

**VMC Q/M4-Q SERIES
VERTICAL MACHINING CENTER**

**OPERATION MANUAL
(MECHANICS)**

 Warning

To use the product safely and correctly, please read carefully the pages of safety at the beginning of the operation specification as well as the pages of used functions, and correctly understand the contents. If attentions and indications about safety in the operation manual are not observed, the operator can be injured even killed. It is required that the specification must be placed nearby the machine for reference on time.




**UNITED INFORMATIVE SMART ENGINEERING
CO.,LTD**

 Warning

When setting, operating and maintaining machine, ensure the safety countermeasures has been read carefully and understood clearly. Otherwise, it presents a danger of injure or kill to the operator.

The manual describes the VMC Q/M4-Q series machine tool.

To avoid the accidents caused by incorrect operation, marks are attached before the attention items in the specification. The definitions of the marks are as followed. Please grasp the meaning of the content th0roughly before reading the text.

 Danger:	To show conditions that will present risk of injure or kill to the operator if operate incorrectly.
 Warning:	To show the potential dangerous conditions that will present risk of injure or kill to the operator if operate incorrectly.
 Attention:	To show the potential dangerous conditions that will present risk of injure or kill to the operator if operate incorrectly.
Notice:	To show the possible dangerous conditions that can damage the properties except the product itself if operate incorrectly.
Notice in use:	Forbid the operator not damaging the product.
Supplementary information:	Reference for using product effectively.

- No part of this manual may be reproduced in any form.
- All appearances and specifications of this series machine are subject to change.

In this manual we have tried as much as possible to describe all the various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as “impossible”. If any question, consult to our company.

Preface

1. Purpose

VMC Q/M4-Q series machines are cutting machining centers controlled by CNC (computer numerical control), which are used for milling, drilling, boring and tapping.

Please do not use the machine for other purposes.

2. User

2.1 Operator

In the manual the personnel who operates the machine is called operator. The operator must read this manual and grasp the meaning of the contents thoroughly. Otherwise, it presents risks of injury to operator himself and also other people around the machine.

Operator can perform "V 1 Routine Maintenance".

Forbidden operations for operator:

- (1) Dismounting removable baffle plate (fixed baffle plate) with equipment.
- (2) Machine installation and remove
- (3) Repaired machine
- (4) Operations in "2 Interval maintenance" of "V Maintenance".

2.2 Routine maintenance and maintenance prevention Personnel

Only those personnel who have received approved trainings by the technical personnel of manufacturer, or the personnel with the same technical level or those who are authorized by the manufacturer.

Permissible operations for routine maintenance and maintenance prevention Personnel

- (1) Dismounting removable baffle plate (fixed baffle plate) with equipment
- (2) Operations in "V 2 Maintenance", except the operation in 2.5.1.

The Routine maintenance and preventive maintenance personnel must read the instruction and grasp the meaning of the contents thoroughly. Otherwise, it presents risks of injury to operator himself and also other people around the machine.

Forbidden operations for routine maintenance and maintenance prevention Personnel


Operations in "2 Interval maintenance" of "V Maintenance"

1. Machine installation and remove
2. Repaired machine
3. Operations in 2.5.1 of "V 2 interval maintenance"

Routine maintenance and prevention maintenance personnel must observe the following "Attentions in Maintenance":

For the routine maintenance, prevention maintenance and maintenance personnel

Maintenance precautions

 warning
Power off the breaker of electrical cabinet door before removing the baffle plate for maintenance. Or else the personnel may be injured by the machine behaving unexpectedly or electric shock.
If only the power to machine for maintenance without baffle plate, assure nobody around the machine. Or else the personnel may be injured by the machine behaving unexpectedly or electric shock. Or else the personnel may be injured by the machine behaving unexpectedly or electric shock.
A brand for noticing the irrelevant people keeping away from the power supply must be placed nearby the breaker of the cabinet door during maintenance. Or else the personnel may be injured by the machine behaving unexpectedly or electric shock.
Before power on for running the machine, make sure no tool is left in the machine during the maintenance or maintenance finished. Otherwise, the left tool may get away and injure the people when the machine behaving unexpectedly.
Equipment with consideration of electric protection (such as resin screwdriver) must be used in electric adjustment with baffle plate removed. Or else the operator may be injured by electric shock.
Mount the removed parts (including screws) after the maintenance. Otherwise, the abnormal work of safety device may occur or people may be injured by the incorrect operation or electric shock.
Always turn off the power to the breaker of cabinet door when replacing parts. Or else the replaced parts may be damaged or the people may be injured by electric shock.
Replacing the fluorescent lamp must be performed by the maintenance personnel only. Routine maintenance and maintenance prevention personnel are forbidden. Or else the abnormal work of safety device may occur, or people may be injured by the machine behaving unexpectedly or by electric shock.

2.3 Maintenance personnel

Maintenance should be performed by the personnel with enough mechanical or electrical knowledge or those trained by the professional personnel of the manufacturers or authorized by their enterprises.

Maintenance personnel are responsible for the following work:

1. Machine installation and remove
2. Repaired machine
3. Operations in 2.5.1 of "V 2 interval maintenance"

Maintenance personnel must read this manual and grasp the meaning of the contents thoroughly. Otherwise, it presents risks of injury to operator himself and also other people around the machine.

Be sure to comply with the "Attentions in maintenance", particularly the skilled maintenance personnel. Make sure no accident caused by negligence or habit happens.

3. Composing of this manual

This manual is for the VMC Q/M4-Q machine tool. The instruction is as followed:

- (1) Operation manual (mechanics) about operation and maintenance of the machine.

- (2) Operation manual (electrics) about operation and program creation of NC(Numerical Control).
- (3) Maintenance manual (mechanics) about the tracing of alarm and troubleshooting as well as the parts replacement .
- (4) Maintenance manual (electrics) about troubleshooting and debugging of NC (Numerical Control) .

Necessary contents in (1) must be read before using the machine.

(1) and (2) should be referred while making routine operation and reference.

(3) and (4) should be referred while troubleshooting, parts replacement and components debugging.

The NC used in the machine is the specific control device. For the basic specifications being able to be used and the classification of the specifications of the optional devices, please refer to the copies of the main specifications and order specifications. In addition, descriptions in (1) and (3) are prior to those in (2) and (4). On the contents of inconsistencies, take the descriptions (1) and (3) as reference.

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The contents of this manual are as followed:

Safety Countermeasures describe the Safety Countermeasures, attentions and warning labels.

I. General information described the matters used in the machine, names of all parts and mechanical materials used with the machine.

II. Setup described the operations of moving and initially mounting the machine.

III. Routine run described the operating processes before machining.

IV. Operating details described the operative sub-items.

V. Maintenance described the routine operations such as checks before operating, interval check and the replacement of the Consumable material parts.

Appendix contained the specifications, drawings and documents.

It is necessary to read the pages of safety countermeasures.

Before the initial operation, read carefully about the contents in part I and part III. During the mounting of the machine, please refer to part II. Before the run of machine, read the part V necessarily and complete the scheme of inspection and maintenance.

All the operations of the machine are included in the part IV. For the operations of NC, please refer to the instruction of the above (2).

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S. Safety Countermeasures

Safety Countermeasures

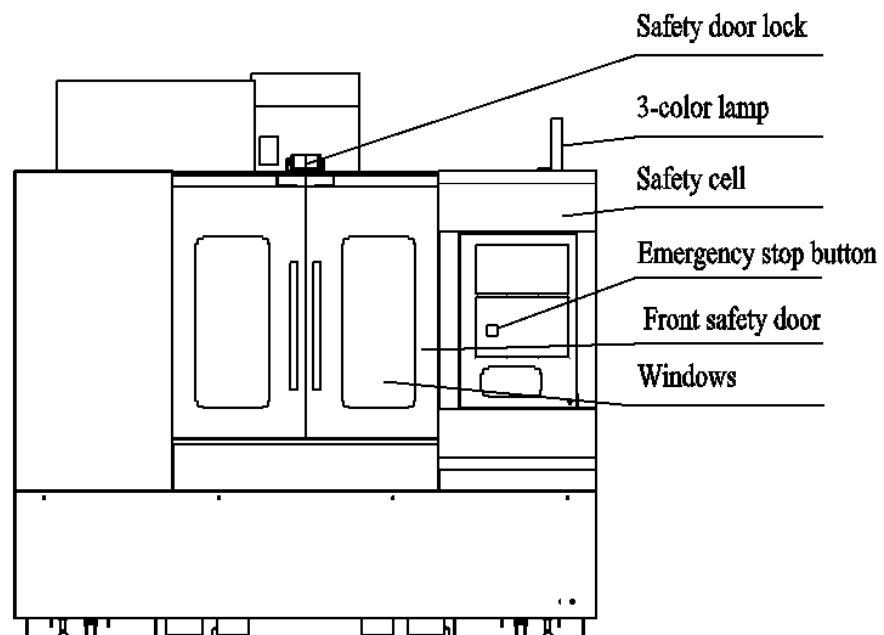
Before using the machine, it is necessary to read and fully understand the contents of the safety issues and relevant functions. Operations without full understanding of the content may lead to unexpected accidents. Please use the machine with full understanding of the content.

When using the machine, if the state or local governments has provided regulations on health and sanitation and safety, the regulations must be followed.

1. Machine Safety Functions

To avoid dangerous, the operator shall not open the safety door during the operation. The lamp for lighting the working area is mounted inside the safety cell.

The machine safety devices are shown in the following figures.



Machine appearance drawing

(A) Solenoid lock switch

The solenoid lock switch is mounted on the upper part of the front safety door.

When the safety door is open, the spindle and X/Y/Z-axis will stop moving.

As the spindle and X/Y/Z-axis have stopped, unlock the doors by the solenoid lock switch, and the safety door can be opened.

(B) Protection cell

The movable parts of the machine tool are equipped with a protection cell.

(C) Emergency stop

The button is mounted on the top left of the control panel.

In case of a machine failure, the operator shall press the emergency stop button in the first place.

Stay alert for pressing the button as necessary. Do not cover the emergency stop button with any objects.

2. Warnings

a) Dangers from the Machine

▲ Warning
The contents related safety countermeasures should be read carefully before setting, operation, and maintenance of the machine. If attentions and indications about safety in the operation manual are not observed, the operator can be injured even killed.

▲ Warning
When opening the protective door, special attention should be paid to avoid touching the moving parts such as the platform and the tool changer etc. Otherwise, wounds may happen by clip.
Do not enter into the machine with the entire body. When entering into the machine with the entire body, other staff may not be able to identify an on-going maintenance, and on some conditions, other staff may start the machine due to the ignorance of the staff within the machine.
Please wipe the coolant and lubricants (grease, oil) from both hands off immediately. The hands with coolant and lubricants will be difficult to carry workpieces, use and operate machine and then it will result in injuries and damage to the workpieces.
Do not open the protective door by using the cross screwdriver to with the power on. Even when the tools are rotating, the processing region is accessible, and thus sometimes injuries may happen. When the power supply is on, use the protective door open and close button to control the protective door.
The total weight of the fixture and workpieces should not exceed the maximum machine load. The weight exceeding the maximum load will bring damage to the platform, injuries to the staff, or the damage to the workpieces and fixtures.
When installing the high-speed spindle, the following specifications and conditions should be met. Otherwise, injuries may happen due to the malfunctioning of the safety devices such as interlocking system etc. 1) When opening the machine protective door, it is necessary to prepare the loop disconnecting the power between the motor and the control unit. 2) The spindle with a velocity transducer is required.
The replacement of the fluorescent lights inside the machine should be only operated by the "maintenance staff", and "routine maintenance and preventive maintenance staff" are not authorized. If the operation is conducted by the staff with insufficient expertise, the safety devices may not fully work, or because of the unexpected movement of the machine, injuries or electric shock may be caused.

▲ Attention
Sharp corners and burrs on processed and unprocessed workpieces should be noticed. They may cause injuries. Gloves or other protective equipment are necessary.
When using or replacing the tools, pay attention to the sharp parts that may cause injuries. When using tools, please wear protective equipment such as gloves etc.
When disposing chips, be careful to avoid injuries. Gloves or other protective equipment are necessary.
The disposal of tools should comply with relevant regulations on the disposal of hazardous materials. Arbitrary discarding will lead to injuries if touched by other people.

Attention
Workpieces should be properly clamped on the fixture for processing. Moreover, the fixture should be kept fixed on the working table. A workpiece in processing that is not completely fixed may come off the fixture and fly out to damage the workpiece and the machine.
Before processing, it should be recognized that the tool has been effectively installed in the tool component. If the installation is improper, the tool may come off and damage the workpiece and the machine.
Before processing, confirmation should be made to ensure that the tool is not worn and broken. Otherwise, the debris of the tool flying out may damage the machine.
Before processing, confirmation should be made to ensure that the tool component is effectively installed on the clamp of the tool magazine in accordance with the instructions (see III.5 "Install the Tool Component"). If the installation is improper, the tool component may come off and fly out to damage the workpiece and the machine.

b) Dangers in the Electrical Operation and Adjustment Process

▲Warning
Due to the dangerous existence of unexpected machine tool movements causing risks of injuries or electric shock, the operation must comply with the following matters. <ul style="list-style-type: none"> ● When setting the machine, the main breaker (out of the electrical cabinet) should be powered off. ● Before the baffle plate is removed for maintenance, the circuit breaker in the electrical cabinet must be powered off. ● When setting and maintaining the components, the circuit breaker in the electrical cabinet and of the optional components should be disconnected. ● When connecting the power supply after the removal of the cover plate for maintenance operations, it is necessary to make sure whether there is other staff nearby
The assembly of the Z-axis motor should be carried out when the main power of the machine is off. Otherwise, unexpected injuries or electric shock may happen.
When carrying out maintenance, a sign should be hung near the circuit breaker in the electrical cabinet, which shows that no one except for the operators is allowed to connect the power supply.
In the process of maintenance operation, as well as when the maintenance operation is done and the power is connected to run the machine, it is important to confirm whether there are tools left in the machine. Otherwise, the movement of the machine may lead to the jam of the tool or damage to the machine, or injured personnel caused by flying tools.
In the process of electrical adjustment with the cover plate removed, tools with fully electrical protection (resin screwdrivers, etc.) should be applied. Otherwise, an electric shock may happen.
After the maintenance finished, all the components including screws disassembled should be mounted. Otherwise, safety devices may not work properly or correctly that cause electric shock or injuries.
The use of the machine should be stopped in the event the power cable and the connection cable are damaged. Otherwise, electric shock or fire may happen. Before the replacement of the damaged cable by the maintenance staff, the machine may not be used.
Before the disassembled cables are installed properly, the power supply of the machine should not be connected. Otherwise, an electric shock may happen.
During the process of replacing the parts, the circuit breaker in the electrical cabinet should always be disconnected. Otherwise, damages to the parts or electric shocks may happen.
In the process of replacement of fuses and batteries, the power must be cut off through the main circuit breaker. Otherwise, an electric shock may happen.

▲Warning
The replacement of the fluorescent lights inside the machine should be only operated by the “maintenance staff”, and “routine maintenance and preventive maintenance staff” is not authorized. If the operation is conducted by the staff with insufficient expertise, the safety devices may not fully work, or because of the unexpected movement of the machine, injuries or electric shocks may be caused.
It should be noticed that although the circuit breaker in the electrical cabinet is disconnected, the power supply at the circuit breaker side is still connected. Moreover, it should be noticed that there are electrical risks in the following devices connected to the main circuit breaker side. <ol style="list-style-type: none"> 1. When an external transformer is installed 2. When external non-standard equipment is installed
Inside the electrical cabinet, even after disconnection of the main circuit breaker, residue voltage still exists in some of the parts, so there presents risks of electric shock. The operation necessary to contact the inside of the electrical cabinet should only be conducted by the staff with enough electrical knowledge.
Do not touch the electrical cabinet with wet hands. Otherwise, an electric shock may happen.
Do not pour liquid onto the operating panel and the electrical cabinet. Otherwise, an electric shock may happen.
Users of pacemakers should keep a distance from the machine. Otherwise, the pacemaker may be affected.

c) Dangers of Heat

▲Warning
Inside the electrical cabinet, even after disconnection of the main circuit breaker, residue voltage still exists in some of the parts, so there is a danger of electric shock. The operation necessary to contact the inside of the electrical cabinet should only be conducted by the staff with enough electrical knowledge.
It should be noticed that following parts should not be touched when machine running and just finish running. Some parts of the machine remained high heat may cause scald. When it is necessary to touch the parts with high heat, heat-resistant gloves are needed. <ul style="list-style-type: none"> ● Servo motor of the axes (X, Y, Z axis, auxiliary axis) ● Spindle motor ● Coolant motor
When the machine power on and off the following positions on the machine should not be touched in short time. Some parts of the machine remained high heat may cause scald. When it is necessary to touch the parts with high heat, heat-resistant gloves are needed. <ul style="list-style-type: none"> ● Power wire ● Hot parts in the electrical cabinet (transformers, radiator)

d) Coolant and Lubricant

Recommended usage of lubricant

Lubricated positions	Mode	Lubricant Type	Lubricant Type	Filling period
LM Track (X, Y, Z) Cast Iron Track (Z) Ball Screw Shaft (X, Y, Z) Bearing (X, Y, Z)	Automatic	Lube oil	ISOVG68 (Turbine Lube Oil)	Supplied when the remaining in the centralized lubrication device pump reduced.
Bearing (X, Y, Z)	Manual	Lube Grease	Lithium Grease	After 3-6 months of running
Magazine Cam Mechanics	Manual	Lube Oil	ISOVG150~IS OVG220 (Turbine Lube Oil)	Lubricant oil cup shortage
Railway of the LM Track Spindle Taper Hole Working Table	Manual	Antirust Oil	SF/Y246B (rust-proof type lube oil) or SF/Y1030 (solvent dilution soft membrane antirust oil)	Being moved In storage

Recommended usage of coolant

Target	Filling Method	Type of Coolant
Cooling Water Tank	Specific coolant is subject to the processing materials (such as steel, copper, special alloys, etc.).	Extreme pressure water-soluble coolant and lubricant
Chiller	Filling to the upper limit of the oil level	ISOVG32

▲Danger

Do not use the coolant with low flash point (2nd oil family with flash point lower than 70°C). Otherwise fire may happen. Even the coolant of 3rd oil family (with a flashpoint between 70°C and 200°C) and 4th oil family (with a flash point higher than 250°C) may be ignited, so it is necessary to pay enough attention to the state and method of use, such as controlling the production of smoke.

▲Warning
<p>Coolant and lubricants (lubricants, grease) are harmful. The following should be paid attention. For the precautions except for the followings and the treatment of the cases of adhesion to human skins, please refer to the instructions implemented on the product packaging.</p> <ul style="list-style-type: none"> ● Do not inhale vapor or misty flue gas ● Avoid contact with skin directly (especially the wound). ● Use protective glasses to avoid splashing into eyes ● Do not swallow
<p>The coolant and lubricant that have deteriorated are extremely hazardous to health and must not be used. Please contact the manufacturer for how to judge the deterioration of the coolant and the lubricant. Retaining and discarding are subject to the indication from the manufacturer.</p>
<p>The use of coolant and lubricant (grease, oil) that make the materials such as PC, nitrile butadiene rubber (NBR), hydrogenated nitrile butadiene rubber (HNBR), fluorinated rubber, nylon, and acrylic resin deteriorate should be avoided. In addition, when the dilution water contains a lot of residual chlorine, the materials above will deteriorate. The machine adopts the materials above as sealing materials and if the sealing is degenerated, electric shocks may happen, or the leaking grease may sinter.</p>
<p>In the use of the coolant and lubricant (grease, oil) other than those recommended by the manufacturer, instructions should be confirmed and pay full attention to the conditions and methods. Otherwise, it is harmful to health, the machine, and the environment.</p>
<p>Adequate amount of coolant should always be guaranteed. Inadequate amount of coolant may cause rise of temperature that leads to fire or damage to the tools and workpieces.</p>
<p>Adjustment of coolant should be avoided during run-time. Otherwise, it may cause injuries.</p>
<p>The coolant hose should not be disassembled when machine running. In this case, it may lead to the splashing of harmful coolant onto people around machine. When removing the coolant hose, the power supply should be disconnected and make sure that the pump has stopped rotation.</p>

▲Attention
<p>Please wipe the coolant and lubricants (grease, oil) from the floor off when they splash out. Or else it presents risks of slip or injuries.</p>
<p>Cleaning should be conducted on a regular basis to avoid blocking of the coolant nozzle and the chip tray with chips. Or else it presents risks of slip or injuries.</p>

Attention
<p>Even if the coolant and lubricant (grease, oil) are recommended, the use of them must follow the instructions from the manufacturer. Improper use will bring adverse impacts on the mechanical components and coatings.</p>
<p>The storage of coolant and lubricants (grease, oil) should be subject to the manufacturer's instructions. Waste coolant and lubricants should comply with the industrial waste implementation of the relevant legislation.</p>

e) Dangers in the Operation

▲ Warning
During the installation, if the components overweight more than hands can do, please use a crane. Or else waist will undertake more burden and they may bring injuries when falling down.
The place where the machine is used should be provided adequate lighting to ensure a safe state, on which components of the machine can be seen clearly. Or else it will lead to accidents. In the place where the machine is running, more than 300 lux of illumination should be ensured.
Do not conduct the operation with an unnatural posture such as assembling and disassembling workpieces far away from the table. In such a case may lead to unexpected injuries. The table should be moved nearby before conducting operations.
For the operations in height, in order to reduce the possibility of falling down, a ladder should be used to ensure a foothold. Stepping on the machine or other objects (stools or desks) that are not used as mounting platforms may likely lead to loss of balance, bringing unexpected accidents.
Emergency stop button operation should be first implemented in the event of the failure. The button should be ready to be pressed at any time when necessary. Nothing should be covered on the emergency stop button.
The cause that triggers the emergency stop should be eliminated before the clearance of the emergency stop. Otherwise, the danger may happen again to bring injuries.
Connections of the emergency stop to the external equipment should be effectively implemented. Accidents with inadequate connections may lead to injuries or damage to the tools due to malfunctioning of the emergency stop device.
When installing the high-speed spindle, the following specifications should be met. Otherwise, injuries may happen due to the malfunctioning of the safety devices such as interlocking system etc. 1) When opening the machine protective door, it is necessary to prepare the loop disconnecting the power between the motor and the control unit. 2) The spindle with a velocity transducer is required.
It is allowed to control 1 or 2 servo motors as the 4 th and 5 th axis (auxiliary axis). Auxiliary axes must be configured on the working table. With the axes in other positions, the operator will not be protected by the fixed baffle plate and the protective door and may thus be injured.

Enough space should be kept when installing machine. For the maintenance space, please refer to the layout plan in “II. Setting Method 3 Installation Method 3.1 Installation of Leveling Bolts and seats”.

f) Clothing

▲ Warning
Operations of the operating panel and the display with gloves on should be avoided. Operations of the operating panel and the display with gloves on may cause mistakes while pressing keys and pressing more than one key. Thus, a wrong operation of the machine may happen that leads injuries or the damage to the workpiece and the machine.
In order to prevent the accident of being caught in the machine in operations, the safety clothes as shown below should be worn. <ul style="list-style-type: none"> ● A cap is always required. Long hair may be caught in the machine and affect sight, so it must be tied up in the cap. ● Safety shoes are always required. ● Protective glasses should be used ● Buttons at the ends of sleeves should be fastened. ● No necklaces and bracelets ● No scarves

g) Settings about Power on, Operating inside the Machine, and Parameter

▲Warning
The operator should not open the electrical cabinet. The high voltage parts inside may lead to an electric shock. When connecting the power supply, the operation should be conducted through the main breaker (out of the electrical cabinet) and the power switch (on the operating panel).
The operator is not allowed to remove the fixed baffle plate. Parts of high-speed rotation and moving parts are installed inside. The removal of the fixed baffle plate may bring the following dangers. <ul style="list-style-type: none"> ● Dangers of touching the parts of high-speed rotation and moving parts ● Broken tools and debris of workpieces may fly out ● The chips may fly out ● The coolant may spray out of the machine ● Noises may be released
The operator is not allowed to open the protective door with the power on. Otherwise, the safety device may not work properly to lead to injuries.
When needing to open the protective door with the power off, please entrust the maintenance staff. Operations with inadequate expertise may lead to injuries due to unexpected movement of the machine.
The modification of the parameters should be conducted by the staff with adequate expertise. In some cases the interlock system may not work when modifying parameters, and thus the dangers of injuries may increase. The availability of the interlocking system should be confirmed when modifying parameters.

h) Warnings on Fire

▲Danger
Do not use the coolant with low flash point (2 nd oil family with flash point lower than 70°C). Otherwise fire may happen. Even the coolant of 3 rd oil family (with a flashpoint between 70°C and 200°C) and 4 th oil family (with a flash point between 200°C and 250°C) and flame resistant coolant (higher than 250°C) may be ignited, so it is necessary to pay enough attention to the state and method of use, such as controlling the production of smoke.
Flammable and incendiary materials such as dilute agent, gasoline, paper, wood, cloth, fiber, and aerosol sprays are not allowed around or near the machine (including power cables and connection cables. These materials may be ignited by the heat of the chips and sparks.

▲Warning
Guard against fire when using flammable workpieces.
They should be processed with appropriate tools on appropriate conditions. On the processing conditions that are not suitable with worn tools may cause fire due to heat in cutting. Moreover, the sparks caused by broken tools that splash onto the chip may cause fire. Please refer to the information provided by the tool manufacturers to perform processing with appropriate tools and on appropriate conditions.
The machine must be stopped when the tool is damaged. Otherwise, the residual tools in the workpiece and the Z-axis (spindle nose) may produce sparks due to friction, and thereby lead to a fire of chips.
Do not use the machine with sparks splashing. Otherwise, fire may happen. Procedures and various types of settings should be fully confirmed in advance to make sure the movements, eliminating the interference between the fixtures in order to avoid imposing heavy loads to the tools.
Chips should be cleaned. Or else it presents the potential fire danger with too much chips inside the machine.
Oil mist and dust are not allowed around the machine. Otherwise, fire will be caused due to sparks.

