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# SHARP

## VERTICAL MILL

### GENERAL & ELECTRICS MANUAL



Manual Number : KRDM24C0 Date : NOV,2018 REV : V4.0S

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## **IMPORTANT SAFETY NOTICE WARNING**

The following documentations are provided by us.

- (1) Introduction manual
- (2) Electrical document
- (3) Other document provided by OEM partners

### **WARNING !!!**

**Please read these documentations thoroughly before using the machine. An adequate training by the manufacturer or by OEM is required before starting to use these machines.**

### **WARNING !!!**

**It is the customer's responsibility to ensure the machine is installed in a safe operating position with all service pipes and cables clear of the operation area so as not to cause a hazard. Access must be allowed for safe maintenance, swarf and oil disposal including safe stacking of machine and unmachined components.**

### **WARNING !!!**

**The machine is equipped with safety devices. Do not change any safety devices on the machines. If changes to these safety devices are made, the manufacturer and OEM partner will not be responsible for any ensuing issues of product liability. This action will also invalidate any remaining warranty entitlement."**

### **NOTE !!!**

**The recipient hereof agrees not to copy or distribute this document without the written consent.**

## SPECIFICATION

MODEL		V-1
Working table	Working area	1473 × 305 mm
	No.of T slots	15.9 mm 3 off
Travel	Longitudinal travel-X axis	1016 mm (Standard) mm (with DRO system)
	Cross travel-Y axis	400 mm (Standard) mm (with DRO system) mm (with Roller chip guard ON)
	Knee vertical-Z axis	406 mm (Standard) mm (with DRO system)
	Distance from spindle nose to	50 ~ 457 mm
	Distance from spindle center to	450 mm
Spindle	Taper	ISO 40
	Spindle speed	LOW:60-540rpm HIGH:540-4000rpm (60Hz)
		LOW:60-540rpm HIGH:540-4000rpm (50Hz)
Spindle motor	5 HP	
Quill	Quill travel	127 mm
	Quill dimensions	105 mm
	Quill feeds	.038 .076 .152mm
Head tilt	Overarm swivel	360°
	Front to back	45° - 0 - 45°
	Left to right	90° - 0 - 90°
General specificati	Gross weight	1700 kg

\*\*\*\* To keep improving and developing new functions,the Specifications is subject to change without future notice.

## STANDARD ACCESSORIES

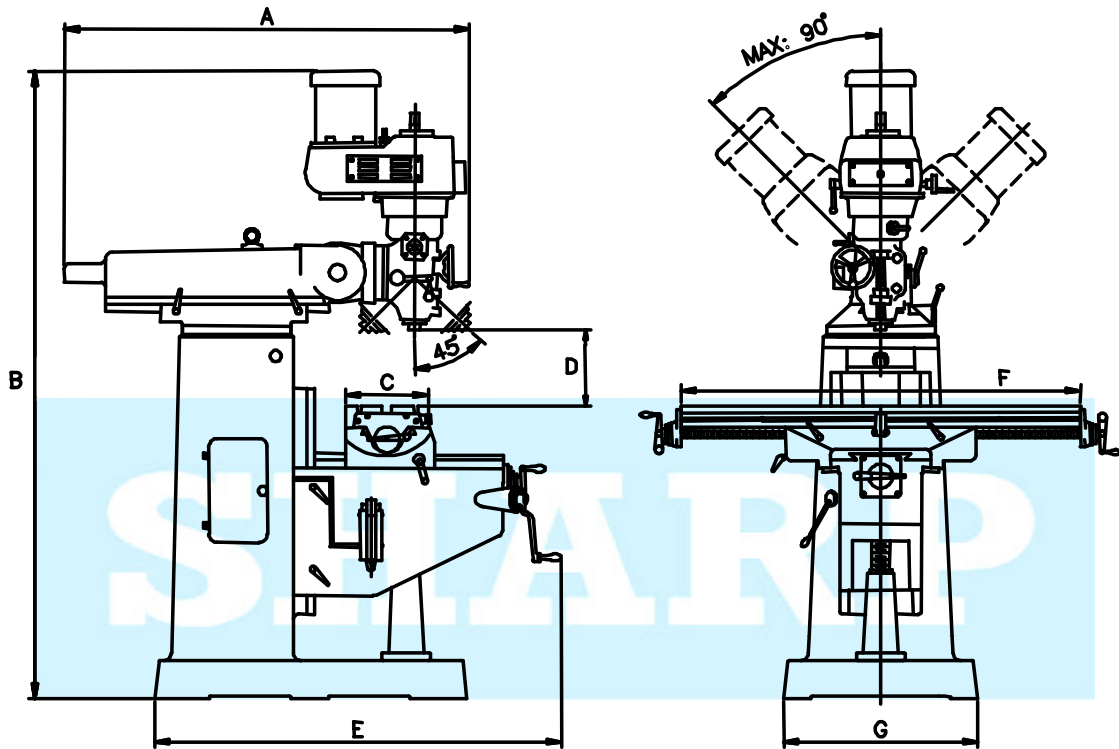
- ⊙ American red turcrite on X and Y axes.
- ⊙ Dovetail slideways on X axis.
- ⊙ Square slideways on Y axes.
- ⊙ Square slideways on Z axis.
- ⊙ Hardened and ground X, Y, Z axes .
- ⊙ Hardened and ground table.
- ⊙ 1.5 HP A.C. Rapid Vertical motor.
- ⊙ Electrics system.
- ⊙ Auto lubrication.
- ⊙ Coolant pump.
- ⊙ Power longitudinal feed ( X axis ).

## OPTIONAL EQUIPMENT

- ⊙ Inverter head.
- ⊙ Air power drawbar.
- ⊙ DRO system.
- ⊙ 60 mm raised column.
- ⊙ X and Y axes ballscrews.
- ⊙ Power cross feed ( Y axis ).
- ⊙ Working light.
- ⊙ Roller type Y axis up-down chip guard.
- ⊙ Iron or Fiberglass coolant tray.

**\*\*\*\* To keep improving and developing new functions, the Specification is subject to change without future notice.**

### DIMENSION (STANDARD)



	A	B	C	D		E	F	G
				MIN	MAX			
V-1	1480	2290	305	50	457	1720	1473	620

UNIT : mm



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# CHAPTER 1



**SHARP**  
**HEALTH AND SAFETY**

PLEASE READ CAREFULLY BEFORE  
OPERATION OF YOUR MACHINE

## 1.1 OPERATOR SAFETY

Safety devices are installed in this machine to protect the operator from injury. However, this machine is fast, powerful machine can be dangerous if used under improper circumstances.

Please read the following health and safety guidance notes and understand how to operate the machine before using the machine.

### **WARNING !!!**

**The machine is equipped with safety devices. Do not change any safety devices on this machine. If changes to these safety devices are made, the manufacturer and our OEM partner will not be responsible for any ensuing issues of product liability. This action will also invalidate any remaining warranty entitlement."**

## 1.2 HEALTH AND SAFETY AT WORK

In accordance with the requirements of the Health and Safety at Work, this manual contains the necessary information to ensure that the machine tool can be operated properly and with safety. It is assumed that the operator has been properly trained, has the requisite skill and is authorized to operate the machine, or, if undergoing training, is under the close supervision of a skilled and authorized person.

Attentions are drawn to the importance of compliance with the various statutory regulations, which may be applicable, such as "The Protection of Eyes Regulations". It is further stressed that good established workshop practice is essential.

Adequate information is also provided to enable the machine to be properly serviced and maintained by persons with the necessary skills and authority.

## 1.3 NOISE LEVEL

The noise level of this machine is within 80dB(A). In real life, the noise level can be higher than 80dB(A) because actual working conditions might be different.

### **WARNING !!!**

**Do not stay in the working area with an unpleasant noise level without wearing appropriate protective equipment, such as the earplug. Otherwise this might cause hearing pain or more serious problems.**

## 1.4 OPERATING HAZARDS

When using the machine be fully aware of the following operating hazards.

### 1.4.1 METAL CUTTING FLUIDS

Cancer of the skin may result from continuous contact with oil ; Particularly with straight cutting oils, but also with soluble oils. The following precautions should be taken :

1. Avoid unnecessary contact with oil.
2. Wear protective clothing.
3. Use protective shields and guards.
4. Do not wear oil soaked or contaminated clothing.
5. After work, thoroughly wash all parts of the body that have come into contact with oils.
6. Avoid mixing different types of oils.
7. Change oils regularly.
8. Dispose of oils correctly.

## 1.5 VARIABLE SPEED DRIVE

Note that these machines are designed to allow fast and easy change of the spindle speed. Take care to ensure that the workpiece is secure and the maximum safe speed for any operation are not exceeded.

## 1.6 POTENTIAL DANGER AREAS

Keep away from those areas having moving or rotating machine parts. Do not touch or reach over moving or rotating objects. They cause a serious accident if not used properly. Fully understand all the safety procedures before starting to use the machine. Beware of potential dangerous area and warning and dangerous awareness to avoid any injury and accident.



## 1.7 OPERATING SAFETY PRECAUTIONS

1. Never use the machine without adequate lighting or if the machine light is broken.
2. The floor could become slippery because of the spilt water or oil and cause accident. Ensure the floor is clean, dry and orderly.
3. Keep the machine and work area clean and orderly.
4. Always provide an ample working space.
5. Keep all guards and cover plates in place and all machine cabinet doors closed.
6. Never lay anything on the working surfaces of the machine, where it may be fouled with rotating or moving parts.
7. Do not touch or reach over moving or rotating machine parts.
8. Do not touch any switch without care.
9. Ensure you know the function of the switch and how to use it before using it.
10. Do not operate the machine in excess of its rated capacity.
11. Stop the machine immediately if anything unexpected happens.
12. Ensure that you know how to stop the machine before starting it.
13. Eye protection must be worn by the operator and all exposed persons operating these machines.
14. Beware to reset the coordinates after you take over the machine unless it is not necessary due to common coordinates when several people share the machine operation.
15. Isolate machine when leaving it unattended.



## 1.8 GENERAL PRINCIPLES CONCERNING OPERATOR SAFETY FOR THE MACHINE

1. Do not wear rings, watches, ties or loose sleeved clothing.
2. Always use the recommended or equivalent hydraulic oil, lubricant oil and grease.
3. The working table adjacent to the machine should be secured to prevent the workpiece room falling onto the machine.
4. Ensure the machine is stopped and the power is off before replacing the fuse.
5. Always use the fuse with the same specification for replacement.
6. Do not use other workholding devices without checking for compatibility with these mill.
7. Do not touch the switch with wet hands that could result in electric shock.
8. Do not touch the electric equipment and operating panel with wet hands, this could result in electric shock.
9. Do not grip a component with grease or oil on it.
  - (a) Grip all components firmly.
  - (b) Do not attempt to hold components that are too awkward or too difficult to hold.
  - (c) Do not hold components that are too heavy for the machine.
  - (d) Know how to hold components properly when lifting.
10. Be sure to clean oil or grease from hand tools, levers and handles.
11. Be sure there is enough texture on the surface of the hand tool or lever handle for proper safe hand contact.
12. Grip hand tools and lever handles firmly.
  - (a) Always choose the proper hand tool and appropriate grip position on the lever handle.
  - (b) Do not use hand tools or lever handles in an awkward position.
  - (c) Do not apply excessive force.
13. Always use the recommended gripping position to grasp hand tools and lever handles.
14. Do not use broken, chipped or defective tools.
15. Be sure that the workpiece is immobile in vice or other holding device.

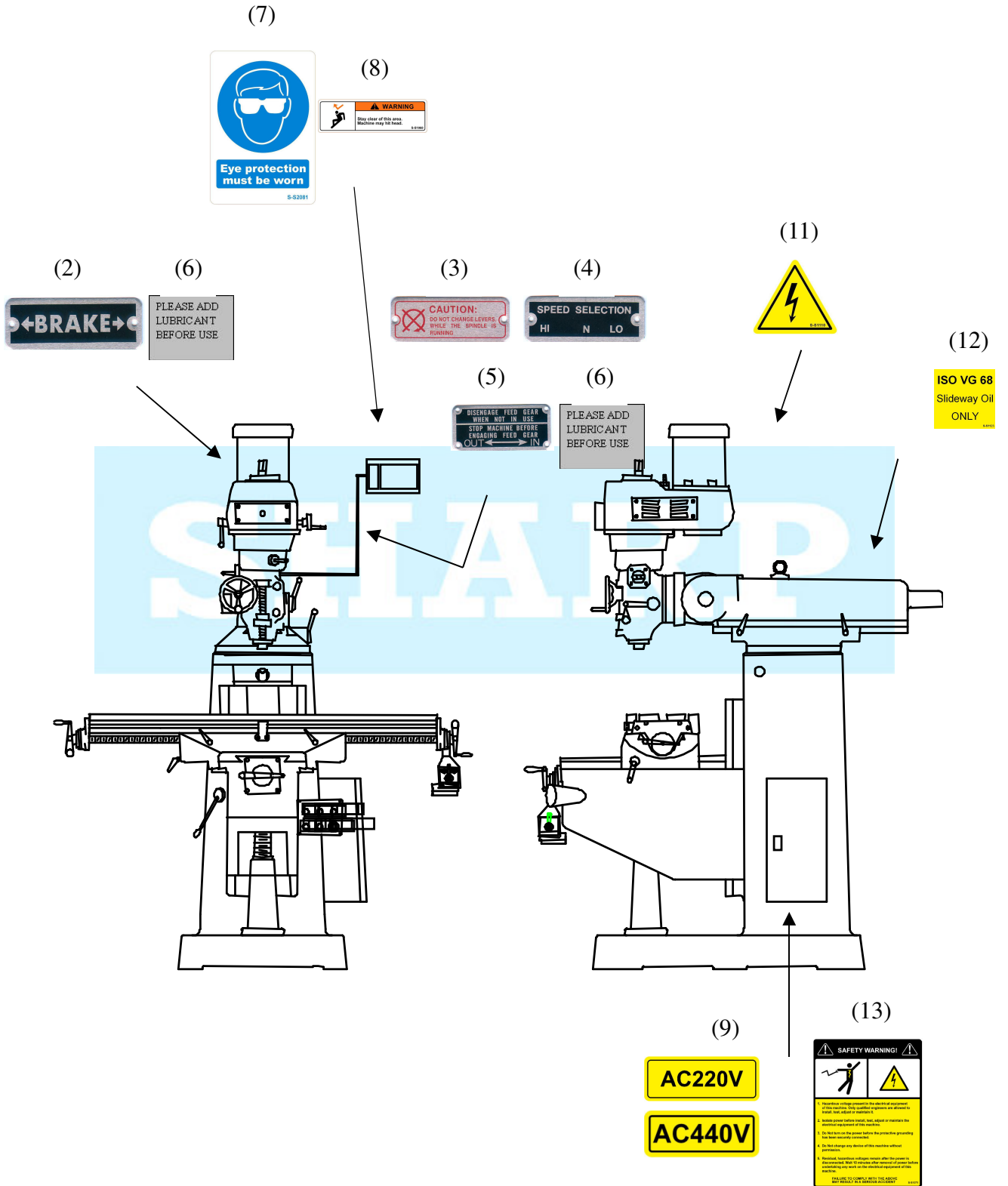
16. Beware of irregular shaped workpieces.
17. Beware of large burrs on workpieces.
18. Always select the correct tool for the job.
19. Do not run the machine unattended.
20. Do not use tools without handles.
21. Always support the workpiece as necessary-using vice.
22. Do not rush work.
23. Never substitute for the wrong size tools if the correct sized tool is not available or cannot be located in the shop.
24. Do not move guards while the machine is under power.
25. Do not place hand or body in path of moving objects.
  - (a) Beware of moving machine parts that can fall.
  - (b) Be aware of where you are moving your hand or body in relationship to the machine.
  - (c) Be aware of hands or other parts of the body that may be in position to be hit by a spindle or workpiece.
26. Know the function of each and every control.
27. Never place hand on spindle or workpiece.
28. Make sure power has been turned off when the machine is unused for some time.
29. Never start spindle with tool key in the tool.
30. Do not allow distractions to interfere with machine operations.
31. Do not operate machine while talking.
32. Beware of machine dangers when attending to other aspects of machine operation.
33. Beware of loose clothing near the rotating parts of the machine.
34. Beware of loose hair near the rotating parts of the machine.

35. Beware of performing another operation while in close proximity to the rotating parts of the machine.
36. Be sure spindle is not running when using gauges on the machine.
37. Always wear protection before operating the machine.
  - (a) Never remove protection for even a short time when operating the machine.
  - (b) Wear protective devices correctly.
  - (c) Know the correct way to wear protective devices.
38. Beware of material and tool flying from the machine.
39. Beware of where you leave tools during set up.
40. Keep protective guards at the point of operation.
  - (a) Know how to set or attach protective guards properly.
  - (b) Never use the wrong protective guard.
  - (c) Know how to select the proper guards.
41. When the spindle and workpiece are in motion, never reach over under or around a workpiece to make an adjustment.
42. Never reach over, under or around a workpiece to retrieve anything.
43. Never reach over, under or around the workpiece to tighten a machine part.
44. Never reach over, under or around a workpiece to move hand tool to another position.
45. Never reach over, under or around a workpiece to remove swarf.
46. Know the proper procedure for applying loads. Never apply force from an awkward position.
47. Never mount a workpiece too large for the machine.
48. Never mount a workpiece too large for the operator to handle.
49. Use the equipment necessary for handling workpieces.
50. Never apply undue force on the accessory.
51. Secure all workpieces.
52. Secure all jaws, nuts, bolts and blocks.

53. Always use the correct equipment.
54. Never take cuts beyond the machine's capability.
55. Never use excessive forces in polishing, filing.
57. Always use the proper hand tool to remove swarf.
  - (a) Never hurry to remove swarf.
  - (b) Beware of swarf wrapped around the spindle or workpiece.
58. Beware of tools or machine parts falling on controls.
59. Do not change the original setting parameters unless it is necessary. Always keep records of the original setting values before change.
59. Do not blur, block or take away any however according to set-back afterward plate and sign for warning、notice、danger. Please contact us or our local dealer or distributor to purchase a new plates or signs.
60. Disconnect the circuit breaker of the main power immediately if the power supply is short or unsteady.

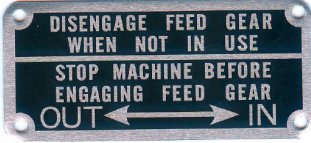
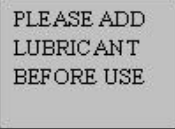

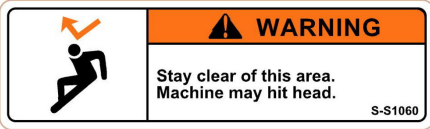

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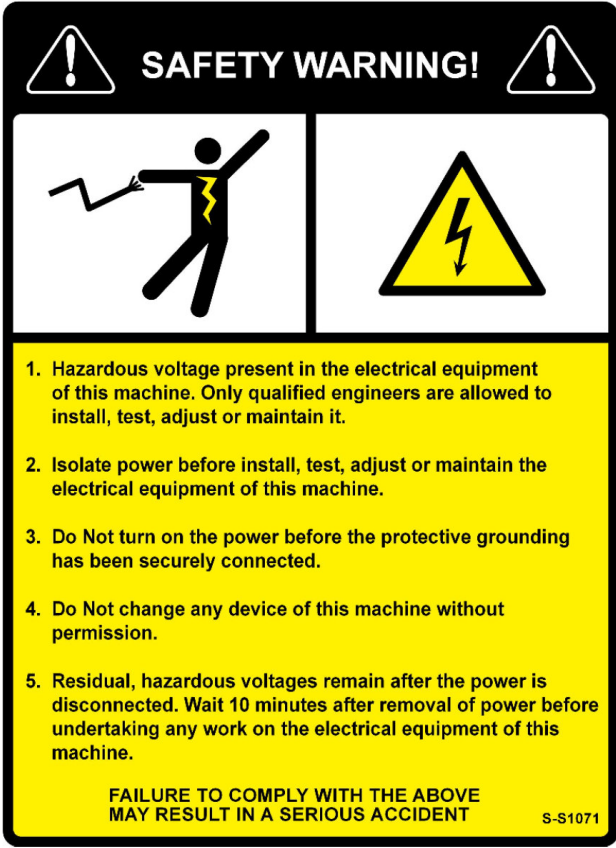
# 1.9 SIGNS



### 1.9.1 MACHINE SIGNS

(1)-1	
(1)-2	
(1)-3	
<p>(2)</p> <p>Spindle air brake</p>	
<p>(3) S-A1230</p> <p>Speed selection change caution</p>	
<p>(4) S-A1210</p> <p>Speed selection</p>	

<p>(5) Engage power feed warning</p>	 <p>A rectangular sign with a black background and white text. The top line reads 'DISENGAGE FEED GEAR WHEN NOT IN USE'. The bottom line reads 'STOP MACHINE BEFORE ENGAGING FEED GEAR'. In the center, there are two arrows pointing left and right, with the word 'OUT' to the left and 'IN' to the right.</p>
<p>(6) Lubrication added</p>	 <p>A rectangular sign with a grey background and black text. The text reads 'PLEASE ADD LUBRICANT BEFORE USE'.</p>
<p>(7) S-S2081 EYE Protection Warning</p>	 <p>A circular sign with a blue background and white text. The top part features a white silhouette of a person wearing safety glasses. Below the silhouette, the text reads 'Eye protection must be worn'. At the bottom right, there is a small code 'S-S2081'.</p>
<p>(8) S-S1060 Hit head warning</p>	 <p>A rectangular sign with a white background. On the left, there is a black silhouette of a person falling, with a red arrow pointing to their head. To the right, there is an orange triangle with a black exclamation mark, followed by the word 'WARNING' in black. Below this, the text reads 'Stay clear of this area. Machine may hit head.' At the bottom right, there is a small code 'S-S1060'.</p>
<p>(9) -1 S-S1101 AC220V Yellow Sticker (9) -4 S-S1105 AC440V Yellow Sticker</p>	 <p>Two yellow rectangular stickers with black borders and black text. The left sticker reads 'AC220V' and the right sticker reads 'AC440V'.</p>
<p>(10)</p>	

<p>(11) S-S1110</p> <p>Lightning Mark-S</p>	
<p>(12) S-S1123</p> <p>ISO 68</p>	
<p>(13) S-S1071</p> <p>Safety Warning</p>	 <p><b>SAFETY WARNING!</b></p> <ol style="list-style-type: none"> <li>1. Hazardous voltage present in the electrical equipment of this machine. Only qualified engineers are allowed to install, test, adjust or maintain it.</li> <li>2. Isolate power before install, test, adjust or maintain the electrical equipment of this machine.</li> <li>3. Do Not turn on the power before the protective grounding has been securely connected.</li> <li>4. Do Not change any device of this machine without permission.</li> <li>5. Residual, hazardous voltages remain after the power is disconnected. Wait 10 minutes after removal of power before undertaking any work on the electrical equipment of this machine.</li> </ol> <p>FAILURE TO COMPLY WITH THE ABOVE MAY RESULT IN A SERIOUS ACCIDENT</p>

**NOTE!!!**

On the MILL machine there are shipping brackets the hold the machine head, ATC and axes in place during shipping. These brackets must be removed before operating the machine. Do not discard the shipping brackets. The shipping brackets must be replaced if the machine is ever moved.



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# CHAPTER 2

## **SHARP** **SHIPPING AND HANDLING**

PLEASE READ CAREFULLY BEFORE SHIPPING

AND HANDLING OF THIS MACHINE

## 2.1 SHIPPING AND HANDLING

This mill is composed of bed base, variable speed head or, saddle working table, operation panel, hydraulic system, lubrication system and electrical cabinet.

The shipping and handling equipment used should be able to lift a gross weight of 4 tons at least. Due to sizes of the machine, it is recommended to lift this machine with crane and use only the sling frame provided by our local agent or us. Nevertheless, read the following section carefully before handling the package.

### 2.1.1 DANGERS

Ensure the shipping and handling equipment can handle a gross weight of 4 tons at least. If can't make certain of the load capacity of the handling equipment, please contact with the manufacture which provide the handling equipment, be ensure the load capacity. **Don't try to do handling under unknown the load capacity of the handling equipment otherwise might happen accident that damaged handling equipment and machine, even person injury.**

Use only the sling frame provided by us to lift this machine. Uses of any other sling frame are prohibited because might happen accident that damaged handling equipment and machine even person injury. Ensure the wire ropes can withstand at least a gross weight of 4 tons if they are used with the lifting equipment to lift the machinery package.

### 2.1.2 WARNINGS

1. Ensure the lifted machinery package is balanced before starting to move it.
2. Abrupt changes in lifting & lowering speed might cause unexpected damage on the machinery package and are therefore prohibited.
3. No people or vehicle is allowed to stay under the lifted package.
4. Make sure nobody is around the working area before starting to lift the package. Clinging onto the sling frame or wire ropes by any person is very dangerous and is definitely prohibited.

### 2.1.3 NOTICES

1. Check if there is any people or blockage around the working area before starting to lift the package. Blockage should be removed and people be told to leave before proceed.
2. Do not stop the lifting motions suddenly during the process. Prevent sudden movement of the machine, too quick and the machine could become unbalanced. This might result in a serious accident that causes the machine to drop.
3. Only qualified people are allowed to operate the lifting equipment to handle this machinery package so that prevent accident happen.

**NOTE!!!**

**The packing is subject to change without prior notice.**

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## **2.2 LIFTING WITH THE MACHINE PACKED**

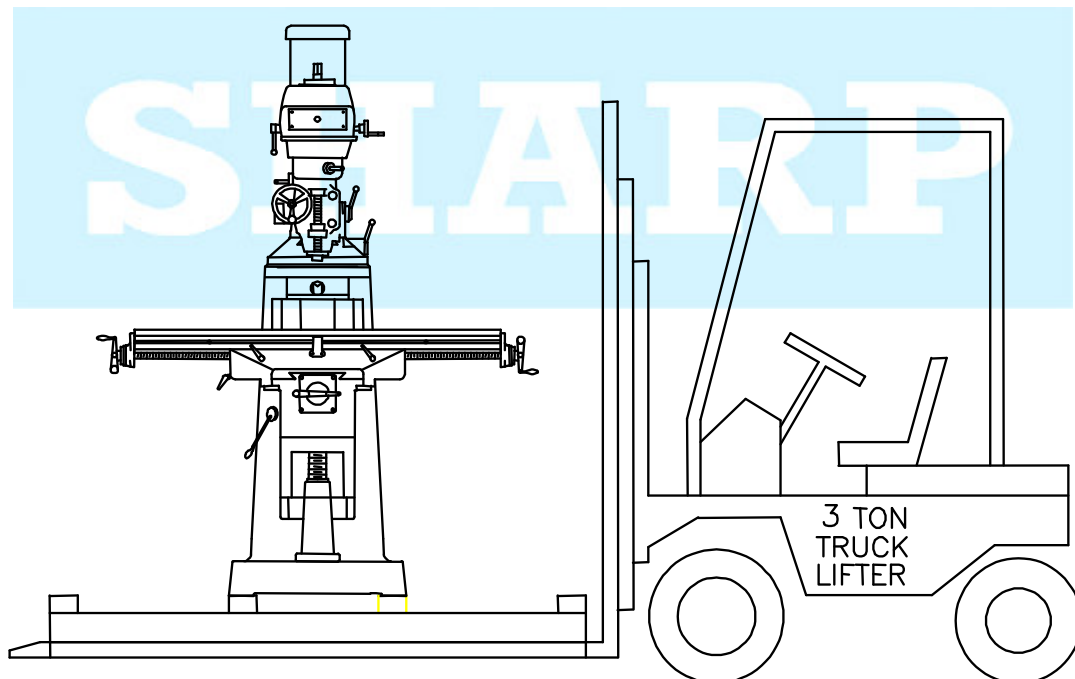
### **2.2.1 SAFETY RULES FOR MACHINE LIFTING**

The following safety rules must be absolutely followed when lifting and/or moving the machine :

1. Ensure all the parts of the machine are fully secured before lifting or moving it.
2. Use a forklift of sufficient capacity to raise or move the packed or machine.
3. Pay special attention to machine balance while lifting.
4. Have another person to help guide the way while lifting the machine.
5. Make sure the forks of the forklift protrude past the far edge of the machine bottom.
6. Do not raise the machine too high as this may cause a loss of stability.
7. The forklift should be driven by experience personnel.

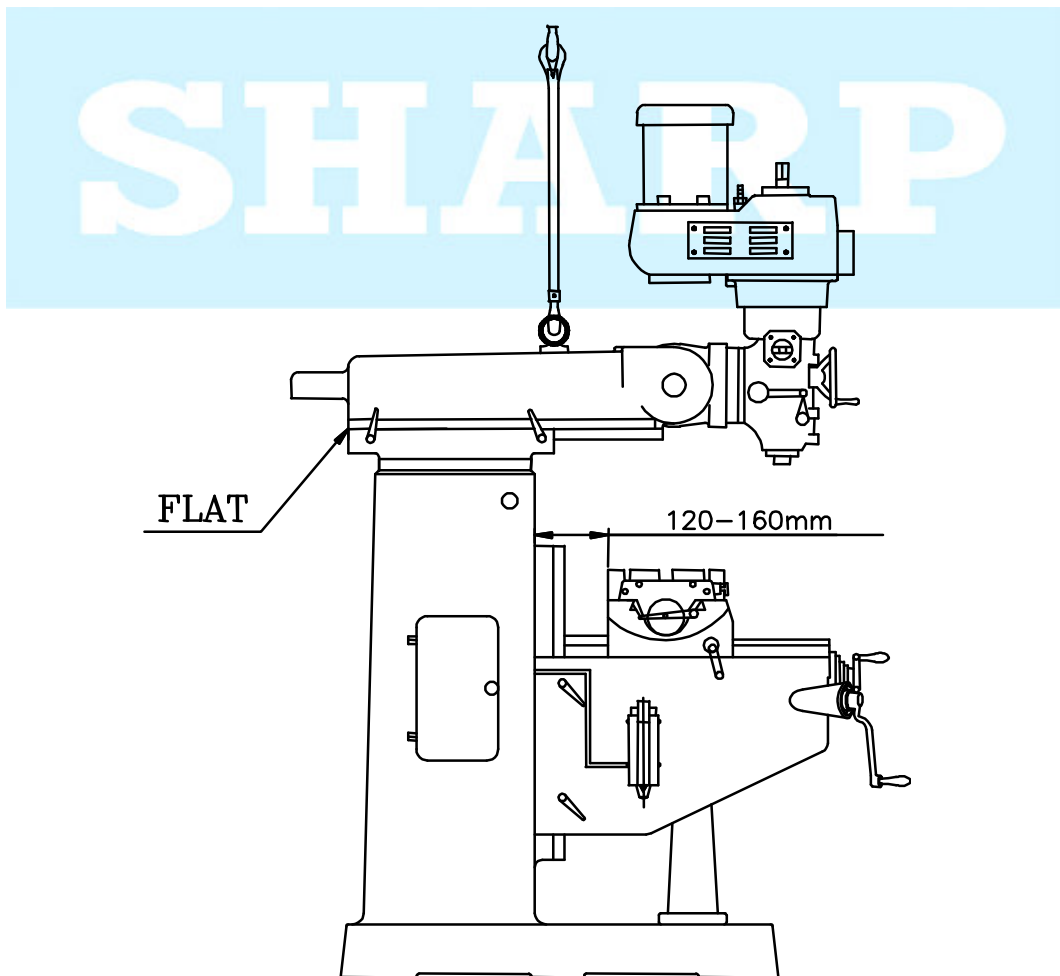
## 2.2.2 USING FORK-LIFTING TRUCK

1. For V-1 machine, the loading capacity of the lifting equipment should be 4 tons at least.
2. For V-1 machine, if 2 machine package in one pallet, the loading capacity of the lifting equipment should be 7 tons at least.
3. Beware that the lifting truck might overturn because of an improper lifting height. This might cause people injury and damage the machine.
4. Always assign a person to guide the way to ensure safety.



### 2.2.3 SING CRANE OR OTHER LIFTING EQUIPMENT

1. Wire cables and chains of the lifting equipment should be able to bear a load of 4 tons at least. The loading capacity below 4 tons is prohibited.
2. Use only the sling frame provided to lift the machine. Other fixture or rope is prohibited.
3. Pay special attention to machine balance while lifting. Please adjust the machine like the figure.
4. Beware that the machine might overturn because of an improper lifting height. This might cause people injury and damage the machine.
5. Always assign a person to guide the way to ensure safety.



## 2.3 FIX MACHINE DURING TRANSPORTATION

Ensure to fasten all the loosen parts firmly inside the crate before transportation.

## 2.4 REMOVE FIXTURE

Ensure to remove all the fixtures listed below before operating the machine :

1. Remove the wooden block under the headstock.
2. Remove the fixture which fix the working table.
3. Remove all fixtures on the machine.

## 2.5 STORAGE

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### 2.5.1 STORAGE WITH THE MACHINE PACKED

1. Ensure to fasten all the loose parts and have an anti-rust treatment of the machine.
2. Ensure to fix the machine firmly inside the crate to prevent the machine move from falling.
3. Ensure to enclose the machine with a waterproof cover to keep this machine from moisture or corrosive substance. It prevents the mechanical and electrical parts from damage.
4. Ensure to put an anti-moisture substance inside the crate.
5. Do not place the whole packing directly under the sunlight or near any other heat source.
6. Keep away from any corrosive substance or any equipment causing abnormal vibration.
7. The ambient temperature and moisture should be moderate and kept as constant and smooth as possible.



