

SHARP

OD-1320X
CNC Cylindrical Grinder
Operation Manual

Sharp Industries, Inc.

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When requesting the parts for the replacement, please kindly indicate as following :

1. Machine serial number

2. Machine produce year

3. Part number and specification as per request

4. If the requesting parts does not mentioned on the parts list so please make an simple drawing or take a picture to indicate the request part to prevent of sending the wrong part.

Chapter 0 Forward

0.0 Preface

Thank you for your purchasing this high precision Universal Cylindrical Grinding Machine. We believe that this machine is capable of meeting your requirement and to make your product with best high precision quality.

This brochure is an operation and maintenance manual and it should be stored at a place where it can be reached easily by the operator for reference. It is required that the operator should be well trained and fully understood about the machine so that it can make sure the operator to operates all the functions of the machine without problems and make the machine can work with fully efficiency.

All the drawing, diagrams, pictures inside this operation manual are used for illustration purpose only. There is no other special regulation for the detail of dimensions; and tolerance of parts. Our company reserve the right to continuously improve, modify our machines in performance and engineering change without prior notice. It is also our obligation to supply replacement parts with free charge against any problem occurred due to manufacturing defects during the Warranty Period. However, the warranty exclude the duties that the machine damages comes from the misuse machine.

It is also required that the user should make sure the serial number of the instruction manual will be the same as the number of the machine body. This machine is provided for one year warranty for material and workmanship under normal operation and maintenance. However, any improper use or maintenance which are not recommended by us will be excluded of warranty period.

The machine had been checked and inspected before it was delivery. All the parts installed on this machine that is for the purpose to make the product with best quality. It is required to check all the accessories that listed in the packing list and the machine condition upon receiving the machine. Please inform your dealer. immediately if there is any short of shipments or damage of the machine. Also, if any service or complain you want to contact with us, please indicate the serial number of the machine.

0.1 General Safety Notices

1. This machine is only grinding for cylindrical outer grinding or internal grinding (only use for internal grinding attachment) that is not strictly grinding as below as cutting 、 surface grinding 、 tool grinding.....etc.
2. This machine is only used for metal material processing, any flammable material such as plastic or wood are strictly not allowed. unhealthy
3. It is not allowed to use this machine for the grinding of material as unhealthy as the generate dust hazardous. fierier
4. It is not allowed to use this machine for the grinding of aluminum 、 magnesium or other materials which may cause that will be fierier explosion.
5. The machine should be operated and maintenance only by an operator who is well trained and with good knowledge about the grinding.
6. The owner of the machine shall ask the operator to attend the relative safety and practical seminar.
7. It is required to read this instruction manual before starting the machine. Please pay attention on the explanation labels on the machine while you are operating or executing maintenance.
8. Be sure all the protection guard and door shall be in close condition unless the necessity of the maintenance operation.
9. Do not unload/load workpiece while the workhead spindle is rotating or the work table is moving.
10. Never clean, remove chips the workpiece before finishing the grinding operation.
11. Before first time operation it is required to check the wheel condition and be sure the rotation should be clockwise direction, then, let the spindle test run at least 5 minutes.
12. Be sure the stop button and the emergency button shall be in the “OFF” position before starting the machine.
13. A protection eye glasses and muffler and safety shoes are required to wear by the operator while s/he is operating the machine.
14. Do not wear loose fitting clothes. Clothing should be comfortable, but long sleeve, neckties,...etc. should not be worn.
15. Cover long hair with a hair cap or net.
16. Please keep the working area clean and dry in any time, and always remove chips, obstacles away from the working zone.
17. Be aware of the high temperature and the sharp angle or edges while you are loading and unloading workpieces.

19. The operators should be sure that the main power is switched off before s/he goes away from the machine.
20. It is required to remove all the unnecessary goods or obstacles on the work table except the workpiece before start grinding.
21. Do not attempt to brake or slow down the wheel spindle or moving parts with your hands contact. The spindle should be stopped with the way of free run after it is turned off.
22. When wet grinding, it is not allowed to adjust the coolant nozzle after the spindle is starting, and the coolant should be turn off before stopping the spindle.
23. It is strictly not allowed to make any change of the machine's mechanical /electrical structure or function.
24. It is strictly not allowed to open the electrical cabinet if there is any fail or malfunction happened to the electrical system, and should ask a electrical technician or a qualify person for further help.
25. Please notice service department or manufacture if machines have any problem or broken down.
26. It is not allowed to use this machine in an explosive environment.
27. It is not allowed to use flammable coolant liquids, the flash point must excess168°C.

Chapter 1 Mechanical Specification

1.1 Specifications of the machine series

| Description | Items | | Unit | CNC Angular Grinder |
|---------------------------------|-------------------------------------|--|--------|---|
| | Model | | | 13/1520X |
| General Capacity | Swing Over Table | | mm(in) | Ø 320 (Ø 12.6) / Ø 380 (Ø 15) |
| | Distance Between Centers | | mm(in) | 500 (20) |
| | Max. Grinding Diameter | | mm(in) | Ø 300 (Ø 12) / Ø 360 (Ø 14) |
| | Max. Load Held Between Centers | | kg(lb) | 150 (330) |
| Grinding Wheel | Wheel Diameter (Dia. ×Width × Bore) | | mm(in) | Ø510 × 50 ~ 100 × Ø152.4 (Ø20 × 2 ~ 3 × Ø6) |
| | Wheel Speed | | rpm | 1390 |
| | Max. Peripheral Speed | | m/sec | 37(121 ft/sec) |
| Wheelhead | Sliding Angle | | deg | 60 |
| | Automatic Rapid Traverse | | m/min | Ø 10 (393 in/min) |
| | Infeed Travel | | mm(in) | 225 (9) |
| | Min. Increment Infeed | | mm(in) | ±0.001 (±0.0001) |
| Workhead | Spindle Speed | | rpm | 30 ~ 350 |
| | Center Taper | | MT | NO.4 / NO.5 |
| | Spindle Type | | | Fixed and Rotary |
| | Diameter Of Bore | | mm(in) | Ø 23 (0.91) |
| Tailstock | Quill Travel | | mm(in) | 25 (1) |
| | Center Taper | | MT | NO.4 / NO.5 |
| Table | Swiveling Angle C. C. W | | deg | 7 |
| | Rapid Feedrate | | m/min | 10(393.7in/min) |
| | Min. Increment Infeed | | mm(in) | 0.001(0.0001) |
| Motor | Wheel Spindle Motor | | Kw(hp) | 5.6(7.5) |
| | Workhead Spindle Motor | | Kw(hp) | 1KW(1.33) |
| | Hydraulic Motor | | Kw(hp) | 1.5(2) |
| | Wheel Spindle Lubrication Motor | | Kw(hp) | 0.19(1/4) |
| | Coolant Motor | | Kw(hp) | 0.375(1/2) |
| | X Axis Servomotor | | Kw(hp) | 0.6(0.8)[FANUC] 1(0.75)[MITSUBISHI] |
| | Z Axis Servomotor | | Kw(hp) | 0.6(0.8)[FANUC] 1(0.75)[MITSUBISHI] |
| Net Weight (Half Enclosed) | | | Kg(1b) | 4600(10120) |
| Cross Weight | | | Kg(1b) | 4800(11660) |
| Packing Dimension (L × W × H) | | | mm(in) | 3630×2300×2040 (145×92×82) |

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- 6.1 Coolant System
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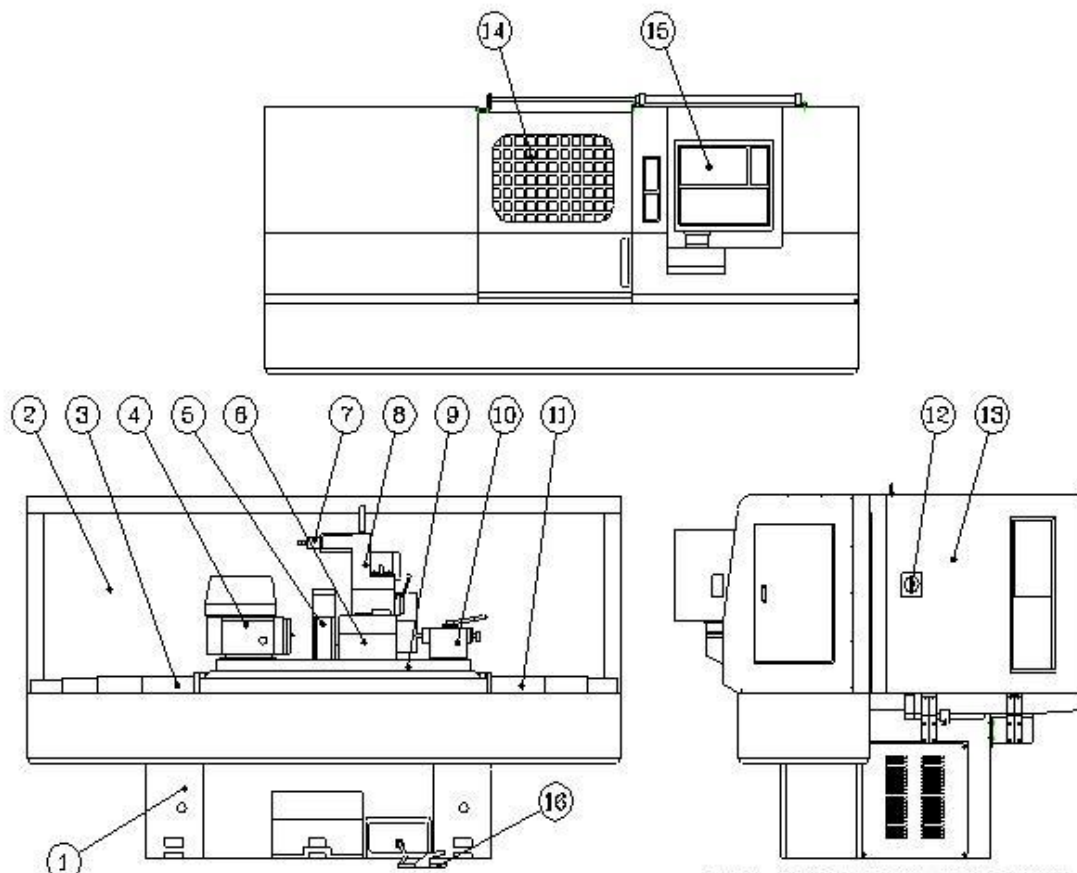
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25. Please notice service department or manufacture if machines have any problem or broken down.
26. It is not allowed to use this machine in an explosive environment.
27. It is not allowed to use flammable coolant liquids, the flash point must excess168°C.

| teams | | Unit | CNC Universal Grinder | |
|---------------------------|----------------------------------|-----------|----------------------------------|----------------------------|
| Description | Model | | OD-13/1524 | OD-13/1530 |
| General Capacity | Swing Over Table | mm(in) | Ø 320(Ø 12.6)/ Ø 380(Ø 15) | |
| | Distance Between Centers | mm(in) | 600(24) | 750(30) |
| | Max. Grinding Diameter | mm(in) | Ø 300(Ø 12)/ Ø 360(Ø 14) | |
| | Max. Load Held Between Centers | kg(lb) | 150(330) | |
| Grinding Wheel | Wheel Diameter (Dia.×Width×Bore) | mm(in) | Ø510×50~100×Ø 152.4 (Ø20×2~4×Ø6) | |
| | Wheel Speed | rpm | 1390 | |
| | Max. Peripheral Speed | m/sec | 33(109 ft/sec) | |
| Wheelhead | Sliding Angle | deg. | 90 | |
| | Automatic Rapid Traverse | mm/min | 10 (393 in/min) | |
| | Infeed Travel | mm(in) | 225(9) | |
| | Min. Increment Infeed | mm(in) | Æ0.001(0.0001) | |
| Workhead | Spindle Speed | rpm | 30~350 | |
| | Center Taper | MT | NO. 4 | |
| | Spindle Type | | Fixed and Rotary | |
| | Diameter Of Bore | mm(in) | Ø 23(0.91) | |
| Tailstock | Quill Travel | mm(in) | 25(1) | |
| | Center Taper | MT | NO. 4 | |
| Table | Swiveling Angle C. C. W. | deg | 9 | 7 |
| | Rapid feedrate | m/min | 10(393.7in/min) | |
| | Min. Increment Infeed | mm(in) | 0.001(0.0001) | |
| Motor | Wheel Spindle Motor | Kw(hp) | 3.75(5) | |
| | Workhead Spindle Motor | Kw(hp) | 1(1.33) | |
| | Hydraulic Motor | Kw(hp) | 1.5(2) | |
| | Wheel Spindle Lubrication Motor | Kw(hp) | 0.19(0.25) | |
| | Coolant Motor | Kw(hp) | 0.375(1/2) | |
| | X Axis Servomotor | Kw(hp) | 0.6 (0.8) | |
| | | | 1 (0.75) | |
| Z Axis Servomotor | Kw(hp) | 0.6 (0.8) | | |
| | | 1 (0.75) | | |
| Net Weight(Half Enclosed) | | Kg(lb) | 5600(12320) | 5800(12760) |
| Cross weight | | Kg(lb) | 64200(14124) | 7000(15400) |
| Packing Dimension(L×W×H) | | mm(in) | 4760×2280×2260 (185×90×89) | 3780×2300×2040 (152×92×82) |

1.2 Main parts of the machine



OD-13/15 24-40CNC

| No. | Description | No. | Description |
|-----|--|-----|--|
| 1. | Machine body (Base) | 9. | Table |
| 2. | Safety guard | 10. | Tailstock |
| 3. | Telescope covers(OD-13) Protective covers(OD-820) | 11. | Telescope covers(OD-13) Protective covers(OD-820) |
| 4. | Work head | 12. | Main power switch |
| 5. | Abrasive wheel | 13. | Electrical cabinet |
| 6. | Wheel head | 14. | Safety door |
| 7. | Internal grinding spindle | 15. | Control panel |
| 8. | Internal grinding attachment | 16. | Foot switch (for hydraulic tailstock) |

1.3 Power supply and environmental demand

Power supply

1. Main power : $220\pm 10\%$ Vac.....Standard
2. Frequency : $60\pm 10\%$ Hz.....Standard
or : $50\pm 10\%$ Hz.....Ref. to actual necessity

3. Earth wire

The client need to install the earth wire from the power supply unit, also earth wire diameter should over 4mm ,electrical resistance of earth wire should be low than 10Ω .

Environmental demand

1. Temperature: normal temperature within $+0^{\circ}\text{C}$ to 45°C .
2. Humidity : 30% to 95%.
3. Keep away from gas, chemical, or explosive staff.
4. Keep away from electrical magnetic interference.
5. Other: keep away from ashes, acid or salty area.
6. Stock temperature: -25°C to $+55^{\circ}\text{C}$.

1.4 Noise level

1.4.1 The Noise level under 80 db(A) is checked before the machine leave the factory.

1.4.2 Location of Inspection

1. Inspection point -1 m away the machine, and 1.5 m height.
2. Scope of inspection - front, back, right side, and left side of the machine.

Chapter 2 Machine Transportation & Installation

2.1 Unpacking

Remove first the top plate of wooden case and then the plate on for sides (Fig2.1). Carefully take out fittings at first. If necessary, remove the set screws used for holding the machine on the base (Fig.2.2)

CAUTIONS :

1. Be careful of the nails and burrs on the dismantled plates.
2. Wear gloves while dismantling the case.

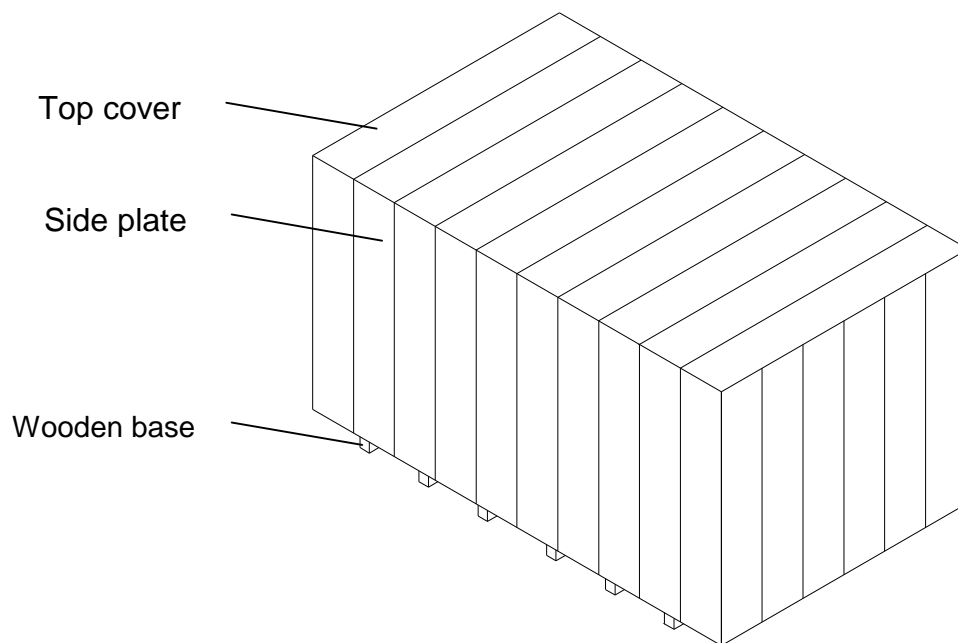


Fig.2.1

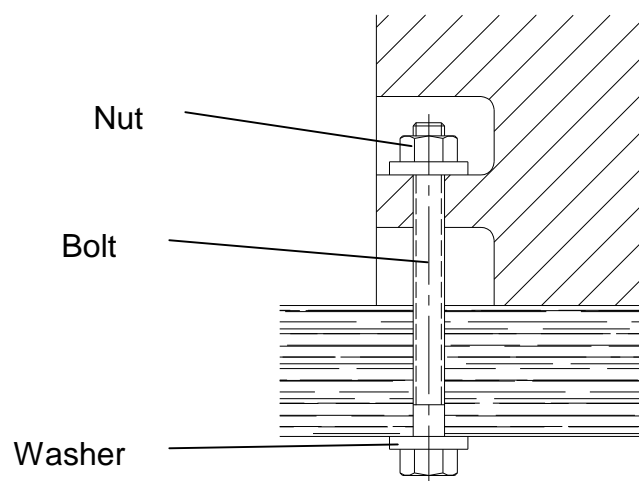


Fig. 2.2

2.2 Transportation

The worktable and wheelhead are fixed together with red color fixed plates in order to avoid any damage while its transportation. It is required that all these red color plates shall be removed before operating the machine. There is no oil and coolant supplied when the machines are shipped.

