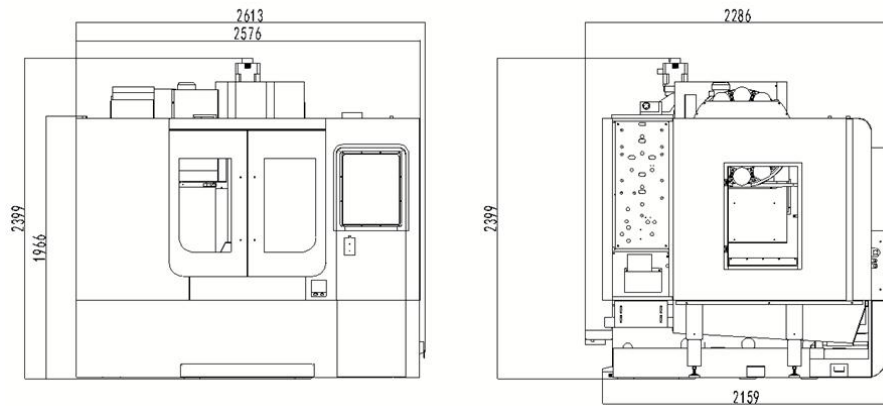
V4/VMC400E Outline



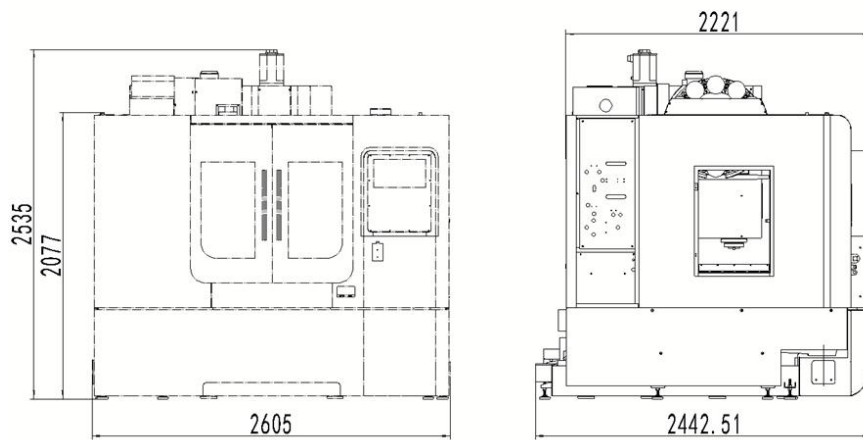
VMC640/VMC740 Outline



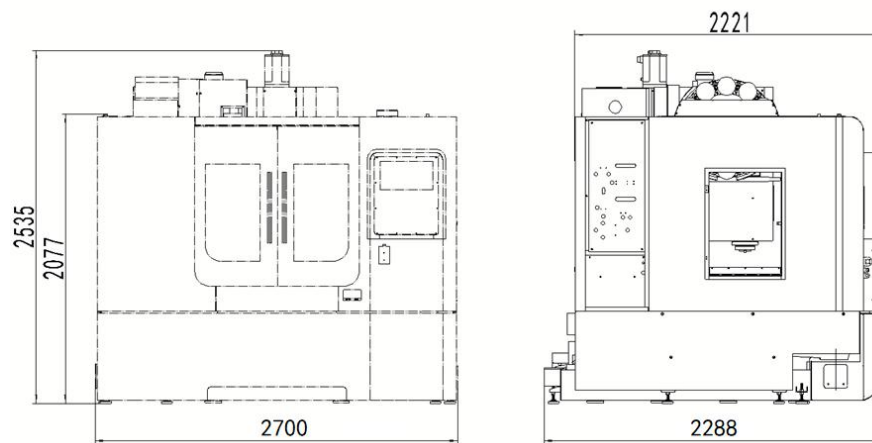
VMC855/VMC855B Outline



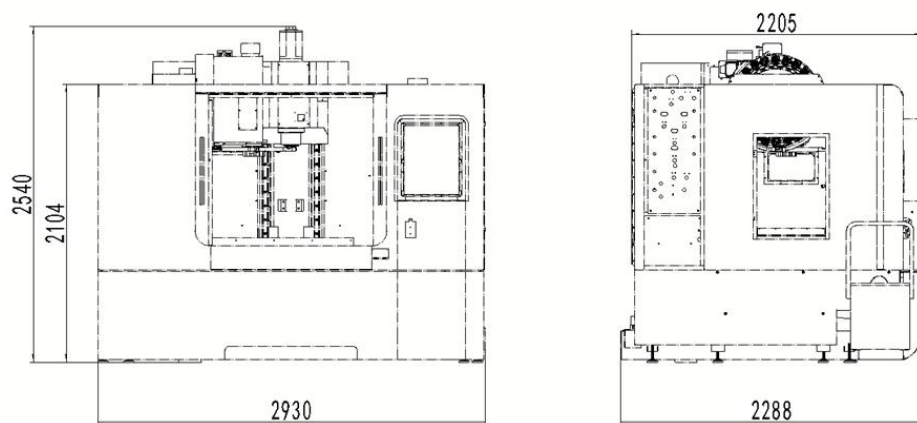
VMC850B Outline



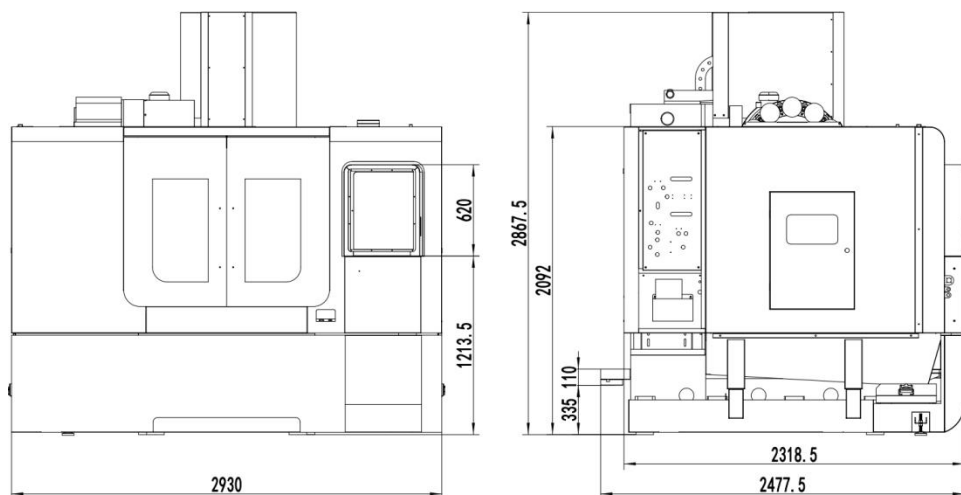
V8 Outline



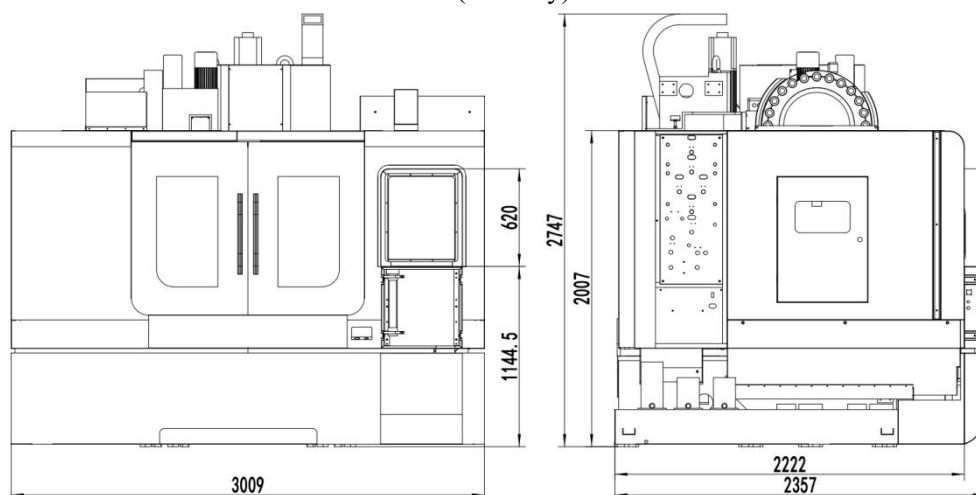
VMC966 Outline



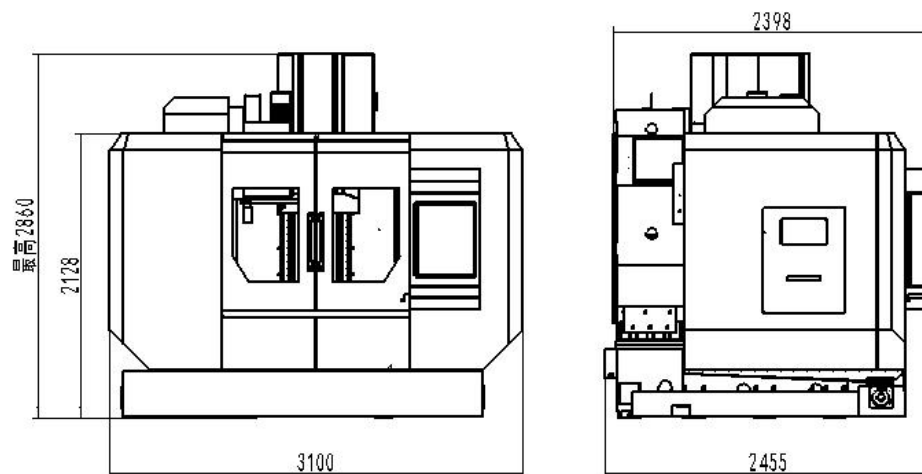
VMC1000 Outline



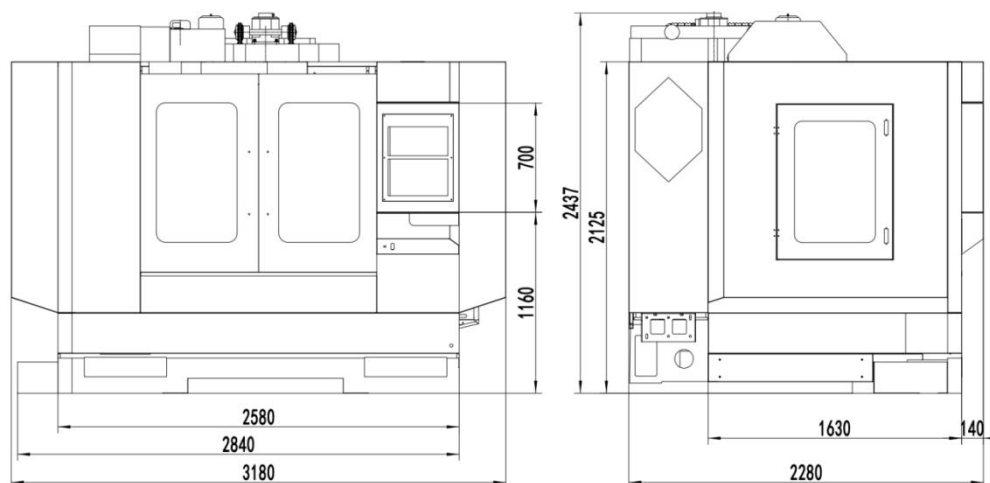
VMC1100(box way) Outline



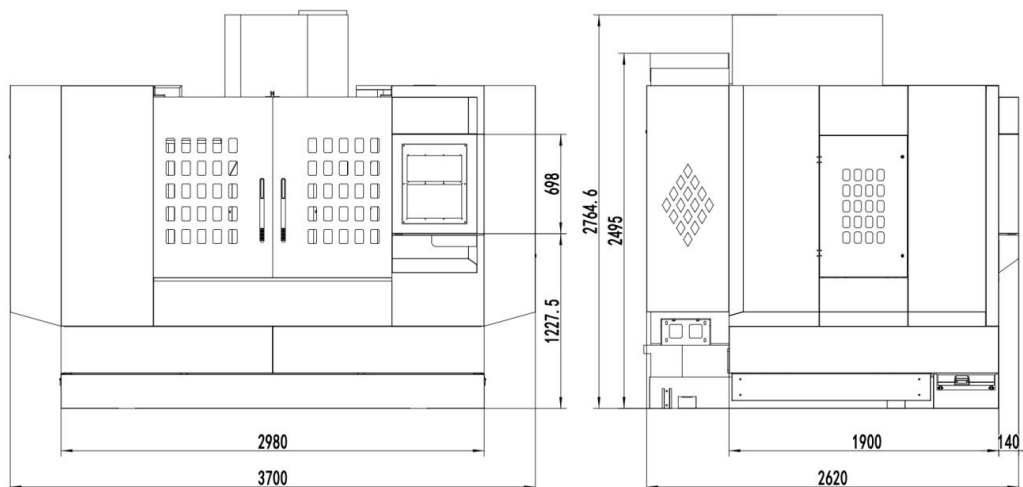
VMC1100(linear way) Outline



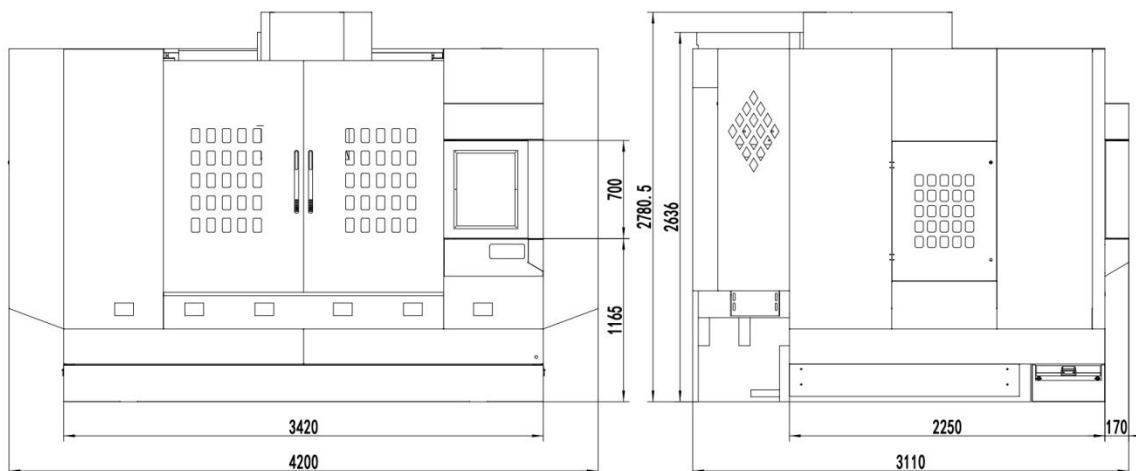
VMC1160 Outline



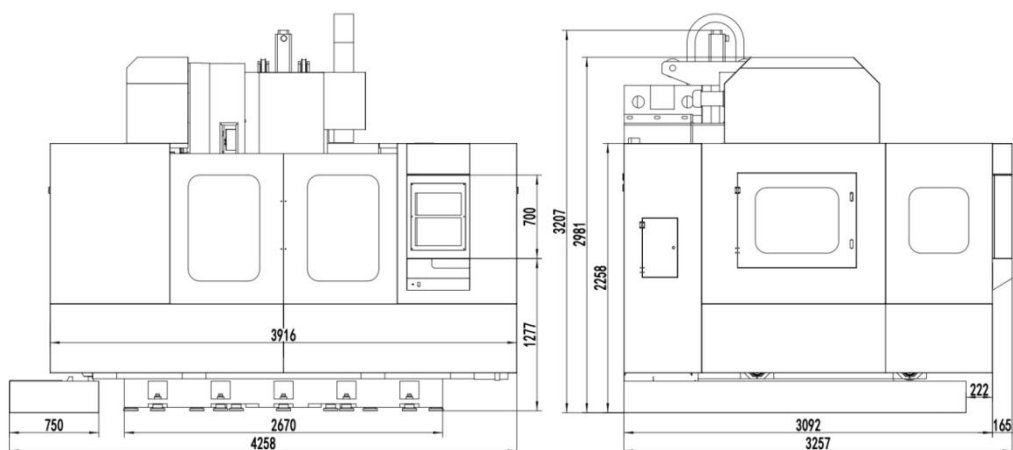
VMC1200 Outline



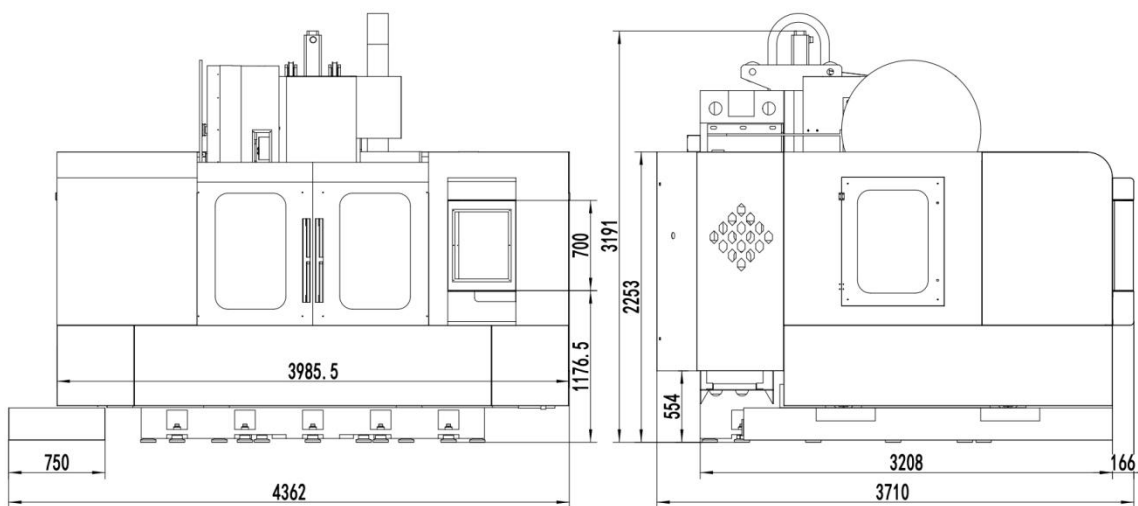
VMC1300 Outline



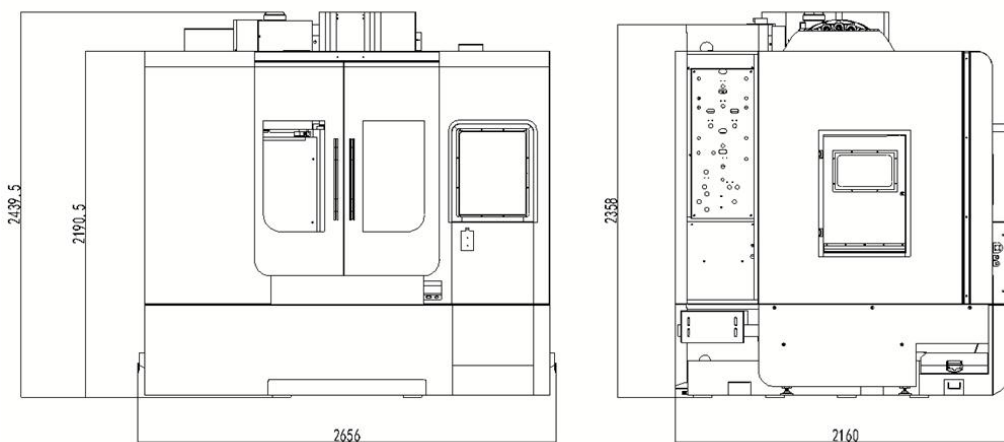
VMC1580 Outline



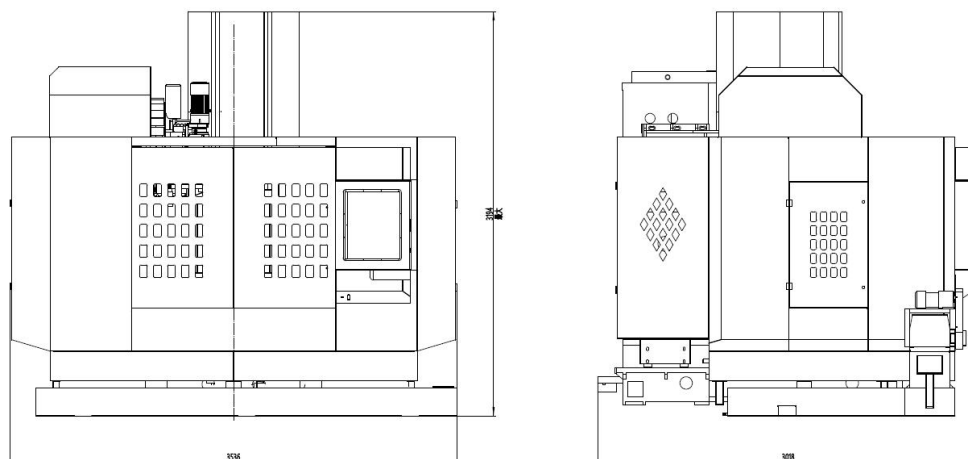
VMC1600 Outline



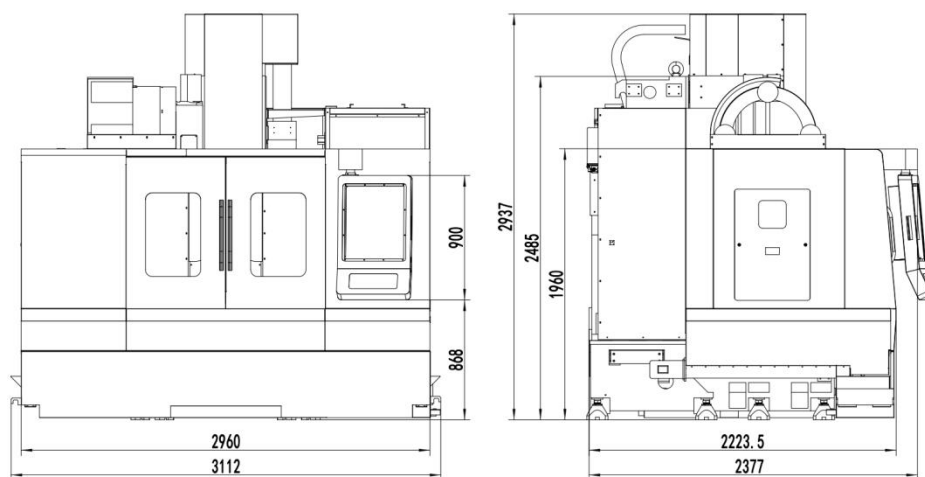
VMC1800 Outline



VDC4050 Outline



VDC1270 Outline



VNM5710 Outline

#### 4.2.3 Machine foundation and foundation plan

To install the machine tool, choose a flat place first. Then determine the installation space and make the foundation according to the specified environmental requirements and foundation plan.