## 2.5.2 STORAGE OF THE BARE MACHINE

1. Ensure to fasten all the loose parts and have an anti-rust treatment of the machine.
2. Ensure to fasten all the sliding guards and doors to prevent from moving even falling.
3. Ensure to enclose the machine with a waterproof cover to keep this machine from moisture or corrosive substance. Otherwise might cause the mechanical and electrical parts damage.
4. Ensure to put anti-moisture substance inside the electric cabinet, operating panel, and any other enclosure of this machine.
5. Do not place the machine directly under the sunlight or any other heat source. Keep away from any corrosive substance or any equipment causing abnormal vibration. The ambient temperature and moisture should be moderate and kept as constant and smooth as possible. Otherwise might cause the mechanical and electrical and electrical parts damage.
6. Ensure all the power supplies are off and the main power supply cables are taken off before put the pack in store.

# CHAPTER 3

The SHARP logo is displayed in a light blue rectangular box. The word "SHARP" is written in large, white, bold, sans-serif capital letters. Below the word "SHARP", the word "INSTALLATION" is written in smaller, black, bold, sans-serif capital letters.

## INSTALLATION

PLEASE READ CAREFULLY BEFORE  
INSTALLATION THIS MACHINE

## 3.1 PREPARATION

Ensure the site space and the path width is large enough to install and transport the whole machine at least 30 working days before the arrival of this machine. If short of space, please inform local agent or us as soon as possible, we will provide a suggestion and information service for you. Please clear the space in advance for the machine to move in and install.

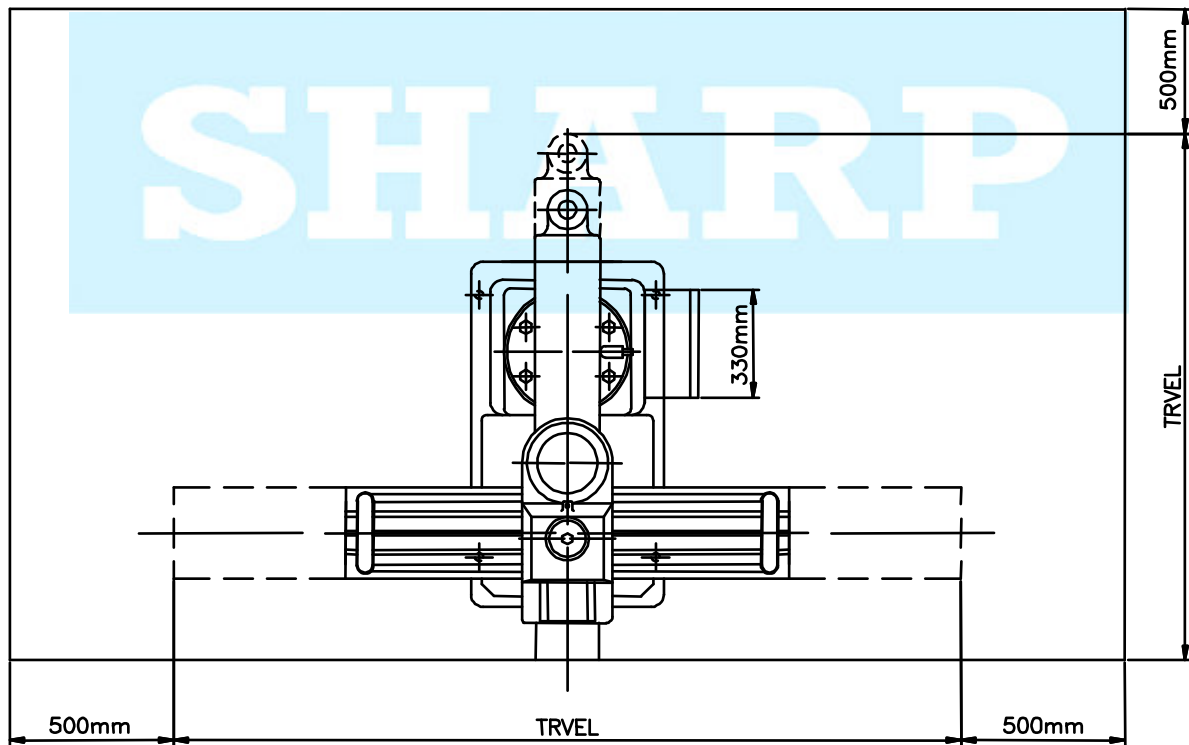
**WARNING !!!**

**Ensure to reserve space for optional equipment. Please contact local agent or us if you have any problem in installing this machine.**

The SHARP logo is displayed in a large, bold, white font, centered within a light blue rectangular background.

### 3.1.1 SPACE REQUIREMENT

A distance of at least 500 mm is required from machine to wall end objects or between machines to ensure easy repair, cleaning and maintenance of machine. Recommended site space for the machine with standard equipment:



## 3.2 INSTALLATION LOCATION

To upgrade the operation efficiency and accuracy of this machine, a proper foundation is required.

It is recommended that this machine should be located in a plant with ambient temperature of around 20 °C, and without the influence of dampness, chemical gas or trembling.

1. Do not install the machine in a location near vibration sources, such as air compressor, punch press, etc. Otherwise poor machining accuracy may result.
2. Do not expose this machine and its NC controller to direct sunlight, moisture, etc.
3. Keep this machine away from flying powder, corrosion substances, etc.

### 3.2.1 ENVIRONMENTAL REQUIREMENT

This machine should be installed under the right environments as following :

1. Supply voltage : 90% to 110% of the rated voltage.
2. Source frequency : Rated frequency  $\pm 1$  Hz.
3. Ambient temperature : 5°C to 40°C.
4. Altitude: shall be at altitudes up to 1000m above mean sea level.
5. Relative humidity – less than 90%, and not exceed 50% at 40°C.  
The moisture condense to water drop due to emperature alternation is unacceptable.
6. Atmosphere: Free from excessive dust, acid fume, corrosive gases and salt.
7. Do not expose the machine directly under sunlight or heat source, which might result in considerable environmental temperature changes.
8. Do not place the machine near any abnormal vibrations.
9. Do not place this machine near the magnetic and static electric fields.
10. Do not place this machine near the air compressor and presser.

11. Do not place this machine near any equipment causing electronic noise.
12. Electrical equipment shall withstand the effects of transportation and storage temperature within a range of  $-25^{\circ}\text{C}$  to  $55^{\circ}\text{C}$  and for short periods not exceeding 24 hours at up to  $+70^{\circ}\text{C}$ .

### 3.3 FOUNDATION CONSTRUCTION PLAN

This machine should be placed upon a solid foundation to maintain the machine accuracy for a long run. Dig the planning site to about 100cm underground. Pave the bottom with a layer of pebble that is 20 cm thick, then fill the site with concrete. The foundation surface should be level and flat. Ensure to reserve spaces for the foundation-fixing studs. Please refer to the section of foundation construction plan for details.

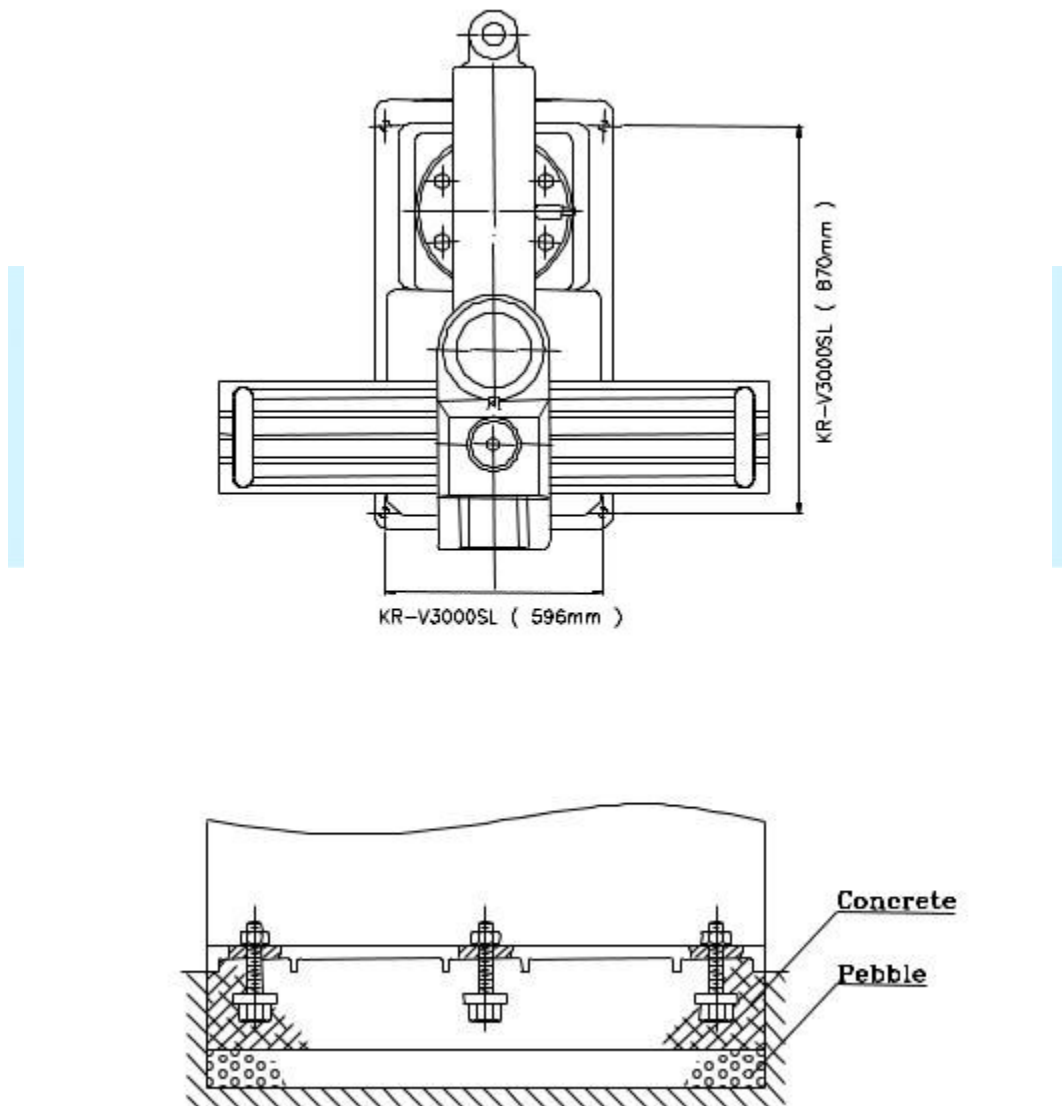
#### 3.3.1 FOUNDATION CONSTRUCTION PLAN ONE

1. Ensure the foundation construction work is finished at least 12 days prior to the arrival of the machine. Refer to the following foundation construction diagrams for details. The construction procedures are listed as follows : Dig the foundation site. Pave the site bottom with a layer of pebble stone.
2. Ensure to reserve 6 spaces for installing the L shape fixing studs and foundation pads before filling up the foundation site with concrete. Ensure those 6 surfaces are level and flat.
3. After the concrete is dry and solid, place temporary foundation pads on those 6 reserved spaces, then place the machine above the foundation pads. Ensure to leave a space of 50mm between the machine base bed and ground to install the L shape fixing stud.
4. Place foundation pads on those reserved spaces, insert the L shape fixing stud through the foundation pad and foundation bolt, then fasten the fixing stud with the nut, as shown in the following figures.
5. Adjust the L shape fixing studs based on dimensions shown in the following figures. ( see 3.3.3 ) Fill up those reserved spaces with concrete. Level the machine after the concrete is dry and solid.

### 3.3.2 FOUNDATION CONSTRUCTION PLAN TWO

Ensure the ground is rigid enough to place the machine. Place the leveling blocks on the ground, then place the machine upon the leveling blocks. Level the machine accordingly. ( see 3.3.3 )

### 3.3.3 FOUNDATION CONSTRUCTION



#### **WARNING!!!**

After Leveling the machine base, you need to lock 8 reserved spaces as well.

## 3.4 ELECTRICAL REQUIREMENT

This machine should be installed under the right electrical environments.

### **WARNING!!!**

**Before connecting the power wires, make sure the voltage is the same for both the machine and the plant power.**

### 3.4.1 POWER SUPPLY

1. Ensure all the associated connections and wiring are appropriate, that is, connections and wiring should conform with the local safety rules at least.
2. Ensure to install a adequate current-fault breaker ( see 3.4.5 ) prior to the power supply switch or transformer of this machine.
3. Thread the power supply cable through the cable inlet positioned at the lower right side of the machine, rest the cable upon the electric cabinet frame, then connect the cable to the main power supply switch of this machine.



### 3.4.2 POWER WIRING

Follow the instructions below to wire power :

1. Ensure the electrical cables have the same or better power rating as prescribed in the electrical document.
2. Only qualified engineers are allowed to connect the power cable of this machine.
3. Do not connect any power cable that might generate signal noises on the power panel of this machine.
4. Do not connect the power cable of this machine to any power source or power panel that might cause an abrupt voltage drop.
5. Remove all the anti-moisture substances placed inside the cabinets or panels.
6. Ensure to turn off all the power supplies and place “Under Installation High Voltage Equipment. Do not turn on the Power” warning signs in front of the main power supply switch before connecting the power supply.

#### **WARNING !!!**

**Only qualified engineers are allowed to install or maintain the electrical equipment of this machine. Failure to do so will result in a serious accident.**

### 3.4.3 GROUNDING

Connect the connector marked with “PE” inside the electric cabinet to the external grounding conductor. If it is no “PE” wiring on the external power supply system, please prepare one ground wire and set a grounding copper rod under the ground, then connect the “PE” connector on the electric cabinet and the ground rod with the ground wire.

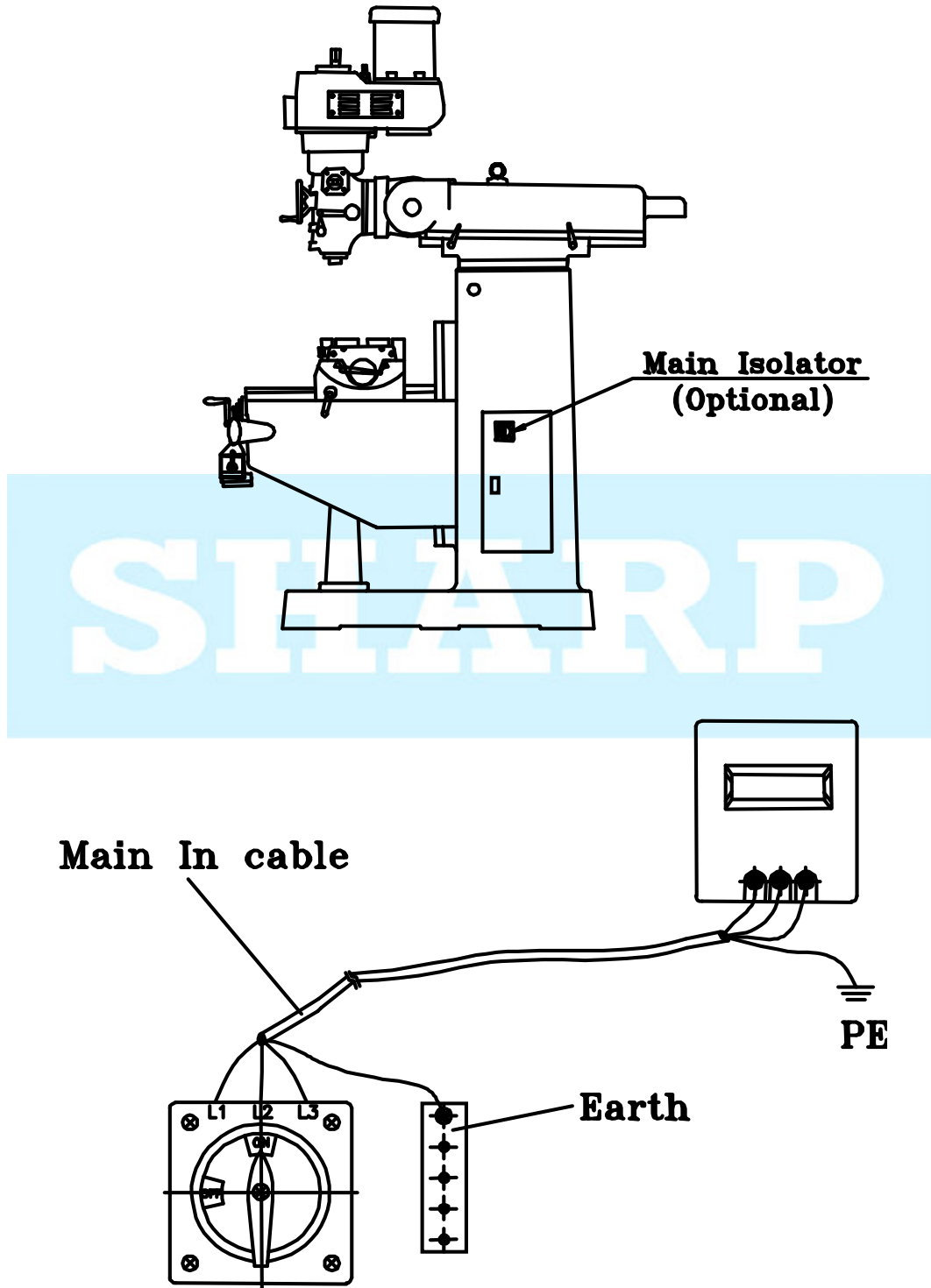
The minimum cross section area of the grounding wire lead used is 14 mm<sup>2</sup>. The impedance of the grounding wire should be less than 100 ohms(Class 3 grounding). Dimensions of this wire should be larger than A W G No.5 and S W G No.6 . (Ensure this NC machine is grounded to a individual grounding rod.) If this kind of arrangement is not possible, please grounded this machine based on the following instructions :

1. The grounding wire of this machine should be connected to its own grounding terminal individually. This kind of arrangement could prevent external grounding current overflow into this machine. This overflow current might result in a serious damage on this machine and is prohibited.
2. The reinforced concrete steel rod is usually used as a grounding terminal because of its low resistance to ground (less than 100 ohms). In doing so, please make connections according to the following instructions. These instructions are also valid when connecting ground wires to other types of grounding terminal. ( see 3.4.4 )
3. Do not share the grounding terminal of this machine with other equipment, such as welding equipment and high frequency induction machines.
4. Ensure the power rating of the grounding terminal is compatible to the power rating of this machine.
5. Always use an isolated grounding wire with a minimum length.
6. Be sure to measure the impedance to ground of the grounding device if only one equipment is connected, and the resistance should be less than 100 ohms.

#### **WARNING !!!**

**Don't turn on the power before the protective grounding has been well connected. Otherwise this might result in a serious accident.**

### 3.4.4 ELECTRICAL CONNECTION



### 3.4.5 SPECIFICATION OF ELECTRICAL REQUIREMENT

#### 220V

No.	Machine	Rated Capacity	Wire	Current-fault breaker
1	V-1	33 A	$\geq 8.0 \text{ mm}^2$	40 A
2				
3				
4				

#### 440V

No.	Machine	Rated Capacity	Wire	Current-fault breaker
1	V-1	19 A	$\geq 5.5 \text{ mm}^2$	20 A
2				
3				
4				

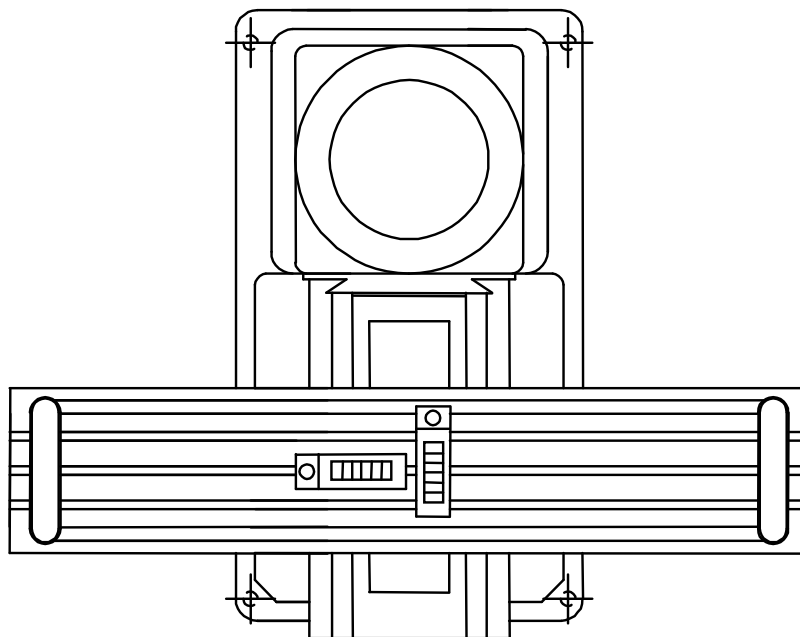
#### **WARNING !!!**

Ensure the electrical cables have the same or better power rating as prescribed in the electrical document.

## 3.5 LEVELING THE MACHINE

### 3.5.1 ADJUST THE MACHINE

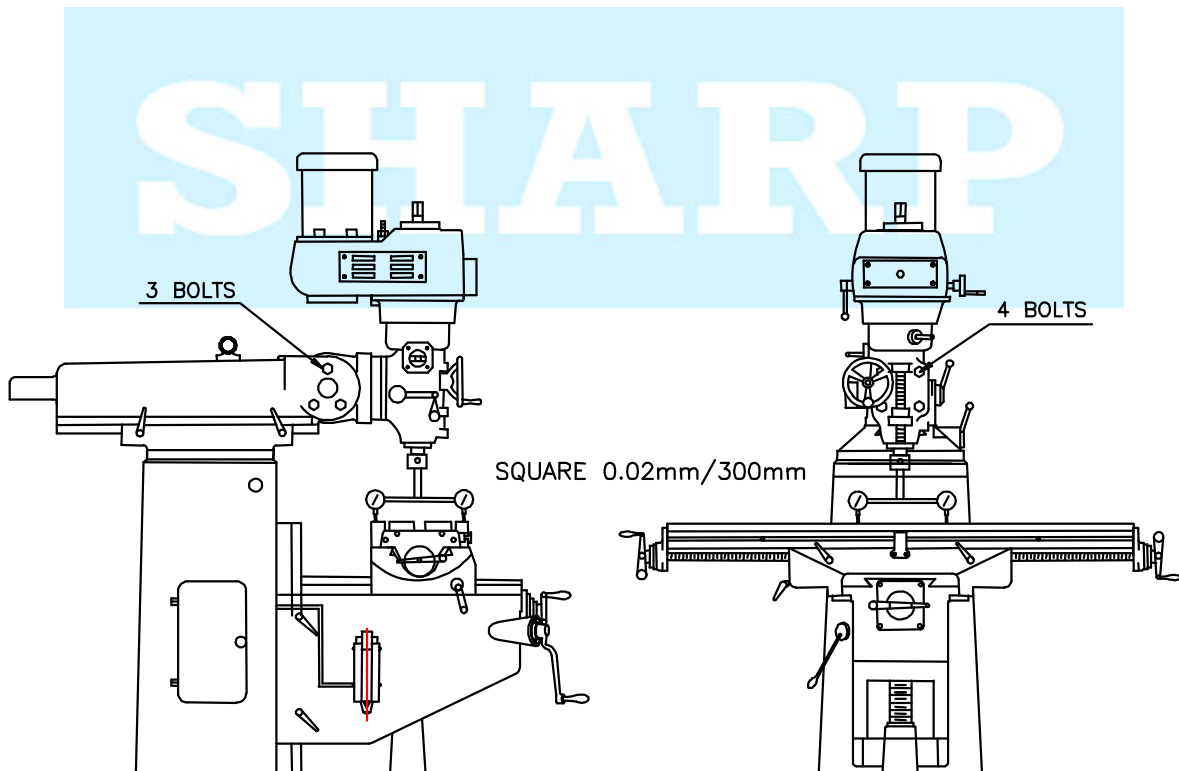
1. Place the temporary foundation pads or leveling blocks on the foundation.
2. In the first case, insert the L-shape fixing stud through the pad and foundation bolt, then fasten the fixing stud with the nut.
3. Adjust foundation bolts until the space between the base bed and foundation pad is 5 mm (approx.) long.
4. Place two horizontal levels on the working table orthogonal, level the machine until differences between levels in both directions are within 0.05mm/m.
5. Fasten the setup nuts for the foundation pads and L shape-fixing studs.
6. Fill up the foundation with concrete.
7. Wait for about seven days until the concrete is dry and solid.
8. Place two 200mm long horizontal levels on the working table orthogonal, level the machine until difference between levels in both directions is within 0.02 mm/m.



### 3.5.2 ALIGNMENT OF HEAD

In order to get precision when machining, the head of machine perfectly square with table is necessary. Use gauge to check the square within 0.02mm. Please check square of machine following instructions:

1. Loosen the binding bolts.(see the figure)
2. Mount the gauge on the spindle nose and check the square within 0.02mm/300mm.
3. Tight the bolts
4. Check the precision again after tight all bolts.



## 3.6 INSPECTION

### 3.6.1 BEFORE POWER START-UP

1. Ensure the power supply specification is correct.
2. Ensure electric cables and connectors are appropriating based on the local safety regulations.
3. Ensure connections between the machine and grounding terminals are correct.
4. Ensure the current-fault breaker required by the local safety regulations is installed on the power supply side.
5. Ensure all the temporary fastening equipment used during the transportation process is removed.
6. Ensure there is no loose part on the working table.
7. Ensure there is no loose part on the folding guard.
8. Ensure all the fixing studs are fastened properly.
9. Secure nuts, bolts, locks, and other parts needed to be secured.
10. Ensure the hydraulic, pneumatic, and cutting coolant systems are connected properly.
11. Ensure safety-guarding shields and doors are in a good condition.
12. Ensure the hydraulic oil, lubricant, and cutting coolant are filled up to the required level.
13. Ensure all the over-travel limit switch are working.
14. Ensure tension of the spindle driver's belt is appropriate.
15. Ensure there is no unexpected person or substance around the machine before starting up the machine.
16. Read manuals carefully and ensure you understand all the safety instructions and operating procedures before starting up the machine.

### 3.6.2 AFTER POWER START-UP

Make sure the power source wires are connected to the right connection points. Follow the instructions below to check the power wiring.

1. Ensure functions of the power supply switches are normal.
2. Ensure the hydraulic pump and cutting coolant pump work normally. Stop the machine immediately if the pressure indication is abnormal. Check the power supply wiring connection if necessary.
3. Ensure the emergency stop switch.
4. Ensure the lubrication pump work and all the machine parts are lubricated properly.
5. Ensure over-travel limit switch work.
6. A time interval of more than 30 seconds is required between power switch off and on at the mains isolator to allow the machine interval self checking circuits to fully reset.

#### **WARNING !!!**

**Only qualified engineers are allowed to install or maintain the electrical equipment of the machine. Failure to do so will result in serious accident.**



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# CHAPTER 4 & 5

## **SHARP** **OPERATIONAL PROCEDURE & MECHANISM**

PLEASE READ CAREFULLY BEFORE  
STARTING TO OPERATE AND ADJUSTMENT THIS MACHINE

## 4.1 MACHINE

This machine could be only operated under manual or automatic mode( with control ). The information about how to operate this machine is given below. Please read carefully before starting to operate this machine.

## 4.2 SAFETY EQUIPMENT

1. Over-traveling limit switches for moving in the X, Y and Z directions.
2. Emergency stop push button
3. Another limit switch for option equipment.

## 4.3 BEFORE START-UP

Ensure all the wires and cables are insulated properly before starting up this machine, otherwise might happen electric leakage and shock.

### **WARNING !!!**

**Ensure the load capacity is correct before turning on the power supply.**

### 4.3.1 INSPECTION BEFORE TURNING ON THE POWER

1. Ensure you know how to use this machine before starting it.
2. Ensure the power supply of this machine is enough to run all the units of this machine easily before starting up the machine.
3. Ensure there is no loose wiring or connector.
4. Ensure all the cable should be protected from contacting with chips, which might result in an electric short.
5. Ensure all the oil levels are normal.

6. Check the coolant level of the cutting water tank regularly. Fill it up if necessary.
7. Always wear the correct protection outfit, such as safety goggles, oil-proof safety shoes, safety uniform, etc. before starting the machine.
8. Ensure all the doors and shields of the machine, the operating panel and the main power supply panel are closed before starting up the machine.
9. Ensure all the machine parts are secured and fixed properly.
10. Check all the switches, push buttons and operating levers to make sure they could be operated smoothly.
11. Ensure turn off the spindle CW/CCW select switch before press the spindle button on the operating panel.
12. Ensure turn off the ON/OFF switch on the power feed before press the power feed on button on the operating panel.
13. Ensure the standby signal light is luminous after switching on the main power supply.
14. Ensure the electrical cabinet, door of operating panel and other safety guarding are closed.
15. Always clean and lubricate all the sliding surfaces before starting up the machine if the machine is just unpacked or has not been used for a long time. Ensure to run the lubrication system for a while until all the sliding parts are lubricated adequately before starting up this machine.
16. Always use the proper type of lubrication oil as indicated in the nameplate or the manual.
17. To turn on the main power, the procedures below must be following :  
Turn on the factory's main power supply → switch "ON" the circuit breaker of the machine's main power supply → release the E-STOP button on the operating panel.

## 4.4 START AND STOP THE MACHINE

### 4.4.1 START PROCEDURE

1. Connect the power supply.
2. To turn on the main power, the procedures below must be following:  
Turn on the factory's main power supply→Switch "ON" the main power switch of the Machine (optional)→Release the "EMERGENCY STOP" button→Press "POWER ON" button.

**WARNING !!!**

Ensure the load capacity is correct before turning on the power supply.

### 4.4.2 EMERGENCY STOP PROCEDURE

If any emergency conditions are happened, push down the emergency stop button on the operation panel to stop the machine immediately. Pull upward to release the emergency stop button.

### 4.4.3 NORMAL STOP PROCEDURE

1. Push the "EMERGENCY STOP" button of NC equipment.
2. Turn off the main power supply switch.

## 4.5 PREPARATION

### 4.5.1 WARNINGS

1. Always use the recommended cutting tools. Otherwise this might cause an accident.
2. Do not use broken or defective cutting tools.
3. Ensure to have a sound lighting facility around the working area.
4. Tools and equipment surrounding the machine should be kept in place. Keep the machine and working area clean and orderly.
5. Do not lay anything upon the working surfaces, including the guideways, saddle, safety guards, etc.

### 4.5.2 NOTICES

1. Check the hydraulic oil level of the hydraulic tank regularly. Please use the recommended oil as described in the oil guide table of the maintenance manual.
3. Use the standard cutting tools and tool length.
4. Always try a light-load machining before doing a heavy-load machining.

**WARNING !!!**

- (a) Ensure the load capacity is correct before turning on the power supply.
- (b) Ensure all the alarm messages of the alarm message indicator are off before proceed.

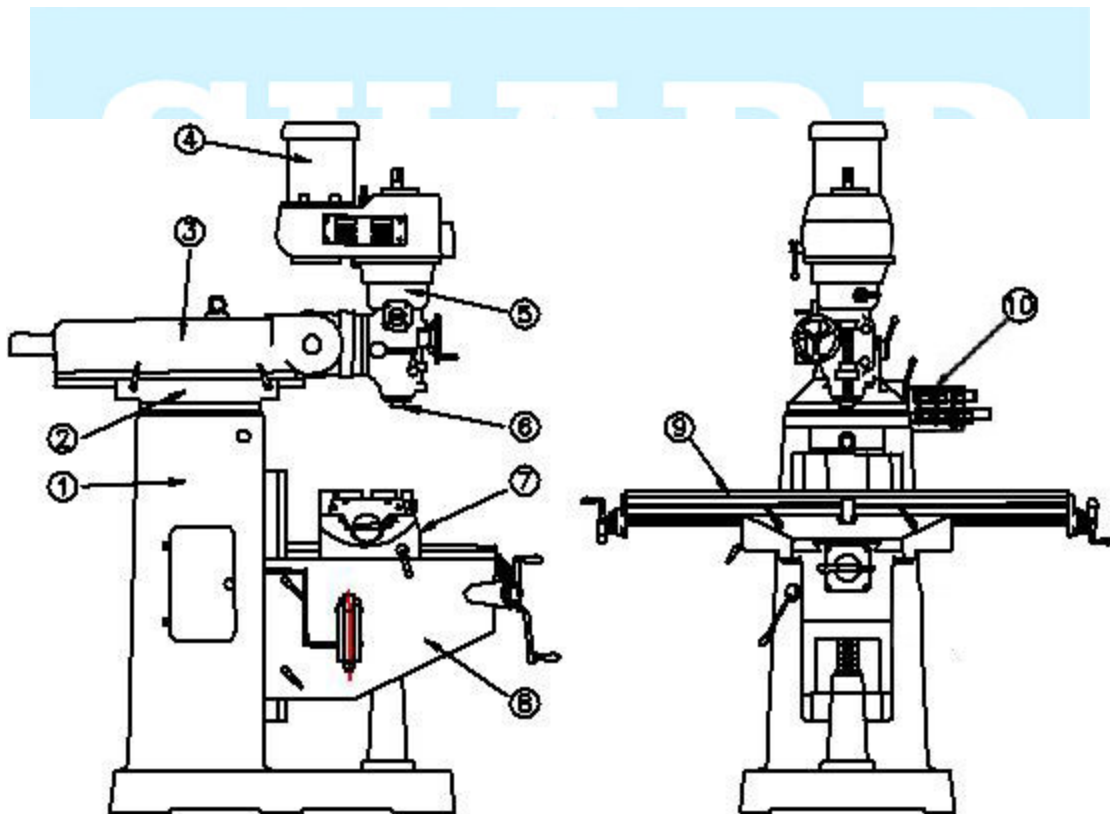
## 4.6 OPERATION

### 4.6.1 WARNINGS

1. Beware of loose or long hair near the working area to avoid unnecessary accident from happening.
2. Do not wear gloves when operating the machine, otherwise it will cause dangers.
3. Always handle large work pieces with appropriate manpower.
4. Only qualified people are allowed to operate the forklift truck, crane, lifting equipment and other materials handling equipment.
5. Never open the guarding doors while machining.
6. Ensure the work piece has been clamped firmly and properly on the holding device before machining the work piece.
7. Stop the machine before adjusting the coolant nozzles.
8. Do not touch or reach over rotating or moving objects.
9. Do not remove any safety equipment.
10. Always use the proper tools, instead of using your hand, to remove the chip from the cutting tool.
11. Do not install or remove the cutting tool and other tool holding equipment unless the machine is fully stopped.
12. Always wear appropriate protective equipment while working in a dusty environment.
13. Ensure to open the dust collecting equipment and wear a safety mask while machining the work piece made with graphite or any other materials might generate powder chip.
14. Always use the appropriate lifting equipment to handle the loads, and beware of the surroundings while operating the lifting equipment to prevent crashing and damaging.
15. Ensure the chips do not pile up so that might cause fire while doing a heavy-load machining.