Carriage by forklift (as shown in Fig 2-3)

Use fork lift with safety load more than 7 tons to transport the machine to the final location in . In this event, it is necessary to remove the base packing plate.

CAUTIONS :

1. The lifting truck or crane lifter must be adequate of lifting weight more than 7tons
2. Place fork between base plate and machine button, and in the mark position. (Fig 2-3).
3. Carriage by fork lift , lift the machine from front. Be careful and slow while laying down the machine to avoid effect in mechanical precision.
4. The work table have to be securely fastened to avoid any slipping during transportation .
5. During carriage , always keep balance of gravity center of machine to carriage.
6. Fork lift should be operated very qualified personnel.

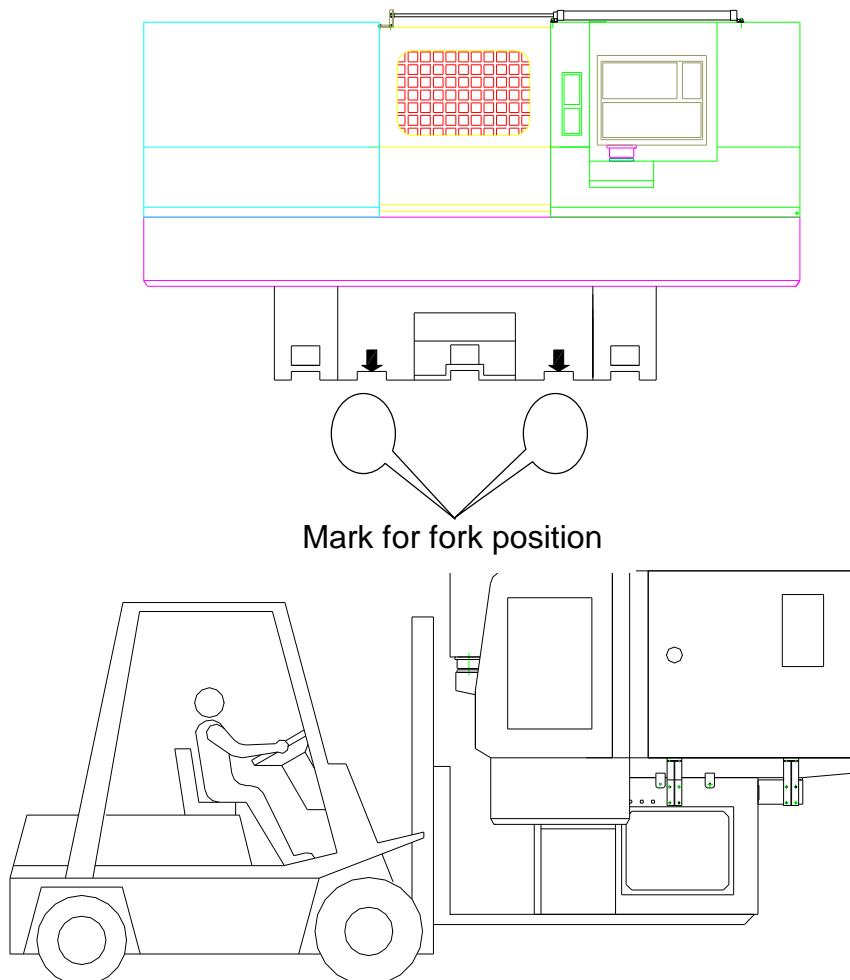


Fig. 2.3

2.3 Cleaning

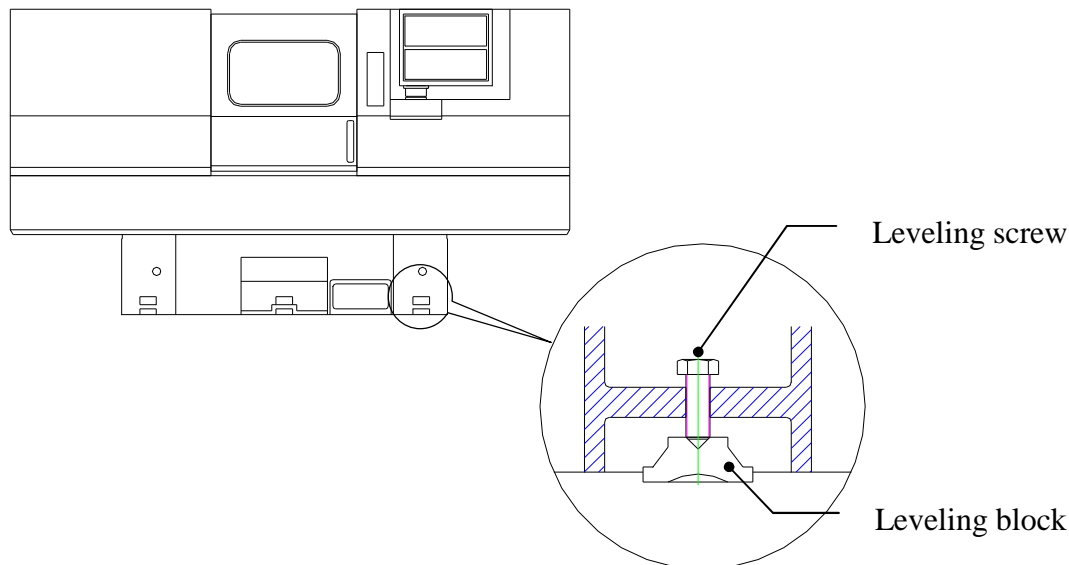
All slideways and ground surface of the machine are coated with anti - rust oil before it's delivery. Please remove the coating with kerosene prior to operation.

2.4 Installations

Since the base of this machine has strong anti-torque capability, there is no special requirement for the machine foundation. A concrete floor with 150mm thickness is needed. While placing concrete, an enough space has to be reserved for the leveling components of this machine. It must be considered that the strength of the ground when the machines is installed in the first or second floor. Be sure the strength of the ground that is strong enough to support the machine and it loading.

The following items are required to pay attention on them while doing the installation :

1. Never install the machine at a place where has direct sun light in order to keep its precision capability and maintain the machine with a longer life. A place where has a permanent temperature is preferable.
2. Never install the machine at a place where is dusty, nor a place next to another vibration machines, such as air compressor, press machines...etc.
3. This machine is equipped with leveling screws and blocks and can be used as to facilitate leveling and to avoid any vibration.(Fig2.4)
4. A proper foundation is required to build before 10 days machine arrival, and please refer (Fig 2-5) as reference.



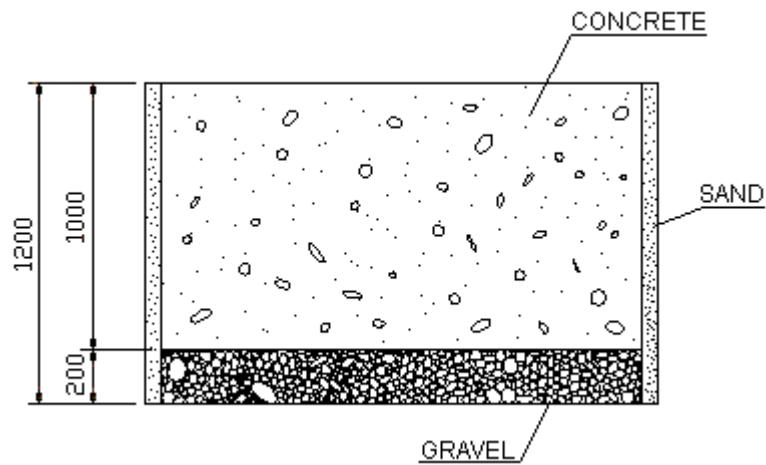


Fig. 2.5

2.5 Leveling

It is very important to level the machine before operation. The following items shall be pay attentions on them when leveling the machine.

1. Prepare a two precision levels with dial 0.02/1000
2. Move the work table to the middle of machine base.
3. Clean the work table surface and make it with no any dirty on it.
4. Place the level in the middle of table (Fig2.6) and adjust the leveling screws to position of "ZERO" point, then move the table to both extreme left hand and right hand side in order to gain the tolerance value. If the tolerance value within 0.02 mm indicate that the leveling is set properly.
5. The leveling may be varied due to work load or other factors, it is required the leveling shall be checked again after 30 days the machine installation. And check the leveling every semiannually afterwards to retain grinding precision.

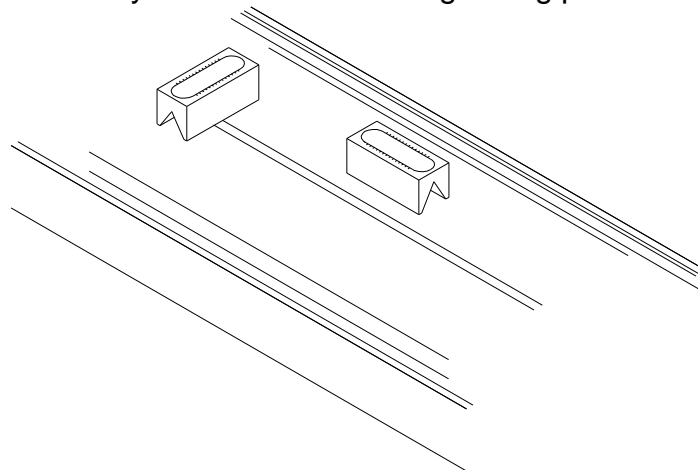


Fig. 2.6

2.6 System assembly / dismantling

When the machine has arrived the suitable place, and also has been finish adjusts level with machine, please following the sequence as connecting other equipment as below :

1. Connecting the main power source.
2. Connecting the all hydraulic / lubrication pipes.
3. Connecting the coolant system.
4. Connecting the mist filter (option)

The dismantling machine, please enforce the opposite sequence as above. When finish the connecting all of the equipment, please try to test running the machine first ,the operating start before must be deciding all of system of normalization.

2.7 Connection of Power Line

This machine is required to connect to the power source with 220V, 3 Phase, and 60 Hz , However, it is also required to check the direction of motor's rotation direction before operate the machine.

1. Make sure the power voltage is same as machine voltage (ref 1.3), and power source is shut down.
2. The main power line can be connected with power wire in the back of electrical cabinet.
3. Use the power line (4 cords), connected to ground and over-voltage protector according to the local electricity regulations.

NOTE : Do not turn on the motor of machine , when its voltage is different from power voltage and contact electric technician reparation.

2.8 Test of motor rotation

It is required to check the direction of the motor rotation before operate the machine.

The direction of the motors rotation are described as following :

| | | |
|------------------|---|-------------------------|
| Wheel Head Motor | : | Counter clockwise (CCW) |
| Work Head Motor | : | Counter clockwise (CCW) |
| Coolant Pump | : | Clockwise (CW) |
| Hydraulic Motor | : | Counter clockwise (CCW) |

All the electrical equipment has been installed with this machine at the moment of delivery. Plug into the power source is only thing needs to do.

2.9 Connection of hydraulic and lubrication system

1. Put down the hydraulic unit on the harden and leveling ground, and to confront the hole position of the hydraulic tank. (symbol “T” as over of hydraulic tank.) to the pipe behind of the machine.
2. Following as the symbol “T” within each hydraulic pipe to connect within each hole in hydraulic tank. (for example, symbol “A” pipe connect with symbol “A” hole, “B” connect with “B”etc.)
3. The power connection of hydraulic tank should be connected with the socket behind the electrical system box.

Warning :

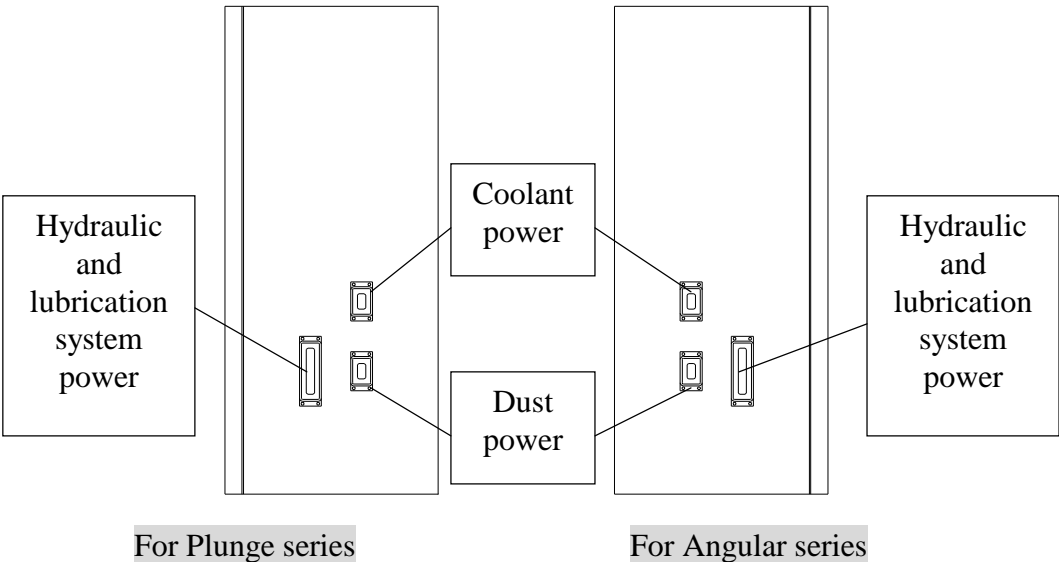
1. Before test running, please following the remark in hydraulic tank for indicate. Choose the suitable Oil level till Max. of fluid level gauge.)
2. Before running the motor, please recheck if the steering of pump motor is correct.

2.10 Connection of coolant system

1. Connect the two pipes between the outlet pipe of cooling water pump and cooling water pipe on over the wheel guard.
2. Connect the two pipes between the exhaust pipe behind the machine and Inlet pipe of coolant tank. (If the machine has installation the coolant system with magnetic separator.)
3. The-power connection of coolant tank should be connected with socket behind the electrical cabinet.
4. Choose the suitable coolant water, than pour it into the cooling water tank (re-check the cooling water level till Max. of fluid level gauge.)

Warning :

1. If the operator unfamiliar about the coolant so we suggest to ask the local agent or supporter of the coolant water about the suitable coolant water for each material.
2. Before operation, please recheck the steering on pump motor. (The steering must follow the sign as arrows on pump motor.)



2.11 Test running

When finishing of the connecting system, please execute the test running as below before start running for insure every function of normalization.

2.11.1 Grinding wheel spindle

For the safety reason, it is required for a new wheel to be run freely at least 5 minutes within its allow speed range before its commissioning. All people should stay away from the wheel, especially the left side of the wheel. Only the wheelhead can be used while dry run being held.

2.11.1.1 Start the spindle

1. Start grinding wheel spindle.
2. Turn on the main power switch.
3. Press the power on button on the control panel.
4. Press the over travel release button on the control panel.
5. Press the grinding wheel spindle "ON" button. Then the spindle should be rotated. Please check the rotation direction of the spindle, it should be same as the label shown on the wheel motor cover. Turn off the spindle immediately if the rotation direction is different from the indicator on the wheel motor cover. Change the wire connection, then test running again.

2.11.1.2 Stop the spindle

To stop the spindle rotation, press the spindle stop button from control panel. It's also able to stop the spindle by pressing the Emergency stop button from panel.

2.11.2 Safety door interlock function

1. Start the machine power
2. Reference point for X and Z axis.
3. Close the door
4. Change the mode selection switch to MDI mode.
5. Input the "M03 S50" on MDI mode, then press cycle start button, the working head spindle will start running.
6. When open the door, the working head spindle should be stopped immediately. If the spindle still keep running, this mean is lose the signal by the interlock, so please inform to our service department for getting the necessary information as soon as possible.
7. Keep the machine stop without operation till the problem on item 6 has been solved totally.

2.11.3 The hydraulic and lubrication system

1. Turn the main power switch ON
2. Press the power on button on control panel.
3. Release the emergency stop button.
4. Recheck the label of pressure meter, to insure the hydraulic pressure should be standard scope, please adjust it when the hydraulic pressure has too high or too low.
5. Check the oil gauge on the oil tank, make sure if the oil have keep provide for lubrication, please adjust the discharge and rechecking index number of hydraulic.

2.11.4 Coolant water

1. Turn the main power switch ON
2. Press the "POWER ON" button on control panel
3. Release the emergency stop button.
4. Change the mode selection switch to "JOG" mode.
5. Turn on the valve of cooling water above grinding wheel guard.
6. Close the safety door.
7. Press "COOLANT ON" button, then cooling water should be flowing normally.
8. Push down "COOLANT OFF" button to turn off the cooling water.
9. If the cooling water could not be normal flowing, please rechecking the steering of pump, or please rechecking might have some of unusual on inlet / outlet water of pump, or have extruding on cooling water pipe. Please kindly inform to our service department if there any further problem.

Warning :

1. Before the test running, please to be insured that both side of pipe have already be fixed by pipe clamp, also the coolant tank already have flowing the decide cooling water, to avoid damage pump when doing the testing.
2. Before turning ON the cooling water, please adjust the injection nozzle to avoid the cooling water spurting onto the grinding wheel. Specially when grinding wheel is stopped.
3. When opening the cooling water, please avoid the cooling water spurting to eyes or skin.

2.12 The alarm message

1. PS ××× alarm : the controller has been alarm refer in the electrical manual on the page name “ERROR CODE LIST”.
2. APC ××× alarm : alarm on the absolute pulse coder (APC).
3. Servo alarm : alarm on the server system.

Above the alarm message, please refer to the error code list by FANUC maintenance manual, also please asked for local FANUC service center if still could not solve the above problem.