In addition to the space required for the operation of the machine tool, the space required for maintenance should also be considered. This requirement has been specified in the foundation plan.

**Cautions:**

(1) The deeper the foundation concrete for laying the foundation, the better the stability of the machine tool, and it must be noted that the concrete must not be cracked.

(2) Please measure and reserve the positions of the foundation bolt holes and foundation adjustment holes. Please note that the reserved holes are preferably wedge-shaped holes and the surface should be rough and uneven to ensure that the next time the foundation is poured, the best strength can be obtained

(3) When pouring foundation concrete, please reserve a grounding hole and bury a copper rod with a length of 2m or more and a diameter of 15mm.

(4) The machine can be installed 7-10 days after foundation construction. (Depending on actual local conditions).

(5) After the initial level adjustment of the machine, the foundation bolts are buried in the reserved holes, and quick-drying non-shrinking cement is poured.

(6) High-strength non-shrinkage grouting material is recommended for quick-drying cement for secondary irrigation of anchor bolts.

(7) Incoming power cable: cable YJV4\*16.

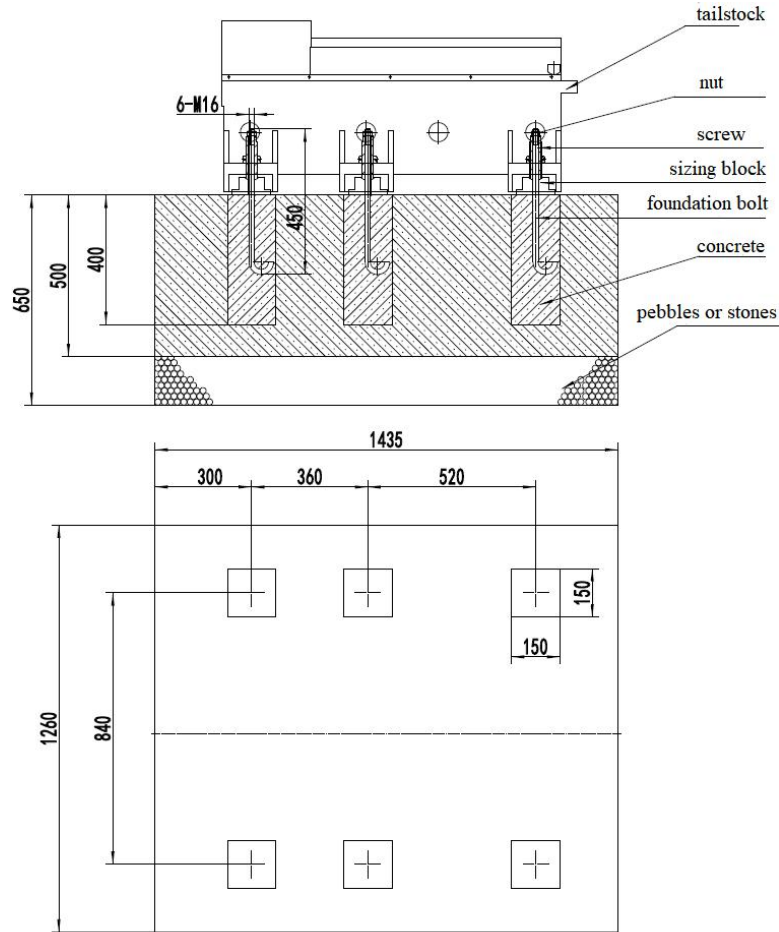
(8) Compressed air access preparation: air source filtration accuracy 100  $\mu$  m, air pipe outside diameter 10mm.

(9) Preparation for installing the spreader: wire rope (the load is within the corresponding

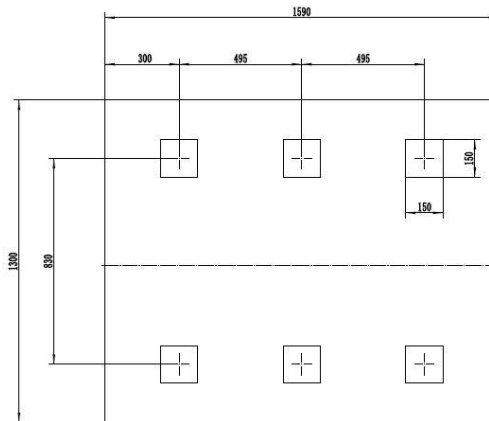
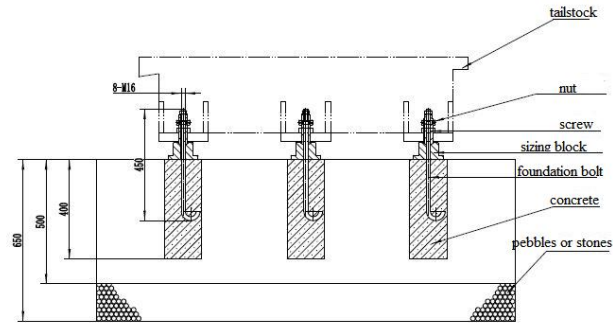
load-bearing range).

(10) After 7 days of pouring, finely adjust the machine level.

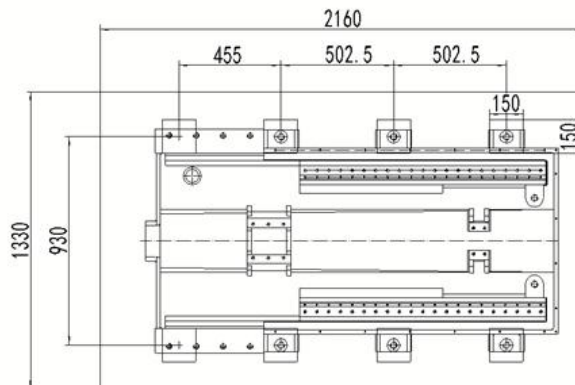
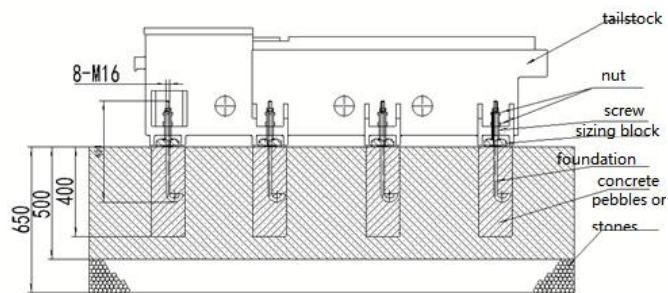
(11) The foundation drawing is as follows:



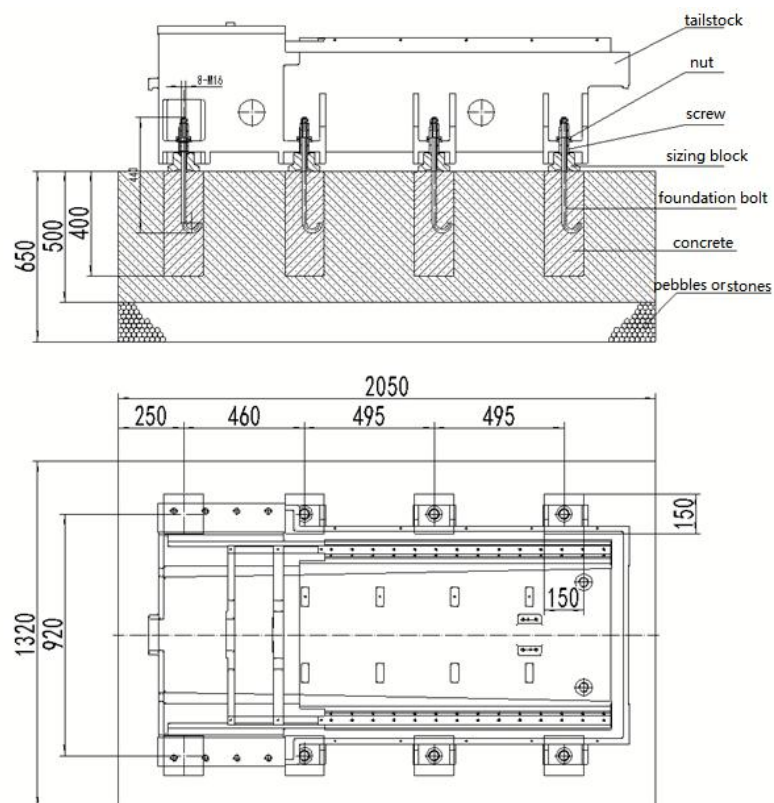
VMC400E foundation drawing



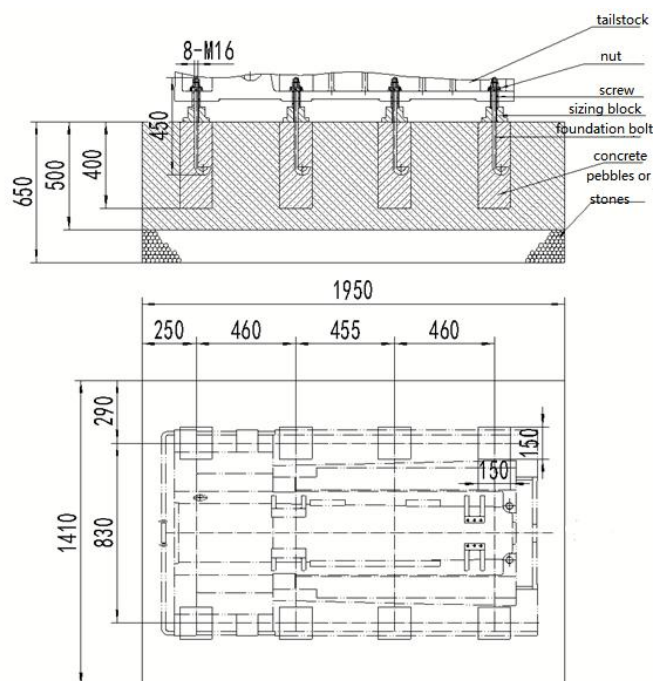
VMC640/VMC740 foundation drawing



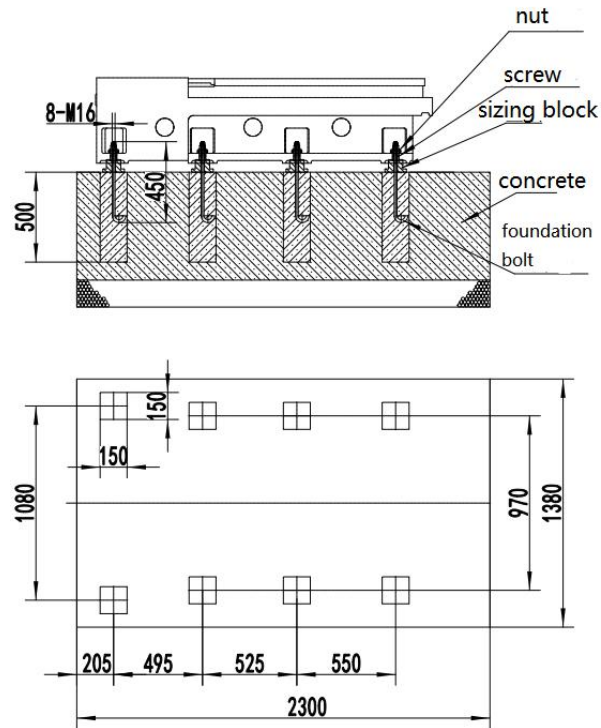
VMC855/VMC855B/VMC966 foundation drawing



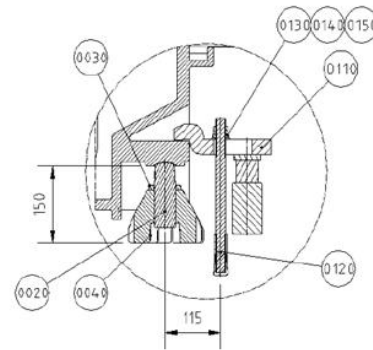
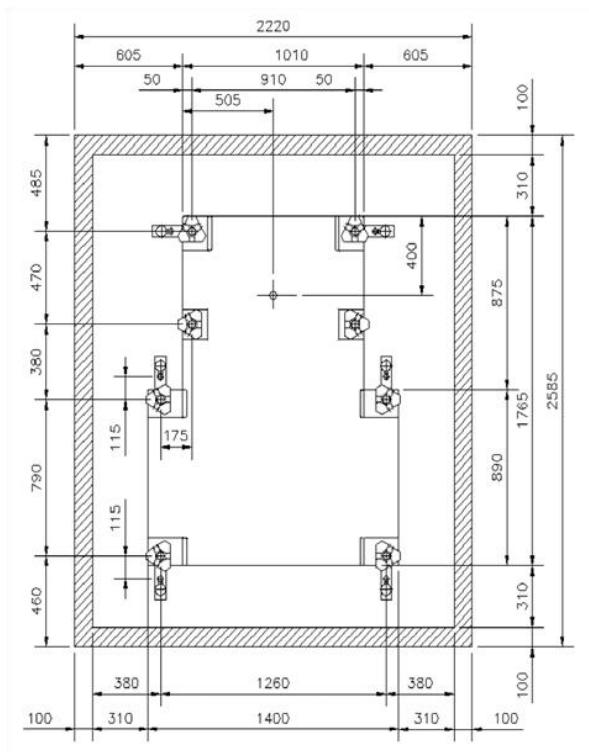
V8/VMC1000 foundation drawing



VMC850B/VDC4050 foundation drawing

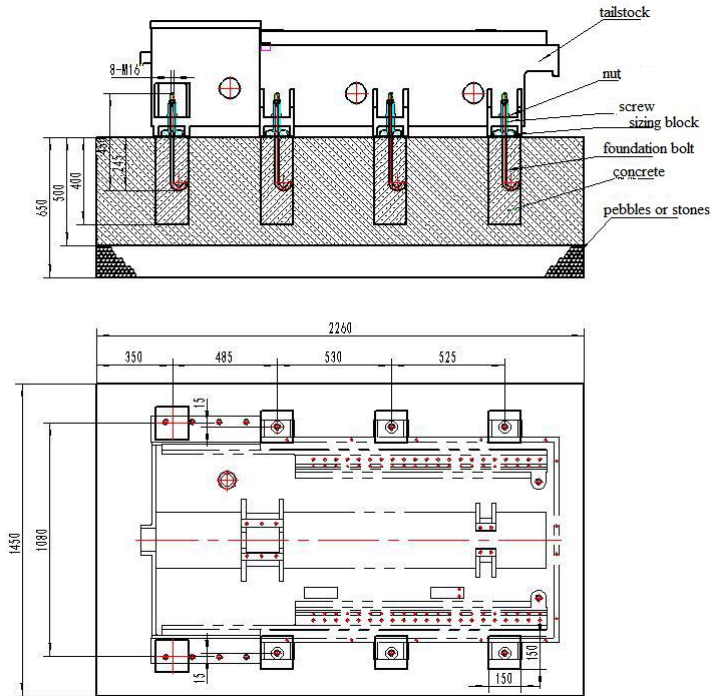


VMC1100 (box way) foundation drawing

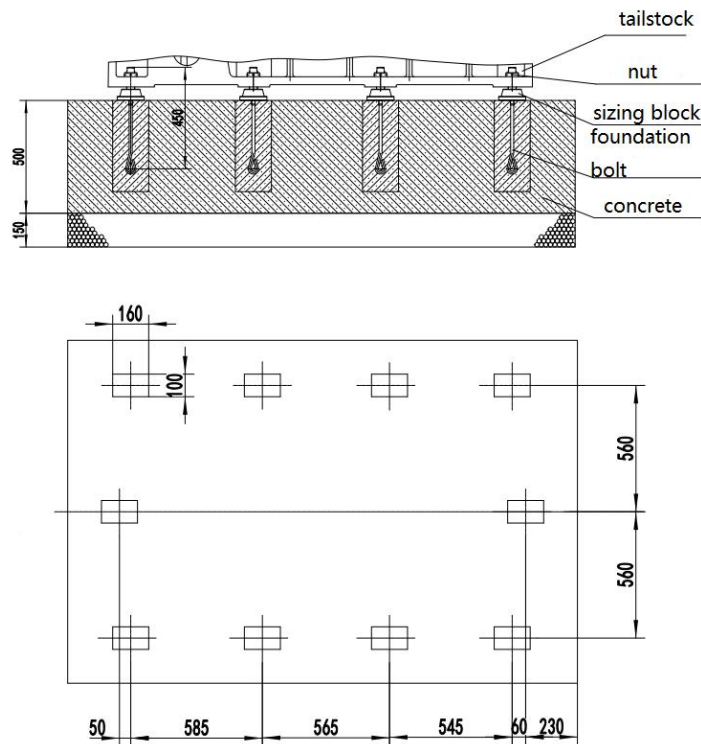


| NO.  | ITEM NO.     | DESCRIPTION           | Q'TY | MAT./SPEC | REMARKS |
|------|--------------|-----------------------|------|-----------|---------|
| 0020 | 120110-00005 | BOLT, LEVELING, VC430 | 8    |           |         |
| 0030 | S6260090     | NUT, LOCK             | 8    |           |         |
| 0040 | C64021113    | BLOCK, LEVELING       | 8    |           |         |
| 0100 |              | Z-clamp               | 6    |           | OPT     |
| 0110 |              | SUPPORT               | 6    |           | OPT     |
| 0120 |              | BOLT, ANCHOR          | 6    |           | OPT     |
| 0130 | S4001131     | NUT, HEX              | 6    | NA M20X16 | OPT     |
| 0140 | S5101101     | WASHER, SPRING        | 6    | ZS M20    | OPT     |
| 0150 | S5001101     | WASHER, PLAIN         | 6    | ZP M20    | OPT     |

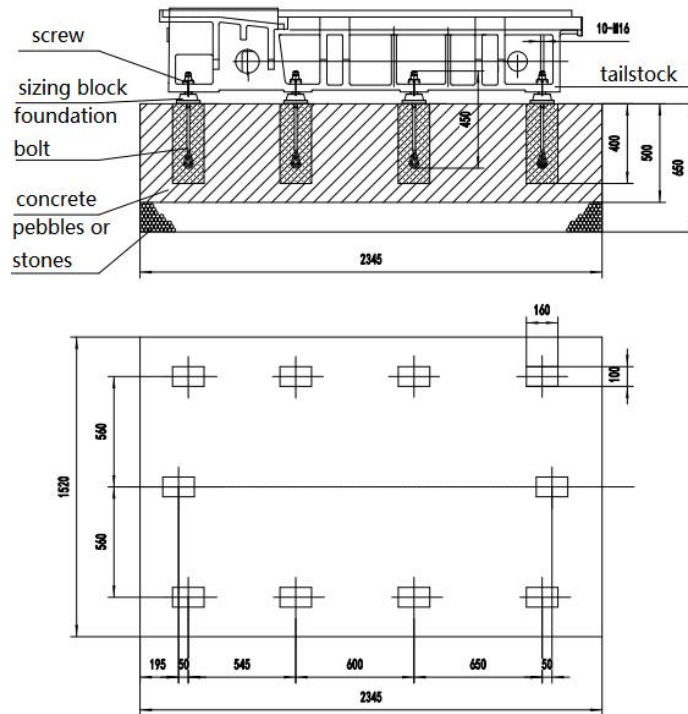
VMC1100 (linear way) / VNM5710 foundation drawing