## 4.6.2 MAIN PARTS

1. Bed base
2. Turret
3. Ram
4. Spindle motor
5. Variable head
6. Spindle
7. Saddle
8. Knee
9. Table
10. Control panel

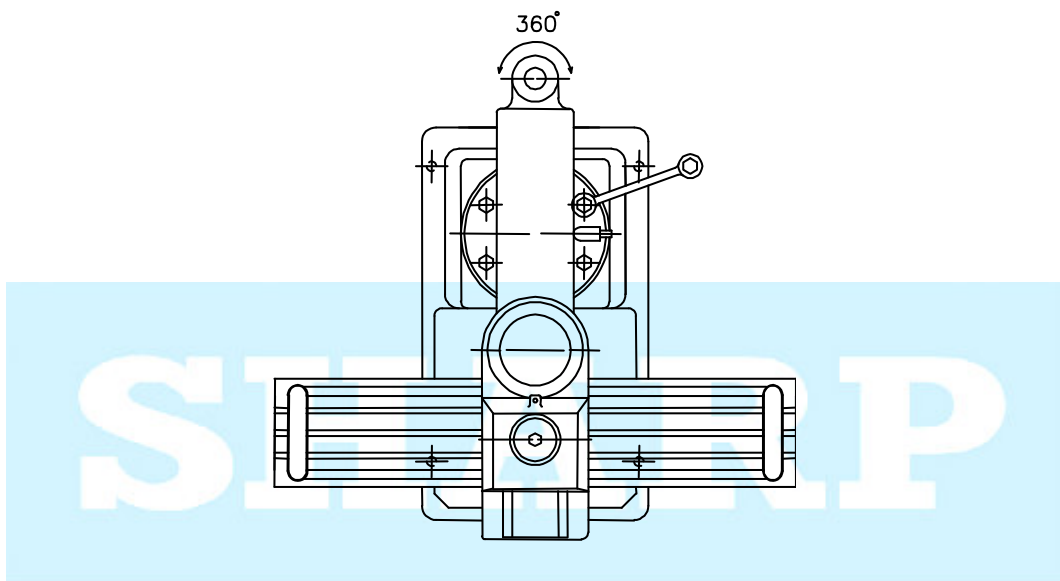




### 4.6.3 SWIVEL TURRET

To swivel turret, the procedures below must be following:

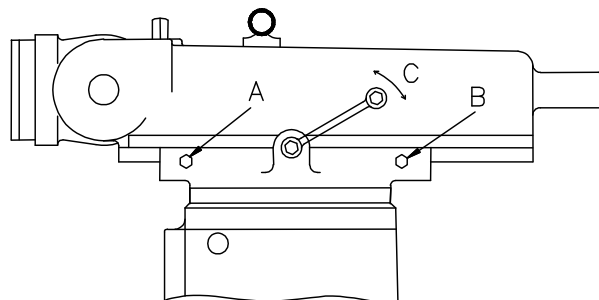
1. Use spanner to unlock the 4 bolts.
2. Swivel the turret to the required location that you need an
3. Lock the 4 bolts.



### 4.6.4 MOVE RAM SLIDE

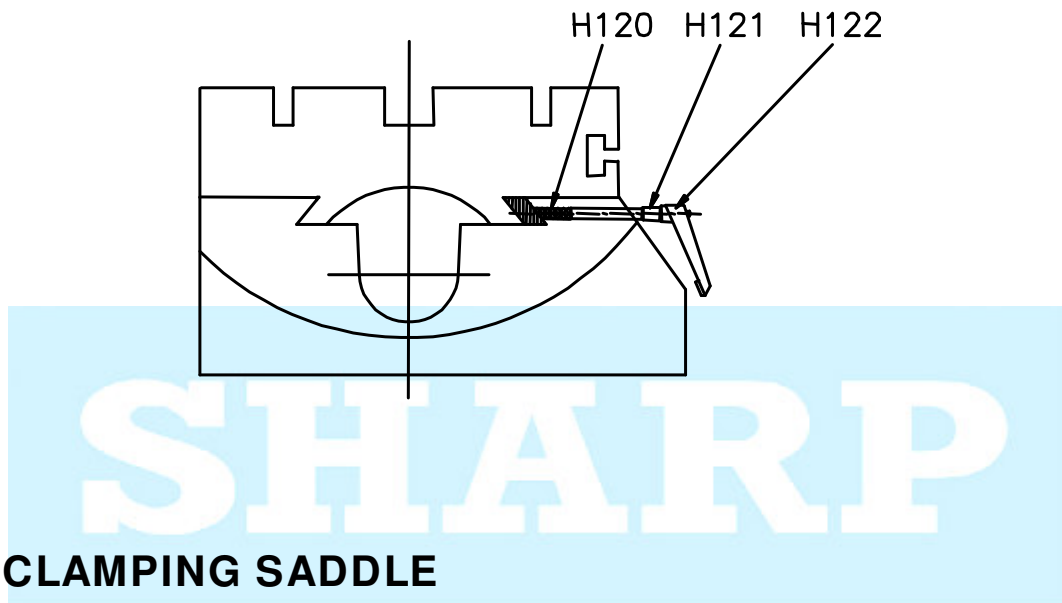
To move ram slide, the procedures below must be following:

1. Release the two setting screws "A" and "B" .
2. Use spanner "C" to move ram slide.
3. Lock the setting screws "B" and "A" .



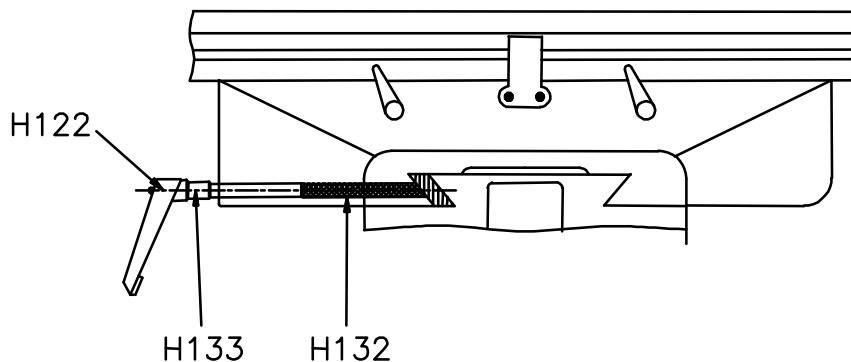
### 4.6.5 CLAMPING TABLE

If operator don't use longitudinal table feed, it can be clamped to add rigidity. This can decrease vibration when doing heavy cut. The clamping table locking lever is located on the front of saddle. Ensure to use a sequeately clamping pressure to set it, otherwise excessive pressure will broke the clamping parts.



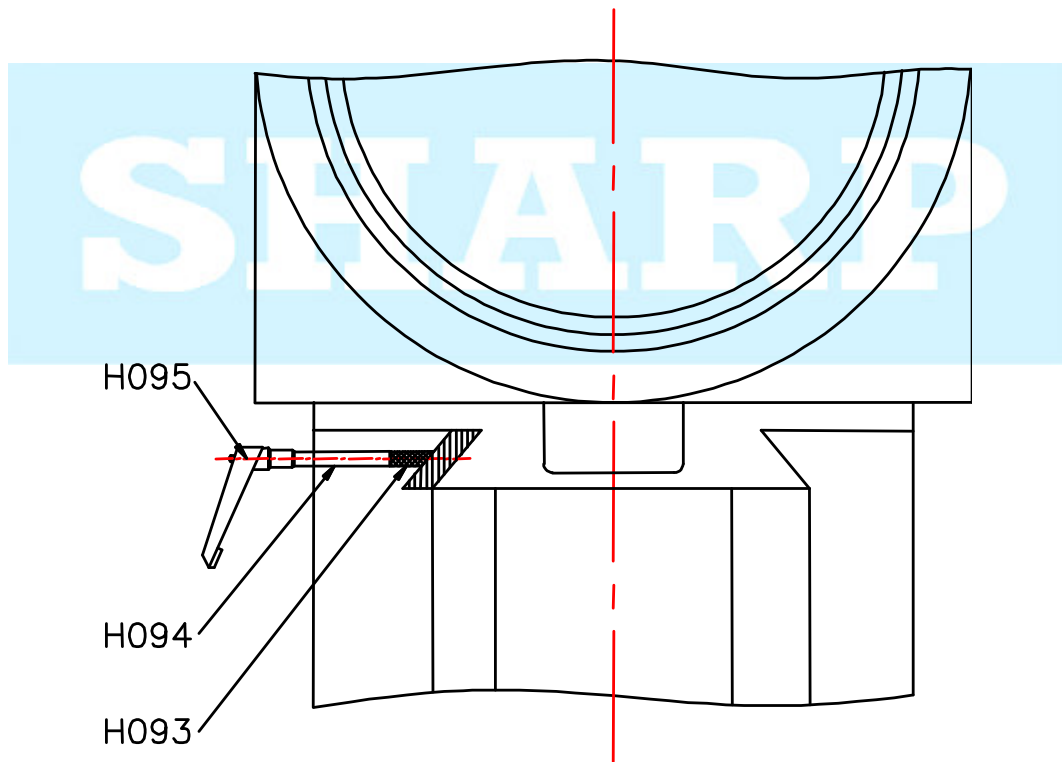
### 4.6.6 CLAMPING SADDLE

If operator don't use saddle feed, it can be clamped to add rigidity. This can decrease vibration when doing heavy cut. The clamping saddle locking lever is located on the left side of saddle. Ensure to use adequately clamping pressure to set it, otherwise excessive pressure will broke the clamping parts.



### 4.6.7 CLAMPING KNEE

If operator don't use knee feed, it can be clamped to add rigidity. This can decrease vibration when doing heavy cut. The clamping knee locking lever is located on the left side of knee. Ensure to use adequately clamping pressure to set it, otherwise excessive pressure will broke the clamping parts.

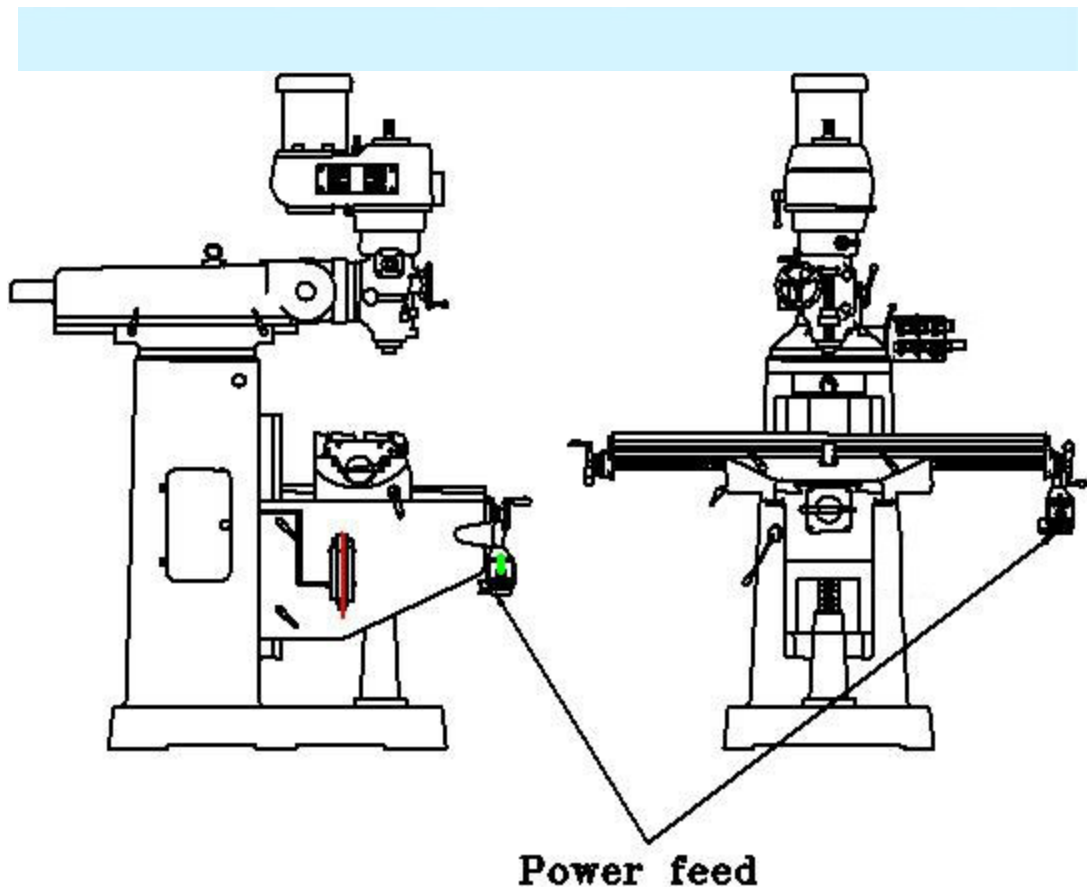


#### 4.6.8 SAFETY RULE OF POWER FEED ( OPTIONAL )

The power feed equipment is powerful and fast, please uses this equipment carefully. Before using these power feed, please read the operation manual first. Do not try to use this equipment unless you understand how to operate and stop it.

**WARNING !!!**

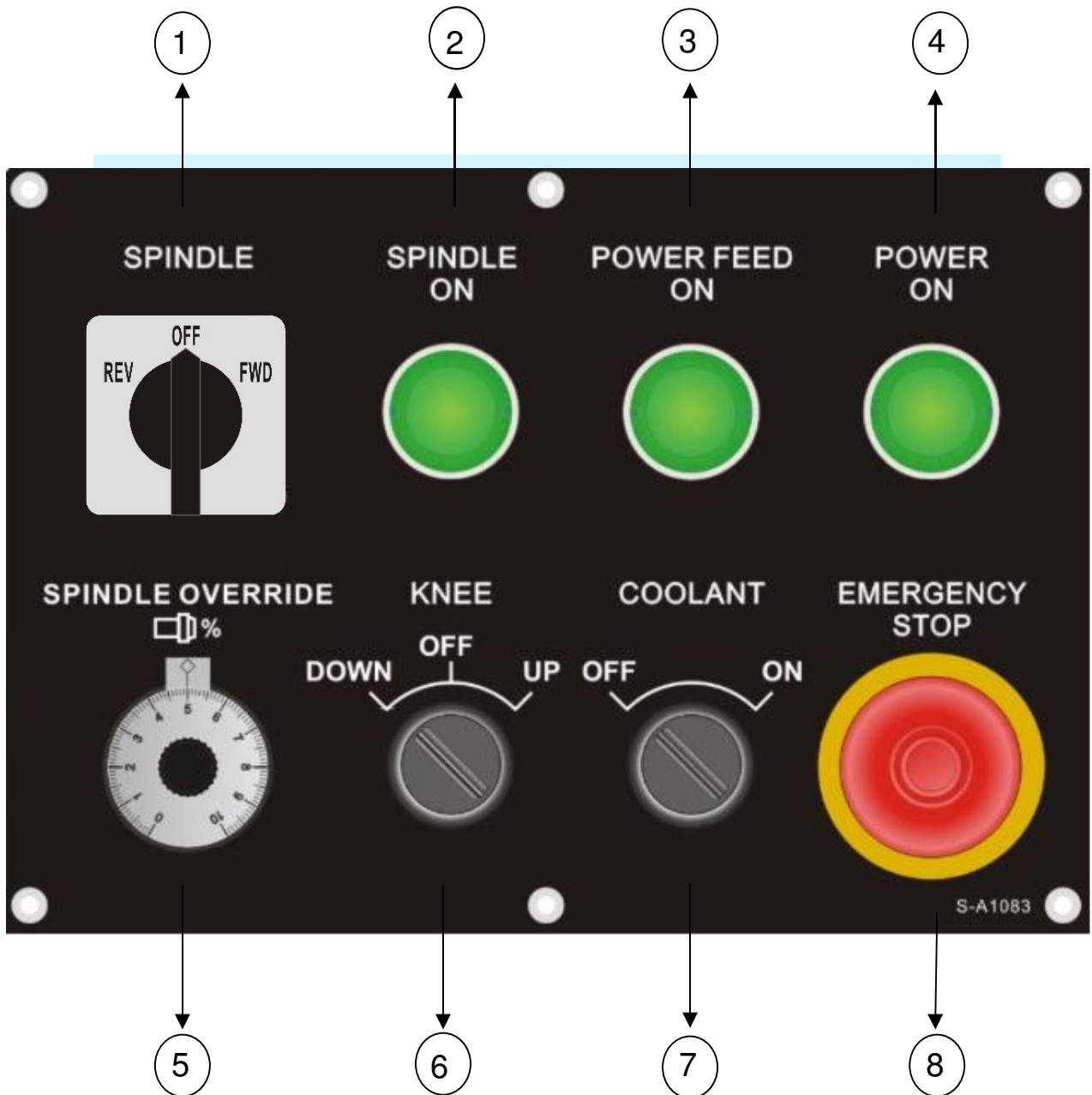
Ensure to turn off the ON/OFF switch on the power feed before press on the power feed on button on the operating panel.



### 4.6.9 CONTROL PANEL

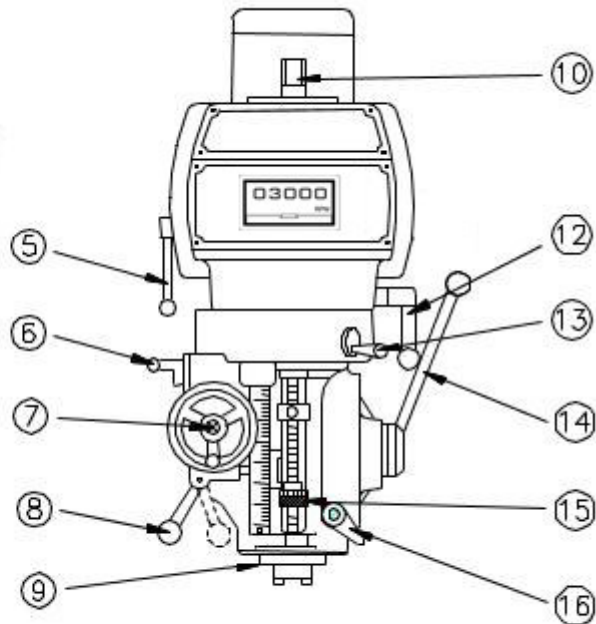
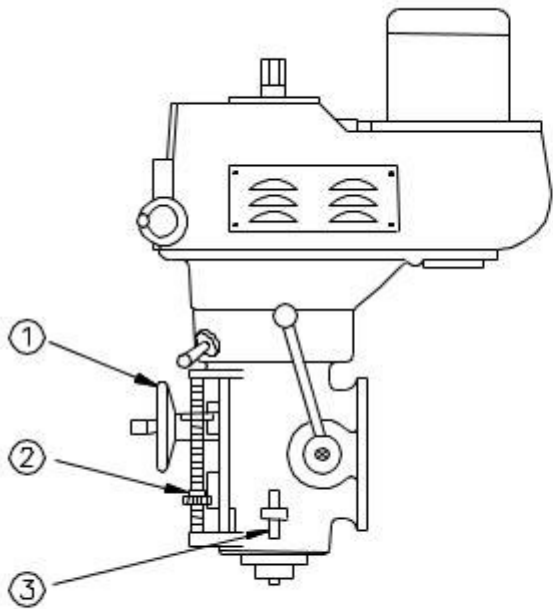
#### 4.6.9.1 CONTROL PANEL (WITH INVERTER HEAD)

- 1. SPINDLE REV / FWD SWITCH
- 2. SPINDLE ON BUTTON
- 3. POWER FEED ON BUTTON
- 4. POWER ON LAMP
- 5. SPINDLE OVERRIDE SWITCH
- 6. KNEE UP / DOWN SWITCH
- 7. COOLANT ON / OFF SWITCH
- 8. EMERGENCY STOP BUTTON



### 4.6.10 VARIABLE SPEED HEAD

- 1. Handwheel for manual feed of quill
- 2. Indicator mounting rod
- 3. Indicator mounting rod
- 4. Adjustable micrometer depth stop
- 5. Spindle brake
- 6. Quill feed speed selector lever
- 7. Quill feed reversing knob
- 8. Quill feed clutch control lever
- 9. Quill
- 10. Draw bar
- 11. Spindle override
- 12. Speed range select lever
- 13. Power feed transmission lever
- 14. Quill feed handle
- 15. Quill stop
- 16. Quill lock



### 4.6.11 CHANGE HIGH / LOW SPEED RANGE

There are 3-speed range, low-speed range, high-speed range and neutral.(see below range list). To change the speed range, the procedures below must be following:

Ensure the spindle is full stop → Move speed range select lever “12” to change the speed range→rotate the spindle by hand until the clutch engages fully.

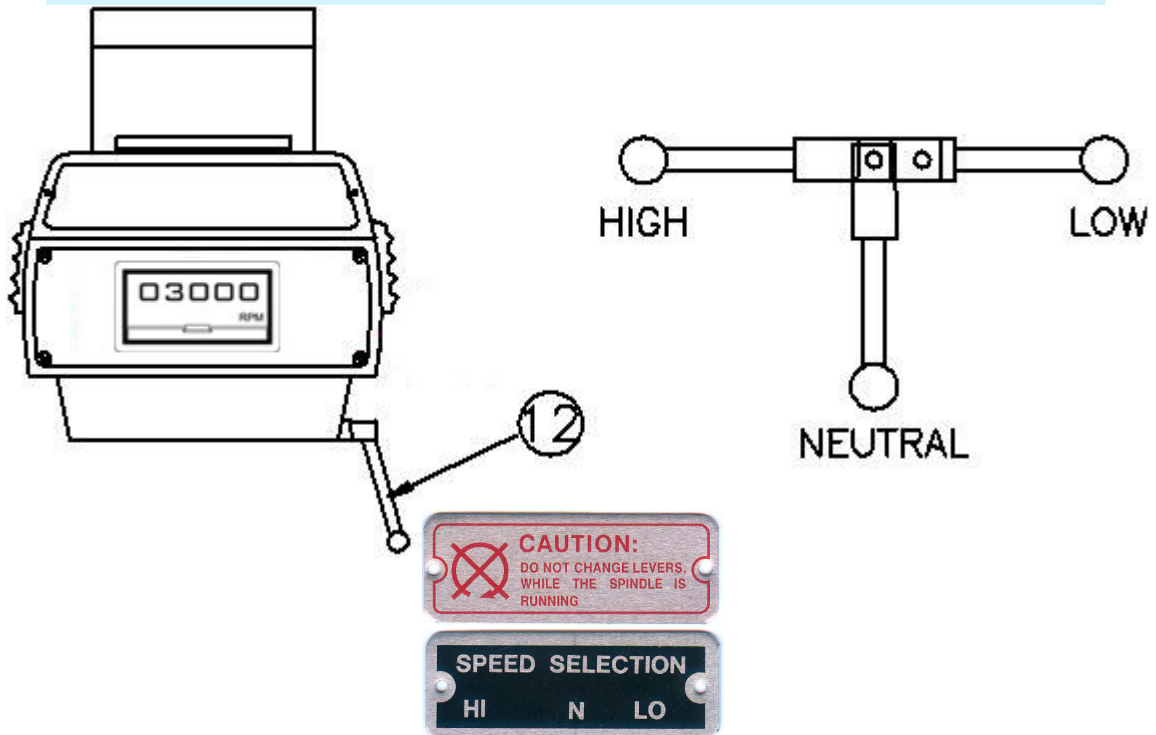
	50Hz		60	
	LOW	HIGH	LOW	HIGH
V-1	60-390 rpm	420-3000 rpm	70-460 rpm	460-3600 rpm

**NOTE !!!**

Due to gear construction, when machine is running in low-speed range, spindle rotation is opposite to the high-speed range. Therefore ensure the rotation direction before machining.

**WARNING !!!**

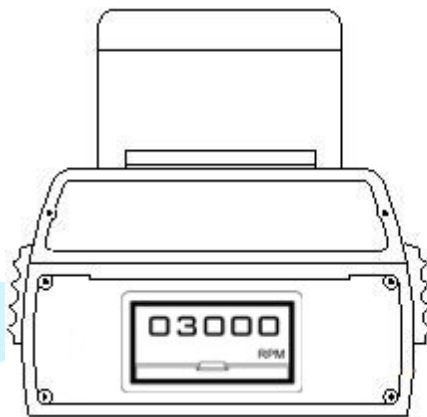
Do not change the speed range unless the spindle is full stop. Otherwise might cause serious accident.



### 4.6.12 CHANGE SPINDLE SPEED

Start the spindle and turn the spindle override button to change the spindle speed.

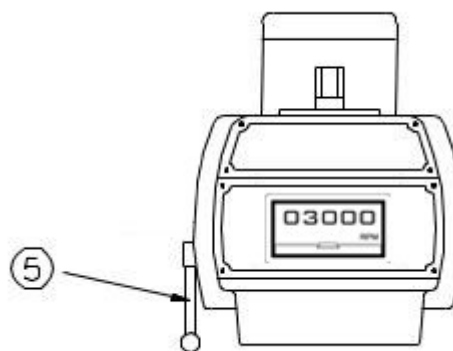
**WARNING !!!**  
Do not change the spindle speed when the spindle is stationary.



### 4.6.13 SPINDLE BRAKE

Move the spindle brake lever "5" front or back can stop spindle.

**WARNING !!!**  
Do not use the spindle brake unless turn off the spindle motor. Also, ensure that the spindle brake is released before starting the motor. Otherwise might cause serious accident.





### 4.6.14 AUTOMATIC QUILL FEED

There are 6 parts ( NO. "6" , "7" , "8" , "13" , "15" , "16" ) necessary to adjust when use automatic quill feed. To use automatic quill feed, the procedures below must be following:

Ensure the spindle is full stop and the quill lock "16" is off → use the micrometer dial "15" to set travel → set the power feed transmission lever "13" at location "IN" → use the quill feed speed selector lever "6" to select feed rate → use the quill feed reversing knob "7" to select the feed direction → engage quill feed control lever "8".

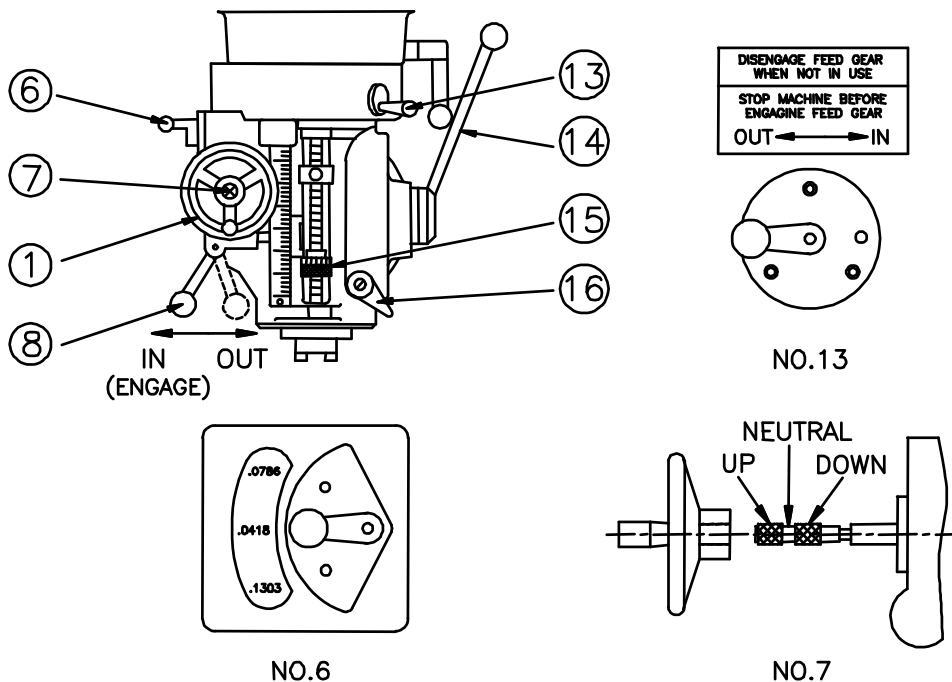
### 4.6.15 HAND QUILL FEED ONE

There are 6 parts ( NO. "1" , "7" , "8" , "13" , "15" , "16" ) necessary to adjust when use hand feed. To use hand quill feed, the procedures below must be following:

Ensure the spindle is full stop and the quill lock "16" is off → use the micrometer dial "15" to set travel → set the power feed transmission lever "13" at "OUT" → set the quill feed reversing knob "7" at "neutral" → engage quill feed control lever "8" → the quill is under the handwheel for manual feed of quill "1" control.

**WARNING !!!**

**Do not engage power feed transmission lever "13" when spindle is running. Otherwise might cause serious accident.**



### 4.6.16 HAND QUILL FEED TWO

To operate feed by quill feed handle, the procedures below must be following:

Ensure the spindle is full stop and the quill lock "16" is off → use the micrometer dial "15" to set travel → set the quill feed control lever "8" at location "OUT" → the quill is under the quill feed handle "14" control.

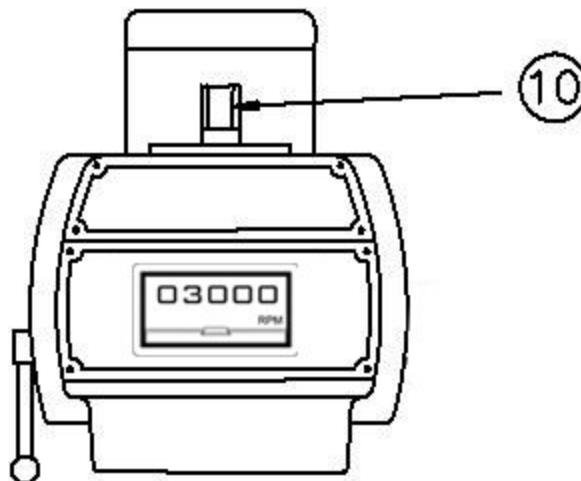
### 4.6.17 INSTALL THE TOOL

The specification of drawbar "10" is M12-P1.75 ( ISO30 ), 1/2" -12NC ( ISO30 ) or 7/16" -20NF ( R8 ), M16-P2.0 ( ISO40 ), 5/8" -11NC ( ISO40 ). When tightening or loosening the drawbar it is necessary to lock the spindle. Use the spindle brake "5" to lock the spindle.

1. To tight the tool, the procedures below must be following:  
Use spindle brake to lock the spindle → use spanner to turn the drawbar clockwise until tightening tool.
2. To loose the tool, the procedures below must be following:  
Use spindle brake to lock the spindle → use spanner to turn the drawbar counterclockwise → use mallet tap the drawbar to loose the tool → turn the drawbar counterclockwise until loosening the tool.

#### **WARNING !!!**

**Do not install the tool when spindle is running. Otherwise might cause serious accident.**



### **4.6.18 LOCK QUILL**

If operators don't use quill feed, he can use the quill lock lever "16" to clamp the quill. It is necessary to be clamped when operators do cutting. Ensure to use adequately clamping pressure to set it, otherwise excessive pressure will broke the clamping parts.

## **4.7 BREAK-UP**

Ensure to turn off the emergency stop on the operating panel and the circuit breaker of the main power whenever the machining job is done and the machine is left unattended.

## **4.8 FINISH**

Ensure to turn off the machine power when finish work, the procedures below must be following:

Push down the emergency stop button → Switch off the main power switch of the machine (optional) → Turn off the factory's main power supply.

