

# 1. SPECIFICATION & FLOOR SPACE

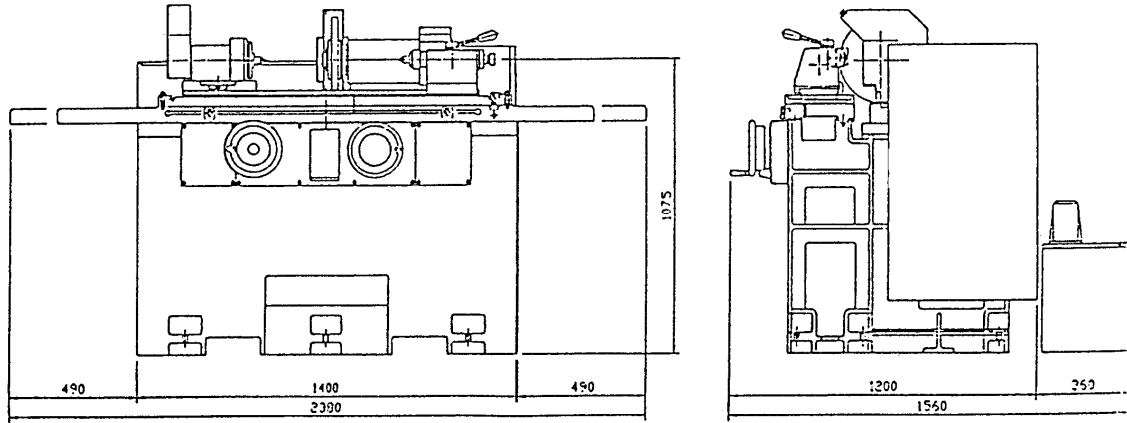
DESCRIPTION	MODEL	UNITS	OD-820
<b>GENERAL</b>	Distance between centers.	mm	500mm
	Swing over table	mm	200mm
<b>CAPACITY</b>	Max. grinding O/D of wheel	mm	200mm
	Max. load held between centers	kg(lb)	80kg
<b>WHEELHEAD</b>	Manual in feed travel	mm	140mm
	Auto increment in feed	mm	0.001~0.019
	In feed of hand wheel per division	mm	0.005mm
	In feed of hand wheel per revolution	mm	1mm
<b>GRINDING WHEEL</b>	Diameter´ Width´ Bore	mm	305´ 25´ 76.2[mm]
	Wheel speed (50/60)	rpm	1620/1960rpm
<b>TABLE</b>	Swiveling angle(R & L)	degree	±7°
	Travers speed (3 steps)	mm/min	80/128/192
	In feed of hand wheel per revolution	mm(in)	9(3/8 )
<b>WORKHEAD</b>	Swiveling angle (R & L)	degree	±90°
	Center taper	MT	MT3
	Spindle speed(4 Steps)	rpm	150/264/356/480
<b>TAILSTOCK</b>	Center taper	MT	MT3
	Quill travel	mm(in)	25(1")
<b>INTERNAL GRINDING SPINDLE</b>	Spindle speed	rpm	14000(OPT:25000)
	Max. grinding bore	mm(in)	24~70(2.76 )
	Max. grinding length	mm(in)	70(2.76 )
	Max. chucking length	mm(in)	275 ( 10-3/4 )
	Max. chucking diameter	mm(in)	110 ( 4-1/3 )
<b>MOTER</b>	Wheel spindle motor	HP	3 ( 4P )
	Work head motor	HP	1/4 ( 4P )
	Table traverse motor	HP	1/4 ( 4P )
	Coolant pump	HP	1/8 ( 4P )
	Internal grinding motor	HP	1/2 ( 4P )
<b>MACHINE</b>	Net weight (approx)	kg(lb)	1500 ( 3300 )
	Gross weight (approx)	kg(lb)	2000 ( 4400 )
	Packing dimension (L´ W´ H)	cm(in)	2080´ 1190´ 1970 ( 82"´ 47"´ 78" )

NOTE : The contents of this brochure are for reference only and are subject to change without notice.

FLOOR SPACE

UNIT : mm

OD-820



## 2. MACHINE TRANSPORTATION & INSTALLATION

### 2-1. TRANSPORTATION:

The table and wheel head are fixed with red color of clamping plate during transportation to avoid any damage. It is must remove all these red color of clamping plates prior to operations.

The wires outside the electrical cabinet and control panel are covered in a flexible conduit for easy transportation, and there is no oil and coolant supplied when machines are shipped.

Before lifting the machine, prepare an adequate cable. Hook the cable unto the eye-bolts fixed at base (Fig. 2-1). Please take a note of the following items while lifting is to be made.

- a. The cable must be adequate of lifting weight more than 7 tons.
- b. Place wooden wedge or rags between cable & machine to prevent the machine from damage.
- c. Lifting cable must be strong enough with diameter over 12mm.
- d. Table must be securely fastened to avoid any slip during movement.

### 2-2. CLEANING:

All slideways and ground surface are coated with anti-rust preventive before delivery. Remove the coating with solvent agent prior to operation.

### 2-3. INSTALLATIONS:

While doing the installation, special cares must be paid to the followings:

- a. Never install the machine at an area where has direct sun light to maintain a longer life, preferable at an area has constant temperature.
- b. Never install the machine at an area where is dusty, nor at an area next to high-shocking machines, such as, air compressor, press machine, etc.
- c. Machine is supplied with leveling screws and blocks as standard to facilitate leveling and to avoid any vibration.

- d. Prepare a proper foundation in reference of the drawing (Fig. 2-2) prior to machine arrival.

#### 2-4. LEVELING:

It is essential to level the machine before operation. Cares must be paid to the followings while leveling to be made.

- a. Prepare a spirit level with dial 0.01/1000 mm.
- b. Move the table to the middle of machine base.
- c. Clean the table surface.
- d. Place the spirit level in the middle of table and adjust the leveling screws to set "zero" point. And move the table to extreme left hand side and right hand side to gain the tolerance value. The tolerance is 0.002 mm between the right value to the leveling.
- e. Check leveling which maybe varied due to work load and others in 30 days after installation. And check semiannually afterwards to retain grinding accuracy.