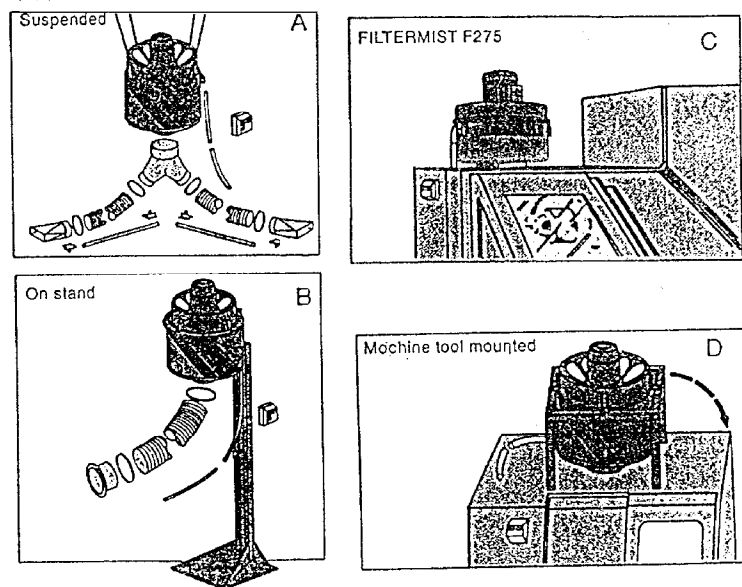
1010 alarm

The inverter alarm. Please rechecking the alarm number on the screen of inverter, then refer to the operating manual by manufacture to solve the alarm problem.

2.12 Connection of external mist filter

1. Please follow the suggestion about the installation of the mist filter to the machine as below. (Might need asked the local supplier if have any problem within installation)

TYPICAL ARRANGEMENTS



2. The connection of electrical system
This machine just supply for one units point to connect to the controller when the machine have been turning on, mist filter will start by automatic, please refer to the electrical system manual to the point site.

Wire number : A , B

Specification : 250V,1A

Chapter 3 The Description of the Machine

3.1 The features of the machine

HYDRAULIC TAILSTOCK

An extra robust tailstock is furnished as standard for strong support of heavy workpiece. Clamping & unclamping is controlled by a foot pedal conveniently. The tension of clamping can be adjusted easily by the knob at rear of the unit.

AUTO LUBE SYSTEM

The slideways of wheelhead, table, and spindles are constantly lubricated by the AUTO LUBE SYSTEM to extend machine life and ensure grinding accuracy.

CONTROL PANEL

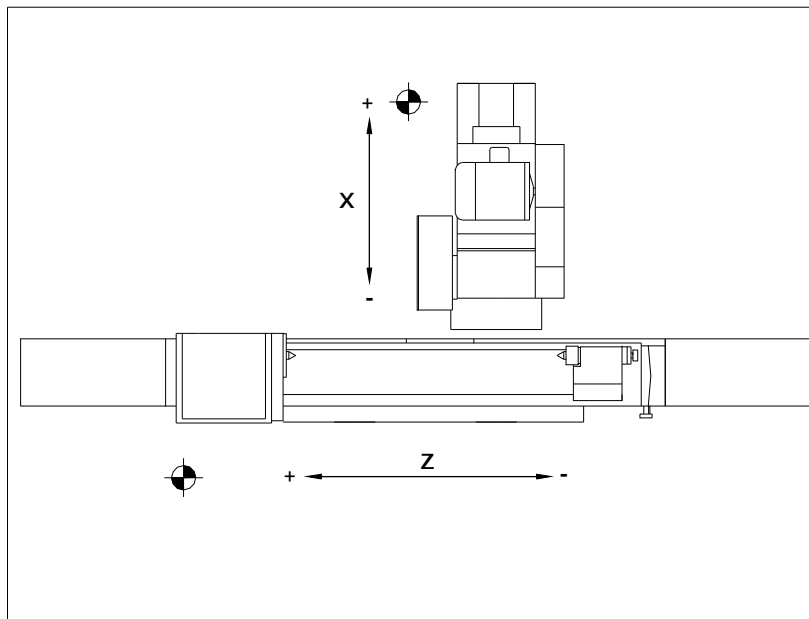
Centralized control panel is utilized to simplify operations and maintenance.

INTERNAL GRINDING ATTACHMENT (FOR 820/1020/13/15 ONLY)

This unit is supplied as optional accessory which can be swung down into operating position instantly to reduce set-up time and is capable of internal grinding bore from 20-100mm (0.79" ~ 3.94") to max depth of 110mm (4.33") with different spindles for 1020/13/15 series and from 24-70mm (0.95" ~ 2.76") to max depth of 70mm (2.76") for OD-820.

3.2 The explanations of the axis movements

FOR OD Plunge series



For OD angular series

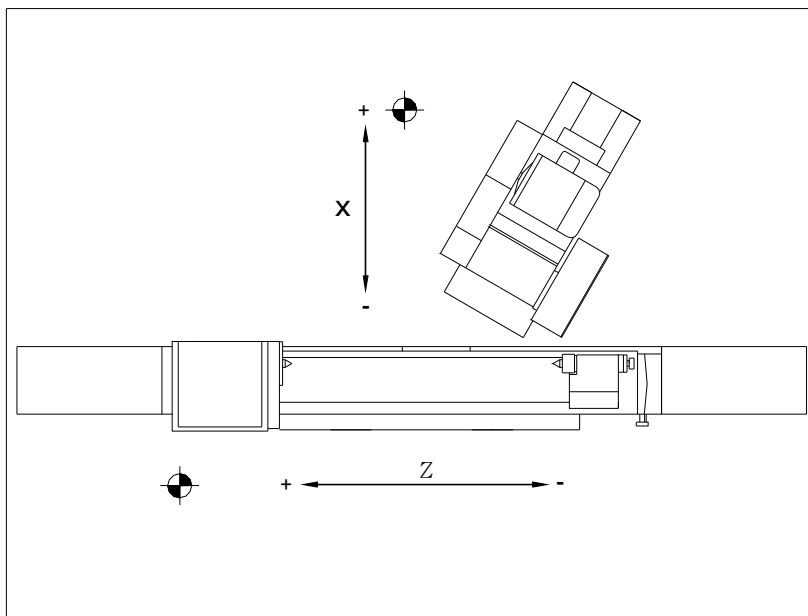


Fig : 3 - 2 Control Axis

1. The X axis is for sand wheel feeding, The [+] sign shows the X axis moves to backward direction and [-] signs shows the X axis moves to forward direction.
2. The Z axis is for workpiece movement. The [+] sign shows the workpieces move to left hand and [-] signs shows the workpiece move to right hand.
3. The angles between X axis and Z axis are 90 degrees. (For 820, 1020, OD13, OD15)
The angles between X axis and Z axis are 60 degrees. (For OD13, OD15)

3.3 The configuration of the control panel.

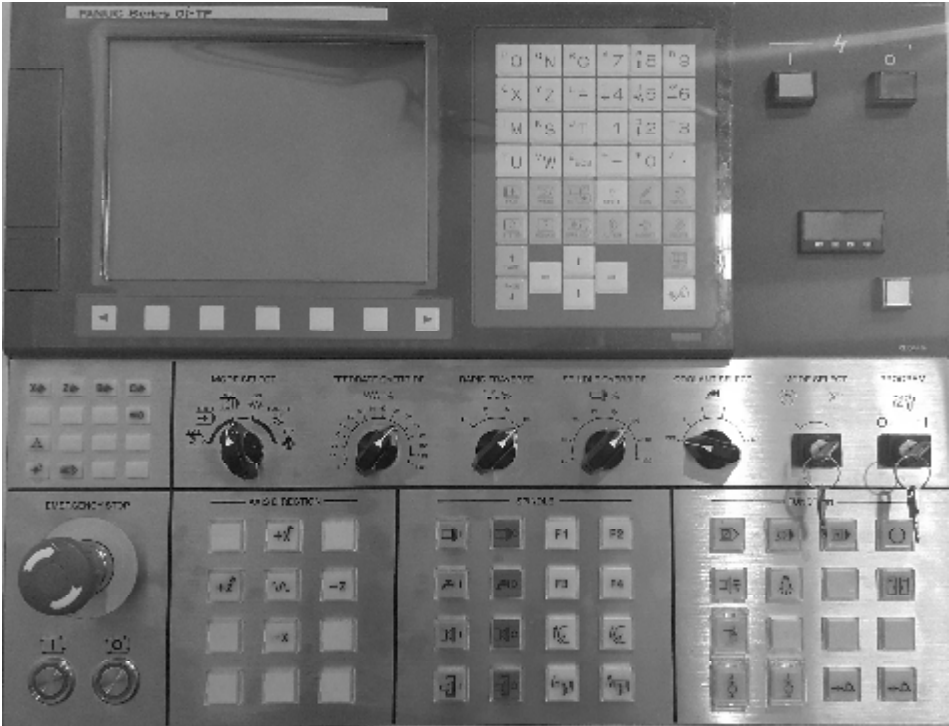


Figure 3.3.A The configuration of the NC controller and Mechanical control panel.

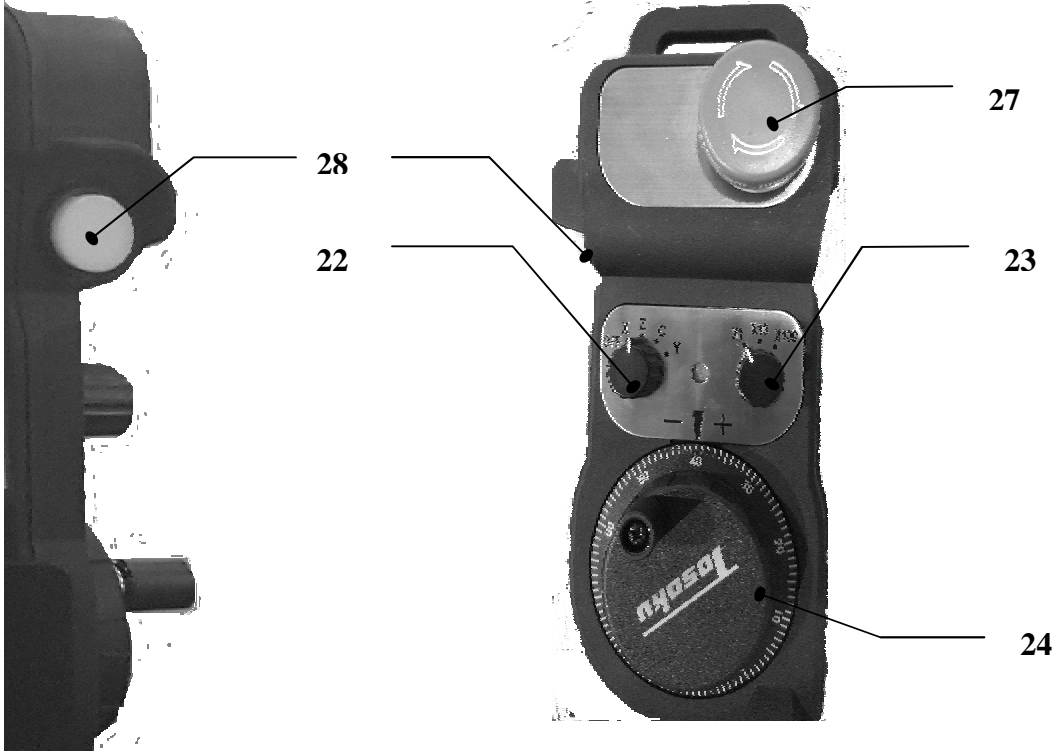
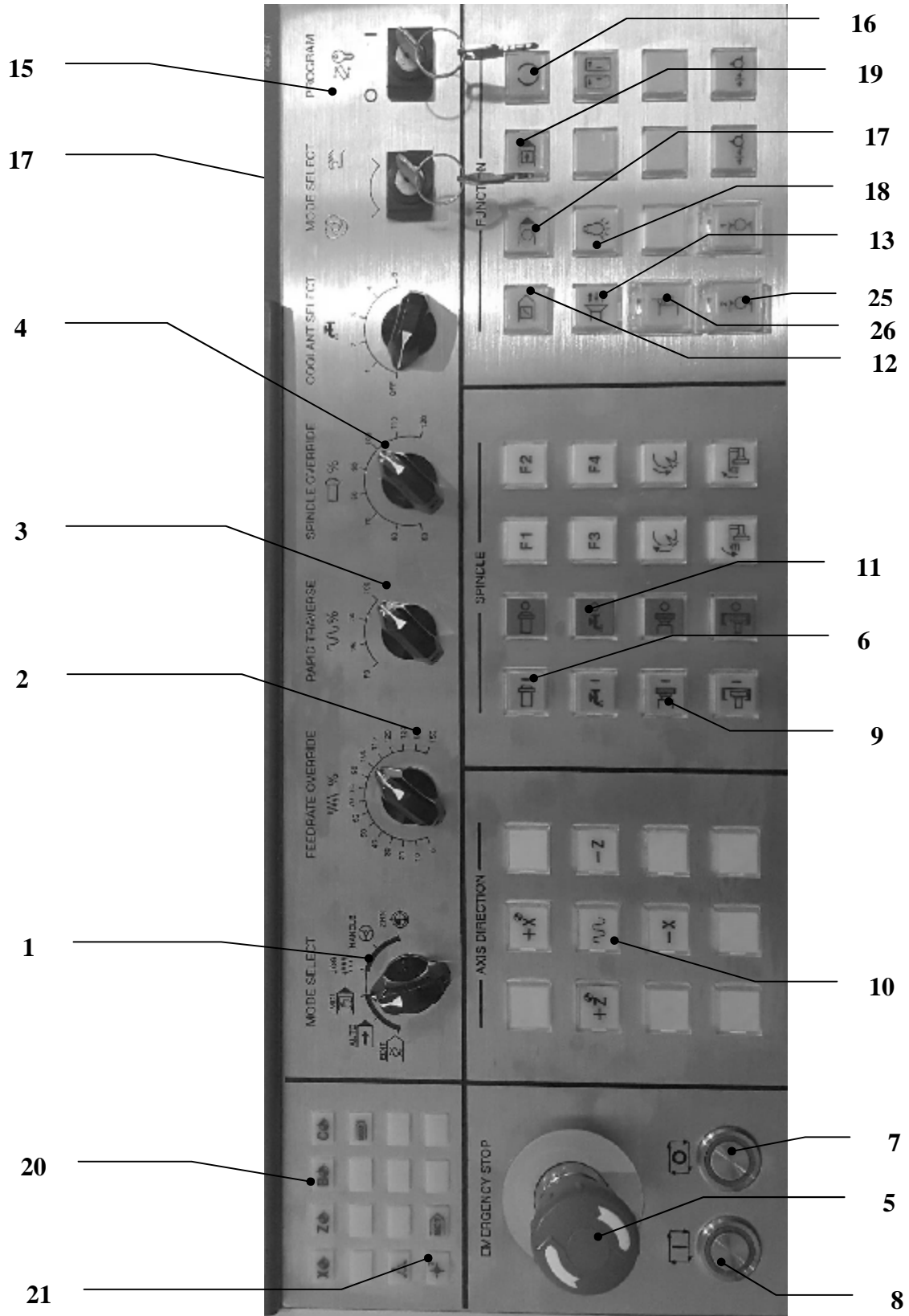
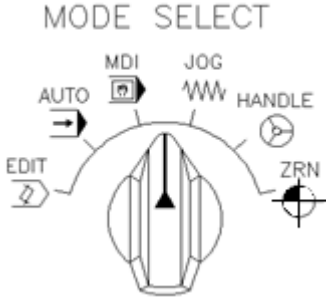






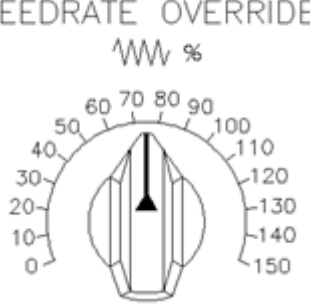
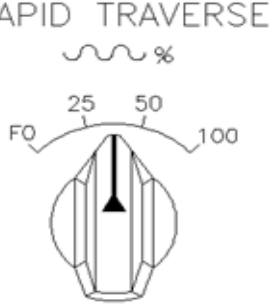


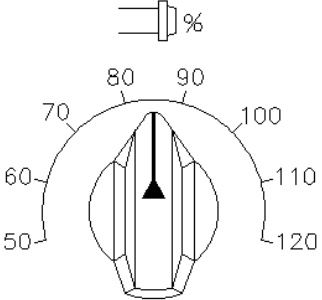
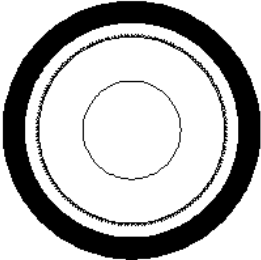
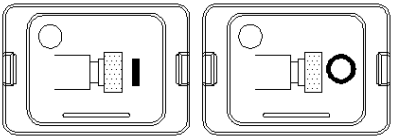
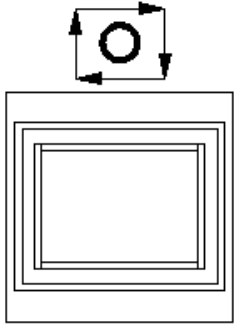
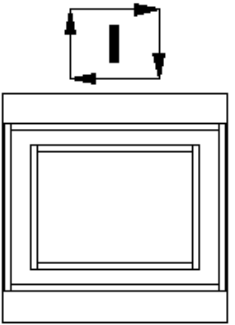
Figure 3.3.B The control panel of the hand wheel and hold to run knob.