## **4.9 INSPECTION AFTER FINISH**

1. Ensure all the machine parts are in good conditions.
2. Check the centralized lubrication system. Fill up or refill the oil if necessary.
3. Ensure there is no leakage occurred in the pipe lines.
4. Ensure all screws are secured properly.
5. Ensure all the gauges and indication meters are in normal conditions.
6. Clean up the cutting chips. Keep the machine and working area clean and orderly.

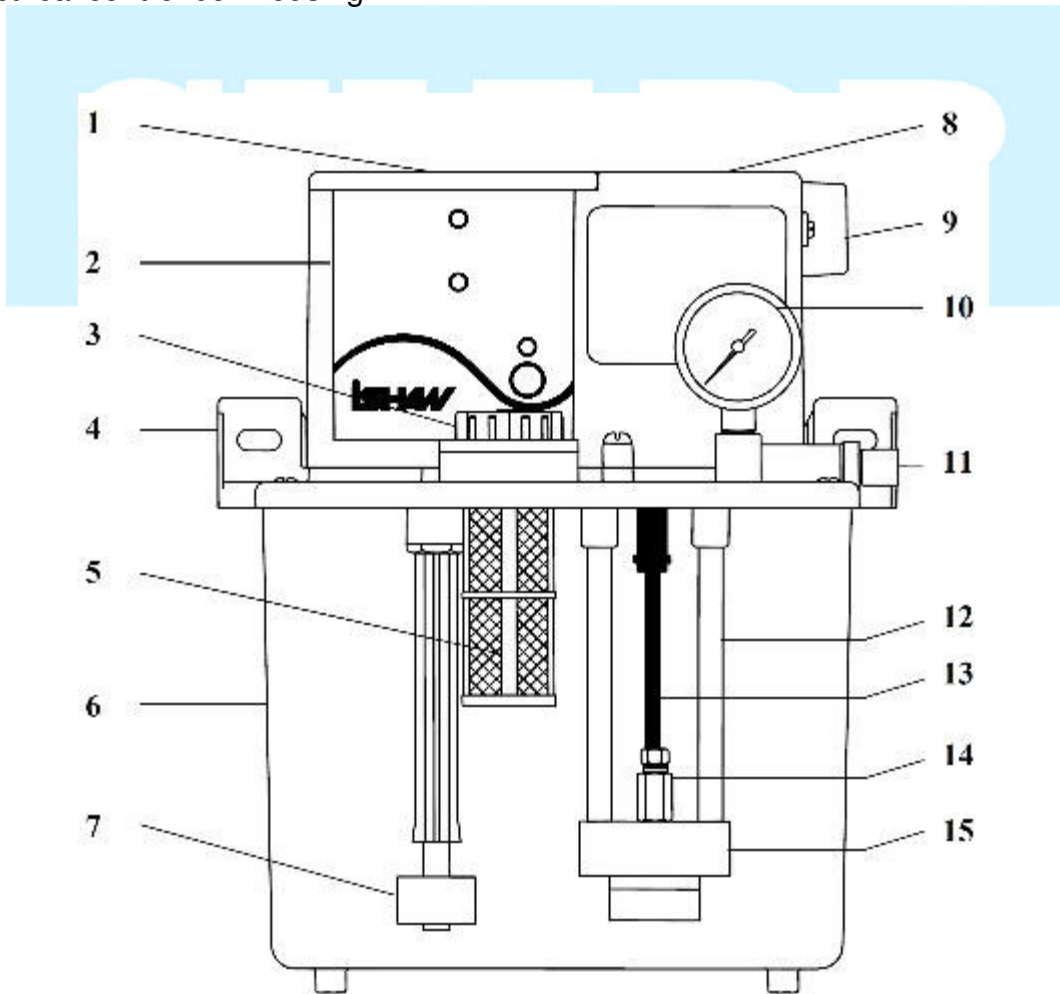
### 4.9.1 NOTICES

1. Ensure to turn off the power supply of the machine and put “Under Maintenance. Do not turn on the power supply” warning signs on visible spots before cleaning the machine or accessories. Ensure the machine is fully stopped before maintaining the machine.
2. Ensure to clean the machine and its surroundings and put everything in order after the machining job is done. Ensure to put anti-rust oil on the machine bed and all the moving parts to keep them from rust and dirt.
3. The machine moving parts should be returned to the adequate location.
4. Check and replace the broken wipers.
5. Check and replace the lubricant or hydraulic oil if they are dirty or emulsify.
6. Check and replace the coolant if they are dirty.
7. Check and refill the lubricant, hydraulic oil and coolant if necessary.
8. Clean the filters of the lubrication, hydraulic, and cutting cooling systems.
9. Turn off all the power switches and main power circuit breakers when leaving the machine unattended.

## 4.10 LUBRICATOR


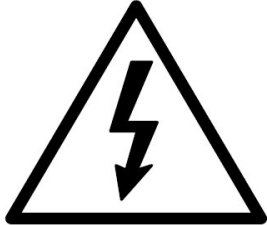
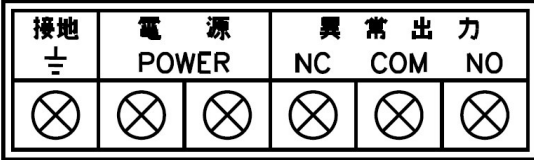
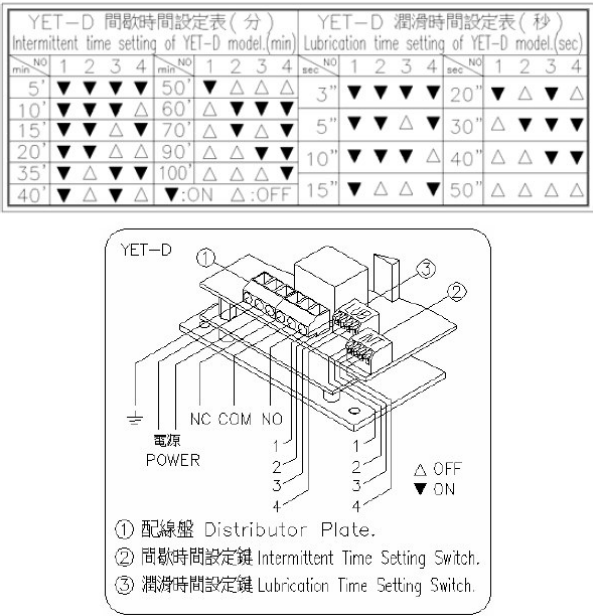
### 4.10.1 PARTS OF LUBRICATOR

- |                                   |                            |
|-----------------------------------|----------------------------|
| 1. Electrical control box cover   | 9. Alarm beeper            |
| 2. YET-D1 control box             | 10. Pressure gauge         |
| 3. Oil tank cap                   | 11. One-way elbow adapter  |
| 4. Upper lid                      | 12. Lifting rod            |
| 5. Inlet filter                   | 13. Shaft set              |
| 6. Oil tank                       | 14. Pressure release valve |
| 7. Folat switch                   | 15. Gear Pump              |
| 8. Electrical control box housing |                            |



(Fig.1)

4.10.2 LABEL

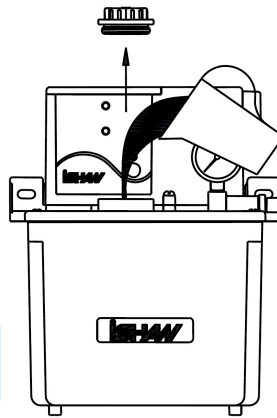
<p style="text-align: center;">Name Plate</p>	<p style="text-align: center;">Danger</p>
	
<p style="text-align: center;">Front side of the electrical control box</p>	<p style="text-align: center;">Outside of the electrical control box top cover</p>
<p style="text-align: center;">Wiring Diagram</p>	<p style="text-align: center;">Operation Notice</p>
	<p style="text-align: center;"><b>操作說明 (OPERATION)</b></p> <p>一、異常接點規格 Alarm Panel Point :</p> <ol style="list-style-type: none"> <li>1.接點最大電流 Max. Amp : 3A</li> <li>2.接點最大電壓 Max. Volt. : 250V</li> </ol> <p>二、操作方式 Operation :</p> <ol style="list-style-type: none"> <li>1.請參照時間設定表，設定潤滑/間歇時間。 See Time Setting List for Lub / Int time's setting.</li> <li>2. (FEED) 強制潤滑鍵 - 按住此鍵進入潤滑狀態開始運作 - Restart button: push the button will restart the lubricator with lubrication setting.</li> </ol> <p>3.使用前須檢查電源及接線是否正確，油量是否足夠 - Make sure voltage, panel point are correct and oil is enough before operate.</p> <p>4.間歇時間須為潤滑時間 5 倍以上，建議最短期間為 3 分鐘 - The intermittent time should be set at least 5 times than the lubricating time, and the proposed minimum intermittent time is 3 minutes.</p> <p>三、注意事項 Notes :</p> <ol style="list-style-type: none"> <li>1.本機限用新油，油品適用粘度約 30~150cSt - Always use new oil with viscosity 30~150cSt.</li> <li>2.請定期清理油箱底部及泵浦入口端濾網 - Clean the filter and reservoir periodically.</li> <li>3.本機出口之接頭為特殊零件，請勿自行更換 - Never change the output part of lubricator by self.</li> </ol> <p><b>ISHAW</b> 裕祥精機工業股份有限公司 E-mail : ishan@tcts.seed.net.tw</p>
<p style="text-align: center;">Inside of the electrical control box</p>	
<p style="text-align: center;">Time Index Table</p>	
 <p>① 配線盤 Distributor Plate. ② 間歇時間設定鍵 Intermittent Time Setting Switch. ③ 潤滑時間設定鍵 Lubrication Time Setting Switch.</p>	
<p style="text-align: center;">Inside of the electrical control box top cover</p>	<p style="text-align: center;">Left side of the oil tank</p>

### 4.10.3 LUBRICANT FILLING

Remove the oil tank cap and fill the tank with clean lubricant at the level of 80% of the tank height (Fig. 3). Approved lubricant viscosity range is 30~150 cSt.

#### NOTE !!!

Viscosity higher than 150 cSt may result the burn down of the lubrication systems.

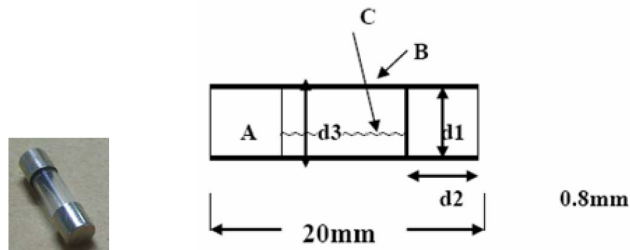


(Fig.3)

### 4.10.4 FUSE ON THE CONTROL BOARD

#### 4.10.4.1 THE SPECIFICATION OF THE FUSE

1. TYPE : 350204 glass tube fuse slow blow type 5.2\*20.
2. Availabe range : For protecting instruments, power supplies, computers, the related equipment of computers and telephone sets.
3. Shape & Size as following illustrations : (Unit : mm)



- (a) Structure & shape : As shown in above figure.  
Body size of fuse : Dia 5.2 mm \* L 20mm.
- (b) Rated Voltage : 250 V AC
- (c) Rated Current I : 2A

4. Characteristics of Electrical Appliances :

- (a) Loading Capacity : Loading the 110% Listed Electrical Current (i.e. 2.2 A) for flowing, and it's available to let current keep on following without any melting.
- (b) Temperature : Proceed the preceding test for 1.5 hours, keep testing it with the original current every 10 minutes. Continue to test it for 3 times. The temperature is not allowed to be higher. The main temperature rise is below 70°C by way of Thermocouple Method, while it keeps below 50°C by way of Thermocouple Method.
- (c) Fuse current character :

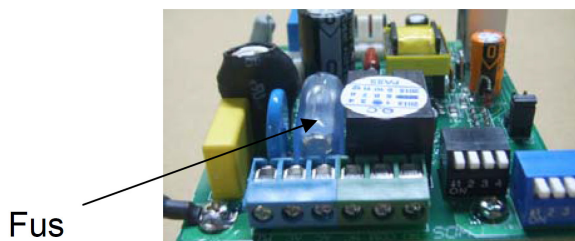
Rated Current	1.35 In	1.5 In	2 In	
100mA-10A	MAX.	MAX.	MIN.	MAX.
	60 MINUTE	NON	3 S	120 S

4.10.4.2 FUSE REPLACEMENT

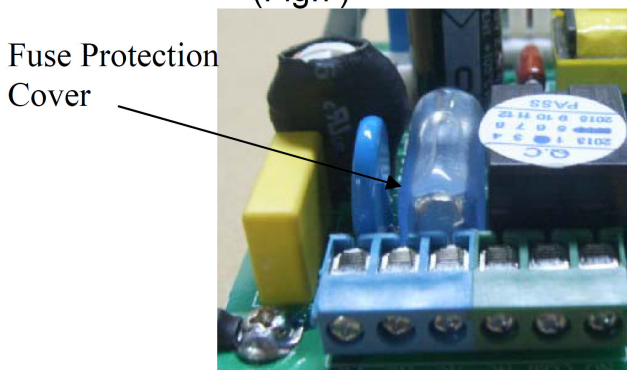
Make sure the power cable is disconnected before the fuse replacement. Remove the electrical control box cover and find the fuse (Fig. 7).

Remove the fuse protection cover (Fig. 8) and replace the fuse with the new one (Fig. 9). Fit-in the fuse cover and close the electrical control box cover.

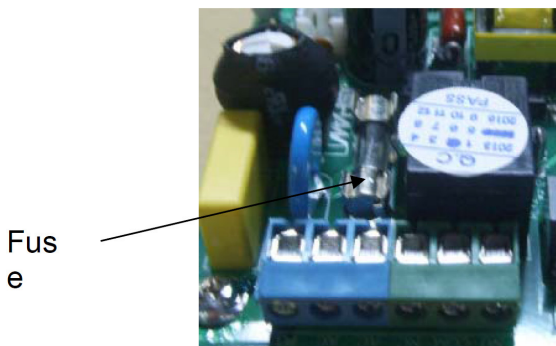
**NOTE !!!**  
**No contact with other components during the replacement.**  
**The fuse should be of the original parts. Please refer to 4.10.4.1 The Specification of the Fuse.**



(Fig.7)



(Fig.8)

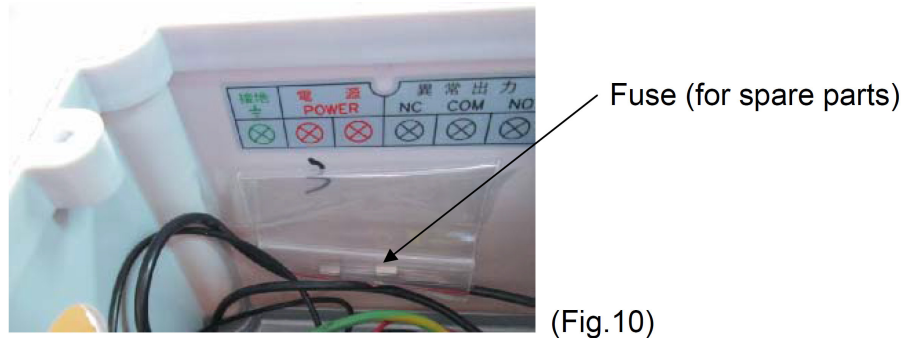


(Fig.9)



### 4.10.4.3 EXTRA FUSE FOR SPARE PARTS

One extra fuse for spare parts is attached inside the electrical control box.



### 4.10.5 LUBRICATOR MAINTENANCE

iSHAN centralized lubrication systems are of low maintenance. However, related connection needs to be reviewed if properly fitted to secure the proper function of the system. Please clean periodically the oil tank of iSHAN centralized lubrications. If the user wants to clean the bottom of the tank, please TURN OFF the system first and remove the bolts on the tank to separate the tank for cleaning. After cleaning the tank, please fasten the bolts to fix the tank. Please follow below requirements :

- (a) ALWAYS Turn ON the power after more than 20 seconds of turning OFF to protect the lubricator.
- (b) It is prohibited for changing to non-original set-up to avoid malfunction.
- (c) The outlet of YET-D1 is a one-way adapter. It is prohibited to revise into other adapters.

# CHAPTER 6

**SHARP**  
**ADJUSTMENT**

PLEASE READ CAREFULLY BEFORE ADJUSTMENT  
OF THIS MACHINE

## 6.1 MECHANICAL ADJUSTMENT

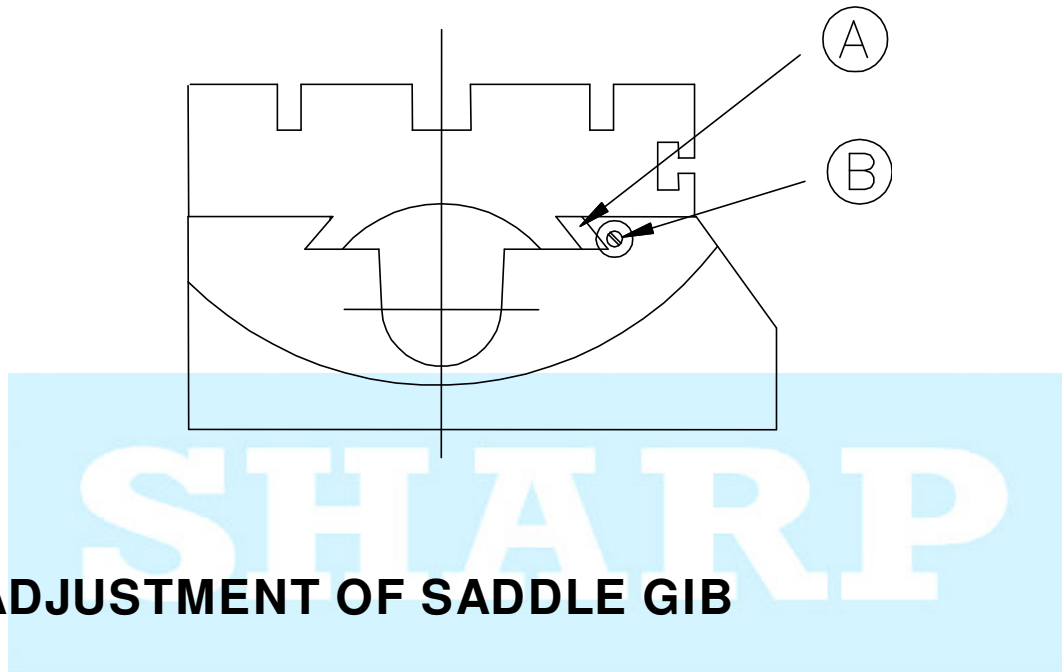
Ensure to turn off the main power supply and put warning signs on visible spots before inspecting the belt tension. Do not touch or reach over the pulleys and the belts if the power is still on. Otherwise this might result in squeeze to wounded and disabled.

### 6.1.1 NOTICES

1. Check the pressure readings regularly to make sure all the system pressures setting are normal.
2. Observe regularly if there is any abnormal noise arising inside the rotating motors and other moving or rotating parts.
3. Moving or rotating parts are lubricated properly.
4. Ensure all the safety guards and safety equipments are installed properly.
5. Adjust the belt tension based on the tension value given in the maintenance manual.

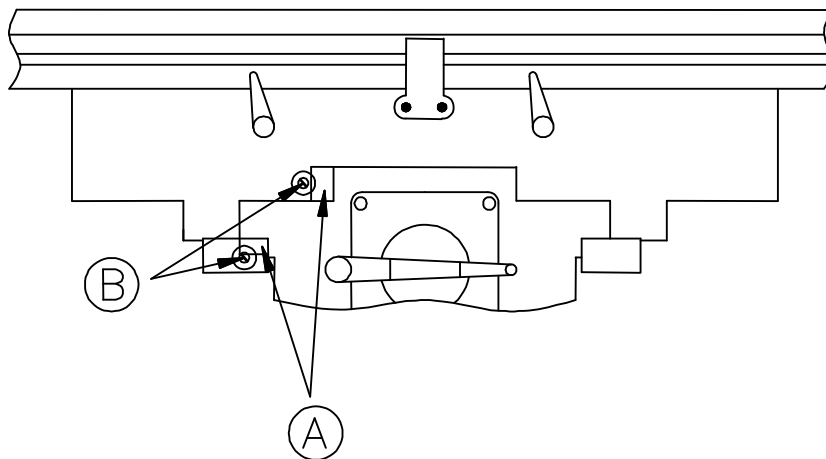
## 6.2 ADJUSTMENT OF TABLE GIB

The taper gib “ A ” is used for adjusting precision of table moving. The screw “ B ” is used for setting the gib. When adjust the gib, turn the screw counterclockwise to loose the gib a little, then turn the screw clockwise to adjust the gib until the table move smooth and precisely.



## 6.3 ADJUSTMENT OF SADDLE GIB

The taper gib “ A ” is used for adjusting precision of saddle moving. The screw “ B ” is used for setting the gib. When adjust the gib, turn the screw counterclockwise to loose the gib a little, then turn the screw clockwise to adjust the gib until the saddle move smooth and precisely.

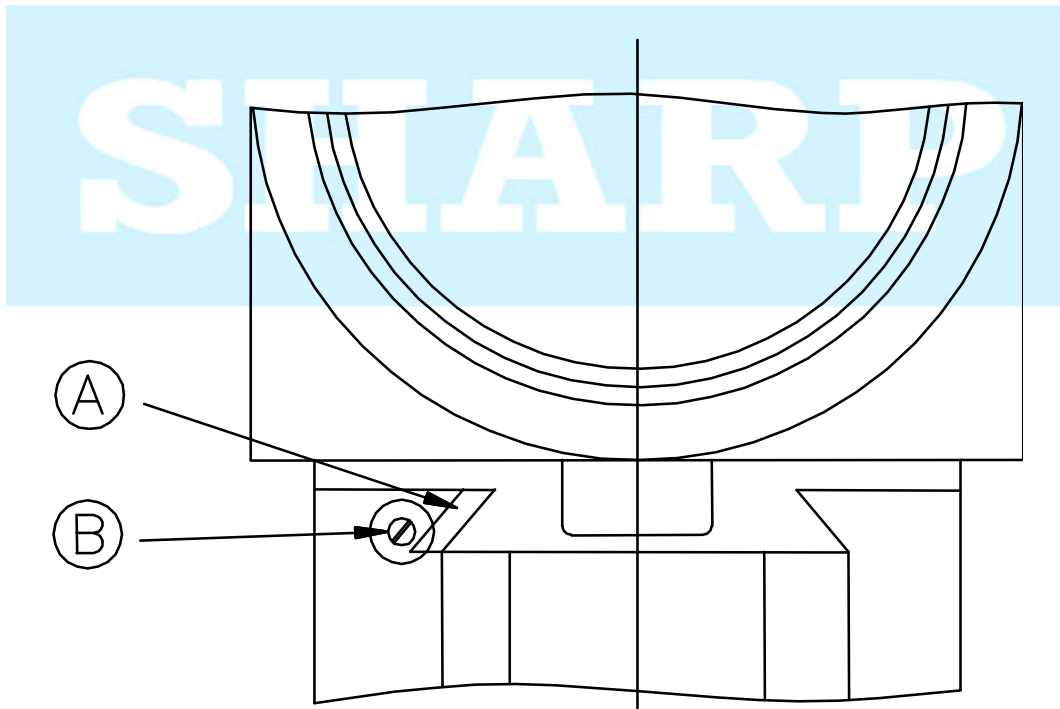


## 6.4 ADJUSTMENT OF HEADSTOCK GIB

The taper gib “ A ” is used for adjusting precision of knee moving. The screw “ B ” is used for setting the gib. When adjust the gib, turn the screw counterclockwise to loose the gib a little, then turn the screw clockwise to adjust the gib until the knee move smooth and precisely.

**WARNING !!!**

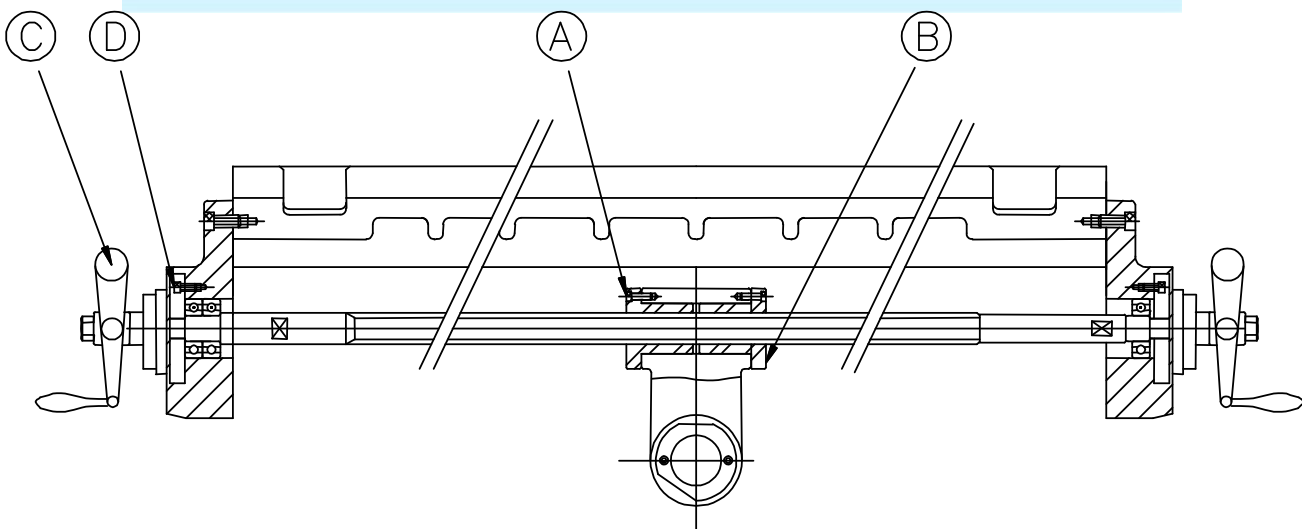
Ensure to check gib every month. Otherwise might result the machine out of accuracy.



## 6.5 ADJUSTMENT OF BACKLASH

To adjust backlash, the procedures below must be following:

1. Move the table or saddle to middle position.
2. Withdraw handwheel "C" and 3 screw "D" .
3. Move table or saddle to the location that you can see screws "A" .
4. Loosen the screw "A" .
5. Tighten the nut "B" unit 0.08-0.12mm.
6. Tighten the screw "A" .
7. Install the all parts.



**SHARP**

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# CHAPTER 7

A light blue rectangular background containing the word "SHARP" in large, white, bold, sans-serif capital letters. Below "SHARP", the words "MACHINE MAINTENANCE" are written in smaller, black, bold, sans-serif capital letters.

**SHARP**  
**MACHINE MAINTENANCE**

PLEASE READ CAREFULLY BEFORE MAINTENANCE

ON THIS MACHINE



## 7.1 PREPARATION BEFORE MAINTENANCE

Ensure to turn off the main power supply and put “under maintenance” warning signs on visible spots before maintenance the machine.

### 7.1.1 NOTICES

1. Fully Understand all the safety instructions illustrated in the manual.
2. Always maintain the machine under the foreman’s instruction.
3. Prepare all the necessary spare parts, such as washer, O ring, seal, etc., in advance.
4. Fully understand all the maintenance procedures written in the maintenance manual.
5. Follow the maintenance procedures and be sure to establish the maintenance records after work.

#### **WARNING!!!**

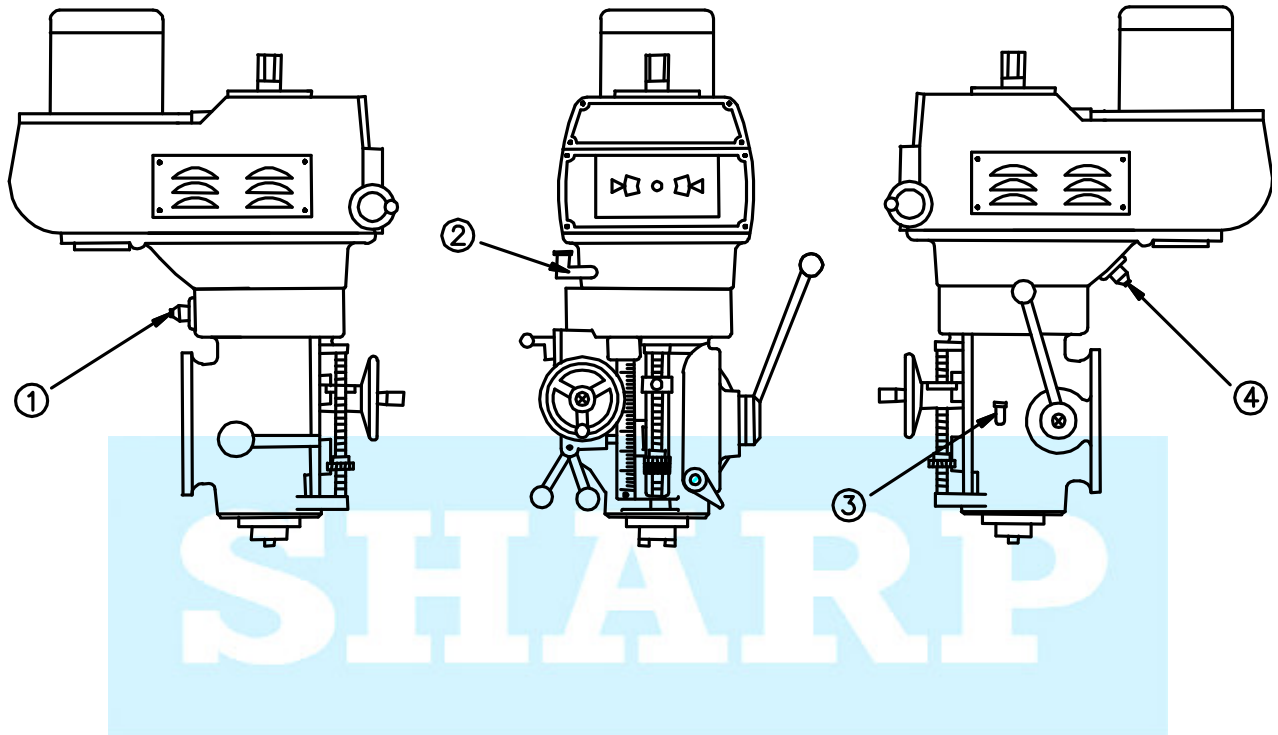
**Do not touch or reach over the pulleys and any movable parts if the power is still on. Otherwise might result in squeeze to wounded and disabled.**

## 7.2 LUBRICATION SYSTEM

Running conditions of this machine depend heavily on the lubrication management. Ensure to check the lubrication system frequently to keep this machine in a good service condition. The following describe how to lubricate various machine parts properly. Recommended lubrication oil used in the pneumatic system, lubrication grease and cutting coolant are listed in the oil guide table.(see 7.3.4)

### 7.2.1 LUBRICATION OF VARIABLE SPEED HEAD

Please lubricate the parts of head following the directions.



THE GUIDE TABLE

LUBRICANT POSITION	LUBRICANT CHARACTERISTIC	FREQUENCY	QUANTITY
1,4 HI-LOW speed gear mechanism	Grease	Every month	Suitable amount
2 Quill	Light oil	Twice a day	5-10 drops
3 HI-LOW change	Light oil	Once a day	5-10 drops

**WARNING!!!**

Ensure to lubricate the parts according to this guide table. Otherwise might result in parts damage.

## 7.3 LUBRICATION

### 7.3.1 THE OIL GUIDE TABLE (V2.7)

#### 7.3.1.1 OIL GUIDE TABLE A (For all machine type)

Lubricant Position	Lubrication Tank Slideway and Ballscrew	Cutting Coolant	
Lubricant Characteristic	<ul style="list-style-type: none"> <li>⊙Viscosity ISO VG68</li> <li>⊙Anti-wear, Extreme-pressure</li> </ul>	<ul style="list-style-type: none"> <li>⊙Good Heat conduction</li> <li>⊙Good lubricant performance</li> </ul>	
Lubrication Method	Centralized Lub	Circulating Lub	
Replace& add Period	Daily As needed	As needed	
Tank Capacity	3 Liters	100 Liters ※Depend on Model	
Recommended Grade of Oil	<ul style="list-style-type: none"> <li>⊙BP Macurrat D 68</li> <li>⊙Mobil Vactra No.2</li> <li>⊙Shell Tonna S2 M68</li> <li>⊙BECHEM Staroil CGLP 68 MF</li> </ul>	<ul style="list-style-type: none"> <li>⊙CPC Cutting Oil 31C</li> <li>⊙Shell Dromus B or Macron 32</li> <li>⊙BECHEM AVANTIN</li> </ul>	

\*\*\*\* This is recommended that use ISO68 grade of oil for Slideway and Ballscrew if this machine is located in a plant with ambient temperature of under 25 °C.