OD-820

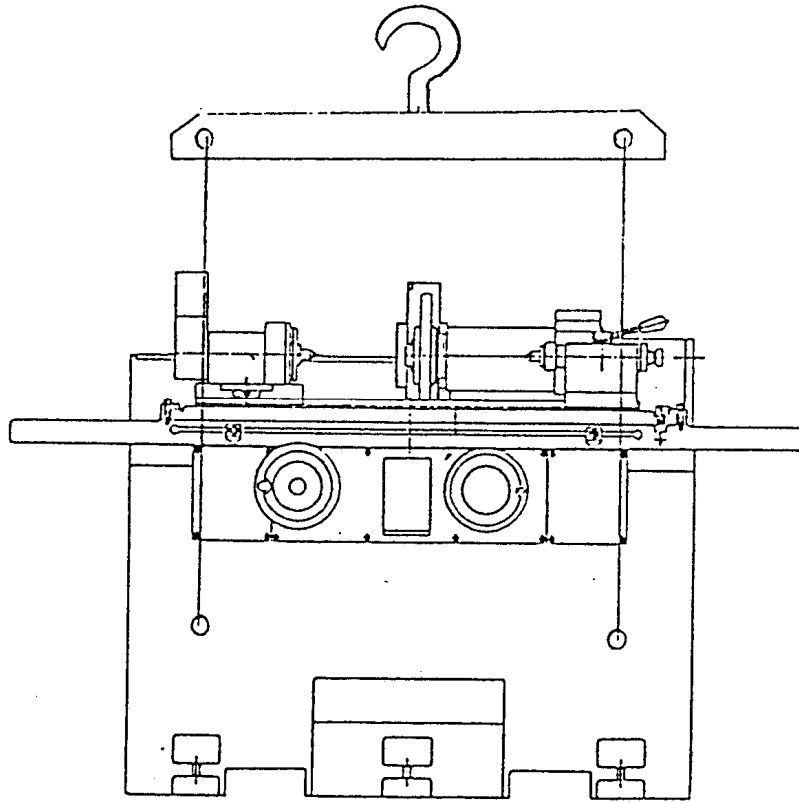


Fig. 2-1

OD-820

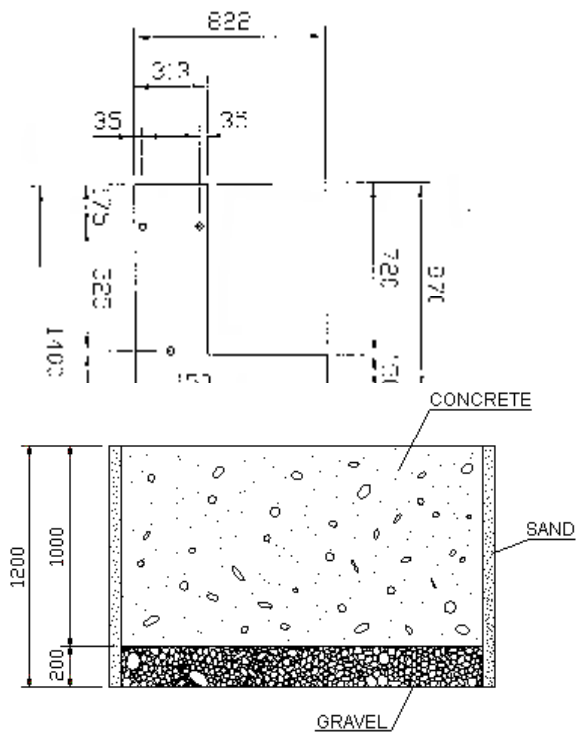


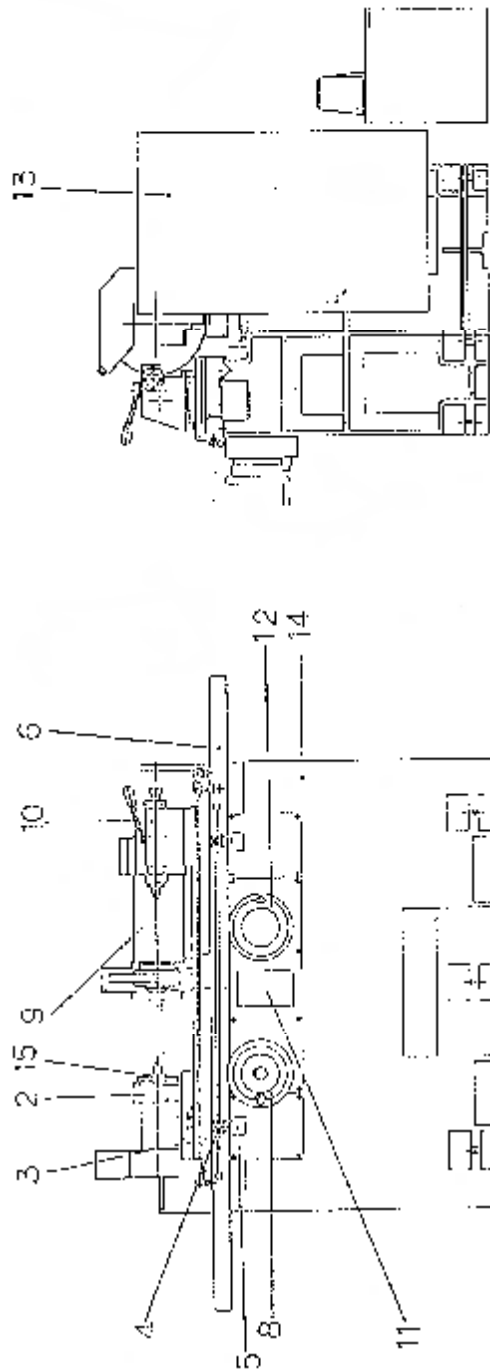
Fig. 2-2

## 3. DESCRIPTION OF MACHINE

### 3-1. ILLUSTRATIONS OF MACHINE (FIG. 3-1):

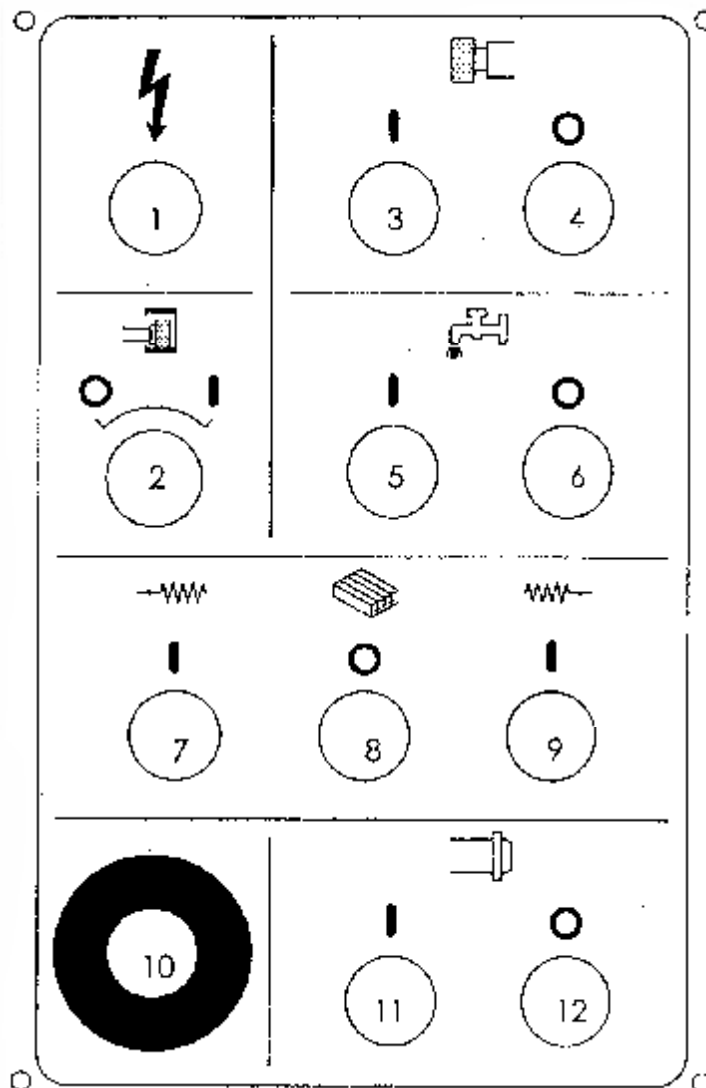
1. INTERNAL GRINDING ATTACHMENT (OPTIONAL ACC'S)
2. WORK HEAD
3. TOP TABLE SLIDE
4. TABLE TRAVEL LIMIT DOG
5. REVERSE LIMIT SWITCH
6. BOTTOM TABLE SLIDE
7. AUTO/MANUAL OPERATING KNOB
8. TABLE HANDWHEEL
9. WHEEL HEAD
10. TAILSTOCK
11. CONTROL PANEL
12. WHEEL HEAD HANDWHEEL
13. ELECTRICAL CABINET
14. BASE
15. 5C COLLET CLOSER (OPTIONAL ACC'S)

FIG. 3-1



**3-2. ILLUSTRATIONS OF CONTROL panel for OD-820 M TYPE**  
**( Fig 3-2.)**

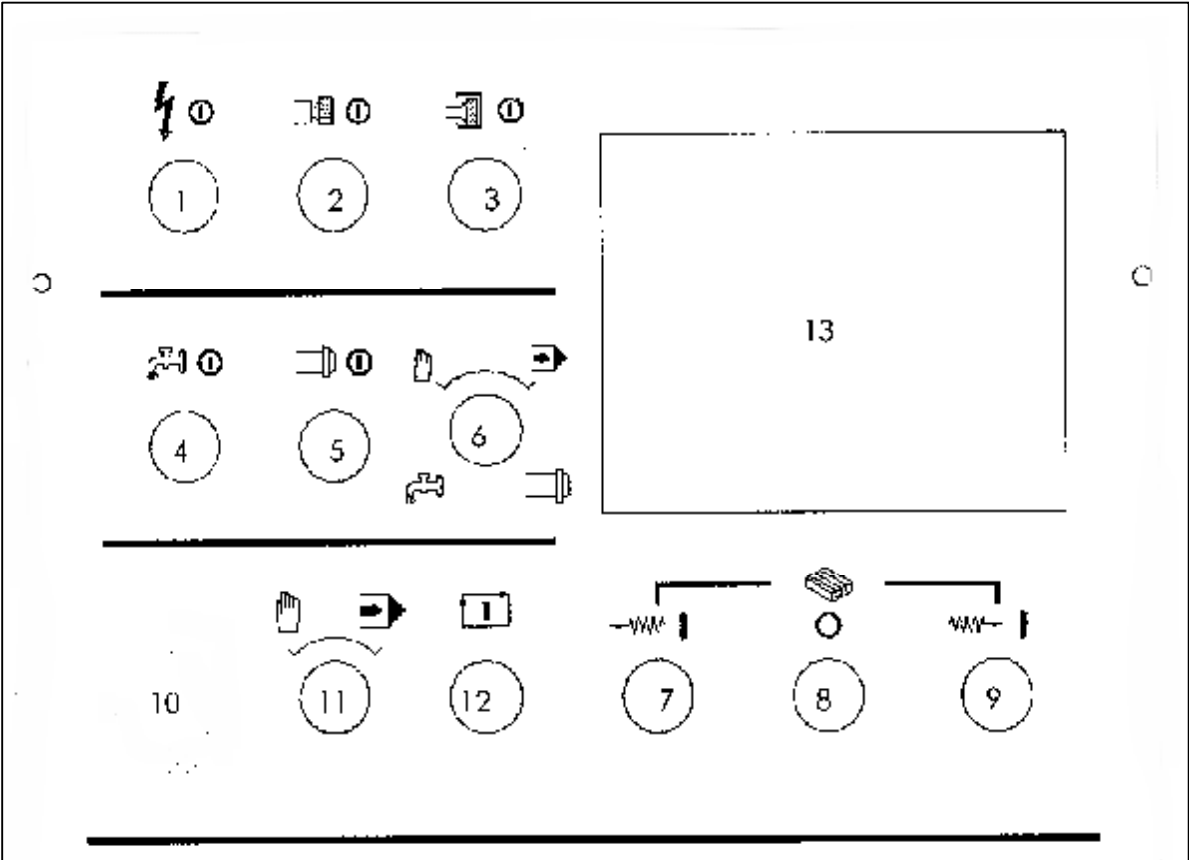
1. Power "ON / OFF" button
2. I/D spindle "ON / OFF" selection switch
3. Wheel "ON " button
4. Wheel "OFF " button
5. Coolant "ON " button
6. Coolant "OFF " button
7. Table right side movement button
8. Table "STOP" button
9. Table Left side movement button
10. Emergency stop button
11. Work head spindle "ON " button
12. Work head spindle "OFF " button





**3-3. ILLUSTRATIONS OF CONTROL panel for OD-820 NC TYPE : ( Fig 3-3.)**

1. Power "ON / OFF" button
2. Wheel spindle "ON / OFF" button
3. I/D spindle "ON / OFF" switch
4. Coolant "ON/OFF " button
5. Work head spindle "ON/OFF" button
6. Work head & coolant "Manual / Auto" selection switch
7. Table right side movement button
8. Table "STOP " button
9. Table Left side movement button
10. Emergency stop button
11. "Manual / Auto " mode selection switch
12. Cycle start button
13. Touch screen



## 4. ELECTRICAL POWER & MOTORS

### 4-1. ELECTRICAL EQUIPEMENT:

Check the machine voltage with power source before connection. And check the rotation of motors before operation.

### 4-2. ROTATION OF MOTORS:

Check the rotation of motors in details before operating the machine.

Wheel head motor : the grinding wheel should rotate **inward** in the operator's direction.

Work head motor : the tipped center should rotate **inward** in the operator's direction.

Coolant pump : clockwise (CW)

NOTE: The rotation of motors are checked in the plant before delivery. In case any of the motors run in opposite direction, just switch any of the "R/S/T" cables in the electrical cabinet. In case there are more than 2 motors run in opposite direction, the cable change from the individual motor connection is required.

## 5. LUBRICATIONS & COOLING

### 5-1. LUBRICATION SYSTEM

There is an one-shot lubricator supplied as standard for lubrication on all slideways. The volume of the unit is of 400 c.c.

### 5-2. COOLANT SYSTEM

The volume of coolant tank is of 75 liters (18 US gallons). Just hook up the pipe to the coolant nozzle before connecting power.

### 5-3. RECOMMENDED COOLANTS

An appropriate coolant is essential for precision grinding, and it is resulted in the finishing of the work piece and wheel life.

A: Purpose of using coolant

- a. Refrain work piece from temperature rise.
- b. Flush off the grinding dust & peel-off grains.
- c. Lubrication.

B: Category of coolant

- a. Soluble coolant: mainly with non-organic solution, mostly suitable for cast iron, cast steel grindings.
  1. Emulsion type
  2. Soluble solution type
  3. Solution type
- b. Non-soluble coolant: a coolant with mineral oil in sulfuric objects, suitable for lubrication.

## 6. TABLE

### 6-1. TABLE TRAVERSE AND ADJUSTMENT

The table can be driven both by manual and mechanical:

#### A: MANUAL TRAVERSE:

Release the AUTO/MANUAL operating knob (Fig. 6-1-1) at table handwheel. Push the handwheel forward to disengage the clutch gear (Fig. 6-1-2) from the clutch unit (Fig. 6-1-3). Swivel the handwheel to drive table manually.

#### B: MOTORIZED AUTO DRIVE:

Adjust the table travel limit dogs to a desired position. Tighten the AUTO/MANUAL operating knob at the table handwheel to engage the clutch gear with the clutch unit. Press the table "RIGHT" or "LEFT" movement switches to drive table automatically. The table is of 3-step speeds that can be altered by adjusting the step pulley at back of the machine.

### 6-2. ADJUSTMENT OF TABLE INCLINATION

The table consists of top & bottom slides in which the top slide is adjustable as follows (Fig. 6-2):

1. Release the two hex bolts at both table ends.
2. Pull up the knob (Fig. 6-2-1).
3. Turn the adjusting knob in conjunction of the indicator to desired angle.
4. Tighten the two hex bolts at both table ends & begin grinding.

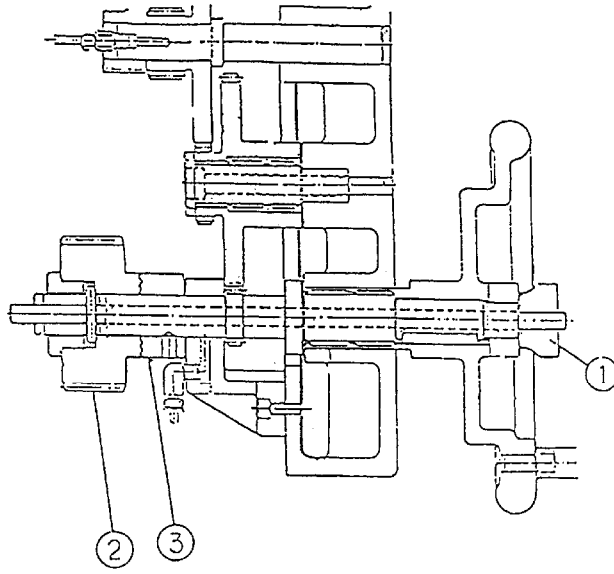


Fig. 6-1

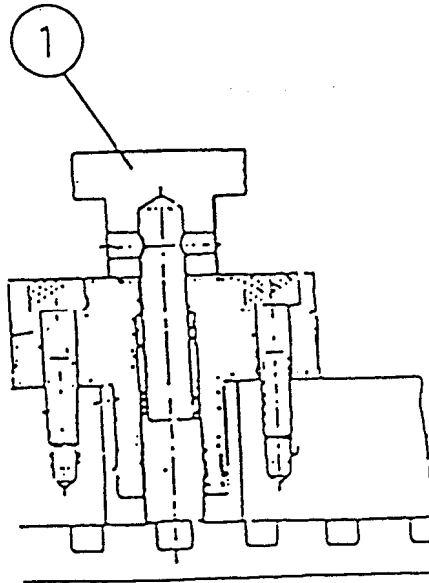


Fig. 6-2

## 7. WORKHEAD

### 7-1. STRUCTURE OF WORKHEAD

1. The workhead is furnished with 1/2HP motor and it's capable of generating 4 speed by means of a step pulley. Please refer to the speed chart and pulley position on the side cover of work head while changing the speed.
2. Dead center & live center are available for supporting workpiece. Use a dead center for external grinding. When using a 3-jaw chuck, the spindle can be shifted for a free rotation.

