

## **DOUBLE COLUMN HIGH PRECISION**

### **SURFACE GRINDER**

**MODEL: 4860AHD**

**4880AHD**

**48120AHD**

**48160AHD**

**48200AHD**

**48240AHD**

**This series of machine hydraulic and electric combined precision machine tool. The operator is asked to know the general operational procedure, and the special features of the machine. This is to make sure that the operator can use the machine properly.**

**When the machine is malfunctioning, please advise us immediately with the problem, model number, serial number, and manufacturing date of the machine, so that we can service you responsively.**

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## **20. Complete Mechanical Parts List and Drawing**

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**\*We follow a policy of continuous improvement of all our products, and reserve the right to change specification, mechanics, or designs at any time without prior notice.**

# SPECIFICATIONS:

MODEL		AGS-4860 AHD	AGS-4880 AHD	AGS-48100 AHD	AGS-48120 AHD	AGS-48160 AHD	AGS-48200 AHD	AGS-48240 AHD
Working surface of table (W x L)		47.3"x59.3"	47.3"x79"	47.3"x98.3"	47.3"x118.3"	47.3"x157.4"	47.3"x196.8"	47.3"x236.2"
Max. Grinding (W x L)		51.2"x63"	51.2"x82.7"	51.2"x102.4"	51.2"x122"	51.2"x161.4"	51.2"x200.7"	51.2"x240.1"
Max. table travel		66.9"	86.6"	106.3"	126"	165.4"	204.7"	244.1"
Max. crossfeed travel		55.1"						
Distance between table surface and spindle center		37.4"						
Variable table speed by oil cylinder		16~80fpm						
Automatic crossfeed carriage movement		0~1"						
Downfeed handwheel	Per (min) graduation	0.0002"						
Crossfeed handwheel dial	Per graduation	0.001"						
	Per revolution	0.2"						
Auto downfeed micro adjustment dial	Per graduation	0.0001"						
Longitudinal travel from-to		6"~70.9"	6"~90.6"	6"~110.2"	6"~129.9"	6"~169.3"	6"~208.6"	6"~248"
Crossfeed travel from-to		0~55.1"						
Spindle motor		20HP x 4P (30HP x 4P OPTION)						
Hydraulic pump motor		10HP x 6P			15HP x 6P			25HP x 6P
Auto crossfeed motor		1/4HP x 6P or 1/2HP x 4P						
Auto downfeed motor		800W DC SERVO MOTOR						
Grinding wheel (O.D. x T x I.D.)		20" x 3" x 8"						
Rotation speed of spindle (Horizontal)		1250RPM / 60HZ						
Flow rate of coolant pump		80 l/min			120 l/min			
Max. load capacity in addition to magnetic chuck (lbs)		8,250	9,900	1,1550	13,200	15,400	18,700	22,000
Machine weight (lbs)	Net	26,400	30,800	35,200	39,600	44,000	48,400	52,800
	Gross (Apprx.)	29,920	35,200	38,720	46,200	50,600	56,320	61,600
Packing dimension (L x W x H) (Approx.)		256"x137"x138"	276"x137"x138"	350"x137"x138"	378"x137"x138"	480"x137"x138"	582"x137"x138"	684"x137"x138"

NOTE: 1. The manufacturer reserves the right to modify the design, specifications, mechanism, etc., to improve the performances of the machine without notice. All the specifications shown above are just for reference.

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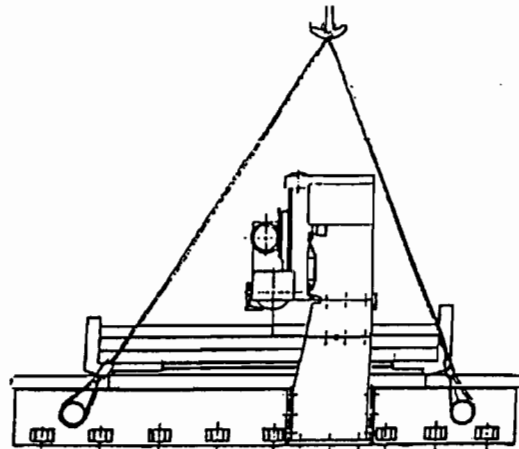
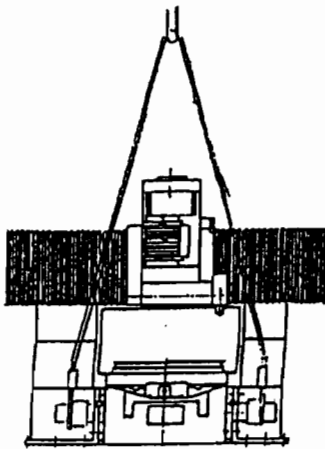
## Standard accessories

- |  |  |
|--|--|
| 1. Grinding wheel.....1 pc.                        | 2. Wheel flange and weight.....1 pc.         |
| 3. Tool box with tools.....1 set.                  | 4. Splash guard.....1 set.                   |
| 5. Base screw & Plate.....1 set.                   | 6. Wheel balancing base.....1 pc.            |
| 7. Wheel balancing arbor.....1 pc.                 | 8. Flange extractor.....1 set.               |
| 9. Diamond dresser.....1 pc.                       | 10. Automatic lubricant equipment.....1 set. |
| 11. Coolant equipment with paper filter.....1 set. |  |

## 2. MOVEMENT AND INSTALLATION

### A. Movement

1. During transport, please prevent machine from vibration in order to keep precision of the machine.
2. After take off the wooden crate, please prepare two steel bars and hanging cables. Put the two steel bars through the two end holes on the base (see below figures).
3. Put some soft cloth or separators between the steel cables and machine to protect the four contacting areas. This is done to ensure no damage will occur during machine moving. Hang the machine carefully with the steel bars and cables. Please make sure the cables and bars are rated to hold the machine weight.



### B. Cleaning

Some parts of the grinder are coated with rustproof oil to prevent surface from rusting. After settling the grinder in place, please wipe off the anti-rust oil with soft cloth and cleaning agent such as WD 40.