**7.3.1.2 OIL GUIDE TABLE D (FOR MILLS )**

Lubricant Position	<b>Tool Release Drawbar</b>		
Lubricant Characteristic	◎Viscosity ISO VG32 ◎Anti-rust, anti-oxidation ◎Good Stability		
Lubrication Method	Centralized Lub		
Replace& add Period	Once Weekly As needed		
Tank Capacity	---		
Recommended Grade of Oil	◎BP Energol HLP 32 AW ◎Mobil DTE Light ◎Shell Tellus 32 ◎Chevron Hydraulic Oil AW32 ◎BECHEM Staroil NR 32		

**WARNING!!!**

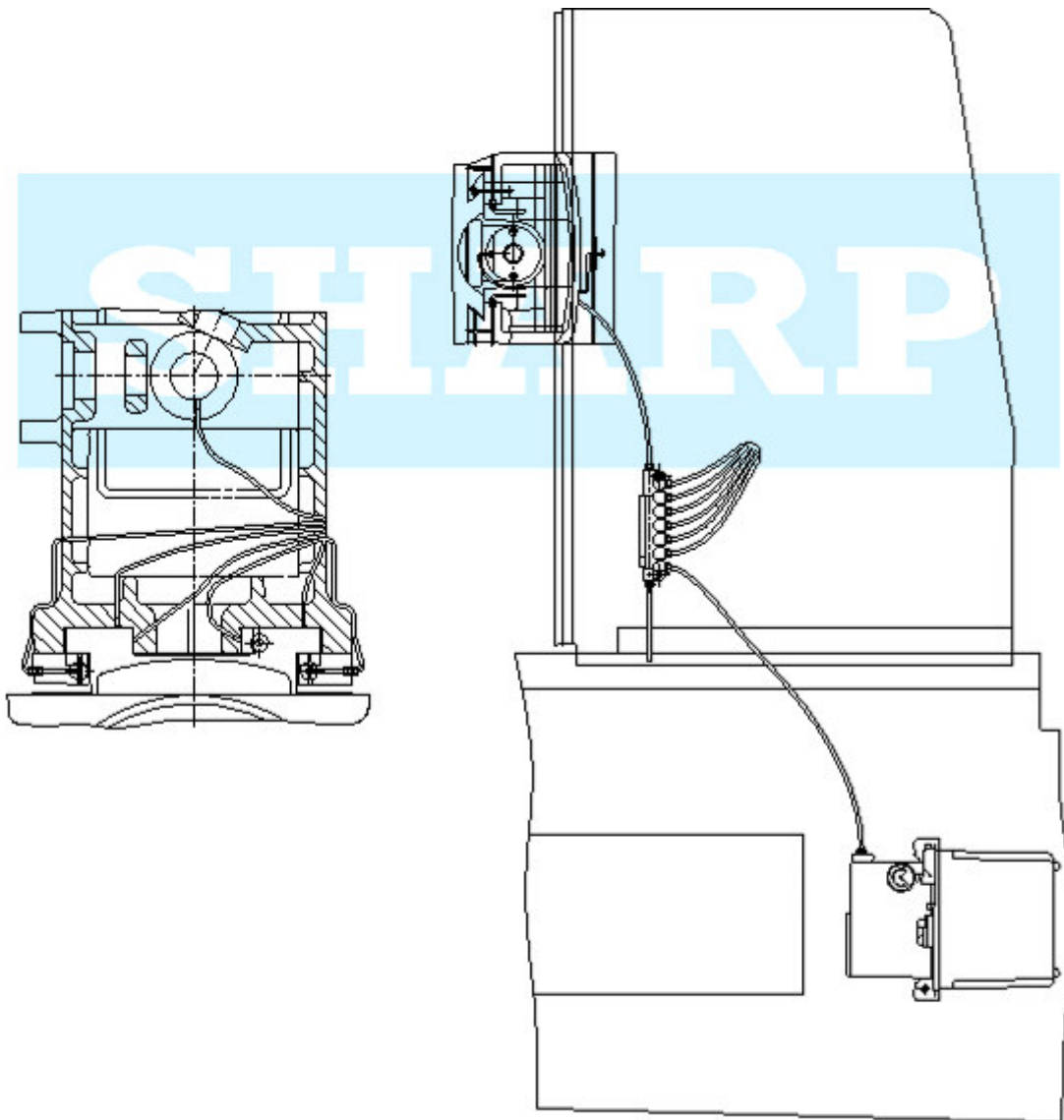
**Ensure to use the recommended fluids as listed in the oil guide table.**

**7.3.2 AUTO CENTRALIZED LUBRICATOR (OPTIONAL)**

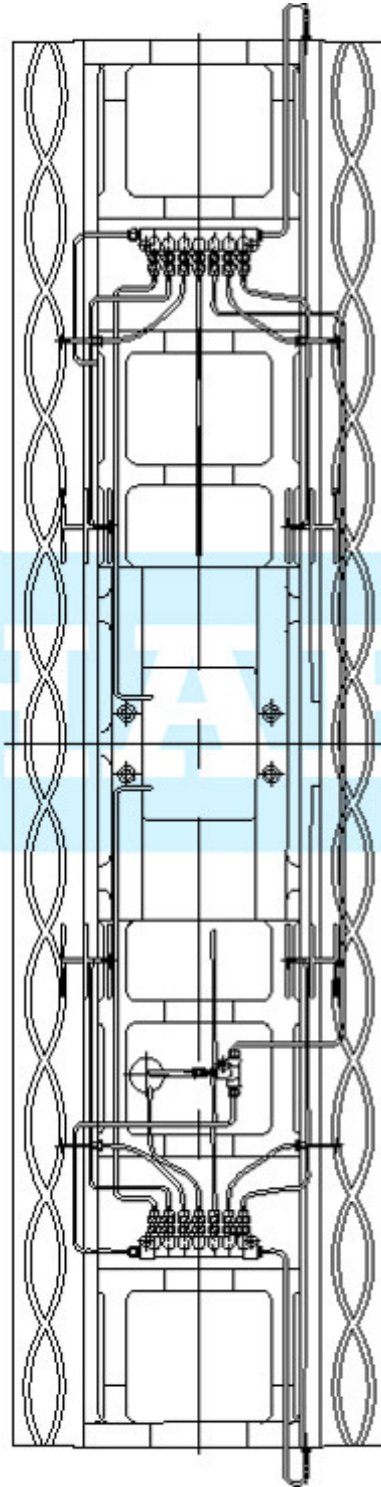
A warning system is designed to notify users of checking and filling up the slideway lubricator. Please fill up the tank immediately when the warning alarm message is shown. The warning alarm will be continuing if the warning status is not released. Ensure to check the centralized lubricator weekly at least, and fill up the tank if necessary. Recommended lubrication oil is listed in the oil guide table 7.3.4.1 and 7.3.4.2.

## 7.4 OIL SYSTEM

### 7.4.1 V-1 OIL SYSTEM



UP-DOWN OIL SYSTEM



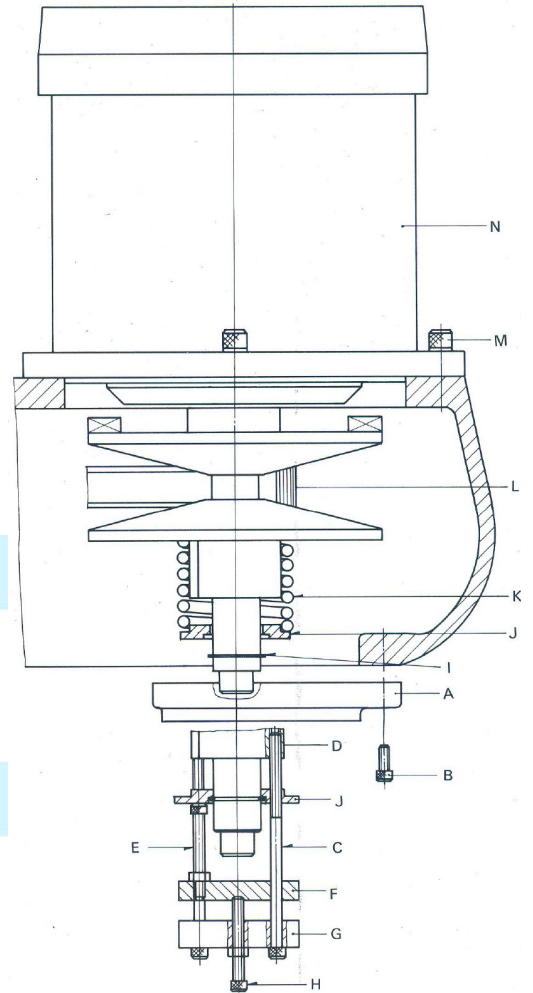
SADDLE OIL SYSTEM

CH7-7

KRDM24C0 V4.0S

## 7.5 MOTOR REMOVAL

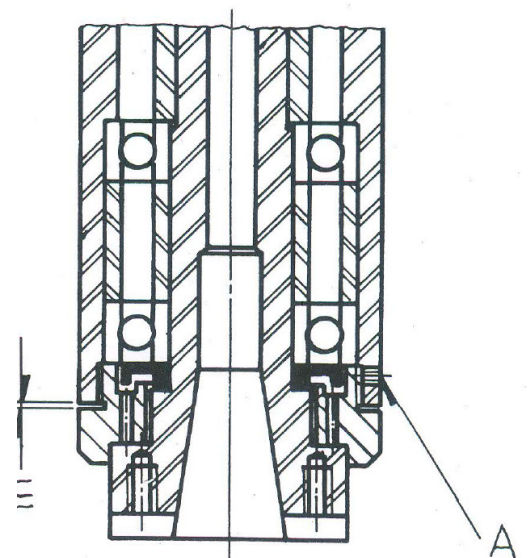
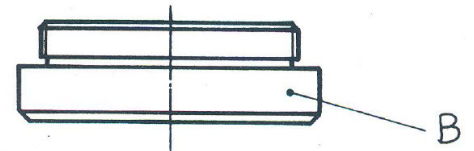
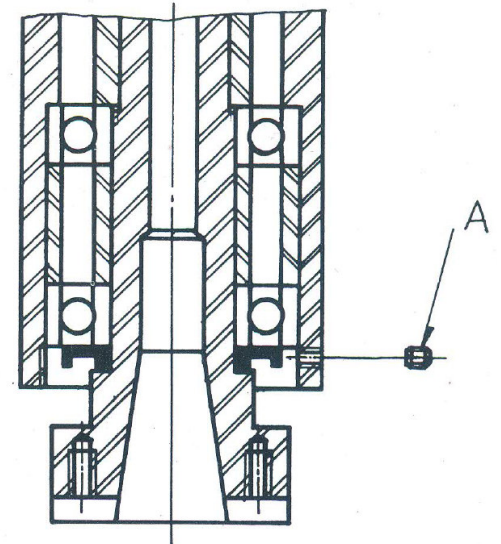
1. Run head to adjust lowest speed.
2. Remove 3 screws 'B' and cover 'A'
3. Make a fixture comprised of 'C' 'E' 'F' 'G' 'H'
4. Tighten 2 belts 'C' on pulley "D" and work with fixture. Rotate 'H' clockwise and move spring 'F' up by 10mm.
5. Remove C-type retaining ring 'I' and fixture.
6. Remove pulley 'D' and 4 screws 'M'
7. Remove motor 'N'



## 7.6 COLLET ALIGNING SCREW REPLACEMENT

### 7.6.1 FOR #30

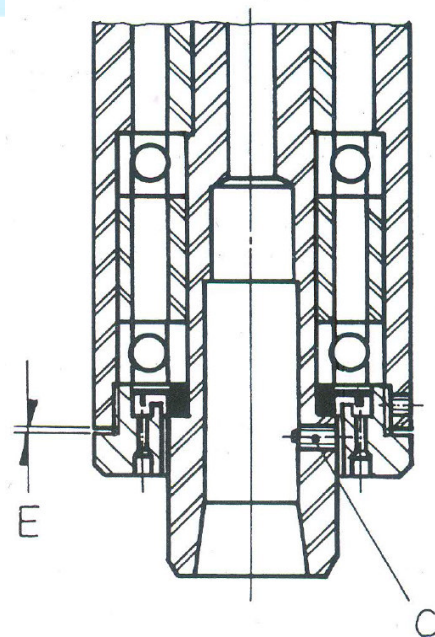
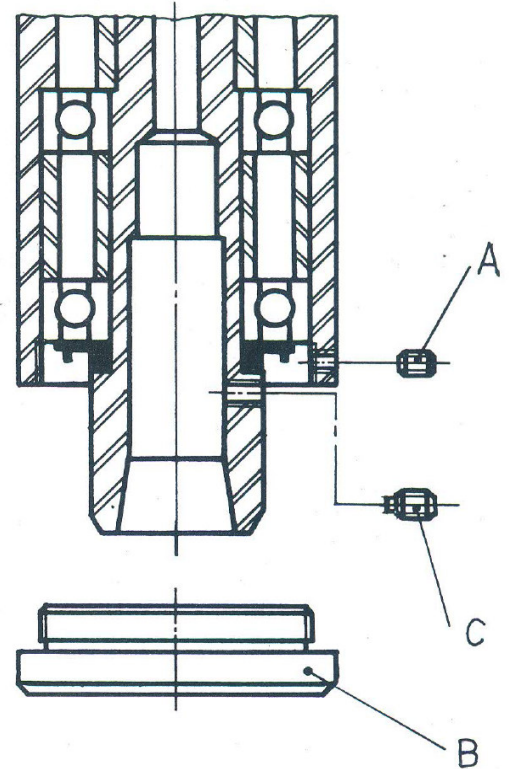
- (1) Use felt pen, mark reference line on quill and nose cap 'B'.
- (2) Remove set screw 'A'.
- (3) Unscrew nose cap 'B'.
- (4) Replace nose cap 'B';  
check felt pen markings for correct alignment.
- (5) Replace set screw 'A'  
Caution do not overtighten as this will cause distortion.
- (6) Check gap 'E'. (.003"=.08mm).





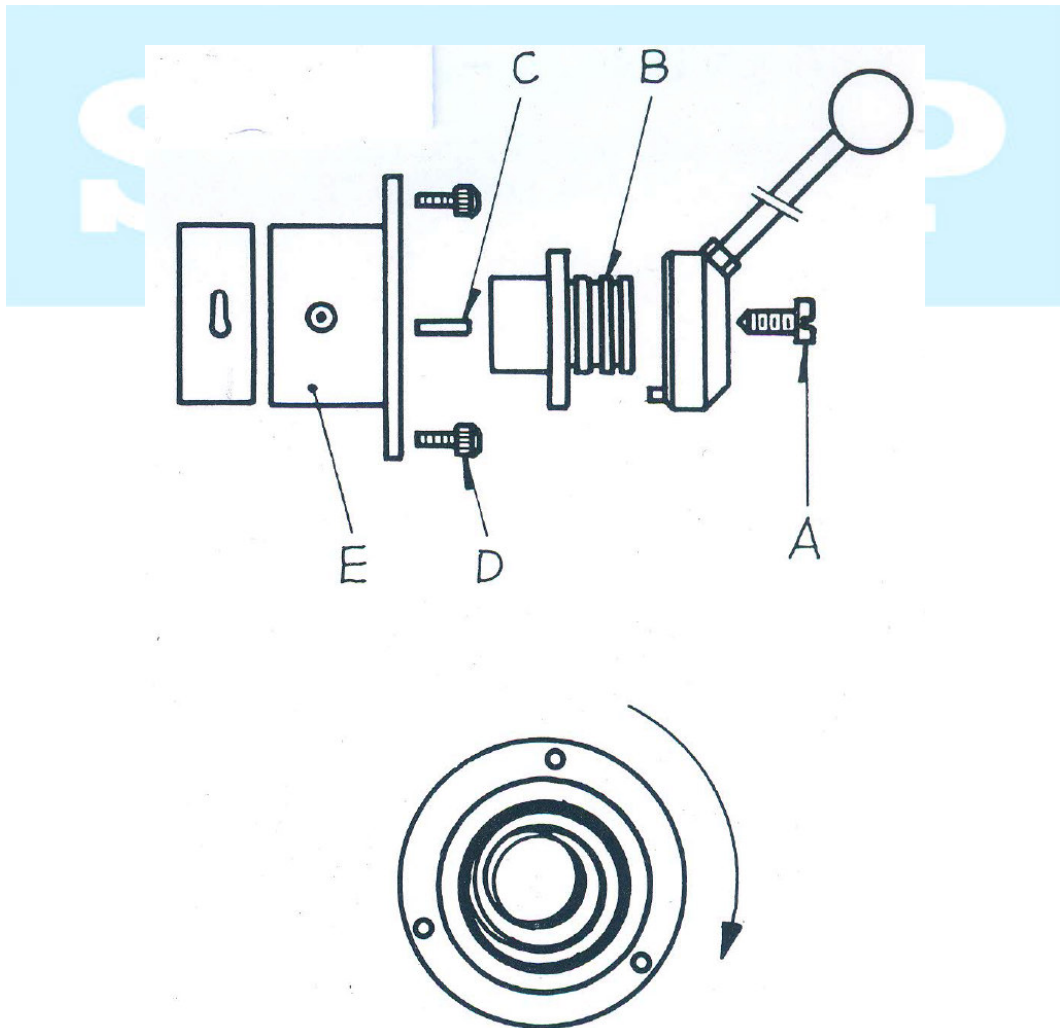
## 7.6.2 FOR R8

- (1) Use felt pen, mark reference line on quill and nose cap 'B'.
- (2) Remove set screw 'A'.
- (3) Unscrew nose cap 'B'.
- (4) Remove lock screw 'C' and collet aligning screw.
- (5) Replace 'C' ; insert R.8 collet and check that the dog on the end of the screw does not foul on the bottom of the guide slot.
- (6) Replace lock screw 'C'.
- (7) Replace nose cap 'B' ; check felt pen markings for correct alignment.
- (8) Replace set screw 'A' ; Caution do not overtighten as this will cause distortion.
- (9) Check gap 'E'.



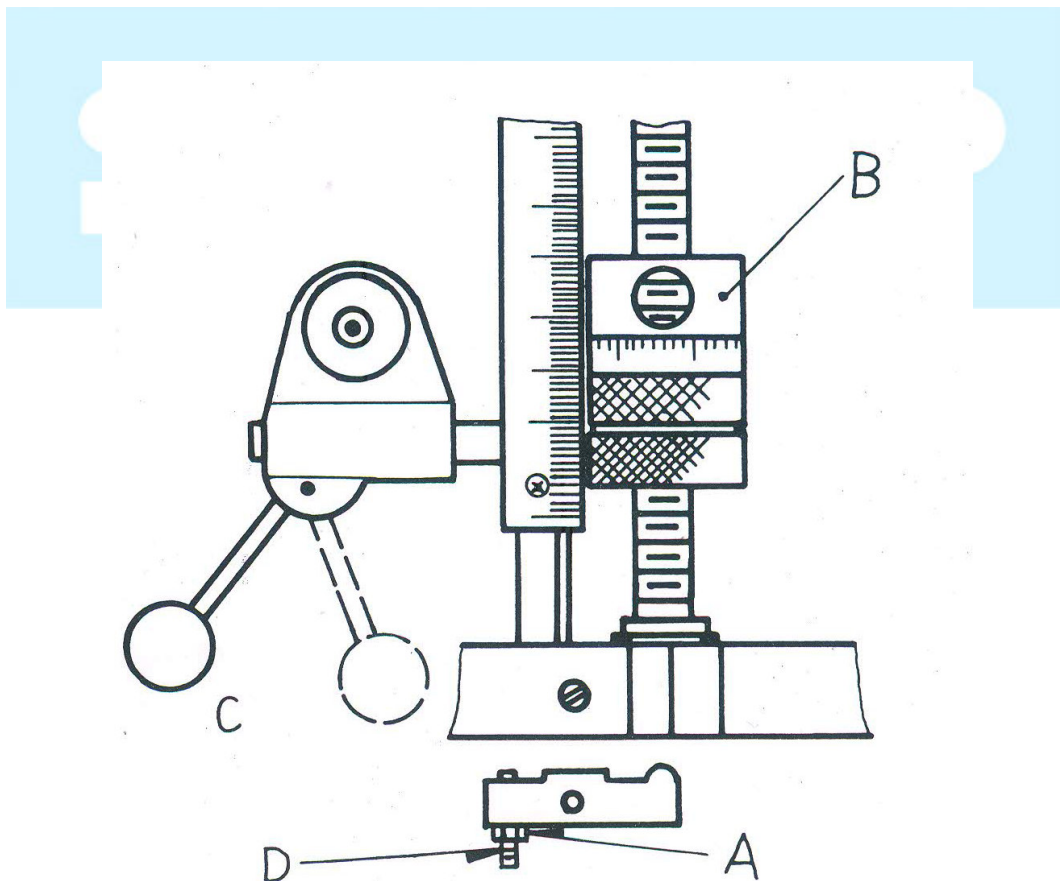
## 7.7 BALANCE SPRING REPLACEMENT

1. With quill at top of movement apply quill lock.
2. Remove screw 'A', hub 'B', and key 'C'.
3. Remove screws 'D', allowing housing to rotate slowly releasing spring tension.
4. Lift end of spring from peg on the pinion shaft.
5. Rotate housing 'E' anti-clockwise from head casting.
6. Remove spring from housing and replace.
7. Refit spring to main housing casting, turning housing clockwise until spring locates no peg in pinion shaft.



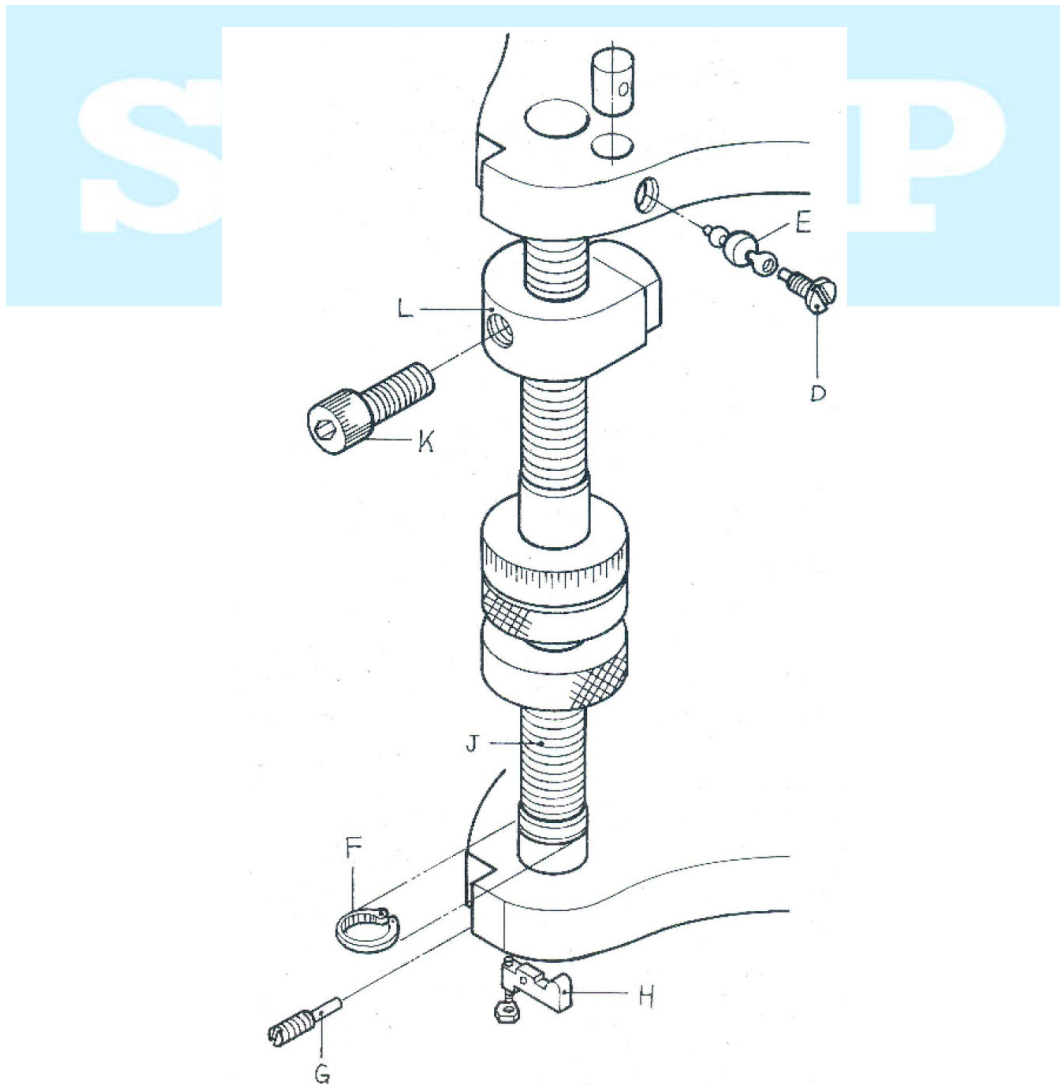
## 7.8 FEED TRIP ADJUSTMENT

1. Release locknut 'A'.
2. Engage trip handle 'C'.
3. Adjust micro nuts against quill stop 'B'.
4. Slowly turn adjusting screw 'D' until lever 'C' trips.
5. At this point secure locknut 'A'.
6. Check that smart trip action is obtained.



## 7.9 QUILL REMOVAL

1. Remove screw 'D' and ball reverse lever 'E'.
2. Remove circlip 'F', screw 'G' and arm 'H'.
3. Thread shaft 'J' through micro nuts and remove.
4. Remove screw 'K' and stop 'L'.
5. Remove quill
6. Clean all areas, oil liberally and reassemble.
7. Check correct operation of feed trip linkage. See instruction on sketch #30.  
Re-assembly of spline alignment. See sketch #31.



## 7.10 THE MACHINE MAINTENANCE

Ensure to turn off the main power switch, the power switch of the machine panel and main power circuit breaker and put **“Under maintenance, Do not touch any power switch”** warning signs on visible spots before starting the maintenance work.

### 7.10.1 NOTICES

1. Only qualified engineers are allowed to maintain or install the electrical equipment.
2. Do not remove or alter any over-traveling limit switch and related mechanical parts without permission.
3. Always use ladders when working in the high place.
4. Ensure all the appliances, such as fuse, cable, etc., are reliable.

### 7.10.2 CLEANING RULE

1. Ensure to clean up the anti-rust treatment with the kerosene or the diesel on the contact surfaces of the moving machine parts. Don't clean up the anti-rust solvent on other places than where mentioned above.
2. Do not clean the machine with organic solvent.
3. Do not use compressed air to remove the dust on the machine, which might damage surfaces among sliding parts.
4. Remove all the anti-moisture substances placed inside the enclosures.
5. Always clean up the working area and machine after the maintenance job is done. Keep the machine and work area neat, clean, dry and orderly.
6. Remove all the garbage and leftover after the maintenance work is done.
7. Always keep the maintenance records and inspection results.
8. Report to our local dealer or us if any abnormal condition was found during maintenance. Do not disassemble the machine by yourself.

## 7.11 PREVENTIVE MAINTENANCE

To keep the machine in good service conditions, please follow the procedures below to maintain the machine.

### 7.11.1 DAILY MAINTENANCE

1. Check to see if the oil quantity in the automatic lubricator is sufficient.
2. Check to see if the cutting fluid quantity in the fluid tank is sufficient.
3. Clean up the machine and working area after finishing the work. Ensure to put a layer of rust-prevent oil on those exposed sliding surfaces.
4. Turn the power source switch off after job is finished.
5. Release the water accumulated in the air filter cap.
6. Remove chips from the machine every day after job is finished.
7. Check the spindle taper bore after finishing the machining. Clean up the spindle taper bore with the spindle taper bore cleaner, as illustrated in the following chapter.
8. Stop the machine immediately and find out sources of the problems if any part of the machine is overheated.
9. Stop the machine immediately and fix the problems before resuming the machine if any electrical part, such as the connector, switch, electrical socket and electrical wire, is out of order.
10. Ensure there is no abnormal noise occurs when the machine is running.

### **7.11.2 WEEKLY MAINTENANCE**

1. Ensure all the pumps work well.
2. Ensure the air power drawbar system (optional ) could be operated normally.

### **7.11.3 MONTHLY MAINTENANCE**

1. Check gibs on the bed and cross slide. If necessary, adjust gibs according to the instructions in “GIB ADJUSTMENT” .
2. Clean the cutting fluid pipes and lubrication oil pipes.
3. Clean up the cutting oil tank, and then fill up the tank with recommended oil.
4. Check ball screws and clean them.
5. Ensure any nuts and screws are locked.

### **7.11.4 HALF-YEARLY MAINTENANCE**

1. Ensure the spindle run out and bearing clearance are within the specified precision's
2. Ensure there are no loose nuts and screws.
3. Ensure all the electrical parts, such as connectors, switches, cables, are in normal service conditions.
4. Check out all the insulation resistors. Ensure to keep a record.
5. Ensure the tool exchanger do not interfere with the spindle.

### **7.11.5 YEARLY MAINTENANCE**

1. Ensure the push buttons and switches on the control panels work properly.
2. Remove all the carbon deposited on the electrical relay points, then clean all the electrical relay points with alcohol liquid.
3. Check if the balance chains are in good service conditions.
4. Clean up the hydraulic system, including the oil tank, and refill the oil tank. Ensure all the setting pressure are normal.
5. Check the machine leveling and adjust if necessary.
6. Check all electric wire connections for looseness.
7. Replace oil of the spindle cooler system, if you have this equipment.

### **7.12 HOW TO ORDER REPLACEMENT PARTS**

1. Quote components part number and description, against each part's illustration for all component parts required.
2. Some parts are standard items, which can generally be purchased locally- e.g. nuts, bolts, screws, washers, etc.
3. Always quote the machine serial number in all parts orders or technical inquiries. This number can be found at the nameplate at the machine bed.



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# CHAPTER 8

**SHARP**  
**APPENDIX**

## 8.1 TROUBLE SHOOTING

### 8.1.1 TABLE A

Problem	Diagnostics	Troubleshooting
MACHINE START FAILURE	<ol style="list-style-type: none"> <li>1. Fuse in control circuit burnt out</li> <li>2. Incorrect power source</li> <li>3. Overload thermal relay tripped</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace</li> <li>2. Correct it</li> <li>3. Reset</li> </ol>
INSUFFICIENT POWER OR MOTOR OVERHEATING	<ol style="list-style-type: none"> <li>1. Less phase running</li> <li>2. Overload cutting</li> <li>3. Poor magnetic contractor</li> </ol>	<ol style="list-style-type: none"> <li>1. Correct</li> <li>2. Reduce load</li> <li>3. Replace</li> </ol>
TOOL CHATTERING	<ol style="list-style-type: none"> <li>1. Workpiece not clamped securely</li> <li>2. Improper tool type or material</li> </ol>	<ol style="list-style-type: none"> <li>1. Clamp it securely</li> <li>2. Use correct tool only</li> </ol>
NO LUBRICANT DELIVERY	<ol style="list-style-type: none"> <li>1. Lubrication pump failed</li> <li>2. Lack of oil</li> <li>3. Filter clogged</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and correct it</li> <li>2. Fill up oil</li> <li>3. Clean it</li> </ol>

## 8.1.2 TABLE B (FOR MILLING)

Problem	Diagnostics	Troubleshooting
Cutter misalignment during rotation	Misalignment in cutter itself	Properly grinding of cutter and cutting edge
	Misalignment while mounting cutter	Reducing clearance between shank and hole
	Bending of shank	Grinding the shank properly, reducing tangential forces, and clearing debris
Vibration during milling	Workpiece moving up while up milling	Using oblique cutting and down milling
	Shank is long and small	Increasing rigidity of shank
	Large backlash of lead screw	Adjusting the backlash
	Workpiece is not clamped well	Clamping workpiece firm ly
	Heavy load in cutting	Reducing spindle speed, cutting depth, and feeding rate
	The frequency of cutting force variation is close to machine natural frequency	Using cutter with less teeth
Loose of End milling cutter	Axial force acts toward the direction away from spindle	Selecting proper oblique and rotational to change the direction of axial force
Deformation of workpiece	Workpiece is not clamped properly	Change clamping style and do not put excessive clamping force during finishing cutting
	Damage on table surface	Smoothing the table surface
	residual stress in workpiece	Annealing workpiece thoroughly
Discontinuity occurred in plain milling	The center of spindle is not perpendicular to table or saddle	Modifying the sliding way and making it to be perpendicular to spindle
	Thermal deformation	Controlling the temperature rising of machine
Actual cutting depth does not match the setting value	Shank deforms while milling	Increasing the rigidity of shank and reducing cutting force
	Workpiece deformed and was not fixed well	Fixing the workpiece properly

### 8.1.3 TABLE C (FOR LUBRICATOR)

Problem	Diagnostics	Troubleshooting
Indication light does not work	Power cable is not connected	Check the power cable
	Indication light fails to work	The repair needs to be done by authorized personnel.
	Incorrect power connection to burn out the inside wiring.	Check if power cable is connected in mistake or incorrect power input.
	Impermissible lubricant to cause the motor burned-down.	Replace with a new motor and revise to the lubricant of suitable viscosity 30~150cSt.
	The broken control board	Replace a new control board. The repair needs to be done by authorized personnel.
Indication light is ON but no lubricant is discharged from the system	Insufficient lubricant	Refill the tank
	Float switch fails to work	Replace with a new float switch. The repair needs to be done by authorized personnel.
	Motor fails to work.	Replace with a new motor. The repair needs to be done by authorized personnel.
	Incorrect input power at low voltage	Ensure the input power
	Oil suction set is blocked.	Clean the suction set
	Impermissible lubricant	Revised to the lubricant of suitable viscosity 30~150cSt.
Leaking at the connection of the pipe and the lubricator	Incorrect installation	The pipe must be inserted into the compression sleeve and at least 1mm over the end of the compression sleeve further into the adapter.
No lubricant discharging when pushing FEED button.	1. Incorrect wiring or input power	Check the wiring diagram and the input power.
	2. Insufficient lubricant (Abnormality Indication light become RED)	Refill the tank
	3. The fuse of the control board is broken (Indication light does not work when the power is connected).	Replace the fuse of the control board
	4. The control board is damaged (If all the checking shows normal, the control board could be broken)	Replace with a new motor. The repair needs to be done by authorized personnel.