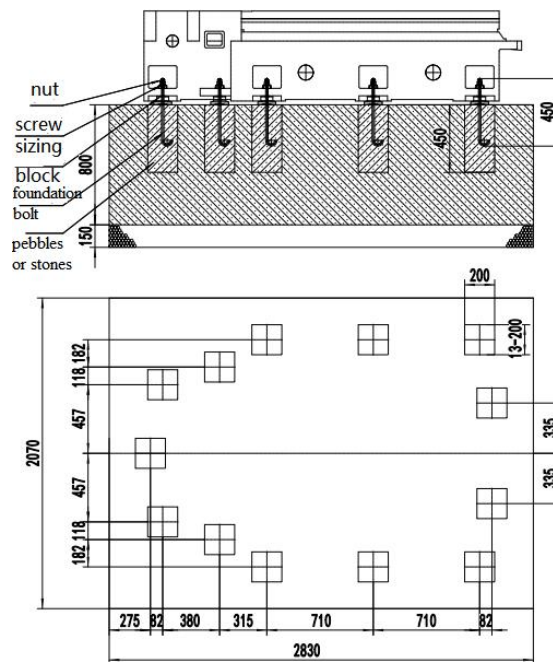
VMC1160 foundation drawing



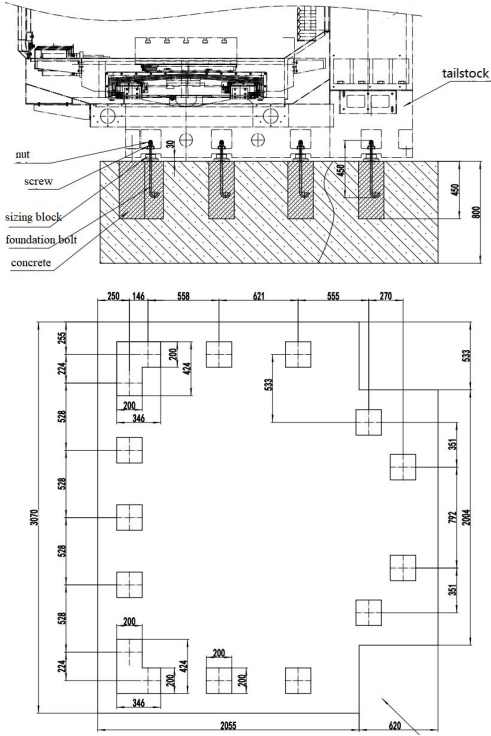
VMC1200 foundation drawing



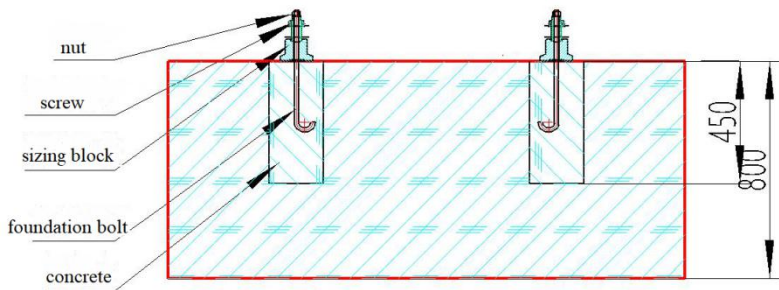
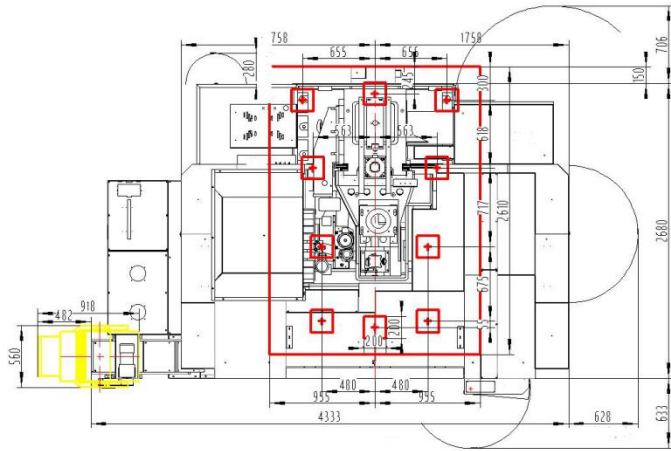
VMC1300 foundation drawing



VMC1580 foundation drawing



VMC1600/VMC1800 foundation drawing



VDC1270 foundation drawing

#### 4.2.4 Installation caution

- (1) Before positioning the machine, please put the sizing block in place. After the machine is put down, pay attention to check. Check that the sizing block is evenly supported under the machine.
- (2) After removing the anti-rust oil from the anti-rust parts of the machine with a clean cotton cloth, apply another layer of lubricating oil.
- (3) After confirming that the voltage, frequency and phase are all specified specifications, connect to the main power supply of the machine and perform grounding.
- (4) Connect the air pipe and adjust the air source pressure to 0.6~0.8MPa.
- (5) Wire the chip conveyor, cooling pump, and hydraulic station to confirm the direction of rotation.

### 4.3 Machine test run and debugging

#### 4.3.1. Precision adjustment

In order to maintain the accuracy of the machine tool, please carefully adjust the level of the machine tool according to the following steps.

- (1) Place the level in the center of the worktable.
- (2) Adjust the bolts at the four corners, first move the X axis direction and then move the Y direction repeatedly to adjust to the machine level.
- (3) Then adjust the other adjusting bolts, and pay attention to the weight of the machine to be evenly distributed on the bolts without affecting the level of the machine.
- (4) For the steps and tolerances of level adjustment, please refer to the "Accuracy Inspection Sheet" attached to each machine tool
- (5) After the level adjustment is completed, the anchor bolts and nuts should be tightened firmly to ensure that the level accuracy remains unchanged. The minimum scale of the level used is 0.02mm.

(6) The level of the machine tool needs to be checked and adjusted every six months to maintain the accuracy of the machine tool.

#### 4.3.2. Inspection before machine test run

(1) Check whether the transportation fixing components of the saddle, column and headstock are removed.

(2) All parts are complete, the placement and installation method are correct.

(3) Fill the lubrication pump, cam box, and oil cup with the specified type and quantity of lubricating oil.

(4) Fill the hydraulic station and the oil tank of the oil cooler with the specified type and quantity of hydraulic oil.

(5) All pipelines and joints are connected in good condition.

#### 4.3.3. Check before turning on the machine

##### (1) Power supply capacity

Where the machine tool is installed, the power supply capacity is sufficient and stable. Otherwise, insufficient power supply capacity or large voltage changes will have unexpected effects on various functions of the machine tool, reduce the life of various electrical components, and may also cause safety accidents. Therefore, please pay attention to the capacity of the power supply. For the total capacity of the power supply of the machine tool, please refer to the "Electrical Schematic and Interconnection Diagram" attached with the machine.

##### (2) Power phase sequence inspection

The phase sequence of the total power supply should be the same as specified by this machine tool. Otherwise, the NC device will be connected to the power supply, the machine tool will malfunction, the fuse will be blown, and even cause safety accidents, so the total power phase sequence must be checked.

##### (3) Servo transformer and spindle transformer inspection

When leaving the factory, the output terminal of the transformer is connected as

required, and the output terminal can be connected differently according to the actual situation. If the transformer is improperly connected and the power is turned on, the electrical parts of the machine tool will be burnt out. Please refer to the "Instruction Manual (Electrical Part)" and related materials for careful inspection.

#### 4.3.4. Test run of machine tool

The operator first carefully read the operating instructions (mechanical, electrical, hydraulic parts), machine tool numerical control system operating manual, servo unit, servo motor operating instructions and other documents, and operate manually, then automatically in accordance with the relevant operating methods and procedures.

#### 4.3.5 Machine adjustment

The movement speed and power of various hydraulic transmission parts of the machine tool have been adjusted to an appropriate state. If the user thinks it is not the best and needs further adjustment, please read the relevant content of this machine hydraulic operating manual.

#### 4.3.6. Machine operation

The operation of all actions of this machine tool and various instruction input, programming, modification and operation of various auxiliary functions are concentrated in the machine button station, and the machine tool can be operated by pressing the operation panel. For specific use and operation methods, please read the relevant content of the machine "Instruction Manual (Electrical Part)".

## **5. Features and usage methods of machine parts**

### **5.1 Base**

The base is the basic part of the machine tool and bears the weight, cutting force and cutting vibration of the machine tool. The base is designed and manufactured with high rigidity, and there are horizontal adjustment screws under the base to install the machine tool. A saddle is installed on the guide rail of the base, and the worktable is installed on the saddle, and the workpiece can be loaded and unloaded on the worktable. The saddle carries the worktable on the base to move forward and backward (Y direction), and the worktable moves in the left and right direction (X direction) on the saddle.

### **5.2 Column**

The column is a high-rigidity component that is installed on the base. A tool magazine is installed on the left side of the column, an electrical cabinet is installed on the right side, and a Z-axis feed motor is installed on the upper side.

### **5.3 Spindle box**

The spindle box is mounted on the guide rail in front of the column, and moves up and down (Z direction) on the column. The spindle motor, spindle and pneumatic cylinder are installed on spindle box. The spindle power is transmitted from the spindle motor to the spindle through the toothed belt (belt drive structure) or the spindle motor is directly transmitted to the spindle through the coupling (direct connection structure).

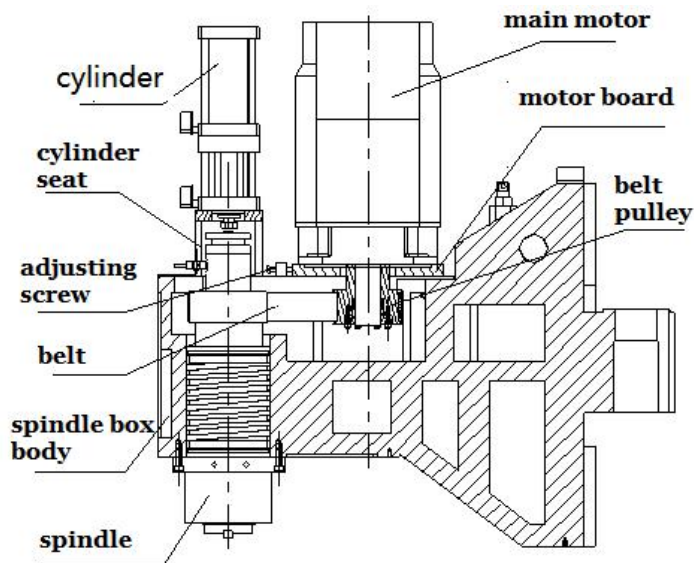
#### **5.3.1. Principle of belt spindle drive**

The spindle drive of the machine tool is driven by a synchronous toothed belt, and the power is transmitted from the spindle motor to the spindle through the toothed belt. When replacing the spindle drive belt, the original specifications and manufacturer's products should be used. The steps to replace the belt are as follows:

Remove the connecting pipe on the boosting cylinder → remove the cylinder seat → replace the belt → install the cylinder seat → install the connecting pipe on the cylinder → tension the belt.

The assembly diagram of the spindle box is as follows:

The belt is tightened by screwing two adjusting screws, moving the spindle motor board to tighten the belt, then locking the screws on the spindle motor board, and locking the loose nut of the adjusting screw. If the belt is too tight, it will cause additional load on the spindle bearing and reduce the belt life. When replacing the belt, avoid oil or grease contaminating the belt. This will also affect the belt life.



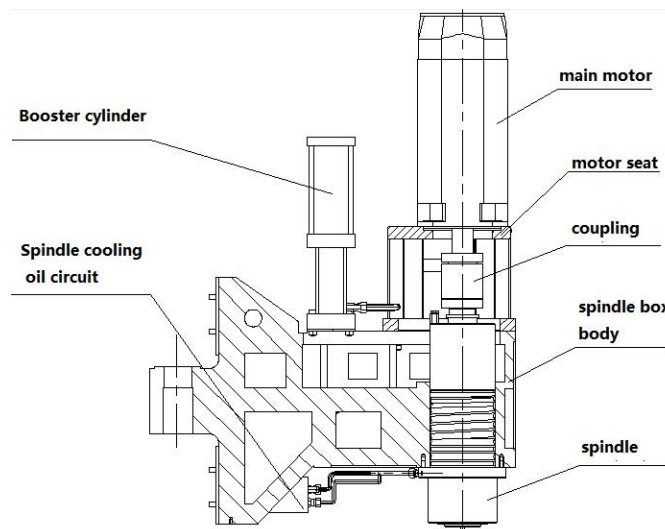
The spindle is equipped with an automatic tool clamping mechanism, and the pull stud at the end of the tool holder is pulled by the draw bar, butterfly spring and clamping jaw. Due to the use of different standard tool holders and pull studs, the tension mechanism has also been changed accordingly (users must pay attention when using the machine tool and ordering tool holders and pull studs). The pull studs used by different spindles and the required punching force are detailed in the following parameter table. When the tool is released, under the action of the cylinder located above the spindle, the draw bar is pushed to compress the butterfly spring to move forward until the outer side of the front end of the

gripper falls into the spindle front end groove . The draw bar continues to move forward to push the tool holder out of the spindle hole. The specific distance depends on the specifications of the selected pull stud. See the parameter table for details, and the tool release ends. In the process of loosening the tool, dry and clean compressed air is sent into the small hole in the middle of the draw bar and sprayed out through the spindle taper hole to clean the spindle taper hole and the taper surface of the tool holder. The parameter table is as follows:

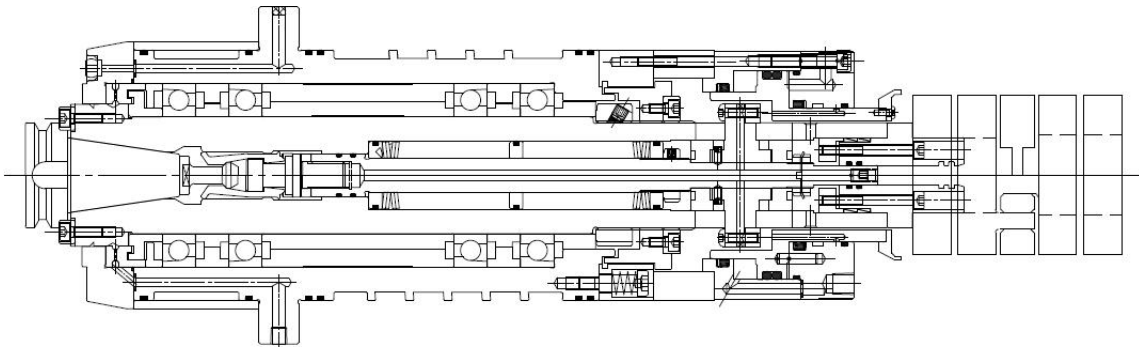
| Model<br>Item | boosting force | Boosting amount | Tool holder specifications |
|---------------|----------------|-----------------|----------------------------|
| 40#           | 3.5t           | 0.4-0.7mm       | BT/CAT/DIN/SK              |
| 50#           | 4.5/6t         | 0.5-1mm         | BT/CAT/DIN/SK              |

### 5.3.2. Principle of Direct-connected Spindle Drive

The spindle transmission of the machine tool is a direct-connection transmission, and the power is directly transmitted to the spindle by the spindle motor through the coupling. When the spindle fails, it needs to be disassembled. Please pay attention to the positioning pin connected to the motor base. When reinstalling, ensure that the coaxiality of the spindle rotation center and the motor rotation center is within  $5\ \mu\text{m}$ . Schematic diagram of spindle box assembly:



The spindle is equipped with an automatic tool clamping mechanism, and the pull stud at the end of the tool holder is pulled by the draw bar, butterfly spring and clamping jaw. Due to the use of different standard tool holders and pull studs, the tension mechanism has also been changed accordingly (users must pay attention when using the machine tool and ordering tool holders and pull studs). The pull studs used by different spindles and the required punching force are detailed in the following parameter table. When the tool is released, under the action of the cylinder located above the spindle, the draw bar is pushed to compress the butterfly spring to move forward until the outer side of the front end of the gripper falls into the spindle front end groove. The draw bar continues to move forward to push the tool holder out of the spindle hole. The specific distance depends on the specifications of the selected pull stud. See the parameter table for details, and the tool release ends. In the process of loosening the tool, dry and clean compressed air is sent into the small hole in the middle of the draw bar and sprayed out through the spindle taper hole to clean the spindle taper hole and the taper surface of the tool holder. The boosting cylinder part of the direct-connected spindle is a part of the spindle body. If there is a failure, please contact the manufacturer for assistance. Spindle structure diagram:



### 5.3.3. Spindle specification

The machine tool can use BT40 and BT50 spindles. If the customer has special options,

special spindles such as CAT40 and SK40 can also be used.

#### 5.3.4. Description of the coolant through spindle (optional configuration)

When the workpiece material is special (such as aluminum alloy, titanium alloy, stainless steel, etc.), or the processing technology requires special (drilling small holes, deep holes, or using U drills, etc.), the customer can choose the machine tool with coolant through spindle. This spindle is special. Its draw bar, pull studs, and tools are all hollow structures. At the end of the spindle, a high-speed and well-sealed rotary joint is used as a transition device for the central water outlet of the spindle. The manrel of rotary joint is connected with the spindle and rotates together at a high speed, and the shell part is connected with the water circuit and fixed. It is also equipped with a special water tank and filtering device for the central water outlet. The filtering accuracy is generally  $25\ \mu$ , and the filtering accuracy can also be improved according to needs; the function of the special water tank is to ensure the water consumption of the central water outlet function, and perform a rough filtration for the cutting fluid, and is equipped with a high pressure water pump which provides the central outlet pressure.

#### 5.3.5. Spindle transmission principle of ZF gearbox (optional configuration)

##### (1) Principle and function of ZF gearbox

The motor is directly connected to the input end of the ZF gearbox, and the output end of the ZF gearbox transmits power to the spindle through a pulley-belt drive system. The ZF gearbox is equipped with a shift solenoid valve, which can realize two transmissions of 1:1 and 4:1. When using 4:1 gear transmission, the spindle speed is reduced by 4 times, and the corresponding torque is increased by 4 times, thus realizing high torque cutting.

##### (2) Main part

Connecting components: drive hub (1), intermediate end plate (2) with radial shaft seal (3) and hub bearing (4) (as required);

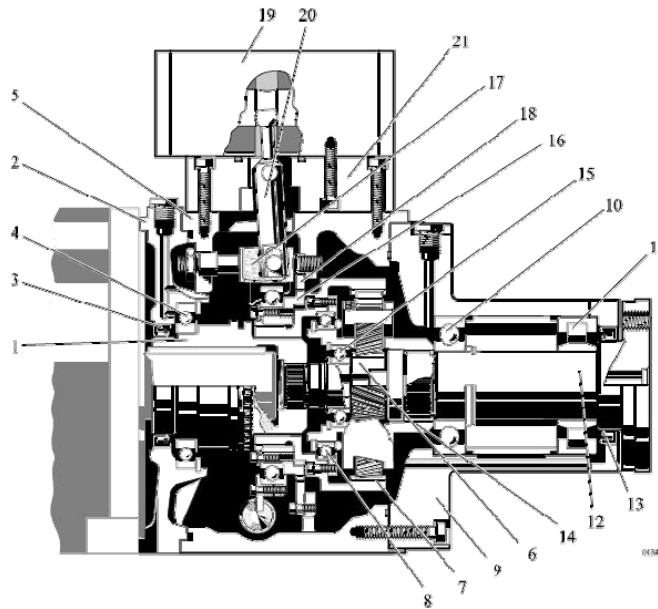
Housing: Gearbox housing (5) ;

Input: sun gear (fixed gear) (6) , Surround gear (7) , Surround gear bearing (8) ;

Output: Bearing housing (9) , Output bearing (10,11) , Output shaft (12) , Radial shaft seal (13) , Planetary gear carrier (14) , sun gear bearing (15) ;

Shift mechanism: Sliding sleeve (16) , Shift fork (17) , Brake disc (18) ;

Shift mechanism assembly: electromagnetic valve (19) , Lever (20) , connection plate (21) 。



### (3) Shift principle

1:1 Transmission gear:

- a) The shift lever (20) drives the shift fork (17) to move to the left
- b) The sliding sleeve (16) slides to the left, and its outer ring teeth are separated from the brake disc (18);
- c) The inner ring teeth of the sliding sleeve (16) slide on the outer teeth of the ring wheel (7) meshing with it;
- d) The sliding sleeve (16) meshes with the external teeth of the drive hub (1) when sliding to the left;

e)After the gear shift, the sliding sleeve (16) meshes with the drive hub (1) and the ring wheel (7) at the same time;

f)The inner ring teeth of the driving hub (1) mesh with the sun gear (6);

g)The entire planetary differential mechanism is solidly integrated and rotates with the rotation of the drive hub (1), and the power is output through the output shaft (12);

h) Realize 1:1 transmission

4:1 transmission gear:

a)The shift lever (20) drives the shift fork (17) to move to the right (position shown);

b)The sliding sleeve (16) slides to the right, and its outer ring teeth mesh with the brake disc (18);

c)The inner ring teeth of the sliding sleeve (16) slide on the outer teeth of surround gear (7) meshing with it;

d)The sliding sleeve (16) is disengaged from the outer teeth of the drive hub (1) when sliding to the right;

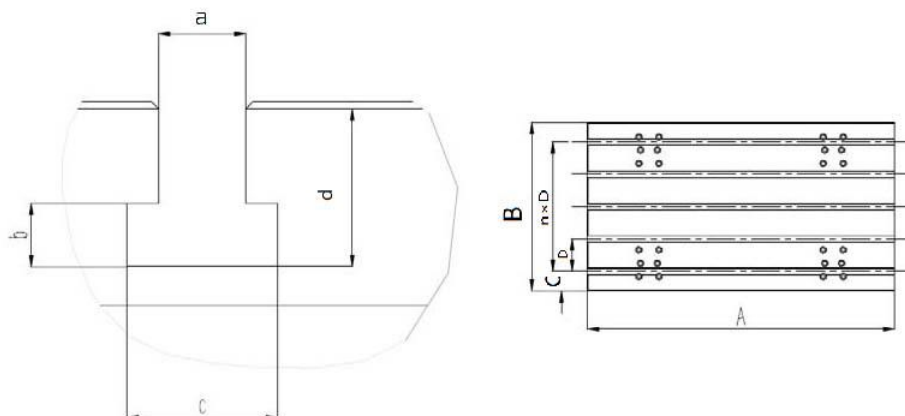
e)After the gear shift, the sliding sleeve (16) meshes with the brake disc (18) and surround gear (7) at the same time;

f)The inner ring teeth of the driving hub (1) only mesh with the sun gear (6);

g)The power is transmitted from the drive hub (1) to the sun gear (6), and then it is transmitted to the planetary gear carrier (14) through the planetary differential mechanism, and then output through the output shaft (12);

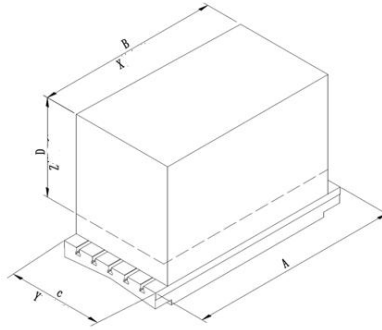
h)Realize 4:1 transmission.