### 7-2. ADJUSTMENT OF WORKHEAD

1. MOVEMENT OF WORKHEAD: Release the two fixed bolts at back of the unit to move the workhead to ideal position. Then clamp the two bolts. Clean the table surface before moving is to be made.
2. INCLINATION OF WORKHEAD: Release the two setting bolts at bottom of the unit to swivel the workhead  $\pm 45^\circ$  to an ideal angle. Then clamp the bolts.
3. ALTERNATION OF DEAD CENTER & LIVE CENTER: The spindle rotates when a chuck is used. Pull out the cotter (Fig. 7-1-1) at back of the unit & press the clutch of driving plate into the groove ( Fig. 7-1-2) of spindle nose for free rotation. Start the procedures reversely while changing the live center to dead center.

### 7-3 5C TYPE OF WORKHEAD

1. Due to the different size of workpiece, you have to change the different size of 5C collets. First, by releasing the black nut (Fig. 7-2-2), you can pull the collet out and put the different size of collet in. Pull out the handle of the 5c collet closer (Fig. 7-2-1) to hold the workpiece, and push it in to release the workpiece.
2. If you want to grind the workpiece by using two carbide tip center, you must put the 5C carbide tip center into the 5C collet closer.
3. If you want to use 3-jaw chuck, you must tight the 3-jaw chuck into the 5C face plate first, then tight the 5C face plate into the 5C collet closer.

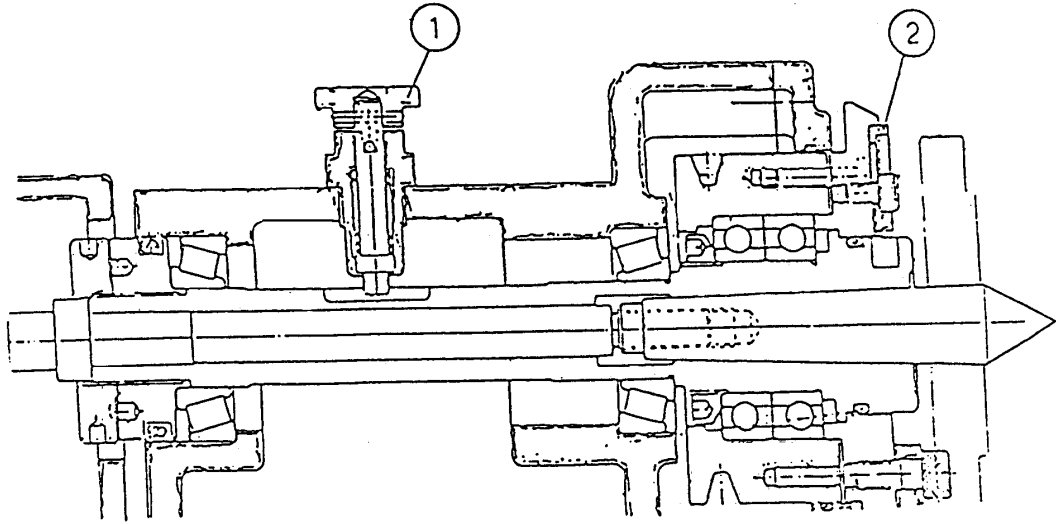


Fig. 7-1

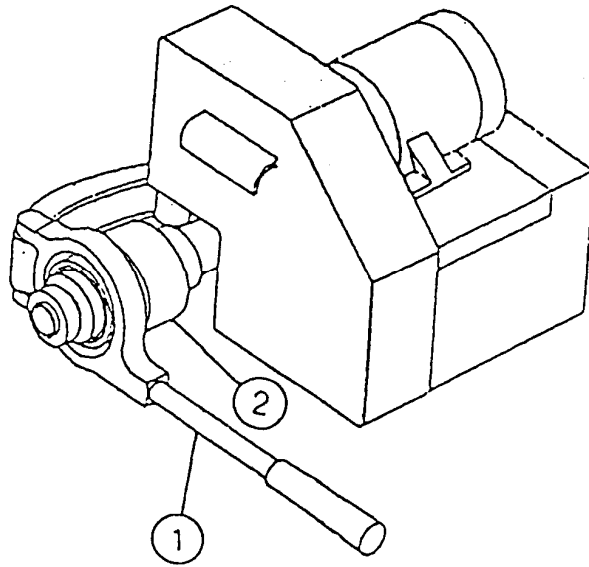


Fig.7-2

## 8. TAILSTOCK

- A. Move the tailstock in position according to the workpiece length.  
Clean the table surface before moving the tailstock to maintain the accuracy.
  
- B. Adjust the tension of carbide tip center from the knob at rear of tailstock according to the workpiece length and forms. Turn the knob clock wisely to increase the tension while turn counter clock wisely to release it. The workpiece may possibly be deflected or its center bore expended in case the center tension is too great. To the contrary, the workpiece would vibrate if it is small.
  
- C. Clean the center bore of the workpiece and tailstock before clamping to ensure grinding accuracy.



## 9. WHEELHEAD

The wheelhead comprises of wheelhead base, rotary base, saddle and saddle slide, etc. That can be driven both by manual and automatically and is inclinable for taper grinding.

### 9-1. WHEEL SPINDLE AND BEARINGS

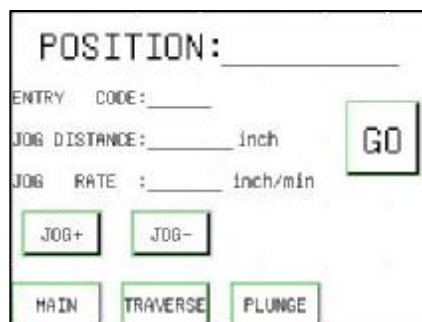
The wheelhead is the key part of the machine that adopts 3 pieces of precision angular contact ball bearings providing a higher rigidity so as to obtain a finer straightness and roundness.

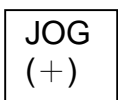
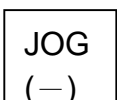
### 9-2. WHEEL SPINDLE DRIVE MECHANISM & ADJUSTMENT

The wheel spindle is driven by a multiple V belt. A big tension may cause a poor surface finish while a small tension may cause vibration. Therefore it is imperative to keep an adequate belt tension that can be adjusted thru the bolts at back of motor.

### 9-3. WHEELHEAD INFEEDES MECHANISM

1. RAPID INFEEED & RETRACT: It can be executed in FX2N-1PG control.



Press  will be rapid infeed. Press  will be retracted.

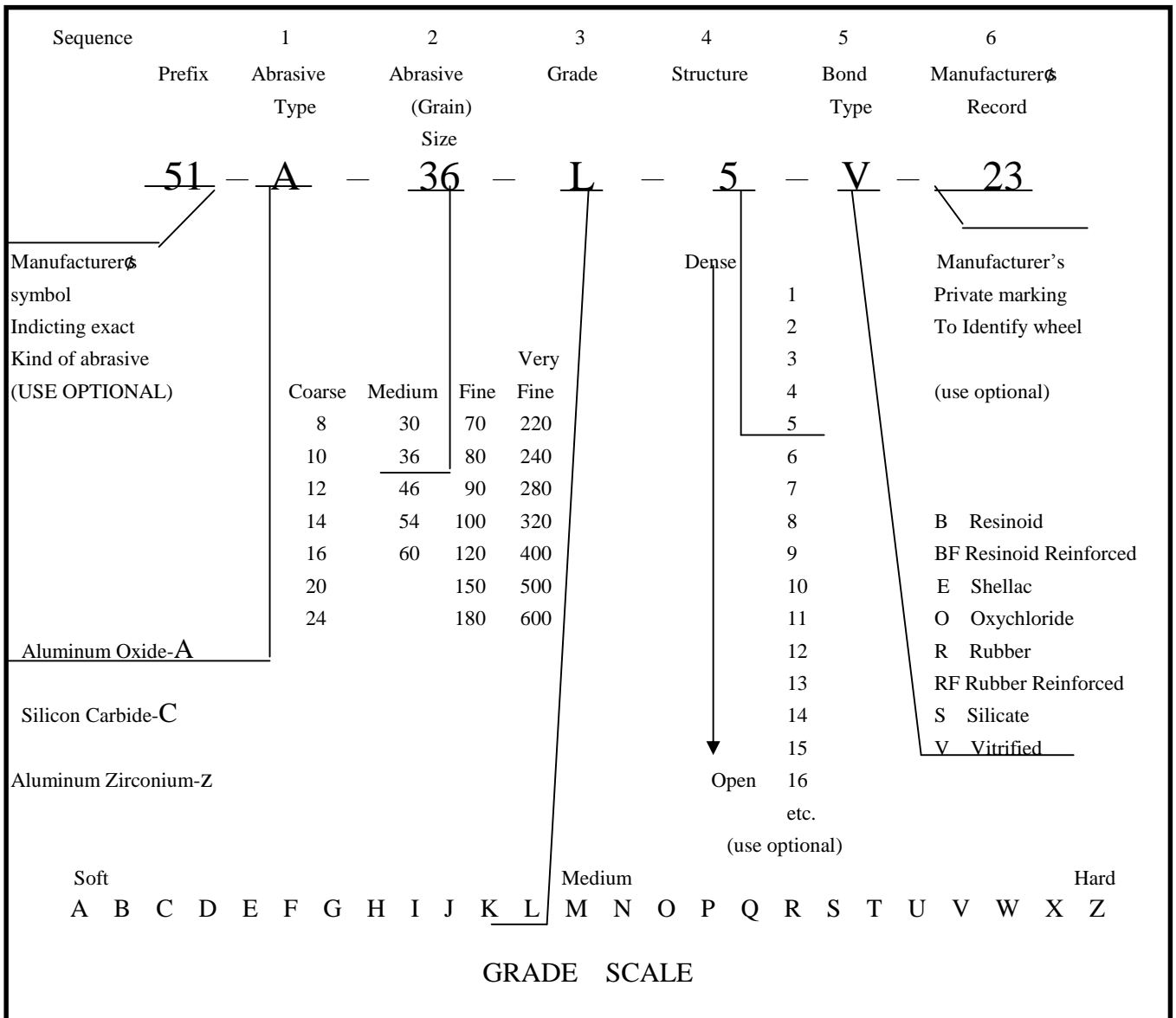
2. MANUAL INFEEED: Swivel the wheelhead handwheel for manual infeed. Infeed of handwheel per division is of 0.005mm ( 0.0002<sup>2</sup> ), that is, the diameter of workpiece decrease 0.005mm ( 0.0002<sup>2</sup> ) on each division feed.

# 10. GRINDING WHEELS

## 10-1. SELECTION OF GRINDING WHEELS

A successful grinding is depend on a qualified operator who knows well about the forms, types and property of grinding wheels and knows how to use them in different conditions.

### STANDARD MARKING SYSTEM CHART



The letter & number of the above chart represents the meanings described as below. The basic abrasives of a grinding wheel are grains, bond agent, class & structure.

A. Abrasive:

The abrasive of a grinding wheel widely used 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. The crystal of silicon carbide is extremely crispy. This abrasive of grinding wheel is mostly suitable for grinding high tensile material such as cast iron, bronze, brass, aluminum, copper, etc.

B. Grain Density:

The grain density is denominated by the sifting capacity. When a grain that passes a sifter with 24 net-eye/inch, its grain density is 24. A rough grain density wheel is used for parts that need not fine finish, vice versa.