**Note:** Any volatile oil and cutting liquid are prohibited to use as cleaning agent.

### C. Installation procedure

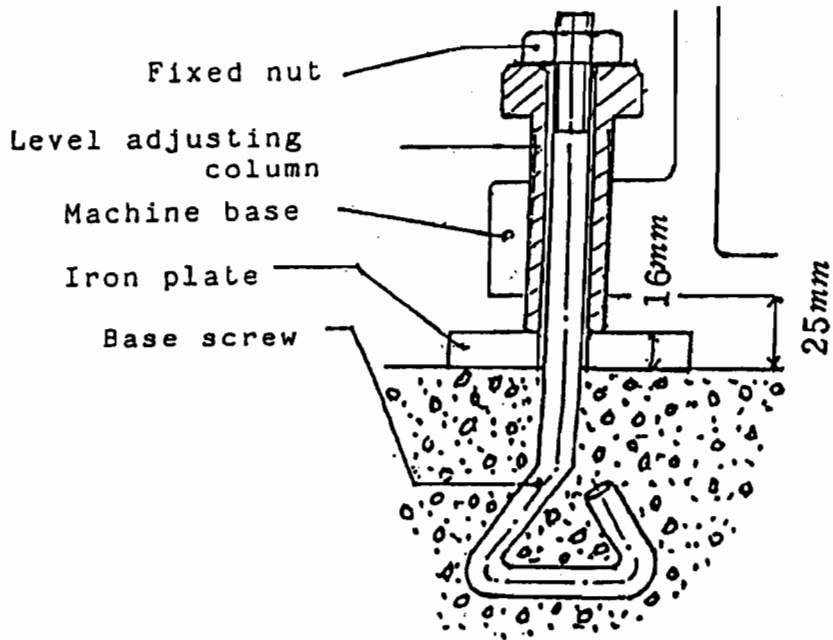
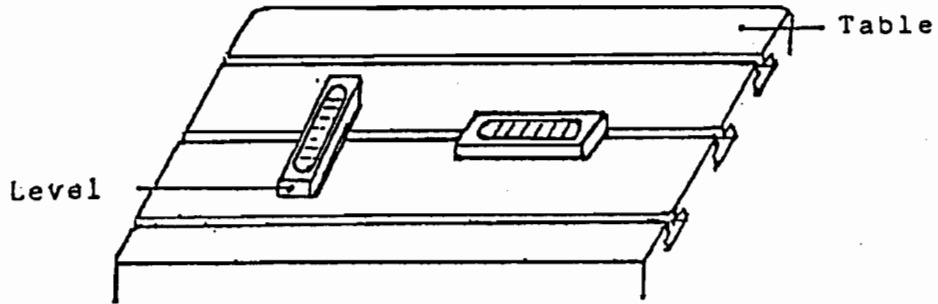
- 1. Location of the grinder has to be far from unsteady ground, direct sunshine and varying temperature.**
- 2. Build the foundation to the specifications by matching the supplied foundation map. (Supplied by factory)**
- 3. Dig the foundation screw holes at indicated places on the concrete ground.**
- 4. Installation order:**
  - 4-1. Lift the grinder off the ground; put leveling screws and base screws onto the grinder. Screw in the hex nuts where it is required.**
  - 4-2. Aim and lower the grinder at foundation screws on the ground. Make sure all foundation screws are through the holes on the machine base. Meanwhile cap the tip of the screws with proper hex nut.**
  - 4-3. Next, please use iron plates (prepare by the user) as the spacers between the foundation ground and leveling screws. Each hole needs an iron plate. After lowering down the grinder onto the screws, the user should keep a gap of one inch between the foundation ground and the machine base. This is done so for easier leveling when foundation ground is not flat.**
  - 4-4. Fill the foundation screw holes with cement mix and make sure the holes are packed tight with no air bubbles in them.**
  - 4-5. A few days later, after the cement mix has solidified, please adjust the screws until the grinder is in perfect parallel as described in section D. Then, please take out the iron plates.**

#### **D. Adjustment**

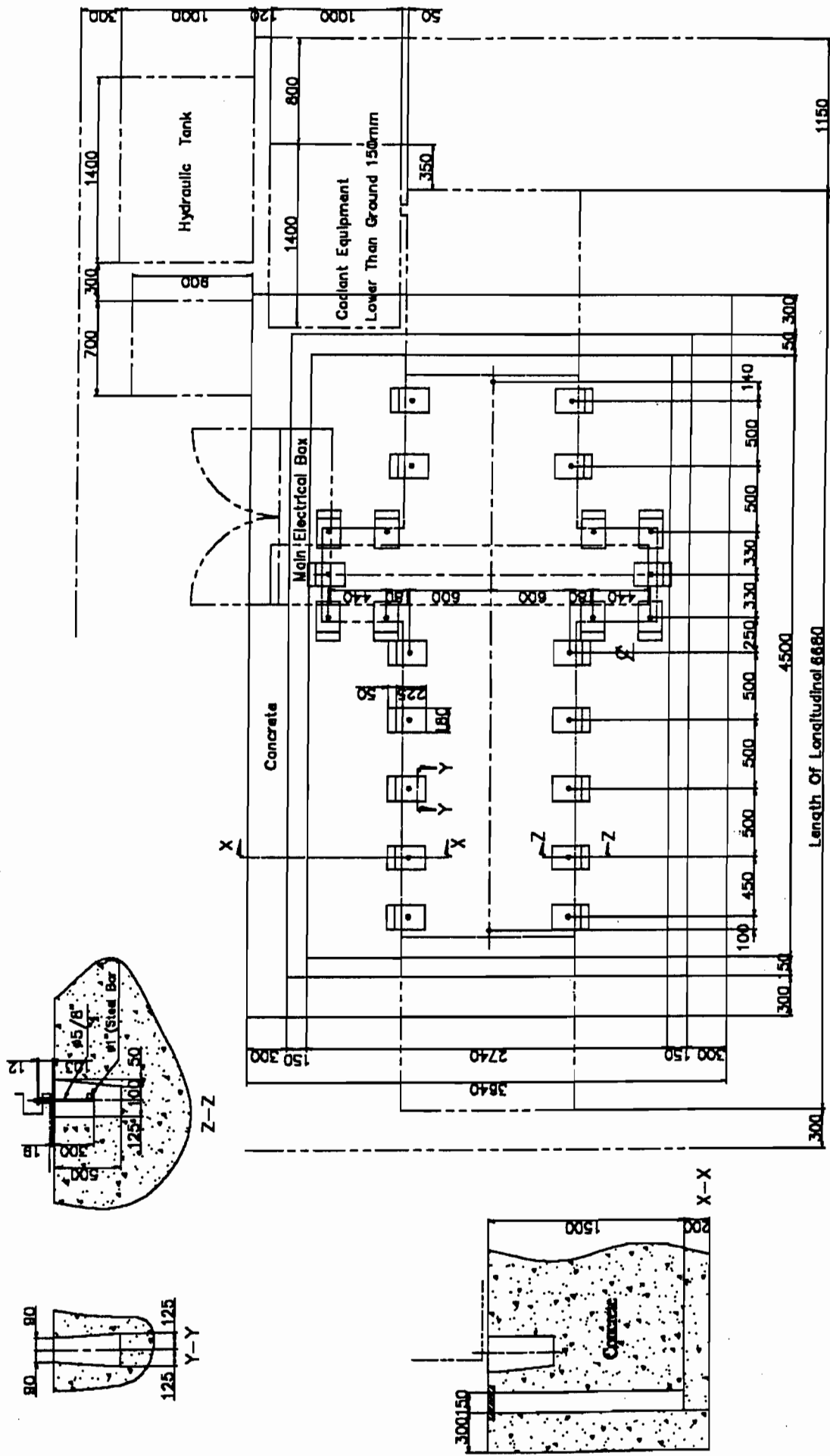
- 1. Leveling adjustment: Put precision levels (0.0005/40" scale) on the middle of the table to adjust the front, rear left and right sides of the table are all within 0.002/40".**
- 2. As described in the above section, please use leveling screws to check the levelness of the grinder.**
- 3. Move the table to both ends of the base; adjust the leveling screws; then move the table between the two columns; adjust the leveling screws around the base. Repeat the procedure until**

desired precision value of  $0.002/40''$  is reached at all area, and then tighten the hex nuts on the leveling screws.

4. Readjust the level once a month for the first two months; then please do it again every six months thereafter. This is done to maintain the grinding accuracy on the grinder.



# 4880 AHD Foundation & Floor Space



Remark: This is a sample diagram, The fit diagram will be offered by factory .