▲Warning
While machining a flammable workpiece, machine should be always monitored in case of fire for appropriate and timely measures.
A fire extinguisher is necessary nearby in case of a sudden fire. Moreover, it is recommended that an automatic fire extinguisher should be installed on the machine.
The material that is suitable for the automatic fire extinguisher is as follows. Materials other than the followings may not be sensitive to the automatic fire extinguisher. <ul style="list-style-type: none"> ● Resin ● Foam resin ● Sawdust ● Cotton ● Water-soluble cutting liquid ● Non-water-soluble flammable liquids (gasoline, lamp oil, cutting oil, machine oil, and lubricants. Almost all the non-water-soluble hazardous material)
Clean regularly the tubing and wiring of the automatic fire extinguisher (especially the sensor and nozzle). Of particular note is that the chips and cutting liquid attached to the sensor and nozzle will affect the sensing of the occurrence of fire and the spraying of liquid.
The use of the machine should be instantly stopped in the event the power cable and the connection cable are damaged. Otherwise, electric shocks or fire may happen. Before the replacement of the damaged cable by the maintenance staff, the machine may not be used.
There must be enough space around the cable clip. If the ceiling, walls, beams, and other items (such as customer-owned roof that is different from the genuine product, etc.) of the building where the machine is set in are too close to the cable, the possibility of fire and electric shock may increase when the power cord in the cable clip is broken.
Adequate coolant should always be guaranteed. Inadequate coolant may cause rise of temperature that leads to fire or damage to the tools and workpieces.
The roof is recommended. The roof can prevent fire from spreading to the ceiling of the building and reduce the spread speed in case of fire. The roof can also reduce the amount of oxygen within the cutting liquid baffle plate to accelerate the extinguishing of fire to promote the effectiveness of the automatic fire extinguisher.

i) Maintenance

▲Warning
Inspection and maintenance should be carried out regularly. The inspection items described in the maintenance sections of the manual must be implemented. Otherwise, the machine will cause death or injuries, or damage.
Maintenance of the replacement parts should be in accordance with the implementation of the elements contained in the manual. Improper use of parts or wrong replacement methods will lead to machine malfunction or injuries.

j) Machine Setting and Operation

▲Warning
<p>Install the machine on a level place. Or else the machine may move and bring unexpected injuries. The floor must in accordance with the following conditions while setting the machine.</p> <ul style="list-style-type: none"> ● The ground can support objects up to 2.5t. ● The floor should be flat without concave or convex; ● The floor can support pressure up to 1.5 Mpa (15kgf/cm²). ● The floor should be smooth; ● The floor will deteriorate with time passing ● The floor will deteriorate with environment changes.
<p>Confirm that the Z axis (spindle nose) won't descend before opening the protective door. In some extreme cases, the Z axis may descend due to failure of the Z axis brake. It is necessary to notice whether the Z axis will descend after opening the protective door. The operation below the Z axis requires a wood block that is placed between the working table and the Z axis in case of failures to support the Z axis from descending.</p>
<p>Confirm if the spindle has stopped before opening the protective door while the power is off. When disconnecting the power in the rotation of the axis, due to the inability to control and stop the spindle, which will continue to rotate because of inertia, the chips may fly out, or injuries may happen if touching the spindle.</p>
<p>Pay attention to the descending of the Z axis (spindle nose) when disassembling the Z axis motor. When the motor is being disassembled, the Z axis may descend because the brake integrated in the motor is also removed. This may lead to injuries by being caught. For the removal of the motor, binds can be employed to fix the working table and the Z axis.</p>
<p>For the first time using the embedded Ethernet function, please contact your network administrator for advice, and pay attention to the IP address settings and make full communication tests. If the IP address is incorrect, failures may happen in the communication of the network that lead to wrong operation in other machines, so full attention should be paid.</p>
<p>Cranes, slings, or steel cables for hoisting the machine should be of the capacity over the weight of main machine part. The weight of the main machine part is as follows. Keep the machine in balance when hoisting.</p>

3. Warning Marks and Signs

Pay more attention to the parts with marks.

The machine is with the following marks on.

The warning marks should be kept clean and convenient to be recognized and never stained, damaged, or tore the warning marks.

In case that the marks are lost or unable to be read, please contact the nearest branch or distributor of Shenyang Machine Tool.



[Safety Placard] It is stuck on the left front door of the protection cell.

Contents: Customer notes and safety code

The operator shall read carefully about the contents before operation.

Correctly and properly operate the machine, avoid incorrect operation, and preclude safety and operation risks.

[Warning Placard] It is stuck on the left front door of the protection cell.



Sign 1: Note that loose clothing or long hair can be caught in rotating parts to cause serious injury or death.

Sign 2: Use common sense when operating the machine tool, do not open the safety door during operation, or it can result in serious injury or death.

Sign 3: Make the spindle stop when changing the spindle.

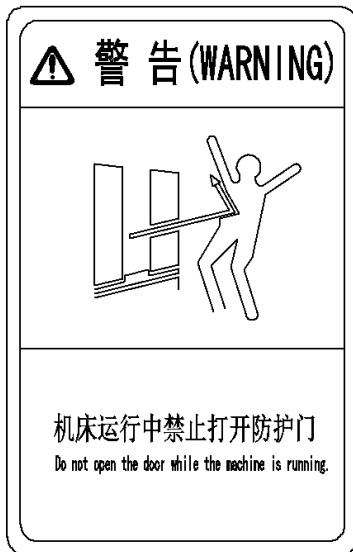
Sign 4: Moving parts and rotating tools can cause injury, turn the switch in the "OFF" position to disconnect the power before entering the machine.

Sign 5: During operation, stay away from the spindle and tools.

Sign 6: Do not stand or place any objects on the telescopic cover. Or it may cause tumble due to unstable or slippery surface, or cause the shield deformed due to pressure.

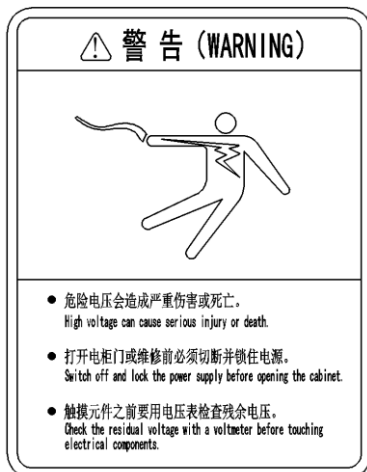
Sign 7: Dangerous voltage can cause serious injury or death.

Sign 8: Cut off and lock the power supply before repairing and maintenance. Use a voltmeter to check the residual voltage before touching the components.



[Warning Placard] It is stuck on the left and right doors of the machine tool.

Use common sense when operating the machine. Do not open the safety door during operation, or it can cause serious injury or death.



[Position] On the doors of the electrical cabinet.

Mark 1: The dangerous electric voltage can result in the serious disservice or death.

Mark 2: Before opening the door of electric cabinet or maintaining, the power supply must be cut off and locked.

Mark 3: Before touching element, the remained electric voltage must be measured by the voltmeter.

Note: Only operations by the personnel with adequate expertise are allowed.

4. Environmental Protection

Notes
Machine tool installation, repairing and maintenance, and scrapped machine tool disposal must be in accordance with environmental protection regulations as follows:
● Recyclable solid wastes such as disused old machinery parts (without pollutants), packaging wooden boxes, paper materials, etc. must be recycled at designated agencies or sites.
● Non-recyclable hazardous solid wastes such as plastics, gloves, electrical elements, batteries, rags, lights, LEDs, parts with paint stains, such toxic, hazardous or non-degradable wastes must be disposed of at designated agencies or sites.
● Non-recyclable hazardous liquid wastes such as lubricant, coolant, cleaning fluid, etc. that pollute environments must be discharged to designated sewage sites. Do not discharge such polluting liquid wastes into ditches or rainwater drainage systems.
● Perform identification and evaluation of safety and environmental factors for disused and scrapped machine tools, apply proper countermeasures to thoroughly disassemble and clean the individual systems of the machine tool, so that no materials left inside the machine tool, qualified through analysis for safely disuse and pollution control.
● The disposal of all types of wastes not only is in accordance with national regulations and standards but also complies with local regulations and requirements.

I . Overview

I. General

1 General

VMC Q/M4-Q series Vertical Machining Center is able to perform milling, drilling, reaming, broaching, boring, rigid-tapping etc..

1.1 Features

(1) High machining efficiency

Multi processes such as milling, boring, drilling, and tapping are able to be performed in one setup which can meet finishing requirements and the production cycle can be shortened.

(2) Linear machining

In milling operations, high-precision linear machining can be performed from different angles.

(3) Fast magazine tool

Fast tool selection and tool-changing

(4) Rigid threading

In the rigid threading with simultaneous feed of the spindle and the Z axis, the threading riveting machine is not used so as to carry out high-speed and high-precision tapping in a short period of time.

(5) Fully NC functions

Fully NC functions are equipped that are engaged in drilling, tapping, milling, and model machining.

(6) The best spindle speed is available

Optional spindles are provided to match specific machining requirements. Therefore, the best spindle speed is available for the best effect.

(7) High performance AC servo motor

Due to the fact that an AC servo motor is used for the X, Y, and Z axis, the best movement in machine coordinate axes is achieved.

Moreover, the rapid traverse of axes prevents waste of time in non-cutting period.

(8) Safety functions

The safety functions are in line with Category 3 based on the European Safety Standards EN954-1.

The machine is manufactured according to the Appendix I of Machine Tool Commands 98/37/EC.

1.2 Usage of the Machine

VMC Q/M4-Q series machines are vertical machining center controlled by CNC performing cutting processes such as milling, drilling, reaming, broaching, rigid tapping, etc.

Please do not use the machine tools for other purposes.

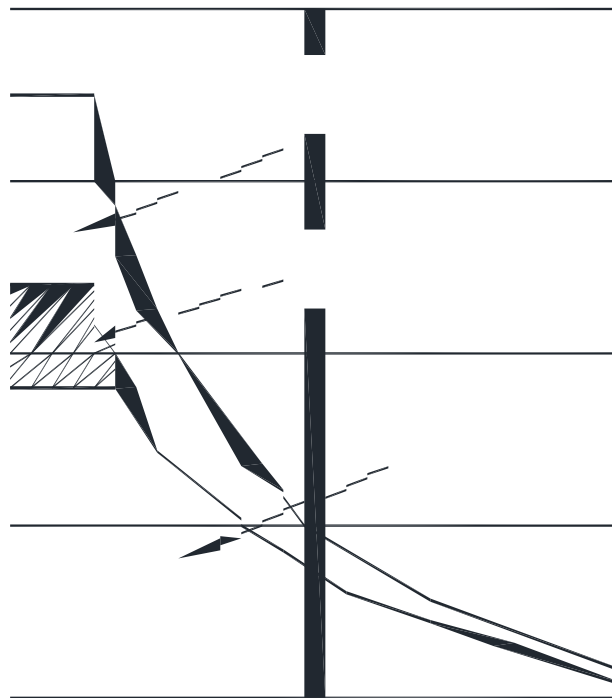
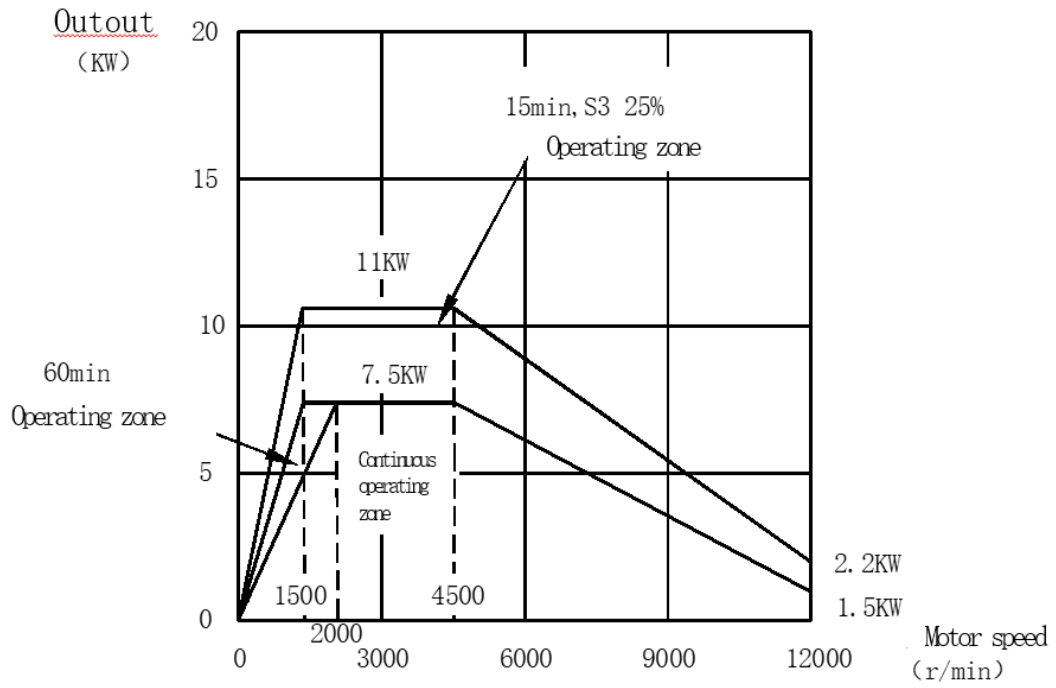
Cutting performance is subject to the differences of workpieces, tools, and coolants. Please refer to the operation manual of tools and coolants when using the machine.

The specifications are as follows

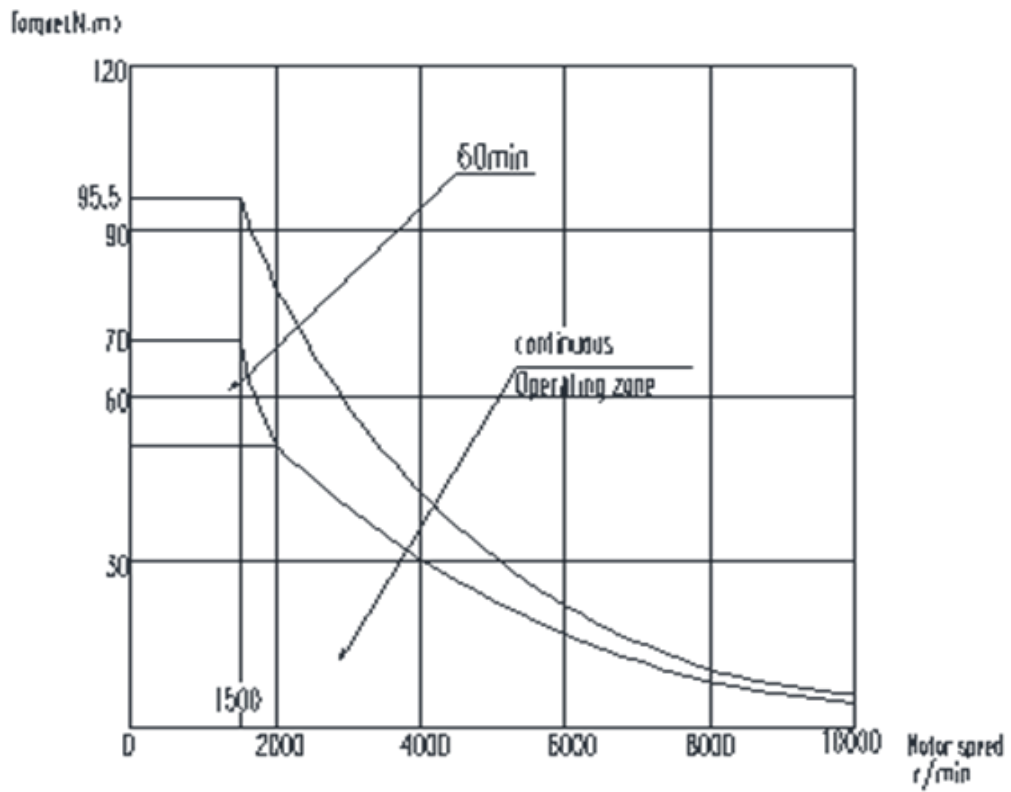
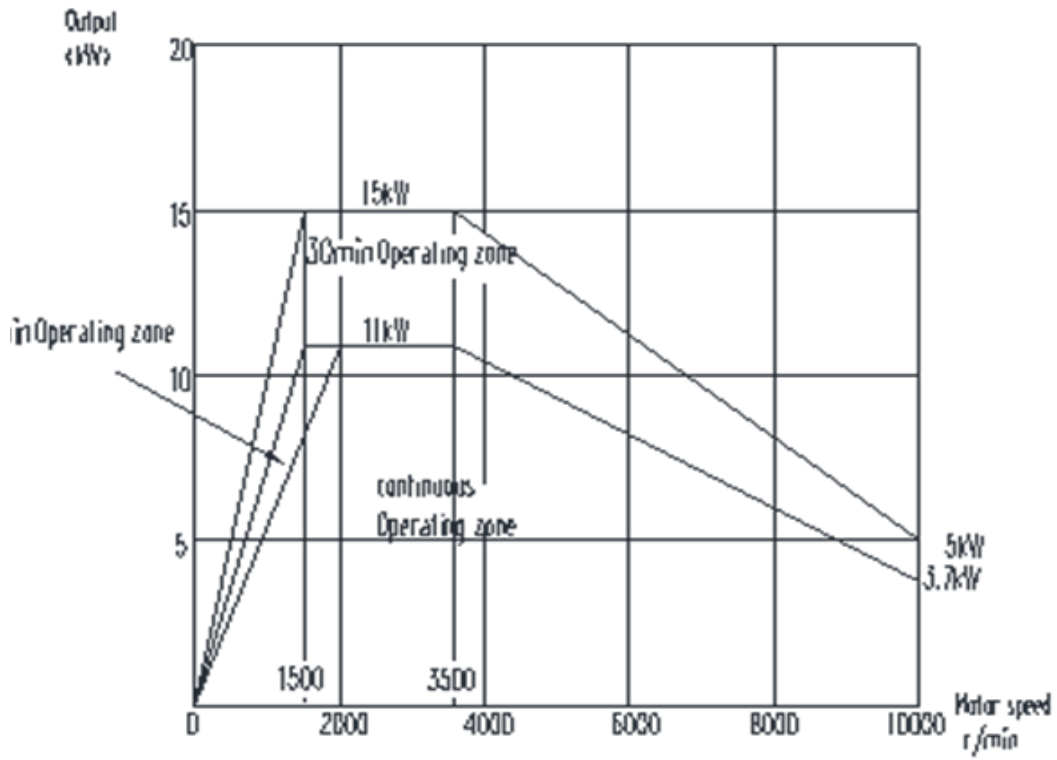
Model		VMC850Q	M4-850Q	VMC1000Q	M4-1000Q	VMC1100Q	M4-1100Q
Worktable	Table Size (mm)	500X1000		500X1150		610X1300	
	Max. Load (kg)	600		600		1000	
	T slots (Qty. × W)	5X18		5X18		5X18	
Working range	Workable travel(X axis)(mm)	850		1000		1100	
	Saddle travel (Y axis) (mm)	500		500		620	
	Headstock travel(Z axis)(mm)	540		540		600	
	Spindle nose to the workable (mm)	120~660		120~660		120~720	
	Spindle centerline to the guideway of the column (mm)	640		640		743	
Spindle	Taper (7:24)	BT40		BT40		BT40	
	Speed Range (r/min)	10000		10000		10000	
	torque(N.m)	35.8	50	35.8	50	35.8	50
	Spindle motor power (kW)	7.5/11		7.5/11		7.5/11	
	Spindle transmission method	Belt		Belt		Belt	
Feed	Rapid traverse (m/min)	X axis	48	48	48	48	48
		Y axis	48	48	48	48	48
		Z axis	48	48	48	48	48
Magazine	Magazine type	Bucket		Bucket		Bucket	
	Capacity (tools)	24		24		24	
	Changing method	Bi-direction shortest path		Bi-direction shortest path		Bi-direction shortest path	
Size & weight	Machine size (mm)	2400×3125×2840		2700×3125×2840		2940×3450×3050	
	Weight (kg)	5100		5400		6200	
CNC system		FANUC 0i MF	i5	FANUC 0i MF	i5	FANUC 0i MF	i5

FANUC Main motor power-torque diagram

β 8/12000i



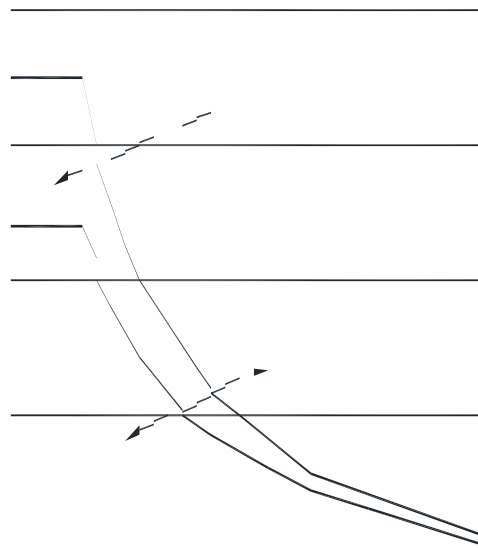
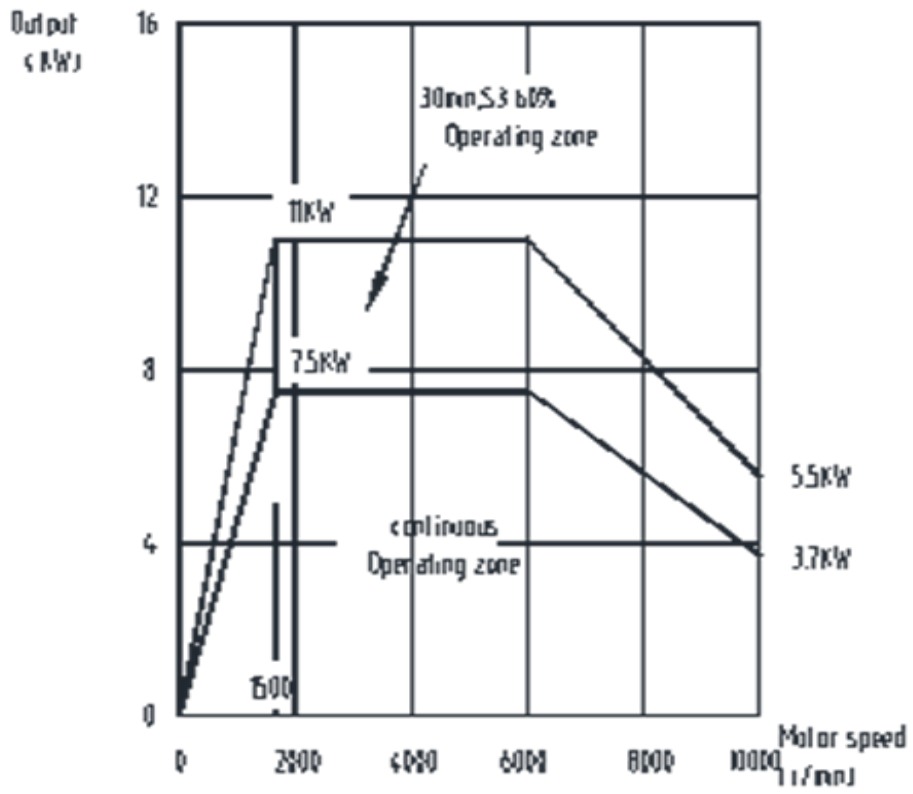
β12/10000i



Power/torque chart

$\alpha 8/10000i$

Power/torque chart



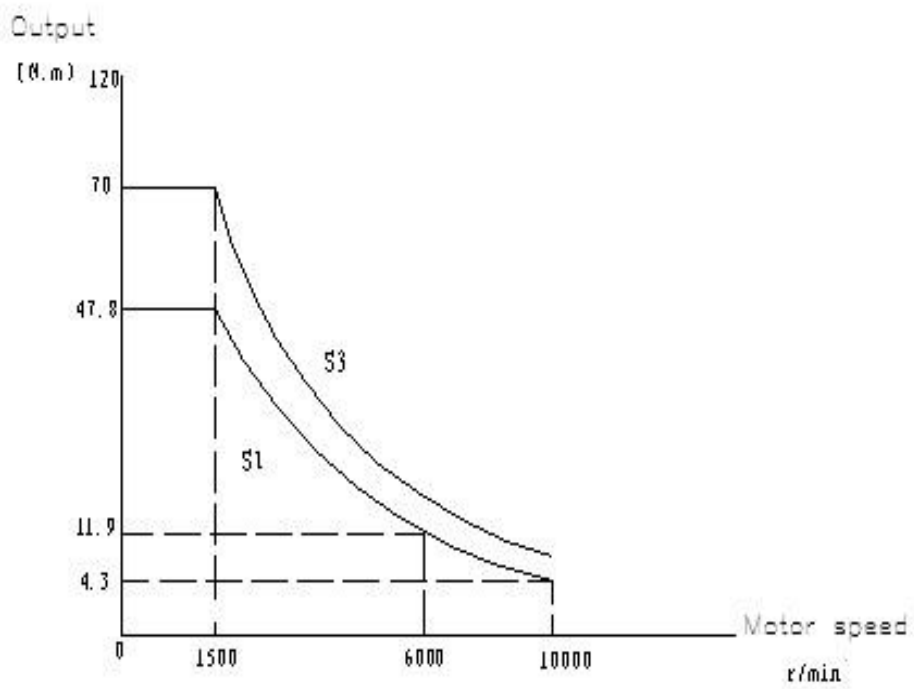
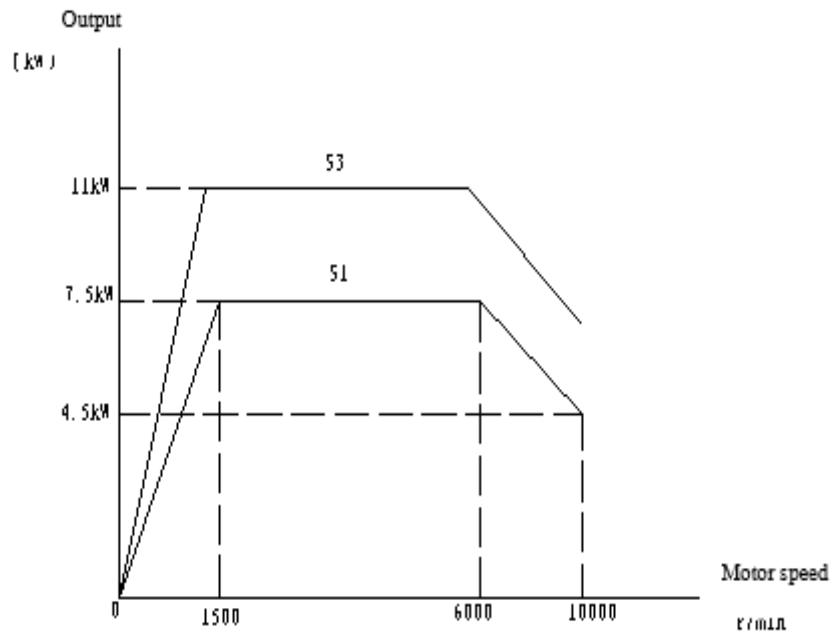
Siemens spindle motor power/torque diagram

1PH8105



Huazhong CNC spindle motor power/torque diagram

Z18-47P5RB15-60HF5G



1.3 Sound Pressure Level

Measured according to the specifications in GB/T 16769, the SPL of the machine noise is less than 83dB (A).