C. Bond Agent:

It sticks the agent and supports wheel abrasive. "SOFT" or "HARD" stands for bonding strength. The bigger the bonding of wheel abrasive is, the thicker and stronger and harder the bonding films surround the abrasive is.

D. 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.

E. Structure:

It stands for the distance among grains, namely, density. A wide-bonded wheel is likely to wear out than those which have intensive bonding. A hard & crispy workpiece must use an intensive-bonded wheel for better finish.

**NOTE:** As described above, the property of workpiece is the key factor for selecting a grinding wheel.

**RECOMMENDED WHEELS FOR EXTERNAL GRINDINGS**  
(with coolant, finish 1 - 6 mm)

<b>PARTS MATERIAL</b>			<b>HARDNESS (HRC)</b>	<b>WHEEL SPECS</b>	
STEEL	CARBON STEEL	STEEL PLATE CARBON STEEL	BELOW HRC 25	A 54M	
		CARBON STEEL PIPE CARBON STEEL CASTINGS CARBON STEEL CASTINGS	ABOVE HRC 25	WA 54L	
	ALLOY STEEL	NI-CR ALLOY STEEL NI-CR-MO STEEL CHROME STEEL	BELOW HRC 55	SA 54L WA	
		CH-MO STEEL 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 54K WA
			ALLOY TOOL STEEL	ABOVE HRC 60	SA 54K WA
STAINLESS STEEL	STAINLESS STEEL HEAT RESISTENCE STEEL		WA 54K 46L		
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		C 46J	
		BRONZE		WA 54L	
		ALUMINUM ALLOY		C 46J	
SINTERED CARBIDE			GC 80I		

## F. Main factors for choosing a grinding wheel

- (I) Fixed factors:
1. property of workpiece
  2. accuracy required
  3. contact area of grinding
  4. procedures of grinding operation
- (II) Variable factors:
1. wheel speeds
  2. infeed rate
  3. condition of machine
  4. operators skill

### (I) FIXED FACTORS:

1. If a workpiece is made of steel or alloy steel, use an aluminum oxide wheel. For cast irons, non-ferrous metal and non-metal, use a silicon carbide wheel. Fine grain wheels are ideal for soft and malleable materials while 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 as to prevent congestion and overload from grinding. Intensive-bonded wheels are suitable for hard and crispy material while wide-bonded wheels are suitable for soft and malleable parts.
2. In case a rough grinding wheel is used for precision and fine finishing, by using the highest spindle speeds. Normally fine grinding wheel is used for fine finishing.
3. Use a harden & fine grinding wheel is for small area grinding. Intensive grinding wheel is suitable for small area grinding while rough grinding wheel is for big area grinding.
4. In view of grinding operations, for precision grinding, a glass bond wheel is normally required, and for a super find grinding, a resin or rubber bonded or shellac-bonded wheel is more suitable.

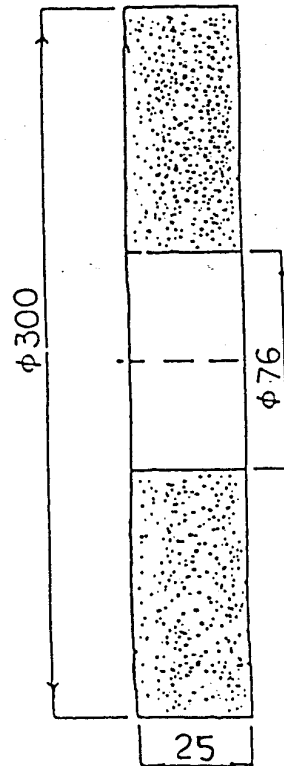
### (II) VARIABLE FACTORS:

1. In case a high speed grinding is required, use a soft wheel. Otherwise, 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. A high infeed rate, the grinding pressure & a hard wheel is required.

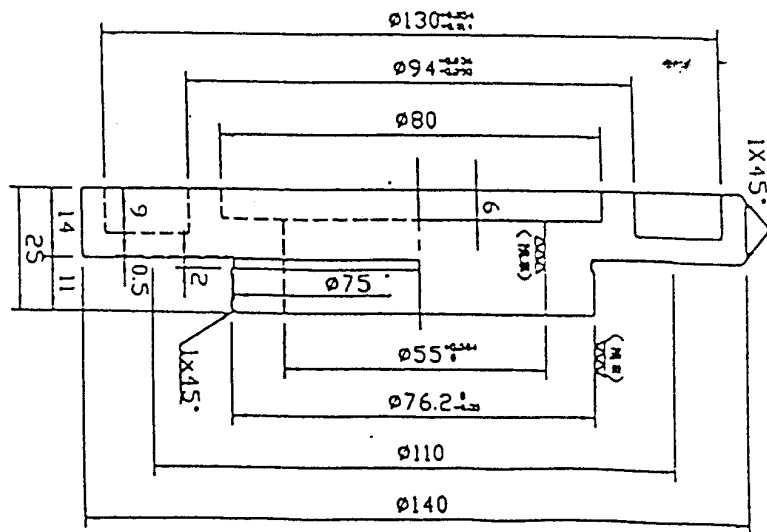
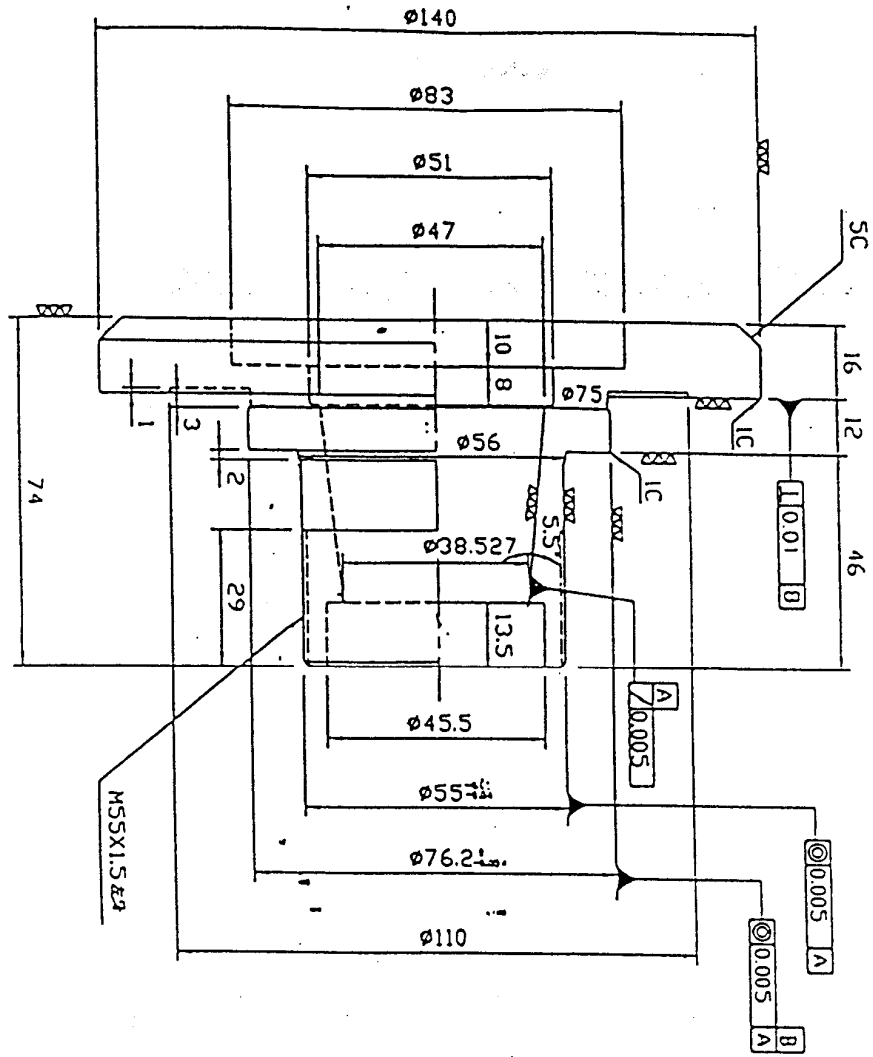
3. A hard wheel is more suitable for jobs paid by time.

## 10-2. GRINDING WHEEL

A. Dimension of grinding wheel



B. Dimension of wheel flange



### C. Assembly of grinding wheel

- a. Place a piece of blotter paper with 0.25mm between wheel and flange.
- b. Check the support surface, groove of wheel flange, nut, and screw holes for any defects.
- c. Put the flange into wheel bore slightly. The clearance between the wheel bore and flange must be equal, namely, the wheel flange can not stay at one side.
- d. Screw up the flange cover with spanner.
- e. Tighten the wheel nut again after 1 - 2 days running.

### D. Installation of wheel

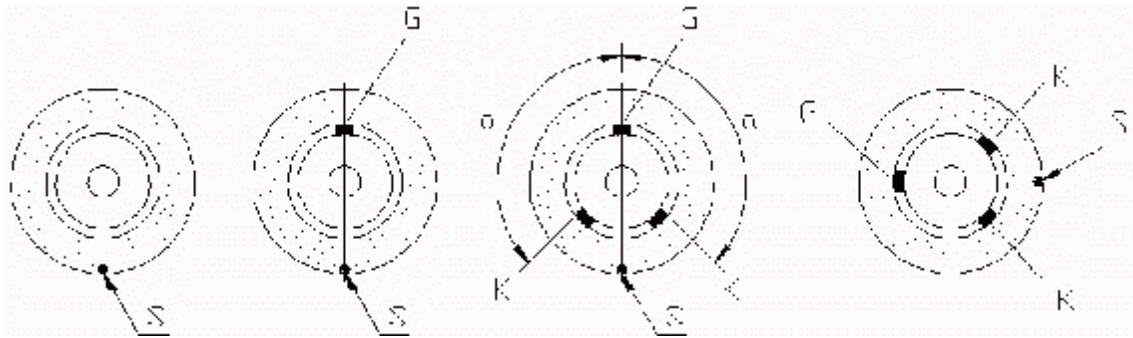
- a. Clean the wheel bore and flange surface before mounting.
- b. Put the assembled wheel onto spindle slightly.
- c. Turn nut CCW to clamp the flange.

### E. Extract of grinding wheel

- a. Remove the splash guard (if used) and open the wheel door.
- b. Insert and turn the wheel extractor CW to remove the wheel clamping nut.
- c. Insert the wheel extractor into the wheel flange, till the bottom of extractor contacts the wheel surface to remove the wheel flange slightly. In no any condition, it is strictly prohibited to use a hammer or punch to take off the wheel forcibly.



### 10-3. BALANCE OF GRINDING WHEEL



- a. Insert the flange into wheel and tighten it.
- b. 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 minute or so to drop the water off the wheel.
- c. Dismantle the wheel set from spindle and put the balancing arbor thru flange bore, and put the wheel set on balance stand. – Clean the flange bore and balance arbor tapered surface before mounting.
- d. Set the wheel for free rotation to locate its gravity center “S” and mark it with a chalk.
- e. Put a balance weight at “G” position. Turn the wheel for 90 degree see in which side (S&G) weights more.
- f. Place 2 balance weight “K” at weightier side with same distance from “G”.
- g. Turn the wheel for 90 degree 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.

#### 10-4. DRESSING OF GRINDING WHEEL

##### A. Installation of diamond dresser.

- a. Fix the diamond seat onto table.
- b. Put the diamond bit into the seat and tighten it.