### **3. NOTICES BEFORE OPERATING THE MACHINE:**

- A. Connect the power supply according to the electric diagram of the operation manual, and make sure the power cable's capacity can handle all machine's power requirements. The ideal case is 1.5 times of the total power requirement.**
- B. The total area of foundation for the grinder must have enough space to lay out the machine and its accessories. This must include all its mobile parts.**
- C. When grinding, please wear the safety glasses.**
- D. Please confirm the grinding wheel is well balanced.**
- E. Before installing the grinding wheel, please confirm the spindle rotation is counterclockwise.**
- F. Please confirm the grinding wheel is firmly in place.**
- G. Please confirm the wheel guard is locked tight.**
- H. Before grinding, please match the grinding wheel to the work piece. This is the only way to obtain the best grinding finish on the work piece.**
- I. Please confirm all moving parts ( slideways, leadscrews, etc.) are lubricated with waylube oil.**
- J. Check the hydraulic tank and confirm there is enough oil in the tank.**
- K. Check the lubrication pumps and make sure there is enough way oil in the pumps.**
- M. Check the coolant system and confirm there is enough coolant in it.**
- N. Make sure the filter paper on the coolant system is set up correctly.**
- O. Confirm the hydraulic flow control lever is set at "OFF" position.**
- P. "WARNING"—If the following conditions are not met, there may be a greater risk of injury, when operating the grinder.**
  - 1. Confirm the rotation of spindle is counterclockwise.**
  - 2. Confirm the workpiece or workpieces are held tightly.**
  - 3. Never let the linear velocity of the wheel over its limit.**
  - 4. Never overload the grinding wheel.**
  - 5. Whenever the wheel is running out of balance, please**

**re-balance it again.**

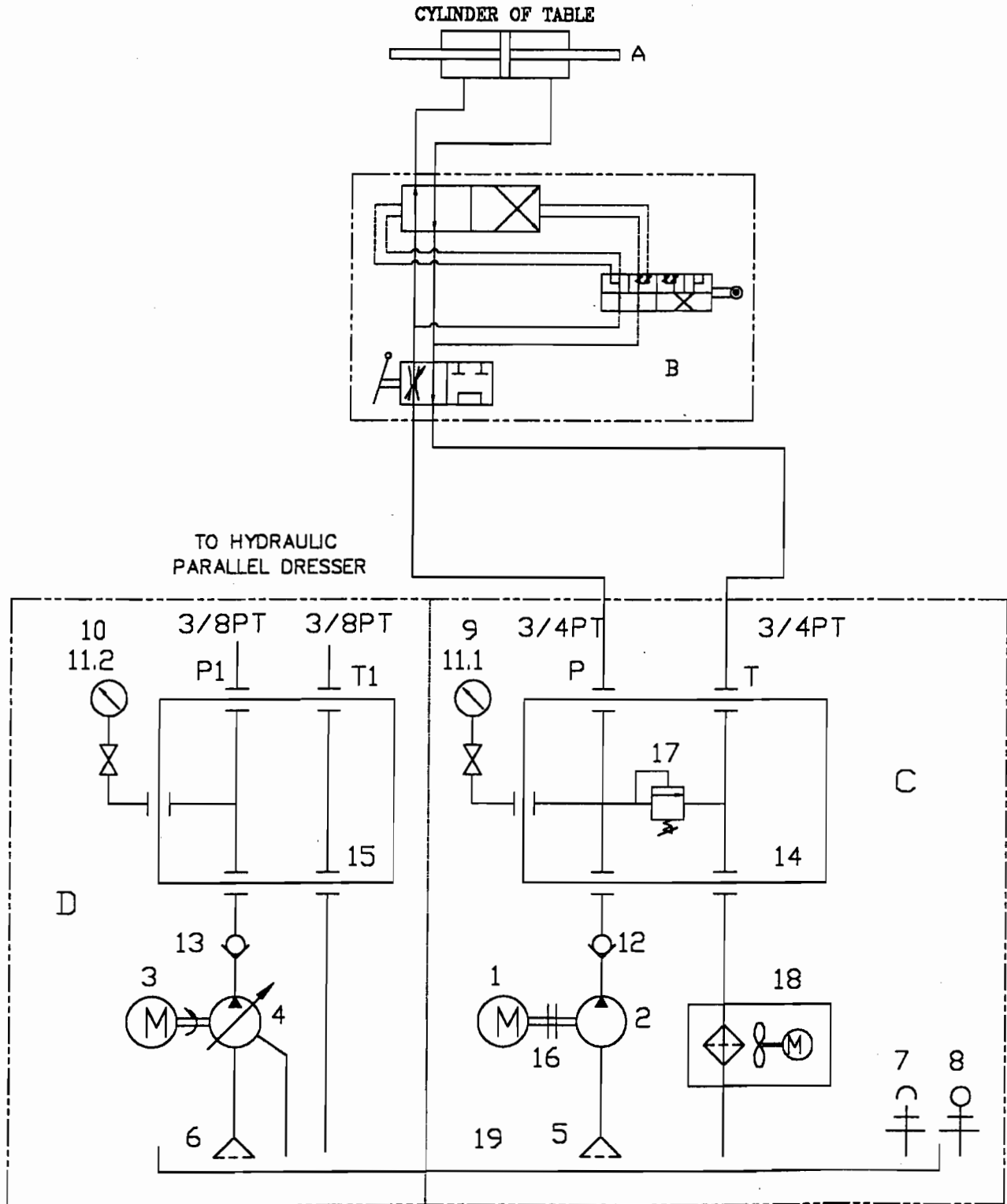
- 6. When operating the grinder, please never wear spacious cloth and loose hair.**
- 7. Except the operator, keep all other personnel out of the area.**
- 8. All electric equipments must be grounded.**