2 Names of Parts

2.1 Main Body

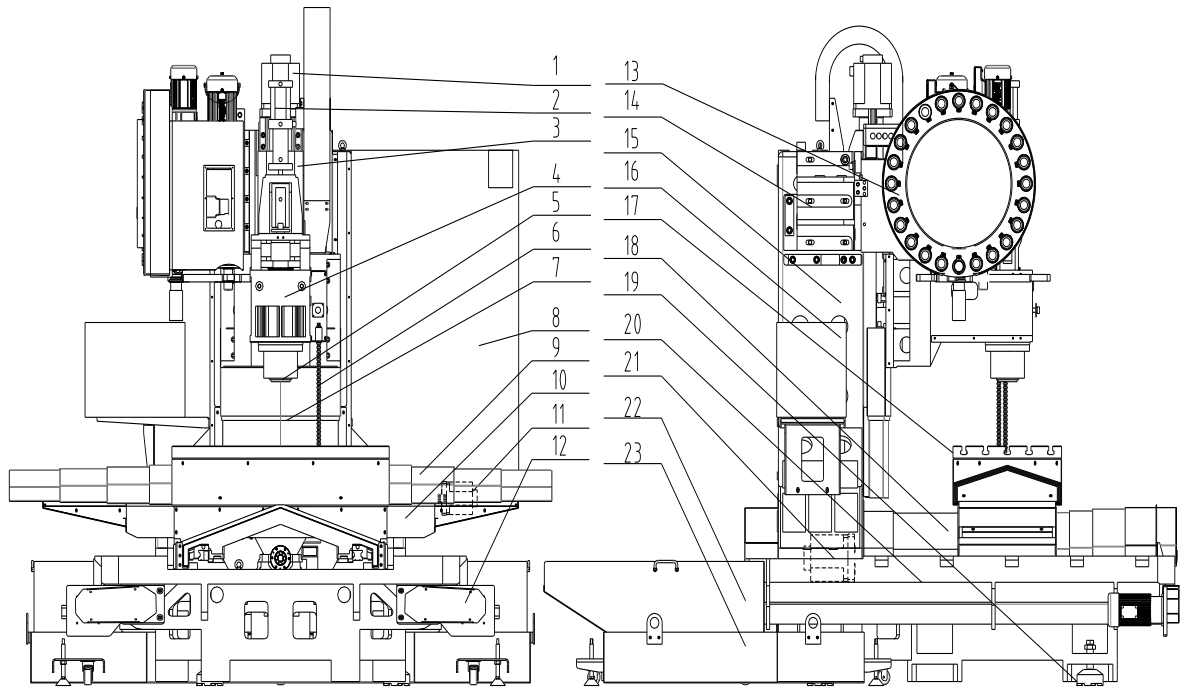


Figure 2.1(a) Machine tool structure

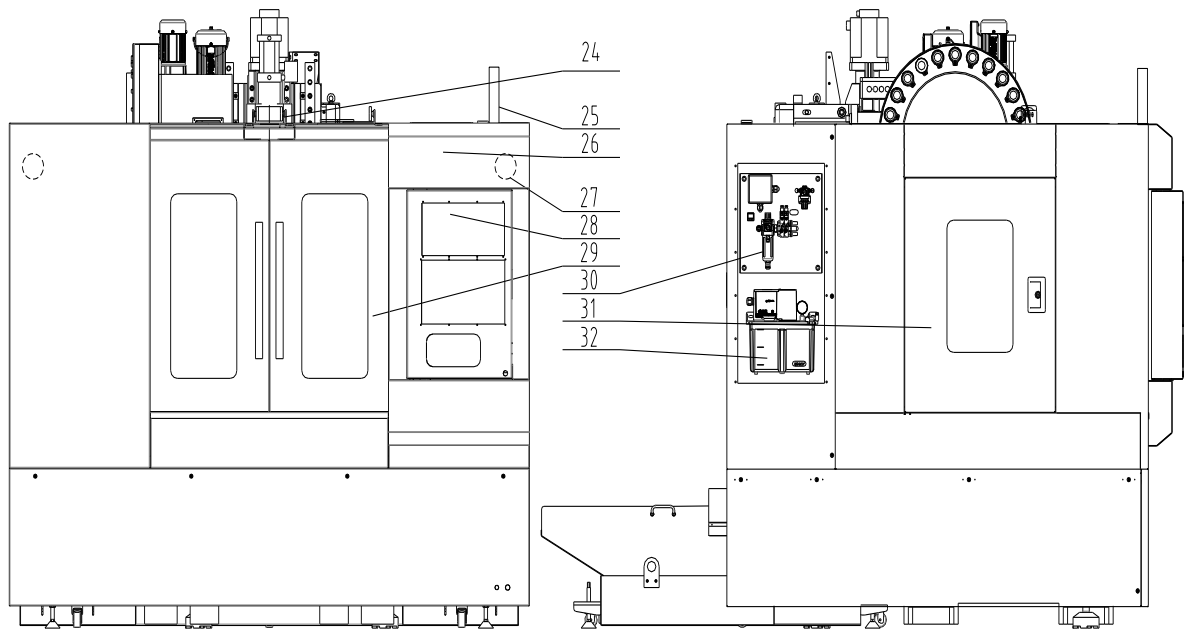


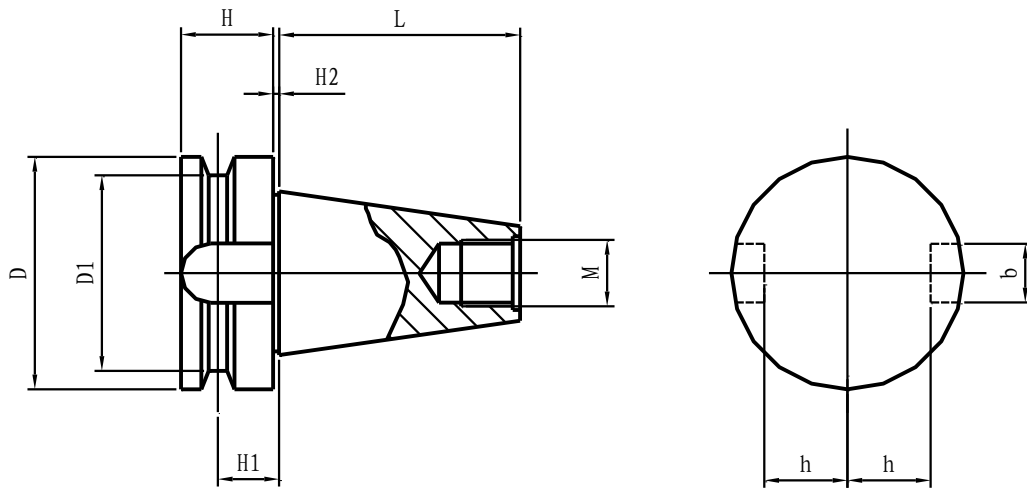
Figure 2.1(b) Machine tool enclosure

- 1) Z-axis servo motor
- 2) Pressure cylinder
- 3) Main motor
- 4) Spindle box
- 5) Spindle
- 6) Adjustable coolant tube
- 7) Z-axis telescopic cover
- 8) Electrical cabinet
- 9) X-axis telescopic cover
- 10) Slide
- 11) X-axis servo motor
- 12) Helical chip removal mechanism
- 13) Tool magazine
- 14) Tool magazine holder
- 15) Column
- 16) Transformer
- 17) Working table
- 18) Y-axis telescopic cover
- 19) Foot parallels
- 20) Machine bed
- 21) Y-axis servo motor
- 22) Chip disposal tank
- 23) Water tank
- 24) Front door lock
- 25) 3-color lamp
- 26) Safety cell
- 27) Light
- 28) Operating box
- 29) Front doors
- 30) Pneumatic unit
- 31) Side window
- 32) Lubrication pump

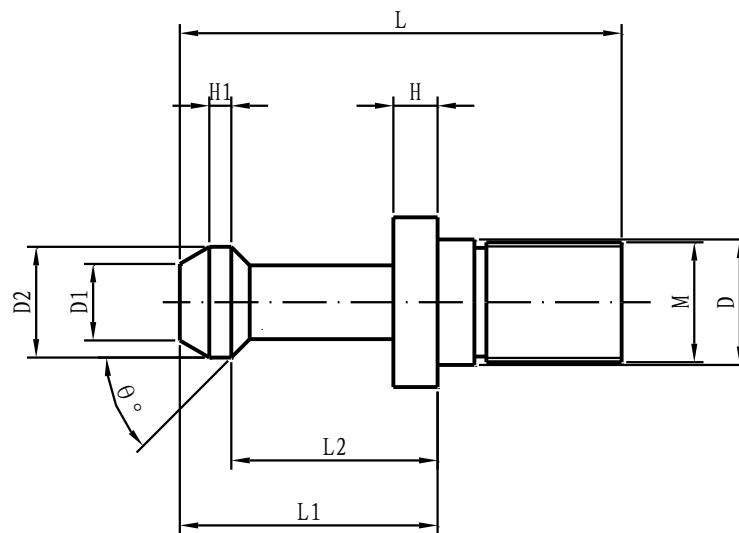
3 About the tool components

The tool components are standard tools (MAS403 BT40). Purchase tools after confirming the shape and size below.

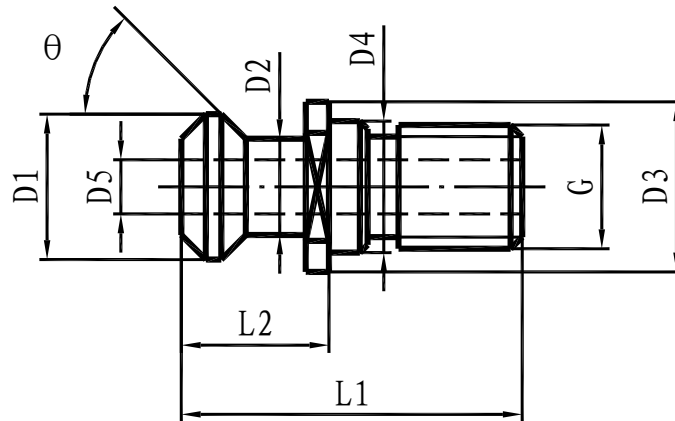
Shapes and sizes of standard taper shanks (MAS403-1982 BT40) and rivets (LDA-BT40) are as follows.



Size & Spec	D	D1	h	b	L	M	H	H1	H2	Draw bar
BT40	∅ 63	∅ 53	22.6	16.1	65.4	M16	25	16.6	2	LDA-40BT



Size & Spec	D	D1	D2	M	L	L1	L2	H	H1	θ	Shank
LDA-40BT	17	10	15	M16	60	35	28	6	3	45°	40BT



Size & Spec	L1	L2	ϕ D1	ϕ D2	ϕ D3	ϕ D4	ϕ D5	W	G	θ	Draw bar
MAZAK-BT40	44.1	19.1	18.8	12.45	22	17	7	19	M16	45°	40BT

The max diameters, lengths, and weights of tools for VMC Q/M4-Q series are limited as follows. Confirm the sizes and weights before running the machine.

Tool handle type	Max Diameter (mm)		Max Length (mm)	Max Weight (kg)
	Full tool	Adjacent tool		
BT40	ϕ 80	ϕ 125	200	7
BT40	ϕ 80	ϕ 125	250	7
BT40	ϕ 80	ϕ 125	250	7

The following failures may occur if the tools with sizes exceeding the limits above are used. Pay attention to the issues in question.

- (1) Tools with excessive length interfere with the protective chamber and working table, and do not meet the requirements of the machining travel of the workpiece.
- (2) Tools in excessive diameters may not be able to conduct normal cutting, failing to reach the best cutting performance.
- (3) Tools with excessive weights,
 - * May lead to failure in automatic tool changing.
 - * Especially with extremely excessive weights, may lead to high temperature of the spindle bearing, and thus reduce its service life.

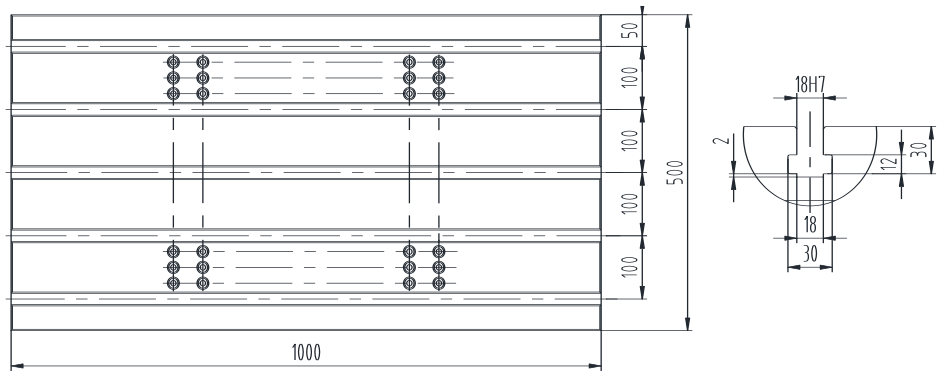
4 About the fixture

Warning

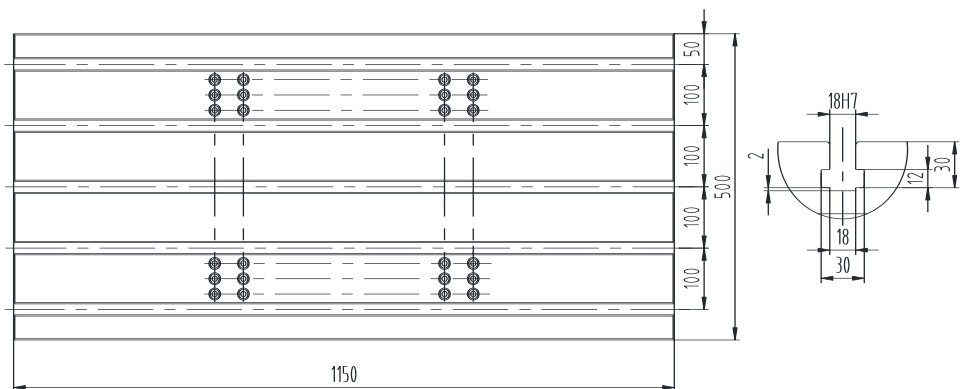
The total weight of the fixture and workpieces should not exceed the maximum machine load.

Loads exceeding the maximum will cause damage to the working table, workpiece, and the fixture, and may be dangerous to injure operators.

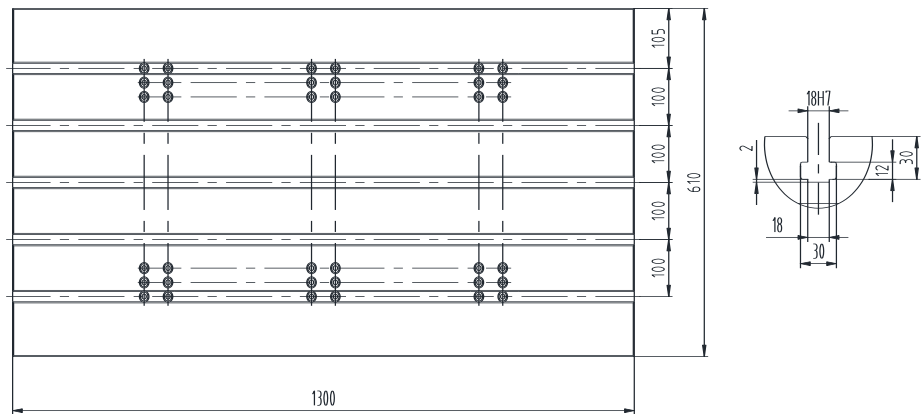
T-slots are arranged at intervals on the working table.
Please prepare applicable fixtures for the working table.



VMC850Q/M4-850Q



VMC1000Q/M4-1000Q



VMC1100Q/M4-1100Q

5 Coolant and lubricating oil

Please refer to “2 d) Coolant and Lube” and “V. 1.1.2 Supplement of Coolant” in the “Safety Policies” for the use of coolant.

II . Setting method

Safety precautions when machine setting

Warning

Read carefully about the “Safety precautions in machine setup” and perform as procedures. Or people may be injured or killed.

The conveying and mounting of machine must be performed by the maintenance personnel.

Maintenance personnel indicate the personnel, who have the enough mechanical or electrical knowledge required by maintenance, are trained by the professional personnel of the manufacturers or with equal grade of professional acknowledge, and get the certificate issued by their enterprises. In addition, the operators of folk lift hoist and crane must own the relative qualification certificate.

warning

Set the machine in the flat and stable place. Or the machine will move when machining and the personnel may be injured.

The ground must comply with all the following conditions:

- The ground can not deform with the object of 5 ton on it.
- The ground must be flat and no convex or concave place.
- The ground must be hard and can not deform even with the pressure of 1.5Mpa (15kgf/cm²) .
- Being smoothing.
- The ground condition should get worse with time.
- The ground must get worse with the changes of daily condition.

Take care the falling of Z axis (spindle nose) when the motor of Z-axis is dismantled. Because a brake is mounted in the motor, the Z axis can fall down when the motor is dismantled. Therefore the people may be injured. It is suggested that working table and Z axis must be fixed by the bundled components

The machine must be the place with enough light, so as to make sure the machine and its parts can run safely within the view of operator. Fault operations may occur when the working place is with dim light, which can cause the accident. Make sure more than 300 Lux Illumination of the place where the machined located. The optional component “Internal lamp” can be equipped additionally.

When machine hoisting, use the cranes, slings or steel cables which have the capacities more than the weight of the main machine body. Keep the machine in balance when hoisting.

Notes:

Pay attention to the moving and bundling f the machine:

- Fix the Z axis (spindle nose) and working table with bundled components.
- Cover the anti-corrosive oil on the designated parts.
- Fix the rotary table with nylon belts.

Reserve the maintenance space when machine setting (please refer to the layout in 3.1“installing and leveling of screw and padding block” of 3 “mounting” in II “setup”.

1 Setting conditions

Notes:

The machine body should be positioned the place where can meet the requirements of setting conditions. Or the machine body may be fault.

- (1) Working environment
 - Atmospheric pressure 86~106KPa
 - Away from vibration source, heat source and heat flow, limit the vibration of 0.5G or less (G as the acceleration of gravity)
- (2) Power supply, Frequency (Hz), Power capacity (kVa)
 - Power supply error is within -15% ~ + 10% at 220V (optional 380V, 440V)
 - Frequency error is within ± 1 at 50 Hz (optional 60Hz)
- (3) Ambient temperature
 - In operation 15~25°C
 - In storage or in transit -20~60°C
- (4) Temperature range
 - Within 1.1°C/min, max. $\pm 5^\circ\text{C}$
- (5) Humidity
 - In general: 40% ~ 75% (relative humidity)
 - In short time: within 95%
- (6) Air pressure source

Air quality grade	Grade 5 or above
Operating pressure	0.5 ~ 0.7 Mpa (0.6 Mpa recommended)
Flow rate	350 L/min
Solids (nominal value)	10 mg/m ³ or less
Moisture	Pressure dew point 7°C or less
Oil concentration	25 mg/m ³ or less

2 Conveying

2.1 Conveying process

For the whole machine packaging, keep the machine in the movable state as the following steps:

- 1) Removed the front side baffle plate of Y axis.
- 2) Completely open the protecting doors and fix it on the protecting room.
- 3) Moved the working table to the centers of the journals of X and Y axes in the coordinates of the machine,
- 4) As shown in Figure 2.1 (a), position the fixed bracket above the working table with T-slot and screws, then fall down the spindle nose slowly. Take care to see the distance of the spindle touched and the fixed bracket. Make sure the fixed bracket can support the spindle. (there must be rubber washers among the connecting surfaces of fixed bracket, working table and headstock to avoid the damages of working table surface and headstock).

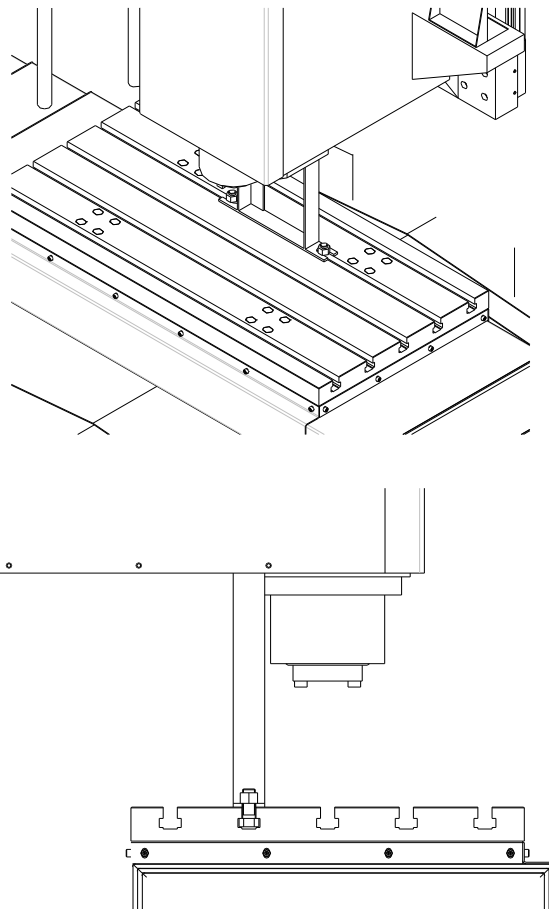


Fig. 2.1 (a) Fixture of Z axis

- 5) Position the fixing block on the machine; adjust the fixing bolt and tighten it; fix the sliding base. As shown in Fig.2.1 (b) .
- 6) Position the working table on the sliding base by fixing plate as shown in Fig.2.1 (c) .
- 7) Cut off the power supply.

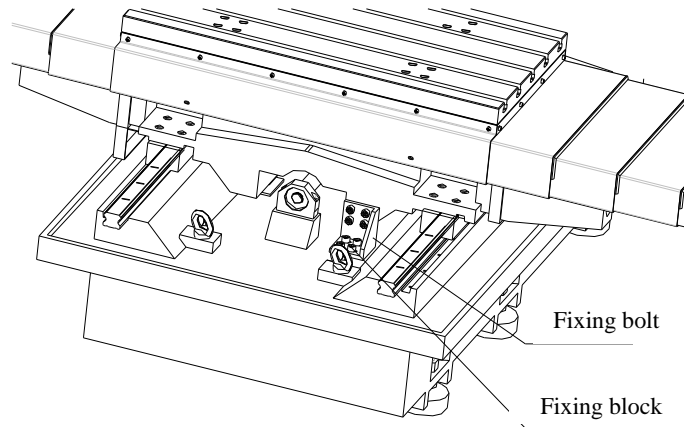


Fig. 2.1 (b) Fixture of sliding seat

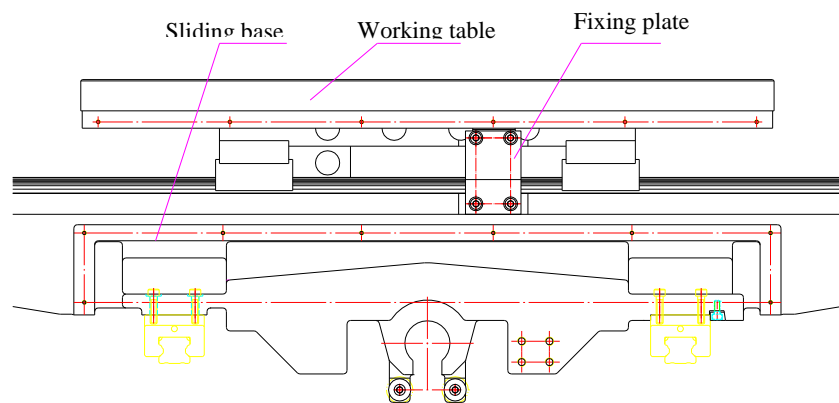


Fig. 2.1 (c) Fixture of worktable

- 8) Mount four M30 eye bolts above the front surface of base as well as column.

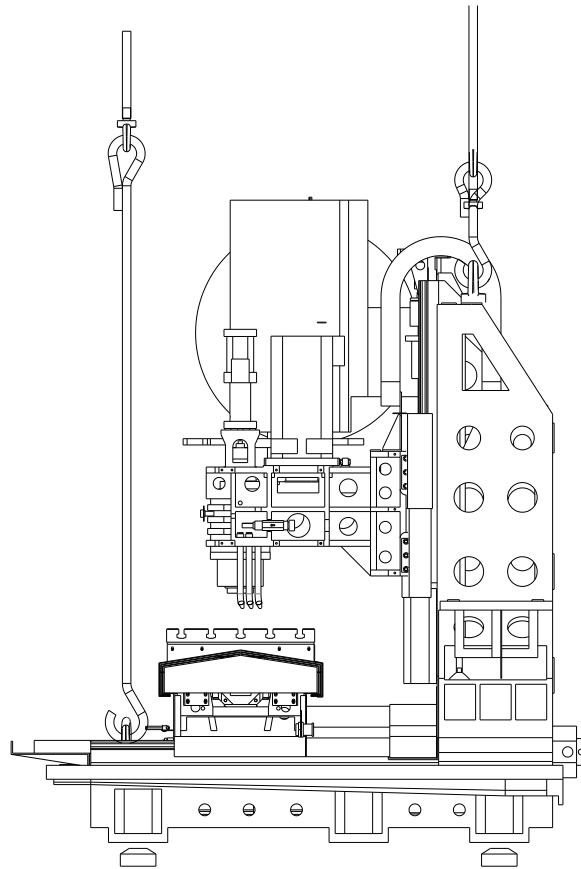


Fig. 2.1 (d) Conveying posture

▲ Warning

The specified conveying postures must be observed when the machine is conveyed or hoisted. Or people can be injured by the falling of machine.

2.2 Conveying

The whole hoisting

Hoist the machine by cables or steel wires with 4 eye bolts.

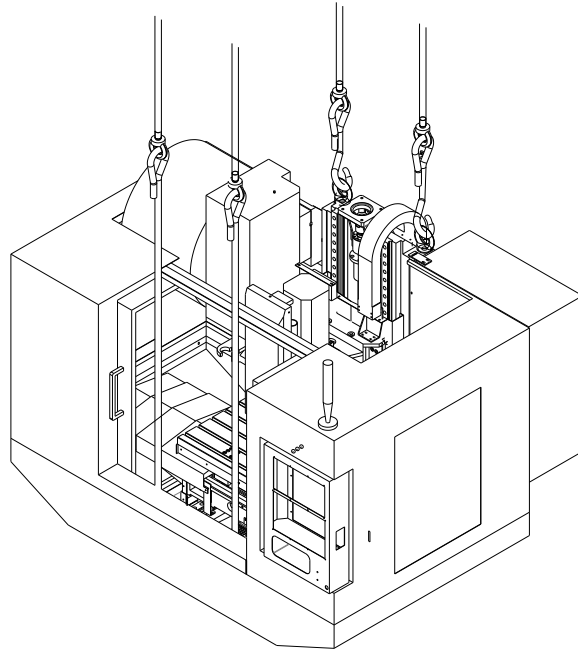


Fig. 2.2 (a) Hoisting of machine

Warning

Utilize the crane, hoisting cables or steel wires which have the capacities more than that of the machine body. Keep the machine balanced when hoisting.

Notice in use

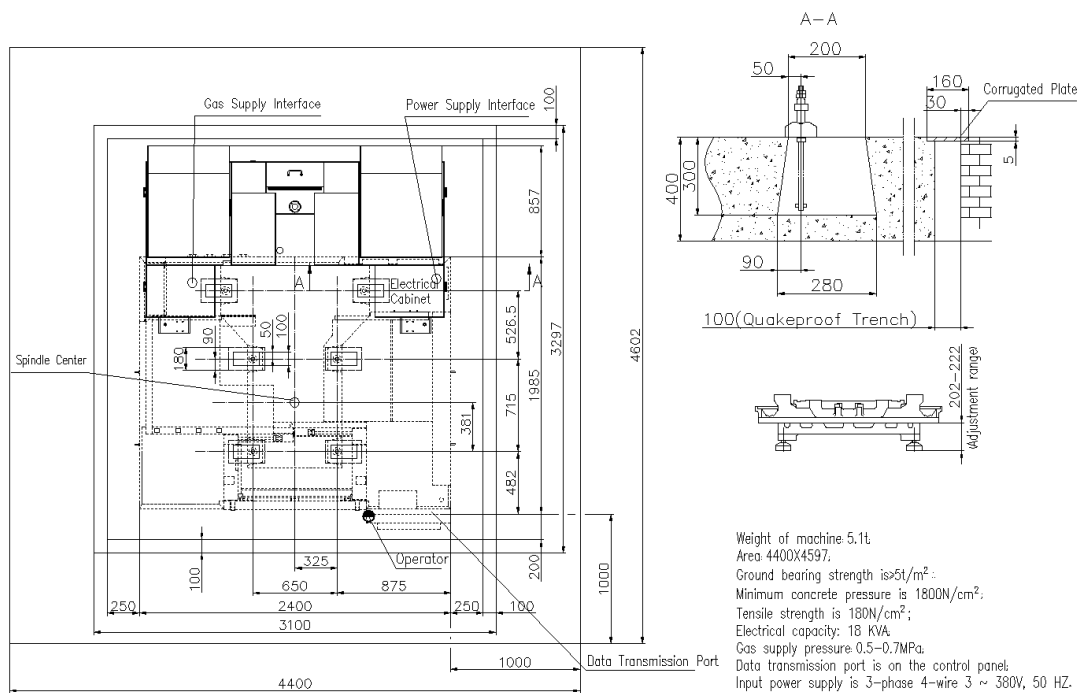
- Slowly lift up the machine in hoisting to avoid the impact on machine.
- The direct connecting parts of cables and machine must be padded with cloth piece or wood to avoid damage of machine.