## 5.4 Machine tool table size chart



| Parameter<br>Machine model | A    | B   | C    | N×D   | a  | b  | c  | d  |
|----------------------------|------|-----|------|-------|----|----|----|----|
| V4/VMC400E                 | 600  | 350 | 55   | 2×120 | 14 | 11 | 24 | 24 |
| VMC640/VMC740              | 920  | 400 | 80   | 2×120 | 14 | 11 | 24 | 25 |
| VMC855/VMC855B/VMC966      | 1000 | 550 | 95   | 4×90  | 18 | 12 | 32 | 30 |
| VMC850B                    | 1100 | 500 | 100  | 2×150 | 18 | 12 | 30 | 31 |
| V8                         | 1000 | 550 | 75   | 4×100 | 18 | 12 | 32 | 30 |
| VMC1000                    | 1200 | 550 | 75   | 4×100 | 18 | 12 | 32 | 30 |
| VMC1100(box guide)         | 1100 | 600 | 70   | 4×115 | 18 | 12 | 32 | 30 |
| VMC1100(linear guide)      | 1300 | 600 | 70   | 4×115 | 18 | 12 | 32 | 30 |
| VMC1160                    | 1200 | 600 | 100  | 4×100 | 18 | 12 | 32 | 30 |
| VMC1200                    | 1220 | 620 | 80   | 4×115 | 18 | 12 | 31 | 31 |
| VMC1300                    | 1500 | 700 | 80   | 4×135 | 22 | 20 | 40 | 40 |
| VMC1580                    | 1700 | 800 | 130  | 4×135 | 22 | 17 | 38 | 42 |
| VMC1600                    | 1800 | 800 | 100  | 4×150 | 22 | 17 | 38 | 40 |
| VMC1800                    | 2000 | 900 | 150  | 4×150 | 22 | 17 | 38 | 40 |
| VDC1270                    | 1400 | 700 | 80   | 4×135 | 22 | 20 | 40 | 40 |
| VDC4050                    | 1100 | 500 | 100  | 3×150 | 18 | 12 | 30 | 31 |
| VNM5710                    | 1300 | 570 | 97.5 | 3×125 | 18 | 12 | 30 | 32 |

## 5.5 Travel and maximum workpiece size



| Parameter<br>Machine model | A    | B    | C   | D   |
|----------------------------|------|------|-----|-----|
| V4/VMC400E                 | 600  | 600  | 350 | 400 |
| VMC640                     | 920  | 650  | 400 | 500 |
| VMC740                     | 920  | 700  | 400 | 500 |
| VMC855/VMC855B             | 1000 | 800  | 500 | 550 |
| VMC850B                    | 1100 | 800  | 500 | 500 |
| V8                         | 1000 | 850  | 550 | 600 |
| VMC966                     | 1000 | 900  | 600 | 600 |
| VMC1000                    | 1200 | 1000 | 550 | 600 |
| VMC1100(box guide)         | 1100 | 1100 | 600 | 600 |
| VMC1100(linear guide)      | 1300 | 1100 | 600 | 600 |
| VMC1160                    | 1200 | 1100 | 600 | 600 |
| VMC1200                    | 1220 | 1200 | 600 | 600 |
| VMC1300                    | 1500 | 1300 | 700 | 700 |
| VMC1580                    | 1700 | 1500 | 800 | 700 |
| VMC1600                    | 1800 | 1600 | 850 | 700 |
| VMC1800                    | 2000 | 1800 | 900 | 700 |
| VDC1270                    | 1400 | 1300 | 700 | 700 |
| VDC4050                    | 1100 | 800  | 500 | 700 |
| VNM5710                    | 1300 | 1050 | 570 | 600 |

## 5.6 Tool magazine

The tool magazine is installed on the tool magazine support, and the tool magazine support is fixed on the left side of the column. The tool magazine realizes tool storage and exchange. The tool change action of the tool magazine is fast, accurate and reliable.

### 5.6.1. Arm type tool magazine



#### Tool magazine principle

The tool magazine driving system is used to realize the tool exchange of the machining center, including parts such as tool magazine and manipulator. When the tool needs to be changed, the CNC system issues an instruction, and the automatic tool change system performs tool exchange.

The tool magazine adopts a cam device to realize the indexing and tool change of the tool magazine. For details, please refer to the tool magazine operating manual.

The tool magazine is equipped with 20 tools and 24 tools. The tools are managed by PMC (Machine Programmable Controller). The tools do not need to be coded or switched, and the methods of sequential tool change and shortest distance tool selection are adopted. Each tool has a fixed tool position, which is manually set by the operator. If the tool position or tool number is changed, it must be set in CNC again. For safety, generally set the spindle tool number to 00, that is, the spindle has no tool, and the tools needed for processing are placed in each tool position in turn.

Like the coordinate axis, the tool magazine also has a reference point. When the machine is powered off, the emergency stop is released, or in other situations where zero return is required, the tool magazine zero return command is executed, and the No. 1 tool position, that is the T01 tool, is in the tool change position. The tool change process can be divided into two situations: the spindle has no tool and there is a tool. If it's former, before the tool change in the tool magazine, the tool change position is the  $\times \times$  tool; if it's latter, before the tool change in the tool magazine, the tool change position must be an empty tool position, that is, the  $\times \times$  tool position corresponding to the spindle  $\times \times$  tool. For safety reasons, during the tool change, when spindle orientation, the X axis is moved to the negative limit and the Y axis is moved to the positive limit .

The sequence of tool change action: the spindle moves to the tool change point → tool magazine search → tool sleeve flip → ATC tool grabbing → spindle tool release → ATC tool drawing (spindle blowing) → ATC rotary tool change → ATC tool loading → Spindle broach → ATC return to zero → tool magazine tool sleeve return.

#### 5.6.2. umbrella type tool magazine



Generally, the number of tools cannot be stored too much. 10~24 tools are suitable. It has the characteristics of small size and convenient installation. It is widely used in vertical machining centers.

The action process of the umbrella type tool magazine

When changing the tool, the entire tool magazine moves parallel to the spindle. First, remove the original tool on the spindle. When the tool on the spindle enters the slot of the tool magazine, the spindle moves upward and separates from the tool; secondly, the spindle installs a new tool. At this time, the tool magazine rotates. When the target tool is aligned directly below the spindle, the spindle moves down to make the tool enter the spindle taper hole. After the tool is clamped, the tool magazine returns to its original position and the tool change ends. The specific action process of the tool magazine is as follows:

(1) The tool magazine is in the normal state, and the tool magazine stays away from the spindle center at this time. This position is generally installed with a signal sensor (for easy understanding, defined as A), sensor A sends a signal to the PLC of the CNC machine tool to confirm the status of the tool magazine.

(2) The CNC system analyzes the target tool number of the command and the tool number of the current spindle. If the target tool number is the same as the current spindle tool number, the tool change completion signal will be sent directly. If the target tool number is inconsistent with the current spindle tool number, start the tool change program and proceed to the next step.

(3) The spindle moves in the Z direction to a safe position. Generally, the safe position is defined as the first reference point position of the Z axis, and the spindle completes the positioning action and maintains the positioning state; the spindle positioning is often completed by detecting the one-turn signal of the position encoder attached to the spindle.

(4) The tool magazine moves parallel to the spindle position. When the tool center of the tool magazine and the center line of the spindle are in a straight line, it is the tool change position. The position reached is confirmed by the feedback signal of the signal sensor (B) to the CNC system PLC.

(5) The spindle moves down to the tool exchange position. Generally, tool exchange position is defined as the second reference point of the Z axis

(6) After confirming that the tool magazine grabs the tool, the spindle blows air to release the tool. The tool release confirmation sensor (C) is installed on the spindle. After the CNC machine tool PLC receives the feedback signal sent by the sensor C, it confirms that the execution of this step is completed and allows the next step to start.

(7) The spindle is raised to the first reference point position of the Z axis. The purpose of this operation is to prevent interference between the tool magazine and the spindle when the tool magazine rotates.

(8) Tool magazine rotation is enabled. The numerical control system sends out the tool magazine motor forward/reverse start signal, starts the rotation of the tool magazine motor, finds the target tool that the instruction requires to be replaced, and makes the center of the tool position and the spindle center in a straight line.

(9) The spindle moves down to the second reference point position of the Z axis, and the tool is grabbed.

(10) The spindle tool is tightened. The tightening sensor (D) sends out a confirmation signal.

(11) The tool magazine translates to the side away from the center of the spindle until the PLC receives the feedback confirmation signal from sensor A.

(12) Spindle positioning is released and the tool change operation is completed

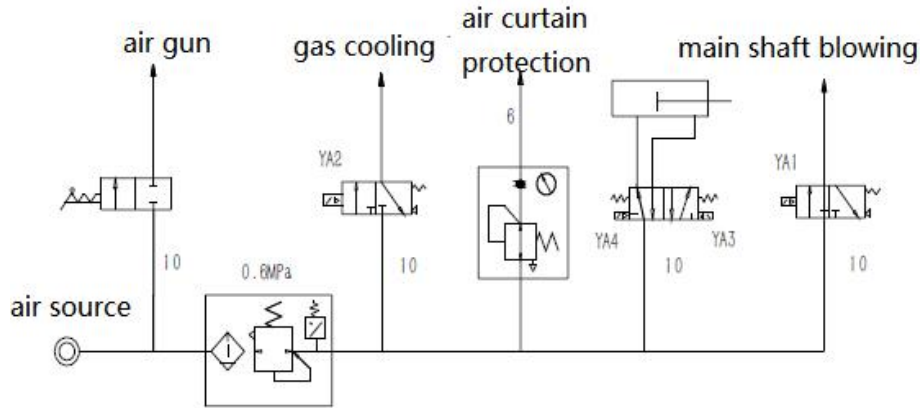
## 5.7 Pneumatic lines

Pneumatic pipeline controls the actions of spindle tool loosening, spindle tool holder cleaning, tool magazine movement, air cooling, air gun, front seal, etc.

### 5.7.1 Pneumatic principle (standard)

The tool loosening of the machine tool and the blowing action of the spindle are all

realized by compressed air. The system air pressure is 0.6~0.8MPa, after filtering to remove moisture, compressed air is sent to each execution port. The pneumatic schematic diagram is shown in the figure below.

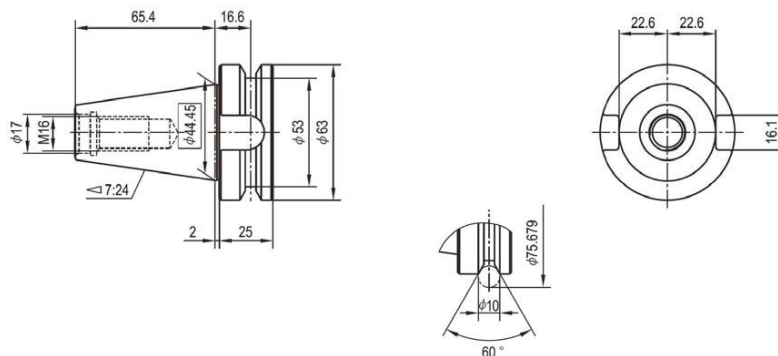


### 5.7.3 Air source requirements

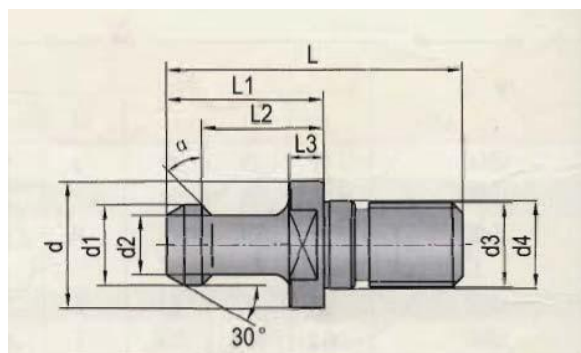
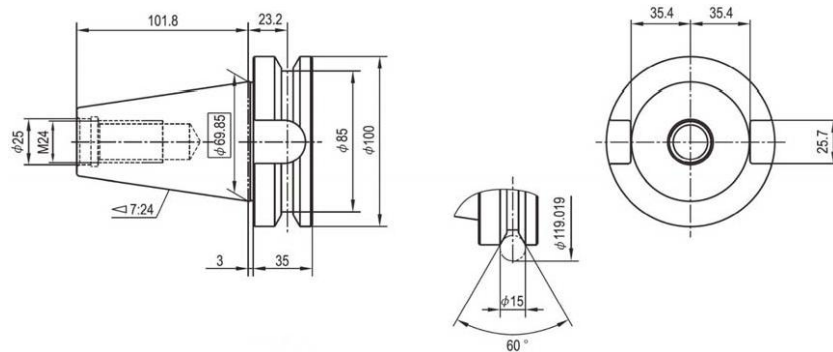
The air source flow rate of the machine tool is greater than 280L/min, and the air source pressure is 0.6~0.8MPa. The pneumatic system is equipped with a pressure switch. When the pressure drops below 0.4MPa, an alarm signal is generated. After the pressure rises, the alarm signal disappears automatically. The filter has the function of removing water, and the separated water is drained from the bottom of the filter, but the user should always check whether the drain valve is blocked.

## 5.8 Tool and pull stud size

### 1. BT40

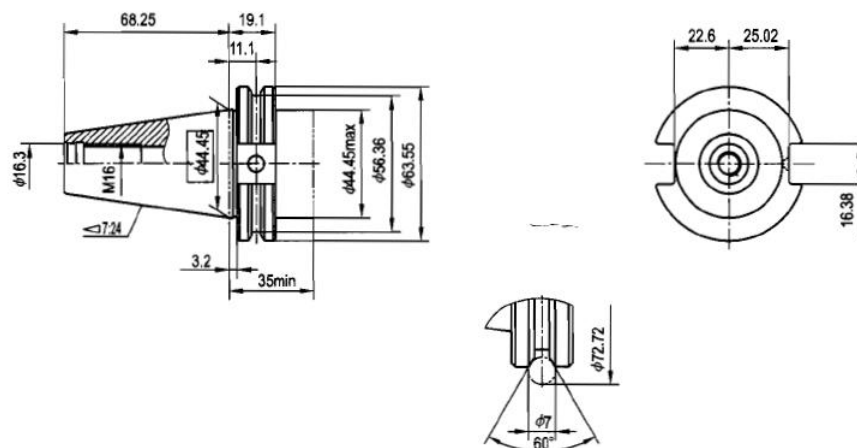


## 2. BT50

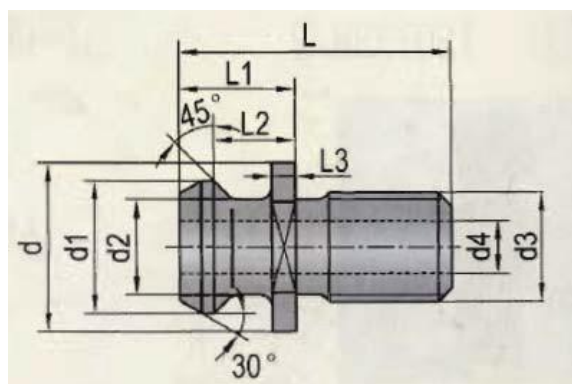
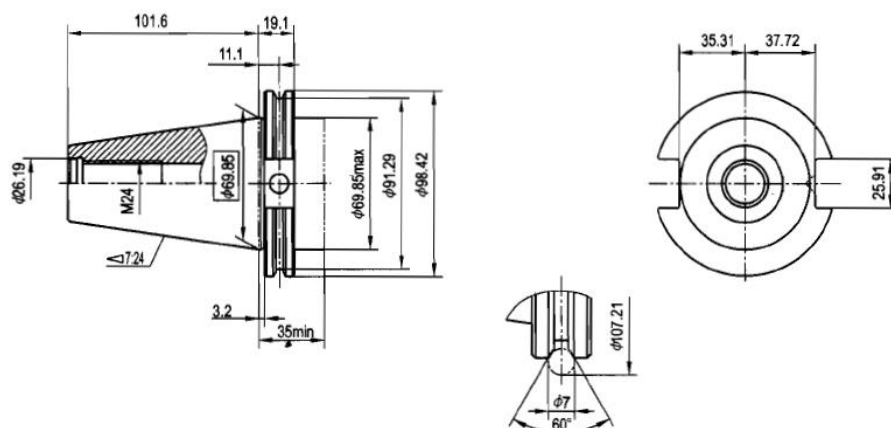


| Model | Size (mm) |    |    |    |    |    |    |     |    |          | weight |
|-------|-----------|----|----|----|----|----|----|-----|----|----------|--------|
|       | L         | L1 | L2 | L3 | d  | d1 | d2 | d3  | d4 | $\alpha$ |        |
| P40T  | 60        | 35 | 28 | 6  | 23 | 15 | 10 | M16 | 17 | 45°      | 0.06   |
| P50T  | 85        | 45 | 35 | 10 | 38 | 23 | 17 | M24 | 25 | 45°      | 0.26   |

## 3. CAT40 (optional)

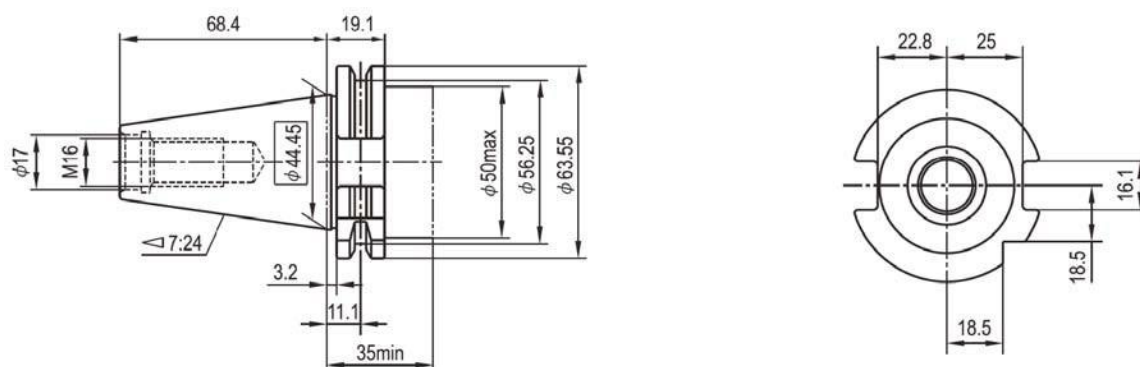


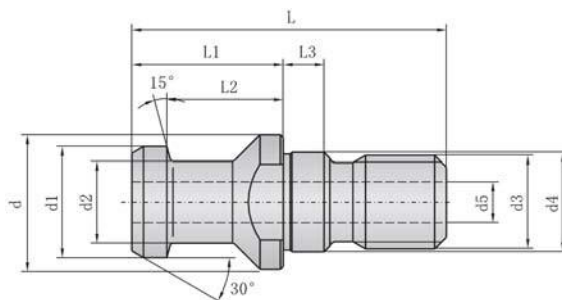
#### 4. CAT50 (optional)



| model | size (mm) |       |       |      |      |       |       |     |       |        |
|-------|-----------|-------|-------|------|------|-------|-------|-----|-------|--------|
|       | L         | L1    | L2    | L3   | d    | d1    | d2    | d3  | d4    | weight |
| A40   | 39        | 16.4  | 11.15 | 3.25 | 22.5 | 18.95 | 12.95 | M16 | 7.35  | 0.05   |
| A50   | 60        | 25.55 | 17.95 | 5.25 | 37   | 29.1  | 19.6  | M24 | 11.55 | 0.2    |