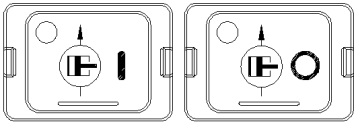
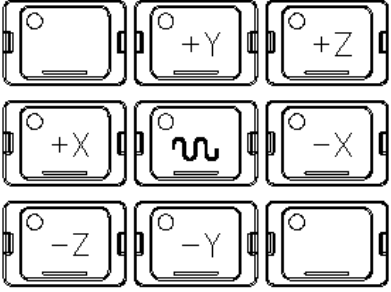
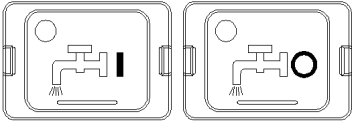
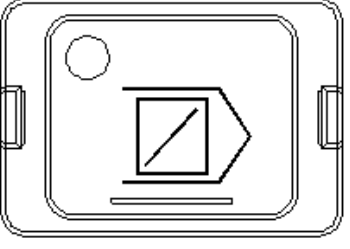
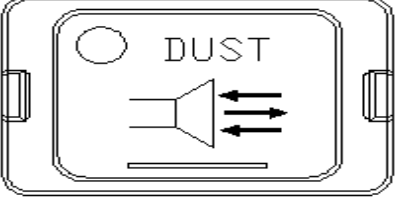
3.4 The Switches Functions of the Control Panel


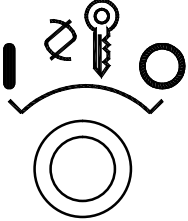

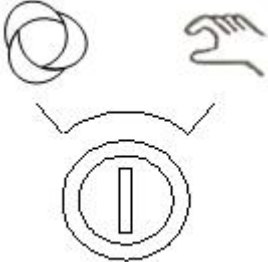
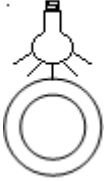

3.4.1 The control panel for the mechanism

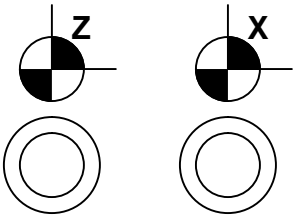
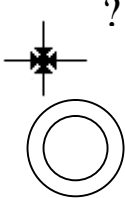
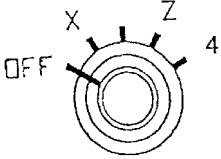
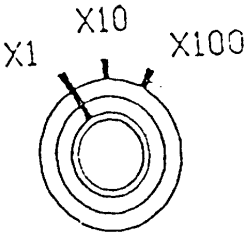
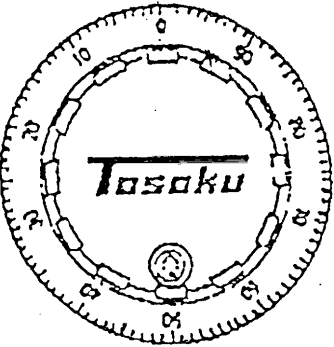


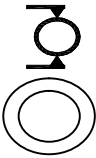
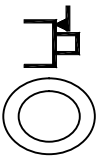
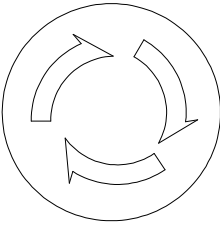
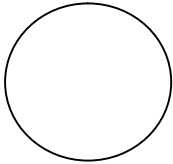
| No. | Switch Knob and Push Button | Functions |
|-----|---|---|
| (1) |  <p style="text-align: center;">MODE SELECT</p> | <p>Operation Mode Selection Knob</p>  This mode, use for edit new program or Modify exist the one.  This mode is for executing the existing program.  This mode is for setting or modify the Parameters and for single MDI operation.  This mode is for manual mode to drive X axis and Z axis to have movement which combined with +X/-X/+Z/-Z axis manual feed button and rapid override switch (9) and rapid override knob.  This mode can do micro adjustment that goes with MPG hand wheel  This mode is for zero point return, upon completion of the reference point, the “reference point return lamp” (20) will be lighten up. |
| (2) |  <p style="text-align: center;">FEEDRATE OVERRIDE % 〰</p> | <p>Feedrate Override(%)</p> <p>The range for adjustment is 0~150%, each scale is 10%, the feed rate will follow the presetting value when the value is within 100%, the feedrate will be increase when the knob is turn right and 120% indicate the feedrate is 20% more than now. This function can work only in auto cycle mode.</p> |
| (3) |  <p style="text-align: center;">RAPID TRAVERSE % 〰</p> | <p>Manual Rapid Override(%)</p> <p>Turn the mode selector to the position of JOG, by setting this knob, rapid feedrate can be varied from FO to 100%</p> |

| No | Switch Knob and Push Button | Functions |
|-----|---|---|
| (4) | <p>SPINDLE OVERRIDE</p>  | <p>Work Spindle Override (%)</p> <p>By turning this knob, the spindle speed can be varied from the preset range 50 % to 120 %, when it turn right which indicate the speed is increased and when it is turn left, the speed will be decreased.</p> |
| (5) | <p>EMERGENCY STOP</p>  | <p>Emergency Stop Button</p> <p>When this button is pressed all the controls and hydraulic system , and all axes movement will be stop, and a ready state can be obtained by turning the button follow the arrow on it.</p> |
| (6) |  | <p>Wheel Start/Stop Buttons</p> <ul style="list-style-type: none"> When the start button is pressed, the wheel spindle starts rotating, the indicator will be lighten up. When the stop button is pressed, the wheel spindle stops to rotate. However, this button will NOT work if the machine is under the auto operation with the cycle start. |
| (7) |  | <p>Feed Hold</p> <ul style="list-style-type: none"> By pressing this button, the working process will be stop in auto cycle mode, and the indicator lamp of feed hold will be light up. The working press can keep going by pressing the cycle start button again. |
| (8) |  | <p>Cycle Start</p> <p>Under auto mode, the working program will be executed by pressing this button, and the indicator lamp will be light up.</p> |
| No | Switch Knob and Push Button | Functions |

| | | |
|------|--|--|
| (9) |  | <p>Work head Spindle Start/Stop Buttons</p> <ul style="list-style-type: none"> • When the start button is pressed, the work head spindle starts to rotate, the indicator lamp will be light up. • When the stop button is pressed, the workhead spindle stop rotating. • These stop button will become invalid while it is in the condition of Auto Mode |
| (10) | <p style="text-align: center;">— AXIS DIRECTION —</p>  | <p>The Rapid Jog function for the X and Z axis [+] X indicate the wheel direction will move toward to X axis zero point [-] X indicate the wheel direction will move to the working spindle. [+] Z indicate the working table will move to the left hand of the operator or to Z axis zero point. [-] Z indicate the working table will move to the right hand of the operator</p> <ul style="list-style-type: none"> • The rapid movement for +X/-X/+Z/-Z axis can be obtained by pressing the rapid button together with the each axis button simultaneously. • The adjustment speed for the rapid feed rate can be obtained by turning the rapid over ride knob to change the ratio. • The feed rate for +X/-X/+Z/-Z is adjusted by the feedrate override knob. |
| (11) |  | <p>Coolant Pump Start/Stop Buttons</p> <ul style="list-style-type: none"> • To start the coolant pump, press the start button, the indicator lamp will be light up. • To stop the coolant pump, press the stop button. |
| (12) |  | <p>Optional Single Block Skip</p> <ul style="list-style-type: none"> • Under the auto mode, by pressing this button, the program will skip the single block program with a “/” in front of it and jump to the next single block program. • This button will be valid only in the auto mode, and the indicator lamp will be lighten up when this button is pressed. |
| (13) |  | <p>Combine dust sys.</p> |

| No | Switch Knob and Push Button | Functions |
|------|---|--|
| (14) |  | <p>Crash Control Reset</p> <ul style="list-style-type: none"> · Before any bump accident happen which is result from misusing, the MARPOSS will work effectively and make the X axis return zero point, by pressing the button, it can reset the bump gap and release the abnormal |
| (15) |  | <p>Program Protection Lock and Open</p> <ul style="list-style-type: none"> · Lock All the edited programs and its parameters can not be modified under this choice. · Open All the edited programs and its parameters can be modified or edited only under this choice. · This switch is equipped with key. |
| (16) |  | <p>OPT Stop</p> <ul style="list-style-type: none"> · This button shall be used together with the M01. When the program goes to M01, it will stop executing if the button is pressed. By pressing the “Cycle Start” button, the program will continue executing the single block which is next after M01 command. |
| (17) |  | <p>MODE SELECT</p> <ul style="list-style-type: none"> · Use the key to select automatic or setting |
| (18) |  | <p>Work Light</p> <ul style="list-style-type: none"> · By pressing this button, the work lamp will light up, and the indicator of the start also light up simultaneously. · The work lamp will be turn off by pressing the button again. |
| (19) |  | <p>Single Block</p> <ul style="list-style-type: none"> · Under the auto mode, by pressing this button, the processing program will just execute only one single block when the “Cycle Start” button is pressed each time. To release it, just press this button again, the program will become continuously. · This button is valid only under auto mode. |
| No | Switch Knob and Push Button | Functions |

| | | |
|------|---|---|
| (20) |  | <p>Home for X axis and Z axis</p> <ul style="list-style-type: none"> · Under Home mode, by pressing the +X key of the Jog function, the X axis will return to zero point after the jog function · Under Home mode, by pressing the +Z key of the Jog function, the Z axis will return to zero point after the jog function |
| (21) |  | <p>Alarm Indicator</p> <ul style="list-style-type: none"> · Controller The indicator lamp will be light up when misuse or controller malfunction. · Machine The indicator lamp will lighten up when the machine over travel or malfunction. |
| (22) |  | <p>Axis Select</p> <ul style="list-style-type: none"> · Under MPG mode, just turn this switch to the axis you want to remove, then the selected axis can be removed by the MPG control handle. |
| (23) |  | <p>MPG Infeed Rate Select</p> <ul style="list-style-type: none"> · Multiple infeed rate switch. For multiple adjust infeed: ×1 ⌀ Every one graduation on the MPG hand wheel will be 1 micron. ×10 ⌀ Every one graduation on the MPG hand wheel will be 10 micron. ×100 ⌀ Every one graduation on the MPG hand wheel will be 100 micron. |
| (24) |  | <p>MPG Handle</p> <ul style="list-style-type: none"> · Under the manual mode, this knob works together with axis select switch (22) for both X axis and Z axis movement.. · When turning to the [+] direction which indicate both X and Z axis will move to zero point. When turning the [-] direction which indicate the X axis will move to work table and Z axis will move to the right hand of the operator.. |

| No | Switch Knob and Push Button | Functions |
|------|---|---|
| (25) |  | <p>Auto. Sizing Gauge - (Manual mode)</p> <ul style="list-style-type: none"> · Push this button to move the gauge forward (button is lit). · Push this button again to retract the gauge (button is off) |
| (26) |  | <p>Side Surface Touch Probe - (Manual mode)</p> <ul style="list-style-type: none"> · Push this button to move the touch probe forward (button is lit). · Push this button again to retract the touch probe (button is off). |
| (27) |  | <p>Emergency Stop Button</p> <ul style="list-style-type: none"> · When this button is pressed all the controls and hydraulic system , and all axes movement will be stop, and a ready state can be obtained by turning the button follow the arrow on it. |
| (28) |  | <p>Enable button</p> <ul style="list-style-type: none"> · you need keep push this button when you are using the hand wheel |

3.5 Power On and Off Switch

3.5.1 Turn ON the Main Power

1. Turn the power switch to the position of “ON”.
2. The power switch is located on the door of the electrical cabinet which is placed at the right or left rear side of the machine, and the door handle is placed in the bottom of the cabinet. A heat exchanger is placed at the right or left side of the cabinet.

3.5.2 Turn on the machine power

1. Release the emergency stop button
2. By pressing the power on button, both of the hydraulic and lubrication pump will be started simultaneously and its peripheral equipment power will be on too.
3. Completing the starting procedures for the machine.

3.5.3 Turn off the machine power

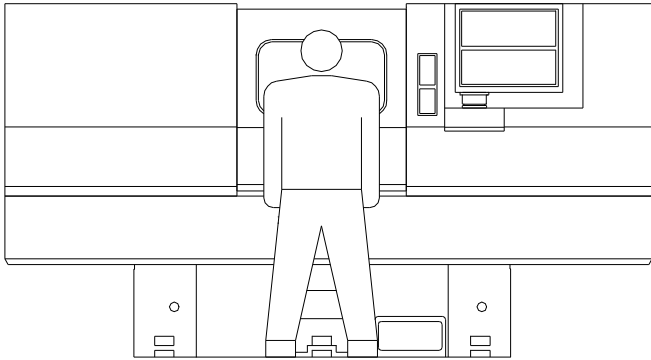
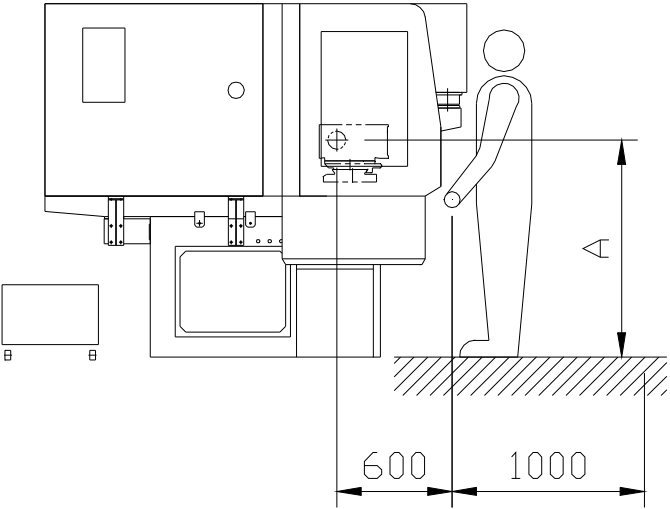
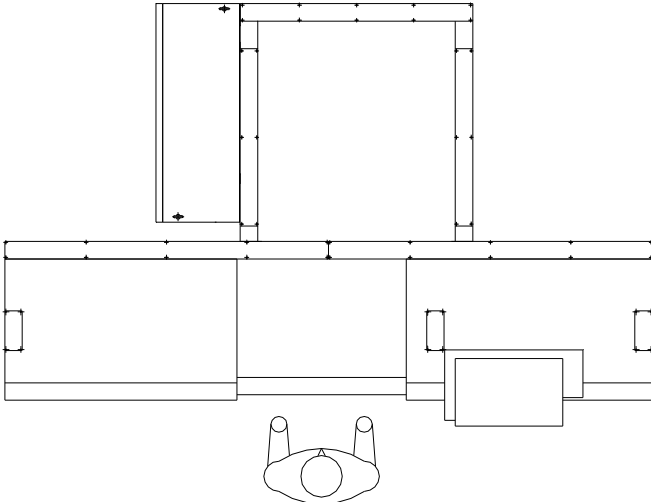
1. The input power will be terminated by pressing the emergency button, all the power for the spindle wheel, work table, coolant pump and lubricant pump will be cut off.
2. By pressing the power off button to execute shutting down the power that comes from outside.

3.5.4 Turn Off the Main Power

Turn the main power switch to the position “OFF”— Shut down the power.

It is necessary to confirm that the procedure of the 3.5.3 has been done before turn off the main power, or it may result in data lost when CNC shut down.

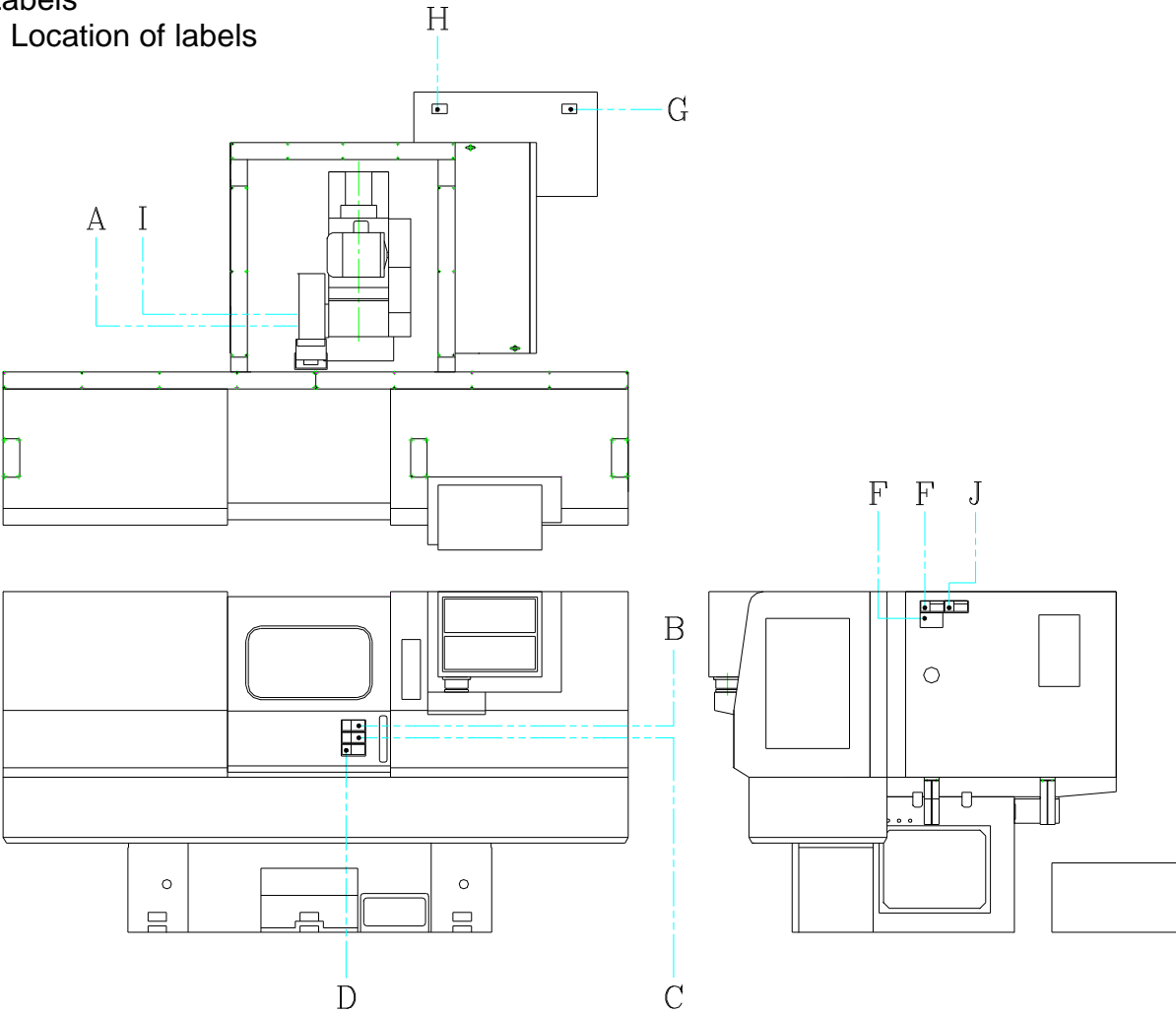
3.6 Operator Position



| Model | OD-15CNC | OD-13CNC | OD-820CNC |
|-------|----------|----------|-----------|
| A | 1160 | 1130 | 1075 |

3.7 Labels

3.7.1 Location of labels



3.7.2 Label

1. Do not touch the grinding wheel when the wheel is rotating (Fig 3.7.1) . Located in position “A”.

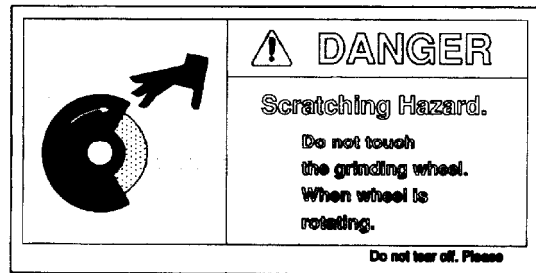


Fig 3.7.1

2. Be aware of hand and fingers. While the work table is moving (Fig 3.7.2). Located in position “B”.

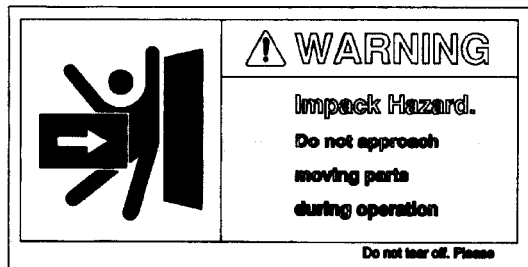


Fig 3.7.2

3. Using a proper kneel position to lift or move heavy weight in order to avoid twitching. (Fig 3.7.3). Located in position “C”.