3 Installations

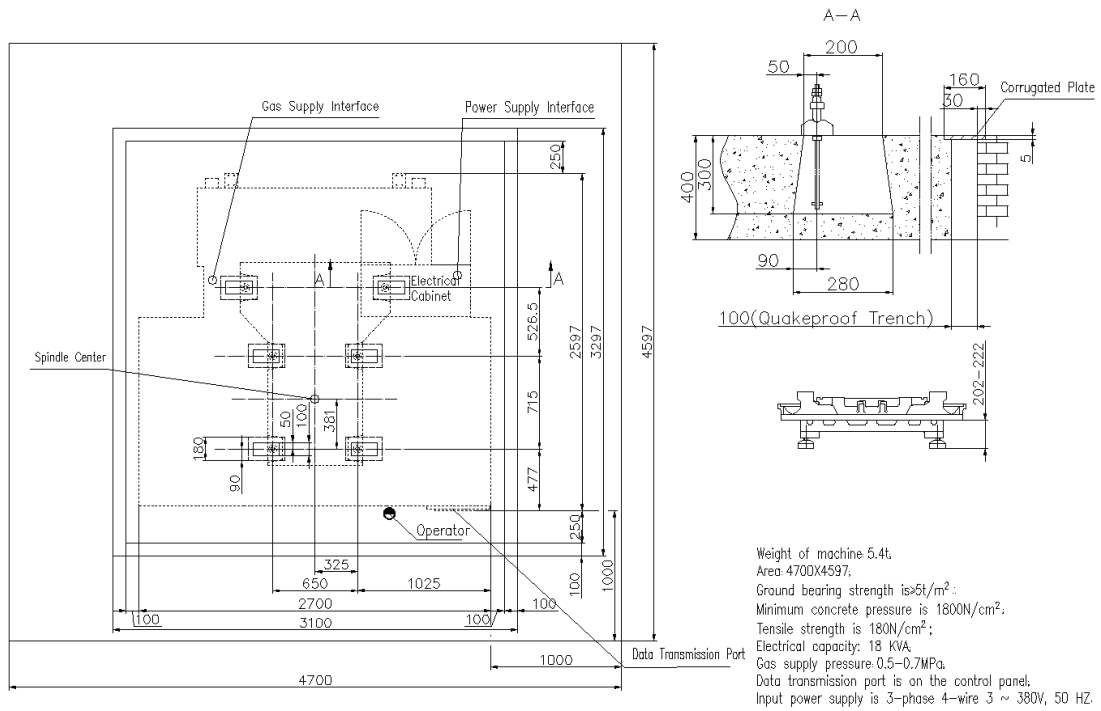
3.1 Installations of leveling bolts and padding blocks

The VMC850Q/M4-850Q、VMC1000Q/M4-1000Q and VMC1100Q/M4-1100Q do not require a foundation to mount. For heavy cutting works, a foundation is recommended in accordance with the foundation plan before the machine is installed. If the machine tool needs a foundation, please contact with your distributor and we will pack the bolt kits for foundation. Mount the foot bolts in right size, pad them with the foot parallels inside the package, and then put the machine tool on them. Place the screw nuts for fixing the foot bolts and levelling bolts on the casting (machine bed).

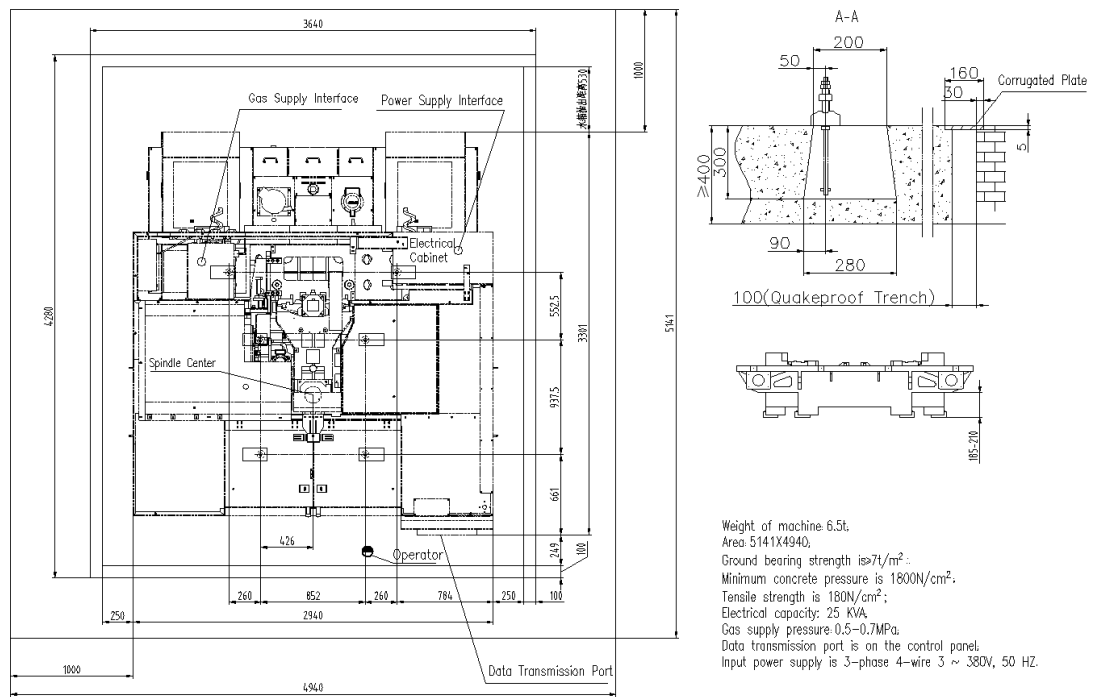
The foundation plan is as follows:



VMC850Q/M4-850Q foundation Drawing

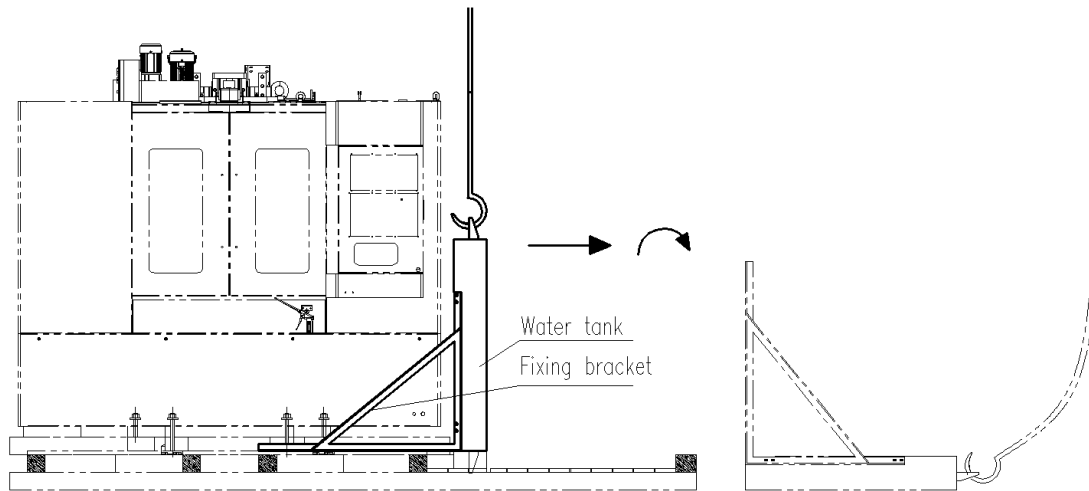


VMC1000Q/M4-1000Q foundation Drawing



VMC1100Q/M4-1100Q foundation Drawing

3.2 Water tank disassembly



Use 2 lifting hooks go through the lift holes(see the picture), after lifting rope force then remove the bolts between the fixing bracket and packing bottom completely and put the water tank and fixing bracket on the flat ground by rope (instruction see picture), make sure the water tank in the horizontal position, then dismiss the bolts between water tank and fixing bracket and remove the bracket, and put the water tank in the right location. Make sure the safety of lifting and rotary in the whole processes, follow the instructions of lifting strictly.

3.3 Dismounting of hoisting accessories

Screw off the eye bolts under machine body.

3.4 Dismounting of packaging components

Dismount the fixed brackets as the following steps:

- 1) Slowly lift up spindle nose after power supply is switched on. Remove the fixed brackets on working table and under headstock.
- 2) Dismount the fixing bolts and fixing brackets of the fixed sliding base on machine body.
- 3) Dismount the fixing bolts and fixing brackets on sliding base for fixing working table.

3.5 The connection of air pressure source

The tool clamping, blowing of spindle center, location of blowing of optical scale and air cooling functions must be performed with air pressure.

The gas tank inlet is at the rear of the safety cell.

The entrance of pneumatic triple-connecting parts attached at the rear part of protecting room must be contacted with the dry air with the following qualifications.

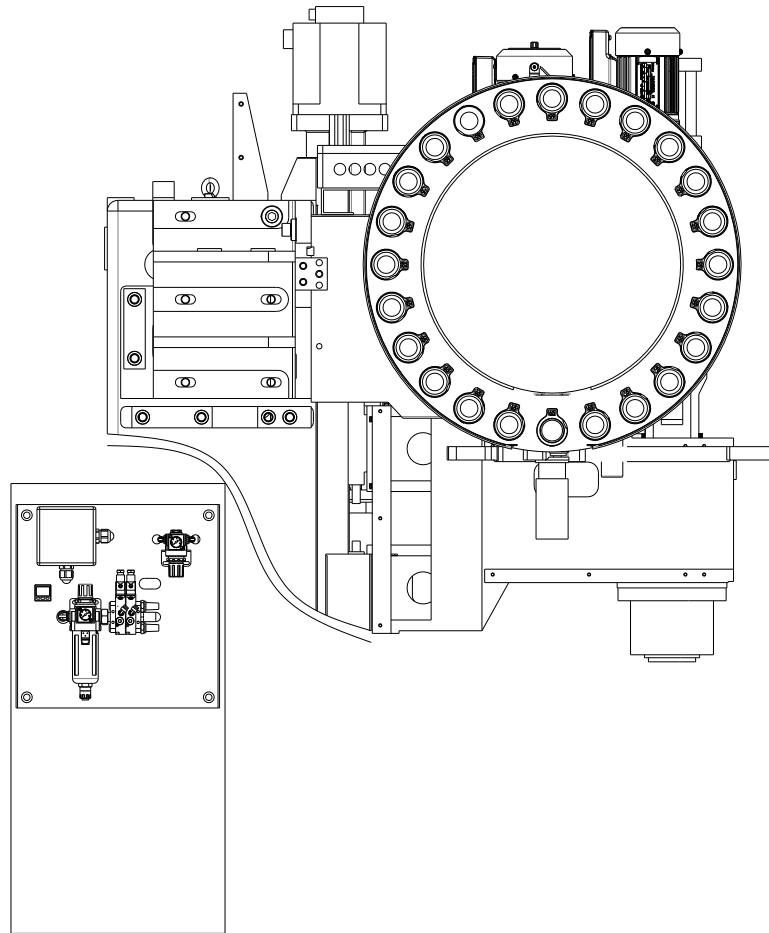
Air pressure source: 0.50~0.70Mpa (belongs to gauge pressure) (0.6MPa is suggested)

The initial setting pressure of filter/ adjuster must be adjusted to about 0.5Mpa.

If a different value is needed, the set value must be in 0.50~0.60Mpa (the working pressure of pressure switch must be set to be 0.1MPa) .

/





3.6 Removal of anticorrosive lubricating grease

Remove the anticorrosive lubricating grease which is covered on the following parts to prevent the corrosion in delivery.

- (1) Rolling guideways of X、Y and Z axes
- (2) The inner of taper bore of spindle
- (3) Working table top

3.7 Assembly of Z axis motor when mounting machine

Z axis motors of the machine may be dismantled when delivered for the convenience of transport. In this case, when Z axis is assembled, adjust the origin of machine correctly to the state when the machine is delivered.

Adjust as the following procedures:

- 1) Cut off power supply of machine. Or make sure the power supply has been cut off.

Warning

The assembly of Z axis motor must be finished when the power supply of machine body is cut off. Or people may be accidentally injured or electrical shocked.

- 2) Dismount the cover of Z axis motor cabinet (packaged separately when delivery).
- 3) Wipe away the anticorrosive lubricating grease covered on coupling.
- 4) Position the servo motor above the motor seat as Fig. 3.7 (a) ; get the motor shaft into the bore of coupling; tighten the fixing screw.

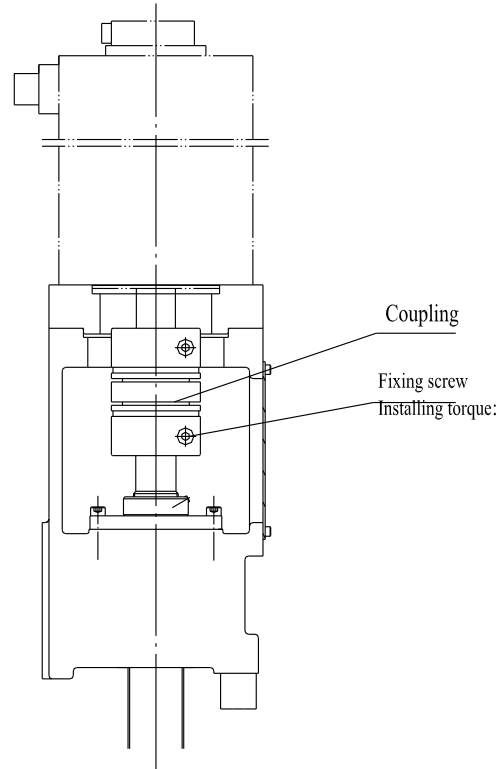


Fig. 3.7 (a) Installation of Z axis motor

- 5) Make sure the connector of the motor is at the rear of machine from the side of machine and tighten the screws for motor mounting. When the motor is not aligned with the installing hole of motor seat, manually rotate the motor proper force to get it aligned with the hole.

- 6) Tighten the fixing screws at the side of the motor shaft of coupling with the specified torque (25Nm) . When the bolt is in the phase impossible of tightening, rotate Z axis manually after (10) is connected with cable and power supply is connected, align them and tighten the screws (automatic running without tightening the screws of coupling is forbidden.).
- 7) Connect the three cables of Z axis motor.
- 8) Mount the cover of Z axis motor seat and tighten the screws.
- 9) Return to the referring position after power supply is switched on.

Supplementary instruction

The network positions as the returning standard of reference position are always different because of the different servo motors. When the servo motor provided by other manufacturer is used, the origin of machine will deviate, which can get the normal operation of machine impossible. To avoid this case, please mount the servo motor relative with the supplied motor of machine.

3.8 Assembly of Y axis motor when mounting machine

Y axis motors of the machine may be dismantled when delivered for the convenience of transport. In this case, when Y axis is assembled, adjust the origin of machine correctly to the state when the machine is delivered.

Adjust as the following procedures:

- (1) Cut off power supply of machine. Or make sure the power supply has been cut off.

Warning

The assembly of Y axis motor must be finished when the power supply of machine body is cut off. Or people may be accidentally injured or electrical shocked.

- (2) Wipe away the anticorrosive lubricating grease covered on coupling.
- (3) Position the servo motor above the motor cabinet as Fig. 3.8 (a) ; get the motor shaft into the bore of coupling; tighten the fixing screw.
- (4) Make sure the connector of the motor is downward from the side of machine as Fig.3.8 (a) and tighten the screws for motor mounting. When the motor is not aligned with the installing hole of motor cabinet, manually rotate the motor proper force to get it aligned with the hole.
- (5) Tighten the fixing screws at the side of the motor shaft of coupling with the specified torque (25Nm). When the bolt is in the phase impossible of tightening, rotate Y axis manually after (6) is connected with cable and power supply is connected, align them and tighten the screws (automatic running without tightening the screws of coupling is forbidden.).
- (6) Connect the two cables of Y axis motor.
- (7) Return to the referring position after power supply is switched on.

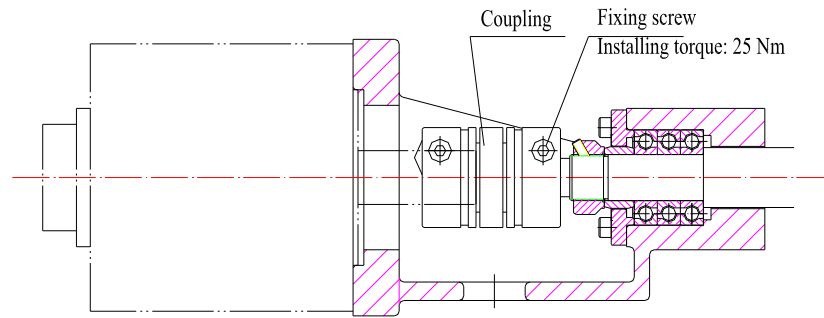


Fig. 3.8 (a) installation of Y axis motor

Supplementary instruction

The network positions as the returning standard of reference position are always different because of the different servo motors. When the servo motor provided by other manufacturer is used, the origin of machine will deviate, which can get the normal operation of machine impossible. To avoid this case, please mount the servo motor relative with the supplied motor of machine.

3.9 Level adjustment

Perform the level adjustment after spindle box, sliding base and fixing fittings of working table are dismantled:

- 1) Switch on power supply, move the working table to the centers of journals of X and Y axes.
- 2) Loose the fixing nut and adjust the leveling bolts to the adequate length.
- 3) Adjust all the leveling bolts alternately and adjust the level to be under 0.03mm/m with level gauge. Finally fix leveling bolts and anchor bolts with fixing nuts.
- 4) Make sure the level has been under the value mentioned above with the positive (+) and the negative (—) journal ends of Y axis.

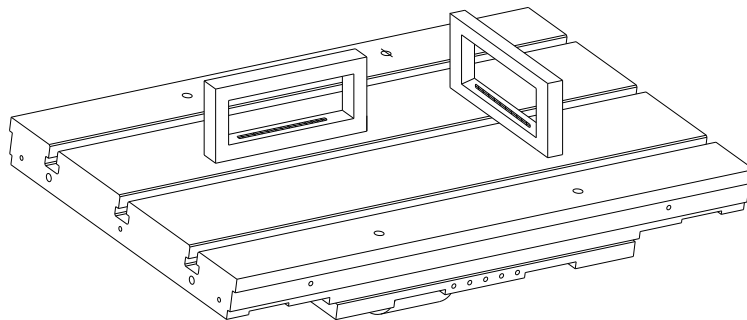


Fig. 3.9 Level adjustment

3.10 Assembly of tool component

Warning

Each tool component mounted on tool magazine can not exceed 7kg (for

BT40 tool bar) , if tool with weight of more than 7kg (for BT40 tool bar) is used, the tool may separate from the tool component and splashes, which can cause the damages of workpiece and machine.

1. Mounting tool in manipulator tool magazine

Tool mounting can be manually performed by opening the door of protecting room or it can be performed as the following procedures:

- 1) Operate system, manually mount tool for spindle and make sure the mounting is correct.
- 2) Operate system, automatically change tool for tool magazine, mount the spindle tool into tool magazine and make sure the mounting is correct.
- 3) Repeat steps (1) and (2), until all the tools are mounted.

2. mounting tool in bucket type tool magazine

- 1) manually mounting the tools on the spindle .
- 2) Operate system, automatically change tool for tool magazine, mount the spindle tool into tool magazine, and then rotate tool magazine and repeat step (1) until all the tools are mounted.

Press down emergency stop button at once when abnormal condition occurs.

Warning

Make sure tool components are properly mounted on the clamps of tool magazine as specified. Or the tool components can fall down and splash, which can cause the damages of workpiece and machine.

Notices in use

Tool magazine has been precisely adjusted, therefore, do not carelessly grasp tool magazine or put load on it.
Pay attention to the weights of mounted tool components, so as to avoid the unbalance of tool magazine.

3.11 Assembly of coolant device

Mounting cooling device as the following steps after machine mounting:

- 1) Position cooling water tank under the body of machine and water pump is at the rear of machine from the front side of machine.
- 2) Mount nozzle under spindle head, swivel joint at the end of spindle and water nozzle at the front end surface of protecting room.
- 3) Assemble pipes between nozzle and coolant pipes and external cooling pump.
- 4) Assemble pipes between water nozzle and coolant pipe and external cooling pump.
- 5) Connect the terminal of cooling pump with the inner of cabinet by cables.

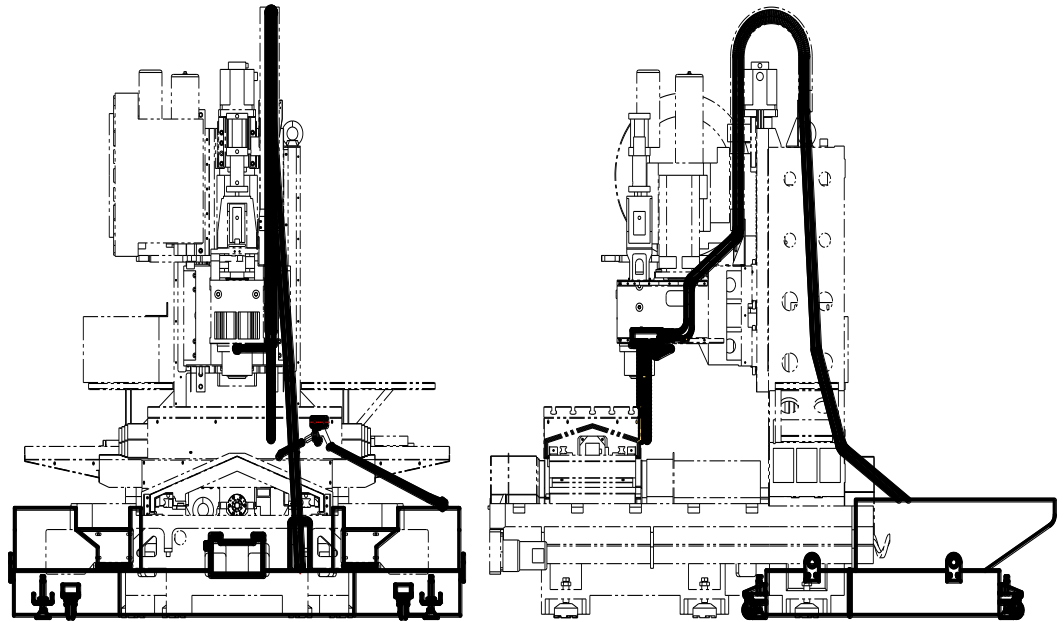
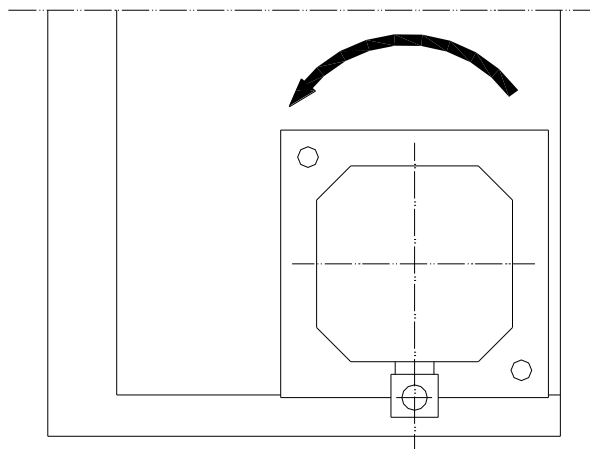


Fig. 3.11 (a)

- 6) Press down coolant button and stop the rotating of pump after the rotating of pump as the arrow direction is assured by the window on the pump.
- 7) Filling cutting liquid into the channel of coolant.

Rotating direction



▲ Warning

Connect the mounted pipes well to avoid the leakage of coolant from the pipes. The leakage of coolant can get the ground slippery, which can cause the operator slipped or injured.

3.12 Assembly of lubricating device

Mounting the lubricating device used for the lubrications of linear guideways, ball screw and screw bearing as the following steps:

- 1) Fix the lubricating pump under the bracket of the cabinet.
- 2) Mount pipe fittings on sliding block of linear guideways, nut of ball screw and bearing seat.
- 3) Fix certain lubricators on the indicated positions.
- 4) Assemble pipes from constant lubricator to the pipe fittings of sliding block of linear guideways, nut of ball screw as well as bearing seat.
- 5) Assemble pipes between certain lubricator and lubricating pump.

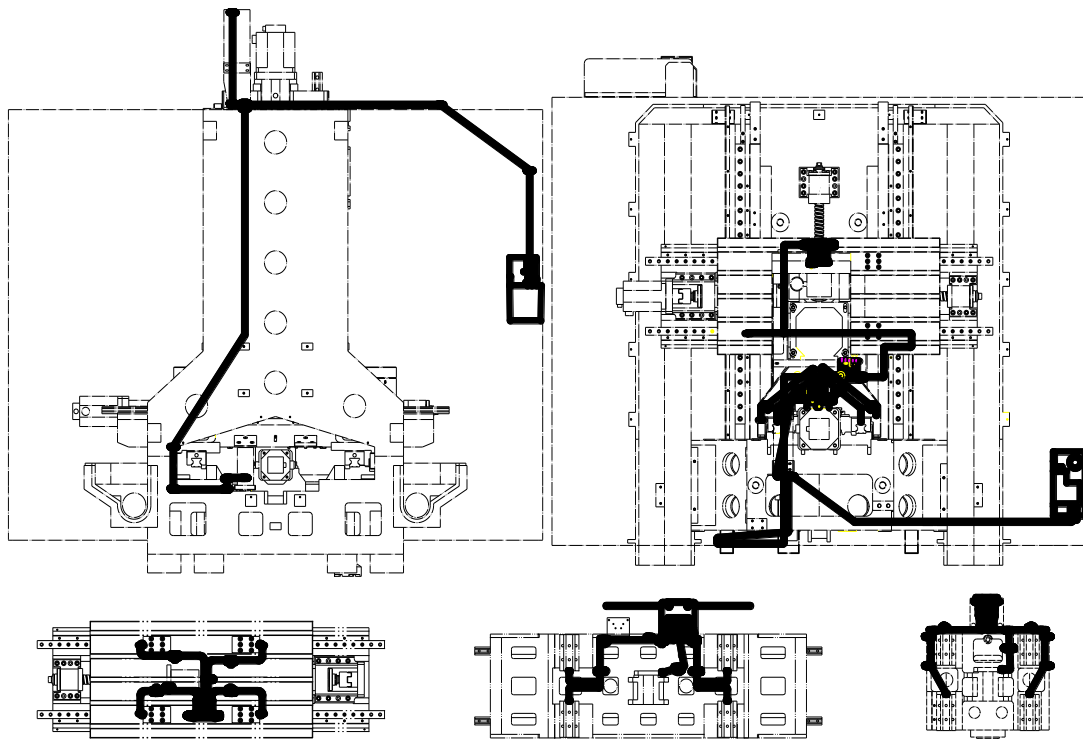


Fig. 3.12

- 6) Connect the terminal of lubricating pump with the inner of cabinet by cables.
- 7) Fill lubricating oil into lubricating pump.
- 8) Press down the button of lubricating pump to make sure the normal running.

▲ Warning

Connect the mounted pipes well to avoid the leakage of oil from the pipes.
The leakage of oil can get the ground slippery, which can cause the operator slipped or injured.

3.13 Telescopic cover of X、Y and Z axes

(1) Installation of X-axis telescopic cover

- 1) Install the telescopic cover as shown in Fig. 3.13(a), and temporarily tighten the fixing bolts of the shield.
- 2) Install the left and right baffles, the cover plate, and the chip guard, and temporarily tighten the fixing bolts of all.
- 3) Move the working table, and check if the telescopic cover works smoothly without abnormal noise. Loosen the fixing bolts to adjust until the requirements are met.

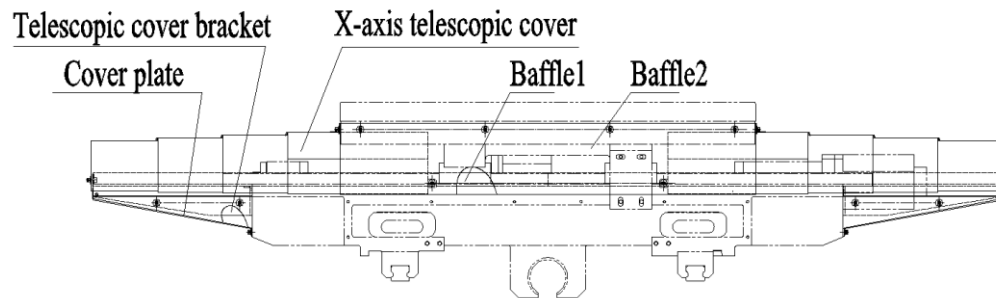


Figure 3.13(a)

(2) Installation of Y-axis telescopic cover

- 1) Use the fixing bolts to fix the telescopic cover and gaskets on the slide and column, as shown in Fig. 3.13(b).
- 2) Install the left and right baffles and chip guard, and temporarily tighten the fixing bolts of all.
- 3) Move the slide, and check if the telescopic cover works smoothly without abnormal noise. Loosen the fixing bolts to adjust until the requirements are met.