#### 5. DIN40 (optional)



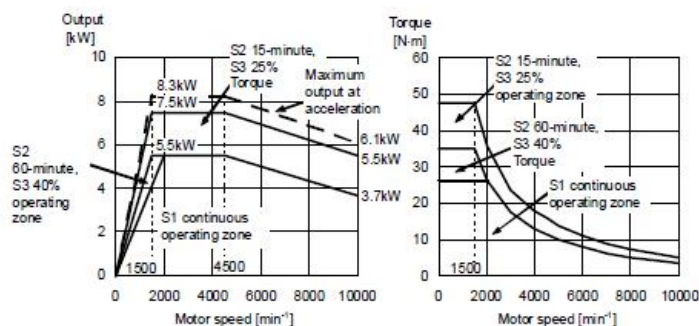


| model | size (mm) |    |    |    |    |    |    |     |    |    |        |
|-------|-----------|----|----|----|----|----|----|-----|----|----|--------|
|       | L         | L1 | L2 | L3 | d  | d1 | d2 | d3  | d4 | d5 | weight |
| D40   | 54        | 26 | 20 | 7  | 23 | 19 | 14 | M16 | 17 | 7  | 0.05   |

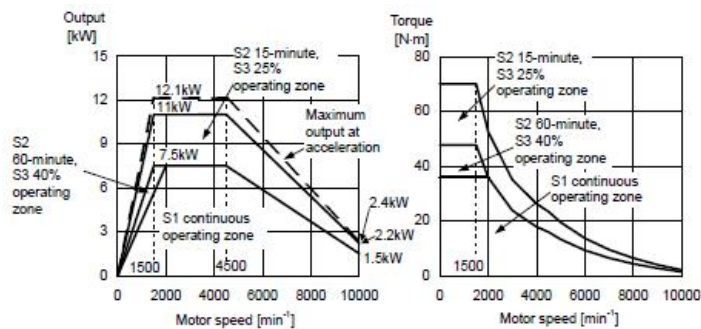
## 5.9 Machine spindle motor output characteristics

### 5.9.1. FUNUC series

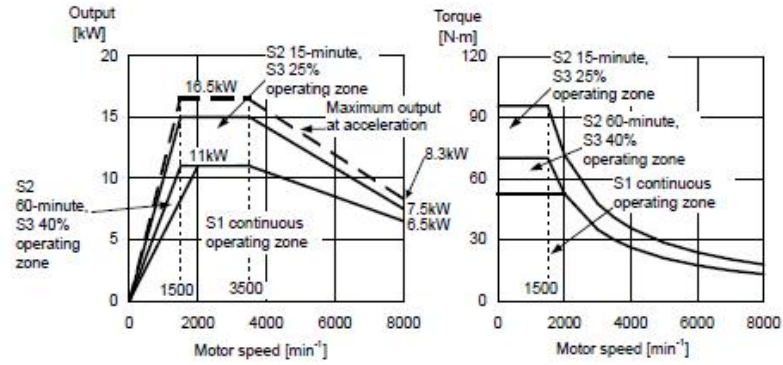
(1) The spindle motor adopts  $\beta$  6/10000i motor, and the output characteristics are as follows:



(2) The spindle motor adopts  $\beta$  8/12000i motor, and the output characteristics are as follows:

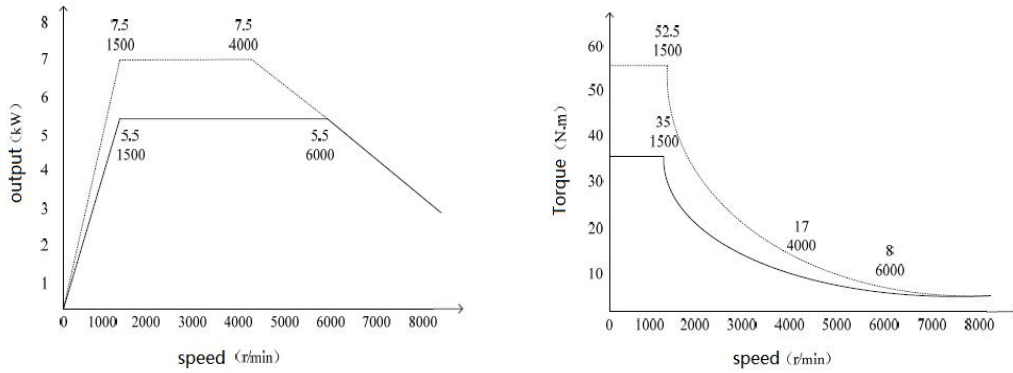


(3) The spindle motor adopts  $\beta$  12/10000i motor, and the output characteristics are as follows:

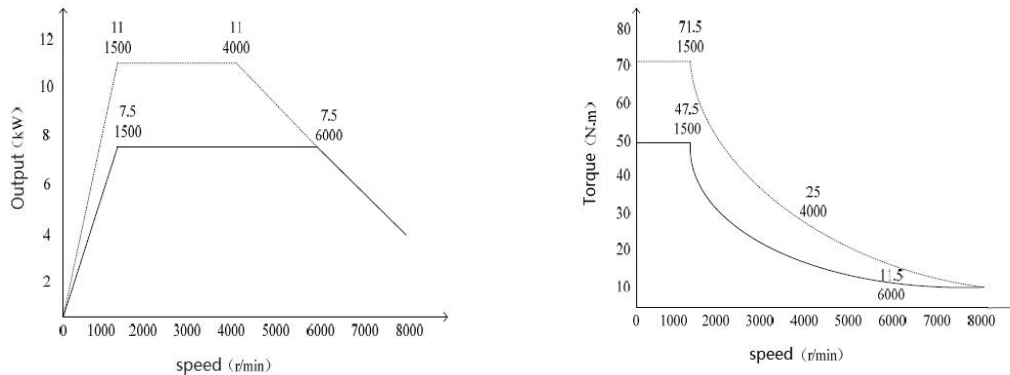


### 5.9.2. KND series

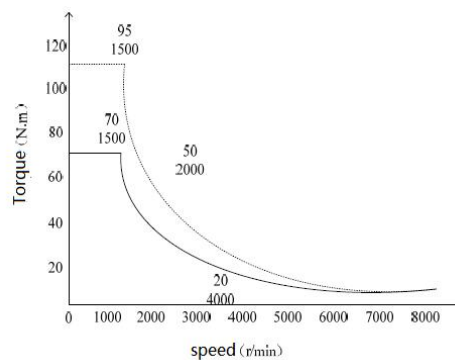
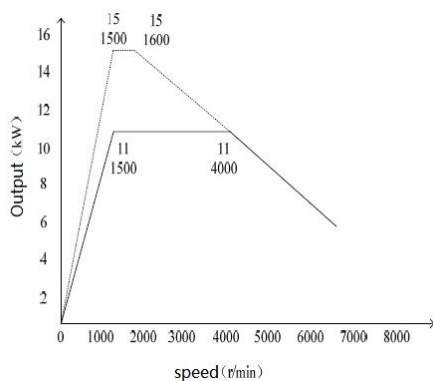
(1) ZJY-F205-5.5-1500 spindle motor, the output characteristics are as follows:



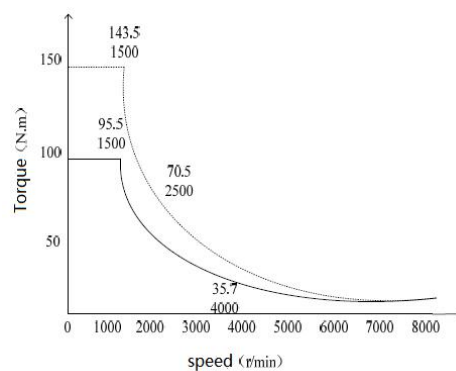
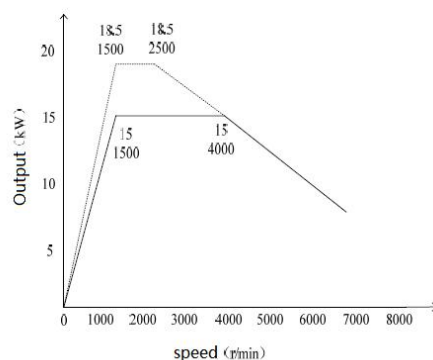
(2) ZJY-F205-7.5-1500 spindle motor, the output characteristics are as follows:



(3) ZJY-F270-11-1500 spindle motor, the output characteristics are as follows:



(4) ZJY-F270-15-1500 spindle motor, the output characteristics are as follows:

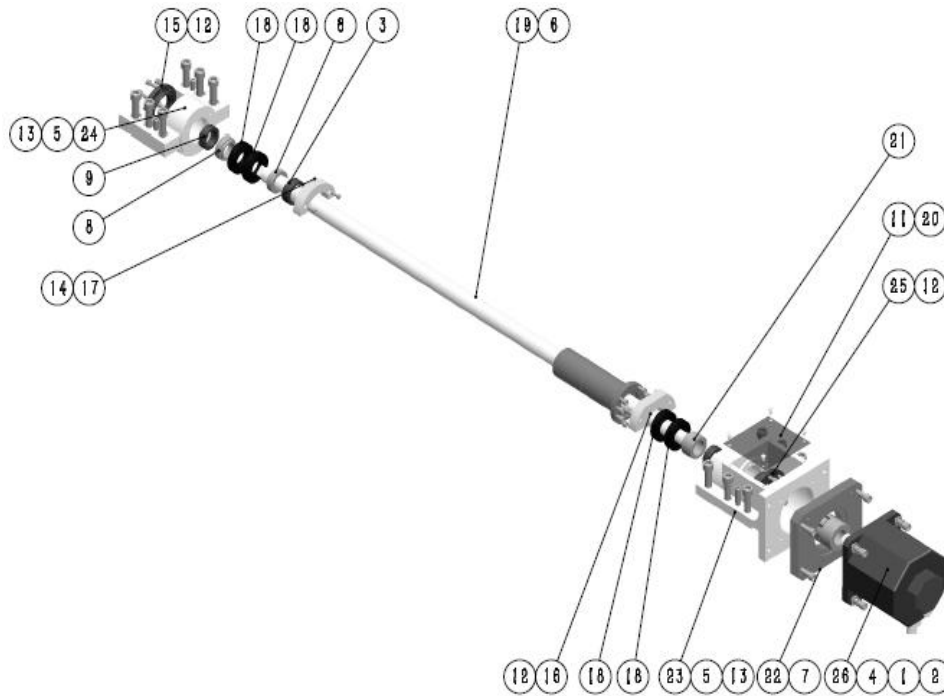


## 5.10 Transmission system

AC servo motor is selected for the three-axis feed system of this machine tool.

### Principle of Feed System

The principle of the feed drive mechanism is to receive instructions from the CNC system, and drive the worktable (X), saddle (Y), and headstock (Z) of the machine tool through the servo amplifier unit, servo motor, and ball screw to achieve X , Y, Z three coordinate feed motion and positioning. Schematic diagram of the feed system.



The three-coordinate feed drive mode is basically the same, and the servo motor is directly connected to the lead screw through a gapless elastic coupling. This kind of coupling is a keyless connection with the motor shaft and the lead screw shaft. Its advantage is that it is easy to install and unload, has good concentricity, and is a gapless connection. The ball screw adopts a high-speed screw structure, which is pre-stretched during assembly in the manufacturer, which improves the accuracy, stability and rigidity of the lead screw and ensures the accuracy of operation.

The feed servo system of this machine tool is a semi-closed-loop control system. The semi-closed-loop control system is equipped with an angular displacement detection device in the servo motor. By detecting the rotation angle of the servo motor shaft, the displacement of the moving parts is indirectly detected, and then feed back to the numerical control device's comparator, it is compared with the input original command displacement value, and the compared difference is used for control, so that the moving part supplements the displacement until the difference is eliminated to the control system

within the allowable range.

## 5.11 Lubrication system

### 1. Lubrication of machine tool guide ways

The lubrication of the machine tool's guide rail is directly supplied by the timing and quantitative centralized lubrication pump to the moving parts to lubricate the three-coordinate guide rail surface: base-saddle guide rail surface, saddle-table guide rail surface, headstock-column guide rail surface and lead screw nut. After the machine tool is powered on, the lubricating oil is injected into the slider and ball screw nut of each guide rail through the oil pipe and the joint. The timing lubrication device is equipped with an oil level switch. When the lubricating oil level in the oil tank is lower than the set height, the machine tool will alarm. Generally, refuel in the tank every two weeks or so.

When adding lubricating oil, according to the seasonal temperature change, choose an oil agent with approximate viscosity value to achieve a good lubrication effect. Lubricating oil with too low viscosity may cause the exhaust valve in the pump to fail to work, thereby making the pump unable to pressurize. It is recommended to use 68# hydraulic rail oil.

### 2. Use high-speed grease

The machine tool spindle bearings and lead screw bearings are filled with a certain amount of NBU15 high-speed grease, which is resistant to friction and high temperature, and does not lose at high speed. Generally, it can be replaced when the machine is overhauled, and the user does not need to fill it normally.

## 5.12 Cooling and flushing

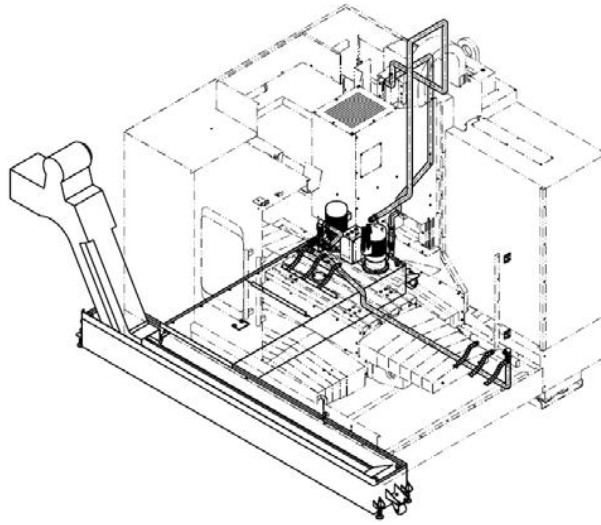
The cooling system mainly cools the tool and the workpiece, and the chip conveyor is used to automatically discharge the iron chips generated during the processing.

### 5.12.1 Workpiece cooling and chip flushing

The cooling system of this machine tool includes: chain type automatic chip conveyor and cooling water tank. The machine tool is equipped with a chip receiving box or automatic chip removal device, which can automatically collect iron chips, which can greatly reduce the labor intensity of the operator. Add mineral oil or emulsion to the cooling box of the machine tool. The cooling liquid from the cooling pump of the machine tool will be sprayed from the nozzle on the headstock through the column to the headstock hose. Turn the nozzle and adjust the flow rate of the valve as needed. The coolant flows through the workpiece and flows back to the cooling box through the water pan, and is used repeatedly after precipitation. The start and stop of the cooling pump are controlled by the selection button on the operation box and the instructions of the processing program.

The workpiece cooling water outlet is arranged on the headstock near the nose of the spindle. In addition to manual button control, the work and stop of the cooling pump can also be controlled by the M command code in the processing program to facilitate cooling of the tool and workpiece during processing. Each outlet pipe uses a ball valve to control the flow rate and adjust the direction of water outlet.

The chip flushing pipe is located at the position of the protective chassis. A total of slub pipes are arranged on the left and right sides for chip flushing. The high pressure of the water pump ensures that the chips are quickly washed away after falling into the chassis, thereby taking away the heat of the chips and avoiding thermal deformation to the processing accuracy. influences. The start and stop of the chip flushing pump can also be controlled by the panel buttons and the program M command code respectively.



#### 5.12.2. ZF gearbox cooling (optional configuration)

According to the customer's cutting requirements, after the machine tool adds the ZF gearbox, the ZF gearbox cooling function needs to be added accordingly. Generally, oil cooler is added to cool and lubricate the gears and bearings in the ZF box through circulating cooling oil.

### 5.13 Main features of machine tool

1 The main castings such base, saddle, worktable, headstock, column, etc. are made of resin sand castings, with stable organization; the casting structure adopts box structure, plus a reasonable arrangement of reinforcing ribs, so that the machine tool has high rigidity and high strength. , and can maintain high precision and stability for a long time.

2 The three-axis motor and high-precision ball screw are directly connected and driven. The ball screw is pre-tensioned and installed to further improve the transmission rigidity and positioning accuracy.

3 The three linear coordinates are all linear rolling guides or sliding guides, so that the machine tool has low vibration during high-speed feed, no crawling during low-speed feed, and has high accuracy and stability.

4 The main spindle motor is transmitted to the main spindle of the machine tool through a

synchronous toothed belt or coupling. The machine tool has strong processing capacity, high precision and stable quality.

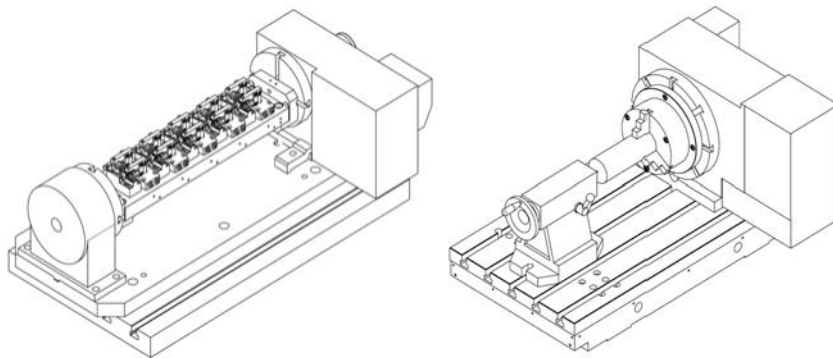
5 In order to ensure the quality of the whole machine, the main outsourcing parts are all the products of famous brand manufacturers.

6 A fully enclosed safety protective cover is used on the periphery of the machine tool, which not only allows the coolant and iron filings in the machining process to be safely and fully recovered, but also avoids accidental injuries to workers.

7. The machine tool is equipped with a chain type automatic chip removal device, which can greatly reduce the labor intensity of the operator.

#### 5.14 CNC rotary table (optional configuration)

By adding a CNC rotary table, it can realize the four-axis simultaneous machining of this machine tool, or realize the processing requirements that require indexing and rotation at a certain angle; the use of CNC indexing discs, chucks, and tailstocks can be used to achieve disc alignment , Processing of bar parts. For example, under the function of four-axis linkage, the processing of milling spiral grooves; the CNC indexing plate can also be used alone to realize the multi-angle and multi-face machining of the disc or the parts that need to be indexed.



## 5.15 How to use the machine

The processing accuracy, processing efficiency, and degree of automation of the machining center basically depend on the advancement and reliability of the high-quality mechanical main body and the performance of the control system. However, in order to achieve good use results and obtain ideal economic benefits, in addition to the selected machine tool (high precision, high efficiency, and good working reliability), correct and reasonable use is also a very critical issue. Fully understand the performance characteristics and processing technology characteristics of the machine tool, take corresponding technological measures, and fully understand the difference between it and ordinary machine tools from the production organization and management, treat them separately, and master the use, operation, adjustment technology, etc., are the necessary prerequisites for using machining centers. The following briefly introduces the process of use for users' reference.

### 5.15.1. Machine operation

Most of the operations of this machine tool are performed through the keyboard or buttons (see the electrical part of the Operation Manual for details), and only the following two operations are performed manually

( 1 ) Manual tool release: In most cases, the tool is loaded into the spindle by a manipulator. In special cases, when the tool needs to be manually loaded into the spindle, there is a button in the spindle box, and the button can be operated in manual mode. (When the light of the button is on, it is the state of loosening the tool, otherwise it is the state of tightening the tool). Note: When the machine tool is in processing state, this button has no effect.

#### (2) Tool magazine manual movement

In order to facilitate the debugging of the machine tool, there is a set of button

switches on the operation panel for manual control of the tool magazine. For specific operation instructions, please refer to the electrical part of the Operation Manual.

#### 5.15.2. Select processing object

Generally, as long as the shape and dimensions of the parts are compatible with the worktable and travel of the machine tool, in order to maximize the economic benefits of the machine tool, it is recommended that the user's production management department consider the following principles when arranging parts for this type of machine tool:

##### (1) Small batches and repetitively produced parts

Machining parts with machining centers ,Preparation time occupy a higher proportion. For example, the man-hours for process preparation and programming are often more than ten times the man-hours for a single part, but these work contents, such as common tools, fixtures, process documents, and program lists, can be saved and reused later. Therefore, when a part is trial-processed on the machining center and then put into production again, the production cycle and processing time are greatly reduced.