##### B. 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 keep using.
- b. The feed rate for each dressing should not be large as the diamond is an element of hard and crispy & is unbearable of impact. In order to prevent the diamond bit from impact against grinding wheel, start the dressing from the middle of wheel thru both ends.
- c. A fixed moderate dressing rate: less than 5um for precision dressing, and 10-30um 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 & sharp dressing angle.
- e. Formula of dressing speed:

$$F = \frac{d \times N}{2.5 \times 1000}$$

F: feed rate (mm/min)

d: wheel grain size (m)

N: wheel speeds (rpm)

### C. Influence of mechanical condition & grinding results

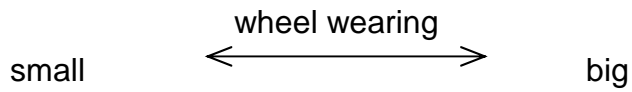
#### a. Influence of feed rate

	feed rate	
small	←—————→	big
	grinding resistance	
small	←—————→	big
	heat generation	
small	←—————→	big
	ground surface	
fine	←—————→	rough
	wheel surface	
smooth	←—————→	stuff shell off
	wheel wearing	
small	←—————→	big

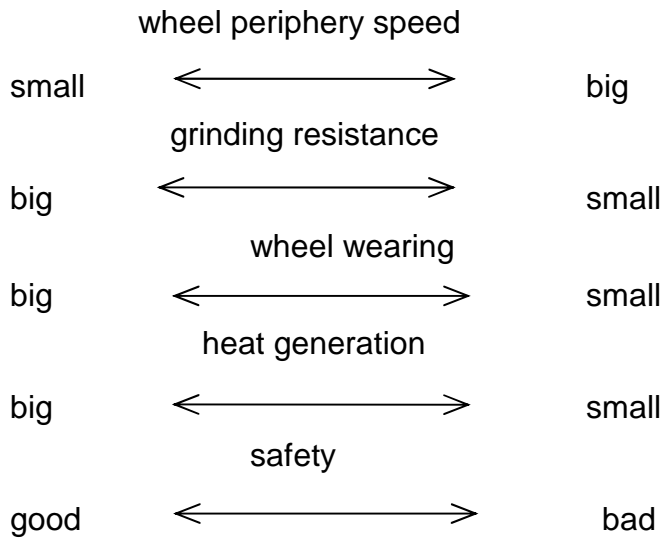
#### b. Influence on traverse speed

Provided feed rate for rough grinding is set at  $100 - 150 \text{ mm}/_{\text{min}}$  and fine grinding is set at  $50 \text{ mm}/_{\text{min}}$  based on workpiece per rotation, the traverse distance is set about  $\frac{1}{2} - \frac{3}{4}$  of the wheel width for rough grinding and at  $\frac{1}{8} - \frac{1}{4}$  for fine grinding.

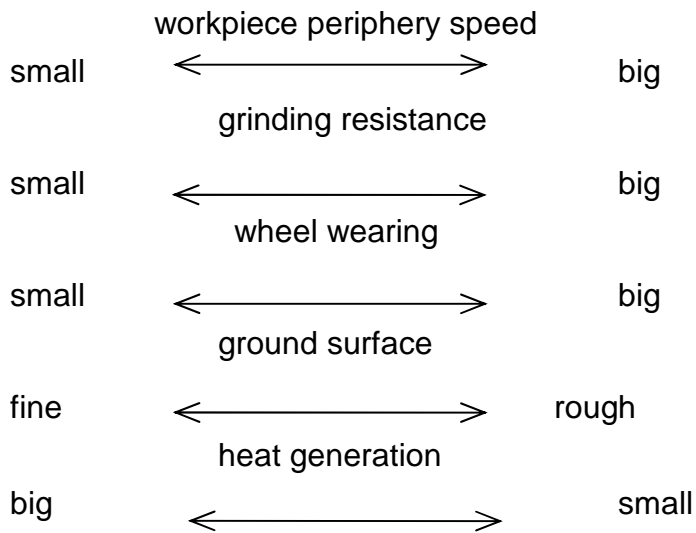
	traverse	
small	←—————→	big
	grinding resistance	
small	←—————→	big
	heat generation	
small	←—————→	big
	ground surface	
fine	←—————→	rough
	wheel surface	
smooth	←—————→	stuff drops



c. Influence of wheel periphery speed



d. Influence of workpiece periphery speed



10-5. REFERENCE TABLE OF GRINDING CONDITIONS

A. Workpiece periphery speed

TABLE 1: 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	6 - 40	20 - 50	40 - 60	40 - 70

B. Wheel infeed rate

TABLE 2: FEED RATE PER GRINDING

UNIT: mm

TYPE OF GRINDING			SOFT STEEL	QUENCHED STEEL	TOOL STEEL	STAINLESS STEEL HEAT RESISTENCE 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	0.005-0.04	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	0.015-0.03	0.005-0.015		0.015-0.03	

## 11. INTERNAL GRINDING ATTACHMENT

### 11-1. INSTALLATION OF INTERNAL GRINDING ATTACHMENT

1. Pull the fixed pin outward to turn for 90 degree & release. (Fig. 11-• )
2. Swing down the unit gently till touching the wheelhead from end.
3. Clamp the unit with 2 screws & spanner supplied.

### 11-2. INSTALLATION OF 3-JAW/4-JAW CHUCK

1. Press the clutch of driving plate into the groove of spindle nose.
2. Attach the chuck plate onto the spindle.
3. Clamp the back plate and spindle with a connecting rod.
4. Pull out the cotter at rear of workhead to enable spindle for free rotation.

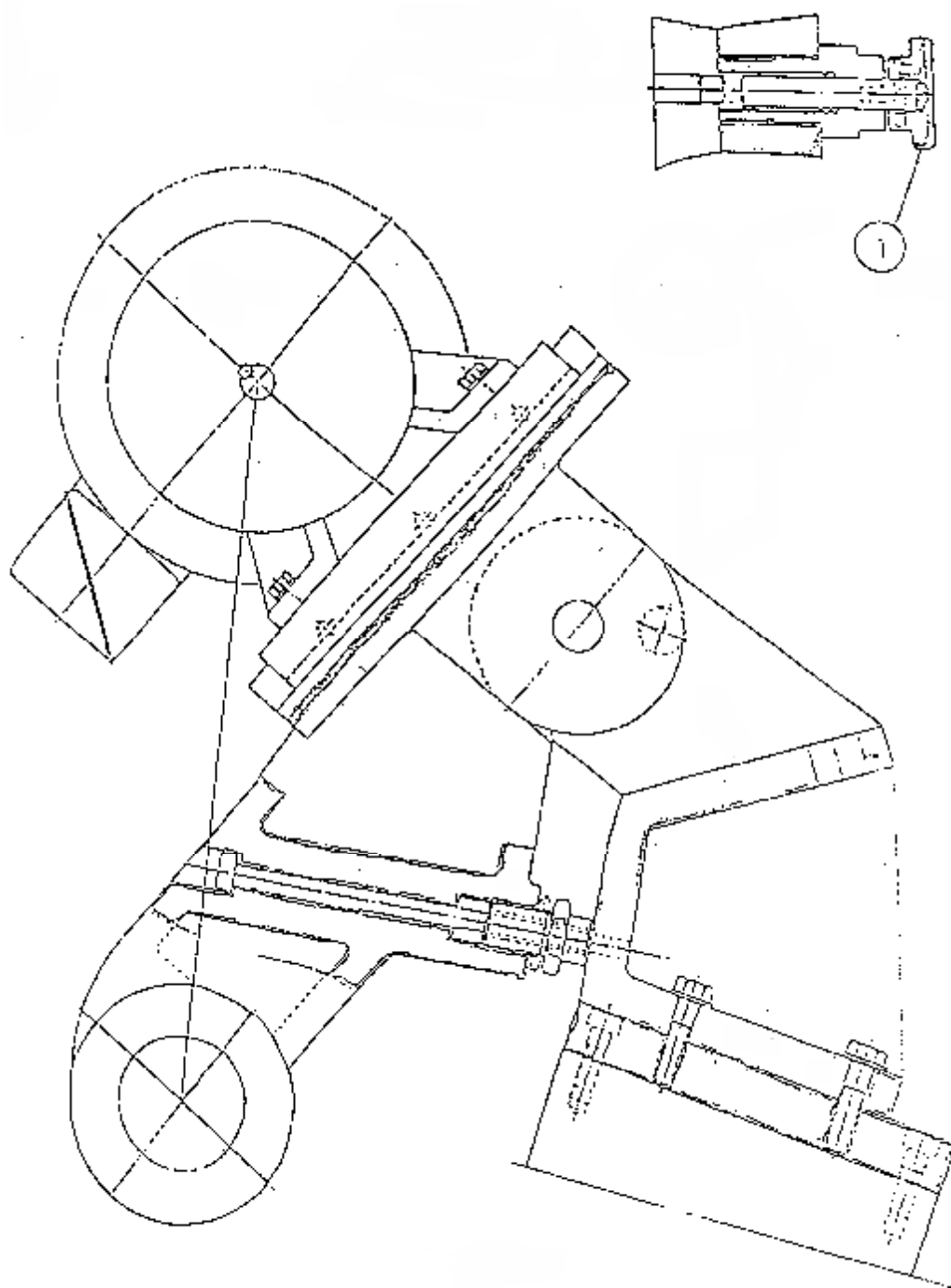


Fig.11

## 12. MACHINE ALIGNMENT

### 12-1. MACHINE ALIGNMENT:

Check the machine accuracy as below in maintenance.

#### A. Alignment of table (Fig. 12-1)

- a. Place a dial gage on top of table and against dovetail surface of the upper table.
- b. Turn the table handwheel to check if the zero-setting is obtained.
- c. If not, adjustment can be made in reference of procedures as stated in paragraph 6-2.

#### B. Alignment of workhead & tailstock (Fig. 12-2)

- a. Place a dial gage on top of table and a test bar into the spindle bore.
- b. Direct the stylus to the test bar.
- c. Turn the table handwheel to check if the zero-setting is obtained.
- d. If not, adjust it in reference of procedures as stated in paragraph 8-2-2. (adjustment of workhead inclination)
- e. Test grind a bar of 300 mm long and measure the diameter at both ends see if it has the same diameter. If not, realign the table.