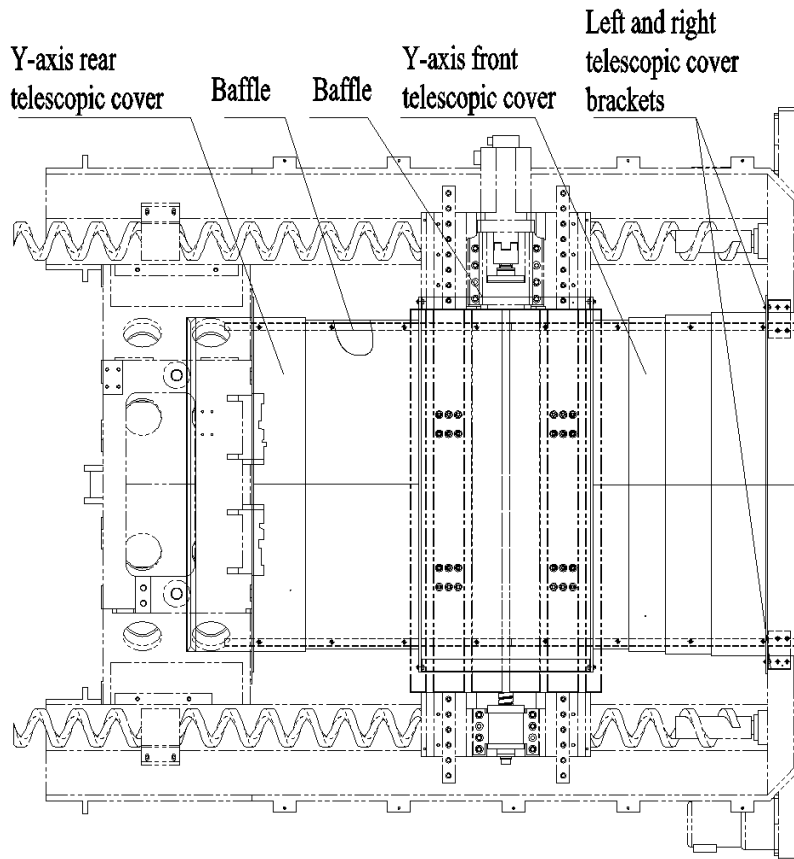


Figure 3.13(b)

(3) Installation of Z-axis telescopic cover

- 1) Use the fixing bolts to fix the telescopic cover and gaskets on the spindle box, as shown in Fig. 3.13(c)
- 2) Move the spindle box, and check if the telescopic cover works smoothly without abnormal noise. Loosen the fixing bolts to adjust until the requirements are met.

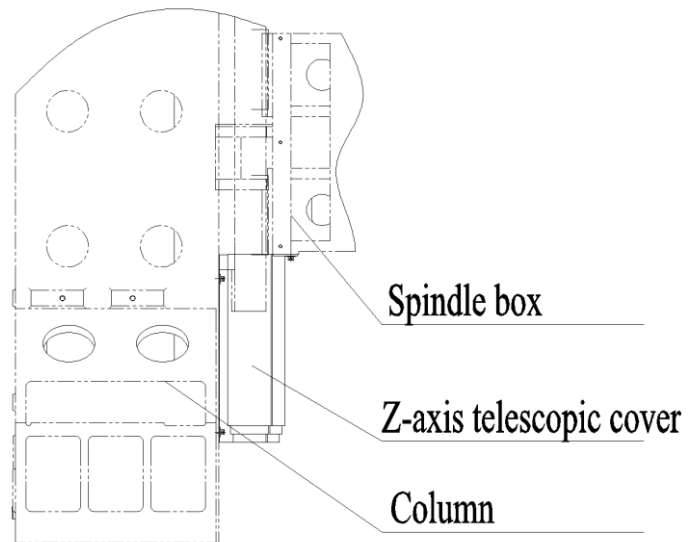


Figure 3.13(c)

- (1) Make sure that the X/Y/Z-axis is reliably installed and well sealed to prevent the cutting fluid and chips from entering the machine during operation, so that it will not affect the service life of the guideways and other components.

3.14 Installation of digital controlled index plate

Digital controlled index plate can increase the machining method of machine and improve the machining efficiency of machine. Mount the device as the following steps:

- 1) Fix the digital controlled index plate at the right side of machine with the structure shown in Fig. 3.14 (b) .
- 2) Fix the tail bed at the left side of working table with the structure shown in 3.14 (b) .
- 3) Install flexible pipe between the digital controlled index plate and the wiring box at the upper right side of the protecting room as Fig. 3.14 (a) .
- 4) Connect the cables of index plate motor by flexible pipes and wiring box.
- 5) Install pipes between index plate and air pressure source by flexible pipes and wiring box.

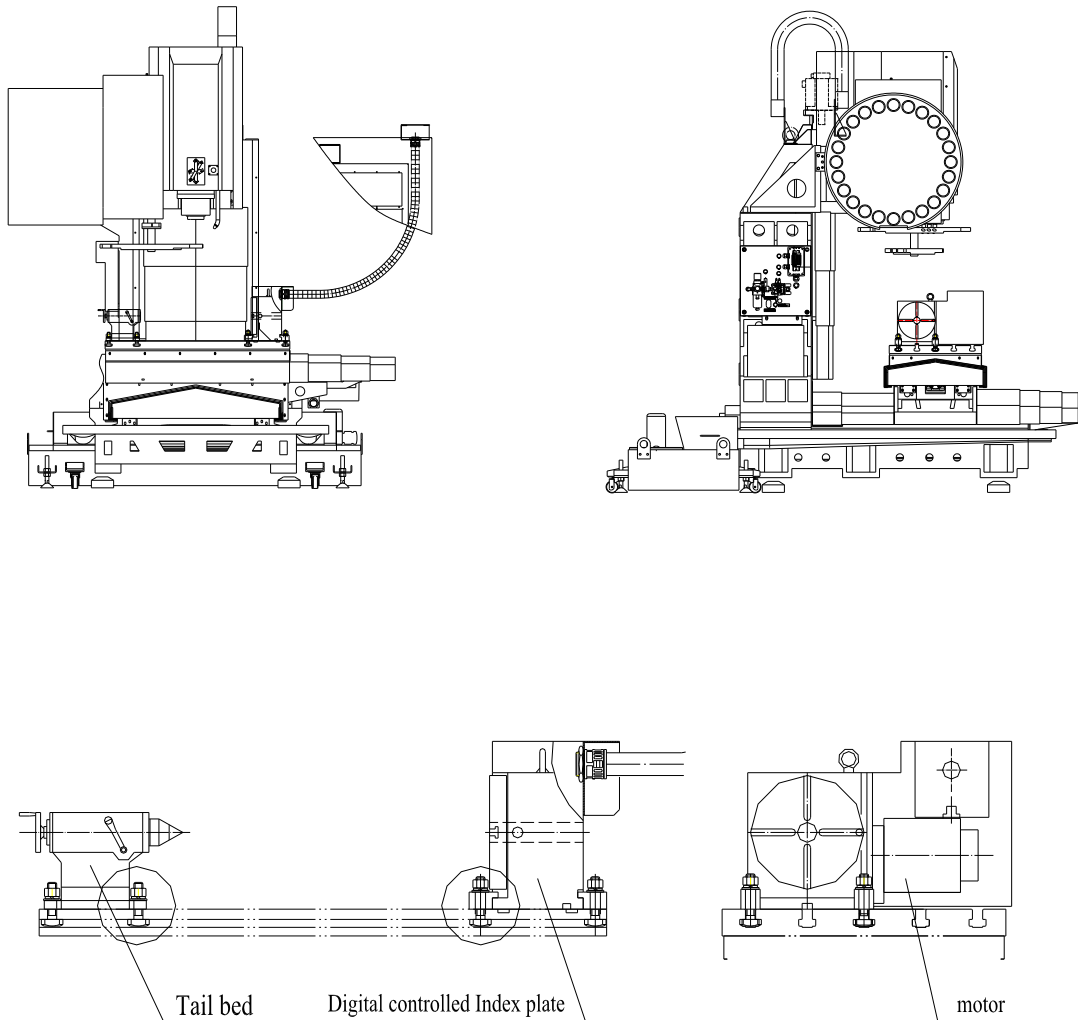


Fig. 3.14 (a)

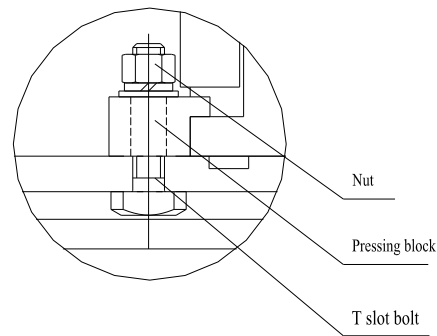


Fig. 3.14 (b)

▲ Warning

Connect the equipped pipes well to avoid the leakage of air.

3.15 Installation of tool magazine device

Tool measuring device can measure the dimensions of tool and feedback the results to the system. The system can compensate for the errors of dimensions, so as to improve the accuracy of machining. Mount the device as the following steps:

- 1) Fix the tool measuring device at the rear of working table with bolts and nuts through T slot as Fig.3.15
- 2) Install flexible pipes between tool measuring device and the wiring box at the upper right side of protecting room.
- 3) Connect the cables of tool measuring device by flexible pipes and wiring box.
- 4) Install pipes between tool measuring device and air pressure source by flexible pipes and wiring box.
- 5) Fix the air pipes and cables at the rear of the working table by hose clamps.

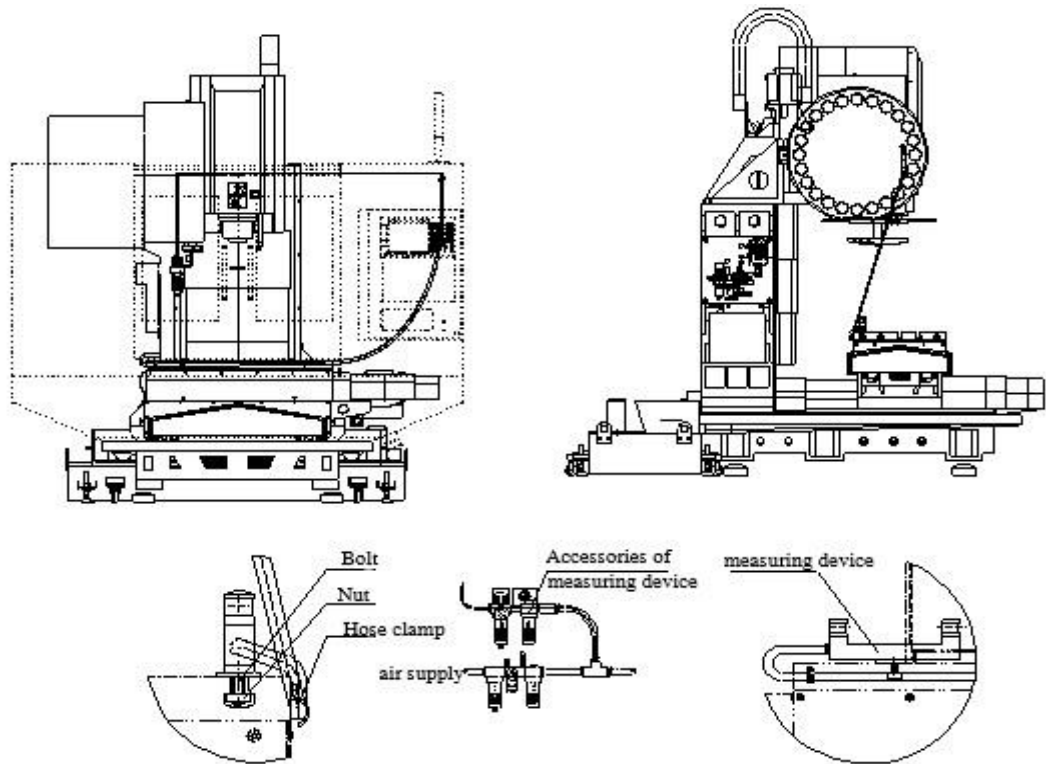


Fig. 3.15

▲ Warning

Connect the equipped pipes well to avoid the leakage of air.

3.16 Installation of workpiece measuring device

Workpiece measuring device can proof the position of the machined workpiece and measure the dimensions of the workpiece, which can improve the efficiency. Mount the device as the following steps:

- 1) Connect the gauging head generator with tool bar as Fig. 3.16.
- 2) Fix tool bar on spindle with clamping loosening command.
- 3) Mount a receiver on the protecting room.
- 4) Connect data wiring into electric cabinet by wiring box.

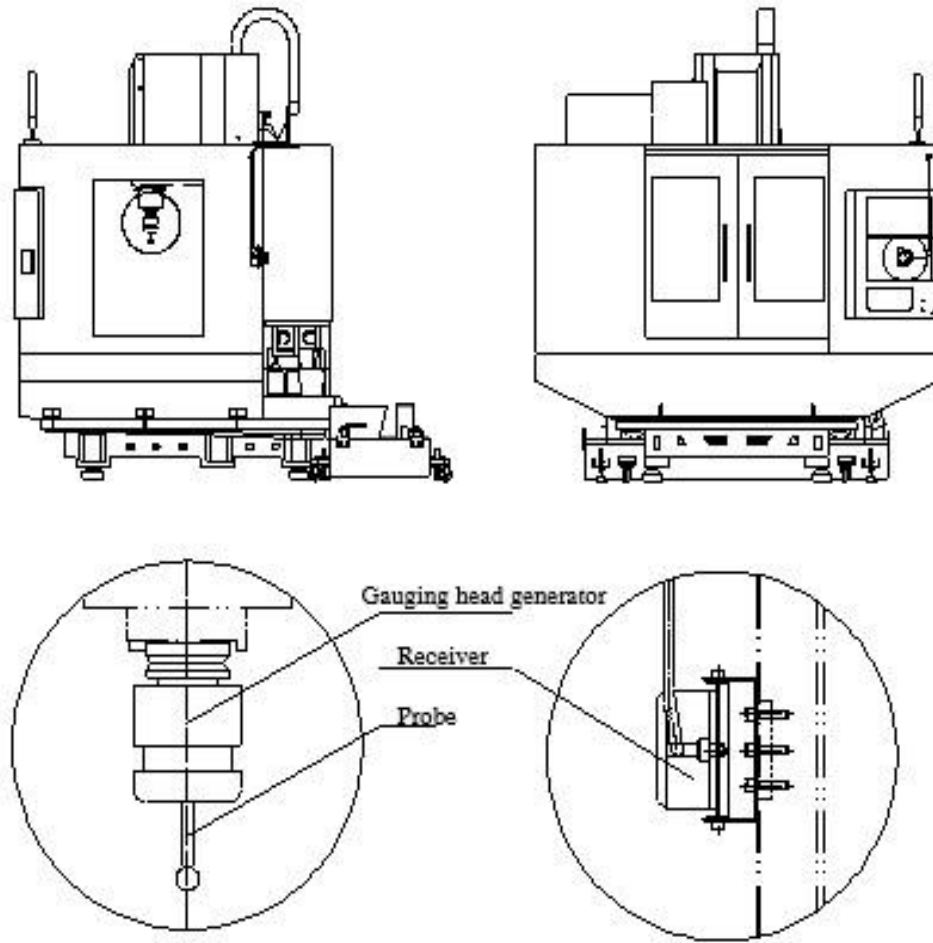


Fig. 3.16

4 Zero Point and Tool Change Point Settings

Point Settings

4.1 Zero Point Settings

4.1.1 Zero point setting for X-axis

Set zero point for X-axis as follows:

1. Make sure that X-axis can move after connecting the power supply.
2. The operator stands against the machine tool, and moves the working table towards right.
3. The zero point of X-axis is set when the distance between the right side of the working table and the center of the spindle is A.
4. As shown in 4.1.1(a), the position is the zero point of X-axis. For detailed parameter settings, see the electrical instructions.

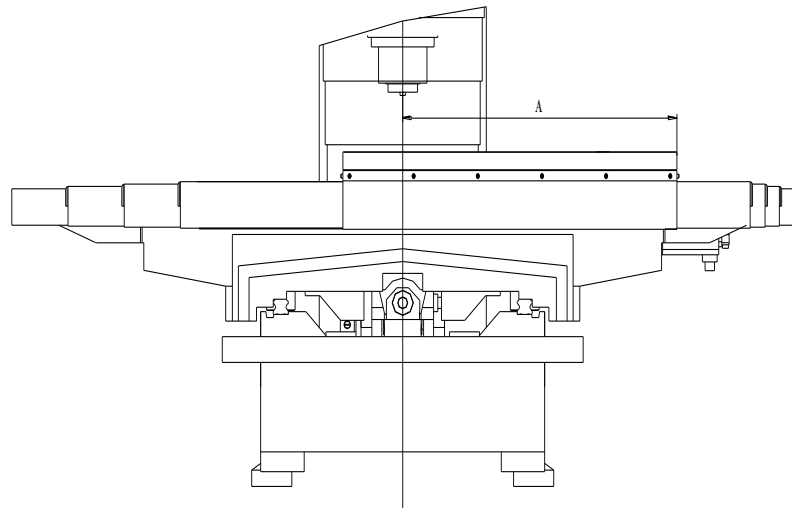


Figure 4.1.1(a) Zero-point setting for X-axis

Machine Model	A Value (mm)
VMC850Q/M4-850Q	925
VMC1000Q/M4-1000Q	1075
VMC1100Q/M4-1100Q	1200

4.1.2 Zero point setting for Y-axis

Set zero point for Y-axis as follows:

1. Make sure that Y-axis can move after connecting the power supply.
2. The operator stands against the machine tool, and moves the working table towards the operator.
3. The zero point of Y-axis is set when the distance between the front side of the working table and the center of the spindle is A.
4. As shown in Fig. 4.1.2(a), the position is the zero point of Y-axis. For detailed parameter settings, see the electrical instructions.

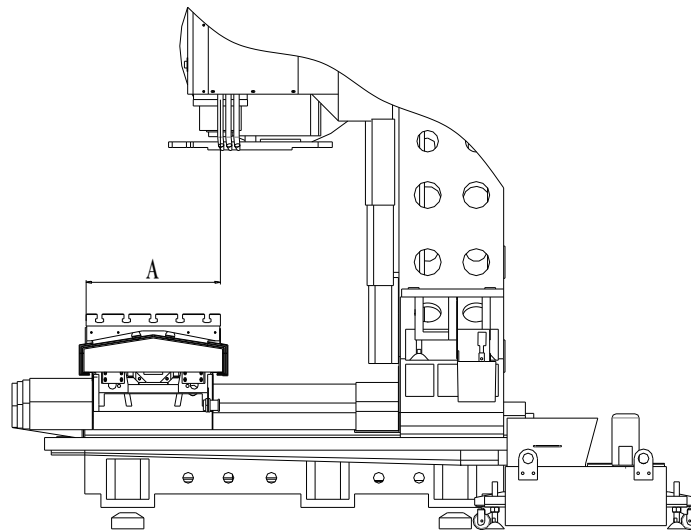


Figure 4.1.2(a) Zero point setting for Y-axis

Machine Model	A Value (mm)
VMC850Q/M4-850Q	500
VMC1000Q/M4-1000Q	500
VMC1100Q/M4-1100Q	615

4.1.3 Zero point setting for Z-axis

Set zero point for Z-axis as follows:

1. Make sure that Z-axis can move after connecting the power supply.
2. The operator stands against the machine tool, and moves the spindle box upwards.
3. The zero point of Z-axis is set when the distance between the working table and the spindle nose is A.

4. As shown in Fig. 4.1.3(a), the position is the zero point of Z-axis. For detailed parameter settings, see electrical instructions.

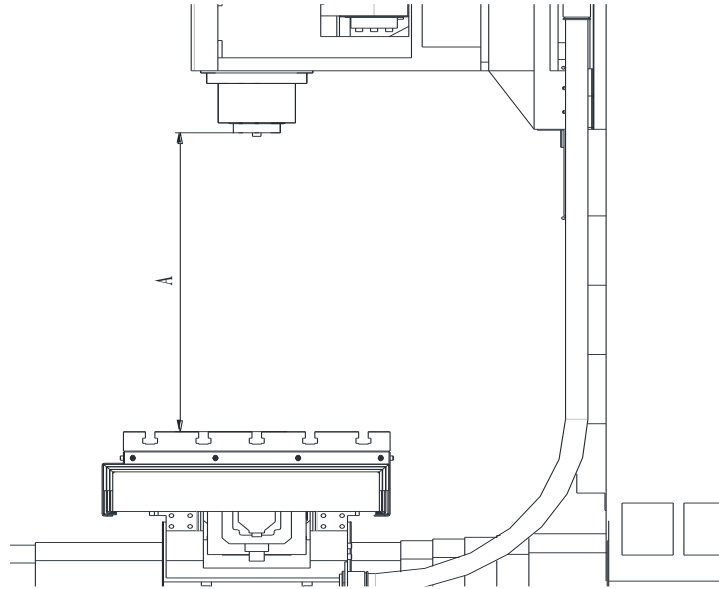


Figure 4.1.3(a) Zero point setting for Z-axis

Machine Model	A Value (mm)
VMC850Q/M4-850Q	660
VMC1000Q/M4-1000Q	660
VMC1100Q/M4-1100Q	720

4.2 Tool Change Point Setting

Set tool change point as follows:

1. Make sure that Z-axis can move after connecting the power supply.
2. Move Z-axis to its zero point.
3. The spindle box moves A forward from the zero point, where is the theoretical tool change point.
4. As shown in 4.2(a), the position is the theoretical tool change point. Due to slight differences in parts, the actual tool change point may be deviated slightly from the theoretical tool change point, which requires debugging on site. For detailed parameter settings, see the electrical instructions.

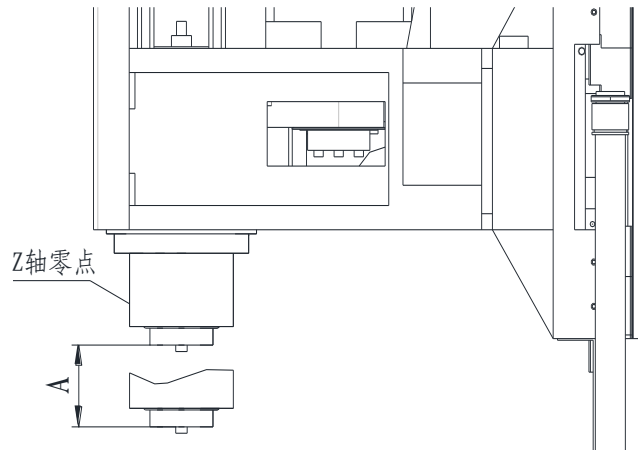


Figure 4.2(a) Theoretical tool change point setting

Product Model			A (mm)
VMC850Q/M4-850Q	Manipulator	BT40	12
VMC1000Q/M4-1000Q	Manipulator	BT40	12
VMC1100Q/M4-1100Q	Manipulator	BT40	19.3

4.3 Tool Magazine Adjustment

Adjust the tool magazine as follows:

1. Lift and mount the tool magazine and the support with a 2-ton hoist.
2. Fix the tool magazine support with screws, and mount a location pin for resetting the tool magazine.
3. Make sure that Z-axis can move normally after connecting the power supply.
4. Move the spindle box to the theoretical tool change point.
5. Rotate the manipulator to the tool change point.
6. Adjust the concentricity of the center of tool magazine and chuck with the axial center of spindle at $\leq 0.02\text{mm}$ with a or a dial gauge.
7. Adjust the spindle box to ensure that the end of spindle is 2~3 mm away from the surface of chuck, where is the actual tool change point, mark the position, as shown in Fig. 4.3.
8. Adjust the spindle orientation to ensure that the spindle positioning button corresponds to the tool magazine and chuck.
9. Once the tool magazine adjustment is completed, make a trial in tool changing. If the chuck jaws bend downwards by 0.5 mm during tool change, the tool change point is set correctly, repeat the step 7 until the chuck jaws bends properly. For detailed parameter settings, see the electrical instructions.

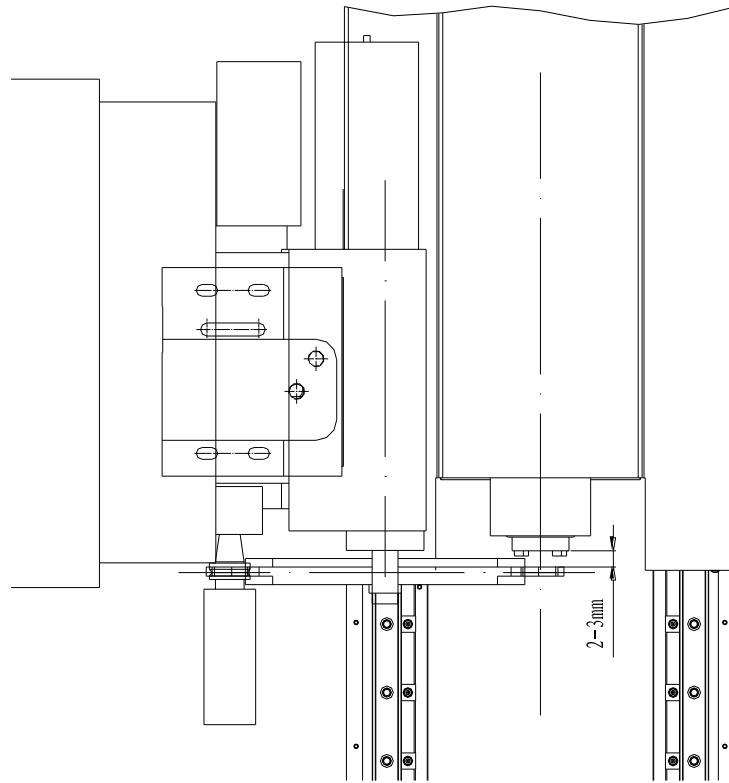


Figure 4.3 Tool Adjustment

5 Repackaging

When moving, delivering or hoisting the machine, the machined must be packaged to avoid mechanical shock.