##### (2) The part processing batch should be greater than the economic batch

Compared with processing on an ordinary machine tool, the man-hours for a single piece of work on a machining center are much shorter, but the man-hours for adjustment are often much longer. Therefore, it is not economical if the batch of parts is too small.

$$\text{Economic batch} = \frac{\text{Machining center preparation time} - \text{Normal machine tool preparation time}}{K \times (\text{Ordinary machine Single processing time} - \text{Machining center single processing time})}$$

Among them: Machining center preparation hours = process preparation hours + site debugging hours;

On-site debugging hours = machine tool adjustment hours + part program trial-run hours + trial cutting hours + tooling and fixture verification hours.

Here, only on-site debugging is the part that really takes up the time of starting the

machine. For repetitive production parts, the process preparation and program preparation hours of the machining center should be divided by the number of repeated production.

The processing hours of ordinary machine sheets should include the sum of the man-hours corresponding to the contents of each process of NC processing, and the impact of the reduction of the entire processing cycle of the parts after the concentration of processes should be properly considered. (For example: Originally, there are five processes that are processed by ordinary machine tools, and it takes 15 days to circulate on the production line, but when five processes are completed on the machining center at a time, the part circulation time is saved). The correction factor K is to consider that the labor-hour cost of the machining center is much more expensive than that of ordinary machine tools. It is hoped that a machining center should be equivalent to several ordinary machine tools, so K should be at least 2 or more. As the level of mastery improves, K should be as large as possible.

( 3 ) Give full play to the various processing characteristics of the machine tool, and complete as many comprehensive processing as possible such as milling, boring, drilling, reaming, and tapping.

( 4 ) The high-precision boring processing in the parts processing content is generally hoped not to be larger than the maximum diameter of the automatic tool change tool of the ATC device, and the large-aperture processing can only manually load and unload the tool, or use the method of circular interpolation to mill the hole, the accuracy of the hole is slightly lower .

( 5 ) The shape and size of the parts should be compatible with the worktable and stroke of the machine

( 6 ) Consider the balance of workshop production capacity.

( 7 ) Some parts are small in batches, but their shapes are complex, and general machine

tools cannot be processed or are difficult to achieve stable processing accuracy.

#### 5.15.3. Determine the processing location and specific content

( 1 ) Determine the relationship between the content of the process completed on the machine and the process before and after it. For example, before the parts are processed by the machining center, what base surfaces and reference holes need to be processed by other machine tools, and what processing procedures and machining allowances are left for later procedures.

( 2 ) Processing with other machine tools is more suitable and more efficient than this machine. Try not to process on this machine.

( 3 ) According to the number of tools required for part processing, the accuracy requirements of the parts, and the heat treatment requirements, it is decided whether to complete all processing in one clamping or to complete it in two.

#### 5.15.4. Preparation of process cards

( 1 ) There are various forms of process cards, and users can compile appropriate formats according to the production habits and needs. The process card is the basis for compiling the "program list", "tool adjustment list" and adjusting the machine tool, as well as the work table of the machine operator.

( 2 ) Be familiar with the relevant regulations of the use of machine tools (preparation work before compiling process cards)

a) The configuration of the origin of each coordinate of the machine tool, the direction of each coordinate axis, and the setting of the workpiece coordinate system.

Machine tool travel range.

b) Spindle speed range S command

c) Feed range F command.

d) Tool T command, exchange command.

e) Cutting specifications.

- f) The working principle and instruction list of CNC system.
- g) Machine tool processing characteristics, machine tool operation methods.
- h) The working trend distance of the tool (refers to the distance from the tip of the tool to the surface to be processed when the work feed is turned after rapid approach).

#### 5.15.5. Determine the sequence of steps

The parts processed on this machine generally have multiple steps and multiple tools. Therefore, a reasonable arrangement of the sequence of steps has a great influence on the machining accuracy, machining efficiency, and the number of tools. The following factors all affect the sequence of work steps:

(1) Perform heavy cutting and rough machining first, then arrange some processing with low heat generation and low processing requirements (such as drilling small diameter holes, tapping threads, etc.), and finally arrange finishing, so that the parts have as much cooling time as possible before finishing.

(2) Carry out the adjacent processing position first, shorten the empty stroke distance. Appropriate consideration of the tool movement trajectory and minimize the movement of each coordinate axis.

It is recommended to arrange the work steps in the following order: milling large end faces (separate rough and fine milling) → rough boring, semi-finish boring → end mill processing → drilling → tapping → hole finishing (reaming, boring, finishing)

#### 5.15.6. Select tool

The tools used on this machine tool generally include universal cutting tools and universal connecting tool holders. Choose the appropriate cutting tools according to the processing requirements and the above-mentioned process card, and then determine the position of the tool on the tool magazine (that is, give the tool number), and work out the tool Card (for tool preparation, adjustment and tool loading into the tool magazine).

Note 1: If the actual value of the tool length and deviation value in the above tool card cannot be determined immediately when the craftsman compiles the card, two methods can be adopted:

( 1 ) Set a nominal size first, add tool compensation during programming, program according to the nominal size, and use the tool compensation function to correct the difference between the nominal size and the measured size during on-site processing.

( 2 ) The length dimension is not written on the tool card first. When programming, the tool length is programmed as "zero", but each tool is assigned a tool compensation number. After the tool is prepared, the measured tool length is stored in the tool compensation value data.

Note 2: Tool length generally refers to the axial dimension from the cutting edge to the end face of the spindle. It is the tool compensation value or the actual measurement of the corresponding processing area after the tool is installed on the spindle.

Please refer to the product catalog of the tool holder manufacturer for the specific specifications and dimensions of the tool holder. If you encounter special processing requirements, consider using special tools, put forward the tool requirements, and design special tools. When selecting tools, you should consider the possibility of various types of tools that can substitute for each other. For example, when machining a relatively large hole, in addition to boring, you can also use an end mill to mill a circular hole through a circular interpolation path. This requires the user to have a full understanding of the tools and the performance of the machine tool and apply it flexibly.

#### 5.15.7. Determine cutting amount

( 1 ) Refer to the cutting amount in the tool cutting manual and modify it based on field experience. With the development of automatic programming, try to use the data in the cutting database as much as possible.

( 2 ) According to the machining-process system (tool-workpiece-fixtured-machine tool)

rigidity to amend it.

(3) Consider the tool life to be corrected. In the processing of small and medium-sized parts, strive to eliminate the need for sharpening and changing tools in one batch to reduce adjustment time. For individual tools with heavy cutting load, such as end mills, deep hole rough boring tools, etc., in order to shorten the processing time, a relatively high cutting amount is used to shorten the durability to 1/2 or 1/3 etc. of a batch of parts.

#### 5.15.8. Tool preparation

Prepare the tool according to the card, the steps are as follows:

- (1) Select the required tool holder and cutting tool according to the card;
- (2) Sharpening the cutting tool or boring head;
- (3) Assemble the cutting tool, tool holder, and tail handle, and paste the set tool number mark;
- (4) Adjust the tool to the set size on the tool probe or machine tool, measure the length of the tool and record it on the tool card. For some high-precision machining tools, try cutting according to the selected cutting amount, such as fine reaming and fine boring. , Modify and adjust parameters according to the trial cut results.

#### 5.15.9. Write "machine tool adjustment sheet"

- (1) When using tool radius compensation and tool length compensation, specify each group number and specific tool compensation value.
- (2) Some on-site selection switch applications (such as mirror switch, select jump, select shutdown, etc.).
- (3) Workpiece cooling method (what kind of coolant is used).
- (4) Precautions for setting tool number of magazine.

Note: This item can also be included in the process card.

#### 5.15.10. Coordinate calculation, working track diagram

Perform numerical calculations according to the drawings. According to the determined

processing route and the allowable programming error, the input data required by the CNC system is calculated. The movement route for point processing is relatively simple, and only some simple size conversions are required during programming. If a reasonable tool coordinate position is selected and the incremental and absolute value methods are used flexibly, these tasks can be simplified. For contour processing, numerical calculation is the prerequisite of the entire programming work, and it is closely related to the contour shape of the part and the interpolation method of the CNC system. This machine tool is a linear-arc interpolation system. It is relatively simple to calculate the parts composed of straight lines and arcs, as long as the connection points of each geometric element are calculated. Parts composed of other curves need to be approximated by a straight line or an arc. For some more complex tool movements, some tool path diagrams can be drawn for programming.

The above work can be realized by automatic programming software (such as: UG/mastercam), which is convenient for the processing and production of complex parts.

#### 5.15.11. Compile the program list

See the programming manual for details.

#### 5.15.12. Input program

There are many ways to input the compiled program list into the machine tool. Using the MDI device on the operation panel to input is a simple and feasible method, but it takes a lot of time and takes up the starting time of the machine tool. For some long programs, there are often more errors in the field input. Therefore, if possible, it is best to use computer programming to input the program sheet into the machine tool. Please refer to the electrical manual for the specific input method.

#### 5.15.13. Trial run

Mainly to check the content of the program. After adjusting according to the machine tool adjustment sheet, test run against the program sheet. There are many methods for test run:

( 1 ) Turn on the "machine lock" switch to run automatically, check whether the entire program works, and whether there is any programming method error.

( 2 ) Turn on the "M, S, T lockout" switch to automatically run, you can check whether the coordinate motion in the program meets the requirements, and you can check the motion track separately after turning on the "trial run" switch to shorten the running time.

( 3 ) Close the "Z axis lock" switch to automatically run, you can check the M, S, T functions in the program. If the Z-axis is locked at the zero position, the tool can be changed automatically. If the Z-axis is locked close to the plane of the worktable, you can install a pencil in the spindle to draw the movement track, or check the position of each processing area near the workpiece surface.

( 4 ) In the trial run, you should also pay attention whether the tool compensation value and sign ( + - ) are appropriate, check the tool and check whether there is any interference in the movement of various parts and fixtures.

( 5 ) There are also some other inspection methods, that is, the above points are not necessarily done one by one for a specific part. The operator can flexibly grasp it according to his own experience. It is hoped that the trial operation will not take too long, and we must also strive to avoid failures in trial machining, especially some accidents that damage machine tools, workpieces, and tools.

#### 5.15.14. Trial cutting

Mount the first workpiece and proceed to formal processing. During processing, check whether the selection of cutting parameters is reasonable (the magnification switch can be used for correction on site), whether the processing sequence is reasonable, and whether the tool path is reasonable. After the end of the automatic cycle, modify the program in time by program editing. Check the machining accuracy of the various trajectories of the trial-cut parts, and accordingly adopt methods such as fine-tuning the tool, correcting the tool length compensation value, radius compensation value, and program content to meet

the requirements. In the trial cutting, the rapid traverse speed (controlled by the rapid override switch) can be reduced for safety, especially the speed of the tool quickly approaching the workpiece, the operator should pay special attention at this time.

#### 5.15.15. Finishing work after parts processing

The program after trial cutting and trimming can be used for batch machining of parts. After processing, it should be stored in the memory, and the modified program after production verification should be stored in a storage card or floppy disk, and stored for later use. In addition, the process files, program sheets, etc. must be modified accordingly for the next use and reference for the preparation of new programs.

## 6. Mechanical maintenance

In order to ensure the safe and correct use of this machine tool and prevent the machine from malfunctioning, the machine must be regularly maintained and repaired. Maintaining the cleanliness of the machine tool is one of the most important aspects of machine maintenance. Dust, humidity, oil, etc. will corrode the machine's mechanical and electrical parts.

Clean the oil, coolant, dirt and other sundries in the machine tool at the specified interval and before repair and maintenance work. Seal all openings with plugs to prevent the entry of detergents. All the protective covers that were set up in advance to prevent the entry of detergent should be removed after machine cleaning . After cleaning, check whether the hydraulic pipeline is leaking, whether the connection is loose, and the joint is worn and damaged. If any undesirable phenomenon is found, it should be adjusted and corrected immediately. Please use a clean, lint-free cloth when cleaning. Cleaning work includes sweeping, vacuuming and wiping.

When cleaning the machine tool, do not use: compressed air, pressurized water, chemical liquids and other substances. At the same time, customers should pay attention to the following items:

### 6.1 Lubrication system

The lubrication pump and the electronic controller form an electromechanical integrated lubrication device, which is equipped with a pressure controller (cut-off protection) and a low oil level indicator. Its running time and intermittent time are set by the controller.

If the machine tool is not working for a long time, the lubricating oil film may be broken. If the machine is started now, the ball screw will wear out strongly and sometimes even burn. Therefore, when the machine tool has not been working for a long time, the

lubrication pump should be manually controlled to supply the oil before starting the machine tool to achieve the purpose of pre-lubrication.

## 6.2 Hydraulic system

Medium used in hydraulic system:

No. 32 hydraulic oil (used in winter), No. 46 hydraulic oil (used in summer). Change the hydraulic oil 3 months after the first use of the hydraulic station, and then change the hydraulic oil every 6 months.

## 6.3 Pneumatic system

Generally the maintenance cycle of the pneumatic system is long. If the color of the filter element in the air filter is found to be dark during the daily inspection, the filter element needs to be replaced at this time; if the filter inlet and outlet pressure difference is found to be large during the regular inspection, the filter element is Clogged and needs to be replaced. The air filter needs to be cleaned half a year.

## 6.4 Cooling system

### 6.4.1 Cooling water tank

The coolant in the cooling water tank must be kept clean and must not be mixed with foreign objects. If the coolant becomes turbid, it needs to be replaced immediately. The choice of coolant depends on the cutting material. The cleaning cycle of the cooling water tank is about 1 month.

### 6.4.2 Oil cooler

The oil cooler has its own volume. The oil should be filled up for the first time; generally, the oil should be replaced every three months. The air filter on the oil cooler needs to be cleaned once a week, and the condensation should be checked at the same time whether it is blocked.

## 6.5 Precautions

(1) This machine tool prohibits cutting non-metals such as graphite, stone, plastic, wood, etc., and materials with low rigidity that cannot be held or fixed, such as metal magnesium alloy with low ignition point.

(2) The position of the impact block and interlock switch, which are particularly important for the machine tool, should not be moved. At the same time, the lubricating oil level, coolant level and pneumatic air pressure should be checked regularly to ensure the normal operation of the machine tool.

(3) Low ignition point cooling cutting fluid can not be used.

(4) Noise statement: When idling at any speed, the sound pressure level of the whole machine shall not exceed 83dB. When EN • ISO11202:2010 is adopted, the uncertainty value  $K=4\text{dB}$ .

(5) "The data provided is the noise emission level of the machine tool, not necessarily the noise level of safe work. The noise level of safe work is sometimes related to both the emission level and the exposure level. The data provided cannot be used as the reliable basis to determine the necessary further preventive measures. Factors that affect the actual exposure level of workers include: workplace characteristics, other noise sources (such as the number of machine tools and adjacent processing conditions), the time that the operator is exposed to noise, etc. In addition, different countries allow different exposure levels. Therefore, this information is provided to enable users of machine tools to better evaluate hazards and risks."

(6) It is forbidden to stack flammable materials around the working environment of the machine tool. When the machine tool operator leaves the machine tool, the machine must be stopped, and the main power supply of the machine tool must be cut off after finishing the work to avoid danger.

## 6.6 Daily inspection

### 1. Inspection before starting work

- (1) Whether the oil level of the oil cooler, cooling water tank, electric lubrication pump is within the allowable range
- (2) Check whether the tool on the machine spindle is loose, and check the correct position of the tool on the tool magazine.
- (3) Check whether the moving parts, screws and nuts are loose.
- (4) Check whether the power connection of the machine tool is normal and whether the workpiece is firmly installed.
- (5) Whether the lubricating oil supply at each lubrication point is normal or sufficient, and whether each pipeline is damaged or leaked.
- (6) Whether the lighting equipment of the machine tool works well.
- (7) Whether there is abnormal sound or abnormal phenomenon in each axis after starting.
- (8) Whether there are obstacles in and around the machine tool.
- (9) The tools and other things should be not placed on all protective surfaces
- (10) The water in the air filter tube is discharged.
- (11) The spindle blowing air pressure is 0.6~0.8Mpa, and the hydraulic system pressure before work should be determined according to the requirements of the technical agreement.
- (12) The indicator lights on operation panel are displayed correctly.

### 2. Inspection after finishing work

- (1) the main power switch must be turned off.
- (2) The machine must be cleaned thoroughly
- (3) Check the oil supply status of each component. If the oil is insufficient, replenish it immediately.

## 6.7 Weekly inspection

- (1) Whether the oil supply condition of each lubricating surface is normal
- (2) Whether the working condition of each moving part is normal
- (3) Whether the air filter is full of water.

## 6.8 Monthly inspection

- (1) Whether the filter of the oil cooler is clean.
- (2) Whether the supply of pneumatic, hydraulic or voltage is stable.
- (3) Whether the balance cylinder is operating normally
- (4) Maintain according to daily maintenance items
- (5) Internal cleaning of electric cabinet and CNC device
- (6) Check the level of the worktable and bed, and adjust if necessary.
- (7) Clean the filter, but not with organic solvents. Replace the filter if necessary.
- (8) Check whether the pipe joints, pipe sleeves, and screws of the hydraulic system are loose.
- (9) Check whether the relay and limit switch are reliable.
- (10) Cleaning and replacement of oil filter of hydraulic system
- (11) Check that the wire terminals cannot be loose
- (12) The action of the interlocking mechanism and the time relay is correct, clean the contacts, adjust or replace if necessary
- (13) Whether the coolant and impurities of the chip conveyor and water tank need to be cleaned.

## 6.9 Annual inspection

- (1) Whether the filter element of the air filter needs to be cleaned or replaced
- (2) Whether the hydraulic oil tank, cooling water tank, oil cooler and other oil tanks

need to be cleaned.

- (3) Check the daily and monthly maintenance items.
- (4) Fully clean the CNC equipment, electrical cabinets, and machine tools.
- (5) Replace all oil in the hydraulic oil tank and clean the oil tank.
- (6) Check all servo motors, spindle motors and ordinary motors.
- (7) Check the connection between the servo motor and the machine tool, and repair or replace it in time.
- (8) Check each positioning and compensation of the machine tool
- (9) Check all electrical components, relays and switchboards.
- (10) Check that all power meters should indicate the correct position, otherwise adjust and replace.
- (11) Clean the oil filters in the centralized lubrication device, hydraulic tank, and cooling oil tank.
- (12) Check the correctness of all machine operations
- (13) Measure each coordinate axis and gap elimination mechanism and make appropriate compensation.