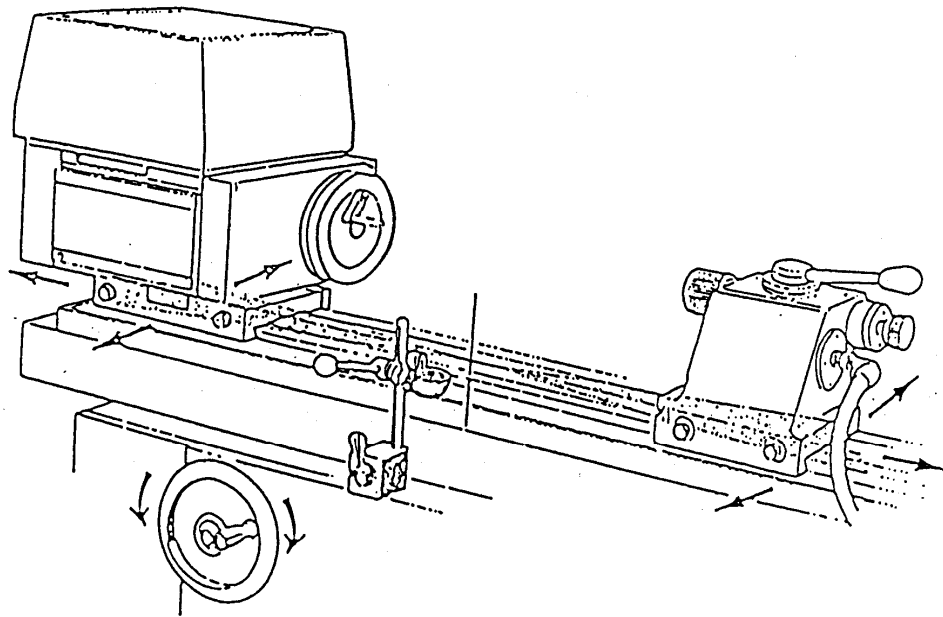


Fig. 12-1

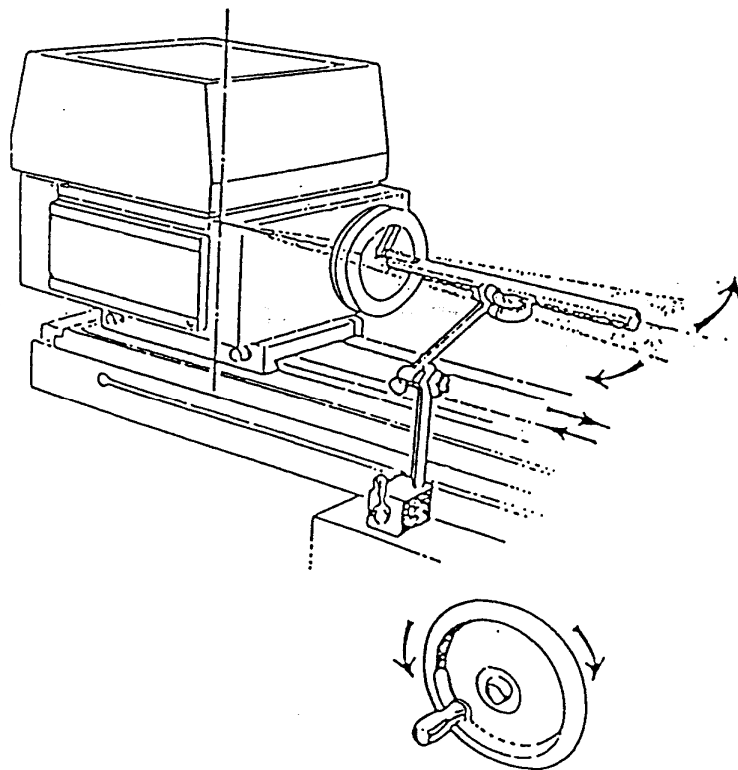


Fig.12-2

## 13. TROUBLE SHOOTINGS & CORRECTIONS

### 13-1. RIPPLE MARKS:

SITUATIONS	CAUSES	REMEDY
Ripple marks	* wheel unbalanced	* rebalance the wheel
	* wheel out of roundness	* redress the wheel
	* hard wheel grains	* use a softer wheel
	* off center or non-aligned	* check the center,
alignment	support or insufficient lube	and supply sufficient lube
	* dressing	* choose a sharp wheel

### 13-2. SCRATCH MARKS:

SITUATIONS	CAUSES	REMEDY
Deep & narrow constant marks	* a rough wheel is used	* use a fine grain wheel
A different deep narrow & non-constant marks	* a soft wheel is used	* use a harder wheel
A wide spot	* oil stains, poor finish	* redress the wheel

### 13-3. SCRATCH MARKS:

SITUATIONS	CAUSES	REMEDY
A fine thread marks	* poor wheel dressing	* replace the diamond bit dressing slowly
	* abnormal operation	* use steady rest to decrease wheel pressure
Ripple stream line	* uneven wheel edge	* dress wheel edge
Chatter marks	* incorrect wheel dressing	* always keep diamond bit sharpen dressing & brush the wheel after cleaning
	* rough grains or dirt on wheel	* redress the wheel
	* bond agent breaks off and grains shell out	* more organic compounds in coolant & less soda compounds

13-4. SCRATCH MARKS:

SITUATIONS	CAUSES	REMEDY
Irregular scratch	* dirt left-over	* clean machine constantly
Irregular wide & long mark or ripple finish	* dirty coolant	* clean coolant tank constantly
Deep but irregulars Scratch	* wheel flange loosened	* tighten the wheel flange
Grains marks	* rough or soft wheel is used	* use a fine grains or hard wheel
	* uneven bond density	* use an even bond wheel
	* rough dressing	* slow dressing rate & speed
	* incorrect fine grinding	* slow table speed to allow a complete spark-out

13-5. THREADING MARKS:

SITUATIONS	CAUSES	REMEDY
Rolling thread marks	* off-center alignment	* adjust the alignment of workhead & tailstock
	* dressing	* redress the wheel slowly

13-6. GRINDING EFFECTS:

SITUATIONS	CAUSES	REMEDY
Insufficient grinding capacity, lack of luster, workpiece searing	* 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 & has high wearing	* wheel is too soft	* Decrease the workpiece traverse speed & feed rate * increase wheel speed, wheel diameter & width * dress wheel slowly * use high density coolant

## 14. LUBRICATIONS & MAINTENANCE

### 14-1. LUBRICATIONS:

A. Pump the one-shot lubricator for several times before turning on the machine to allow the sufficient lubrication on all slideways. Then pump the unit every 2 hours to prevent any wearing, so as to ensure machine accuracy & life. – Check the oil level constantly.

### B. Lubricants:

Please use the following lubricants:

(1) MOBIL NO. 6

(2) SHELL LIGHT OIL

### 14-2. MAINTENANCE:

<u>ITEM</u>	<u>FREQ.</u>	<u>MEASURES</u>
Switch	Daily	Turn on the power & push each button switch
Lubricant	Daily	Check the oil level
Coolant	Daily	Check the coolant level in the coolant tank

## 15. OPERATION INSTRUCTION

### 15-1 INFEED OPERATION OF WHEELHEAD

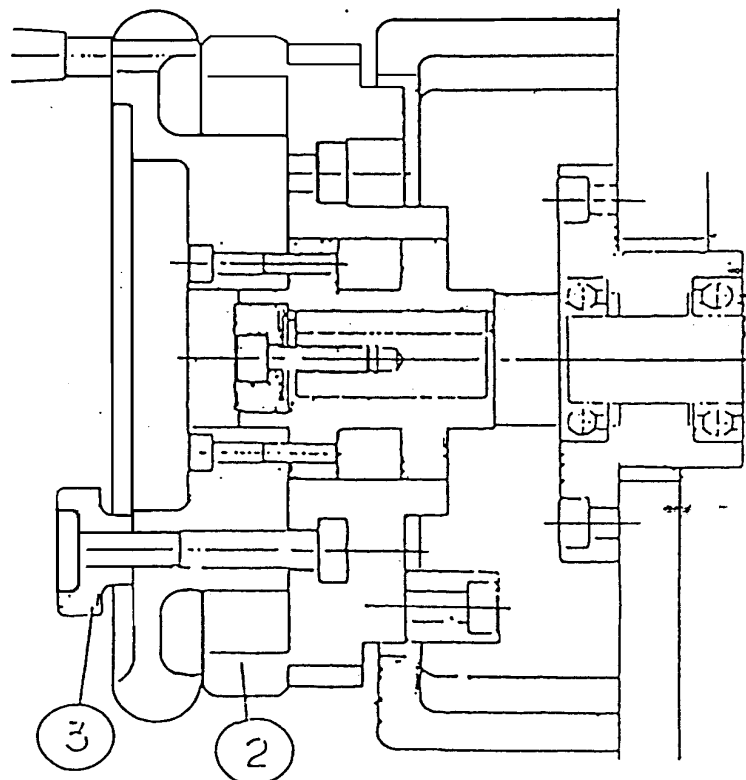
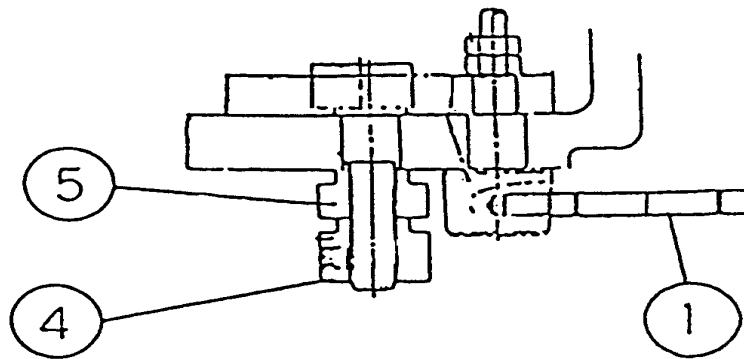
#### 15-1-1 INFEED OPERATION FOR M-TYPE:(Fig. 3-2-1)

1. Measure the workpiece diameter to have the actual grinding allowance.
2. Press the wheel spindle ON button (panel No.4). to run the grinding wheel
3. Press the workhead ON button (panel No.12). to run the workhead
4. Press the coolant ON button (panel No.6). to active the coolant
5. Turn the wheelhead handwheel till the wheel approaches the workpiece.
6. Press the table movement button (panel No.7 or 9). This step is only for the horizontal grinding)
7. Grinding begins.
8. After completing the first workpiece grinding then turn the “ZERO” setting lever to C.C.W. direction (Fig.9-• )
9. Release the fixed knob of the wheelhead handwheel to set the dial ring to “ZERO point then set back the knob tightly.(Fig. 9-, & *f*).
10. To grind the next identical parts, just infeed the wheelhead by turning the handwheel, till the “ZERO” point is met to obtain same grinding size. In case of fail to obtain same grinding size, release again the fixed knob, and adjust the “ZERO” setting till find the required division, then turn the handwheel to complete grinding (Fig. 9-*n* & ...).

#### 15-1-2 MANUAL INFEED OPERATION FOR CII-TYPE:(Fig.3-2-2)

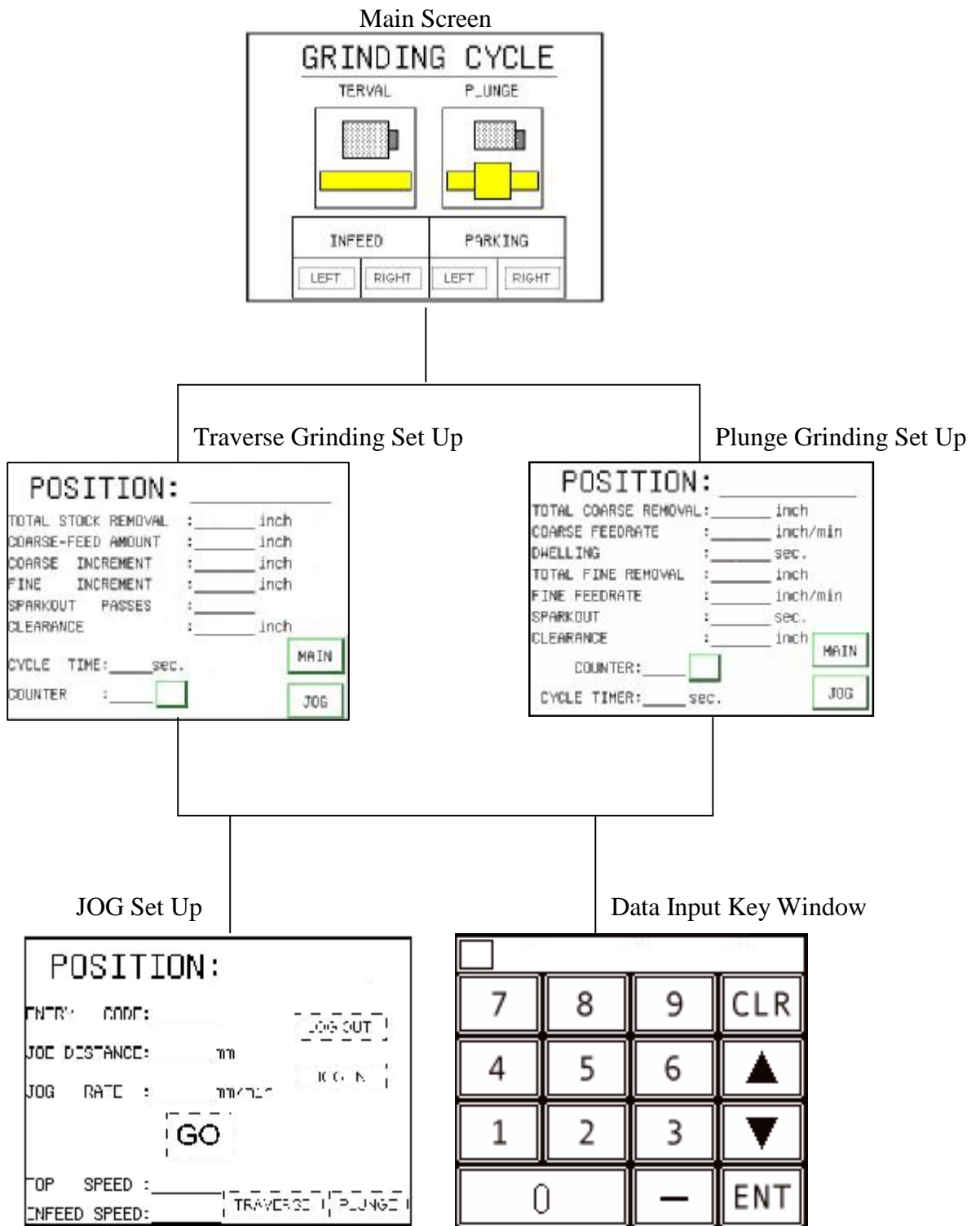
1. Measure the workpiece diameter to have the actual grinding allowance.
2. Press the power “ON” button.(panel no.1)
3. Set the wheel spindle “START” button.(panel no.2)
4. At this stage, the I/D attachment remain inactivated. Set the I/D attachment ON/OFF selection switch at “OFF” position. (panel no.3) Select grinding mode selection. Set the spindle & coolant AUTO/MANUAL selection switch to “MANUAL” position.(panel no.6)
5. Set the MANUAL/AUTO mode selection switch to “MANUAL position. (panel no.11)
6. Press the workhead “START” button. (Panel 6)
7. Press the coolant ON button (panel no.4).