Problem	Diagnostics	Troubleshooting
Motor runs but no lubricant is discharged at the lubrication points	Disassemble the pipe connecting with the output bore and check if the lubricant is discharged from the lubricator.	
	If YES, the lubricator is at normal condition.	The piping layout could be plugged or broken. Find out and replace the part of the pipe with problem.
	If NO, the problem is at the lubricator. The causes could be :	
	1. Air in the pipe	Please disassemble the pipe connecting with the output bore and keep the motor running for minutes to discharge the air in the pipe. Assemble again when the lubricant is discharging
	2. Jammed gear pump	The gear pump could be jammed because of dirty lubricant. The repair needs to be done by authorized personnel
3. The motor runs but not in normal condition.	Replace with a new motor. The repair needs to be done by authorized personnel.	

**WARNING !!!**

- (a) Only original iSHAN centralized lubrication systems spare parts are used for iSHAN centralized lubrication systems. It is prohibited for changing to non-original spare parts.
- (b) TURN OFF the power before any checking or maintenance Faults / Fault finding.
- (c) If the lubricator is sent to repair, please ensure the lubricant is completely removed to protect the electronics from remainder of lubricant.



Working on products that have not been disconnected from the power supply can cause serious injury or death to persons. Installation, maintenance, and repair work may only be carried out by qualified experts on products that have been disconnected from the power supply. The supply voltage must be turned off before any product components are open.

## 8.2 ISO METRIC THREAD DATA

O. Dia.	Core Dia.	Pitch	Depth	Flat	Effective	Tapping	Clear
3.0	2.3866	0.5	0.3067	0.0625	2.675	2.5	3.1
4.0	3.1412	0.7	0.4294	0.0875	3.545	3.3	4.1
5.0	4.0184	0.8	0.4908	0.1	4.48	4.2	5.1
6.0	4.7732	1.0	0.6134	0.125	5.35	5.0	6.1
8.0	6.4664	1.25	0.7668	0.15625	7.188	6.8	8.2
10.0	8.1596	1.5	0.9202	0.1875	9.026	8.5	10.2
12.0	9.8530	1.75	1.0735	0.21856	10.836	10.2	12.2
16.0	13.5462	2.0	1.2269	0.25	14.701	14.0	16.25
20.0	16.9328	2.5	1.5336	0.3125	18.376	17.5	20.25
22.0	18.9328	2.5	1.5336	0.3125	20.376	19.5	22.25
24.0	20.3194	3.0	1.8403	0.375	22.051	21.0	24.25
30.0	25.7060	3.5	2.147	0.4375	27.727	26.5	30.5

## 8.3 CUTTING SPEED

The cutting speed of milling cutter can be expressed by

$$v = \pi D n / 1000$$

Where:

V = cutting speed

D = diameter of cutter

n = revolution per minute of the spindle

Cutting speed varies between wide limits which are determined by the material being cut, the material used in the cutter, and other conditions which are determined by the specific operation to be performed. Consider the following whenever they are needed:

- (1.) Reducing cutting speed will increase cutter life.
- (2.) For roughing operations, using lower cutting speed and higher work feed. In finishing operations, higher cutting speed and lower work feed are recommended.
- (3.) Use cutting speed below averaged value in the beginning of a new operation and increase it during the operation.  
Refer to table 1. In the selection of cutting speed.

### 8.3.1 RECOMMENDED CUTTING SPEED

**TABLE 1.**

Workpiece			Cutting speed			
Material		Brinell hardness HB	High speed steel cutter		Sintered carbide tipped cutter	
			m/min	ft/min	m/min	ft/min
Special alloy steel	hard tough annealed	300-400	13-15	28-45	30-50	90-150
		220-300	15-23	45-70	50-75	150-225
		180-220	23-35	70-110	75-108	225-325
Low carbon steel	ductile free cutting	152-197	28-46	35-140	90-130	270-400
		150-180	35-46	110-140	108-130	325-400
Cast iron	hard medium soft	220-300	15-23	45-70	50-75	150-225
		180-220	23-33	70-100	75-108	225-325
		150-180	35-46	110-140	108-130	325-400
Brasses and bronzes	hard medium free cutting	150-250	21-46	64-140	63-130	190-400
		100-150	46-83	140-250	130-200	400-600
		80-100	83-116	250-350	200-330	600-1000
Magnesium and alloys			116-500	350-1500		
Aluminum and alloys			66-500	200-1500		
Plastics			66-500	200-1500		



## 8.4 CUTTING DEPTH

The following table renders suggested cutting depth of different milling conditions.

Machining type	Cutting depth
finishing	0.3~0.5
medium	0.4~1.4
rough	3~5

## 8.5 FEED SPEED

Feed speed is determined by

$$S = N \times s \times Z$$

Where:

S = table feed speed

N = revolution per minute of cutter

s = feed per tooth

Z = NO. of teeth of cutter

The feed per tooth is used in most cases. Table 2 gives suggested values of different types of milling cutters and kinds of work material in general conditions.

## 8.5.1 RECOMMENDED FEED PER TOOTH FOR CUTTERS

TABLE 2.

Cutter	Workpiece			Feed per tooth (mm)					
	Material		Brinell Hardness HB	Face mills	Helical mills	Slotting and side mills	End mills	Form relieved cutters	Circular saws
High speed steel	Special alloys	hard	300-400	0.1	0.075	0.075	0.05	0.05	0.025
		tough	220-300	0.13	0.125	0.1	0.075	0.05	0.05
		annealed	180-220	0.2	0.175	0.125	0.1	0.025	0.05
	Low carbon steel	ductile free cutting	152-197	0.25	0.2	0.13	0.125	0.075	0.075
			150-180	0.3	0.25	0.175	0.13	0.1	0.035
	Cast iron	hard medium soft	200-300	0.27	0.2	0.13	0.13	0.1	0.075
			150-250	0.325	0.25	0.175	0.175	0.1	0.075
150-180			0.4	0.325	0.225	0.2	0.125	0.1	
Brasses and bronzes	hard medium free cutting	150-250	0.225	0.225	0.13	0.125	0.075	0.05	
		100-150	0.35	0.35	0.2	0.175	0.1	0.075	
		80-100	0.55	0.55	0.325	0.27	0.175	0.125	
Magnesium and alloys			0.55	0.45	0.325	0.27	0.175	0.125	
Aluminum and alloys			0.55	0.45	0.325	0.27	0.175	0.125	
Plastics			0.375	0.3	0.225	0.175	0.125	0.1	
Sintered carbide	Special alloys	hard	300-400	0.25	0.2	0.13	0.125	0.075	0.075
		tough	220-300	0.3	0.25	0.175	0.13	0.1	0.075
		annealed	180-220	0.35	0.27	0.2	0.175	0.1	0.1
	Low carbon steel	ductile free cutting	152-197	0.35	0.27	0.2	0.175	0.1	0.1
			150-180	0.4	0.325	0.225	0.2	0.125	0.1
	Cast iron	hard medium soft	220-300	0.3	0.25	0.175	0.13	0.1	0.075
			180-220	0.4	0.325	0.25	0.2	0.125	0.1
0150-18			0.5	0.4	0.3	0.25	0.13	0.125	
Brasses and bronzes	hard medium free cutting	150-250	0.25	0.2	0.13	0.125	0.075	0.075	
		160-150	0.3	0.25	0.175	0.13	0.1	0.057	
		30-100	0.5	0.4	0.3	0.25	0.13	0.125	
Magnesium and alloys			0.5	0.4	0.3	0.25	0.13	0.125	
Aluminum and alloys			0.5	0.3	0.3	0.25	0.13	0.125	
Plastics			0.572	0.3	0.225	0.175	0.125	0.1	

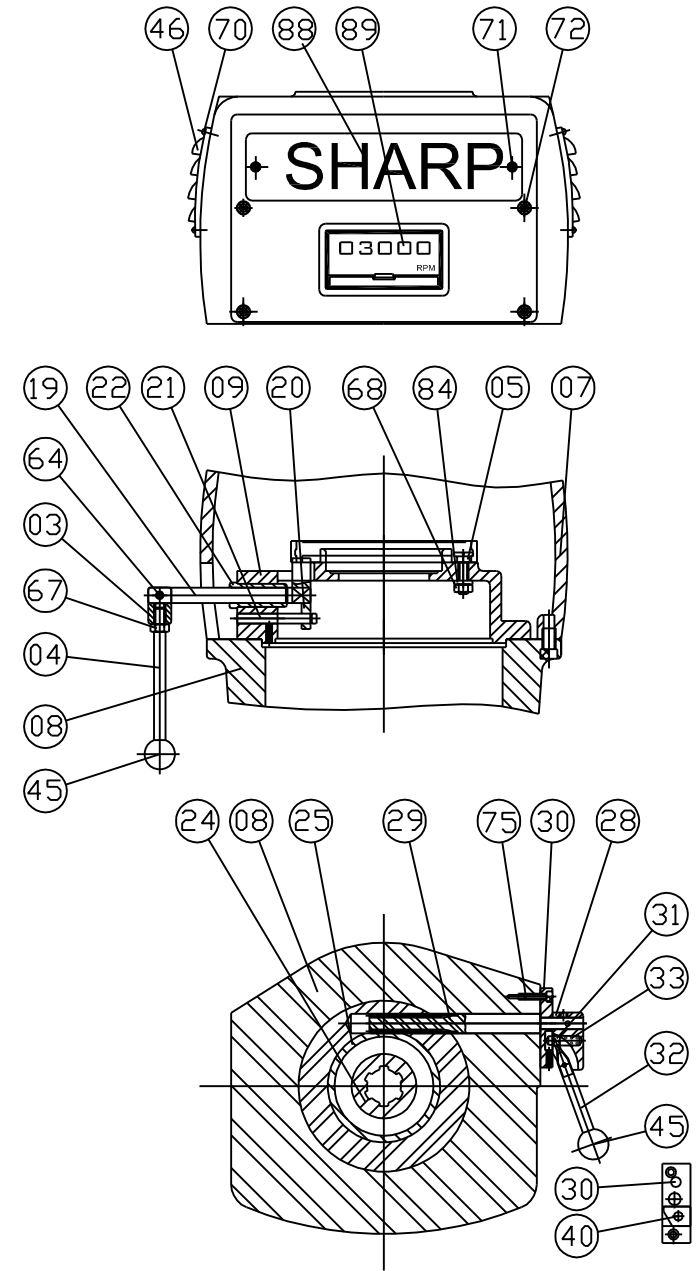
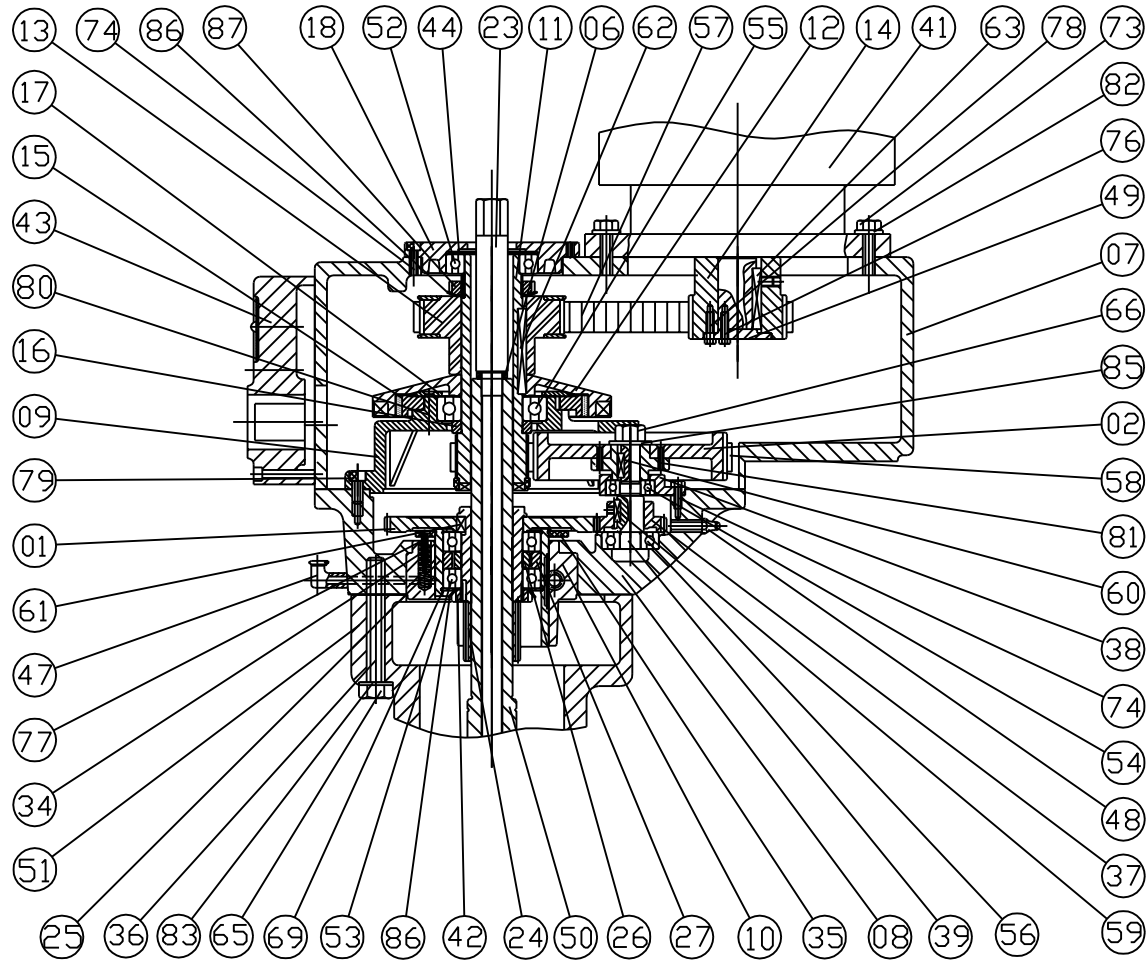
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# CHAPTER 9

**SHARP**  
**PARTS LIST**

# A1. INVERTER HEAD DRAWING



**ANNEX A. PART DRAWING PARTS NAME & NUMBER**

No	Part Number	Description	Q'ty	Remarks
1	210-3	GEAR	1	
2	213-3	TIMING BELT PULLEY	1	
3	231	BRAKE LOCK HANDLE	1	
4	231-1	BOLT FOR BAKE LOCK HANDLE	1	
5	232	BOLT	1	
6	467-3	DRAWBAR WASHER	1	
7	701-7	ALUMINUM CASE	1	
8	702-3	GEAR BOX	1	
9	703-7	MAIN SPINDLE FIXED PULLEY	1	
10	704-3	SUPPORT PLATE	1	
11	706-7	PULLEY SHAFT CLUTCH	1	
12	707-7B	MAIN SPINDLE FIXED PULLEY	1	
13	708-7C	MAIN SPINDLE SLIDING PULLEY	1	
14	709-7A	MOTOR SLIDING PULLEY	1	
15	715-3	SPINDLE BRAKE	1	
16	721-7	WASHER	1	
17	723-7A	BEARING COVER	1	
18	725-3	TOP COVER	1	
19	726-3	BRAKE SHAFT	1	
20	727-7	BRAKE CAMS	2	
21	729	BRAKE SUPPORTER	1	
22	731-3	BRAKE SHAFT SLEVE	1	
23	732-3	DRAWBAR	1	
24	740-3	THREE-ADMISSION CLUTCH	1	
25	741-3	SLIDING BEARING BOX	1	
26	742-3	SPACER(SMALL)	1	
27	743-3	SPACER(LARGE)	1	
28	744	HIGH-LOW SPEED HUB	1	
29	745-3	TOOTH CHANGE SHAFT	1	
30	746	ROTATION PLATE	1	
31	747	LOCKING NOZZLE	1	
32	748	HIGH-LOW SPEED LEVER	1	
33	749	SPRING	1	
34	750	SPRING	3	
35	752-3	DRIVE RING	1	
36	753-3	BOLD	3	
37	755	DRIVE RING	1	
38	757	BEARING COVER	1	
39	758-3	GEAR SHAFT	1	

## ANNEX A. PART DRAWING PARTS NAME &amp; NUMBER

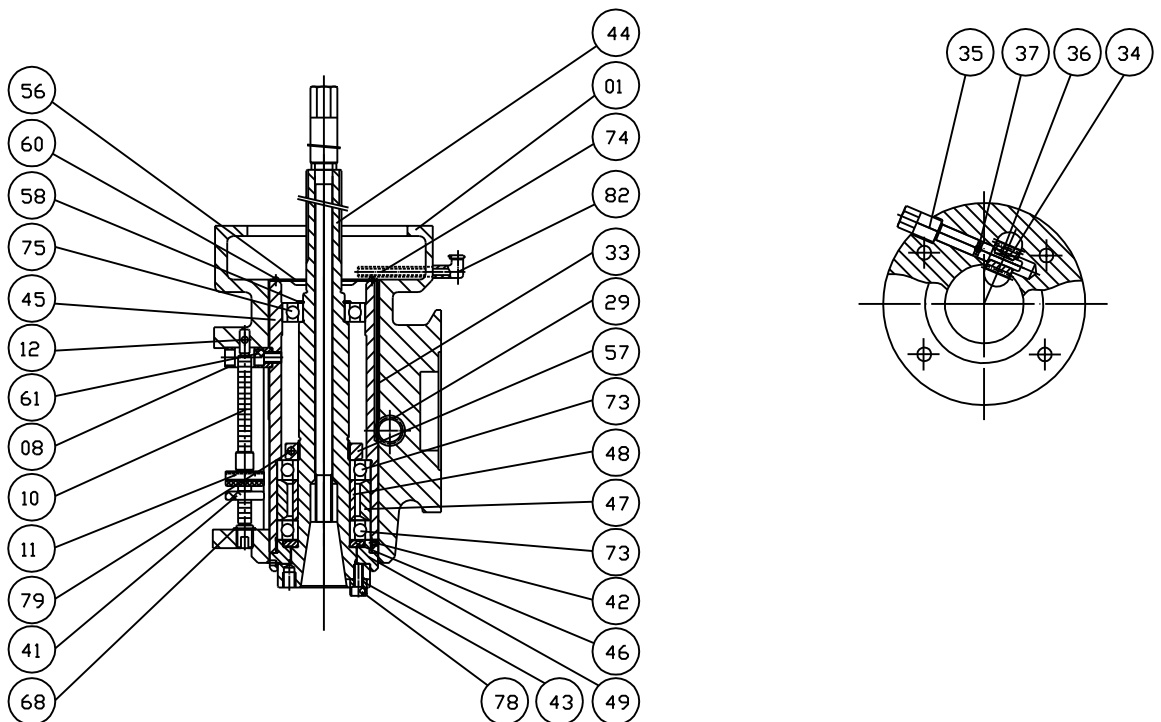
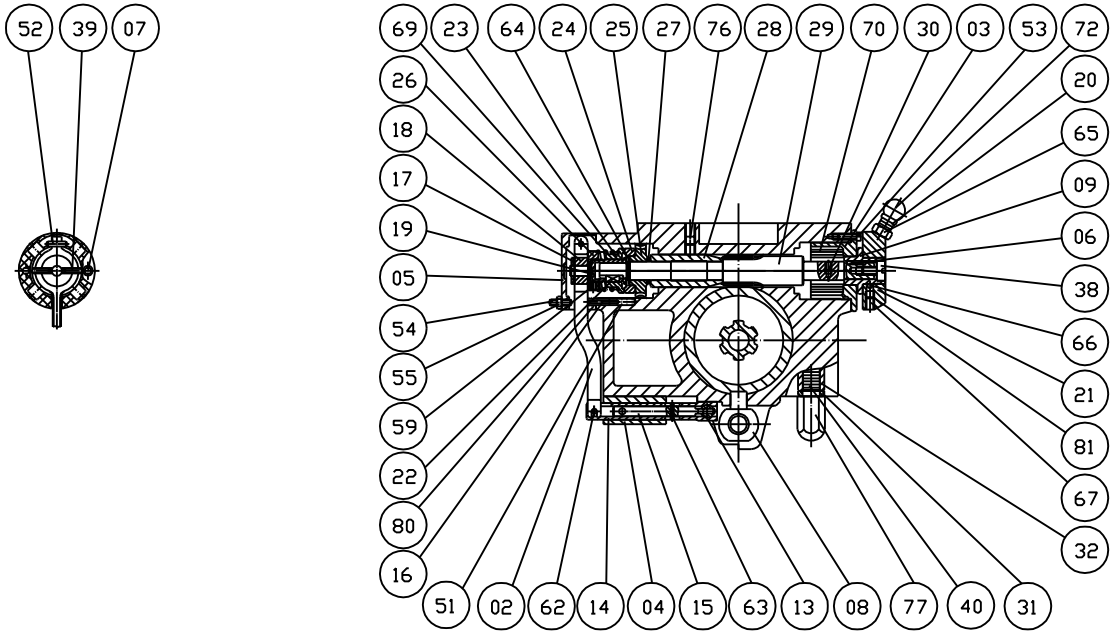
No	Part Number	Description	Q'ty	Remarks
40	759	LOCKING SHAFT	1	
41	760-7	MAIN MOTOR 5Hp	1	
42	764-3	LOCKING NUT	1	
43	770-7C	SPEED CHANGE BOX	1	
44	836-3	WAVE WASHER	1	
45	880	PLASTIC BALL	1	
46	893-7	COVER	4	
47	897	OIL CUP	1	
48	898	OIL NOZZIE	1	
49	760-5A	FIXED COVER	1	
50	HB-127-3	SPINDLE	1	
51	HB-192-3	QUILL HOUSING	1	
52	AB6009	BEARING:6009ZZ	1	
53	AB6010	BEARING:6010ZZ	2	
54	AB6203	BEARING:6203ZZ	1	
55	AB6210	BEARING:6210ZZ	1	
56	AB6303	BEARING:6303ZZ	1	
57	ABE0300720	BELT:HTD-8M-720-25W	1	
58	ABE0300600	BELT:HTD-8M-600-32	1	
59	AK050518	KEY:5x5x18	1	
60	AK050520	KEY:5x5x20	1	
61	AK080714	KEY:8x7x14	1	
62	AK080780	KEY:8x7x50	1	
63	AK100850	KEY:10x8x50	1	
64	AKP10612	PIN: $\phi$ 6x12L	1	
65	ANII12012	NUT:1/2"-12NC	3	
66	ANI118058	NUT:5/8"-18NF	1	
67	ANI116038	NUT:3/8"-16NC	1	
68	ANI118516	NUT:5/16"-18NC	1	
69	ARS125080	RING:R80x2.5	1	
70	ASI231638	SCREW:3/16"-24NC-3/8"L	16	
71	ASI331612	SCREW:3/16"-24NC-1/2"L	2	
72	ASI31414	SCREW:1/4"-20NC-1/4"L	4	
73	ASI612112	SCREW:1/2"-12NC-1 1/2"L	4	
74	ASI61458	SCREW:1/4"-20NC-5/8"L	6	
75	ASI631612	SCREW:3/16"-24NC-1/2"L	2	
76	ASI63161	SCREW:3/16"-24NC-1"L	3	
77	ASI6316112	SCREW:3/16"-24NC-1 1/2"L	3	
78	ASI631634	SCREW:3/16"-24NC-3/4"L	3	

## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
79	ASI65161	SCREW:5/16"-18NC-1"L	4	
80	ASM305012	SCREW:M5x0.8x12L	4	
81	ASM306020	SCREW:M6x1.0x20L	6	
82	AWIH0112	WASHER: $\phi$ 1/2"	4	
83	AWIS0112	WASHER: $\phi$ 1/2"	3	
84	AWIS01516	WASHER: $\phi$ 5/16"	1	
85	AWIS0158	WASHER: $\phi$ 5/8"	1	
86	AWMF01050	WASHER: $\phi$ 50	2	
87	ANM215050	NUT : M50x1.5	1	
88	786-7	NAME PLATE	1	
89	792-3	SPEED DISK	1	
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## A2. VERTICAL MILLING HEAD DRAWING



**ANNEX A. PART DRAWING PARTS NAME & NUMBER**

No	Part Number	Description	Q'ty	Remarks
1	J-01-3	QUILL HOUSING	1	
2	J-010-3	OVERLOAD CLUTCH TRIP LEVER	1	
3	J-016-3	SPRING COVER	1	
4	J-017	FEED TRIP BRACKET	1	
5	J-018	CLUTCH ARM COVER	1	
6	J-019	KEY	1	
7	J-024	MTCRO SCREW JAM NUT	2	
8	J-036-3	QUILL STOP KNOB	1	
9	M-036	PINION SHAFT HUB SLEEVE	1	
10	J-037	QUILL STOP MICRO SCREW	1	
11	J-038	MICROMETER NUT	1	
12	J-039	REVERSE TRIP BALL LEVER	1	
13	J-045	TRIP PLUNGER	1	
14	J-047-3	CAM ROD SLEEVE ASSEMBLY	1	
15	J-048-3	CAM ROD	1	
16	J-051	SPRING PLUNGER	1	
17	J-052	OVERLOAD CLUTCH WASHER	1	
18	J-053	PINION SHAFT HUB SLEEVE	1	
19	J-054	OVERLOAD CLUTCH SLEEVE	1	
20	J-054-3	PINION SHAFT HUB HANDLE	1	
21	J-055-3	PINION SHAFT HUB	1	
22	J-057	KEY	1	
23	J-058	OVERLOAD CLUTCH	1	
24	J-059	OVERLOAD CLUTCH RING	1	
25	J-060-3	OVERLOAD CLUTCH WORM GEAR	1	
26	F-061	QUILL PINION OVERLOAD	1	
		CLUTCH LOCKNUT		
27	J-061-3	PINION SHAFT WORM GEAR	1	
		SPACER		
28	J-062-3	QUILL PINION SHAFT BUSHING	1	
29	J-063-3	QUILL PINION SHAFT	4	
30	M-089	CLOCK SPRING STUD	1	
31	J-091-3	WASHER	4	
32	J-094-3	SPACER	2	
33	J-128-3	QUILL SKIRT	1	
34	J-140	WORM GEAR	1	
35	J-141-3	WORM SHAFT	1	
36	J-142	KEY	1	
37	J-143	SOCKET SET SCREW	1	

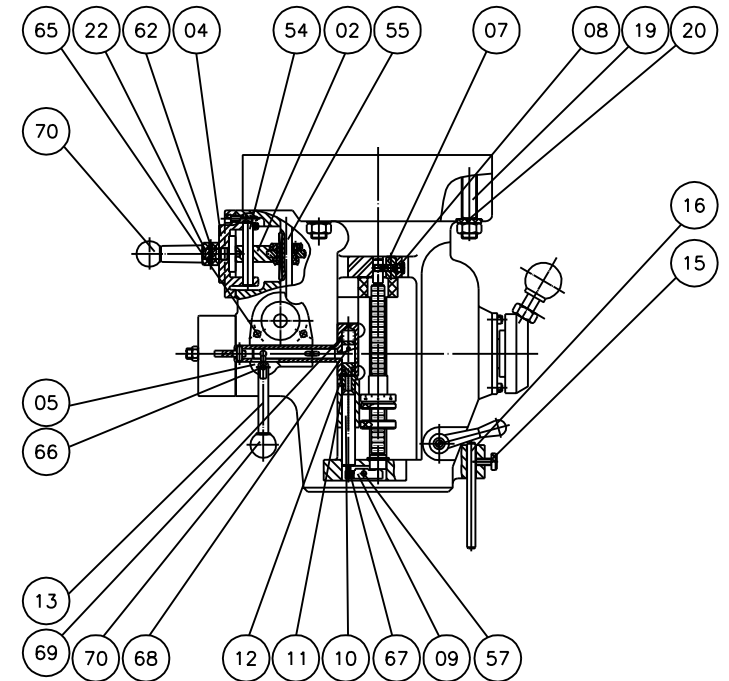
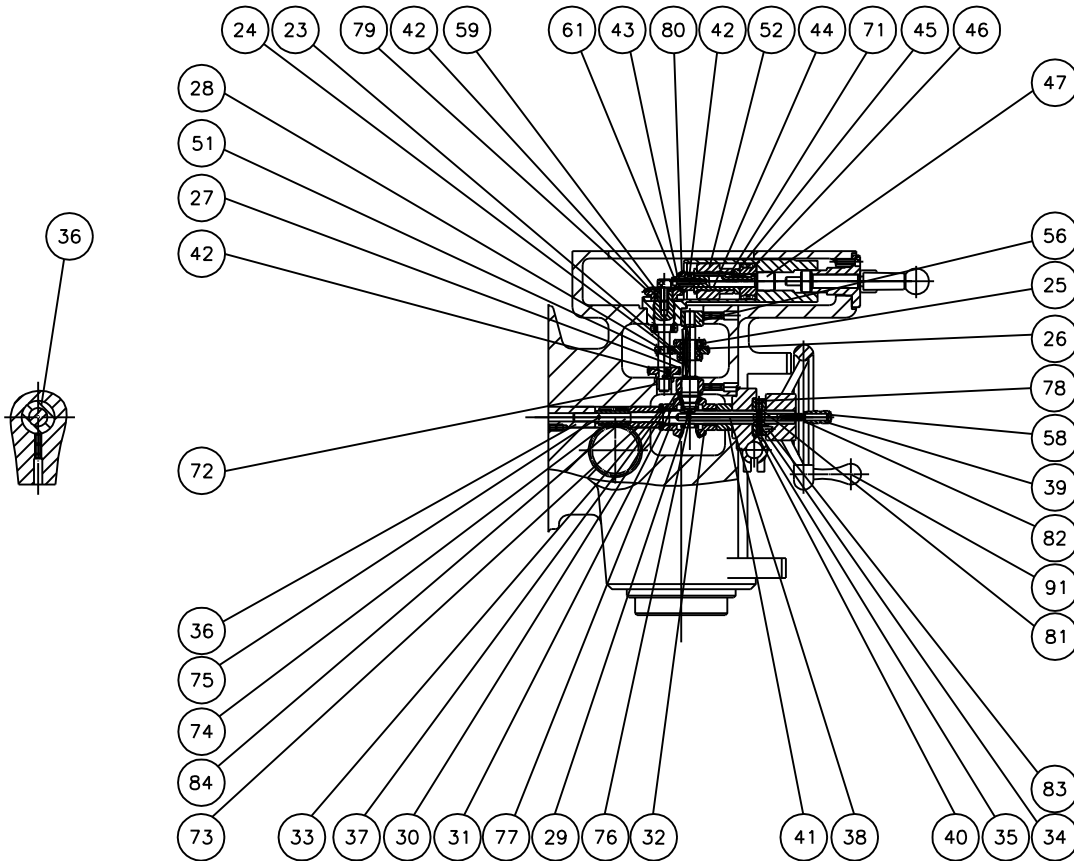
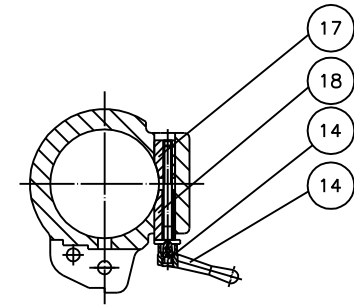
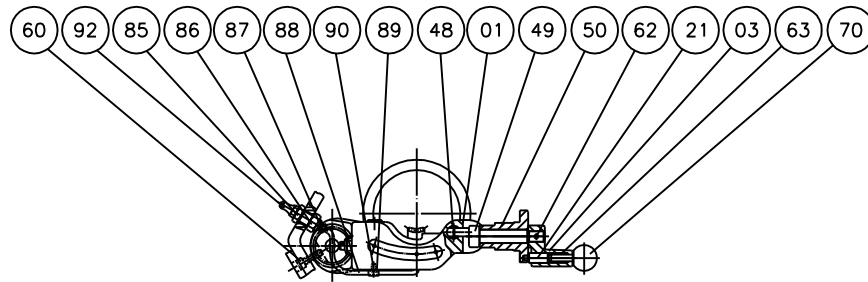
## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
38	J-148	PINION SHAFT HUB SCREW	1	
39	J-154	CLUTCH RING PIN	1	
40	J-155-3	T-BOLT	4	
41	J-157	QUILL MICRO STOP NUT	1	
42	J-163	SET SCREW	1	
43	J-166-B	DRIVING BLOCK	2	
44	J-166-3	SPINDLE	1	
45	J-167	QUILL	1	
46	J-169-3	SPINDLE DIRT SHIELD	1	
47	J-170-3	BEARING SPACER (LARGE)	1	
48	J-171-3	BEARING SPACER (SMALL)	1	
49	J-172-3	NOSEPIECE	1	
50	J-250	SOCKET SET SCREW	1	
51	J-256	COMPRESSION SPRING	1	
52	J-260	DOWEL PIN	1	
53	J-264	CAP SCREW	2	
54	J-268	SOCKET SET SCREW	1	
55	J-269	NUT	1	
56	J-270-3	STELL PLATE	2	
57	J-272-3	LOCK NUT	1	
58	J-273-3	RING	1	
59	J-275	SOCKET SET SCREW	1	
60	J-276-3	SCREW	2	
61	J-278	SCREW	1	
62	J-281	PIN	1	
63	J-282	PIN	1	
64	J-288	SNAP SPRING	1	
65	J-289-3	QUILL HANDLE LOCK NUT	1	
66	J-310	STEEL BALL	1	
67	J-313	SCREW	1	
68	J-319	SNAP RING	1	
69	J-321	SAFETY CLUTCH SPRING	1	
70	J-328-3	CLOCK SPRING	1	
71	J-331	SNAP RING	1	
72	J-333-3	PLASTIC BALL	1	
73	J-346-3	SPINDLE BEARING "FAFNIR" "2MM210WIDUL"	2	
74	J-348-3	OIL GUIDE	1	
75	J-349-3	BEARING 6210ZZ	1	