## 7. Analysis and troubleshooting table of common failures of machine

### 7.1 Common faults and troubleshooting methods of feed system

| No. | Failure                             | cause of issue                                                  | elimination method                                                                                 |
|-----|-------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1   | Ball screw pair noise               | The gland of the lead screw support bearing is not well pressed | Adjust the bearing gland to press the bearing end face                                             |
|     |                                     | Lead screw support bearing may be broken                        | If the bearing is damaged, replace with a new bearing                                              |
|     |                                     | Motor and lead screw coupling are loose                         | Tighten the coupling and lock the screws                                                           |
|     |                                     | Poor lead screw lubrication                                     | Improve lubrication conditions and make enough lubricating oil                                     |
|     |                                     | The ball of lead screw is damaged                               | Replace with new balls                                                                             |
| 2   | Ball screw movement is not flexible | Axial preload is too large                                      | Adjust the axial clearance and preload                                                             |
|     |                                     | The lead screw is not parallel to the guide rail                | Adjust the position of the lead screw support so that the lead screw is parallel to the guide rail |
|     |                                     | The nut axis is not parallel to the guide rail                  | Adjust the position of the nut seat                                                                |
|     |                                     | Lead screw bending deformation                                  | Adjust the lead screw                                                                              |
| 3   | Poor lubrication of the ball screw  | The lubrication system has oil leakage or blockage              | Check the lubrication pipeline                                                                     |

## 7.2 Common faults of tool magazine and manipulator

|                       | Failure                                  | cause of issue                                                                                                        | elimination method                                                 |
|-----------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Tool magazine failure | Tool magazine cannot be rotated          | the coupling of motor shaft and worm shaft is loose                                                                   | Fasten the coupling                                                |
|                       |                                          | the inverter is faulty, check whether the input and output voltage of the inverter is normal                          | Adjust the input and output of the inverter to normal requirements |
|                       |                                          | PLC doesn't have control output, it may be that the relay in the interface board fails                                | Replace the relay                                                  |
|                       |                                          | Mechanical connection is too tight                                                                                    | Adjust connection                                                  |
|                       |                                          | Grid voltage is too low                                                                                               | increase<br>Variable voltage regulator components                  |
|                       | Tool magazine is not in place            | Motor rotation failure, transmission mechanism error                                                                  | Adjust the motor and transmission parts                            |
|                       | The tool pocket cannot clamp the tool    | The adjusting screw on the tool pocket is loose, or the spring is too loose, resulting in insufficient clamping force | Adjust the adjustment screw or replace the spring                  |
|                       |                                          | Tool overweight                                                                                                       | Use tools according to tool specifications                         |
|                       | tool pocket up and down are not in place | Improper installation and adjustment or excessive machining error caused incorrect fork position                      | adjust travel block of fork or repair related parts                |
|                       |                                          | Incorrect installation or improper adjustment of limit switch causes feedback signal error                            | Adjust the position of the limit switch                            |

|                     |                                                   |                                                                                                            |                                                                                                       |
|---------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Manipulator failure | The tool is not clamped tightly and often dropped | Claw spring pressure is too small                                                                          | Adjust the limit nut of claw spring or replace the spring                                             |
|                     |                                                   | The nut behind the spring is loose                                                                         | Tighten the nut to the proper position                                                                |
|                     |                                                   | Tool overweight                                                                                            | Use tools according to tool specifications                                                            |
|                     |                                                   | Manipulator locking pin does not work                                                                      | Check and adjust the locking pin or increase grease                                                   |
|                     | Tool cannot be released after clamping            | The jaw spring is pressed too tightly and the jaw cannot be retracted                                      | Increase lubricating grease to ensure flexible movement of jaws                                       |
|                     | Tool drop during tool exchange                    | The headstock does not return to the tool change point or the tool change point drifts during tool change. | Set the correct tool change point.                                                                    |
|                     |                                                   | When the manipulator is not in place, it begins to grab the tool or the cylinder starts to press the tool  | Adjust the position detection switch to make the system obtain the correct position detection signal. |

### 7.3 Common faults and troubleshooting methods of main drive system

| No. | Failure phenomenon                 | cause of issue                                                          | elimination method        |
|-----|------------------------------------|-------------------------------------------------------------------------|---------------------------|
| 1   | Spindle heating                    | Bearing scratches or damage                                             | Replace with new bearings |
| 2   | Spindle stops during heavy cutting | The transmission belt connecting the motor and the spindle is too loose | Tighten the belt          |

|   |                                            |                                                              |                                                   |
|---|--------------------------------------------|--------------------------------------------------------------|---------------------------------------------------|
|   |                                            | There is oil on the belt surface                             | Wipe clean after cleaning with gasoline           |
|   |                                            | The transmission belt fails after being used for a long time | Replace with new belt                             |
| 3 | Tool cannot be clamped                     | Damaged spring chuck                                         | Replace with new collet chuck                     |
|   |                                            | Disc spring failure                                          | Replace with a new disc spring                    |
|   |                                            | The pull stud on the tool holder is too long                 | Replace the pull studs and install them correctly |
| 4 | The tool cannot be loosened after clamping | Insufficient pressure and stroke of the loosening cylinder   | Adjust pressure and travel switch position        |
| 5 | The headstock is noisy                     | Slack or worn belt                                           | Adjust or replace the transmission belt           |

#### 7.4 Common faults and troubleshooting methods of cooling system

| Failure phenomenon                                                  | cause of issue                                        | elimination method                                                                                             |
|---------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Cooling or chip removal water flows too small or intermittent water | 1.The water tank level does not meet the requirements | Add cutting fluid                                                                                              |
|                                                                     | 2.Filter clogged                                      | Shut down to clean the water tank and filter                                                                   |
|                                                                     | 3.there is air in the pump                            | After filling the cutting fluid, open the air release valve to exhaust, and then tighten the air release valve |
| Cooling or chip removal water pump does not discharge water         | 1.The water tank level does not meet the requirements | Add cutting fluid                                                                                              |
|                                                                     | 2.Filter clogged                                      | Shut down to clean the water tank and filter                                                                   |
|                                                                     | 3.Damaged water pump                                  | Ask the manufacturer to repair or replace the pump                                                             |

|                                                     |                                    |                                               |
|-----------------------------------------------------|------------------------------------|-----------------------------------------------|
| Cooling or chip flushing water pump does not rotate | 1.The pump is stuck by impurities. | Clean the water tank and pump                 |
|                                                     | 2.circuit failure                  | Check circuit wiring                          |
|                                                     | 3.Damaged water pump               | Ask the manufacturer to repair or replace the |

### 7.5 Common faults and troubleshooting methods of pneumatic systems

| No. | Failure phenomenon                         | cause of issue                              | elimination method                         |
|-----|--------------------------------------------|---------------------------------------------|--------------------------------------------|
| 1   | Air pressure alarm                         | Insufficient air pressure                   | Increase air pressure                      |
|     |                                            | The pipeline is leaking seriously           | Replace damaged seals, joints or air pipes |
|     |                                            | Damaged pressure switch                     | Replace the pressure switch                |
|     |                                            | Alarm pressure is set too high              | Adjust the alarm pressure                  |
| 2   | The solenoid valve does not work           | Bad wiring                                  | Correct wiring of solenoid valve           |
|     |                                            | Insufficient voltage                        | Connect the correct voltage                |
|     |                                            | wrong pipe connection                       | reconnect the pipe correctly               |
|     |                                            | The seal is damaged and leaks               | Replace damaged seals                      |
|     |                                            | The valve plug is blocked by foreign matter | Clean up foreign objects                   |
|     |                                            | Spring damaged                              | Replace the spring                         |
| 3   | Pressure reducing valve cannot be adjusted | inlet and outlet are installed reversely    | reconnect the pipe correctly               |
|     |                                            | Spring damaged                              | Replace the spring                         |

|   |                                      |                                             |                                                  |
|---|--------------------------------------|---------------------------------------------|--------------------------------------------------|
|   |                                      | The valve plug is blocked by foreign matter | Clean up foreign objects                         |
|   |                                      | Damaged seal                                | Replace damaged seals                            |
|   |                                      | Pressure reducing valve closed              | Open the pressure reducing valve                 |
| 4 | One-way throttle valve does not pass | inlet and outlet are installed reversely    | reconnect the pipe correctly                     |
|   |                                      | Throttle valve damaged                      | Replace the throttle valve                       |
| 5 | No spindle front seal                | Insufficient air pressure                   | Increase air pressure                            |
|   |                                      | Wrong pipe connection                       | reconnect the pipe correctly                     |
|   |                                      | Pressure reducing valve failure             | Deal with the failure of pressure reducing valve |
| 6 | No air cooling                       | Insufficient air pressure                   | Increase air pressure                            |
|   |                                      | Hand valve closed                           | Open the hand valve                              |
|   |                                      | Solenoid valve failure                      | Deal with solenoid valve fault                   |
| 7 | No action of the boosting cylinder   | Insufficient air pressure                   | Increase air pressure                            |
|   |                                      | Solenoid valve failure                      | Deal with solenoid valve fault                   |
| 8 | No spindle blowing                   | Insufficient air pressure                   | Increase air pressure                            |
|   |                                      | Wrong pipe connection                       | reconnect the pipe correctly                     |
|   |                                      | Solenoid valve failure                      | Deal with solenoid valve fault                   |
|   |                                      | Throttle valve failure                      | Troubleshoot by throttle valve                   |
|   |                                      | Pressure reducing valve                     | Deal with the failure of pressure                |
| 9 | tool pot can not be downward         | Insufficient air pressure                   | Increase air pressure                            |
|   |                                      | Wrong pipe connection                       | reconnect the pipe correctly                     |
|   |                                      | Solenoid valve failure                      | Deal with solenoid valve fault                   |
|   |                                      | Cylinder failure                            | Replace cylinder                                 |

|    |                                                                  |                                       |                      |
|----|------------------------------------------------------------------|---------------------------------------|----------------------|
| 10 | The air storage tank does not replenish air during the operation | The gas storage tank is not sensitive | Replace the gas tank |
|----|------------------------------------------------------------------|---------------------------------------|----------------------|

## 7.6 Common faults and solutions of ZF gearbox

| phenomenon                                                                | reason                                                                                                                                      | solution                                                                                                                                                                             |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The gearbox sound is loud and there is knocking noise                     | The speed sensor contacting the motor is loose, causing the motor to run abnormally; the speed sensor is dirty and the signal is not clear. | Check the speed sensor and the wiring connected to the motor; clean/replace the speed sensor if necessary; check the motor control system and adjust the corresponding speed control |
| The gearbox sound is loud and noisy during operation                      | After cutting at high gear (1:1) for a long time, when switching to gear (1:4).                                                             | Try to change gears several times, the noise of the gearbox will be normal.                                                                                                          |
| The gearbox sound is loud and noisy when running at a certain speed ratio | The motor shaft is too long and the support bearing is damaged.                                                                             | Check the bearings and replace them with new ones if necessary.                                                                                                                      |
| There is oil leakage at the gearbox end                                   | Problem with shaft seal.                                                                                                                    | Renew the shaft seal, if necessary, send the gearbox back to ZF for inspection                                                                                                       |
| Oil leakage from the vent of the gearbox                                  | The oil has aged, or the oil was added too much when changing the oil                                                                       | Change the oil, if necessary, check the oil level and correct position.                                                                                                              |

|                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The machine tool control system cannot receive the gear shifting positioning signal from the gearbox shifting assembly, and the gear is disengaged at high speed, and the gear shift is not working. | The pin of the gearbox shift component is loose; the shift component is faulty; the PLC installation are poor; the tooth tip of the sliding sleeve is worn.                                                                                                                                                | Check whether there is lubricating oil in the shift mechanism, and clean the pins to ensure that the connector is locked with a clamp; send the reduction gear back to ZF for testing;<br>PLC---Motor yaw angle is too large, and the speed is too high |
| Gears cannot mesh                                                                                                                                                                                    | Limit switch failure.                                                                                                                                                                                                                                                                                      | Send the gearbox to ZF for inspection.                                                                                                                                                                                                                  |
| Gearbox temperature rise                                                                                                                                                                             | the oil outlet hole is too small, the basic oil level becomes higher; the oil intake is too large or insufficient; the oil discharge pipe faces upwards and the oil level is more than half; the oil discharge pipe hole diameter is too small, causing the overflow port to be higher than the oil level. | Increase the oil outlet joints and pipelines; adjust the appropriate oil inlet and outlet ports and the amount of oil, the oil outlet faces downward.                                                                                                   |
| Burning of internal parts of the gearbox                                                                                                                                                             | Sun gear bearing wear; improper assembly, foreign matter falling; too little oil in and out; defective original parts or failure of oil cooler.                                                                                                                                                            | Return the gearbox to ZF for testing and maintenance.                                                                                                                                                                                                   |
| Note: For failures that cannot be identified or eliminated, please contact the manufacturer's technical staff for assistance                                                                         |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                         |

### 7.7 List of common wearing parts of machine tools

| Part Name                | Wearing parts                                                                                   |
|--------------------------|-------------------------------------------------------------------------------------------------|
| Boosting cylinder        | Polyurethane oil seal, O-ring seal                                                              |
| Full protection          | Brushes, slide rails, rollers, scrapers                                                         |
| Rail guard               | Three-axis guide rail guard                                                                     |
| Pneumatic lines          | Air source processing unit, solenoid valve, pressure reducing valve, throttle valve, drag chain |
| lubricating              | Lubrication pump, quantitative oiler                                                            |
| Hydraulic station        | Filter element, electromagnetic coil                                                            |
| Cooling and chip removal | Vertical pump, level gauge, screw chip conveyor                                                 |
| electric                 | Proximity switch, fuse                                                                          |

## 8. Recycling and environmental protection

During the production process, customers should refer to the following methods to deal with the waste generated by different workpieces:

| material                 | Method                                                                                                                                                         |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Metal                    | The metal material of this machine is 100% recyclable                                                                                                          |
| Plastic                  | The plastic materials of this machine can be recycled after melting, granulating and crushing.                                                                 |
| Glass                    | It can be disassembled and processed by the glass manufacturer.                                                                                                |
| other materials          | The electrical and other materials of the machine tool can be handed over to an approved collection department for processing.                                 |
| Scraped or damaged parts | Scraped or damaged parts cannot be discarded casually, and those that cannot be recycled can be handed over to an approved collection department for disposal. |

## **9. Description and others**

### **9.1 Description**

Due to the continuous improvement of the product, there may be some differences between the content described in this manual and the actual delivered machine tool, please pay attention to it. The company reserves the right to interpret the contents of this manual.

## **Appendix I**

Vertical machining center

Quality Certificate

The geometrical accuracy of the machine is tested according to 《GB/T 18400.2-2010 Machining Center Inspection Conditions Part 2: Vertical or Vertical Spindle Machine Tool Geometric Accuracy Inspection (Vertical Z-Axis) with Vertical Main Rotary Axis》 ; The linear positioning accuracy and repeat positioning accuracy of the machine are tested according to 《GB/T 18400.4-2010 Machining Center Inspection Conditions Part 4: Positioning Accuracy and Repeat Positioning Accuracy of Linear and Rotary Axis》;The positioning accuracy and repeat positioning accuracy test shall be carried out after the load test and before the work accuracy test.It is approved to leave the factory.

Serial No.:

Director (stamp) year month

Inspector (stamp) year month

| No. | Test items                                                                                                          | Tolerance                                               | Model          | Measured |  | Note |
|-----|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------|----------|--|------|
| G1  | Straightness of the movement of the X-axis:<br>a) In the Z–X vertical plane<br><br>b) In the X–Y horizontal plane   | 0.015<br>Partial tolerance:<br>In any 300mm is<br>0.007 | V4/VMC400E     |          |  |      |
|     |                                                                                                                     |                                                         | VMC640         |          |  |      |
|     |                                                                                                                     |                                                         | VMC740         |          |  |      |
|     |                                                                                                                     |                                                         | VMC855/VMC855B |          |  |      |
|     |                                                                                                                     |                                                         | VMC850B        |          |  |      |
|     |                                                                                                                     |                                                         | VDC4050        |          |  |      |
|     |                                                                                                                     | 0.02<br>Partial tolerance:<br>In any 300mm is<br>0.007  | V8             |          |  |      |
|     |                                                                                                                     |                                                         | VMC966         |          |  |      |
|     |                                                                                                                     |                                                         | VMC1000        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1100        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1160        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1200        |          |  |      |
|     |                                                                                                                     |                                                         | VDC1270        |          |  |      |
|     |                                                                                                                     |                                                         | VNM5710        |          |  |      |
|     |                                                                                                                     | 0.025<br>Partial tolerance:<br>In any 300mm is<br>0.007 | VMC1300        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1580        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1600        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1800        |          |  |      |
| G2  | Straightness of the Y-axis axis movement:<br><br>a) In the Y–Z vertical plane<br><br>b) In the X–Y horizontal plane | 0.010<br>Partial tolerance:<br>In any 300mm is<br>0.007 | V4/VMC400E     |          |  |      |
|     |                                                                                                                     |                                                         | VMC640         |          |  |      |
|     |                                                                                                                     |                                                         | VMC740         |          |  |      |
|     |                                                                                                                     |                                                         | VMC850B        |          |  |      |
|     |                                                                                                                     |                                                         | VDC4050        |          |  |      |
|     |                                                                                                                     | 0.015<br>Partial tolerance:<br>In any 300mm is<br>0.007 | VMC855/VMC855B |          |  |      |
|     |                                                                                                                     |                                                         | V8             |          |  |      |
|     |                                                                                                                     |                                                         | VMC966         |          |  |      |
|     |                                                                                                                     |                                                         | VMC1000        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1100        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1160        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1200        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1300        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1580        |          |  |      |
|     |                                                                                                                     |                                                         | VDC1270        |          |  |      |
|     |                                                                                                                     |                                                         | VNM5710        |          |  |      |
|     |                                                                                                                     | 0.020<br>Partial tolerance:<br>In any 300mm is<br>0.007 | VMC1600        |          |  |      |
|     |                                                                                                                     |                                                         | VMC1800        |          |  |      |

| No. | Test items                                                                                                                                                                                                                                                     | Tolerance                                                   | Model          | Measured |  | Note |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------|----------|--|------|
| G3  | Straightness of the movement of the Z axis:<br>a) In the Z–X vertical plane parallel to the X axis                                                                                                                                                             | 0.010                                                       | V4/VMC400E     |          |  |      |
|     |                                                                                                                                                                                                                                                                | Partial tolerance:<br>In any 300mm is<br>0.007              | VMC640         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC740         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC850B        |          |  |      |
|     | b) In the Y–Z vertical plane parallel to the Y-axis axis                                                                                                                                                                                                       | 0.015<br><br>Partial tolerance:<br>In any 300mm is<br>0.007 | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | V8             |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC966         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1000        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1100        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1160        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1200        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1300        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1580        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1600        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1800        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VDC1270        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VDC4050        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VNM5710        |          |  |      |
| G4  | Angle deviation of the X-axis axis movement:<br>a) In the-Z-X vertical plane parallel to the direction of movement (pitching)<br>b) In the X–Y horizontal plane (deflection)<br>c) In the Y–Z vertical plane perpendicular to the direction of movement (tilt) | a)、b)、c)<br>0.060/1000(or<br>60μrad or 12″)                 | V4/VMC400E     |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC640         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC740         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC850B        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | V8             |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC966         |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1000        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1100        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1160        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1200        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1300        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1580        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1600        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VMC1800        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VDC1270        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VDC4050        |          |  |      |
|     |                                                                                                                                                                                                                                                                |                                                             | VNM5710        |          |  |      |

| No. | Test items                                                                                                                                                                                                                                                      | Tolerance                               | Model          | Measured |  | Note |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------|----------|--|------|
| G5  | Angle deviation of the Y axis motion:<br>a) In the Y-Z vertical plane parallel to the direction of movement (pitching)<br><br>b) In the X-Y horizontal plane (deflection)<br><br>c) In the Z-X vertical plane perpendicular to the direction of movement (tilt) | a)、b)、c)<br>0.060/1000(or 60μrad or 12" | V4/VMC400E     |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC640         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC740         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC850B        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | V8             |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC966         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1000        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1100        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1160        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1200        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1300        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1580        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1600        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1800        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VDC1270        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VDC4050        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VNM5710        |          |  |      |
| G6  | Angle deviation of the Z axis movement:<br>a) In the Z-X vertical plane parallel to the Y-axis axis<br><br>b) In the Z-X vertical plane parallel to the X-axis axis                                                                                             | a)、b)、c)<br>0.060/1000(or 60μrad or 12" | V4/VMC400E     |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC640         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC740         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC850B        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | V8             |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC966         |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1000        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1100        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1160        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1200        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1300        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1580        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1600        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VMC1800        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VDC1270        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VDC4050        |          |  |      |
|     |                                                                                                                                                                                                                                                                 |                                         | VNM5710        |          |  |      |

| No. | Test items                                                        | Tolerance | Model          | Measured |  | Note |
|-----|-------------------------------------------------------------------|-----------|----------------|----------|--|------|
| G7  | Verticality between Z-axis axis movement and X-axis axis movement | 0.02/500  | V4/VMC400E     |          |  |      |
|     |                                                                   |           | VMC640         |          |  |      |
|     |                                                                   |           | VMC740         |          |  |      |
|     |                                                                   |           | VMC855/VMC855B |          |  |      |
|     |                                                                   |           | VMC850B        |          |  |      |
|     |                                                                   |           | V8             |          |  |      |
|     |                                                                   |           | VMC966         |          |  |      |
|     |                                                                   |           | VMC1000        |          |  |      |
|     |                                                                   |           | VMC1100        |          |  |      |
|     |                                                                   |           | VMC1160        |          |  |      |
|     |                                                                   |           | VMC1200        |          |  |      |
|     |                                                                   |           | VMC1300        |          |  |      |
|     |                                                                   |           | VMC1580        |          |  |      |
|     |                                                                   |           | VMC1600        |          |  |      |
|     |                                                                   |           | VMC1800        |          |  |      |
|     |                                                                   |           | VDC1270        |          |  |      |
|     |                                                                   |           | VDC4050        |          |  |      |
|     |                                                                   |           | VNM5710        |          |  |      |
| G8  | Verticality between Z-axis axis movement and Y-axis axis movement | 0.02/500  | V4/VMC400E     |          |  |      |
|     |                                                                   |           | VMC640         |          |  |      |
|     |                                                                   |           | VMC740         |          |  |      |
|     |                                                                   |           | VMC855/VMC855B |          |  |      |
|     |                                                                   |           | VMC850B        |          |  |      |
|     |                                                                   |           | V8             |          |  |      |
|     |                                                                   |           | VMC966         |          |  |      |
|     |                                                                   |           | VMC1000        |          |  |      |
|     |                                                                   |           | VMC1100        |          |  |      |
|     |                                                                   |           | VMC1160        |          |  |      |
|     |                                                                   |           | VMC1200        |          |  |      |
|     |                                                                   |           | VMC1300        |          |  |      |
|     |                                                                   |           | VMC1580        |          |  |      |
|     |                                                                   |           | VMC1600        |          |  |      |
|     |                                                                   |           | VMC1800        |          |  |      |
|     |                                                                   |           | VDC1270        |          |  |      |
|     |                                                                   |           | VDC4050        |          |  |      |
|     |                                                                   |           | VNM5710        |          |  |      |