8. Turn the wheelhead handwheel till the wheel approaches the workpiece.
9. Press the table RIGHT/LEFT movement button. This step is only for the horizontal grinding.
10. After completing the first workpiece grinding then turn the “ZERO” setting lever to C.C.W. direction (Fig.9-• )
11. Release the fixed knob at the wheelhead handwheel to set the dial ring to “ZERO” point. Then set back the knob tightly (Fig. 9-, & 9-*f*).
12. To grind the next identical parts, just infeed the wheelhead by turning the handwheel, till the “ZERO” point is met to obtain same grinding size. In case of fail to obtain same grinding size, release again the fixed knob, and adjust the “ZERO” setting till find the required division, then turn the handwheel to complete grinding (Fig. 9-„ & ...).



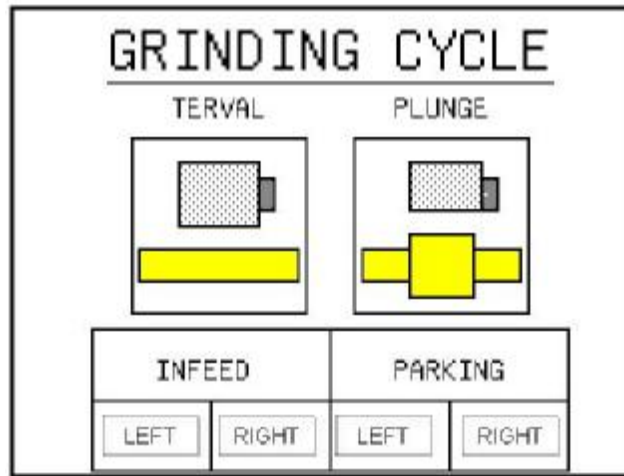
## 15-2 OPERATION OF AUTO INFEEED CONTROL (FOR “NC” TYPE)

### 15-2-1 All SCREENS DISPLAY



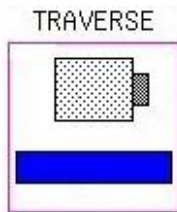
## 15-2-2 Grinding Type Selection

### 2-2-1 Main Screen

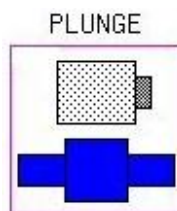


The main screen is the first screen displayed after turn on the power. On this main screen, you can choose the grinding type, feeding position, parking position and workhead speed.

### 2-2-2 Function



By touching this area, you can get into "TRAVERSE GRINDING" data set up screen.



By touching this area, you can get into "PLUNGE GRINDING" data set up screen.



FEED SELECTION	
LEFT	RIGHT

This area is to choose feeding position.

※You can change feeding position during grinding.

<input type="checkbox"/> LEFT <input type="checkbox"/>	Infeed At Left Side ONLY	<input type="checkbox"/> LEFT <input type="checkbox"/> RIGHT	Infeed At Both Side
<input type="checkbox"/> <input type="checkbox"/> RIGHT	INFEEED AT RIGHT -----	<input type="checkbox"/> <input type="checkbox"/>	No Infeed

PARK SELECTION	
LEFT	RIGHT

This area is to choose parking position.

※You can change parking position during grinding.

<input type="checkbox"/> LEFT <input type="checkbox"/>	STOP AT LEFT SIDE ONLY	<input type="checkbox"/> LEFT <input type="checkbox"/> RIGHT	STOP AT EITHER SIDE
<input type="checkbox"/> <input type="checkbox"/> RIGHT	STOP AT RIGHT -----	<input type="checkbox"/> <input type="checkbox"/>	NO STOP

### 15-2-3 Data Set Up

#### 15-2-3-1 Traverse grinding set up screen

$$\text{Total Stock Removal} = \text{Total Coarse Feed Amount} + \text{Total Fine Feed Amount}$$

$$\text{Total Coarse Feed Amount} = \text{Coarse Increment} \times \text{Number of Passes} + \text{Auto Coarse Feed Compensation}$$

$$\begin{aligned} \text{Total Fine Feed Amount} &= \text{Total Stock Removal} - \text{Total Coarse Feed Amount} \\ &= \text{Fine Increment} \times \text{Number of Passes} + \text{Auto Fine Feed Compensation} \end{aligned}$$

※CLEARANCE= Safety distance away from the workpiece. Wheel will retract to starting point plus clearance first, then retract again rapidly to home position by hydraulic. When grinding the next workpiece, the wheelhead will move in from home position first by hydraulic rapid infeed, then slowly move in at clearance distance until starting point.

Examples	•	,
TOTAL STOCK REMOVAL :	0.0135 <b>inch</b>	0.0135 <b>inch</b>
COARSE-FEED AMOUNT :	0.0126 inch	0.0126 inch
COARSE INCREMENT :	0.0012 inch	0.0025 inch
FINE INCREMENT :	0.0002 inch	0.0003 inch
SPARKOUT PASSES :	1	3
CLEARANCE :	0.005 Inch	0.005 inch

Example : • Total Stock Removal = 0.0135inch

Total Coarse Feed Amount = 0.0126inch

$$\begin{aligned} \text{Total Fine Feed Amount} &= \text{Total Stock Removal} - \text{Total Coarse Feed Amount} \\ &= 0.0135 - 0.0126 \\ &= 0.0009 \end{aligned}$$

During grinding, the program will automatically calculate the number of passes and remaining balance...etc by the data you input.

From the above example :

1.  $0.0126 \div 0.0012 = 10$ (passes) . . . . balance is 0.0006  
Coarse increment by 0.0012 inch for 10 passes, & the 11<sup>th</sup> pass by 0.0006 inch.  
(When the balance is larger than fine increment, it will execute the balance by coarse grinding)
2.  $0.0009 \div 0.0002 = 4$ (passes) . . . . balance is 0.0001.  
Fine increment by 0.0002 inch for 4 passes, the 5th pass by 0.0001 inch.
3. After fine grinding, the program will execute sparkout 1 pass, then retract to Home position.

Example : • Total Stock Removal = 0.0135inch  
Total Coarse Feed Amount = 0.0126inch  
Total Fine Feed Amount = Total Stock Removal – Total Coarse Feed Amount  
= 0.0135 – 0.0126  
= 0.0009

During grinding, the program will automatically calculate the number of passes and remaining balance by the data you input. From the above example :

1.  $0.0126 \div 0.0025 = 5$ (passes) . . . . balance is 0.0001  
Rough increment by 0.0025 inch for 5 passes.  
(When the balance is smaller than fine increment, add this balance into fine amount grinding)
2.  $(0.0009 + 0.0001) \div 0.0003 = 3$ (passes) . . . . balance is 0.0001.  
Fine increment by 0.0003 inch for 3 passes, & the 4th pass by 0.0001 inch.
3. After fine grinding, the program will execute sparkout 3 passes, then retract to Home position.

- ※Grinding data can not be changed again during grinding, otherwise, the program will execute abnormal and cause danger seriously.
- ※After finish the 1st workpiece, measure if there is any tolerance. If so, reset the data before next grinding.
- ※The screen will be displayed “SETTING VALUE ERROR” message when entering incorrect data, please correcting the data to dismiss the alarm message.

CYCLE TIME : 000.0 **sec.**

To accumulate the grinding time per cycle

COUNTER : 00000

To count the grinding cycles ,  Reset (Return to zero)

MAIN

Touch it to get back to main screen

JOG

Touch it to get into JOG Set up

### 15-2-3-2 Plunge Grinding Set up Screen

**POSITION:** \_\_\_\_\_

TOTAL COARSE REMOVAL:  inch

COARSE FEEDRATE:  inch/min

DWELLING:  sec.

TOTAL FINE REMOVAL:  inch

FINE FEEDRATE:  inch/min

SPARKOUT:  sec.

CLEARANCE:  inch

COUNTER:

CYCLE TIMER:  sec.

The numbers will be displayed when you touch the data input area

$$\text{Total Stock Removal} = \text{Total Coarse Feed Amount} + \text{Total Fine Feed Amount}$$

※CLEARANCE= Safety distance away from the workpiece. Wheel will retract to starting point plus clearance first, then retract again rapidly to home position by hydraulic. When grinding the next workpiece, the wheelhead will move in from home position first by hydraulic rapid infeed, then slowly move in at clearance distance until starting point.

Example	•
TOTAL COARSE REMOVAL : 0.005	<b>inch</b>
COARSE FEEDRATE : 0.001	inch/min
DWELLING : 3	sec.
TOTAL FINE REMOVAL : 0.002	inch
FINE FEEDRATE : 0.0005	inch/min
SPARKOUT : 10	
CLEARANCE : 1	inch

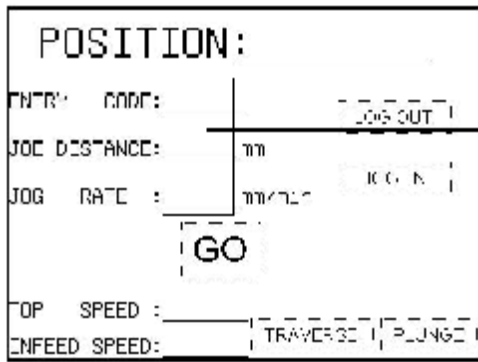
Ex : • Total Coarse Removal = 0.005 inch

Total Fine Removal = 0.002 inch

Total Coarse Removal 0.005 inch + Total Fine Removal 0.002 inch = Total Stock Removal 0.007inch

1. After coarse removal 0.005 inch by feedrate of 0.001 inch/min, dwell for 3 seconds then fine.
2. Fine removal 0.002 inch by feedrate of 0.005 inch/min, then sparkout.
3. After fine grinding, the program will execute sparkout for 10 seconds, then the wheelhead will retract to Home Position.

### 15-2-3-3 JOG SET UP



The numbers will be displayed when you touch the data input area

ENTRY CODE : 000000

This data is a preset value for service use only

JOG DISTANCE : 00.99999 inch

To adjust the distance for wheelhead to move

⊙After entering the data, press "GO" to move the wheelhead.

JOG RATE : 0.0012 inch/min

To Set up the moving speed for wheelhead

⊙After entering the data, press "JOG+" or "JOG-" to move the wheelhead.