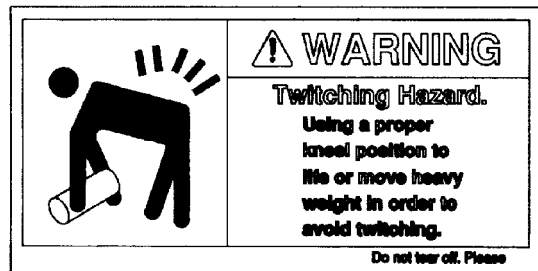


Fig 3.7.3

4. Please put on an eye glass or goggles before starting machine (Fig 3.7.4) .Located in position “D”.

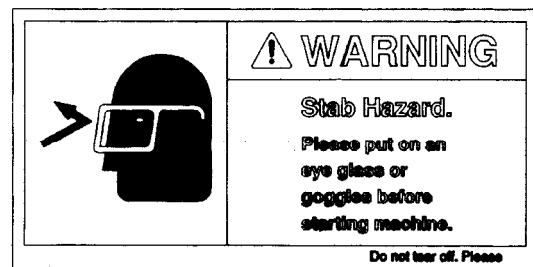


Fig 3.7.4

5. Warning for general safety notices (Fig 3.7.5). Located in position “E”.

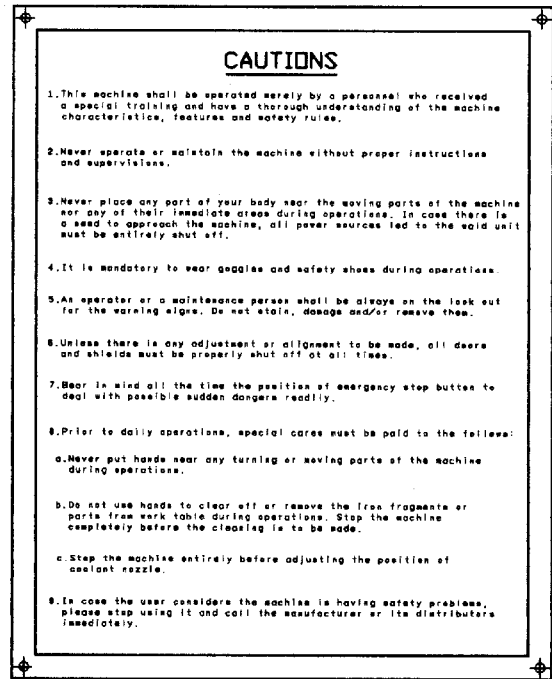


Fig 3.7.5

6. Turn off main power before servicing. (Fig 3.7.6). Located in position “F”

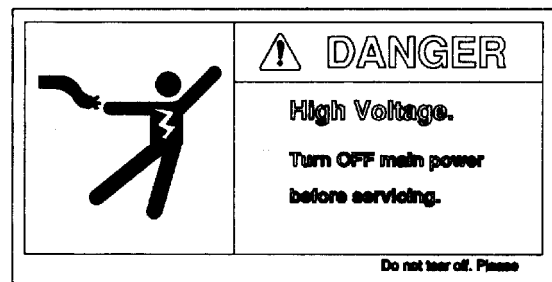


Fig 3.7.6

7. Wheel head spindle lubrication oil indicator (Fig 3.7.7). Located in position “G”

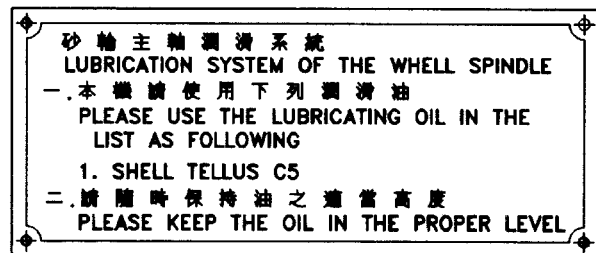


Fig 3.7.7

8. Hydraulic /Lubrication oil indicator (Fig3.7.8). Located in position “H”

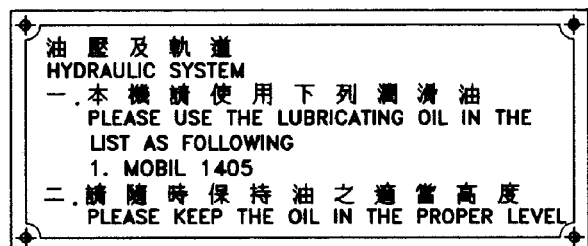


Fig 3.7.8

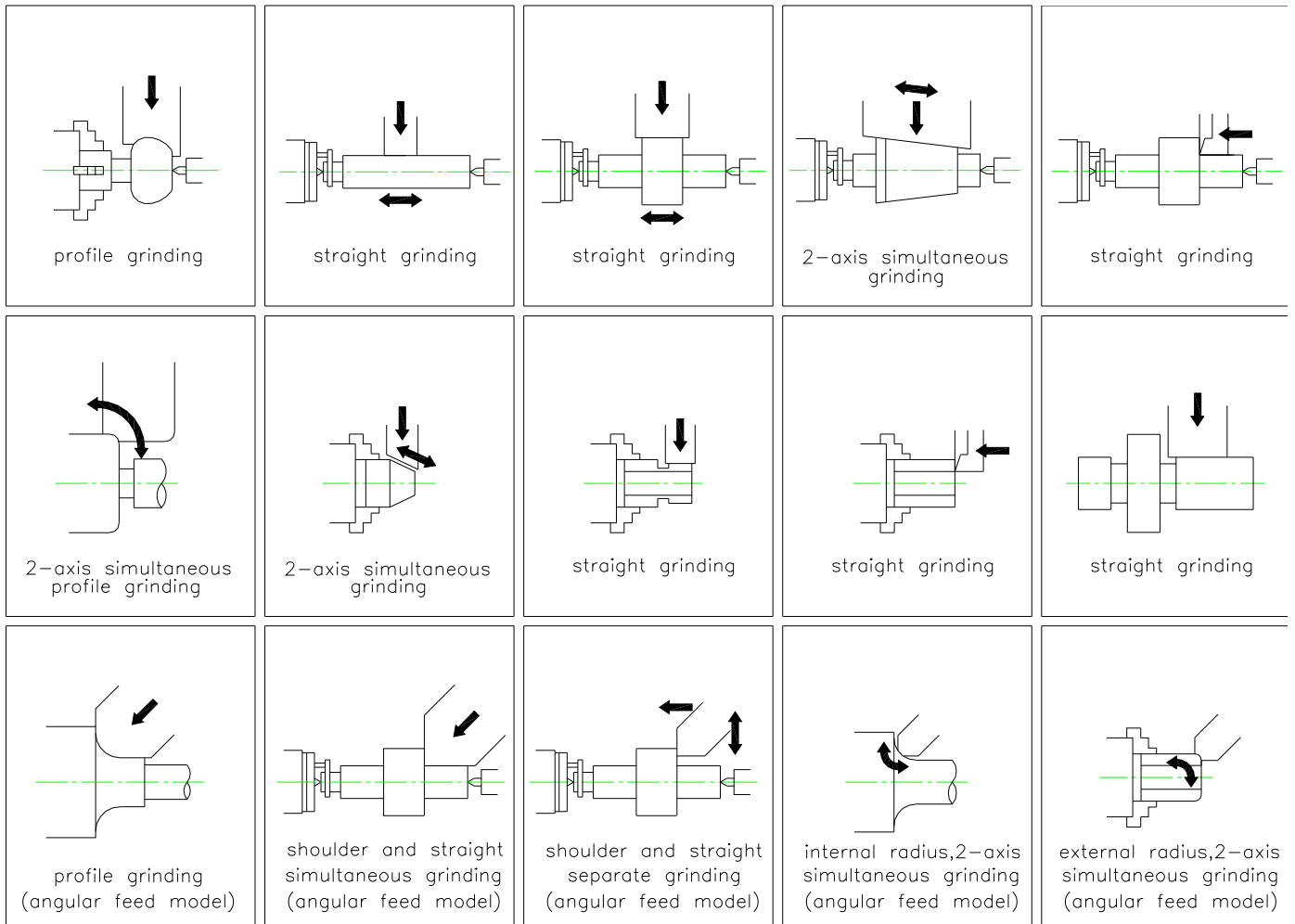
9. Indicator of Max. wheel speed and dimension. (Fig 3.7.9) Located in position “ I “

Max. speed : 32 m/sec.
Max. wheel dimension :
 $\phi 455 \times 50 \times \phi 152.4$

Fig 3.7.9

Chapter 4 Operation

4.1 Grinding Applications



The above illustrations are some application's sample which can be done through the CNC programming.

4.2 Start/Power off the machine

4.2.1 Start the machine

1. Prior to start the machine, please check the safety door is surely closed, and then operate the following steps.
2. Turn on the main power switch from the electrical cabinet.
3. Press “Power On” button from the controller.
4. Release “Emergency Stop” button (Fig3.7 (5)) after title is displayed on the screen.
5. Press “Over Travel Release” button (Fig 3.7 (13)) to start the hydraulic system and auto lubrication system.
6. Perform “Zero Point Return” first before executing the AUTO and MDI operation.

4.2.2 Power off the machine

1. Prior to shut off the machine, please make sure the grinding wheel and work head spindle has been completely stopped, and coolant pump is turned off. Then operate the following steps.
2. Move the table to the center position by using manual JOG feed operation or MPG, and move the wheel head away from X-HOME at least 50 mm.
3. Press “Emergency Stop” button to stop the hydraulic system and auto lubrication system.
4. Press “POWER OFF” button from the controller.
5. Close the safety door.
6. Turn off the main power switch from the electrical cabinet.

4.3 Loading/Unloading workpiece (For tip center type)

4.3.1 Loading workpiece

1. Clean both tip centers of workhead and tailstock, and make sure the centers are firmly fixed.
2. Use proper driving dog to fix at the driving side of workpiece.
3. Hold the workpiece by both hands, and aim the left center hole of workpiece to the tip center of workhead.
4. Step on the pedal to retract the tip center of tailstock. (If the workpiece is small, you can hold the workpiece by left hand, and retract the tip center of tailstock by pulling the handle of tailstock.)
5. Aim the right center hole of workpiece to the tip center of tailstock, and then release the pedal for pushing the tip center against the workpiece.
6. Rotate the workpiece slightly by hand to make sure it is firmly fixed. And turn the pressure knob of tailstock to adjust the proper support.
7. Prior to start rotating the workhead spindle, make sure the driving dog is contacted with the workpiece in order to carry the workpiece rotating.

4.3.2 Unloading workpiece

1. Hold the workpiece by both hands to avoid dropping the workpiece suddenly when the tip center is retracted.
2. Step on the pedal to retract the tip center, and take off the workpiece.

** NOTICE **

1. Hold the workpiece firmly when loading /unloading to avoid danger of suddenly dropping it.
2. Be sure have safety distance between the grinding wheel and workpiece when loading/unloading, it can avoid the injury of hand being hit by the wheel.
3. According to the diameter of workpiece, adjust the adjustable wheel guard properly, so that it can avoid the hand being hit by the wheel.
4. Be sure to use the overhead crane support or proper lifting manner when loading and unloading the heavy workpiece to avoid the injury.

4.4 Zero point return

After starting the machine, and prior to execute an AUTO or MDI operation, be sure to perform Zero Point Return.

1. Make sure the wheelhead has been moved away from X-Home at least 50mm, if not, switch the JOG mode and press “-X” button (Fig 3.7 (10)) to move away the wheelhead.
2. Make sure the table has been moved away from Z-Home at least 100mm, if not, switch the JOG mode and press “-Z” button (Fig 3.7 (10)) to move away
3. Switch the “Operation Mode Selection” knob to HOME mode.
4. Press “+X” button (Fig 3.7 (10)) to execute X-axis zero point return. When “X-Zero Point Return” lamp is on (Fig 3.7 (20)) it means the X-axis zero point return is finished.
5. Press “+Z” button (Fig 3.7 (10)) to execute Z-axis zero point return. When “Z-Zero Point Return” lamp is on (Fig 3.7 (20)) it means the Z-axis zero point return is finished.

4.5 Manual operation

Switch the “Operation Mode Selection” knob to JOG or MPG mode in order to operate manually.

1. There are three functions you can execute under JOG mode.
 - a、Manual JOG feed operation for X-axis and Z-axis.
 - b、ON/OFF coolant
 - c、START/STOP the wheel spindle.
2. You can use the MPG hand wheel to move the direction of X-axis or Z-axis under MPG mode.
 - a、Set the “Axis Select” switch of MPG (Fig 3.7 (25)) to desired adjustment axis (X or Z).
 - b、Set the “Multiple Infeed Rate” switch of MPG to desire infeed rate.
 - c、Turn the hand wheel and X-axis or Z-axis will move in the direction as indicated on the hand wheel.

4.6 The adjusting of grinding wheel safeguard

1. Return the wheel head to zero point of X-axis.
2. Stopping the grinding wheel.
3. After complete stopping wheel, loosening the two screws on both side of wheel safeguard.(Ref bellowing)
4. After adjusts the suitable point by up down, than tightening the two screw.

Warning :

1. Should adjust suitable point of safeguard before operating, also can be avoid Injure by Hand touch.
2. Should not touch the workpiece and avoids interfere with diamond dresser when It is doing adjust suitable point of safeguard.

Chapter 5 Hydraulic System and Lubrications

5.1 Hydraulic And Slideways Lubrication System

The hydraulic system is a single unit that is separated from the machine to against any heat transmission and vibration. This unit comprises of hydraulic tank, motor, pump, pressure gauge and solenoid valve. The main hydraulic control unit is located nearly to the machine base for easy operation and maintenance. The hydraulic oil of MOBIL 1405 is recommended to use and which have high hydraulic property and high viscosity, mostly suitable for slideways lubrications. The oil level can be monitored from the oil sight glass.

The recommend oil is described following :

MOBIL 1405

NOTICE : Please keep the oil in the proper level.

5.2 Wheel Spindle Lubrication System (Except OD-820)

An independent piping system is adopt by this machine and it can adjust & control the lubricant flows by both of throttle valve and pressure valve to ensure a sufficient lubrication on wheel spindle bearings. The pressure for the lubricant should neither bigger than 1 kg/cm^2 nor smaller 3 kg/cm^2 which it can be adjusted by the pressure control valve.

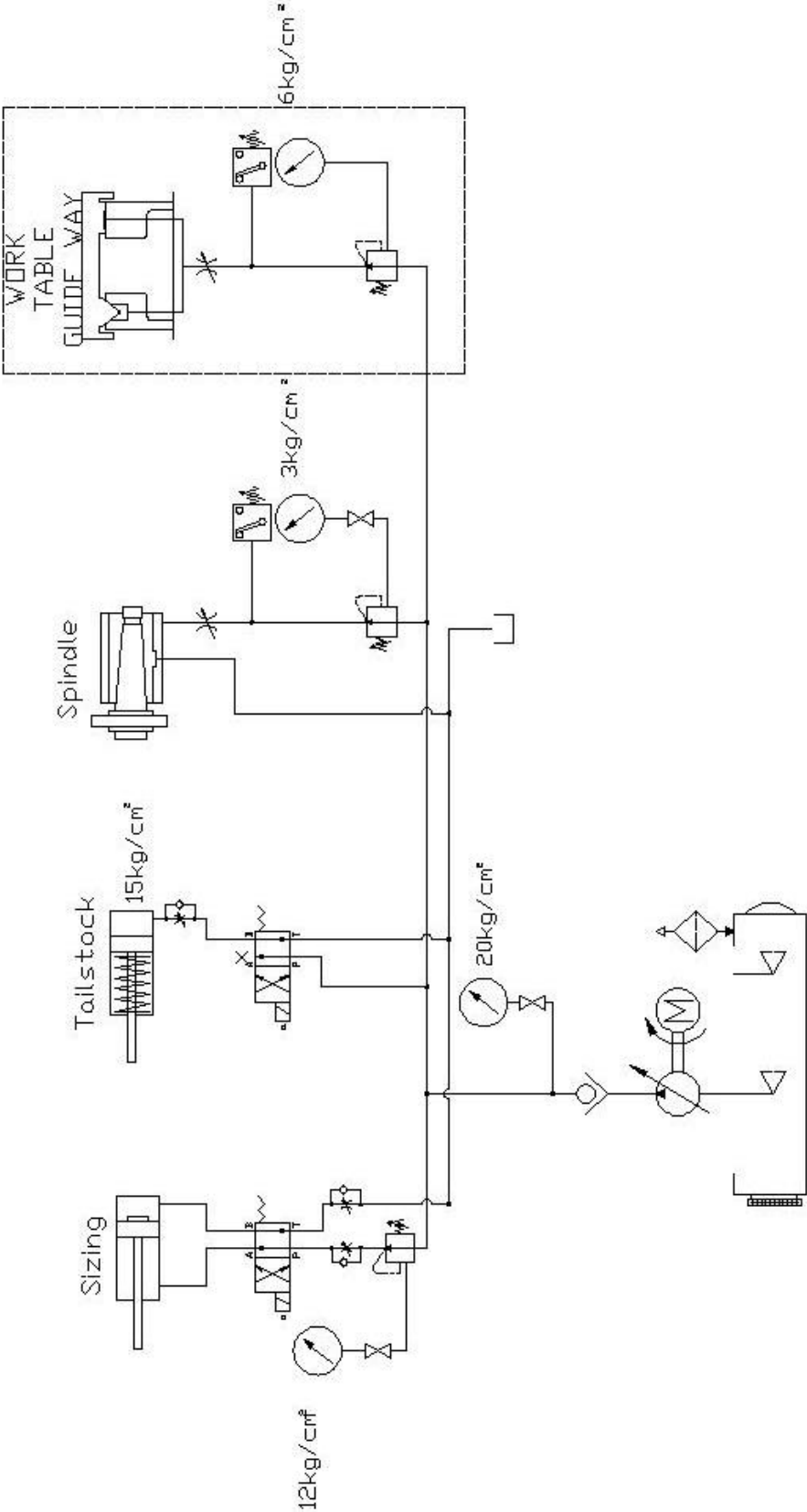
The recommend oil is described following :