# DAILY INSPECTION

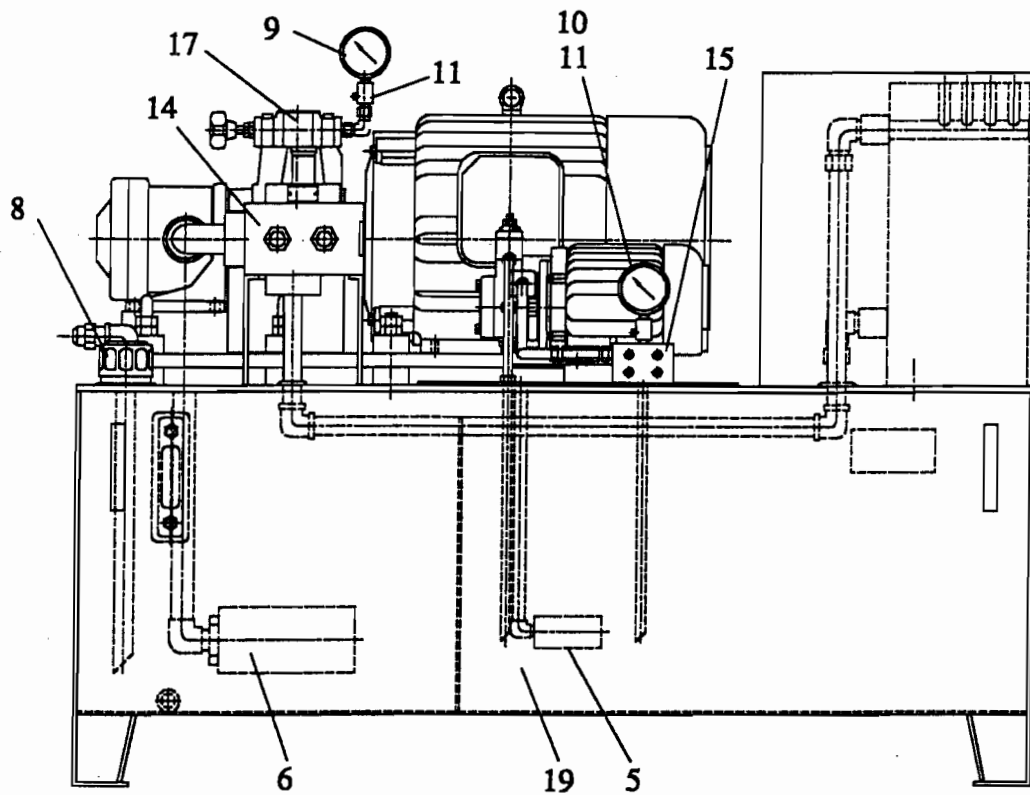
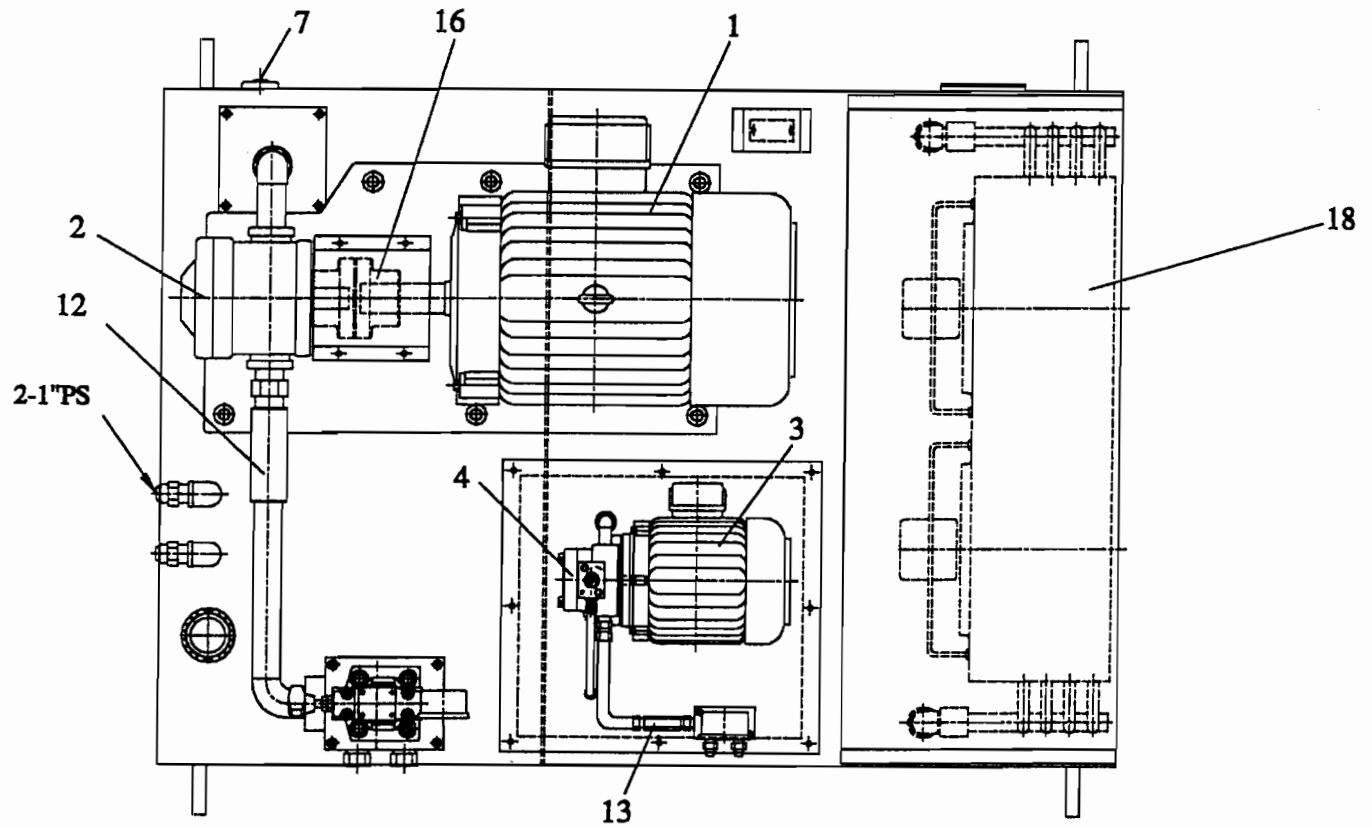
(Pre-operation Checklist)

Item	Inspection Subject	Inspection Condition		Inspection Method	Inspection Interval	Inspection Standard
		Before Start	After Start			
1	Lubrication Mechanism	√		Visual	Daily	Above LOW line
2	Work Table Speed Lever	√		Visual	Daily	At 'OFF' position
3	Wheel	√		Visual	Daily	At least 5 cm distant from work piece
4	Coolant system	√		Visual	Daily	Coolant level is above low line when system is 'OFF'
5	Hydraulic System	√		Visual	Daily	Hydraulic fluid level is above low line when system is 'OFF'
6	Wheel Spindle Motor	√		Visual	Daily	OFF
7	Wheel Guards	√		Visual	Daily	Closed and fastened
8	Electric Control Box	√		Visual	Daily	Closed and locked
9	Warming Up		√	Visual	Daily	Approx. 30 min

# 4. HYDRAULIC SYSTEM CIRCUIT DIAGRAM



# HYDRAULIC TANK LAYOUT



**4860~48200 SERIES HYDRAULIC SYSTEM PARTS LIST**

NO.	PART NO.	PARTS NAME	REMARK	
A	Cylinder Assembly	Cylinder Of Table	The Main Motor & Pump Are Different. If The Machine Type Is Different. For Detail Pls. See Knockdown Drawing & Parts Lists.	
B	Valve Assembly	Flow and direction Control Unit		
C.D	Hydraulic Pump Unit			
C	(Main Pump Unit)			
1		Motor		
2		Pump		
6		Suctioner Strainer		
7		Level Gauge		
8		Oil Filter		
9		Pressure Guage		
11-1		Pressure Guage Cock		
12		Inlet Check Valve		
14		Manifold		
16		Coupling		
17		Relief Valve		
18		Cooler		
19		Tank		
D	(Auxiliary Pump Unit)			
3		Motor		If the user not order the hydraulic parallel dresser , then "D" section won't be installed.
4		Pump		
5		Suctioner Strainer		
10		Pressure Guage		
11-2		Pressure Guage Cock		
13		Inlet Check Valve		
15		Manifold		

## COMMENTS FOR HYDRAULIC OIL CHOICE AND USAGE

**\*Hydraulic oil has to maintain an adequate viscosity.**

More or less viscosity of the oil will decrease after usage. If that happens, it will decrease the working efficiency and increase mechanical wear of the hydraulic system. Therefore we suggest brand and viscosity number of the oil to get the best result from the hydraulic system.

**\*Hydraulic oil will deteriorate after a period of usage.**

When hydraulic oil deteriorates, it takes the physical form similar to grease. This sediment form will cause uneven pressure in hydraulic system, and it will also decrease the life of the hydraulic components.

So please change hydraulic oil according schedule.

**\*The normal hydraulic oil is transparent and colorless.**

Besides periodically changing hydraulic oil, if you find hydraulic oil is in the following conditions, please change oil immediately to protect hydraulic system.

1. Oil became dark brown color and produced funny odor.
2. Oil became milky white color because of water permeation.

**\*Hydraulic oil recommendation**

BRAND	KAO-KUANG	BP	ESSO	MOBIL	SHELL
OIL NO.	R-46	ENERGUL HL100 4.5° E/50°C 33cst/50°C	ESSTIC 50°C 4.7° E/50°C	D.T.E. Oil Medium 3.93° E/50°C 28.9cst/50°C	Teilus oil 29 4.0° E/50°C 29cst/50°C