**ANNEX A. PART DRAWING PARTS NAME & NUMBER**

No	Part Number	Description	Q'ty	Remarks
76	J-350	LOCKSCREW	1	
77	J-355-3	HEX NUT	4	
78	J-356	NUT	2	
79	J-356-5	SET SCREW	1	
80	J-373	SPRING	1	
81	J-330	COMPRESSIVE SPRING	1	
82	897	OIL CUP	1	
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# A2-1. VERTICAL MILLING HEAD DRAWING



H02-5

## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
1	J-09-3	FEED GEAR CRADLE	1	
2	J-011	FEED GEAR SHIFTER FORK	1	
3	J-014	SHIFT CRANK	2	
4	J-015	CLUSTER GEAR BOX	1	
5	J-017	FEED TRIP BRACKET	1	
6	J-021	HANDWHEEL	1	
7	J-040	FEED REVERSE TRIP PLUNGER	1	
8	J-041	SET SCREW	1	
9	J-042	FEED TRIP LEVER	1	
10	J-043	FEED TRIP PLUNGER	1	
11	J-044	TRIP PLUNGER BUSHING	1	
12	J-046	FEED TRIP PLUNGER BUSHING	1	
13	J-049	TRIP HANDLE	1	
14	J-050+J-067	FREE LOCK HANDLE	1	
15	M-051	INDICATOR ROD SCREW	1	
16	M-052	INDICATOR ROD	1	
17	J-065	QUILL LOCK SLEEVE	1	
18	J-066	QUILL LOCK SLEEVE	1	
19	J-070-3	BOLT	3	
20	J-071-3	SPRING WASHER	3	
21	J-097	GEAR SHIFT PLUNGER	2	
22	J-098	CLUSTER GEAR SHIFT CRANK	1	
23	J-099	FEED DRIVE CLUSTER GEAR	1	
24	J-100	FEED DRIVE CLUSTER GEAR	1	
25	J-101	FEED DRIVE CLUSTER GEAR	1	
26	J-102	SET PIN	1	
27	J-103	FEED DRIVE GEAR	1	
28	J-104	DRIVE GEAR SHAFT	1	
29	J-107	KEY	1	
30	J-108	DRIVE SHAFT BUSHING	1	
31	J-109	SPACER	1	
32	J-110	FEED REVERSE BEVEL GEAR	1	
33	J-111	BEVEL GEAR WASHER	1	
34	J-112	FEED REVERSE CLUTCH	1	
35	J-113	SCREW	1	
36	J-114-3	FEED WORM SHAFT BUSHING	1	
37	J-115	FEED FORWARD BEVEL GEAR	1	
38	J-116-3	REVERSE CLUTCH ROD	1	
39	J-117	REVERSE KNOB	1	

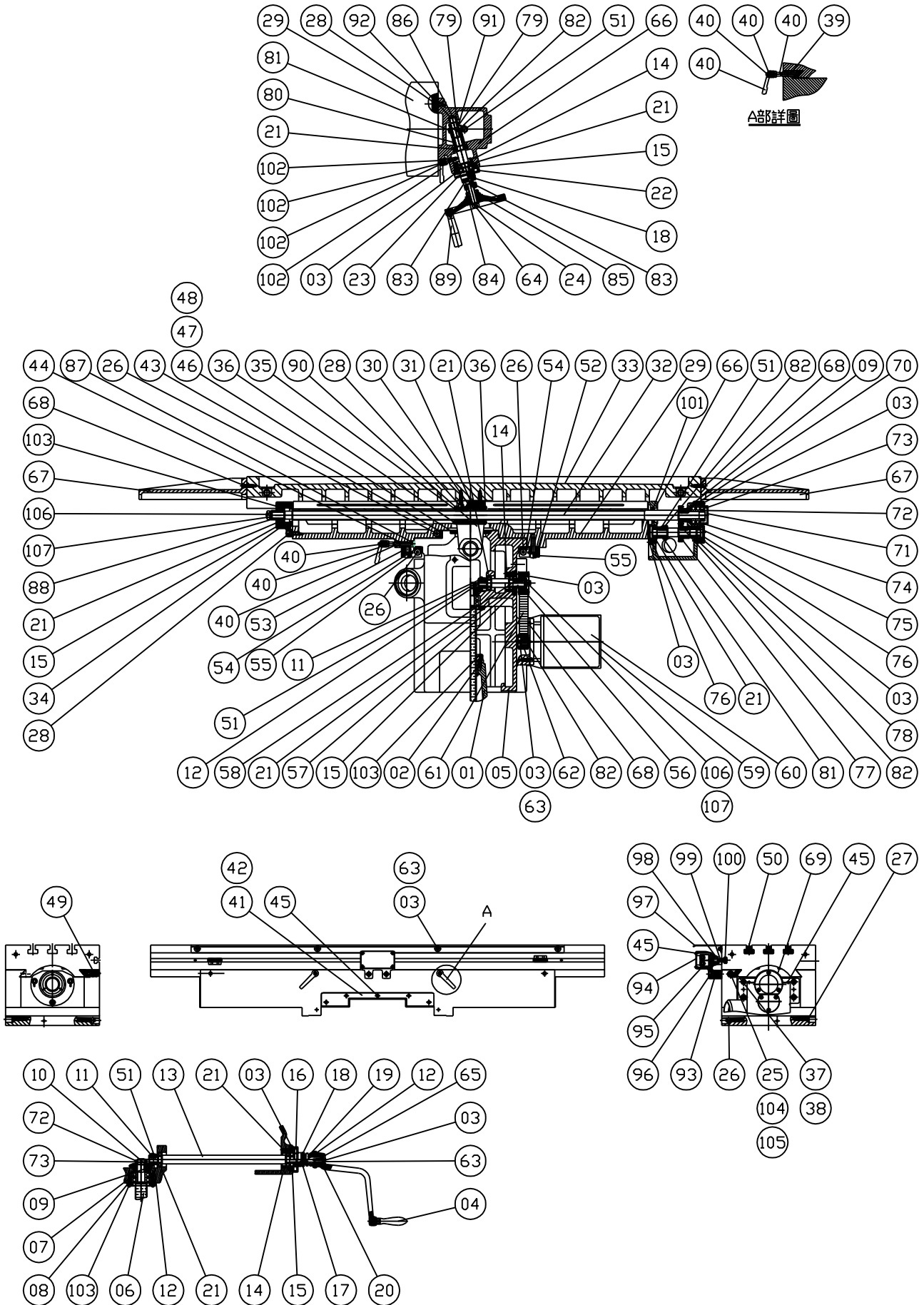
## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
40	J-118	HANDWHEEL CLUTCH	1	
41	J-119-3	HANDWHEEL BUSHING	1	
42	J-122	KEY	1	
43	J-123	BEVEL PINION WASHER	1	
44	J-124-3	FEED WORM GEAR SHAFT SLEEVE	1	
45	J-125	WORM GEAR SPACER	1	
46	J-126-3	FEED DRIVE WORM GEAR	1	
47	J-127-3	FEED DRIVE WORM GEAR SHAFT	1	
48	J-128	FEED ENGAGE PIN	1	
49	J-129-3	WORM GEAR CRADLE THROW OUT	1	
50	J-130-3	SHIFT SLEEVE	1	
51	J-135	CLUSTER GEAR KEY	1	
52	J-136-3	WORM CRADLE BUSHING	1	
53	J-138	PIN	1	
54	J-145	FEED SHIFT ROD	1	
55	J-146	FEED REVERSE BEVEL GEAR PINION	1	
56	J-147	SLEEVE	1	
57	J-151	TRIP LEVEL PIN	1	
58	J-156	FEED REVERSE KNOB STUD	1	
59	J-192	WASHER	1	
60	J-251	SOCKET SET CAP SCREW	1	
61	J-255	R. HEAD SCREW	1	
62	J-261	ROLL PIN	2	
63	J-262	COMPRESSION SPRING	2	
64	J-263	SET SCREW	4	
65	J-265	CAP SCREW	2	
66	J-266	ROLL PIN	1	
67	J-279	SOCKET SET SCREW	1	
68	J-280	ROLL PIN	2	
69	J-283	COMPRESSION SPRING	2	
70	J-284	PLASTIC BALL	3	
71	J-287	KEY	1	
72	J-303	NEEDLE BEARING	1	
73	J-305-3	FEED WORM SHAFT BUSHING	1	
74	J-307	WORM	1	
75	J-308	PIN	2	
76	J-309	PIN	1	
77	J-311	SPACER	2	
78	J-312	SET SCREW	1	





# A3 LEFT-RIGHT DRAWING



## A3 UP-DOWN & LEFT-RIGHT DRAWING

No	Part Number	Description	Q'ty	Remarks
1	H-002-3	ELEVATING HOISING	1	
2	H-003-3	KNEE LEADSCREW NUT	1	
3	H-005	SCREW 1/4"-20NC×3/4"L	24	
4	H-028	KNEE HANDLE	1	
5	H-050-5	KNEE	1	
6	H-051-3	KNEE LEADSCREW	1	
7	H-052	BEARING 6305Z	2	
8	H-053	BEARING COVER	1	
9	H-056	KEY 5×5×20L	2	
10	H-059-6	BEVEL GEAR (LARGE H.)	1	
11	H-060-6	BEVEL GEAR (SMALL H.)	1	
12	H-061	KEY 4×4×18L	3	
13	H-063-3	GEAR SHAFT	1	
14	H-064	BEARING COVER	3	
15	H-065	BEARING COVER	4	
16	H-067	ELEVATING DIAL	1	
17	H-068	DIAL HOLDER	1	
18	H-069	DIAL LOCK NUT	2	
19	H-070	GEAR SHAFT CLUTCH INSERT	1	
20	H-071-3	ELEVATING CRANK	1	
21	H-076	BEARING 6204ZZ	8	
22	H-078	CROSS FEED DIAL	1	
23	H-079	DIAL HOLDER	1	
24	H-081	NUT 1/2"-20NF	1	
25	H-088-3	ADJUSTING SCREW	2	
26	H-088-A	ADJUSTING SCREW	3	
27	H-088-B	ADJUSTING SCREW	2	
28	H-103	SCREW 3/8"-16NC×1 1/4"L	11	
29	H-105-7	SADDLE	2	
30	H-110-6	LONGITUDINAL SCREW BRACKET	1	
31	H-112	LONGITUDINAL LEADSCREW FIXED NUT	1	
32	H-113-6D	LONGITUDINAL SCREW	1	
33	H-114-7	TABLE	1	
34	H-115-6	LONGITUDINAL SUPPORT	1	
35	H-116	LONGITUDINAL LEADSCREW ADJUSTING NUT	1	
36	H-117	SCREW 3/16"-24NC×1"L	4	
37	H-119-7	TABLE GIB	1	
38	H-119-7A	TABLE GIB	1	
39	H-120-3	RAM GIB PLUNGER	1	

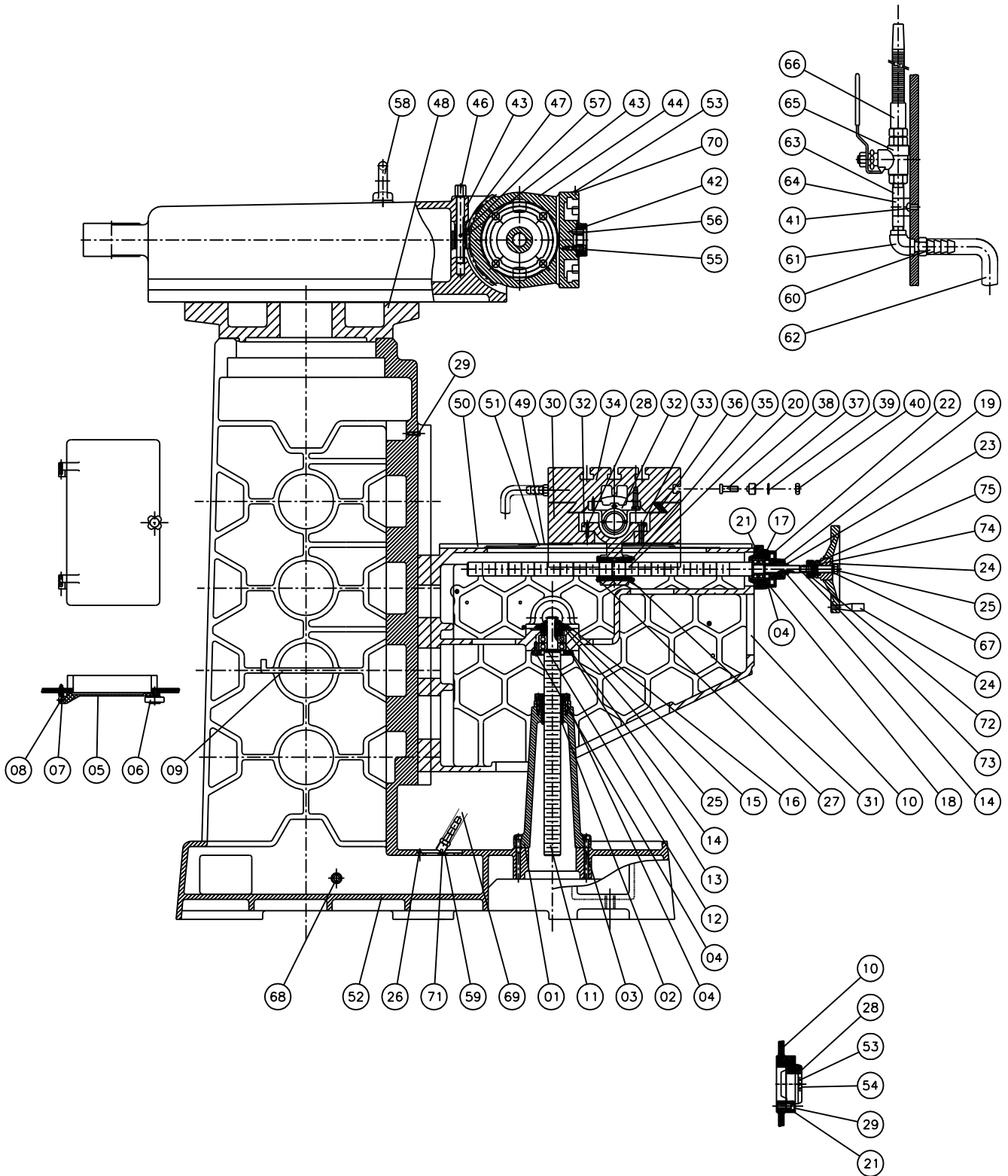
## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
40	H-121+122+422+423	FREE LOCK	2	
41	H-129-3A	ALUMINUM PLATE (2 REQUIRED)	1	
42	H-130-3A	CROSS WIPER (2 REQUIRED)	1	
43	H-131-3	CROSS GIB	1	
44	H-132-6A	CROSS GIB PLUNGER	1	
45	H-136	BUTTON HEAD SCREW 3/16"-24NCx5/8"L	13	
46	H-266-3	CHIP GUARD COVER PLATES (SMALL)	1	
47	H-268-3	CHIP GUARD COVER PLATES (LARGE)	1	
48	H-269-3	CHIP GUARD COVER PLATES (MIDDLE)	1	
49	H-906	SET SCREW	2	
50	H-280	RUBBER PLUNGER	6	
51	H-281	SET SCREW 1/4"-20NCx1/4"L	4	
52	H-402-6	FIXED PLATE (R.)	1	
53	H-403-6	FIXED PLATE (L.)	1	
54	H-404-3	CROSS GIB	2	
55	H-405-3	SCREW 1/2"-12NCx2"L	8	
56	H-408-6	TIMING PULLEY	1	
57	H-409-6	ELEVATING DRIVE SHAFT	1	
58	H-410-3	KEY 5x5x30L	1	
59	H-411-6A	TIMING BELT PROTECTED COVER	1	
60	H-413-6	ELEVATING MOTOR	1	
61	H-414-3	TIMING BELT 225L	1	
62	H-415-6	ELEVATING TIMING PULLEY	1	
63	H-416-3	WASHER 1/4"	6	
64	H-418	SPRING WASHER 1/2"	1	
65	H-420-3	SPRING	1	
66	H-500-8A	LONGITUDINAL SCREW BRACKET	1	
67	H-501	PROTECTED COVER	2	
68	H-502	SCREW 5/16"-18NCx1"L	8	
69	H-503-6	PROTECTED CHIP COVER	1	
70	H-504-6	GEAR	1	
71	H-508	COVER	1	
72	H-509	LOCKING NUT AN05	4	
73	H-510	WASHER AW05	2	
74	H-511	BEARING BS2562	2	
75	H-512	BEARING 6203ZZ	1	
76	H-513-6	COVER	2	
77	H-515-6	GEAR	1	
78	H-515-6A	BUSHING	1	

## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
79	H-518-6	LOCKING NUT	2	
80	H-519-6A	BUSHING	1	
81	H-519-8A	GEAR	2	
82	H-520	KEY 5×5×25L	4	
83	H-521	KEY 3×3×20L	2	
84	H-523-6A	SAFETY CLUTCH	1	
85	H-524-6	COMPRESSION SPRING	1	
86	H-525-6A	LONGITUDINAL FEED DRIVE SHAFT	1	
87	H-527-6	LOCKING BLOCK	1	
88	H-530-6	LOCKING SLEEVE	1	
89	H-531	HANDLE	1	
90	H-532-6A	CROSS SCREW BRACKET	1	
91	H-546	WASHER AW04	1	
92	H-556	BEARING TA1715	1	
93	H-579-7	FIXED HOLDER OF MICRO SWITCH	1	
94	H-579-7A	COVER	1	
95	H-580-7	MICRO SWITCH	1	
96	H-581-7	SCREW 5/16"-18NC×2 1/4"L	2	
97	H-582-7	PROTECTIVE COVER	1	
98	H-583-7	SCREW 3/16"-24NC×3/4"L	4	
99	H-584-6	STOP BLOCK	2	
100	H-586-7	FIXED BLOCK	4	
101	H-587-7	OIL SEAL	1	
102	H-122+422+423+589-7	FREE LOCK HANDLE ASSEMBLY(LONG)	1	
103	H-756	SCREW 1/4"-20NC×7/8"L	9	
104	H-837	WASHER 5/16"	2	
105	H-841	NUT 5/16"-18NC	2	
106	H-859	NUT 5/8"-18NF	2	
107	H-860	SPRING WASHER 5/8"	2	
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# A4 FRONT-REAR DRAWING



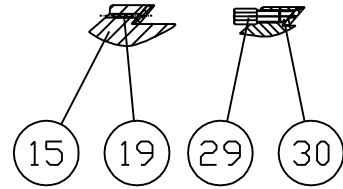
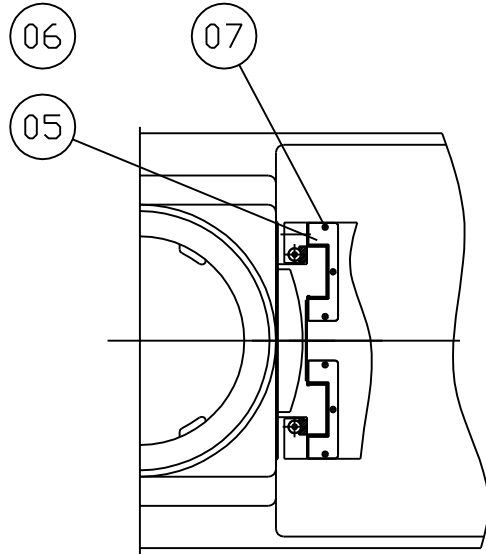
## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
1	H-02-3	ELEVATING HOISING	1	
2	H-03-3	KNEE LEADSCREW NUT	1	
3	H-04	SCREW	2	
4	H-05	SCREW	9	
5	H-06	DOOR	1	
6	H-07	DOOR LOCKER	1	
7	H-08	SCREW	2	
8	H-09	PIN	2	
9	H-012-3	WOODEN SKID	1	
10	H-050-5	KNEE	1	
11	H-051-3	KNEE LEADSCREW	1	
12	H-052	BEARING 6305 ZZ	2	
13	H-053	BEARING COVER	1	
14	H-056	KEY	1	
15	H-510	WASHER AW05	2	
16	H-059-6	BEVEL GEAR (LARGE)	1	
17	H-062	BEARING 6204 Z	2	
18	H-065	BEARING COVER	1	
19	H-069	DIAL LOCK NUT	1	
20	H-075-3	CROSS LEADSCREW	1	
21	H-077	CROSS FEED BEARING BRACKET	1	
22	H-078	CROSS FEED DIAL	1	
23	H-079	DIAL HOLDER	1	
24	H-080-6	BALL CRANK HANDLE	1	Automatic feed
25	H-081	NUT	2	
26	H-098	SCREW	4	
27	H-101	CROSS LEADSCREW FIXED NUT	1	
28	H-102	PIN	4	
29	H-103	SCREW	5	
30	H-105-7	SADDLE	1	
31	H-106	CROSS LEADSCREW ADJUSTING NUT	1	
32	H-110-6	LONGITUDINAL SCREW BARCKET	1	
	H-110-6A	CROSS SCREW BARCKET	1	
33	H-111	SCREW	4	
34	H-114-7	TABLE	1	
35	H-117	SCREW	4	
36	H-119-7	TABLE GIB	2	
37	H-125	TABLE STOP PIECE	2	

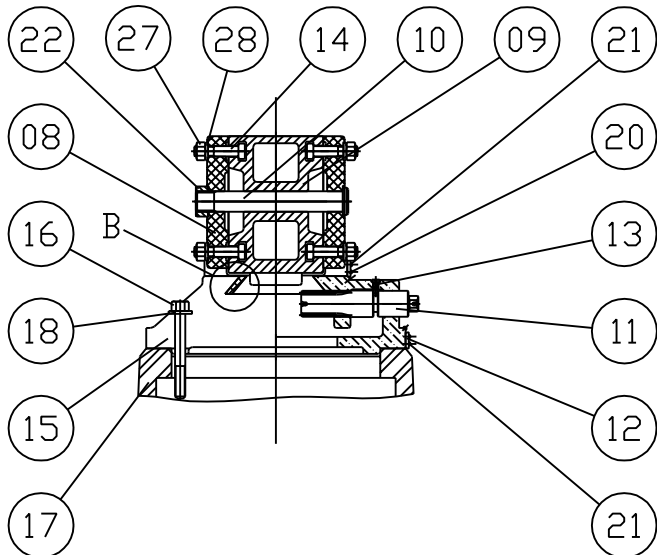
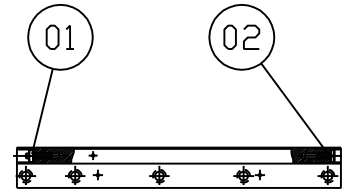
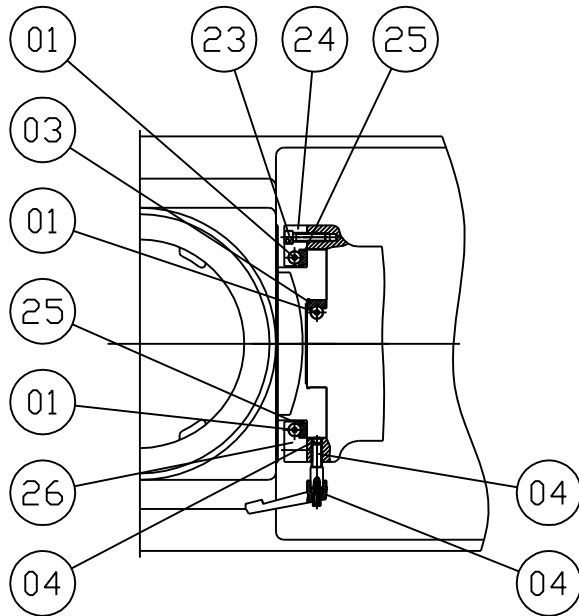
## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
38	H-126	T-BOLT	2	
39	H-127	WASHER	2	
40	H-128	NUT	2	
41	H-136	SCREW	2	
42	H-144	WORM GEAR	1	
43	H-224-6A	RAM	1	
44	H-225-6	RAM ADAPTER	1	
45	H-226	ADJUSTING WORM	1	
46	H-227	ADJUSTUNG WORM SHAFT	1	
47	H-235	WORM KEY	1	
48	H-254-3	TURRET	1	
49	H-266-3	CHIP GUARD COVER PLATES (SMALL)	1	
50	H-268-3	CHIP GUARD COVER PLATES (LARGE)	1	
51	H-269-3	CHIP GUARD COVER PLATES (MIDDLE)	1	
52	H-271-6	MACHINE BODY	1	
53	H-275	RIVET	5	
54	H-279	REFERENCE POINT PLATE	1	
55	H-282	SCREW	2	
56	H-283	PIN	2	
57	H-284	PIN	1	
58	H-285-3	HOISTING RING M33×3.5	1	
59	H-286	OIL NETWORK	2	
60	H-287	COOLANT NOZZLE ADAPTOR	1	
61	H-288	90° TUBE	1	
62	H-289	HOSE	1	
63	H-292-3	PIPE TUBE	1	
64	H-293	CLIPER	1	
65	H-294	VALVE	1	
66	H-295	COOLANT NOZZLE	1	
67	H-418	SPRING WASHER	1	
68	H-431	COOLANT NOZZLE	1	
69	H-432	HOSE	2	
70	H-435-3	ANGLE PLATE	1	
71	H-437	COOLANT NOZZLE ADAPTOR	4	
72	H-080-6A	CLUTCH	1	Automatic feed
73	HT-035-6A	AUTOMATIC SHAFT	1	Automatic feed
74	H-524	COMPRESSION SPRING	1	Automatic feed
75	AK0303010	KEY:3x3x10	1	Automatic feed
76				

# A4-1 UP-DOWN DRAWING



B部詳圖



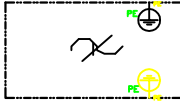

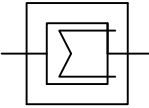

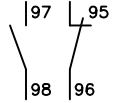
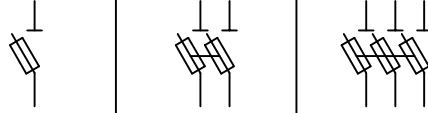




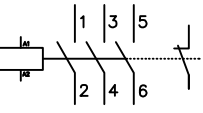




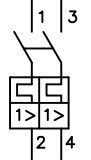

## ANNEX A. PART DRAWING PARTS NAME & NUMBER

No	Part Number	Description	Q'ty	Remarks
1	H-088-A	ADJUSTING SCREW	3	
2	H-088-B	ADJUSTING SCREW	3	
3	H-087-3	ELEVATING GIB	1	
4	H-093-3+H-094-3+H095	ELEVATING LOCK	2	
5	H-097-3B	ALUMINUM PLATE	4	
6	H-099-3B	FELT WIPER	4	
7	H-136	SCREW	12	
8	H-224-6A	RAM	1	
9	H-225-6	RAM ADAPTER	1	
10	H-228-3	ADAPTER PIVOT STUD	1	
11	H-231	RAM PINION	1	
12	H-236-3	ANGLE PLATE	1	
13	H-239	SET SCREW	1	
14	H-240-6	ADAPTER LOCKING BOLT	8	
15	H-254-3	TURRET	1	
16	H-270-6	TURRET CLAMP BOLT	1	
17	H-271-6	MACHINE BODY	1	
18	H-272	WASHER 5/8"	1	
19	H-273	RAM GIB SET SCREW	1	
20	H-274	SCALE	1	
21	H-275	RIVET	8	
22	H-290-3	ADAPTER PIVOT STUD NUT	1	
23	H-405-3	SCREW	10	
24	H-426-3	ELEVATING FIXED PLATE (R.)	1	
25	H-427-3	ELEVATING FIXED PLATE FOR GIB	2	
26	H-428-3	ELEVATING FIXED PLATE (L.)	1	
27	H-859	NUT 5/8"-18NF	8	
28	H-860	SPRING WASHER 5/8"	8	
29	H-904-3	BOLT	2	
30	H-905-3	PLUNGER	2	
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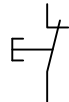
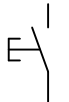

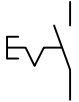




# CHAPTER 10

**SHARP**  
**ELECTRICAL DRAWINGS**

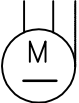
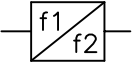
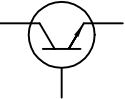

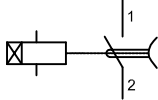

	1	2	3	4	5	6	7		
	LETTER CODE	KIND OF ITEM	EXAMPLES	ITEM DESIGNATION	GRAPHICAL SYMBOLS				
A	A	Filter	Filter	A					
B	E	Miscellaneous	Fan	E					
			Heat exchanger or ventilator	EV					
			Work lamp	EL					
C	H	Signaling devices	Indicator lamp	HL					
D	F	Protective devices	Auxiliary contact	FR					
			Fuse	FU					
E				MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
				CONTROL		1.	V 2.0	01.30,2015	
	TITLE:	SYMBOL	PAGE:	I	DWG NO.	SYMBOL001	2.		
				DRAWER	NICOLE LI	3.			
	1	2	3	4	5	6	7		

1		2		3		4		5		6		7	
A	LETTER CODE	KIND OF ITEM		EXAMPLES		ITEM DESIGNATION		GRAPHICAL SYMBOLS					
	K	Relays, Contactors		Relay		KA							
				Contactor		KM							
	L	Inductors, Reactor		Reactor		L							
	M	Motor				M							
Q	Mechanical switch device for power circuit		Circuit breaker or Nor fuse breaker		Q		  						
E				MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK				
				CONTROL		1.	V 2.0	01.30,2015					
	TITLE:	SYMBOL		PAGE:	II	DWG NO.	SYMBOL002	2.					
						DRAWER	NICOLE LI	3.					

1	2		3	4	5	6	7		
A	LETTER CODE	KIND OF ITEM	EXAMPLES	ITEM DESIGNATION	GRAPHICAL SYMBOLS				
	Q	Mechanical switch device for power circuit	Main power switch	QF					
Circuit breaker (motor breaker)			QM						
B	S	Switching devices for control, Monitoring, Signaling circuit, ETC	Select button (auto-return type)	SA					
			Select button (nor-auto return type)						
C				MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
D				CONTROL		1.	V 2.0	01.30,2015	
E	TITLE:	SYMBOL	PAGE:	III	DWG NO.	SYMBOL003	2.		
					DRAWER	NICOLE LI	3.		