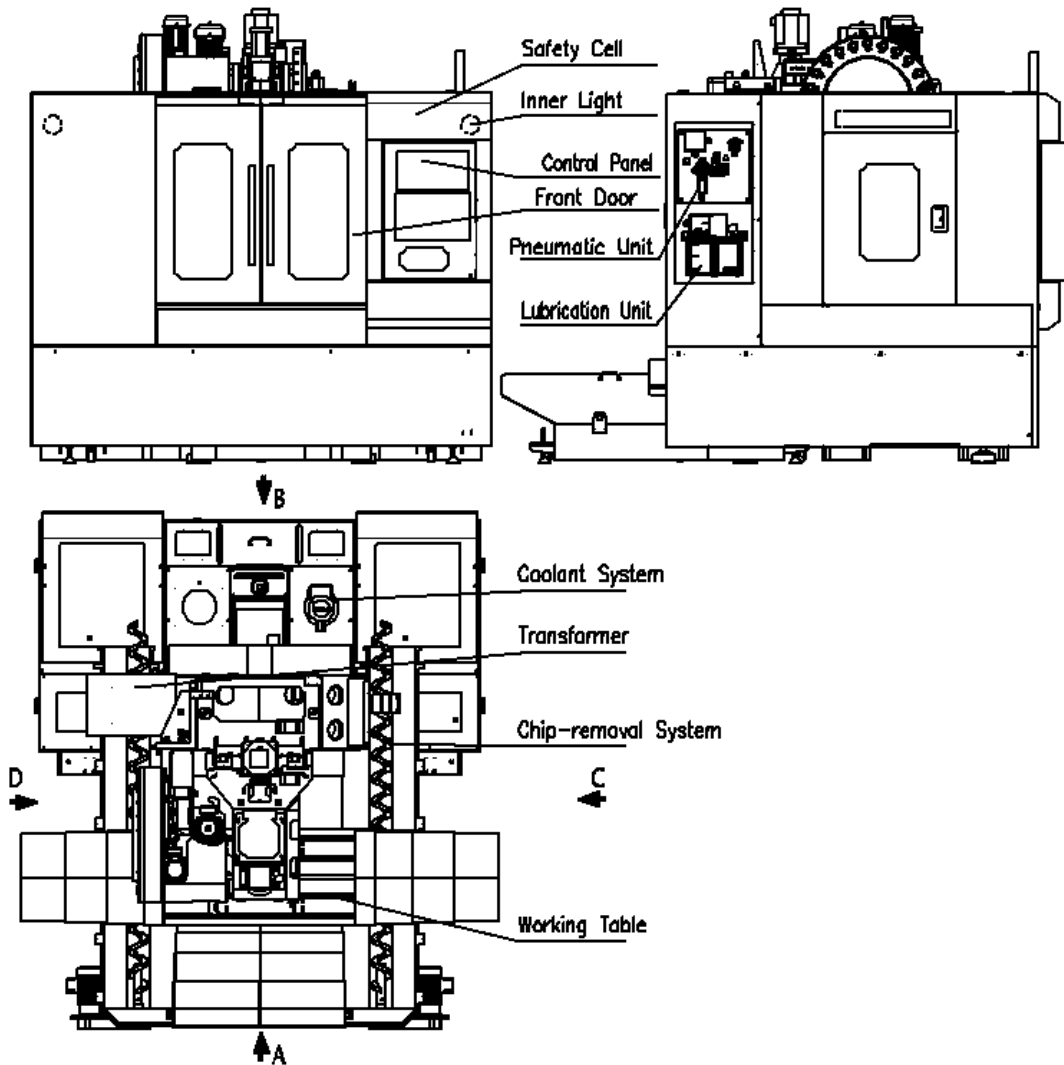
Package the machine as the following procedures:

- 1) Clean completely the table surface, the inner of protecting room and make sure no chip dust in the machine.
- 2) Dismount the tool set on the machine.
- 3) Please refer to the “II-2.1-hoisting posture” to package the machine.

III. Routine Run

1 Operating position

The following drawing is operating parts of VMC Q /M4-Q series machine.



No.	Operation	Position	Working Component	Illustration
1	Work piece change, clamp setup	Headstock	Control panel, working table	A
2	Programming, data input/output	Headstock	Control panel, working table	A
3	Power ON/OFF	Headstock/Tailstock	Control panel, rear of electrical cabinet	A,B
4	Tool change	Headstock	Tool magazine	A
5	Chip cleaning	Headstock	Inside safety cell, chip conveyor	A
6	Coolant filling	Tailstock	Coolant device	B
7	Fuse change	Tailstock	Inside electrical cabinet	B
8	Air pressure supply and shut off	Tailstock	Air device	B
9	Lubricant refilling	Tailstock	Lubrication device	B
10	LED change	Headstock	Inner light	A
11	Spindle motor cleaning	Headstock	Spindle motor	A

Do not operate and work beyond the operating positions. For example, working at the following positions has potential risks due to deterioration of working conditions and instable support.

- Inside the machine tool
- Top of the electrical cabinet
- Top of the column
- Top of the safety cell
- Top of the tool magazine support

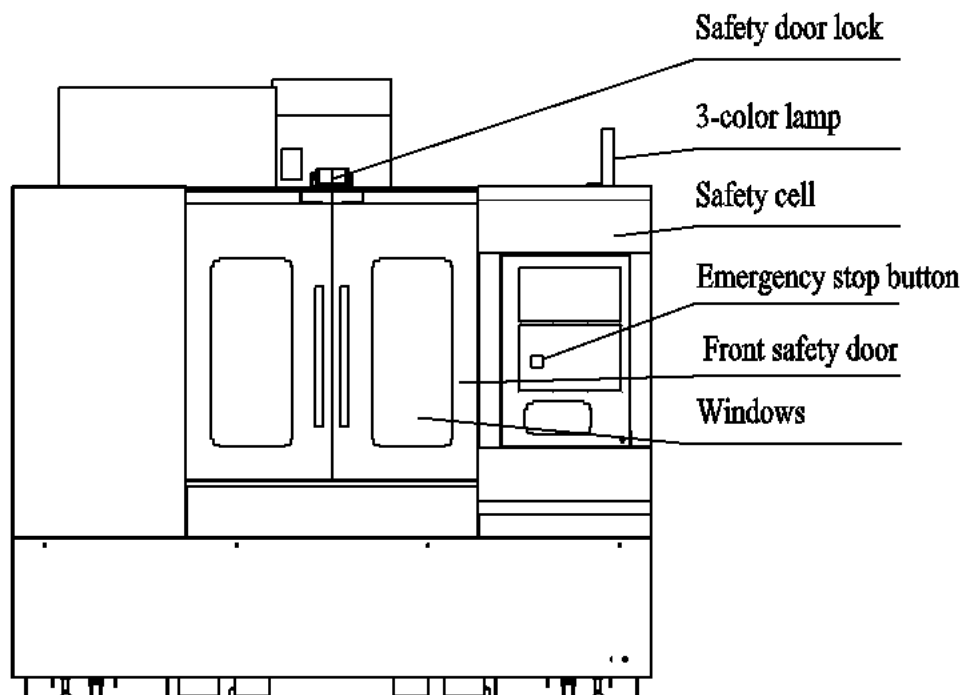
2 Opening or closing safety door

▲ Warning
Make sure the Z axis can not fall down before opening the safety door. Pad wood blocks between working table and Z axis when operating under Z axis after the safety door is opened, so as to avoid the occurrence of danger if the Z axis brake is fault.
If power supply is turned off during the spindle rotating, spindle will rotate continuously depending on inertia, which can cause the splashing of chips. Therefore, it is necessary to open the safety door after ensuring that the spindle has stopped.

2.1 Door lock

Door lock

The door lock is mounted at the top of the safety door, which is used to lock the safety door and prevent the operator to open the door during operation, which is dangerous. To avoid hazards to the operator, do not open the safety door during operation.



2.2 Locking the safety door

The safety door is equipped with a locking mechanism, do not open the door until it is under a safe condition. To safely use the machine tool, do not run the machine while the safety door is open. If unlock the door during operation (press the 'Door Lock' button on the control panel), the operation is paused.

Operation instructions:

- a. Manual operation: Press the "Door Lock" button on the control panel to unlock the safety door, and press the "Door Lock" button again to lock the safety door.
- b. Automatic operation: In automatic mode, execute the M code will do the same operation.

When the lock alarm is triggered: Close the safety door, and check if the lock works normally.

Note: The button for the safety door lock and M code are dependent on actual circumstances.

When executing the following operation the lock is unlocked.

Press the "Door Lock" button on the control panel.

When the safety door is unlocked, the indicator of the "Door Lock" button on the control panel is lighted.

When executing the following operation the lock is locked.

Close the safety door, and press the "Door Lock" button on the control panel, the indicator of the "Door Lock" button on the control panel is off.

With the safety door open, the operation of the machine tool is restricted as follows.

- 1) Automatic operation is disabled.
- 2) Coolant system is switched off.
- 3) Tool change is disabled.
- 4) The speed of manual operation is limited, for the operations only as follows.

Spindle speed is up to 500 r/min.

Manual movement of X/Y/Z-axis is up to 1.9 m/min.

Manual feed of hand wheel.

- 5) During manual operation with the safety door open, the spindle and X/Y/Z-axis are stopped when it switches to another mode.

With the safety door close, the spindle and X/Y/Z-axis are stopped.

When unlocking the safety door, the machine tool stops as follows.

- 1) The rotation of spindle and the movement of X/Y/Z-axis are slowdown to stop.
- 2) During tool change, the machine stops at the end of tool change.
- 3) The coolant system stops.
- 4) During rigid tapping, as moving to the hole bottom, the rotation of spindle and movement of X/Y/Z-axis are slowdown to stop.
- 5) The execution of pause is ended.
- 6) During spindle orientation, the spindle stops as the orientation is completed.


To restart automatic operation, proceed as follows.

- 1) With the safety door open, close the safety door to automatically lock, and the indicator of the “Door Lock” button is off.

With the safety door close, press the “Door Lock” button on the control panel, and the indicator of the “Door Lock” button is off.

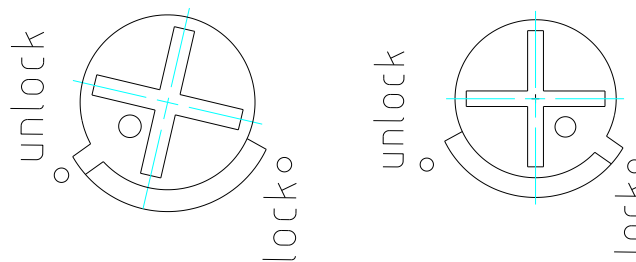
- 2) To run the spindle, press the “Spindle Rotation” button by hand.
- 3) To turn the coolant system on, press the “Coolant System” button by hand.
- 4) In the mode of automatic operation, press the “Start” button.

2.3 Open or close safety door when power supply is off

 Warning
When the power supply is off, the operator can not open the safety door. Otherwise the operator may be injured because the safety device can not work.
Please invite the maintenance personell to open the safety door if it is necessary to open the door. Or people may be injured by the accidental actions of machine.


The concrete operations are as followed:

Maintenance personnel must open the door with cruciform screwdriver. The door switch is at the lower part of the door. Two plugs are mounted on the baffle plate of the lower part. Dismount the plugs and find out the position of unlocking key on an electromagnetic lock switch through a hole. Then unlock or lock the safety door with cruciform screwdriver.



Unlocking state

Locking state

 Warning
Opening the safety door with screwdriver is forbidden when power supply is on. That may get the operator entered into the working area in automatic running mode and cause the personnel injured sometimes. Therefore, please use the door open button on the operating panel.
When the axes are moving and spindle is rotating, if the electromagnetic lock switch is unlocked enforcedly, the machine will be in the emergency stop state.

3 Mounting tool components

Notice

Make sure tools have been effectively mounted on the tool component.

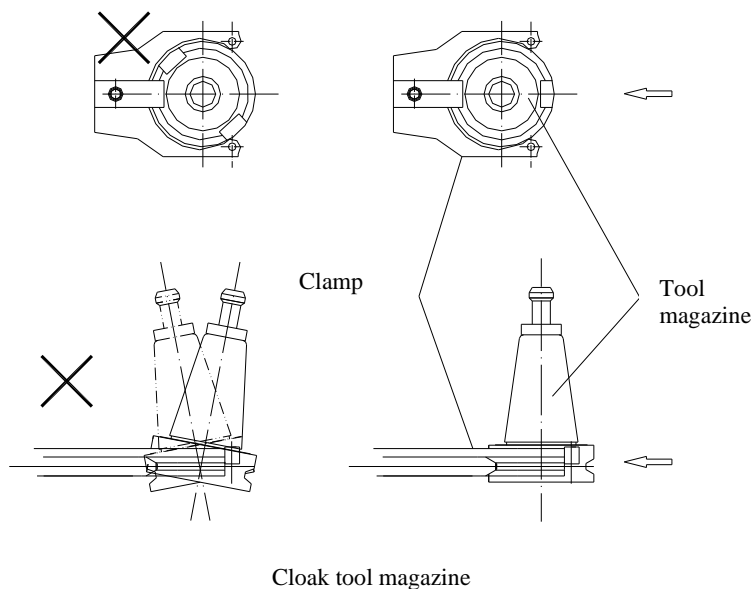
Any fault of the mounting may cause the falling of tool, which can cause the damages of workpiece and machine.

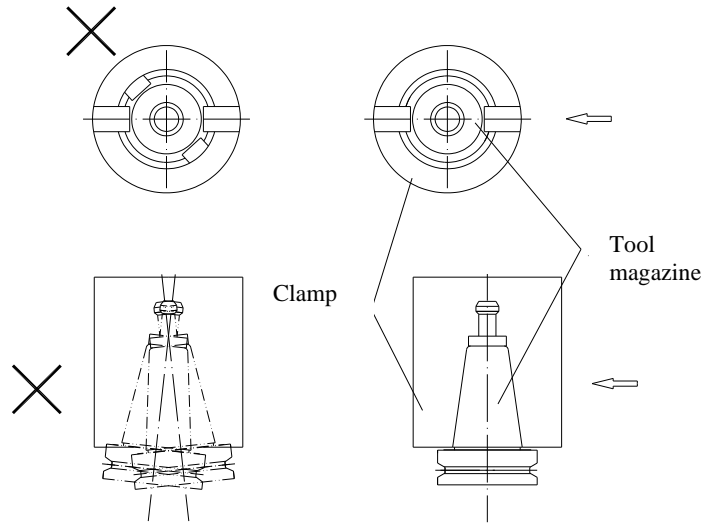
Make sure no wearing or damage on the tools. Or the piece of tool may splash and damage the workpiece and machine.

Mount the tools on the clamp of tool magazine in accordance with the indication (the content in the item). Any fault of the mounting may cause the falling and splashing of tool component, which can cause the damages of workpiece and machine.

The maximum diameter, the maximum length and the maximum weight of tool can not be exceeded. Details of applied tool components and mounting method of tool components, please refer to chapter I-3:"Tool Component".

Mount each tool component with properly pushing it into the clamp.





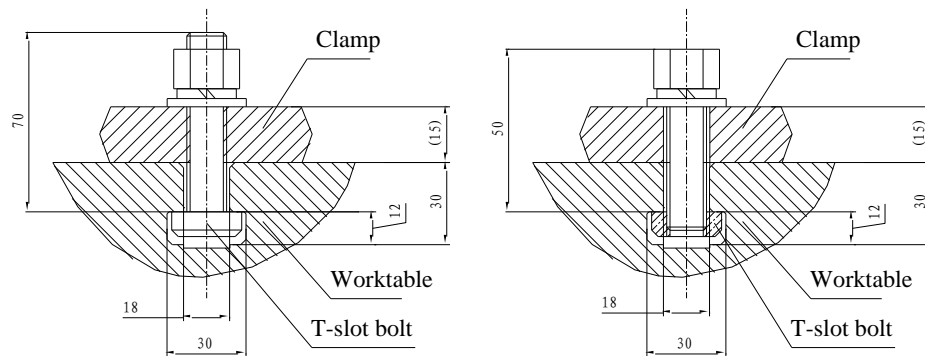
Disc tool magazine

Ensure the stability after mounting the tool.

Assign and mount the tools properly to keep the weight balance of mounted tools.

4 Mounting of clamp and workpiece

When the clamps are fixed on the working table, the T-slot nominal dimension 18/22 of T-slot bolt specified in JIS-B-1166, or the T-slot nominal dimension 18/22 of T-slot nut specified in JIS-B-1167 can be used.



With T-slot bolt

With T-slot nut

Warning

The weights of clamps and work pieces on the table can not exceed the maximum loading weight. Or the table will be damaged, people may be injured and workpiece as well as clamp may be damaged.

Notice

Assure the following items before the automatic running of machine:

- Make sure clamps have been properly fixed on the table.
- Make sure work pieces have been properly mounted on the clamps. If cylinder-way clamps are used, it is necessary to make sure the required air pressure has been supplied.

Machining without properly fixing the workpiece and clamp can cause their falling and splashing, which can damage the workpiece and machine.

5 Warm Machine before Machining

It is recommended to warm machine before machining, or it can affect the operation and machining accuracy.

- Warm the machine tool before machining, especially warm the spindle and feeding axles. Run the machine tool for 20 minutes in automatic operation to warm the machine.
- In automatic operation, each moving part will automatically act in accordance the programs, at this time, check the status of each moving part.
- If the machine tool has shut down for a week or longer, do not operate immediately as it turns on, instead, wait for a while to warm the machine. Because of shutdown, the lubricant may not be sufficient, and the slideways are subject to wear, resulting in thermal expansion of the components and affecting the machining accuracy.

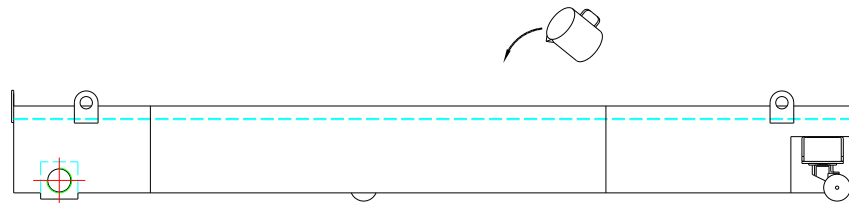
6 Supplement of coolant

Make sure there is enough coolant.

If it is not enough, please add it.

Warning

Keep enough coolant required by the machining. If it is not enough, the temperature will arise, which can cause the fire or the damage of tool and work piece.



If water soluble coolant is used, Put water and the original solution into other container and mix until dissolution, and then put them into the cooling channel.

For coolant, please refer to “safety countermeasure 2--d) . 5 coolant ”“V-1.1.2Makeup of coolant”.

Note

Do not splash the water into baffle plate of cutting fluid, or it will be corroded.

7 Supplement of lubricating oil

▲ Warning

Do not use the coolant and lubricating oil (lubricating grease and oil) which are deteriorated, because they are extremely harmful to the health of people. Store or handle them in accordance with the indications of the manufacturer.

Should be avoided as possible the use of coolant and lubricants (grease, oil) which can cause the deterioration of polycarbonate, nitrile rubber (NBR), hydrogenated nitrile rubber (HNBR), fluorinated rubber, nylon and acrylic resins.

Supplement clear lubricating oil. Change or clean the filter once a year.

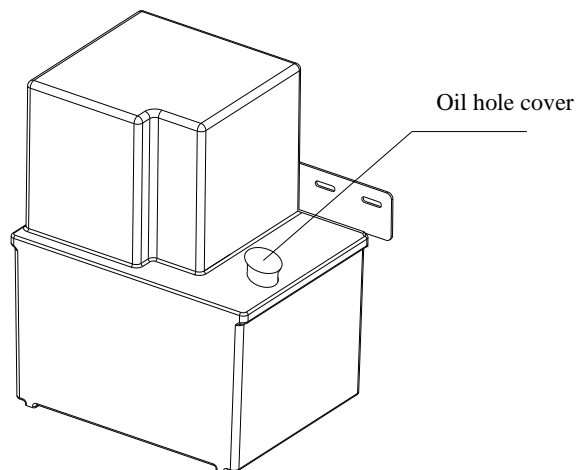
Make sure there is enough lubricating oil.

Supplement the lubricating oil as the following steps if it is not enough.

- 1) Screw off the oil hole cover.
- 2) Fill in the clear lubricating oil to the maximum level indicated on the oil pump.
- 3) Screw on the oil hole cover tightly.

▲ Warning

Keep lubricating oil enough. If it not enough, the sliding surface of the moving parts on the machine can be worse fractionated, which can cause the damage of them.



For lubricating oil , please refer to “d) coolant and lubricating oil” in “Safety countermeasure 2”.

IV. Operating Details

1 Coolant device

VMC Q /M4-Q series machine are equipped with cooling device which is used to supply cutting liquid for the machining surface.

1.1 Coolant device

The cutting liquid can be provided for the machining surface as the following steps:

- 1) Make sure enough cutting liquid in water tank and supplement if it is not enough.
- 2) Open the valve on the nozzle.
- 3) Press down the cooling device button, the water pump rotates, and the cutting liquid sprays out from the nozzle (stop spraying when pushing the button again).
- 4) Adjust the spraying position of cutting liquid by adjusting the nozzle position. Pay attention to that the front end of nozzle can not be too near of the tool. Or they will interfere with each other when tool change.

▲ Warning

Do not adjust the position of the nozzle when the machine is running, which is dangerous and may cause the injury of people.

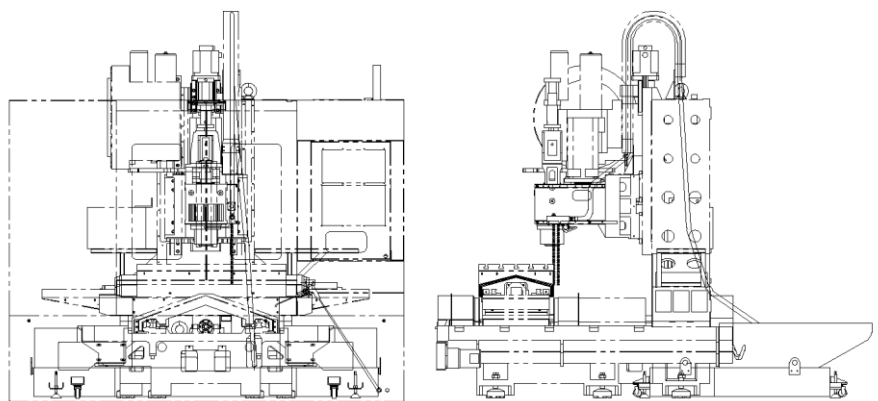


Fig. 1.1 (a) cooling system

The opening (cutting liquid supply) and closing (stop cutting oil supply) of cooling device can be performed by M codes besides the manual operations

introduced in the above item 3. M08 (Opening) and M09 (Closing) can be performed by automatic method (MEM) or menu running method (MDI)

Notice in use

The water pump can no-load run for a long time. Filling cutting liquid into the water tank as the above step 1. Do not run water pump immediately after the valve is opened. Or water pump can be damaged.

Additional instruction

- The cooling device can open or close at the following time when it is running automatically by M codes:
M08: Cooling device opens immediately when the program segment is read.
M09: Cooling device closes immediately when the program segment is read.
- Cooling device closes when tool change. Close the cooling device with operating buttons or M08 command if necessary.
- The rotating direction of water pump is indicated in the Fig.1.1 (b) .

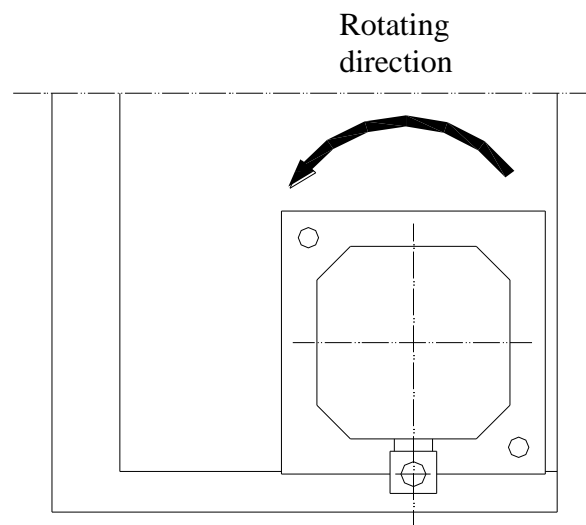


Fig. 1.1 (b) rotating direction of water pump

V. Maintenance

1 Overview

VMC Q /M4-Q series vertical machining centers are designed based on the idea of mechatronics, which integrates the machine tool and the control devices.

This manual is composed of two parts: the machine and the control principle, with maintenance instructions for each part.

Where it refers to “CNC maintenance manuals”, please see:

FANUC maintenance manual / SIEMENS 828D maintenance manual/
i5maintenance manual.

2 Structure

2.1 Working Table, Slide, Machine Bed

Structure of Working Table, Slide and Machine Bed of VMC Q/M4-Q Series

The structure of working table, slide and machine bed is shown as follows.

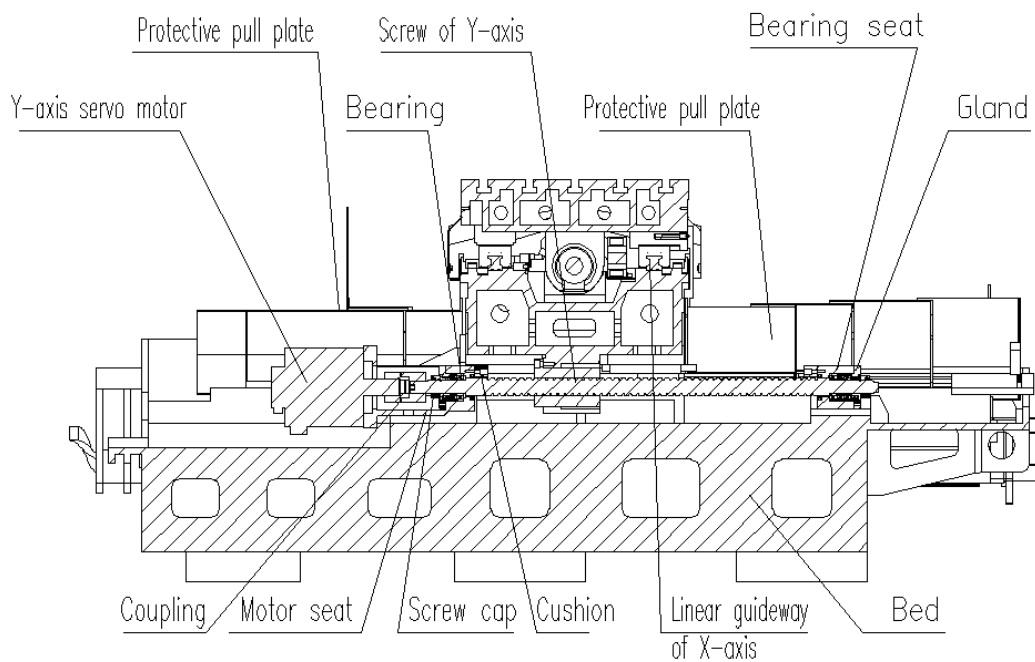


Figure 2.1(a) Structure of working table, slide, machine bed

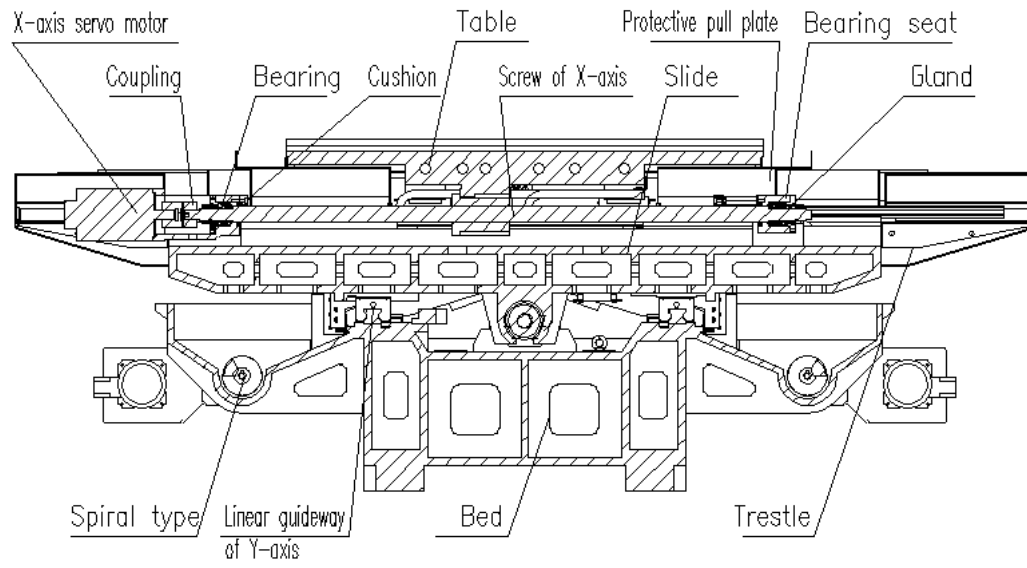


Figure 2.1(b) Structure of working table, slide, machine bed

2.2 Spindle Box

2.2.1 Structure

The structure of spindle box is shown as follows.