**\*First time to change hydraulic oil is three months after usage. Then thereafter please change it once every year.**

**Note: Please compensate the wearing of hydraulic oil anytime in order to maintain a standard working oil capacity.**

**\*Hydraulic oil pressure of the main pump has to be kept between 20~25kg/cm<sup>2</sup>.**

**Note: To adjust the hydraulic pressure, please refer to the hydraulic**

**tank unit layout diagram.**

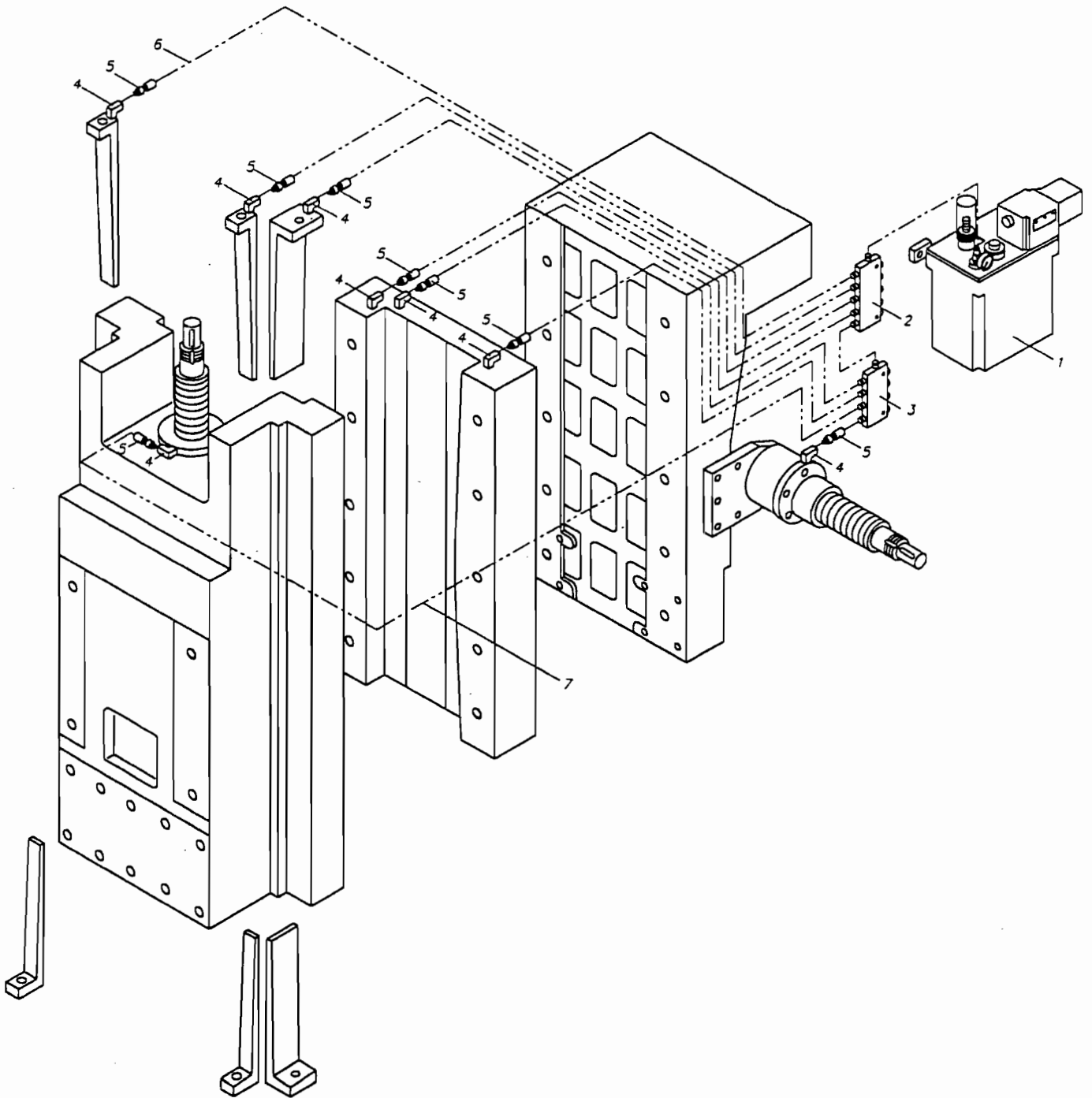
**\*Hydraulic oil pressure of the auxiliary pump has to be kept between 18~22kg/cm<sup>2</sup>.**

**Note: Section “D” of the part list will not exist, if the customer does not order the hydraulic parallel dresser.**

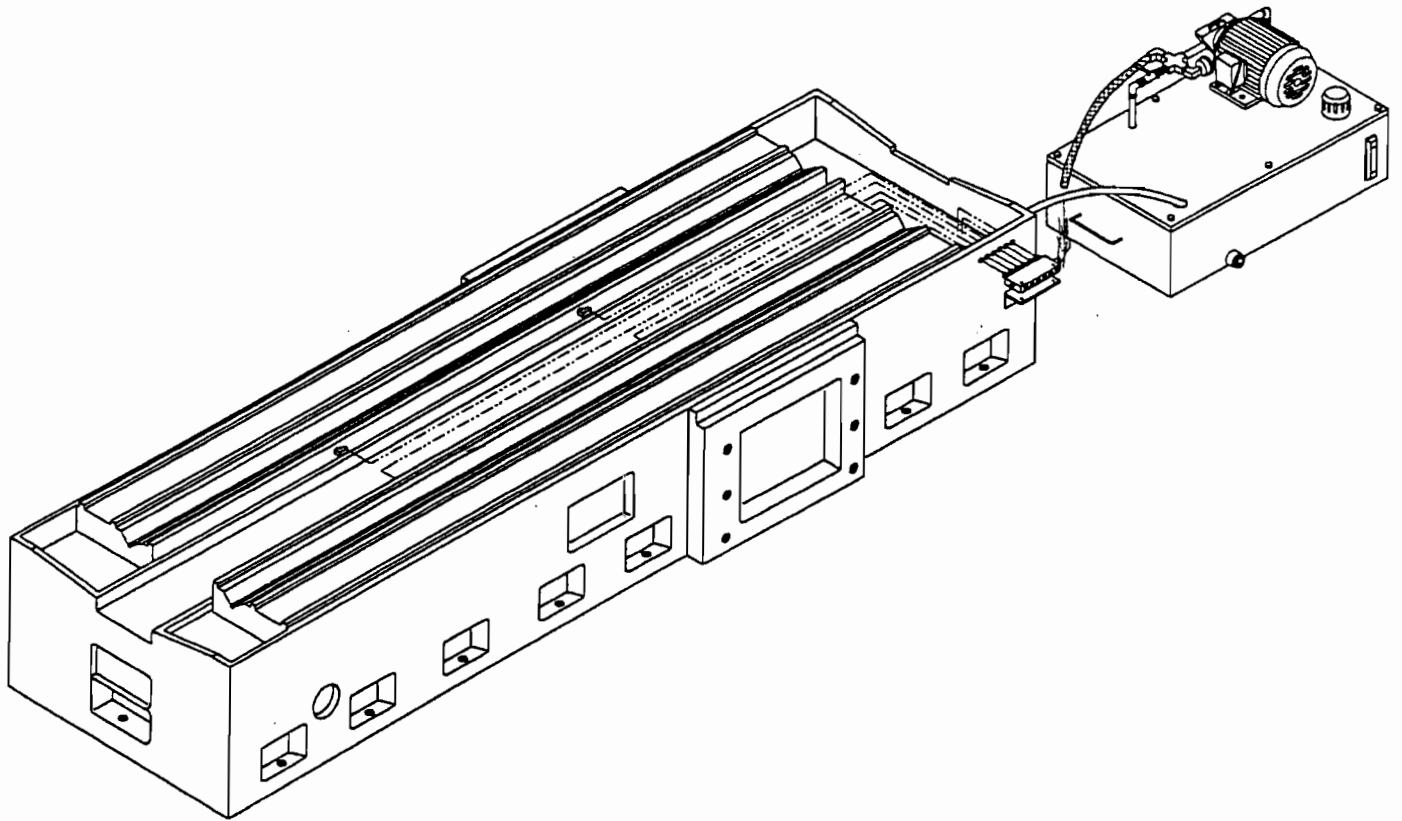
- **The oil capacity of the hydraulic tank is approximately 150~165 gallons.**
- **Every two years, clean the filter inside the hydraulic oil tank. (Replace them if necessary)**