SHELL TELLUS C5

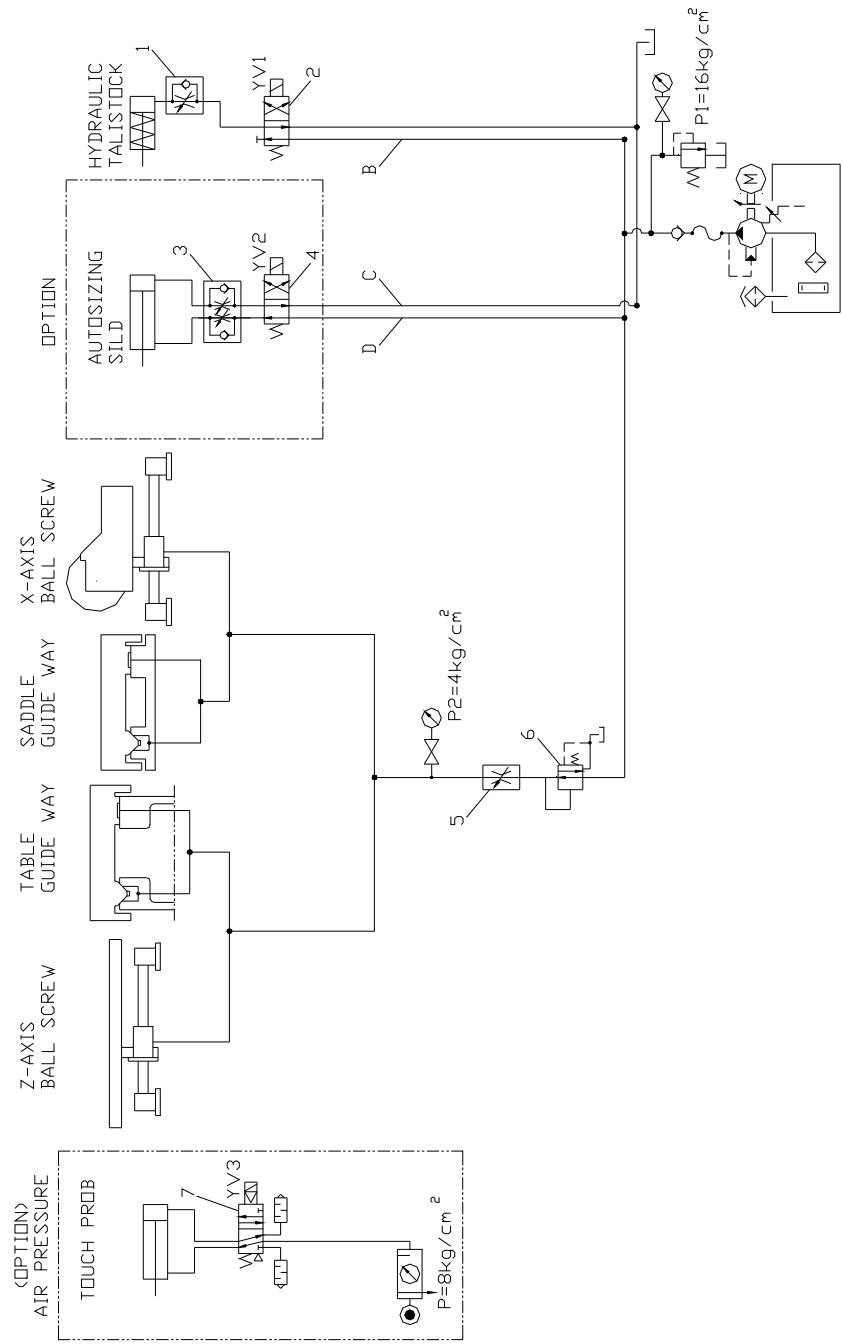
NOTICE : Please keep the oil in the proper level.

5.3 Hydraulic and lubrication system diagram

For OD-13/15 series



Only for OD-820 series



Chapter 6 Coolant System

6.1 Cooling Equipment

The volume of coolant tank is about 130 liters (31 US gallons). Just hook up the pipe to the coolant nozzle before connecting power.

6.2 Recommendation Coolants

An appropriate coolant is essential for precision grinding and which will result in the workpiece finish and wheel life.

A. The purpose of using coolant.

- a · Refrain workpiece from temperature rise.
- b · Flushing off the grinding dust & peel - off grains.
- c · Lubrication.

B. The categories of coolant

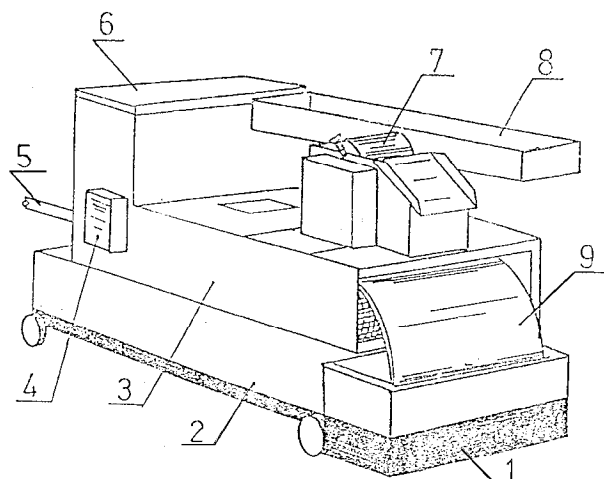
- a · Water soluble coolant : Mainly with non - organic solution, mostly suitable for cast iron.
 - (1) Emulsion type: the mixer will become ivory white color.
 - (2) Soluble solution type : the mixer will become transparency.
 - (3) Solution type: the mixer will become transparency.
- b · Non water soluble coolant : A coolant with mineral oil in sulfuric objects, suitable for lubrication.

**** NOTICE ****

It is not allowed to use flammable coolant liquids, the flash point must exceed 168 °C

6.3 Cleaning of Coolant System

6.3.1 Parts Name



- 1. Paper collecting box
- 2. Water tank
- 3. Paper filter body
- 4. Limit switch box
- 5. Coolant pump
- 6. Cover
- 7. Magnetic separator
- 8. Slot
- 9. Paper

The coolant system is divided into three divisions, the paper room, inlet water tank and magnetic separator are located in upper division . The middle division which includes plate filter and paper filter is used to collect the dirt from grinding. The lowest division supplied clean coolant to the grinding working. Each leg of coolant system is easy to be moved. There is a drained located in the lowest division, enhanced we can be easy to change the coolant.

6.3.2 Maintenance

- a · Renew coolant, please take apart with according No.1 to No.8 as shown in Fig 6.2
- b · Remove drained No.9 to draining out dirt and coolant, then please wash the tank with cleaning compound to prevent germ and stink.
- c · Add uniformly mixing coolant to tank the recover it opposite as (a)

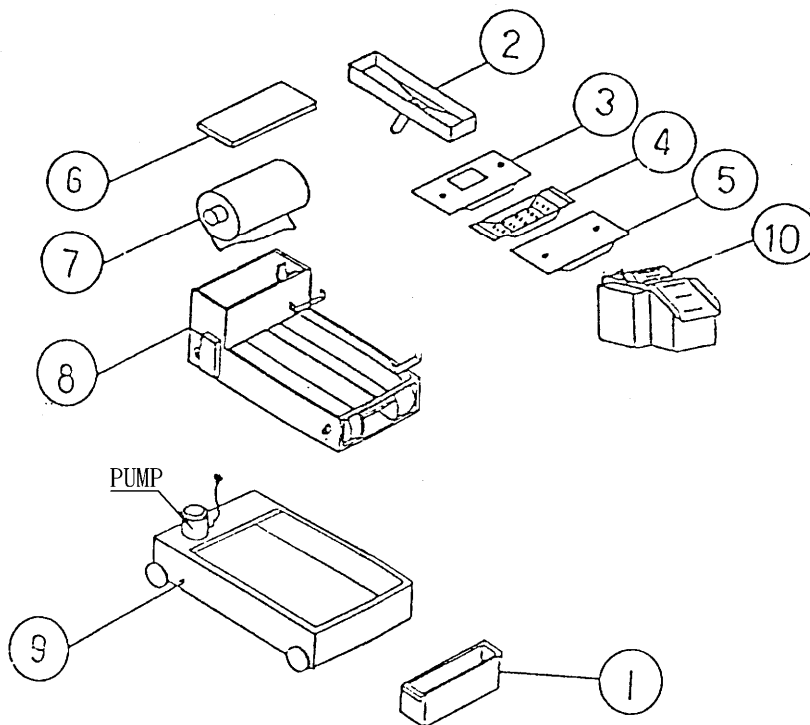


Fig. 6.

** NOTICE **

1. Please be used to clean the parts No.2, No.4 for coolant easily go through.
2. Please be used to check to PH value , germ content amount and contamination of coolant . This will increases coolant life and workpiece quality.
3. It's suggested to change coolant every three months.

6.3.3 Renew paper filter

- a · Remove cover of paper room (ref Fig 6.3 No.1) and inlet water tank (No.2,No.3,No.4)
- b · Place the roll of paper filter on the “U From” bracket of paper room then pull paper Through wire-net to paper collected box with according narrow direction.
- c · Replace the parts 5,4,3,2,1 in sequence.
- d · A paper is carried out when starts the paper transmutation motor.

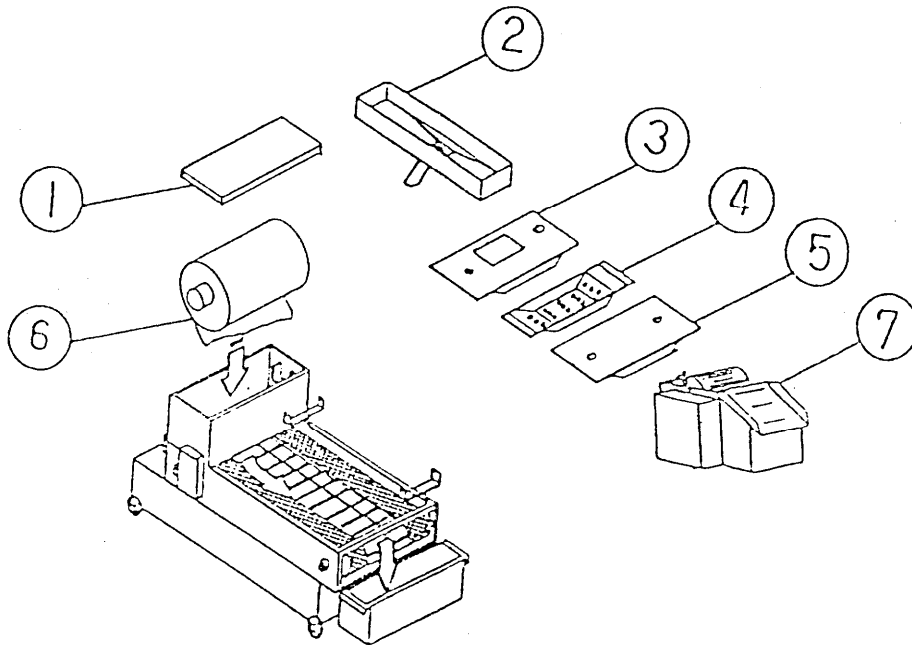


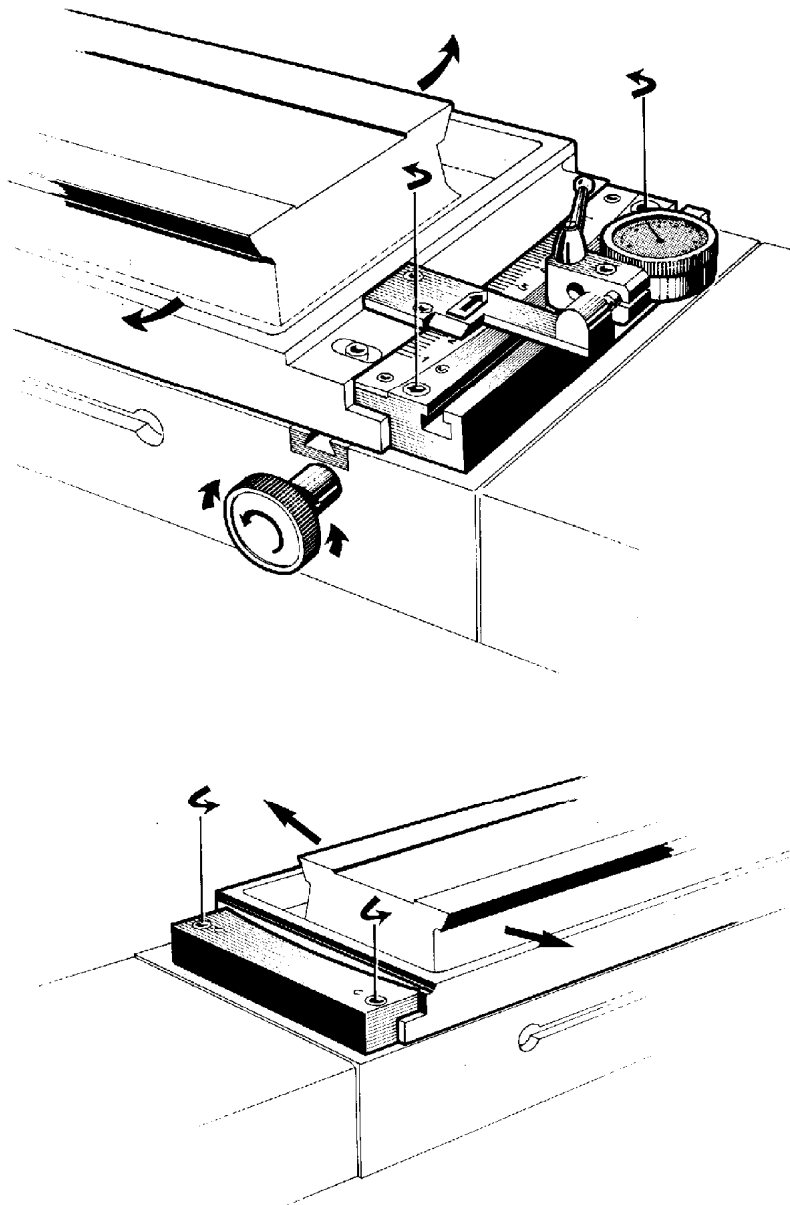
Fig 6.3

Chapter 7 Work Table (Z Axis)

7.1 The Adjustment of the Table Inclination Angle

The worktable is consisted of upper & bottom table slider. The upper table slide can be rotated and the ways for adjustment angles are described as following:

1. Release the 2 sunken head screws at both ends of the worktable.
2. Turn the angle adjustment knob together with the indicator and dial gauge to the required angle.
3. Tighten the 2 sunken head screws up.



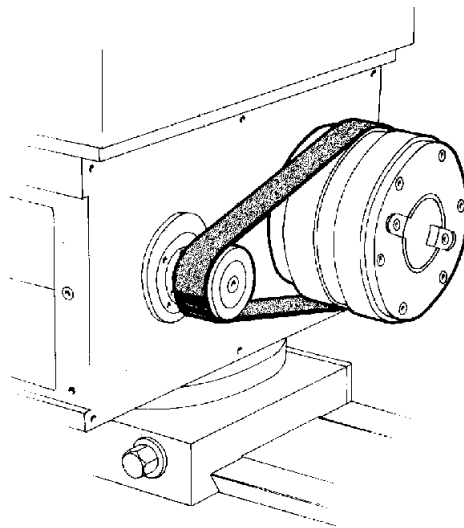
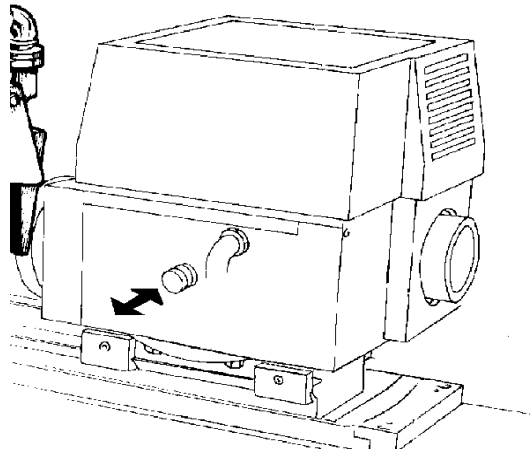
Chapter 8 Work Head

8.1 The Structure of the Work Head

1. The work head motor is together with pulley and inverter, the speed of the motor can become variable.
2. Either of the dead center or the live center can be used on the spindle, the dead center is preferable for external grinding, and the internal grinding will be taken by the live center with 3 – jaw chuck.
3. The work head is equipped and supported with high precision angular ball bearings which make the machine suitable for heavy duty grinding.

8.2 The alternation of the dead center and revolving center.

The spindle will rotate when a chuck is used. Pull out the cotter at rear of work head and press the clutch of driving plate into the groove of spindle nose for free spindle rotation. Start the procedures reversibly while replace the live center to dead center.



Chapter 9 Tail Stock

1. Please according to the workpiece length and move the tailstock to the proper position. It is require cleaning the table surface before moving the tailstock in order to maintain the accuracy.
2. According to the workpiece dimension and it's size to adjust the tension of carbide tip center with the knob, which is at rear of tailstock. Turn the knob clockwise to increase tension, on the contrary, to release the tension, and just turn the knob counterclockwise. If the center tension is too big, the workpiece may possibly be deflected or the bore center will be expended out. On the contrary, the workpiece would vibrate if the tension is too small.
3. Please clean both of the centers bore of workpiece and tailstock center before clamping in order to ensure grinding accuracy.

Chapter 10 Wheel Head

The wheel head include of the wheel head, saddle and saddle base. The wheel head can be driven both by manual and automatically.