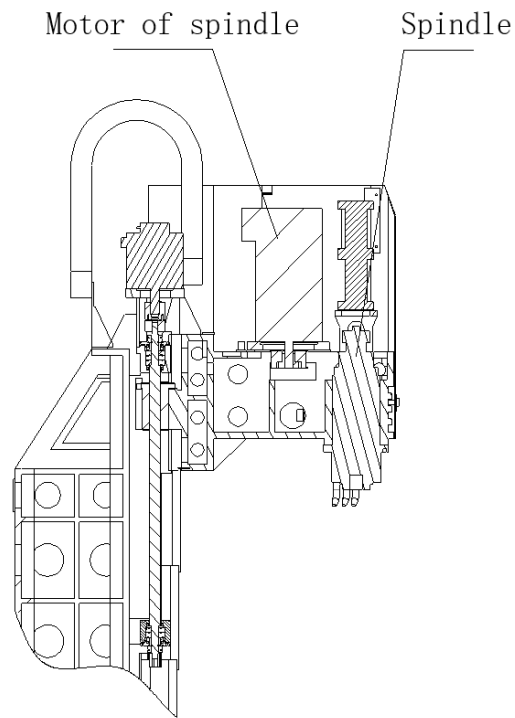


Figure 2.2.1 Spindle box and spindle motor (belt type)

3 Routine Maintenance

The maintenance instructions in Chapter V shall be performed by qualified personnel listed in the table. For the classifications of operator, routine maintenance and preventive maintenance personnel, and maintenance personnel, see the “Preface”.

Qualified Personnel	Work Content
Operator	Operations in “VI.3 Routine Maintenance”
Routine Maintenance and Protective Maintenance Personnel	“VI 4 Scheduled Maintenance”, operations other than 4.5.1
Maintenance Personnel	“VI 4 Scheduled Maintenance”, operations in 4.5.1

3.1 Pre-work Inspection

For the safe use of the machine tool, do the following inspections daily before running the machine.

3.1.1 ATC Inspection

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	ATC alignment	Check with chuck jaws	•		•		
	Tool holder up/down action		•		•		
	Rivet clasper	Check abnormal wear			•		
	Tool holder taper				•		
	Tool holder key				•		
	Input motor voltage	±10%			•		
	Bolt and joint	Check condition	•			•	
Function	Tool change action	Manual operation	•	•			
	Tool magazine action		•	•			
	Tool holder up/down action		•	•			
	Solenoid valve action				•		
	Switch action				•		

Oil	Tool magazine cam follower	Coat lubricating grease			•		
	Tool holder up/down parts				•		
Clean	Tool changer manipulator clamp	Clear foreign objects		•			
	Inside tool holder			•			
	Tool holder up/down			•			
	Tools			•			
	Inside tool magazine		•	•	•	•	

Notes: For detailed inspection and maintenance instructions, see tool magazine instruction manual.

3.1.2 Working Table

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Clean	Working table	Clear foreign objects		•			
	Inside safety cover				•		

3.1.3 Axes

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Check reference point	Check and adjust				•	
	Axis vibration					•	
	Static accuracy					•	
	Position accuracy					•	
	Feed accuracy					•	
	Axis oil scraper	Check abnormal wear			•		
	Servo motor input voltage	±10%			•		
	Bolts and joints	Check connection	•			•	
	Emergency stop action		•				
	Return to reference point	Manual operation	•	•			
Axis movement	•		•				
Oil	Moving parts	Guide screw, etc.			•		
Clean	Moving cover	Clear foreign objects		•			
	Inside protective				•		

	devices						
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3.1.4 Spindle Box

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Tool clamping device	Check and adjust			•		
	Spindle orientation	Adjust stop position	•		•		
	Spindle drive key	Check abnormal wear			•		
	Spindle taper				•		
	Spindle drive belt	Check tautness			•		
	Orientation belt				•		
	Motor input voltage	±10%			•		
	Bolts and joints	Check connection	•			•	
Function	Spindle rotation	Manual operation	•	•			
	Spindle orientation	MDI operation	•	•			
	Clamp/Unclamp	Manual operation	•	•			
	Solenoid valve action					•	
	Switch action					•	
Oil	Moving parts	Coat lubricating grease				•	
Clean	Spindle taper	Clear foreign objects		•			
	Inside safety cover					•	

3.1.5 Pneumatic System

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Pressure gauge	0.6MPa	•				
	Lubricator flow rate	5 drops / min	•				
	Pipeline	Check gas leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Air blow	Spindle chuck clamp/unclamp	•	•			
		Spindle air blow	•	•			
		Tool magazine chuck clamp/unclamp	•	•			
		Spindle end cooling	•	•			
	Air transformer	Check function			•		

	Lubricator				•		
	Pressure switch				•		
Oil	Lubricator	Fluid level gauge	•	•			
Clean	Oil tank for filter	Water removal	•	•			
	Filter strainer	Inspect/clean/replace			•		

3.1.6 Lubrication System

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Pressure gauge	Working condition	•		•		
	Motor input voltage	±10%			•		
	Pipeline	Check leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Pump	Check action	•	•			
	Gear oil distribution	Check condition	•	•			
	Pressure switch					•	
	Fluid level switch					•	
Oil	Gear oil level gauge	Check fluid level	•	•			
Clean	Gear oil filter	Inspect/clean/replace		•			

3.1.7 Coolant System

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Set temperature	Control panel SV=03	•	•			
	Device input voltage	±10%			•		
	Pipeline	Check leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Device action	Check condition	•	•			
	Control panel	Check function			•		
Oil	Gear oil level gauge	Check condition	•	•			
	Gear oil replace				•		
Clean	Gear oil filter	Inspect/clean/replace		•			

Note: For detailed inspection and maintenance instructions, see oil cooler instruction manual.

3.1.8 Protective Device

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Cover surface	Check leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Doors	Open/Close condition	•				
	Door lock switch		•	•			

3.1.9 Plates

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Plates	Check condition	•	•			

3.1.10 Coolant and Chip Devices

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Pump input voltage	±10%			•		
	Coolant flow rate	Adjust		•			
	Pipeline	Check leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Pumps	Check action	•	•		•	
	Chip conveyor		•	•			
Oil	Fluid level gauge	Check condition	•	•			
	Oil replace				•		
	Chip conveyor drive chain	Coat lubricating grease				•	
Clean	Inside fluid tank	Clean			•		
	Strainer and filter	Inspect/clean/replace			•		
	Inside chip bucket	Clear chips		•			
	Chip conveyor (daily)	Manual operation		•			
	Chip conveyor (yearly)	Disassemble				•	

3.1.11 Hydraulic System

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Pressure gauge		•	•			
	Pressure switch		•	•			
	Pump input voltage	±10%			•		
	Pipeline	Check leakage	•	•			
	Bolts and joints	Check connection	•			•	
Function	Pumps	Check action	•	•			
	Pressure switch					•	
Oil	Fluid level gauge	Check condition	•	•			
	Oil replace				•		
Clean	Inside oil tank	Clean				•	
	Inlet filter	Inspect/clean/replace			•		
	Suction filter					•	
	Reflux filter						•

3.1.12 Electrical Device

Item	Check Point	Remarks	After Installation	Every Day	Every 6 Months	Every Year	Reference
Condition	Input voltage	±10%	•		•		
	Bolts and joints	Check connection	•			•	
Function	Emergency stop switches		•	•			
	Operation device	Check function	•	•			
	Operator caller	Check ON/OFF	•	•			
	Work light		•	•			
	Electrical cabinet fan	Check action	•	•			
Clean	Inside electrical cabinet	Check condition			•		

3.1.13 Scheduled Gear Oil Inspection

Oiling Position		Type of Oil	Oil Tank Volume (L)	Inspection Interval (h)	Refill or Replace		Remarks
Unit	Location				Time Interval (h)	Amount (L)	
ATC	Tool changer				1000h	Fill to the upper limit of oil level	
	Tool holder up/down	See "Tool Magazine Instruction Manual"					
Axle	Moving	ISOVG68					

	parts	(Turbine oil)					
Spindle nose	Moving parts	Lubricating grease					Maintenance free
Air supply unit	Lubricator				At low level		
Lubrication system	Oil tank		3		At low level	Fill to the upper limit	
Oil cooler	Oil tank	ISOVG10				Fill to the upper limit	
Coolant and chip devices	Coolant tank	Water soluble extreme-pressure lubricant			At low level		

For lubricant, see “IV Daily Operation 6) Refill Lubricant”

3.2 Clean Devices

Clean the following devices as it prompts repair and maintenance messages. If the message appear during machining, it will not affect processing within 24 hours. Wait until the program ended for repair and maintenance. After the repair and maintenance are completed, tap “cycle stop” and “reset” at the same time in the EDIT mode to clear the message.

During repair and maintenance, please shut off the power to clean devices.

Messages include: 2008, 2009, 2018, 2019 as follows:

Message Number	Message	Cleaning Time
2008	Please clean chips inside tool magazine; clean cooling device and oil cooler of electrical cabinet; clean spindle taper, drain water in FRL unit, fill some lubricant to the lubricator.	7 days
2009	Please clean chip guard mesh of coolant tank.	1 month
2018	Fill oil to gearbox and pneumatic cylinder	3 months
2019	Please clean lubrication pump oil tank; clean coolant tank, and change coolant and spindle coolant oil.	6 months

Note: 1 day is 24 hours of actual operation of the machine tool

3.2.1 Clean Electrical Cabinet Cooling Device and Oil Cooler Strainer

(1) Clean electrical cabinet cooling device

The fan of electrical cabinet is on the door, covered with strainer. Clean the strainer every 7 days to ensure the cooling effect of the electrical cabinet.

Take off the strainer and clean the fan.

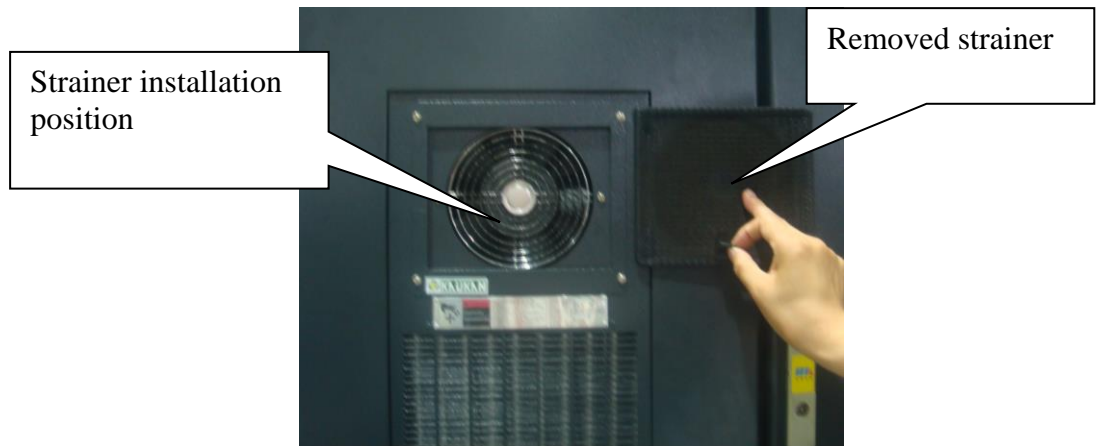


Figure 3.2.1(a) Cooling device of electrical cabinet

(2) Clean oil cooler strainer

The strainer is located at the rear of oil cooler, clean it every 7 days to ensure the normal condition of the oil cooler. Take off the strainer and then clean the oil cooler.

The oil in the tank is recycled and will deteriorate after a long time. Please replace oil every 6 months.

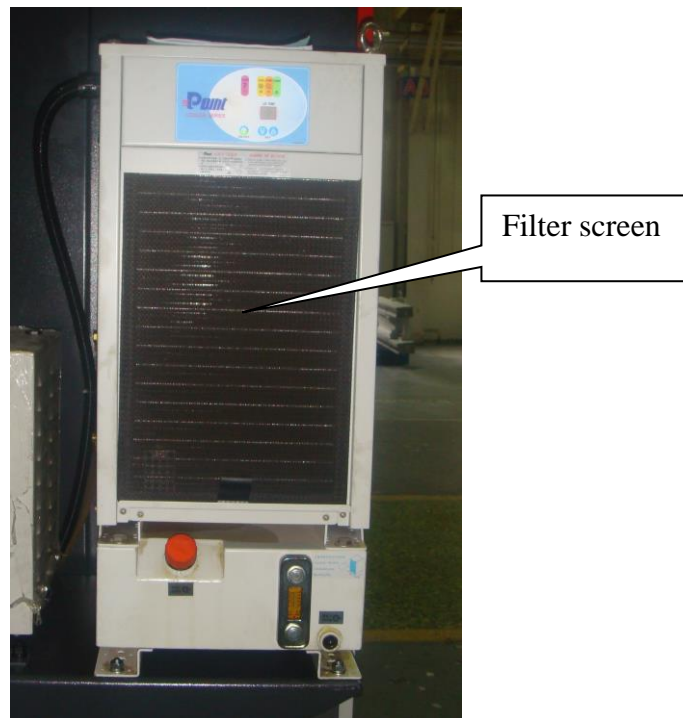


Figure 3.2.1(b) Oil cooler

3.2.2 Clean spindle taper

Please wipe the spindle taper with a clean rag. Clean the spindle taper every 7 days.

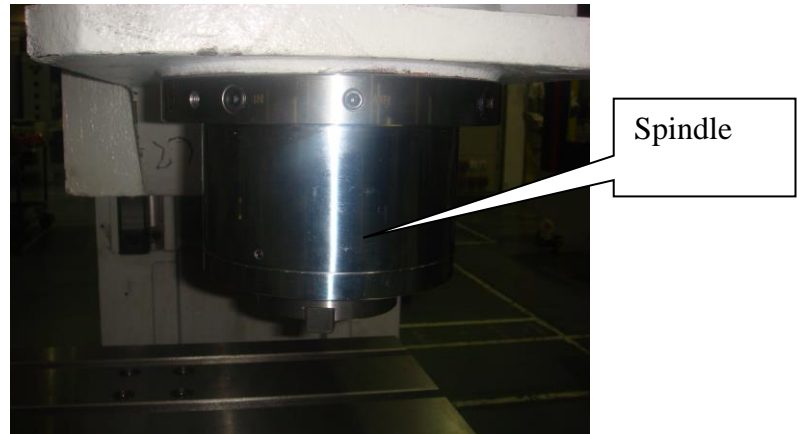


Figure 3.2.2(a) Spindle

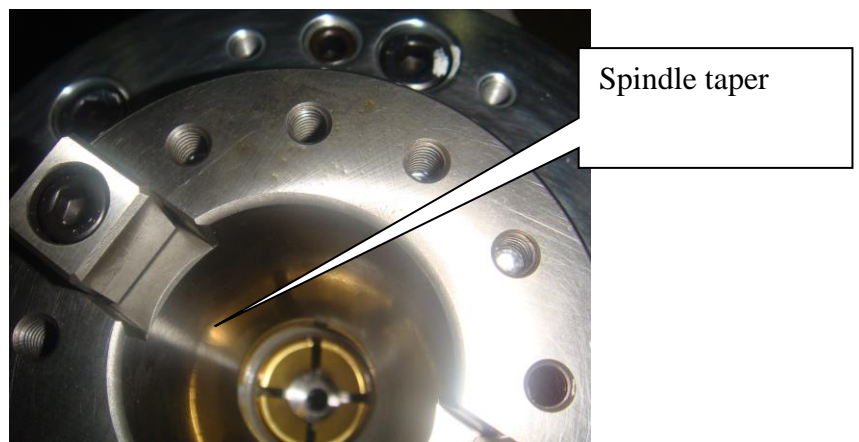


Figure 3.2.2 (a) Upward view (partial)

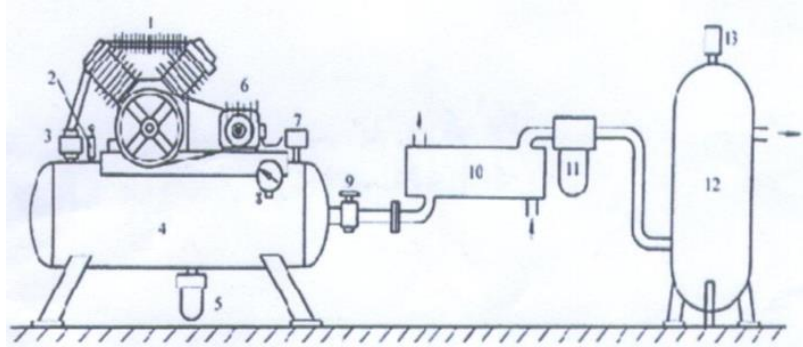
3.2.3 Maintenance and Cleaning of Pneumatic System

(1) Air source

There is a great amount of water, harmful oil and impurities in the compressed air output from the air compressor. To prolong the service life of pneumatic parts, the air source needs to be treated.

Method:

Compressed air from compressor (4) drains plenty of water through the condenser (10), and filters large sized impurities through the filter (11), and enters the tank (12) to be stored.

**Qualified air source:**

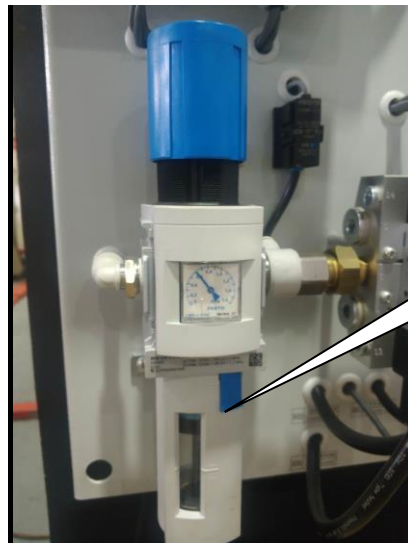
Processed air quality should be class 5 or higher, as described in (Setup Method III 1 Set Conditions)

(2) Air source treatment device

Filter:

∅ Empty the water in the cup every 7 days. Turn the black knob under the cup counterclockwise, empty the water, and knob clockwise to close.

∅ If the filter cartridge turns yellow or has been used for over 3 months, please replace it. First, close off the air source, remove the cup of pressure relief valve, replace the filter cartridge, and put back the cup.



Air purifier cover

Figure 3.2.3 Air source treatment device

3.2.4 Clean Coolant Tank & Strainer

Clean the strainers of coolant tank once a month.

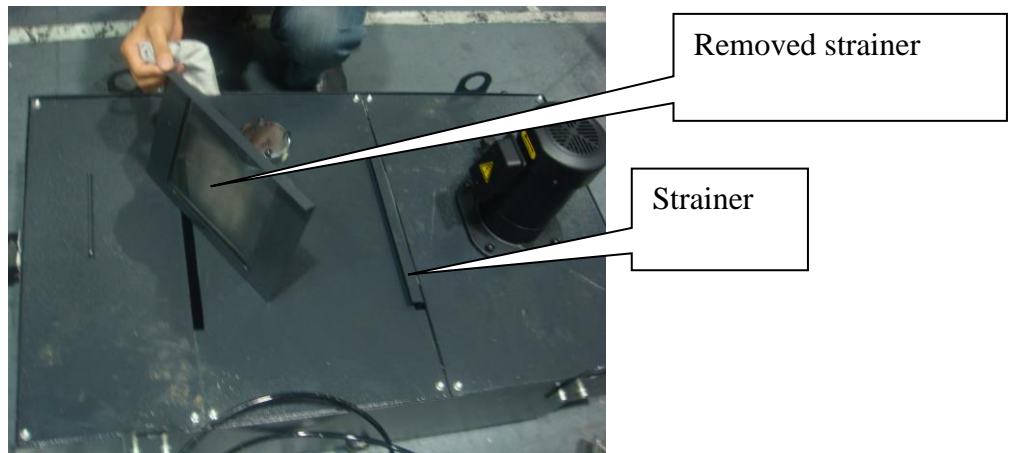


Figure 3.2.4 Coolant tank

3.2.5 Tool Magazine Gearbox

(1) Tool magazine gearbox

Fill appropriate amount of lubricant to the tool magazine gearbox every 3 months.

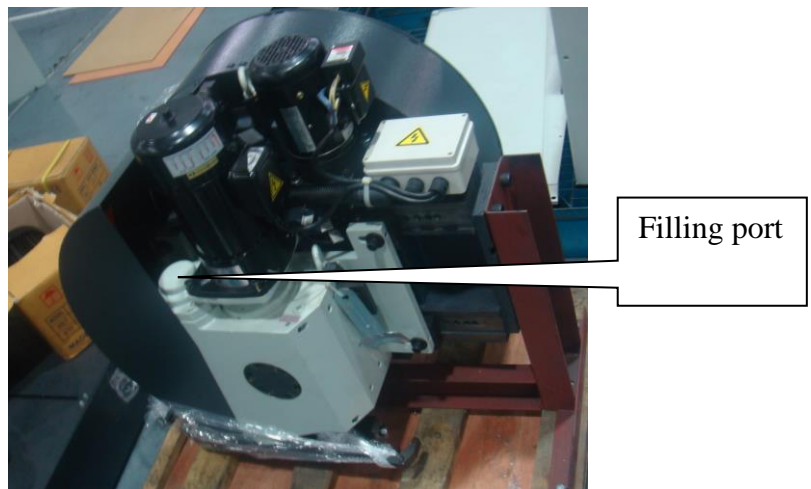


Figure 3.2.5(a) Tool magazine

(2) Boost cylinder

Fill appropriate amount of lubricant to the Boost cylinder every 3 months.

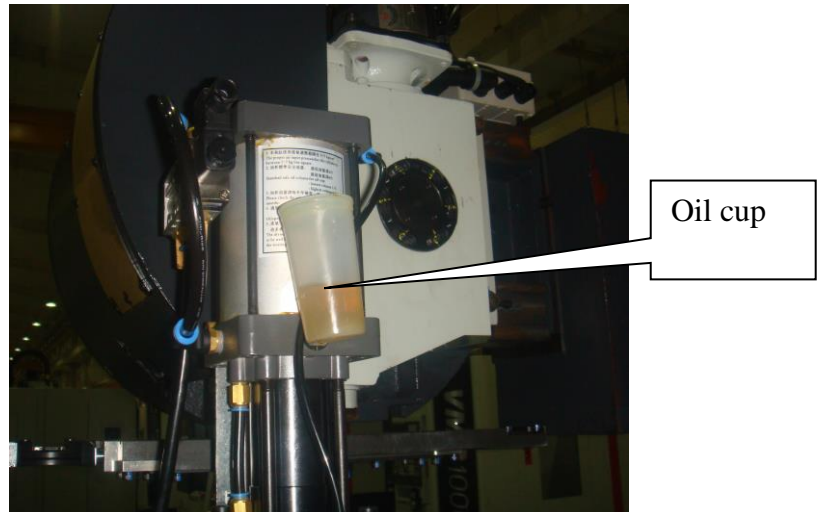


Figure 3.2.5(b) Pressure cylinder

3.2.6 Clean Lubrication Pump & Oil Tank

The lubrication pump is at the tailstock of the machine tool. To ensure clean oil in the pump, clean the oil tank regularly.

Clean the oil tank every 6 months.

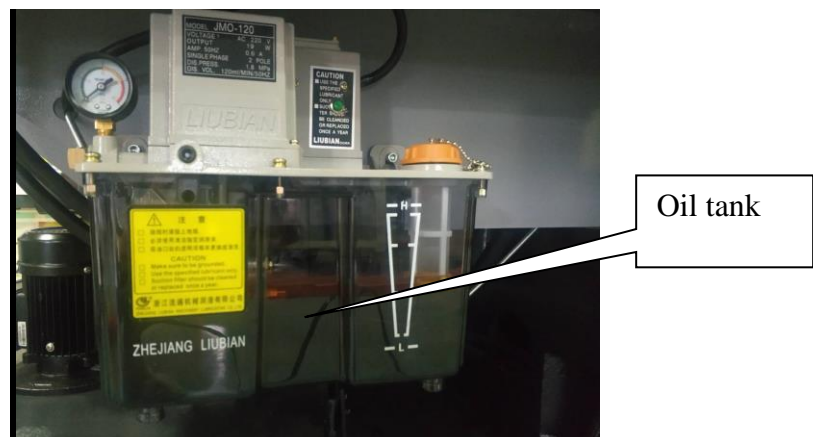


Figure 3.2.6 Lubrication pump

3.2.7 Clean Coolant Tank, Replace Coolant

Clean regularly to prevent the chips from blocking the coolant outlet and chip bucket. To ensure clean coolant for the machine tool, replace coolant every 6 months.

4 Scheduled Maintenance

Scheduled maintenance shall be performed by the “routine maintenance and preventive maintenance personnel” only.

For “routine maintenance and preventive maintenance personnel”, please see “Preface 2.2 Routine Maintenance and Preventive Maintenance Personnel”. For “maintenance personnel”, please see “Preface 2.3 Maintenance Personnel”. Please identify the specific work contents for “routine maintenance and preventive maintenance personnel” and “maintenance personnel”. Scheduled maintenance needs to use tools, remove fixing cover, and open the door of control device. It is dangerous for the operator to perform these operations.
Do not designate the operator for scheduled maintenance.

Precautions before maintenance

Warning

Due to the risk of injury or shock hazard caused by unexpected actions of the machine tool, follow the guidance as follows:

- Remove the baffle, cut off the power supply of the electrical cabinet before conducting the maintenance.
- Turn off the power switch of the electrical cabinet and all accessories before setting and maintaining accessories.
- Clear other people when connecting the power supply with the baffle removed for maintenance.

When replace parts, always turn off the power switch of the electrical cabinet, or it can cause damage to the new part or electric shock.

When open the electrical cabinet for changing fuse and batteries, turn off the main switch, or it can cause electric shock.

Hang a sign near the power switch of the electrical cabinet during maintenance to warn that only the maintenance personnel can connect the power supply.

Inside the electrical cabinet, even after the main power switch is turned off, some parts may maintain residual voltage, so there is shock hazard. Only personnel with sufficient electrical knowledge can touch and control the inside of the cabinet.


Warning

To ensure safety, conduct scheduled maintenance as follows. Or poor mechanics can cause injury.

- ◇ Fill oil to the centralized lubrication unit (see section 4.1.1 Centralized Lubrication by Intermittent Oiling)


<p>when little oil is remained in the oil pump</p> <ul style="list-style-type: none"> ◇ Check and fill lubricant in the oil cup of the boost cylinder every 3 months ◇ Check the electrical cabinet fan (see section 4.3 Check Electrical Cabinet Fan) once a year ◇ Check the spindle motor (see section 4.4 Check Spindle Motor) every 6 months ◇ Replace the cover of regulator and oil-mist separator of the filter once a year (6,000 hours) or pressure reduced by 0.1 Mpa [standard in general] ◇ Replace consumable parts <ul style="list-style-type: none"> Battery for split type absolute pulse encoder, once a year Battery backup for CNC memory: <ul style="list-style-type: none"> When warning message “BAT” is flashed on the LCD screen Fuse: when the small window turns white; Daylight: when the light flashes Absorbing rubber pad for X/Y-axis telescopic covers: <ul style="list-style-type: none"> When there is an abnormal noise (recommended value: every 2,000 hours of operation) Y-axis rear cover: <ul style="list-style-type: none"> When there is a gap on the cleaner (recommended value: every 2,000 hours of operation) Absorbing rubber pad for front door <ul style="list-style-type: none"> When it falls off or damaged (recommended value: the cabinet door is opened and closed 500,000 times)
--

Precautions during maintenance


 Warning
<p>When conduct electric adjustment with the baffle removed, use tools with proper electric protection (screwdrivers made from resin, etc.), or it can cause electric shock.</p>
<p>Only “maintenance personnel” can replace the inner light, do not allow “routine maintenance and preventive maintenance” personnel to do the work. Do not allow personnel without adequate expertise do the work, or the safety devices cannot work properly, or cause injury or electric shock due to unexpected action of the machine tool.</p>
<p>Even if the power supply of the electrical cabinet door is shut off, the switch is still connecting the power. In addition, wiring through the main power switch 1 in the following cases may have electrical hazards.</p> <ol style="list-style-type: none"> 1. When installing an external power transformer 2. When installing a non-standard peripheral equipment
<p>When work at high places, in order to prevent falling off, use a ladder, and find a flat position to place the ladder. If step on the machine tool or on an object (chair or desk, etc.) that cannot be used as a support, you may lose</p>


balance and cause unexpected accidents.
Do not touch the following parts when just connecting or disconnecting the power supply. These parts may have a high temperature and cause burns. Wear thick gloves to touch high-temperature parts. <ul style="list-style-type: none"> ● Power line ● Heating parts inside the electrical cabinet (transformer, radiator fin)
Do not touch the following parts during operation or at the end of operation. These parts may have a high temperature and cause burns. Wear thick gloves to touch high-temperature parts. <ul style="list-style-type: none"> ● Axle servo motors (X/Y/Z-axis, additional axes) ● Spindle motor ● Coolant motor
Before opening the safety door, make sure that Z-axis (spindle nose) will not drop. In rare cases, Z-axis can descend due to a brake failure on Z-axis. After opening the safety door, pay attention to Z-axis. When working under Z-axis, place a wooden block between the working table and the spindle to support Z-axis and prevent Z-axis from descending in a case of brake failure.
When open the safety door with power off, make sure that the spindle has stopped rotating before opening the door. When the power is shut off during the rotation of the spindle, due to inertia, it is impossible to stop the spindle immediately, in some cases, chips may spatter, or cause injury by touching the spindle.
Replace maintenance parts in accordance with the guidance of this manual. Wrong parts or wrong methods may cause machine failure or injury.