JOG IN

Wheelhead jog toward

JOG OUT

Wheelhead jog backward

MAIN

Touch it get back to main screen

TRAVERSE

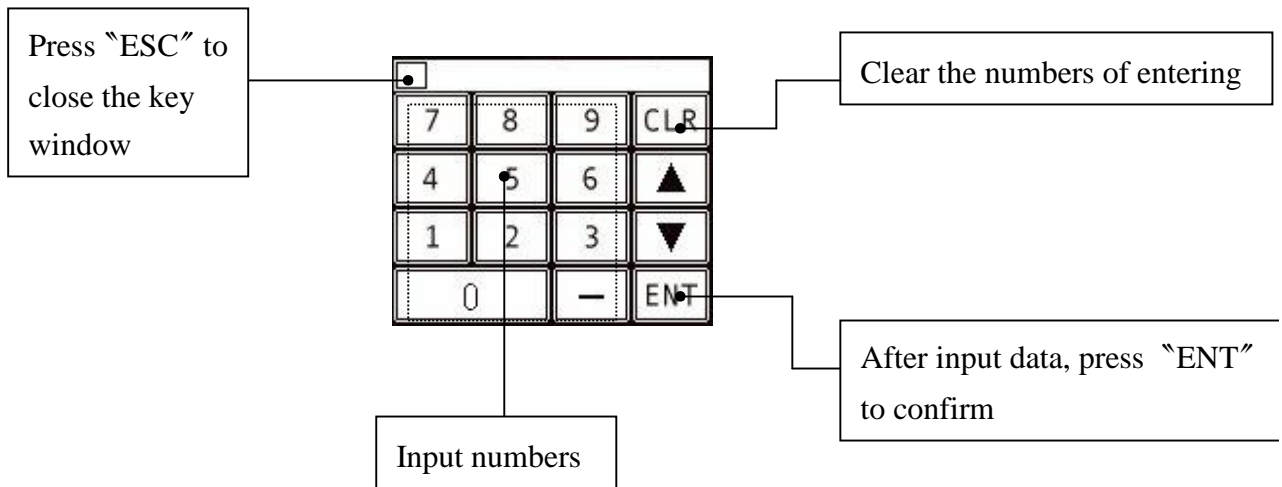
Touch it to get into TRAVERSE grinding Set up screen

PLUNGE

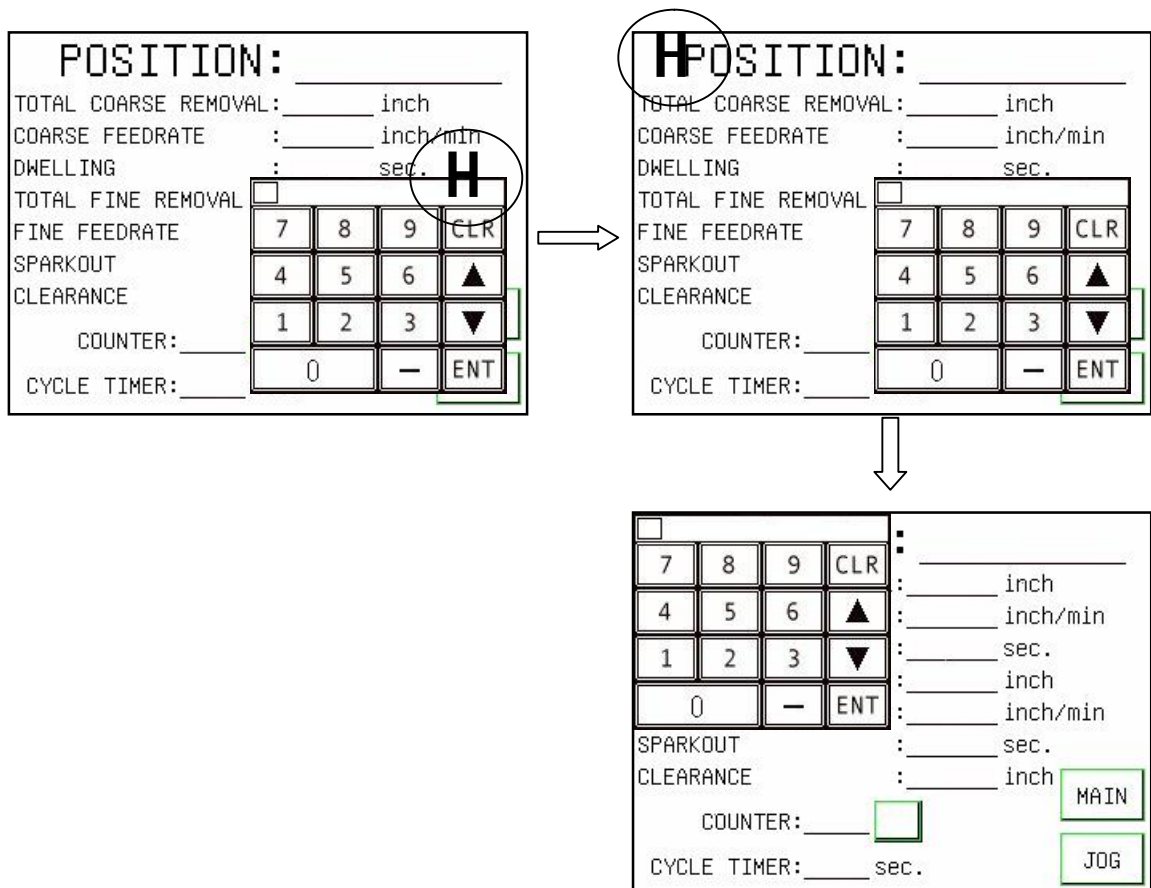
Touch it to get into PLUNGE grinding Set up

※When entering the incorrect data, the system will display "SET NUMBER IS INCORRECT" message, press **6** to dismiss the alarm message, and the previous data will be displayed.

### 15-2-3-4 Data Input Key Window



The key window will be displayed when you touch the data input area. If the key window block the area you want to see, touch the top blank area of key window, then point to any desired position, the key window will be displayed at pointed position. (Fig. Below)

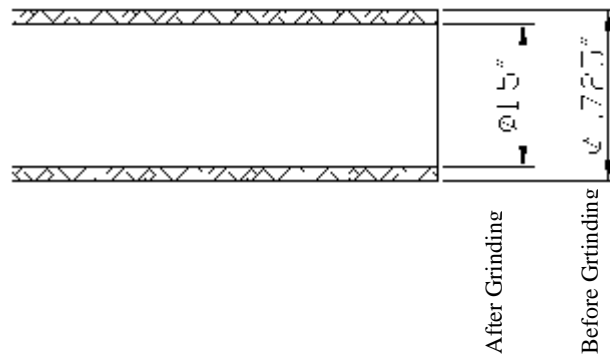


### 15-3. EXAMPLE

#### 15-3-1 TRAVERSE GRINDING

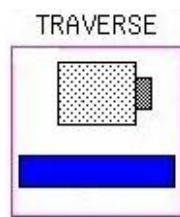
(a) Measure the workpiece, and find out the total stock removal amount. Ex: Diameter of

1.725 inch




(b) Select Type Of Grinding

(1) Press



(2) Input grinding data

TOTAL STOCK REMOVAL	:	<b>0.045 inch</b>
COARSE-FEED AMOUNT	:	0.0436 inch
COARSE INCREMENT	:	0.003 inch
FINE INCREMENT	:	0.0003 inch
SPARKOUT PASSES	:	2
CLEARANCE	:	0.03 inch

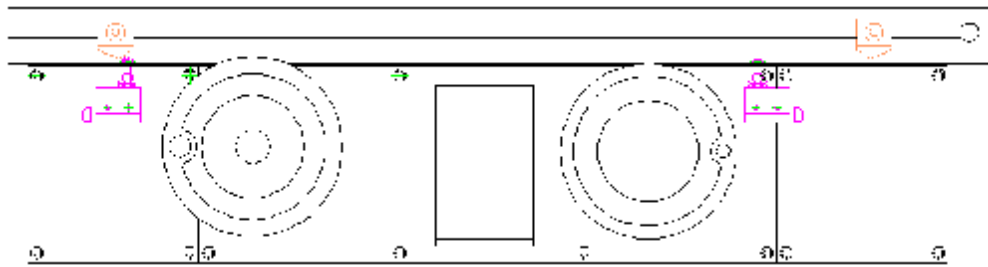
(c) Start the wheel spindle (Control Panel  )

(d) Adjust MAN/AUTO switch to MANUAL mode (Control Panel  )

(e) Move handwheel to let the wheel touch the workpiece slightly



Handwheel for wheelhead infeed



(f) Adjust MAN/AUTO switch to AUTO mode (Control Panel



and also switch the workhead & coolant to auto (Control Panel

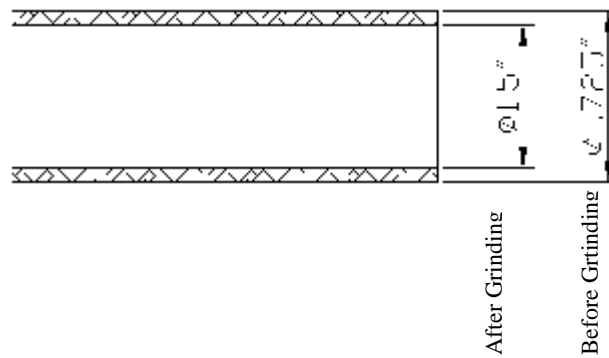


(g) Press the Cycle button to start the cycle (Control Panel



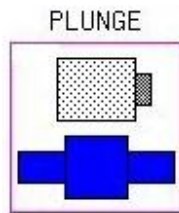
**15-3-2 Plunge Grinding**

(a) Measure the workpiece, and find out the total stroke removal . Ex: Diameter of 1.725




(b) Select type of grinding


(1) Press



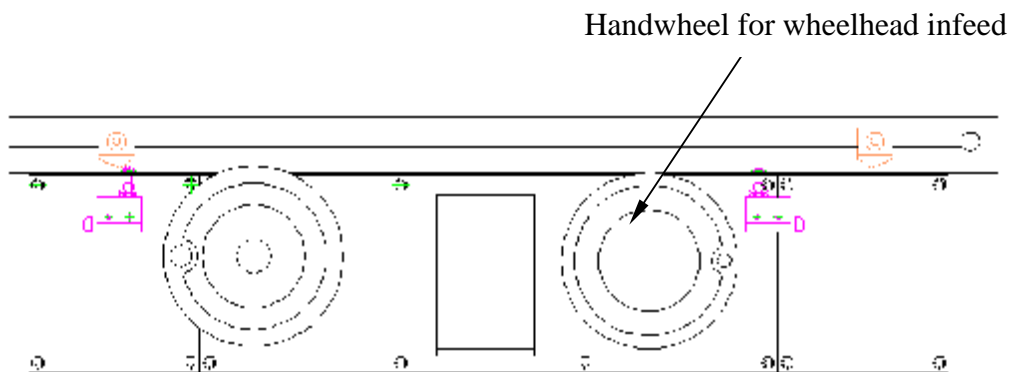
(2)Input Grinding Data


TOTAL COARSE REMOVAL	: 0.0425 <b>inch</b>
COARSE FEEDRATE	: 0.001 inch/min
DWELLING	: 10 sec.
TOATAL FINE REMOVAL	: 0.0025 inch
FINE FEEDRATE	: 0.0005 inch/min
SPARKOUT	2
CLEARANCE	: 0.03 inch


(c)Start the wheelhead spindle (Control Panel  )


(d)Adjust MAN/AUTO switch to manual mode (Control Panel  )

(e)Move handwheel to let the wheel touch the workpiece slightly



(f)Adjuust MAN/AUTO switch to auto mode (Control Panel  )

and also switch the workhead & coolant to auto (Control Panel  )

(g) Press the Cycle Button to start the cycle (Control Panel  )

#### **15-4 INTERNAL GRINDER WORKING MANUAL PROCEDURE**

1. Press Wheel head rapid in feed / retract button to move the wheel head to be forwarded
2. Run I / D spindle by pushing the I / D spindle start button, this action can be done before doing item 1.
3. Use the wheel head in feed hand wheel to find the center of the I / D of work piece
4. Adjust the distance of the two limit blocks length area with depend on the length of the work piece.
5. Use the wheel head in feed hand wheel for touching the grinding wheel to the work piece
6. Use the table traverse hand wheel to touch the whole length of the work piece
7. Move out the grinding wheel far from the work piece by table traverse hand wheel then measure the I / D of the work piece for make sure the last stock removal to find the request dimension.
8. Do as item 5 and continue to grind the work piece by wheel head infeed handwheel with each downfeed amount 0.05 mm for example, then select the table feed selection lever to auto position to grind the whole workpiece till find the actual internal diameter of the workpiece, then move out the grinding wheel by table traverse handwheel
9. Adjust the micro of the wheelhead infeed handwheel to zero position.
10. Move back the position of the wheel head to the safety position for doing the second workpiece.