| No. | Test items                                                                         | Tolerance            | Model          | Measured |  | Note |
|-----|------------------------------------------------------------------------------------|----------------------|----------------|----------|--|------|
| G9  | The perpendicularity between the Y-axis axis movement and the X-axis axis movement | 0.02/500             | V4/VMC400E     |          |  |      |
|     |                                                                                    |                      | VMC640         |          |  |      |
|     |                                                                                    |                      | VMC740         |          |  |      |
|     |                                                                                    |                      | VMC855/VMC855B |          |  |      |
|     |                                                                                    |                      | VMC850B        |          |  |      |
|     |                                                                                    |                      | V8             |          |  |      |
|     |                                                                                    |                      | VMC966         |          |  |      |
|     |                                                                                    |                      | VMC1000        |          |  |      |
|     |                                                                                    |                      | VMC1100        |          |  |      |
|     |                                                                                    |                      | VMC1160        |          |  |      |
|     |                                                                                    |                      | VMC1200        |          |  |      |
|     |                                                                                    |                      | VMC1300        |          |  |      |
|     |                                                                                    |                      | VMC1580        |          |  |      |
|     |                                                                                    |                      | VMC1600        |          |  |      |
|     |                                                                                    |                      | VMC1800        |          |  |      |
|     |                                                                                    |                      | VDC1270        |          |  |      |
|     |                                                                                    |                      | VDC4050        |          |  |      |
|     |                                                                                    |                      | VNM5710        |          |  |      |
| G10 | a)Periodic axial turbulence of the spindle<br>b)Runout of the spindle nose         | a) 0.005<br>b) 0.010 | V4/VMC400E     |          |  |      |
|     |                                                                                    |                      | VMC640         |          |  |      |
|     |                                                                                    |                      | VMC740         |          |  |      |
|     |                                                                                    |                      | VMC855/VMC855B |          |  |      |
|     |                                                                                    |                      | VMC850B        |          |  |      |
|     |                                                                                    |                      | V8             |          |  |      |
|     |                                                                                    |                      | VMC966         |          |  |      |
|     |                                                                                    |                      | VMC1000        |          |  |      |
|     |                                                                                    |                      | VMC1100        |          |  |      |
|     |                                                                                    |                      | VMC1160        |          |  |      |
|     |                                                                                    |                      | VMC1200        |          |  |      |
|     |                                                                                    |                      | VMC1300        |          |  |      |
|     |                                                                                    |                      | VMC1580        |          |  |      |
|     |                                                                                    |                      | VMC1600        |          |  |      |
|     |                                                                                    |                      | VMC1800        |          |  |      |
|     |                                                                                    |                      | VDC1270        |          |  |      |
|     |                                                                                    |                      | VDC4050        |          |  |      |
|     |                                                                                    |                      | VNM5710        |          |  |      |

| No. | Test items                                                                                                                        | Tolerance                             | Model          | Measured |  | Note |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------|----------|--|------|
| G11 | Radial runout of the spindle taper hole:<br>a) Near the end of the spindle<br><br>b) 300 mm from the end of the spindle           | a) 0.010<br>b) 0.020                  | V4/VMC400E     |          |  |      |
|     |                                                                                                                                   |                                       | VMC640         |          |  |      |
|     |                                                                                                                                   |                                       | VMC740         |          |  |      |
|     |                                                                                                                                   |                                       | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                   |                                       | VMC850B        |          |  |      |
|     |                                                                                                                                   |                                       | V8             |          |  |      |
|     |                                                                                                                                   |                                       | VMC966         |          |  |      |
|     |                                                                                                                                   |                                       | VMC1000        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1100        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1160        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1200        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1300        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1580        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1600        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1800        |          |  |      |
|     |                                                                                                                                   |                                       | VDC1270        |          |  |      |
|     |                                                                                                                                   |                                       | VDC4050        |          |  |      |
|     |                                                                                                                                   |                                       | VNM5710        |          |  |      |
| G12 | Parallelism between spindle axis and the movement of Z axis :<br>a) In the Y-Z vertical plane<br><br>b) In the Z-X vertical plane | a) and b) 0.015 over 300 measurements | V4/VMC400E     |          |  |      |
|     |                                                                                                                                   |                                       | VMC640         |          |  |      |
|     |                                                                                                                                   |                                       | VMC740         |          |  |      |
|     |                                                                                                                                   |                                       | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                   |                                       | VMC850B        |          |  |      |
|     |                                                                                                                                   |                                       | V8             |          |  |      |
|     |                                                                                                                                   |                                       | VMC966         |          |  |      |
|     |                                                                                                                                   |                                       | VMC1000        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1100        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1160        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1200        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1300        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1580        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1600        |          |  |      |
|     |                                                                                                                                   |                                       | VMC1800        |          |  |      |
|     |                                                                                                                                   |                                       | VDC1270        |          |  |      |
|     |                                                                                                                                   |                                       | VDC4050        |          |  |      |
|     |                                                                                                                                   |                                       | VNM5710        |          |  |      |

| No. | Test items                                                                 | Tolerance                                                         | Model          | Measured |  | Note |
|-----|----------------------------------------------------------------------------|-------------------------------------------------------------------|----------------|----------|--|------|
| G13 | Verticality between the axis of the spindle and the movement of the X-axis | 0.020/300<br>300 is the distance between the two measuring points | V4/VMC400E     |          |  |      |
|     |                                                                            |                                                                   | VMC640         |          |  |      |
|     |                                                                            |                                                                   | VMC740         |          |  |      |
|     |                                                                            |                                                                   | VMC855/VMC855B |          |  |      |
|     |                                                                            |                                                                   | VMC850B        |          |  |      |
|     |                                                                            |                                                                   | V8             |          |  |      |
|     |                                                                            |                                                                   | VMC966         |          |  |      |
|     |                                                                            |                                                                   | VMC1000        |          |  |      |
|     |                                                                            |                                                                   | VMC1100        |          |  |      |
|     |                                                                            |                                                                   | VMC1160        |          |  |      |
|     |                                                                            |                                                                   | VMC1200        |          |  |      |
|     |                                                                            |                                                                   | VMC1300        |          |  |      |
|     |                                                                            |                                                                   | VMC1580        |          |  |      |
|     |                                                                            |                                                                   | VMC1600        |          |  |      |
|     |                                                                            |                                                                   | VMC1800        |          |  |      |
|     |                                                                            |                                                                   | VDC1270        |          |  |      |
|     |                                                                            |                                                                   | VDC4050        |          |  |      |
|     |                                                                            |                                                                   | VNM5710        |          |  |      |
| G14 | Verticality between the axis of the spindle and the movement of the Y-axis | 0.020/300<br>300 is the distance between the two measuring points | V4/VMC400E     |          |  |      |
|     |                                                                            |                                                                   | VMC640         |          |  |      |
|     |                                                                            |                                                                   | VMC740         |          |  |      |
|     |                                                                            |                                                                   | VMC855/VMC855B |          |  |      |
|     |                                                                            |                                                                   | VMC850B        |          |  |      |
|     |                                                                            |                                                                   | V8             |          |  |      |
|     |                                                                            |                                                                   | VMC966         |          |  |      |
|     |                                                                            |                                                                   | VMC1000        |          |  |      |
|     |                                                                            |                                                                   | VMC1100        |          |  |      |
|     |                                                                            |                                                                   | VMC1160        |          |  |      |
|     |                                                                            |                                                                   | VMC1200        |          |  |      |
|     |                                                                            |                                                                   | VMC1300        |          |  |      |
|     |                                                                            |                                                                   | VMC1580        |          |  |      |
|     |                                                                            |                                                                   | VMC1600        |          |  |      |
|     |                                                                            |                                                                   | VMC1800        |          |  |      |
|     |                                                                            |                                                                   | VDC1270        |          |  |      |
|     |                                                                            |                                                                   | VDC4050        |          |  |      |
|     |                                                                            |                                                                   | VNM5710        |          |  |      |

| No. | Test items                                           | Tolerance                                         | Model          | Measured |  | Note |
|-----|------------------------------------------------------|---------------------------------------------------|----------------|----------|--|------|
| G15 | Flatness of the table surface                        | 0.020<br><br>Partial tolerance: In 300mm is 0.012 | V4/VMC400E     |          |  |      |
|     |                                                      |                                                   | VMC640         |          |  |      |
|     |                                                      |                                                   | VMC740         |          |  |      |
|     |                                                      |                                                   | VMC850B        |          |  |      |
|     |                                                      |                                                   | V8             |          |  |      |
|     |                                                      |                                                   | VDC4050        |          |  |      |
|     |                                                      | 0.025<br><br>Partial tolerance: In 300mm is 0.012 | VMC855/VMC855B |          |  |      |
|     |                                                      |                                                   | VMC966         |          |  |      |
|     |                                                      |                                                   | VMC1000        |          |  |      |
|     |                                                      |                                                   | VMC1100        |          |  |      |
|     |                                                      |                                                   | VMC1160        |          |  |      |
|     |                                                      |                                                   | VMC1200        |          |  |      |
|     |                                                      |                                                   | VMC1300        |          |  |      |
|     |                                                      |                                                   | VMC1580        |          |  |      |
|     |                                                      |                                                   | VMC1600        |          |  |      |
|     |                                                      |                                                   | VDC1270        |          |  |      |
|     |                                                      |                                                   | VNM5710        |          |  |      |
|     |                                                      | 0.030<br><br>Partial tolerance: In 300mm is 0.012 | VMC1800        |          |  |      |
|     |                                                      |                                                   |                |          |  |      |
| G16 | Parallelism between the table surface and the X axis | 0.025                                             | V4/VMC400E     |          |  |      |
|     |                                                      |                                                   | VMC640         |          |  |      |
|     |                                                      |                                                   | VMC740         |          |  |      |
|     |                                                      |                                                   | VMC855/VMC855B |          |  |      |
|     |                                                      |                                                   | VMC850B        |          |  |      |
|     |                                                      |                                                   | VDC4050        |          |  |      |
|     |                                                      | 0.030                                             | V8             |          |  |      |
|     |                                                      |                                                   | VMC966         |          |  |      |
|     |                                                      |                                                   | VMC1000        |          |  |      |
|     |                                                      |                                                   | VMC1100        |          |  |      |
|     |                                                      |                                                   | VMC1160        |          |  |      |
|     |                                                      |                                                   | VMC1200        |          |  |      |
|     |                                                      |                                                   | VDC1270        |          |  |      |
|     |                                                      |                                                   | VNM5710        |          |  |      |
|     |                                                      | 0.040                                             | VMC1300        |          |  |      |
|     |                                                      |                                                   | VMC1580        |          |  |      |
|     |                                                      |                                                   | VMC1600        |          |  |      |
|     |                                                      |                                                   | VMC1800        |          |  |      |

| No. | Test items                                                                                                    | Tolerance                           | Model          | Measured |  | Note |
|-----|---------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------|----------|--|------|
| G17 | Parallelism between the table surface and the Y axis                                                          | 0.020                               | V4             |          |  |      |
|     |                                                                                                               |                                     | VMC400E        |          |  |      |
|     |                                                                                                               |                                     | VMC640         |          |  |      |
|     |                                                                                                               |                                     | VMC740         |          |  |      |
|     |                                                                                                               |                                     | VMC850B        |          |  |      |
|     |                                                                                                               |                                     | VDC4050        |          |  |      |
|     |                                                                                                               | 0.025                               | VMC855/VMC855B |          |  |      |
|     |                                                                                                               |                                     | V8             |          |  |      |
|     |                                                                                                               |                                     | VMC966         |          |  |      |
|     |                                                                                                               |                                     | VMC1000        |          |  |      |
|     |                                                                                                               |                                     | VMC1100        |          |  |      |
|     |                                                                                                               |                                     | VMC1160        |          |  |      |
|     |                                                                                                               |                                     | VMC1200        |          |  |      |
|     |                                                                                                               |                                     | VMC1300        |          |  |      |
|     |                                                                                                               |                                     | VMC1580        |          |  |      |
|     |                                                                                                               |                                     | VDC1270        |          |  |      |
|     |                                                                                                               |                                     | VNM5710        |          |  |      |
|     |                                                                                                               | 0.030                               | VMC1600        |          |  |      |
|     |                                                                                                               |                                     | VMC1800        |          |  |      |
| G18 | Longitudinal axis of working table: Parallelism between the center or reference T-slot and X-axis axis motion | a) and b) and c)<br>In 300 mm 0.015 | V4/VMC400E     |          |  |      |
|     |                                                                                                               |                                     | VMC640         |          |  |      |
|     |                                                                                                               |                                     | VMC740         |          |  |      |
|     |                                                                                                               |                                     | VMC855/VMC855B |          |  |      |
|     |                                                                                                               |                                     | VMC850B        |          |  |      |
|     |                                                                                                               |                                     | V8             |          |  |      |
|     |                                                                                                               |                                     | VMC966         |          |  |      |
|     |                                                                                                               |                                     | VMC1000        |          |  |      |
|     |                                                                                                               |                                     | VMC1100        |          |  |      |
|     |                                                                                                               |                                     | VMC1160        |          |  |      |
|     |                                                                                                               |                                     | VMC1200        |          |  |      |
|     |                                                                                                               |                                     | VMC1300        |          |  |      |
|     |                                                                                                               |                                     | VMC1580        |          |  |      |
|     |                                                                                                               |                                     | VMC1600        |          |  |      |
|     |                                                                                                               |                                     | VMC1800        |          |  |      |
|     |                                                                                                               |                                     | VDC1270        |          |  |      |
|     |                                                                                                               |                                     | VDC4050        |          |  |      |
|     |                                                                                                               |                                     | VNM5710        |          |  |      |

| No. | Test items                                                                                                                                         | Tolerance                                                    | Model          | Measured |  | Note |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------|----------|--|------|
| P1  | Linear axis positioning<br>a) Bidirectional positioning accuracy of linear axes<br><br>b) Bidirectional repeat positioning accuracy of linear axes | a). $\pm 0.005/300$<br>JIS<br><br>b). $\pm 0.003/300$<br>JIS | V4/VMC400E     |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC640         |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC740         |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC855/VMC855B |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC850B        |          |  |      |
|     |                                                                                                                                                    |                                                              | V8             |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC966         |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1000        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1100        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1160        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1200        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1300        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1580        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1600        |          |  |      |
|     |                                                                                                                                                    |                                                              | VMC1800        |          |  |      |
|     |                                                                                                                                                    |                                                              | VDC1270        |          |  |      |
|     |                                                                                                                                                    |                                                              | VDC4050        |          |  |      |
|     |                                                                                                                                                    |                                                              | VNM5710        |          |  |      |

## **Appendix II**

Vertical machining center

Packing list

|                                        |                                         |                    | Packing list         |         |        |        | Total 3 page |         | page 1 |         |
|----------------------------------------|-----------------------------------------|--------------------|----------------------|---------|--------|--------|--------------|---------|--------|---------|
| NO.                                    | Name                                    | Type<br>/number    | Model                |         |        |        |              |         |        |         |
|                                        |                                         |                    | V4                   | VMC400E | VMC640 | VMC740 | VMC855       | VMC855B | V8     | VMC850B |
| 1                                      | inner<br>hexagon<br>spanne              | Type               | 4、5、6、8、10           |         |        |        |              |         |        |         |
|                                        |                                         | number             | 1 pc                 |         |        |        |              |         |        |         |
| 2                                      | Wrench                                  | Type               | S12~14、S17~19、S24~27 |         |        |        |              |         |        |         |
|                                        |                                         | number             | 1 pc                 |         |        |        |              |         |        |         |
| 3                                      | Adjustment<br>screw and<br>horn         | Type               | XH71501206           |         |        |        |              |         |        |         |
|                                        |                                         |                    | XH71501207           |         |        |        |              |         |        |         |
|                                        | Anchor<br>screw,<br>nut, flat<br>washer | Type               | XH71501102           |         |        |        |              |         |        |         |
|                                        |                                         |                    | M16×450<br>M16<br>16 |         |        |        |              |         |        |         |
|                                        | number                                  |                    | 6 pc                 | 6 pc    | 6 pc   | 6 pc   | 6 pc         | 8 pc    | 8 pc   | 8 pc    |
| 4                                      | Operation<br>Manual                     | Mechanical<br>part | ✓                    | ✓       | ✓      | ✓      | ✓            | ✓       | ✓      | ✓       |
|                                        |                                         | electrical<br>part | ✓                    | ✓       | ✓      | ✓      | ✓            | ✓       | ✓      | ✓       |
| 5                                      | Quality Certificate                     |                    | ✓                    | ✓       | ✓      | ✓      | ✓            | ✓       | ✓      | ✓       |
| 6                                      | CNC system operation<br>manual          |                    | ✓                    | ✓       | ✓      | ✓      | ✓            | ✓       | ✓      | ✓       |
| 7                                      | Packing list                            |                    | ✓                    | ✓       | ✓      | ✓      | ✓            | ✓       | ✓      | ✓       |
| note:                                  |                                         |                    |                      |         |        |        |              |         |        |         |
| <div>Inspector:</div> <div>Date:</div> |                                         |                    |                      |         |        |        |              |         |        |         |

|                                        |                                |                 | Packing list         |            | Total 3 page                        | page 2                                               |
|----------------------------------------|--------------------------------|-----------------|----------------------|------------|-------------------------------------|------------------------------------------------------|
| NO.                                    | Name                           | Type /number    | Model                |            |                                     |                                                      |
|                                        |                                |                 | VMC966               | VMC1000    | VMC1100<br>(box way、old linear way) | VMC1100 ( new linear way ) / VNM5710                 |
| 1                                      | inner hexagon spanne           | Type            | 4、5、6、8、10           |            |                                     |                                                      |
|                                        |                                | number          | 1 pc                 |            |                                     |                                                      |
| 2                                      | Wrench                         | Type            | S12~14、S17~19、S24~27 |            |                                     |                                                      |
|                                        |                                | number          | 1 pc                 |            |                                     |                                                      |
| 3                                      | Adjustment screw and horn      | Type            | VMC86601208          | XH71501206 |                                     | VNM571001104<br><br>VNM571001210<br><br>VNM571001211 |
|                                        |                                |                 | VMV86601209          | XH71501207 |                                     |                                                      |
|                                        |                                |                 | XH71501104           | XH71501104 |                                     |                                                      |
|                                        | Anchor screw, nut, flat washer | Type            | M16×450<br>M16<br>16 |            |                                     |                                                      |
|                                        | number                         |                 | 8 pc                 | 8 pc       | 8 pc                                | 8 pc                                                 |
| 4                                      | Operation Manual               | Mechanical part | ✓                    | ✓          | ✓                                   | ✓                                                    |
|                                        |                                | electrical part | ✓                    | ✓          | ✓                                   | ✓                                                    |
| 5                                      | Quality Certificate            |                 | ✓                    | ✓          | ✓                                   | ✓                                                    |
| 6                                      | CNC system operation manual    |                 | ✓                    | ✓          | ✓                                   | ✓                                                    |
| 7                                      | Packing list                   |                 | ✓                    | ✓          | ✓                                   | ✓                                                    |
| note:                                  |                                |                 |                      |            |                                     |                                                      |
| <div>Inspector:</div> <div>Date:</div> |                                |                 |                      |            |                                     |                                                      |

|                                        |                                         |                     |                                        |         |         |         |              |         |         |         |
|----------------------------------------|-----------------------------------------|---------------------|----------------------------------------|---------|---------|---------|--------------|---------|---------|---------|
|                                        |                                         |                     | Packing list                           |         |         |         | Total 3 page |         | page 3  |         |
| NO.                                    | Name                                    | Type<br>/number     | Model                                  |         |         |         |              |         |         |         |
|                                        |                                         |                     | VMC1160                                | VMC1200 | VMC1300 | VMC1580 | VMC1600      | VMC1800 | VDC1270 | VDC4050 |
| 1                                      | inner<br>hexagon<br>spanne              | Type                | 4、5、6、8、10                             |         |         |         |              |         |         |         |
|                                        |                                         | number              | 1 pc                                   |         |         |         |              |         |         |         |
| 2                                      | Wrench                                  | Type                | S12~14、S17~19、S24~27                   |         |         |         |              |         |         |         |
|                                        |                                         | number              | 1 pc                                   |         |         |         |              |         |         |         |
| 3                                      | Adjustmen<br>t screw<br>and horn        | Type                | XH71501206<br>XH71501207<br>XH71501104 |         |         |         |              |         |         |         |
|                                        | Anchor<br>screw,<br>nut, flat<br>washer | Type                | M16×450<br>M16<br>16                   |         |         |         |              |         |         |         |
|                                        | number                                  |                     | 8 pc                                   | 10 pc   | 10 pc   | 13 pc   | 15 pc        | 15 pc   | 10 pc   | 8 pc    |
| 4                                      | Operation<br>Manual                     | Mechanica<br>l part | ✓                                      | ✓       | ✓       | ✓       | ✓            | ✓       | ✓       | ✓       |
|                                        |                                         | electrica<br>l part | ✓                                      | ✓       | ✓       | ✓       | ✓            | ✓       | ✓       | ✓       |
| 5                                      | Quality Certificate                     |                     | ✓                                      | ✓       | ✓       | ✓       | ✓            | ✓       | ✓       | ✓       |
| 6                                      | CNC system<br>operation manual          |                     | ✓                                      | ✓       | ✓       | ✓       | ✓            | ✓       | ✓       | ✓       |
| 7                                      | Packing list                            |                     | ✓                                      | ✓       | ✓       | ✓       | ✓            | ✓       | ✓       | ✓       |
| note:                                  |                                         |                     |                                        |         |         |         |              |         |         |         |
| <div>Inspector:</div> <div>Date:</div> |                                         |                     |                                        |         |         |         |              |         |         |         |