Precautions after maintenance

 Warning
When turn on the power and run the machine tool during maintenance or after maintenance, make sure that there are no tools left in the machine. Or the tools may be caught or the machine tool may be damaged due to the action of the machine, or the tools may dash off and hit people.
After maintenance, install all the removed parts, and tighten the screws. Or the safety devices may not work normally, or it can cause injury due to wrong action or shock hazard.
Do not connect the power supply until the disassembled cables are installed. Or it may cause electric shock.

4.1 Lubrication of Parts

 Warning
Coolants and lubricants (oils and greases) are harmful to health. Follow the guidance below. For other precautions or treatment for exposure coolants and lubricants, please refer to the instructions on the packaging or of the manufacturer. <ul style="list-style-type: none"> ● Do not inhale vapor or mist ● Avoid direct contact with skin (especially wounds) ● Use protective eyewear to avoid splashing into eyes ● Do not ingest
Deteriorated coolants and lubricants (greases and oils) are extremely harmful and should not be used. Please consult the manufacturer on how to determine whether or not coolants and lubricants are deteriorated. Store or dispose of them in accordance with the manufacturer's instructions.

 Warning
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If coolants and lubricants (oils and greases) are spilled on the floor, clean the floor immediately. Slippery floor may cause the operator to slip or be injured.

4.1.1 Centralized Lubrication by Intermittent Oiling

Centralized lubrication device with intermittent oiling will automatically lubricate ball screws and guideways of axes on a regular basis.

With power on, the oil pump discharges lubricant to ball screws and guideways of axes.

Refill the lubricant from the list of recommended lubricants before the oil level in the oil tank drops to Low Level.

Note:


Use clean and fresh oil within the specified viscosity range (*20~2000 mm ² /s). Do not deliver oil while there are cutting fluid and chips in the container. Or it can cause pump failure or pipeline blockage.

※ mm ² /s=cSt

Additional Note

- | |
|--|
| <ul style="list-style-type: none"> ● The oil tank capacity is 3 L / 4 L. And the theoretical flow rate is 108 ml/min. ● A small amount of lubricant has been filled in the machine tool for leakage and drainage inspections at the time of leaving the factory. |
|--|

4.2 List of Designated Lubricant Brands

 Warning
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Avoid using coolants and lubricants (greases and oils) that make polycarbonate (PC), nitrile butadiene rubber (NBR), hydrogenated nitrile-butadiene rubber (HNBR), fluorinated rubber, nylon, and acrylic resin deteriorate. In addition, these materials will deteriorate when the dilution water contains large amounts of chlorine. The machine tool uses these materials in packaging, so if the packaging is not proper, it can cause spindle bearings to burn and stick due to electricity leakage or lubricant leakage.
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When use coolants and lubricants (greases and oils) not recommended by the manufacturer, please read the manufacturer's instructions and understand the conditions and methods of use. Or it can cause adverse effect to the health, the machine tool, and the environment.

Note

Even use recommended coolants and lubricants (greases and oils), do follow the manufacturer's instructions. Improper use can cause adverse effect on mechanical parts and coatings.

4.2.1 List of Recommended Lubricants (Lubricating Grease, Lubricating Oil, Anti-rust Oil)

Use the lubricants in the table

Position of Lubrication	Way of Lubrication	Type of Lubricant	Model of Lubricant	Filling Period
LM guideway (X/Y/Z) Cast guideway (Z) Ball screw (X/Y/Z) Bearing (X/Y/Z)	Automatic	Oil lubricant	SIOVG68 (turbine oil)	Refill when the residual amount in the centralized lubrication pump is reduced
Bearing (X/Y/Z)	Manual	Grease lubricant	Lithium grease	Refill when the machine tool has been operating for three to six months
Tool magazine cam mechanism	Manual	Oil lubricant	ISOVG150 ~ ISOVG 220 (turbine oil)	Refill when the oil cup is running low
LM guideway rail Inside the spindle taper On working table	Manual	Anti-rust oil	SF/Y246B (lubricating anti-rust oil) or SF/Y1030 (solvent-diluting soft film anti-rust oil)	Fill for transportation Fill for storage

4.3 Inspect Electrical Cabinet Fans


Fan motors are consumable parts.

Fan motors of amplifiers (PSM, SPM, SVM) and CNC needs to be maintained and replaced on a regular basis (once a year).

Established criteria

- 1) Whether it rotates normally
- 2) Whether there is abnormal vibration and sound
- 3) Whether there is adherence to dust, oil mist

Grime on fans and inlets will cause amplifiers and CNC to malfunction, please check and clean on a regular basis.

 **Warning**

Shut off the power before checking the fan motor of the electrical cabinet. Or it can cause injury due to unexpected action of the machine tool.

How to clean fan unit

Wipe off the dust and oil mist on the fan motor with a dry cloth. For oil mist difficult to remove, wring the cloth soaked with neutral detergent and use it to wipe off oil mist.

Note, avoid the detergent to flow to the inside of the roller of fan motor.


How to clean and replace air filter

- (1) Remove the filter mounted on the control unit
- (2) Blow both sides of the filter to clear the dust on the mesh
- (3) Use neutral detergent to clean stubborn grime, rinse with water, and dry. Please replace with the product of the same model.

4.4 Inspect Spindle Motor

Do the following maintenance on a regular basis:

Maintain every 6 months (at least once a year)	<ol style="list-style-type: none"> (1) Clean (fan, fan safety net) (2) Check noise and vibration
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 **Warning**

Check AC spindle with power off. Or it may cause injury due to unexpected action of the machine tool.

- (1) Clean

Grime on the fan and fan safety net may cause the spindle motor to overheat sometimes.

To avoid overheating, please clean them on a regular basis.

Clean the spindle motor as follows:

1. Do not let the fixture mounted on the working table interfere with tools, and manually lower Z-axis to negative limit, and turn off the power to the main power switch.
2. 用 Use an airbrush to blow away grime on the fan and fan safety net. And wipe off grime with a rag and a brush.

▲ Warning
Please use protective equipment such as masks, goggles and helmets to keep dust and debris out.

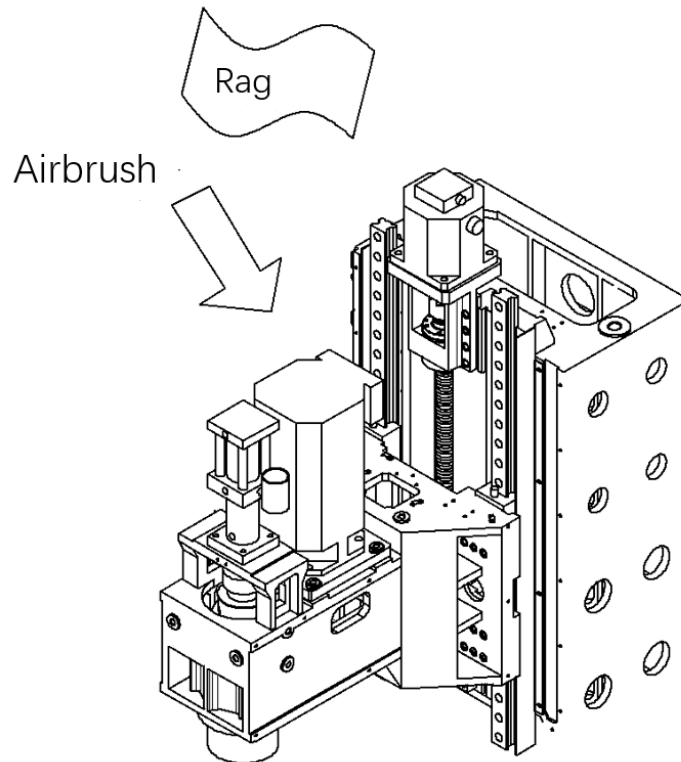


Figure 4.4 Spindle motor

(2) Check noise and vibration

Abnormal noise or vibration indicates the malfunction of the spindle motor bearing. Please check noise and vibration when the spindle is rotating.

4.5 Replace Consumable Parts

4.5.1 Replace Inner Light

As shown in the figure, the inner light is mounted on the upper side of the interior of the safety cell.

▲ Warning
The service life of the light is about 10,000 hours. Replace the light if it stops lighting up or flickers. The dim light will cause injury due to distraction.
▲ Note
When replace the light, keep an eye on the metal plate inside the light.

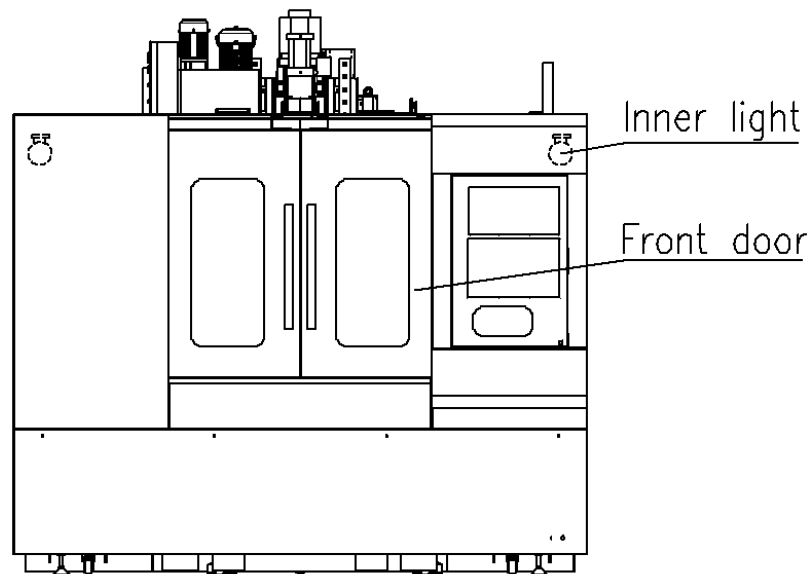


Figure 4.5.1 Light position

4.6 Replace Solenoid Valve

Replace solenoid valve

- 1) Remove the air conduit of air pressure source mounted on the regulator.
- 2) Remove the air conduit connected to the solenoid valve.
- 3) Loosen the screws fixing the terminal box at the top of the solenoid valve, and remove the cables and the terminal box.
- 4) Remove the bolts fixing the solenoid valve, and remove the solenoid valve.
- 5) Remove the joint mounted on the solenoid valve, and install a new solenoid valve. (See Fig. 4.6(a) and Fig. 4.6(b))
- 6) Install the solenoid valve base.
- 7) Connect cables and fix the terminal box with screws.
- 8) Connect the air conduit to the solenoid valve. (See Fig. 4.6(a) and Fig. 4.6(b))
- 9) Install the air conduit of air pressure source to the regulator.

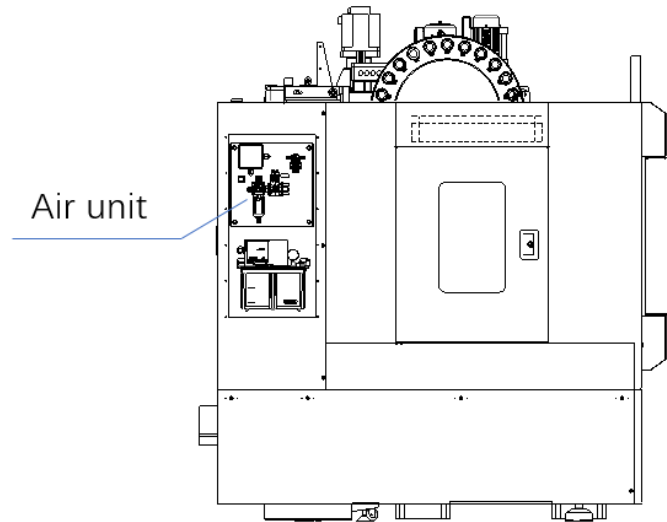


Figure 4.6(a) Air unit installation diagram

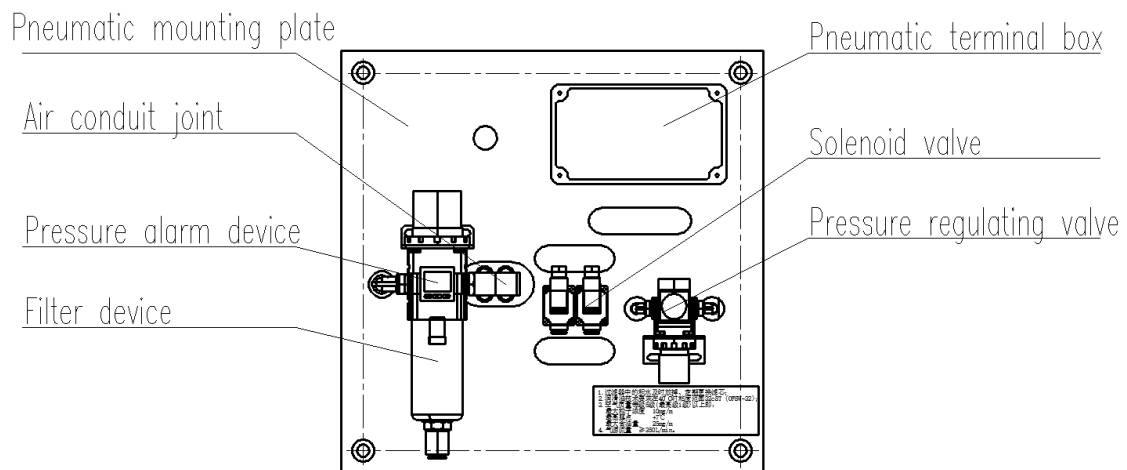


Figure 4.6(b) Air unit

4.7 Replace Cooling Pump and Coolant Conduit

4.7.1 Replace Cooling Pump

- (1) Remove the cable connecting cooling pump.
- (2) Remove the coolant conduit from the connector.

Note

The coolant in the conduit may flow back when removing the water conduit.

- (3) Remove the bolts fixing the cooling pump, and disassemble the pump from the coolant tank.

- (4) Remove the conduit joint from the cooling pump.
- (5) Wrap the sealing tape (NITOFON) around the threaded joint, and install to a new pump.
- (6) Install the pump to the cooling trough, fixing with bolts.
- (7) Install the coolant conduit to the conduit joint, and tighten the coupling.
- (8) Connect the cable to the pump.

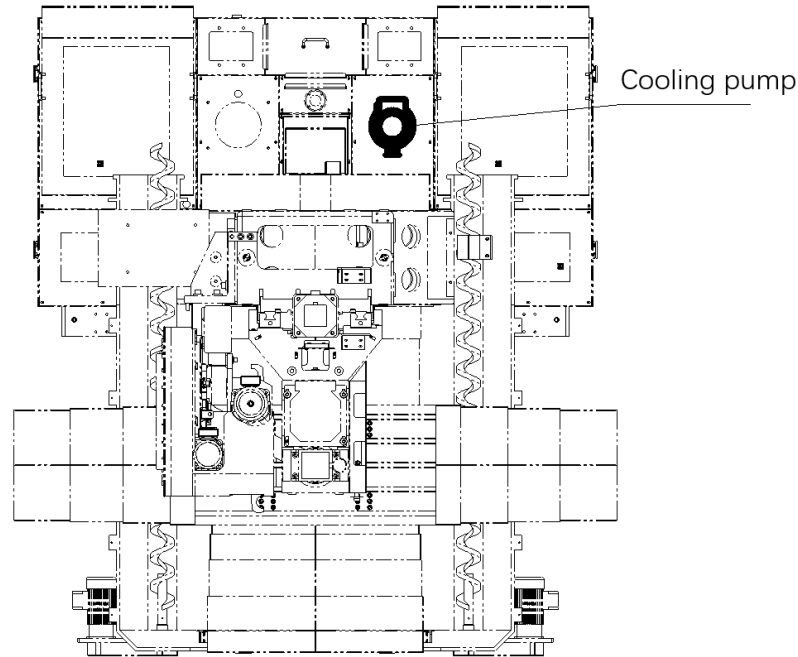


Figure 4.7.1

4.7.2 Change Coolant Conduit

- (1) Replace the coolant conduit in the machine.
 - 1) Remove connectors at the ends of the coolant conduit, and remove the coolant conduit.

Note:

The coolant in the conduit may flow back when removing the coolant conduit.

- 2) Install a new coolant conduit.
- (2) Replace the airbrush.
 - 1) Pull out the pipe from the airbrush joint.
 - 2) Insert the pipe into the new airbrush joint.

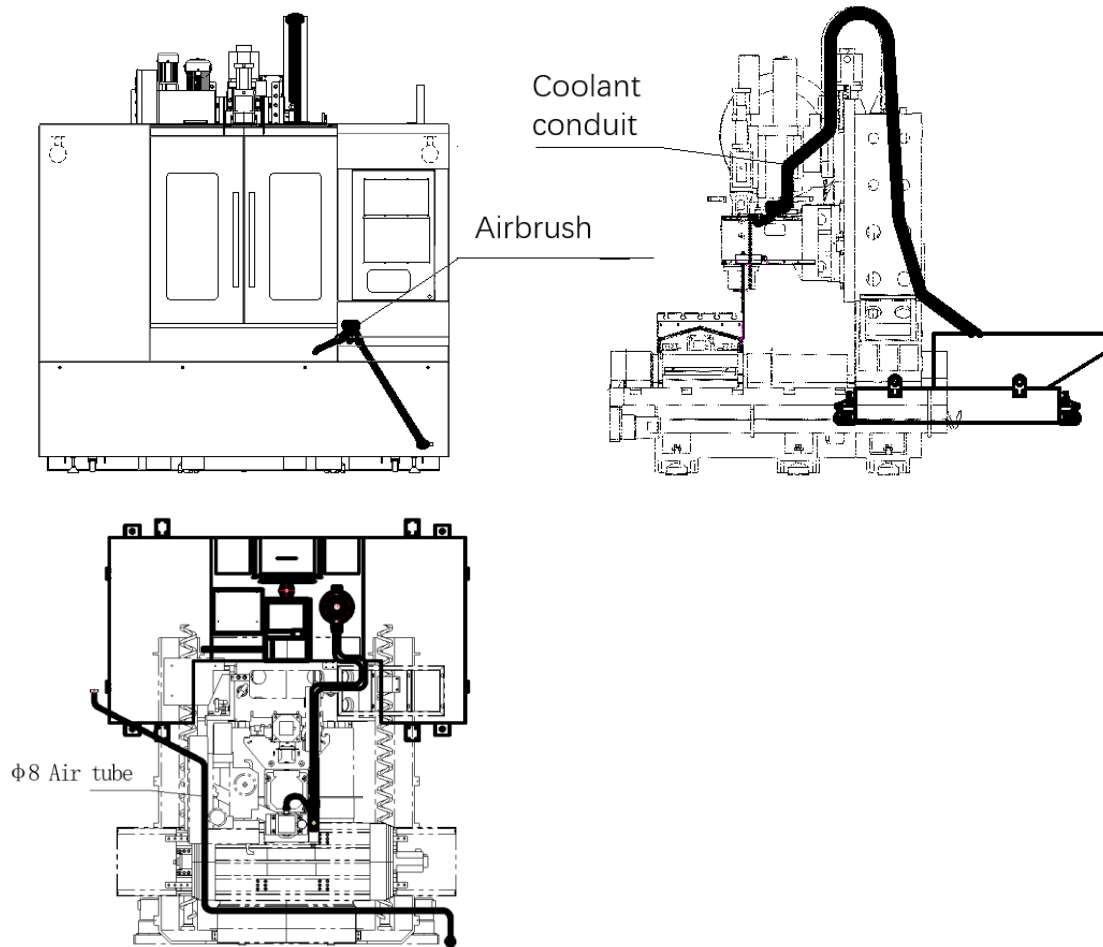


Figure 4.7.2

4.8 Change Oil Pump and Oil Tank (Centralized Lubrication System)

- (1) The oil pump is mounted on the electrical cabinet bracket. Remove the piping and connecting wires from the top of the oil pump.

Note

The oil in the piping may flow back when the pipe is removed.

- (2) Remove the oil pump.
- (3) Replace the oil pump with a new one.

Loosen the screws for fixing the oil tank at the top 4 corners of the oil pump, and replace the oil tank.

- (4) Install the oil pump on the bracket .
- (5) Restore the piping and connecting wires.

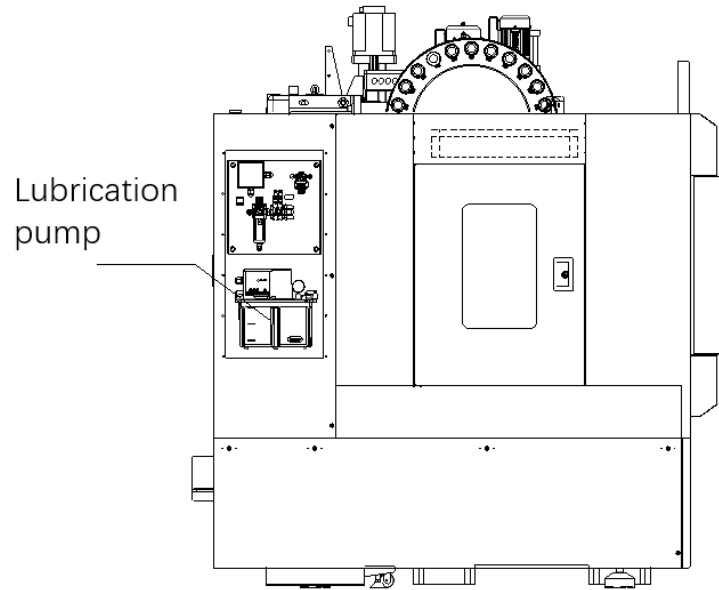


Figure 4.8 Centralized lubrication device

4.9 Change Status Indicator

4.9.1 Change Status Indicator

- (1) Remove the wire duct cover.
- (2) Remove the relay connect on the back of the wire duct cover.
- (3) Remove the screws under the status indicator, and remove the indicator.
- (4) Install the new status indicator, and tighten the screws.
- (5) Put the wire duct cover back.

4.9.2 Change Status Indicator Bulb

- (1) Remove the cover.
- (2) Remove the old bulb.
- (3) Replace a new bulb.
- (4) Put the cover back.

4.10 Change Telescopic Cover

4.10.1 X-axis Telescopic Cover

- (1) Let the working table in the middle of the stroke.
- (2) Remove the screws connecting the front baffle and the telescopic cover.
- (3) Remove the screws connecting the rear baffle and the telescopic cover.

- (4) Remove the screws connecting the working table and the telescopic cover.
- (5) Remove the screws connecting the chip guard and the cover plate.
- (6) Loosen the screws connecting the telescopic cover and the slide.
- (7) Push the telescopic cover to its minimum size.
- (8) Lift the telescopic cover upwards to remove it.
- (9) Install the new telescopic cover in the original position.
- (10) Tighten the screws connecting the working table and the left cover, the screws connecting the front baffle and the left cover, the screws connecting the rear baffle and the left cover, and the screws connecting the left cover and the slide.

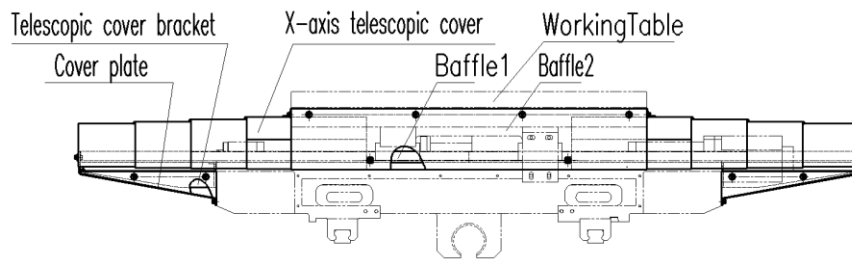


Figure 4.10.1 X-axis telescopic cover

4.10.2 Y-axis Telescopic Cover

- (1) Move the slide to the operator as close as possible.
- (2) Remove the screws connecting the front Y-axis screw guide cover and the slide, and remove the front cover.
- (3) Remove the screws connecting rear Y-axis screw guide cover, the screw guide and the slide, and remove the rear cover.
- (4) Remove the screws connecting the chip guard and the cover plate.
- (5) Install the new telescopic cover in the original position.

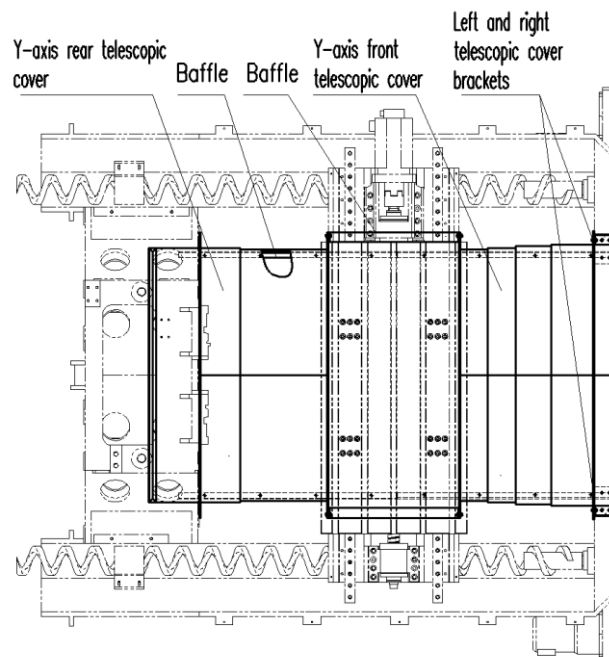


Figure 4.10.2 Y-axis screw guide cover

4.10.3 Z-axis Telescopic Cover

- (1) Remove the screws connecting Z-axis telescopic cover, the spindle box and the column, and push the cover to its minimum size.
- (2) Remove Z-axis telescopic cover.
- (3) Install the new Z-axis telescopic cover in the original position.
- (4) Tighten the screws connecting Z-axis telescopic cover, the spindle box and the column.

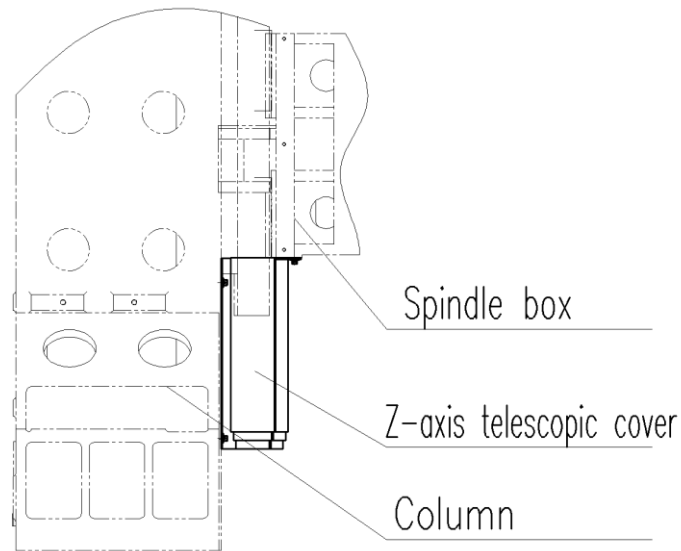


Figure 4.10.3 Z-axis telescopic cover