# 5.LUBRICANT INSTRUCTION SYSTEM &DIAGRAM 1/3



## 5.LUBRICANT INSTRUCTION SYSTEM &DIAGRAM 2/3



## **5. LUBRICATION INSTRUCTION SYSTEM AND DIAGRAM**

### **48" series**

**Reliability and smooth running of the machine are ensured only by the correct choice of lubrication oil.**

#### **1. Lubrication pumps:**

- a. When the hydraulic system is turned on, the circulating lubrication pump will operate continuously. The pump puts out approximately 500cc every minute if the pump pressure is kept between 6~9 kg/cm<sup>2</sup>.**
- b. Automatic timing lubrication pump will be activated when the circuit control power is turned on. It is a one-shot type lubrication pump. It pumps 3~6cc per 30 minutes. The amount of every shot is selected by the user, and the factory default value is 6cc.**

#### **2. Lubrication oil: Mobile Vactra #2 way oil, Chevron Vista way oil #68 or equivalent.**

#### **3. Lubrication tank:**

- a. Tank of circulating pump is about 11 gallons.**
- b. Automatic timing lubrication pump is about 0.4 gallon.**

#### **4. Lubrication point: Please see drawing on the previous page.**

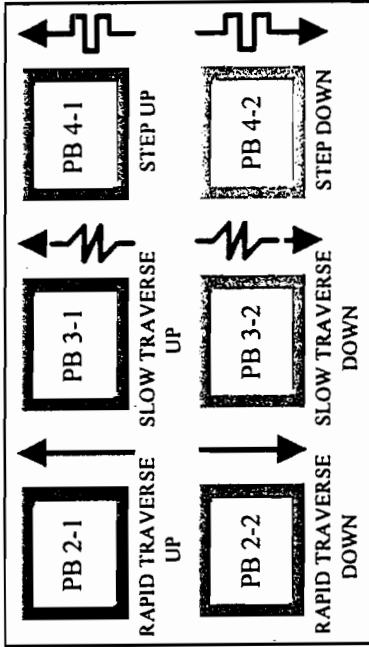
#### **5. Please check the oil quantity of the lubrication tank often. Make sure the oil level is always 70% of the tank.**

#### **6. Occasionally please check every lubrication point. It is very important for maintaining the machine accuracy.**

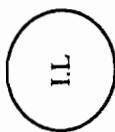
SURFACE GRINDER MICROCOMPUTER CONTROLLER



DISPLAY OF GRINDING WHEEL POSITION



UNIT: 0.0001" FEEDS	UNIT: 0.0002" FEEDS SETTING
SPARK OUT SETTING	FEED TIMES SETTING



ON



CPBa

OFF



ORIGIN



MANUAL

2012-5012AHD CONTROL PANEL (INCH)

MULTIPLIER

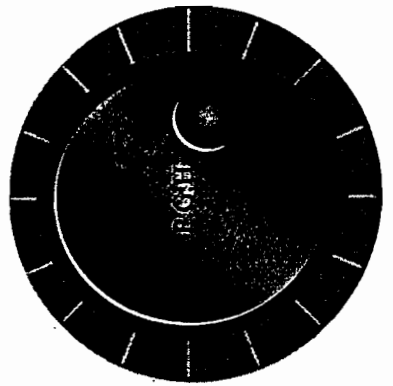


x1 x2 x8

CS1



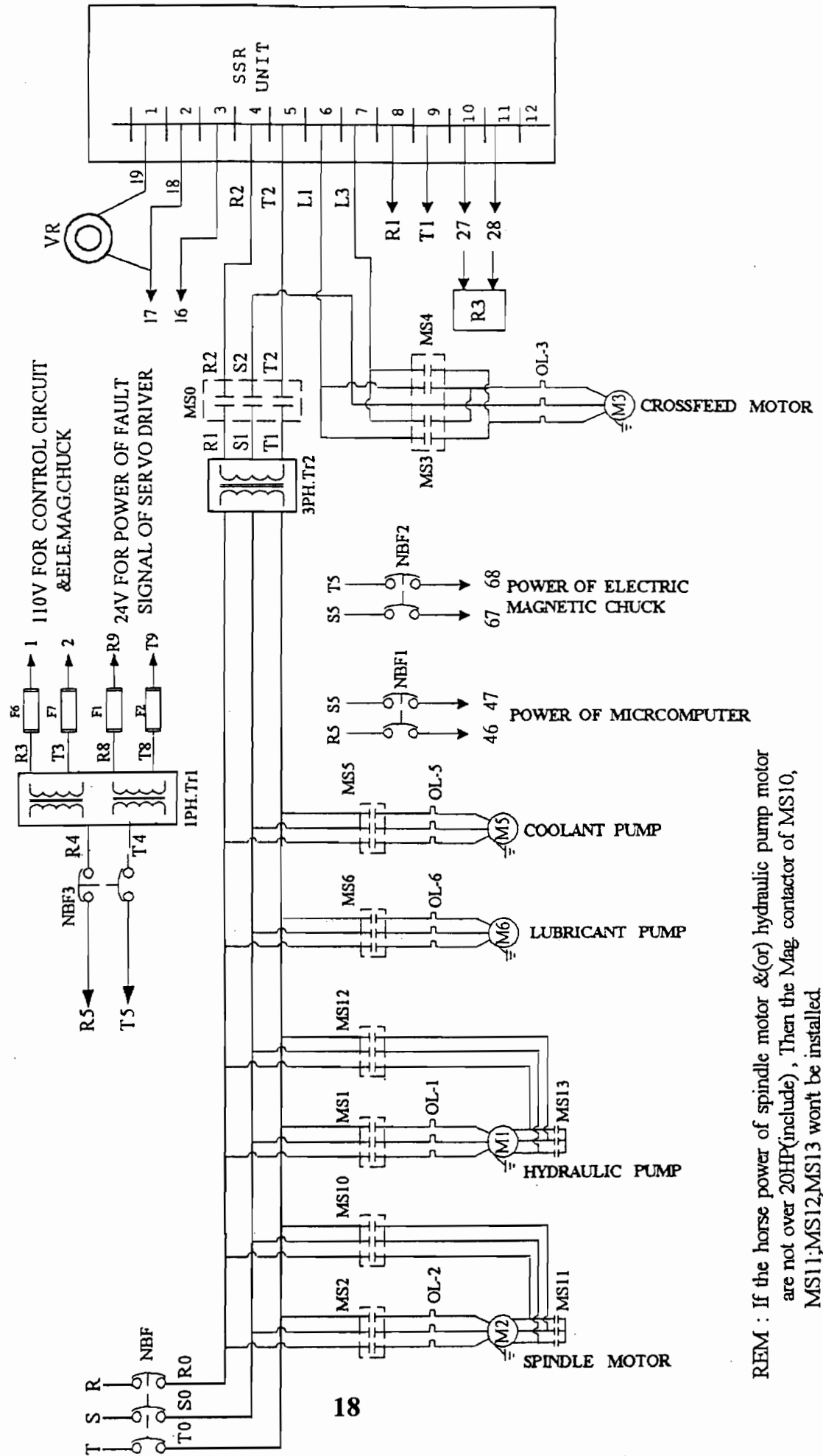
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CIRCUIT POWER	PBa	PBb	S3	S4	S7	S1
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S2	S5	S6	POSITION SETTING	PBI
VR				