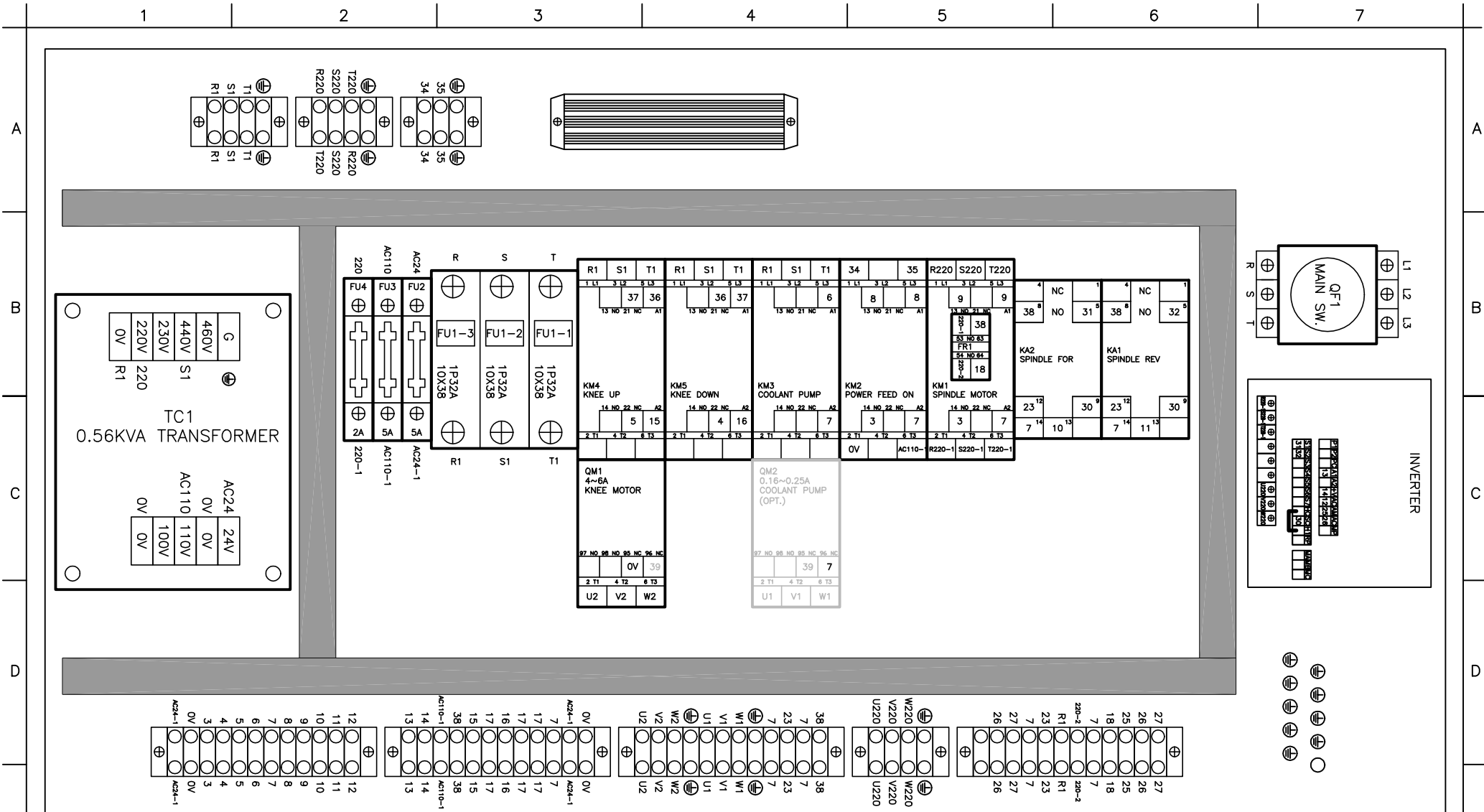
1	2		3	4	5	6	7		
A	LETTER CODE	KIND OF ITEM		EXAMPLES	ITEM DESIGNATION	GRAPHICAL SYMBOLS		A	
B	S	Switching devices for control, Monitoring, Signaling circuit, ETC		E-stop Push button	SB			B	
C				Push button (auto-return type)				C	
D				Push button (nor-auto return type)				D	
E				Key switch				E	
				Position sensor	SC				
				Foot switch	SF				
				Limit switch (O.T/POSITION)	SL				
				MACHINE CONTROL	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
	TITLE:	SYMBOL	PAGE:	IV	DWG NO.	SYMBOL004	1.	V 2.0	01.30,2015
					DRAWER	NICOLE LI	2.		
							3.		



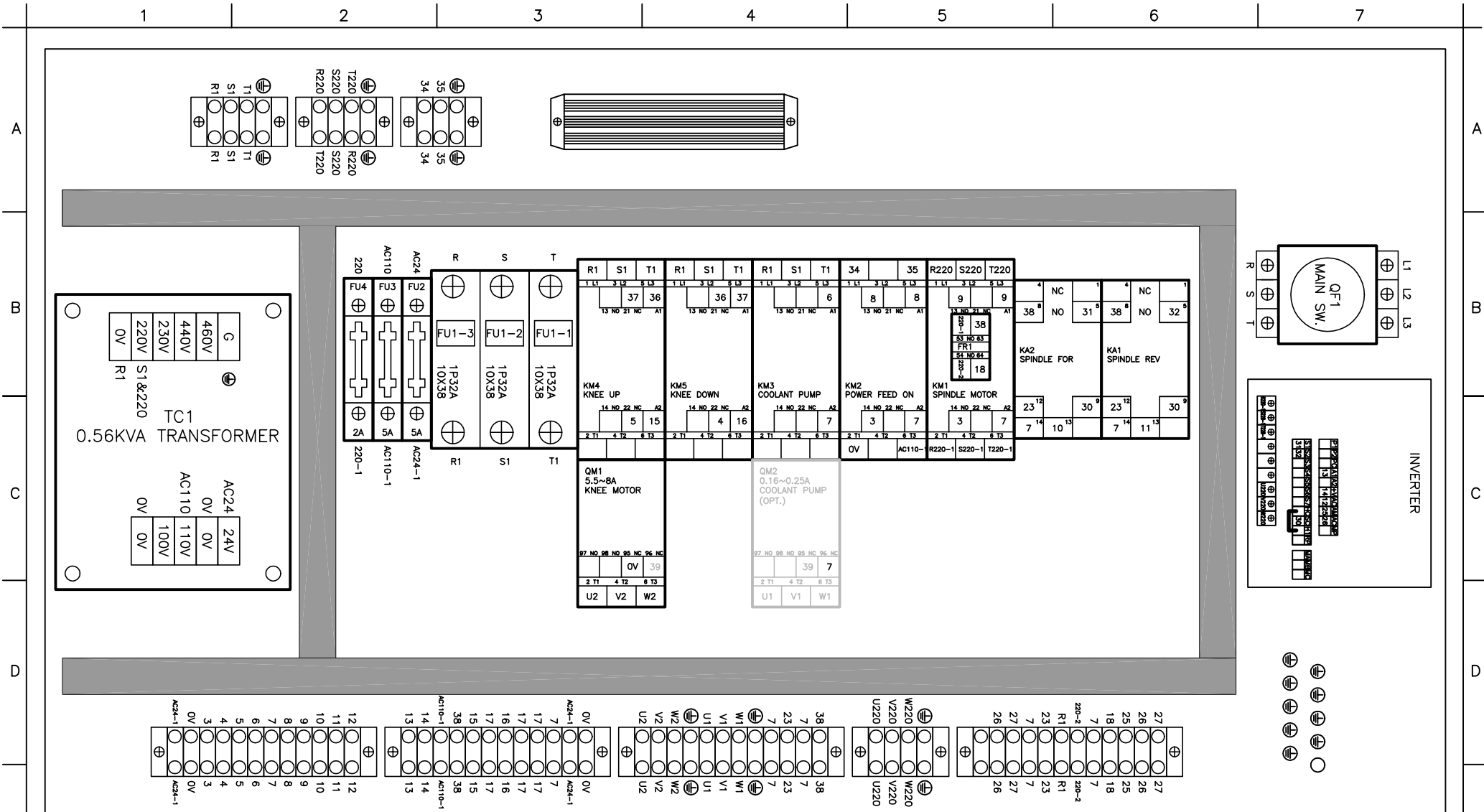
	1	2	3	4	5	6	7
A	 DC Motor	 Frequency changer	 NPN-Transistor	 Spark Killer	 Timer	 Thermal overload relay	
B							
C							
D							

E				MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
				CONTROL		1.	V 2.0	01.30,2015	
	TITLE:	SYMBOL	PAGE:	VI	DWG NO.	SYMBOL006	2.		
				DRAWER	NICOLE LI	3.			
	1	2	3	4	5	6	7		

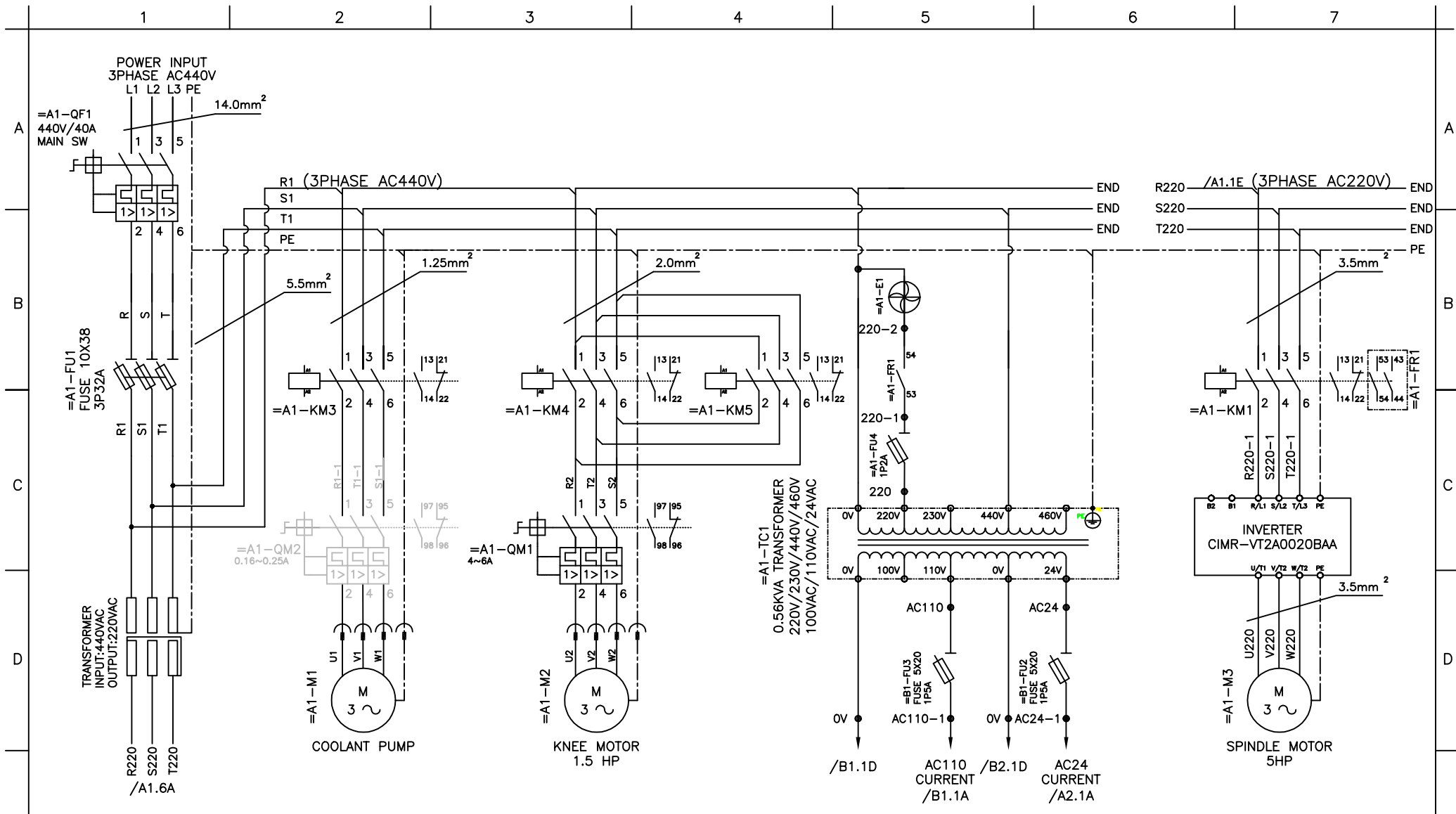




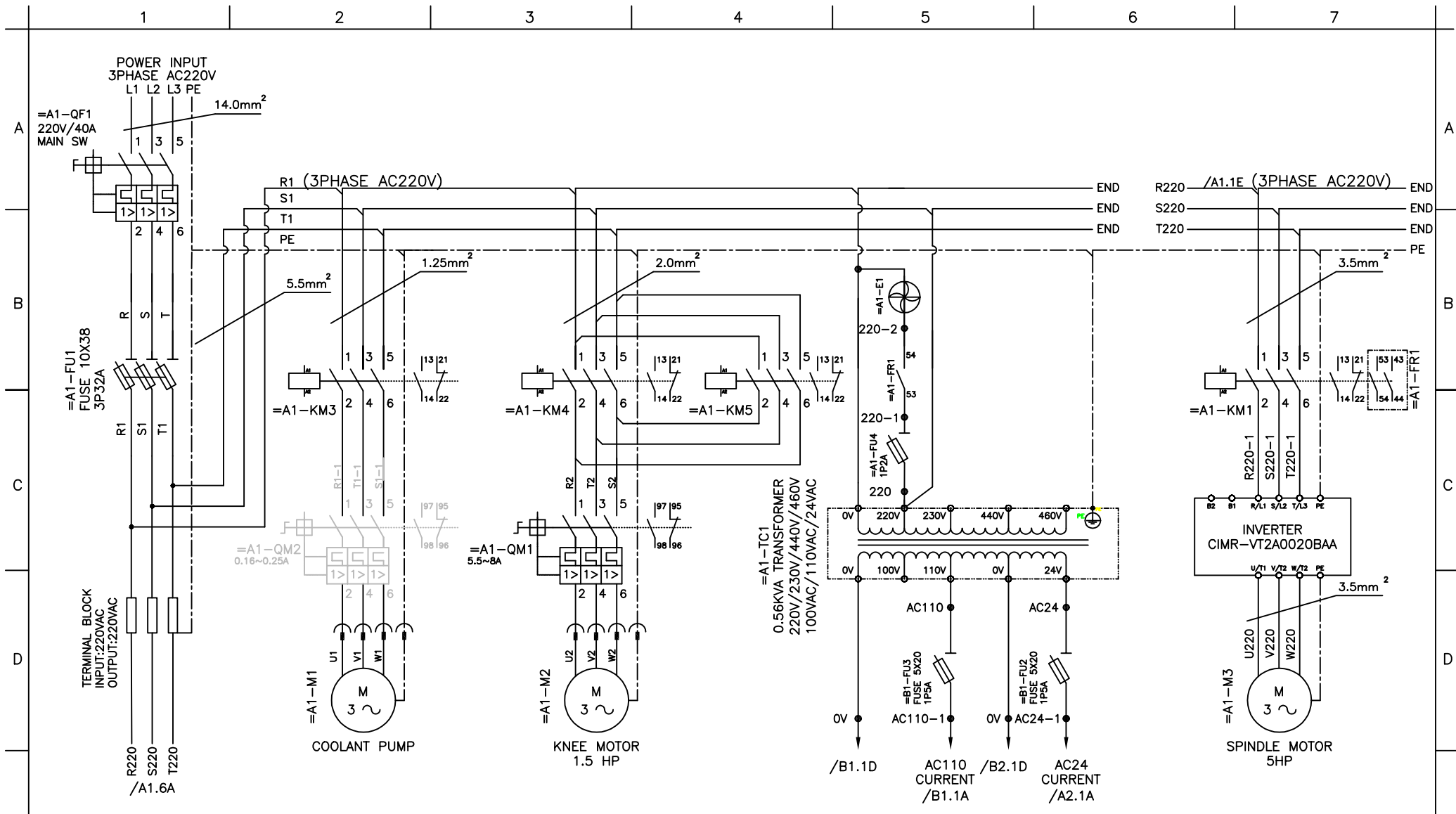
		MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
		CONTROL		1.	V 2.0	01.30,2015	
TITLE:	LAYOUT (FOR I3000SL AC440V)	DWG NO.	MILL0000011	2.	V 3.0S	11.30,2018	
		DRAWER	EVA CHANG	3.			



		MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
		CONTROL		1.	V 2.0	01.30,2015	
TITLE:	LAYOUT (FOR I3000SL AC220V)	DWG NO.	MILL0000012	2.	V 3.0S	11.30,2018	
		DRAWER	EVA CHANG	3.			



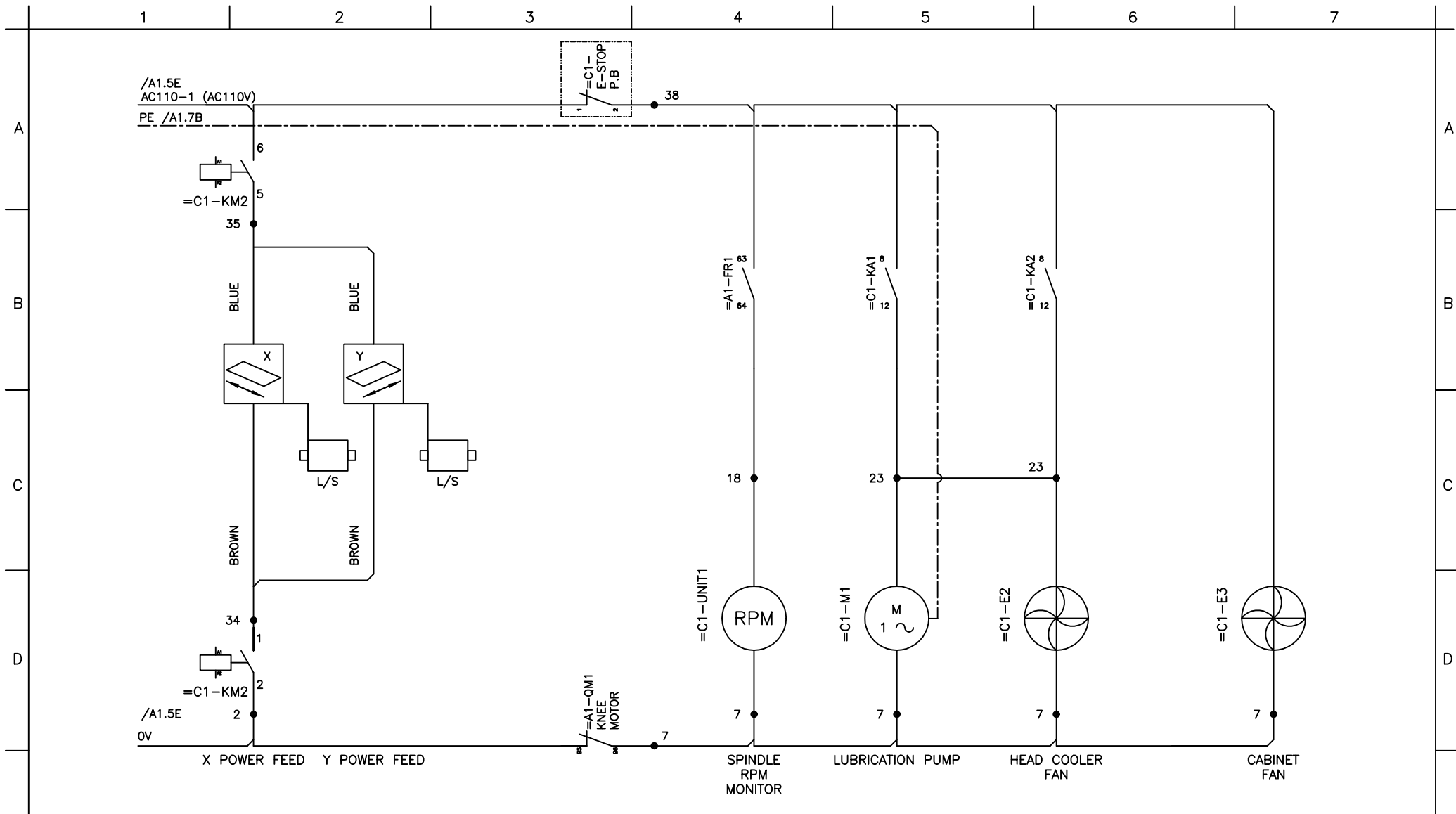
E	MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
	CONTROL		1.	V 2.0	01.30,2015	
	DWG NO.	MILL00A0011	2.	V 3.0S	11.30,2018	
	TITLE:	MAIN CIRCUIT (FOR INPUT POWER 440V)	PAGE:	A / 01		
	DRAWER	EVA CHANG	3.			



MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
CONTROL		1.	V 2.0	01.30,2015	
DWG NO.	MILL00A0012	2.	V 3.0S	11.30,2018	
DRAWER	EVA CHANG	3.			

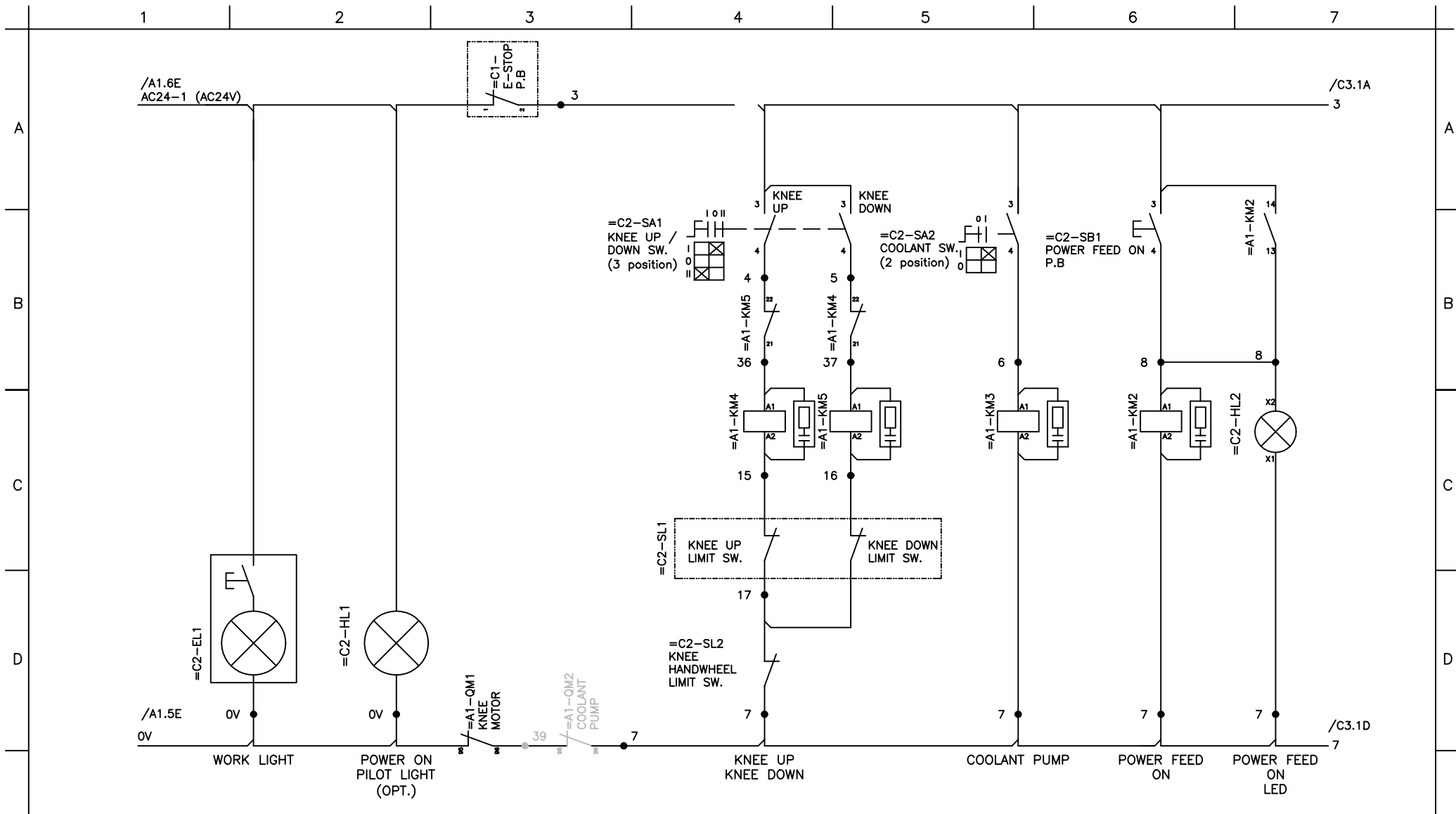
TITLE: MAIN CIRCUIT (FOR INPUT POWER 220V)

PAGE: A / 01



MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
CONTROL		1.	V 2.0	01.30,2015	
DWG NO.	MILL00C0010	2.			
DRAWER	NICOLE LI	3.			

TITLE: AC110V CIRCUIT PAGE: C / 01



MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
CONTROL		1.	V 2.0	01.30,2015	
DWG NO.	MILL00C0020	2.	V 3.0S	11.30,2018	
DRAWER	NICOLE LI	3.			

TITLE: AC24V CIRCUIT      PAGE: C / 02

1                      2                      3                      4                      5                      6                      7

A

A

B

B

C

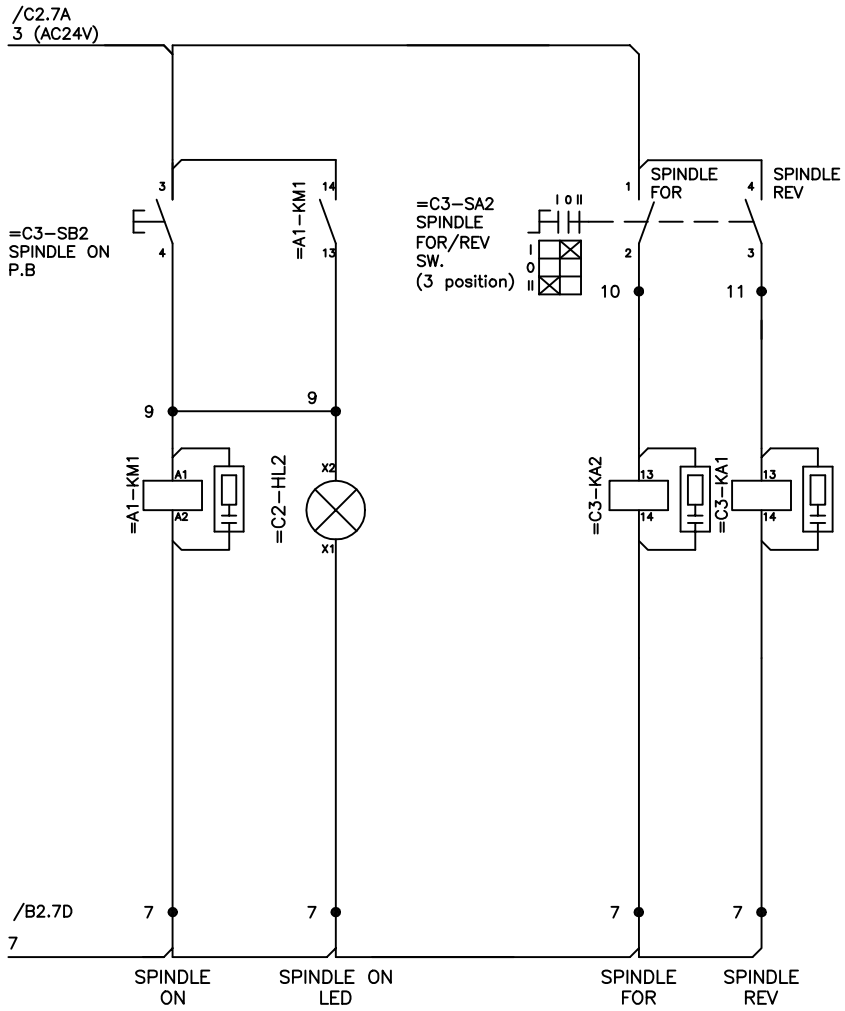
C

D

D

E

E



			MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
			CONTROL		1.	V 2.0	01.30,2015	
TITLE:	AC24V CIRCUIT	PAGE:	C / 03	DWG NO.	MILL00C0030	2.		
				DRAWER	NICOLE LI	3.		

1                      2                      3                      4                      5                      6                      7

1 2 3 4 5 6 7

A A

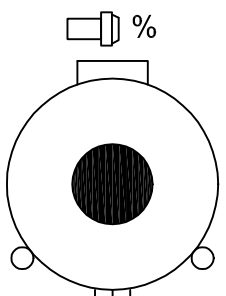
B B

C C

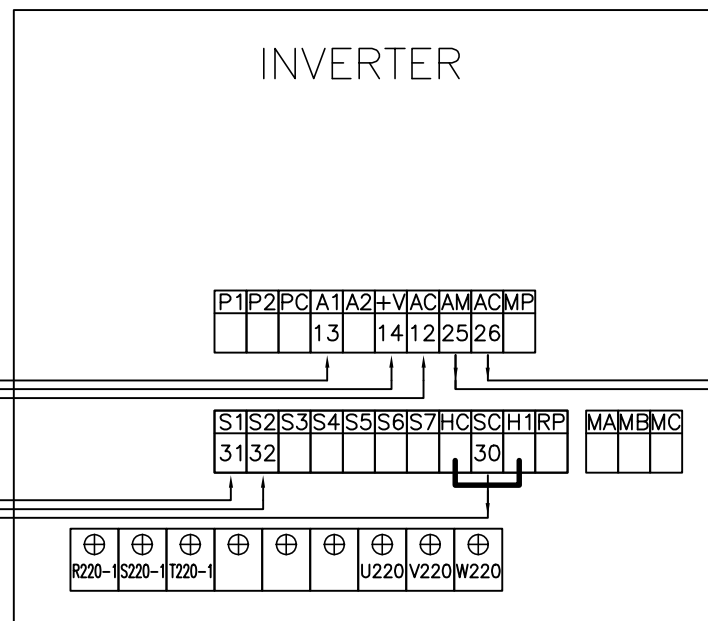
D D

E E

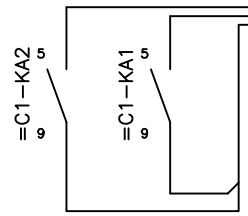
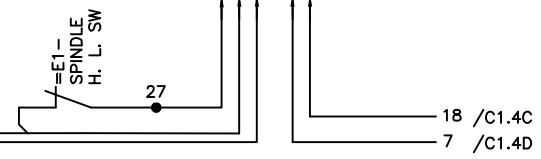
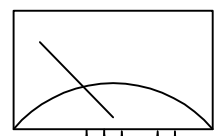
SPINDLE OVERRIDE



INVERTER



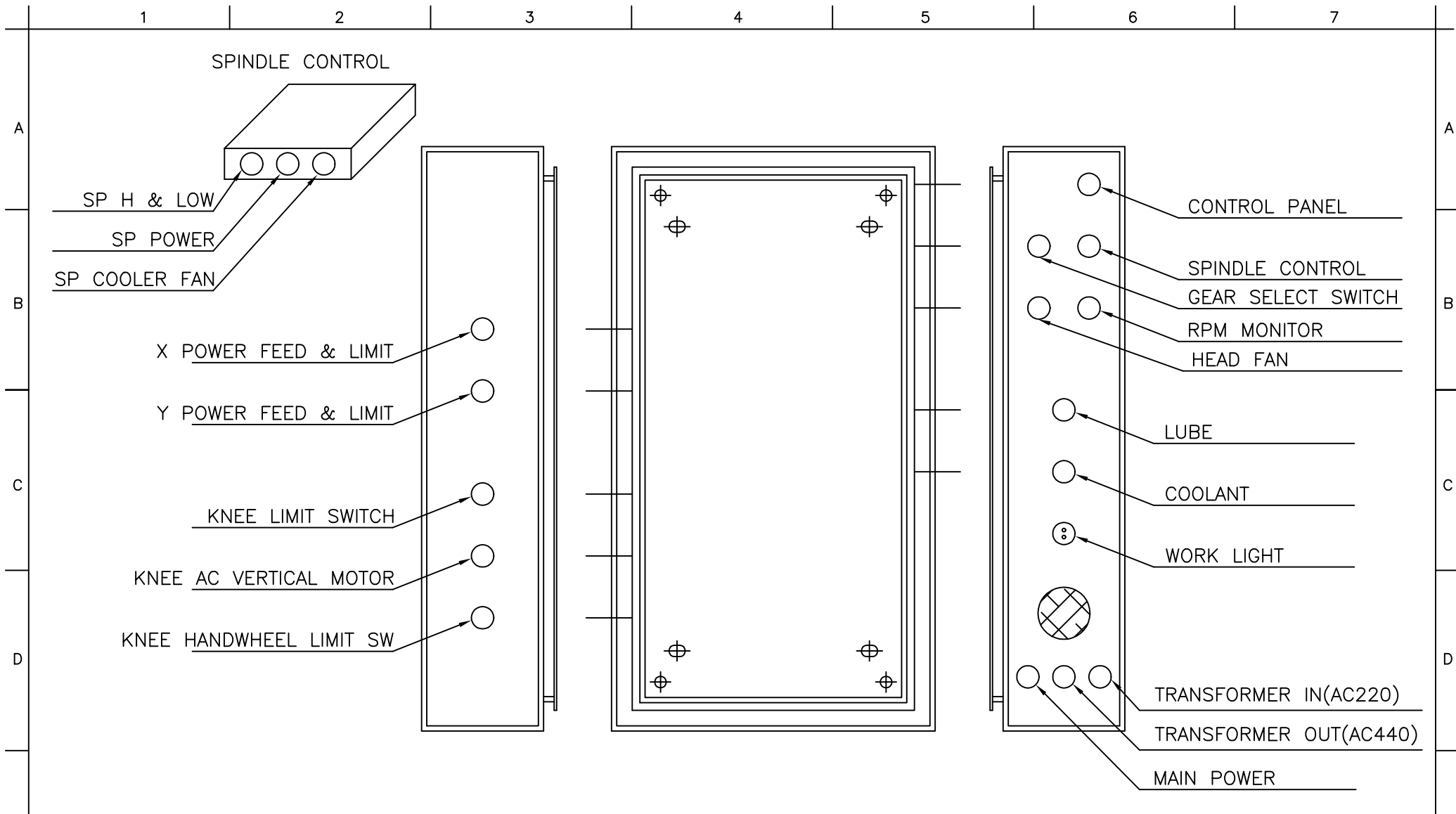
RPM



				MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
				CONTROL		1.	V 2.0	01.30,2015	
TITLE:	SPINDLE INVERTER LAYOUT	PAGE:	E / 01	DWG NO.	MILL00E0010	2.			
				DRAWER	NICOLE LI	3.			

1 2 3 4 5 6 7





MACHINE	TURRET MILL SERIES	NO.	VERSION	DATE	CHECK
CONTROL		1.	V 2.0	1.30,2015	
DWG NO.	MILL00E0020	2.	V 3.0S	11.30,2018	
DRAWER	EVA CHANG	3.			

TITLE: LAYOUT (FOR I3000SL) PAGE: E / 02