10.1 Wheel spindle and Bearings (Except OD-820)

Wheel head is the key part of the machine, and it adapting Static/Dynamic pressure bearings to create an oil film around the spindle which not only can ensure grinding accuracy but also the spindle life. The strong points for this Static/Dynamic bearing are described as following :

1. No Wearing: the oil film supports the bearing and spindle, thus, there is no contact among the metals.
2. High Rigidity: The contact surface between spindle and bearing are enlarged because of oil film to remain the highest grinding accuracy and concentricity.
3. Absorption of Vibration: Any vibration during grinding can be absorbed by the oil film to retain a better grinding finish.
4. The switch of lube system is interlocked with spindle motor. When pressing the wheel "Start Button", the lube oil flows into the spindle through pressure limit switch. In case of insufficient oil pressure, the oil is unable to open the pressure limit switch to start the spindle motor. In another words, when the oil pipe is blocked or oil pressure is insufficient, the pressure limit switch will shut off spindle rotation so as to avoid any wearing away spindle and bearing, and the adjustment range for the oil pressure is among $1 \sim 3 \text{ kg/cm}^2$ (This can be monitored from pressure gauge) Attention : The oil filter can be seen when the oil cap is opened, please clean it monthly to ensure the oil can flow without problems. The spindle lubrication oil is recommended to use SHELL TELLUS C5.

10.2 The Mechanism & Adjustment of the Wheel Spindle Drive

Multi-rib v shape belts drive the wheel spindle. A big tension may result in a poor surface finish and a small tension cause vibration. Therefore, it is imperative to keep an adequate belt tension, which can be adjusted by the bolts at back of the motor.

Chapter 11 Grinding Wheel

A successful grinding is based on a qualified operator who has strong knowledge about the wheel forms types and the property of the grinding wheel. and knows how to use all kinds of wheels in different conditions.

The meaning of each letter & number for the above chart is described as following :
The basic abrasive of a grinding wheel are "Grain", "Bond agent", "Class & Structure".

1. Abrasive :

The most common used for the abrasive of a grinding wheel are ALUMINUM OXIDE & SILICON CARBIDE. The crystal of aluminum Oxide is softer and more crispy than Silicon Carbide and is suitable for high tensile parts grinding such as Carbide & Alloy Steel. However, the crystal of Silicon Carbide is extreme crispy and is an abrasive mostly suitable making grinding wheels to grind high tensile material such as cast iron; bronze; brass; aluminum; copper; etc.

2. Grain Density :

The grain density is denominated by the sifting capacity, for example, a grain has the grain density 24 which means it passed a sifter with 24 net-eye/inch. A rough grain density wheels are used for parts that need not fine finish, vice versa.

3. Bond Agent :

Which is a agent sticks and support wheel abrasive. "Soft" or "Hard" stand for "bonding strength", The bigger the bonding of wheel abrasive is, the thicker and stronger and harder the bonding film surround the abrasive is.

4. Grade :

Grinding wheels are classified according to the bonding strength, we address "soft" class for those abrasive likely to shell off and "hard" class for those binds intensively.

5. Structure :

The meaning of the Structure in grinding wheel stands for the distance among grains, namely, DENSITY. A wide bonded wheel is likely to wear out than those, which have intensive bonding. For a hard & crispy workpiece to get better finish, an intensive - bonded wheel is preferable.

NOTE : As mention above, the property of workpiece is the key factor for
Selecting a grinding wheel

Recommended Wheels for External Grindings

| Parts Material | | | Hardness (HRC) | Wheel Specs | |
|--------------------|---|---|------------------------------------|-------------------------------------|---------------|
| STEEL | Carbon Steel | Steel Plate | Below HRC 25 | A 54 M | |
| | | Carbon Steel Pipe Carbon Steel Casting Carbon Steel Casting | Above HRC 25 | WA 54L | |
| | Alloy Steel | Ni-Cr Alloy Steel Ni-Cr-Mo Steel Chrome Steel Cr-Mo Steel | Below HRC 55 | SA 54 L WA | |
| | | Al-Cr-Mo Steel High Carbon Chrome Alloy bearing Alloy Cast Steel Tool Carbon Steel | Above HRC 55 | SA 54K WA | |
| | | Tool Steel | High Speed Steel | Below HRC 60 | SA 54 K WA |
| | | | Alloy Tool Steel | Above HRC 60 | SA 54J WA |
| | Stainless Steel | Stainless Steel Heat Resistance Steel | | WA 54 K 46 L | |
| | Cast Iron | Gray Cast Iron Special Cast Iron Chilled Cast Iron Malleable Cast Iron | | C 54K GC 54J GC 54J WA 54M | |
| | | | | | |
| | | | | | |
| | | | | | |
| Non - Ferrous Part | Brass Bronze Aluminum Alloy Sintered Carbide | | C 46J WA 54L C 46J GC 80I | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

6. Main Factors for Choosing a Grinding Wheel

- A. Fix factors:
1. Property of workpiece
 2. Accuracy required
 3. Contact area of grinding
 4. Procedures of grinding operation

- B. Variable factors:
1. Wheel speeds
 2. Infeed rate
 3. Condition of the machine
 4. Operator's skill

(A) Fix factors :

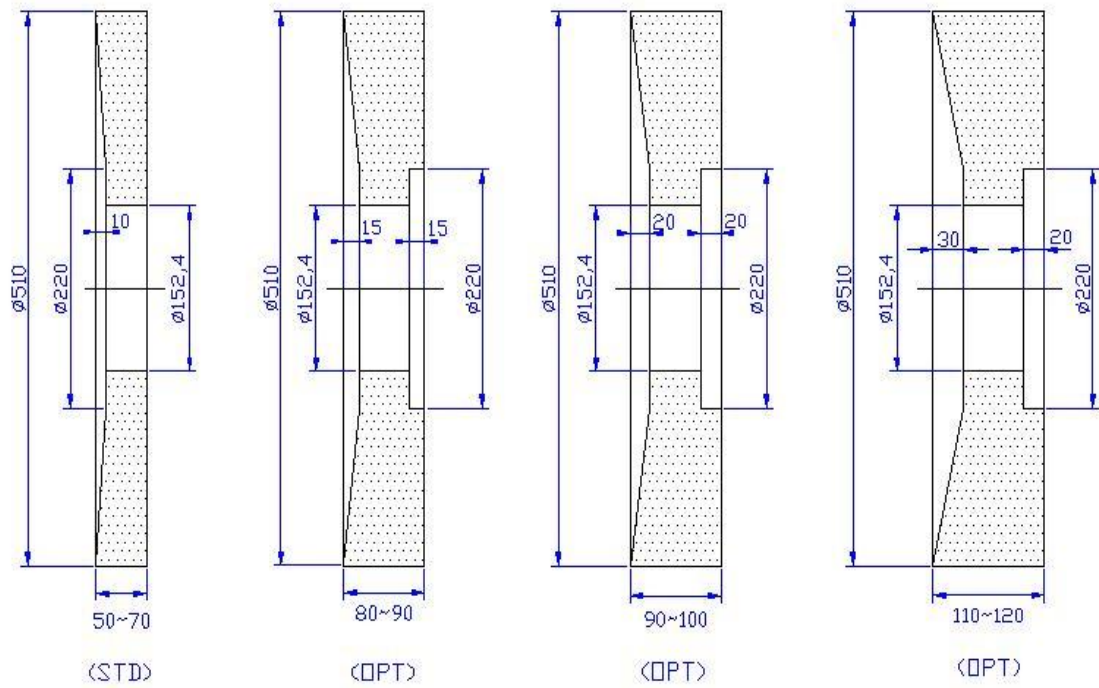
- (1) If a workpiece is made of steel or alloy steel, an aluminum oxide wheel is preferable to be used. For cast iron, non - ferrous metal and non - metal, use a silicon carbide wheel. Fine grain wheels are ideal for soft and malleable materials, hard wheels are ideal for soft parts. Soft wheels are ideal for hard parts. Nevertheless, a soft grinding wheel is recommended for soft materials such as brass so that prevent congestion and overload from grinding. Intensively - bond wheels are suitable for hard and crispy material while wide - bonded wheels suitable for soft and malleable parts.
- (2) In case a rough grain wheel is used for precision and fine finish grinding, It is suggested to use the highest spindle speeds. Normally a fine grain wheel is used for fine finish grinding.
- (3) Use a harden & fine grain wheel for small area grinding. Densive grain wheel is suitable for small area grinding whilst rough grain wheel is for a big area grinding.
- (4) In view of grinding operation, for precision grinding, a glass bond wheel is normally required, and for a super finish grinding, a resin or rubber bonded or shellac - bonded wheel is more suitable.

(B) Variable factors:

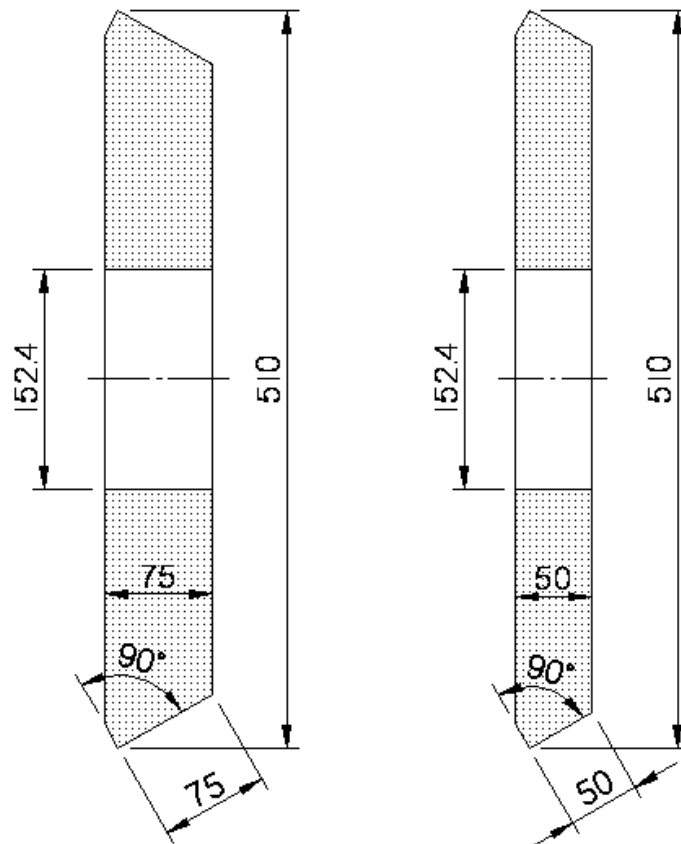
- (1) In case a high speed grinding is required, use a soft wheel or lower the spindle speeds to make the wheel grind like a soft wheel and increase wheel speeds to make the wheel grind like a hard wheel.
- (2) The more infeed rate, the higher grinding pressure is required, thus, a harder wheel is required to use. If workpiece produced rate is asked to raise up with the same infeed rate which may cause the wearing rate of the wheel shall be increased, for such condition, it can be modified to be better by using hard wheel.
- (3) If we consider the operator's skill, we will find that a hard wheel is more suitable for jobs paid by time.

11.2 Grinding Wheel

1-1 Universal Grinder $\phi 510$

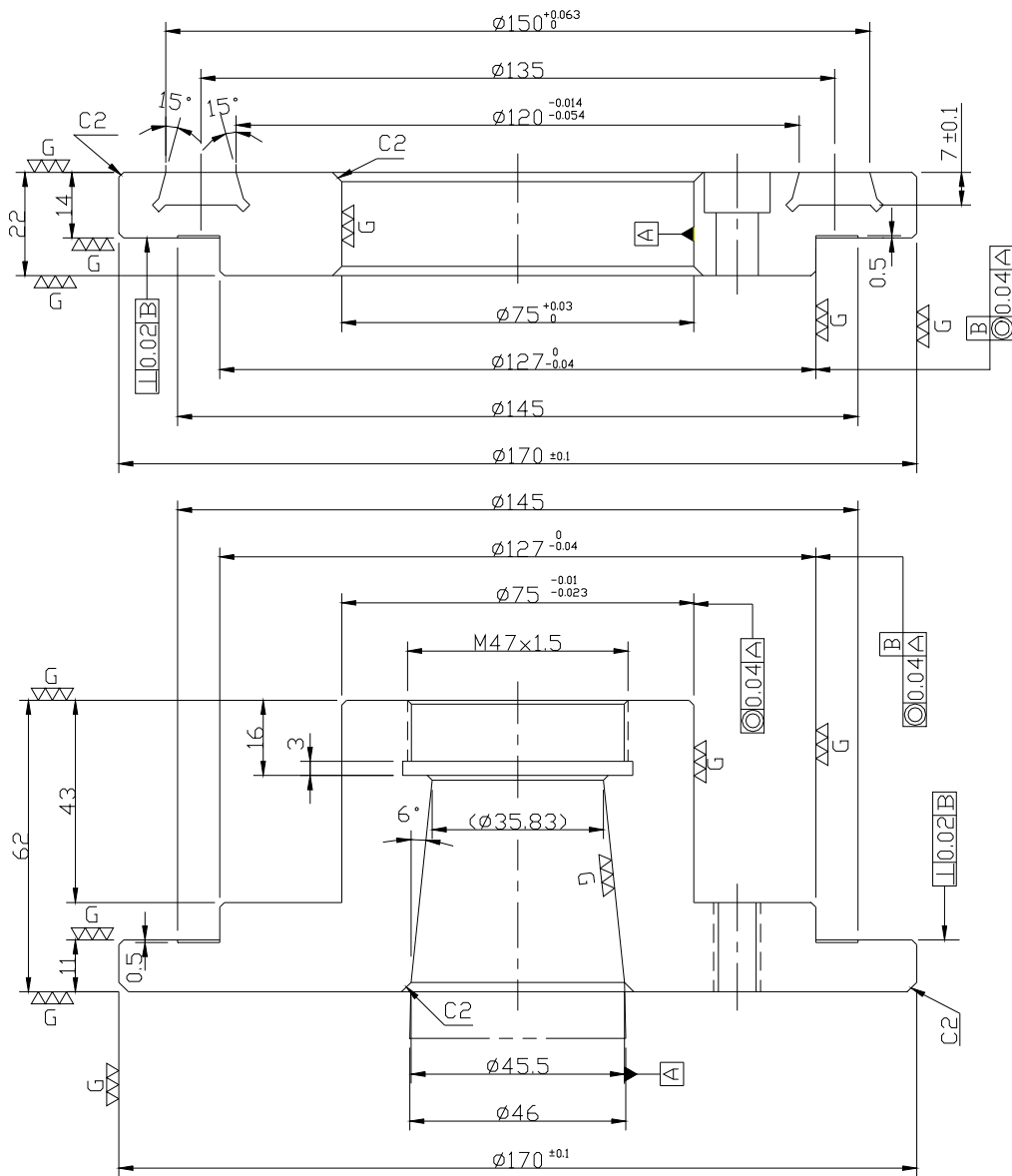


1-2 Angular Grinder $\phi 510$

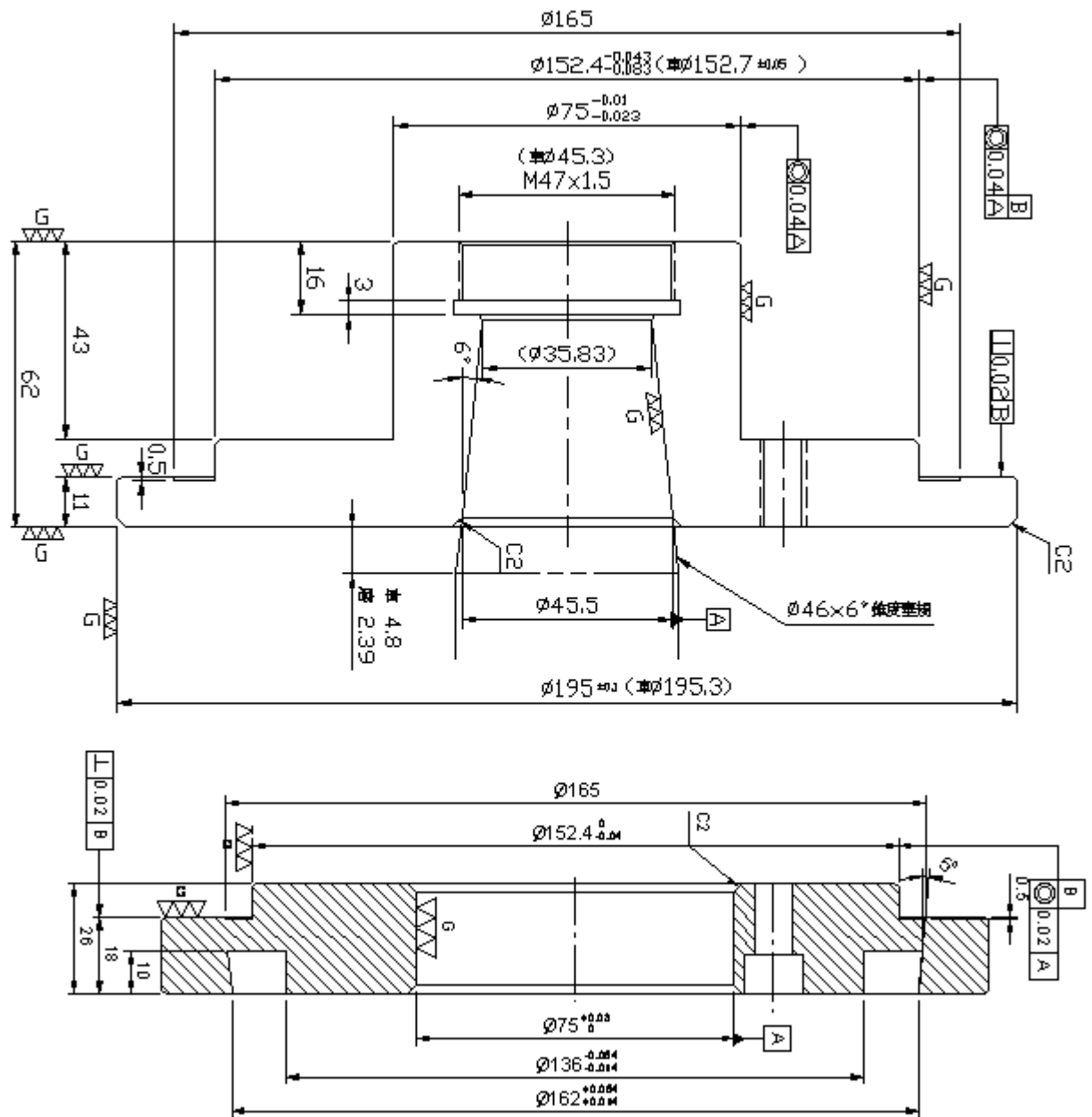


2. Dimension of the Wheel Flange

For OD-1820



6" (Bearing Type)



3. The Assembly of Grinding Wheel

- a · A piece of blotter paper with 0.25 mm thickness should be placed between the wheel and flange.
- b · Check the support surface, groove of wheel flange, nut, screw holes for any defects.
- c · Put the flange into wheel bore slightly. The allowance between the wheel bore and flange shall be equal, namely, the wheel flange can't stay at one side.
- d · Screw up the flange cover with spanner.
- e · Tighten the wheel nut again after 1-2 days machine running.