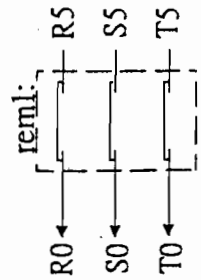
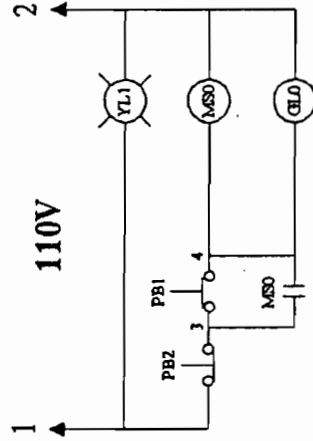
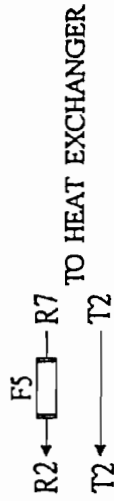
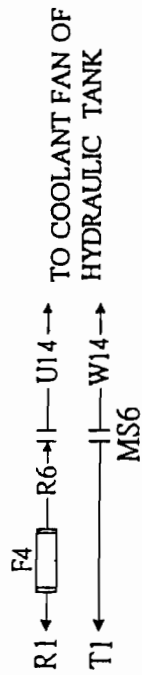
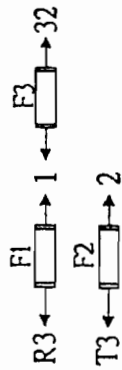
# 48" SERIES MAIN ELECTRIC CIRCUIT DIAGRAM 1/2



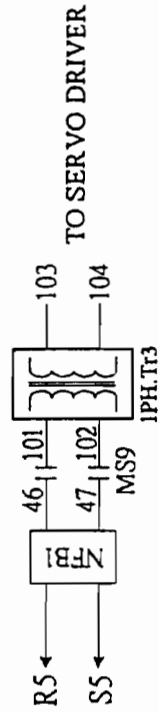
18

REM : If the horse power of spindle motor &(or) hydraulic pump motor are not over 20HP(include) , Then the Mag. contactor of MS10, MS11;MS12,MS13 won't be installed.

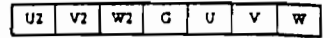
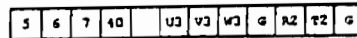
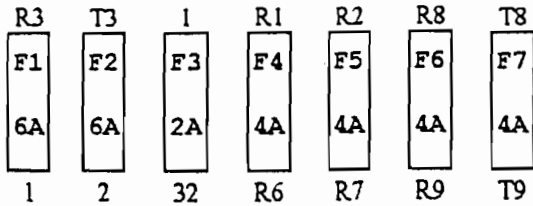
# 48" SERIES MAIN ELECTRIC CIRCUIT DIAGRAM 2/2



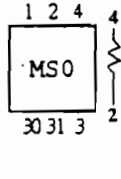
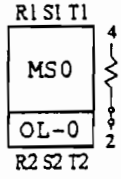
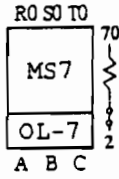
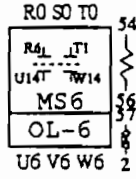
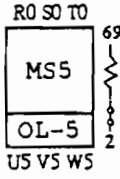
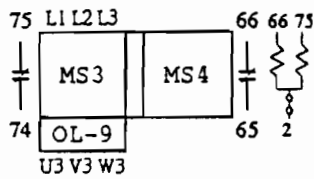
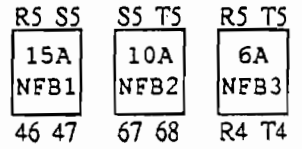
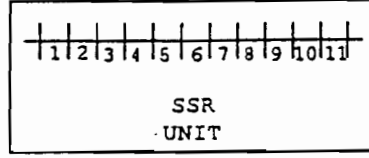
rem.: If need ,the customer can install a 20A power stabler



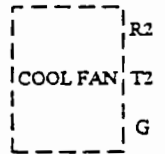
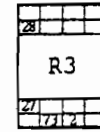
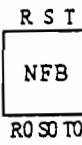
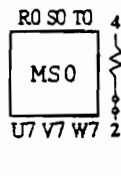
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43  
1  
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5  
26  
71  
72  
73  
R2  
T2  
R1  
S1  
T1  
G  
R0  
S0  
T0  
G  
R5  
S5  
T5  
R9  
T9  
46  
47  
67  
68



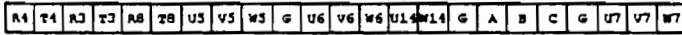
**SHARP JW-10  
JW-1424K  
(PLC)**



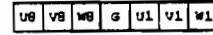
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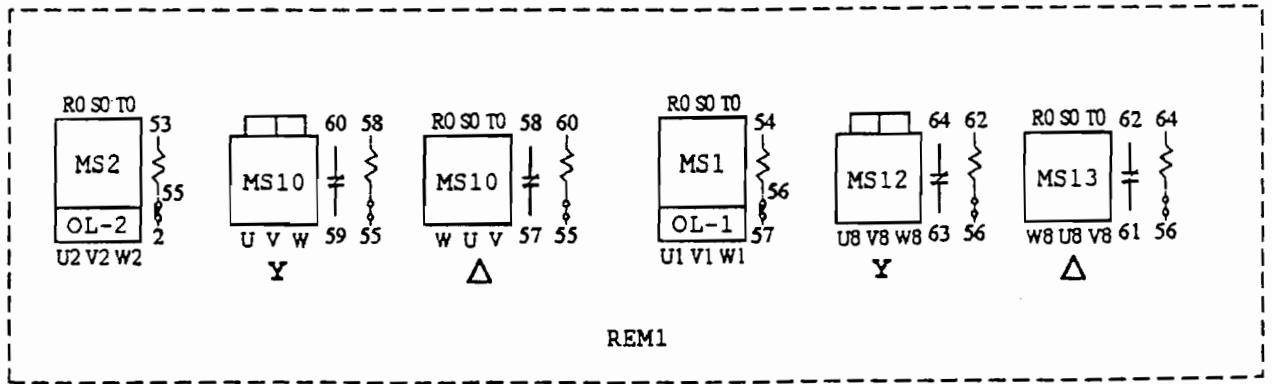
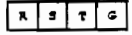
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TB2