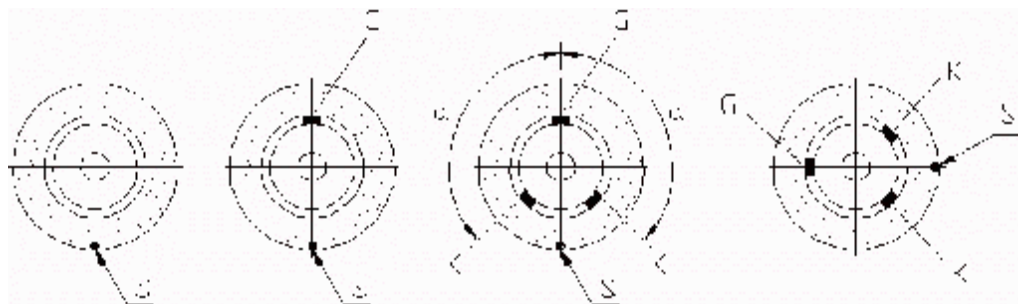
4. The Installation of the Grinding Wheel

- a · Clean the wheel bore and flange surface before mounting.
- b · Put the assembled wheels onto spindle slightly.
- c · Turn the nut with CCW direction to clamp the flange.

Dismounting the Grinding Wheel

- a · Open the wheels door and remove the splashguard.
- b · Insert the wheel extractor and turn it with CW direction to remove the wheel-clamping nut.
- c · Inserts the wheel extractor into the wheel flange till the bottom of extractor contact the wheel surface, then, remove the wheel flange slightly. In any condition, it is strictly prohibited to use a hammer or punch to take off the wheel forcibly.

11.3 Balance of Grinding Wheel



1. Insert the flange into wheel and tighten it.
2. (2) Mount the wheel onto spindle. Switch on the spindle and dressing the wheel with coolant. Stop the coolant after dressing and let the wheel rotate for 10 minutes or so to drop the water off the wheel.
3. Dismantle the wheel set from spindle and put the balancing arbor through flange bore, and put the wheel set on balance stand. Clean the flange bore and balance arbor tapered surface before mounting.
4. Set the wheel for free rotation to locate its gravity center "S" and mark it with chalk.
5. Put a balance weight at "G" position. Turn the wheel for 90 degrees see in which side (S&G) weights more.
6. Place 2-balance weight "K" at weightier side with same distance from "G".
7. Turn the wheel for 90 degrees see if the wheel is balanced. If not, move the balance weight "K" till the wheel is balanced no matter in which position the wheel rotates.

11.4 Dressing of Grinding Wheel

1. Installation of diamond dresser
 - a. Fix the diamond seat onto table
 - b. Put the diamond bit into the seat and tighten it.
2. Notes for wheel dressing:
 - a. A sufficient coolant is required while dressing the wheel. In the event of insufficient coolant, the diamond bit will become carbonized due to high heat generated because of friction. In this case, the life of diamond bit will be shortened and deteriorated if keeps using.
 - b. The feed rate for each dressing should not be large, as the diamond is a material of hard and crispy & unimpeachable. In order to prevent the diamond bit from impact against grinding wheel, start the dressing from the middle of wheel through both ends.
 - c. A fixed moderate dressing rate: For precision dressing, less than 5um. & 10 - 30 um for fine dressing whilst 40um (above) for rough dressing.
 - d. The diamond bit shall become wearing after use for a period of time and cause a poor dressing. Therefore it is suggested to change the diamond bit position at times to regain a good & shape-dressing angle.
 - e. Formula for dressing speed:

$$F = \frac{D' \cdot N}{2.5 \cdot 1000}$$

F: Feed Rate (mm/min)

D: Wheel Grain Size (u)

N: Wheel Speeds (RPM)

11.5 Reference Table of Grinding Conditions

(1) Workpiece periphery speed

Table: Workpiece periphery speed range

UNIT : m/min

| Type of Grinding | | Soft Steel | Quenched Steel | Tool Steel | Cast Steel | Bronze Alloy | Aluminum Alloy |
|-------------------|--------------------|------------|----------------|------------|------------|--------------|----------------|
| External Grinding | Coarse Grinding | 10 ~ 20 | 15 ~ 20 | 15 ~ 20 | 10 ~ 15 | 25 ~ 30 | 25 ~ 40 |
| | Fine Grinding | 6 ~ 15 | 6 ~ 16 | 6 ~ 16 | 6 ~ 15 | 14 ~ 20 | 18 ~ 30 |
| | Precision Grinding | 5 ~ 10 | 5 ~ 10 | 5 ~ 10 | 5 ~ 10 | — | — |
| Internal Grinding | Fine Grinding | 20 ~ 40 | 16 ~ 50 | 16 ~ 40 | 20 ~ 50 | 40 ~ 60 | 40 ~ 70 |

(2) Wheel in Feed Rate

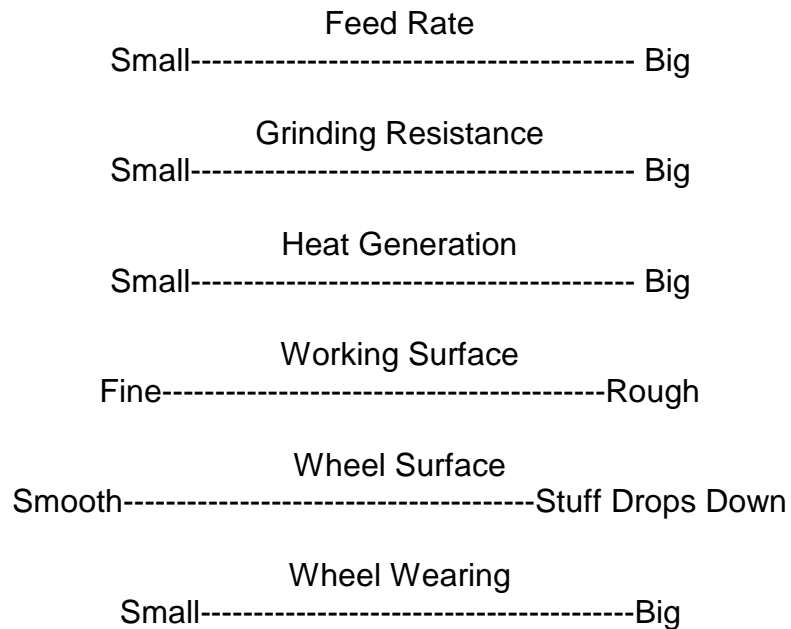
Table 2 : Feed rate per grinding

Unit : mm

| Type of Grinding | | | Soft Steel | Quenched Steel | Tool Steel | Stainless Steel Heat Resistance Steel | Cast Steel |
|-------------------|---------------------|-----------------|---------------|----------------|---------------|---------------------------------------|--------------|
| External Grinding | Plunge Grinding | Fine Grinding | 0.005 ~ 0.01 | 0.01 ~ 0.02 | 0.005 ~ 0.01 | 0.005 ~ 0.01 | 0.005 ~ 0.01 |
| | | Coarse Grinding | 0.02 ~ 0.04 | 0.03 ~ 0.04 | 0.02 ~ 0.03 | 0.02 ~ 0.03 | 0.02 ~ 0.04 |
| | Horizontal Grinding | Fine Grinding | 0.005 ~ 0.015 | 0.005 ~ 0.01 | 0.02 ~ 0.005 | — | 0.005 ~ 0.01 |
| | | Coarse Grinding | 0.015 ~ 0.04 | 0.02 ~ 0.04 | 0.005 ~ 0.01 | — | 0.015 ~ 0.04 |
| Internal Grinding | | Fine Grinding | 0.005 ~ 0.01 | 0.005 ~ 0.01 | ~ 0.005 | ~ 0.005 | 0.005 ~ 0.01 |
| | | Coarse Grinding | 0.015 ~ 0.03 | 0.15 ~ 0.03 | 0.005 ~ 0.015 | — | 0.015 ~ 0.03 |

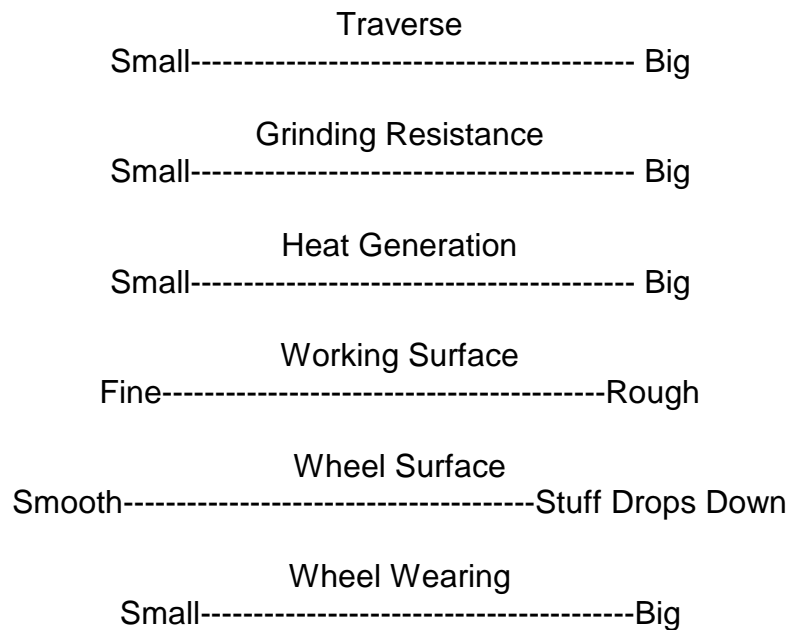
(3) The Influence of the Mechanical Condition & Grinding Results

(1) Influence of feed rate

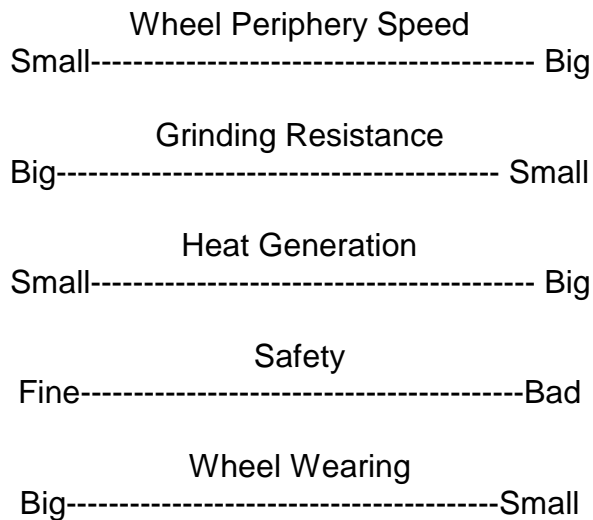


(2) The Influence of the Traverse Speed

The Provided feed rate for rough grinding is set at 100 - 500 mm/min and fine grinding is set at 50 mm/min based on workpiece per rotation, the traverse distance is set about 1/2 - 3/4 of the wheel width for rough grinding and at 1/8 - 1/4 for fine grinding



(3) The Influence of Wheel Periphery Speed



(4) The Influence of Workpiece Periphery Speed

Workpiece Periphery Speed
Small----- Big

Grinding Resistance
Small----- Big

Heat Generation
Big----- Small

Working Surface
Fine-----Rough

Wheel Wearing
Small-----Big

Chapter 12 Machine Alignment

12.1 Machine Alignment

Please check the machine's accuracy according to the following procedures :-

1. Alignment of the work table
 - a · Place a dial gauge on top of the worktable against dovetail surface of the upper table.
 - b · Turn the hand wheel of the worktable to check if the zero setting is obtained.
 - c · If not, please refer the procedures in paragraph 7-2 for the adjustment.

2. Alignment of work head & tailstock
 - a · Place a dial gauge on top of the worktable then put a test bar into the spindle's bore.
 - b · Apply the stylus onto the test bar
 - c · Turn the hand wheel of the worktable to check if the zero setting is obtained.
 - d · If not, please refer the procedures in paragraph 8-2 for the adjustment.
(Adjustment of work head inclination)
 - e · A bar with 300 mm length shall be tested and measure the diameter at both ends to ensure both of them have the same diameters. If not, re-align the table.

Chapter 13 Trouble Shooting and Corrections

13.1 Ripple Marks

| Problems | Caused | Remedy |
|--------------|---|---|
| Ripple Marks | <ul style="list-style-type: none"> * Wheel unbalance * Wheel out of roundness * Hard wheel grains * out off center or out off alignment or insufficient lubricant * Dressing | <ul style="list-style-type: none"> · Re-balancing the wheel · Re-dressing the wheel · Use a softer wheel · Check the center, alignment and the supplying of the lubricant · Choose a sharp wheel |

13.2 Scratch Marks

| Problems | Caused | Remedy |
|---|---|--------------------------|
| Deep & Narrow with Constant Marks | * A rough wheel is used | · Use a fine grain wheel |
| A Different Deep & Narrow with Non Constant Marks | * A soft wheel is used | · Use a harder wheel |
| A wide Spot | <ul style="list-style-type: none"> * Oil stains * Poor finish | · Re-dressing the wheel |

13.3 Scratch Marks

| Problems | Caused | Remedy |
|----------------------------------|--|--|
| A Fine Thread Marks | <ul style="list-style-type: none"> * Poor wheel dressing * Abnormal operation | <ul style="list-style-type: none"> · Replace the diamond tip and dress slowly · Use steady rest to decrease wheel pressure |
| Ripple Stream Line Chatter Marks | <ul style="list-style-type: none"> * Uneven wheel edge * Uncorrected wheel dressing * Rough grains or dirt on wheel * Bond agent breaks off and grains shell out | <ul style="list-style-type: none"> · Dress wheel edge · Always deep diamond bit sharpen and brush the wheel after cleaning · Re-dressing the wheel · More organic compounds in coolant and less soda compounds |

13.4 Scratch Marks

| Problems | Caused | Remedy |
|---|---|---|
| Irregular Scratch | * Dirt from coolant | · Change coolant |
| Irregular Wide & Long Mark or Ripple Finish | * Dirt from coolant | · Change coolant |
| Deep but irregular Scratch | * Wheel Flange Loosen | · Tighten the wheel flange |
| Grains Marks | * A rough or soft wheel is used * Uneven bond density * Rough dressing * Uncorrected fine grinding | · Use a fine grains or hard wheel · Use an even bond wheel · Slow dressing rate & speed · Slow table speed to allow a complete spark - out |

13.5 Threading Marks:

| Problems | Caused | Remedy |
|----------------------|----------------------------------|---|
| Rolling Thread Marks | * Out of alignment * Dressing | · Adjust the alignment of work head & tailstock · Re-dressing the wheel slowly |

13.6 Grinding Effects:

| Problems | Caused | Remedy |
|---|---------------------|---|
| Insufficient Grinding Capacity Lack of Luster, Workpiece Sintering. | * Wheel is too Hard | · Increase the workpiece traverse speed · Decrease the wheel speed & wheel diameter & width · Don't use resin coolant · Use a rough grain & soft wheel |
| Wheel Life Shortened & worn out easily | * Wheel is too Soft | · decrease the workpiece traverse speed & feed rate · Increase wheel speed, wheel diameter & width · Dress wheel slowly · Use high density coolant |

13.7 The alarm message

1. PS ××× alarm : the controller have been alarm refer the electrical manual on the page name "ERROR CODE LIST".
2. APC ××× alarm : alarm on the absolute pulse code (APC).
3. Servo alarm : alarm on the server system.

Please also refer to the error code list by FANUC maintenance manual or ask your local FANUC service center.

1010 alarm

The inverter alarm. Please re-check the alarm number on the inverter displayed and refer also to the operating manual of the manufacture.

Chapter 14 Lubrications and Maintenance

14.1 Lubrications

1. Lubrication of the Wheel Spindle Bearing

Fill the oil tank. The volume capacity is 44 liters. Recommended lubricant: SHELL TELLUS C5

MOBIL VELOCITE # 5

Change the lubricant every 6 months and make sure the oil is always at a proper level, which can be seen at the oil gauge. Clean the oil filter at least once a month.

2. Hydraulic Oil

Fill the oil tank. The volume capacity is 44 liters. Recommended lubricant:

Mobil 1405

CPC WAYLUBRICANT 32

SHELL TONNA S32

Replace the Hydraulic oil every 6 months and make sure the oil is always at a proper level which can be seen at the oil gauge.

3. Lubrication Oil of the track.

The lubrication oil is injected into the hydraulic reservoir, then the machine is operating.

The lubrication oil is flowing through the cylinders and the valve.

Then the lubrication oil will flow back into the hydraulic reservoir in order

To operate the machine cycle by cycle. The capacity of the hydraulic reservoir is about 40L.

Please use the lubrication oil below :

SHELL TONNA 32

MOBIL 1405

ESSO FEBIS 41

14.2 Maintenance

1. Check: Turn on the power and press each button switch

| Item | Periodical | Measures |
|----------------------------|------------|---|
| Hydraulic Oil | Daily | Check the oil gauge from rear side of oil tank |
| Wheel Spindle Oil | Daily | Check the oil gauge from rear side of oil tank |
| Coolant Oil | Daily | Check the coolant level from the coolant tank oil gauge |
| Hydraulic Oil Pressure | Daily | Check the oil meter on the hydraulic tank (about 14 ~ 15 kg/cm ²) |
| Wheel Spindle Oil Pressure | Daily | Check the oil meter on the hydraulic tank (about 1 ~ 3 kg/cm ²) |
| Slideways oil pressure | Daily | Check the oil meter on the hydraulic tank (about 1 ~ 2 kg/cm ²) |

For
OD-
13/15
series

2. Oil feeds

| Items | Periodical | Volume |
|---------------|----------------|-----------|
| Hydraulic Oil | Every 6 Months | 58 Liters |
| Spindle Oil | Every 6 Months | 35 Liters |
| Tailstock | Daily | 3 C.C |