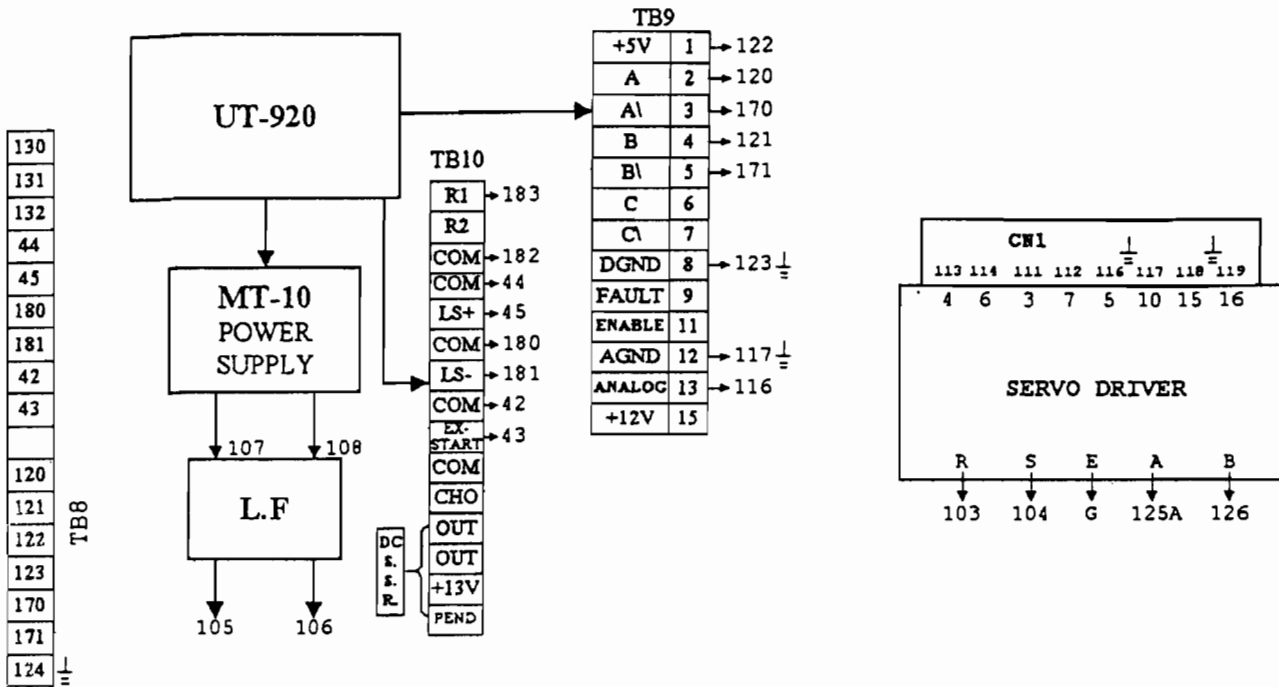


TB1

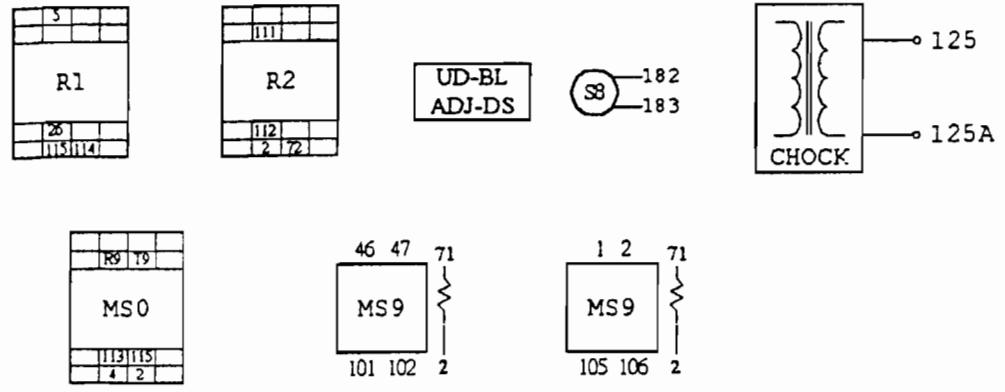


REM1 : IF THE SPINDLE MOTOR OR HYDRAULIC PUMP MOYOR IS OVER 20 HP THE WIRE CONNECT OF MOTOR IS USED Y-Δ CONNECTION

# 48" LAYOUT OF MAIN ELECTRICAL BOX 2/2



- 130
- 131
- 132
- 44
- 45
- 180
- 181
- 42
- 43
- 120
- 121
- 122
- 123
- 170
- 171
- 124  $\frac{1}{2}$
- 118
- 119
- $\frac{1}{2}$
- 125
- 126
- $\frac{1}{2}$



**TB7**

23	24	G	69	70	67	68	R9	T9	46	47	101	102	103	104	1	2	4	5	26	71	72
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ENCODER FEEDBACK						
A	C	H	K	N	R	L
Green	White	Black	Red	Brown	Yellow	$\frac{1}{2}$
120	121	122	123	170	171	124
CHA	CHB	+5V	GND.	CHĀ	CHĒ	CASE

UPPER SWITCH : 44,45
LOWER SWITCH : 180,181
INFED SWITCH : 42,43



## 48" SERIES CONTROL PANEL & ELECTRIC PARTS DESCRIPTION 1/2

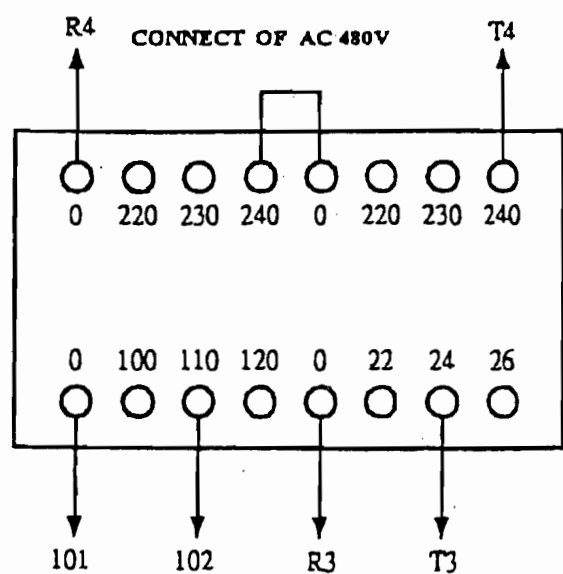
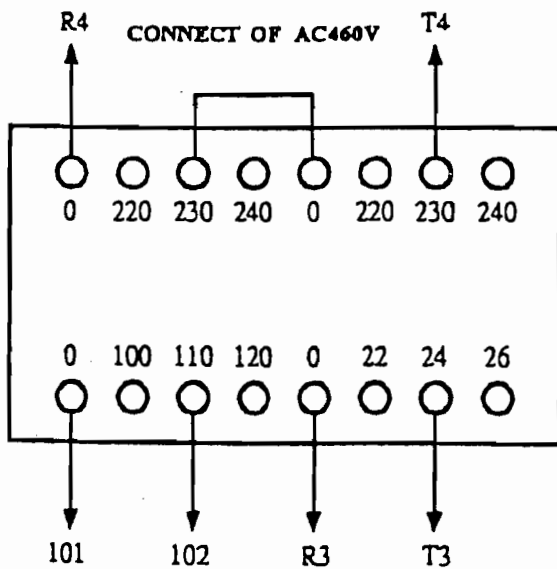
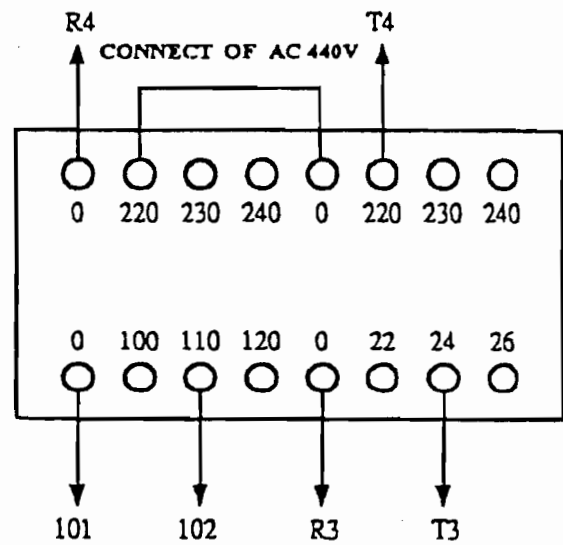
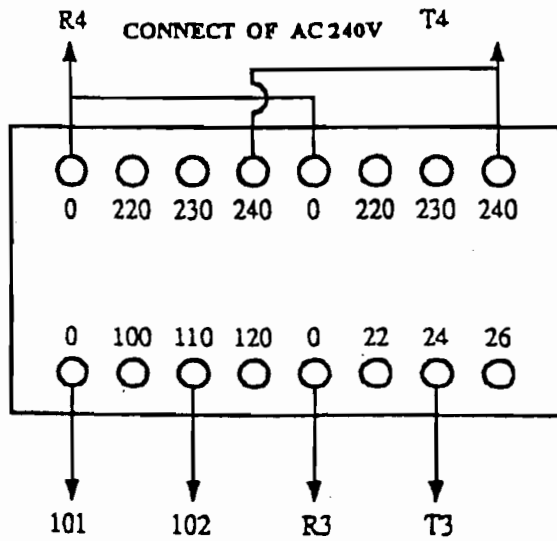
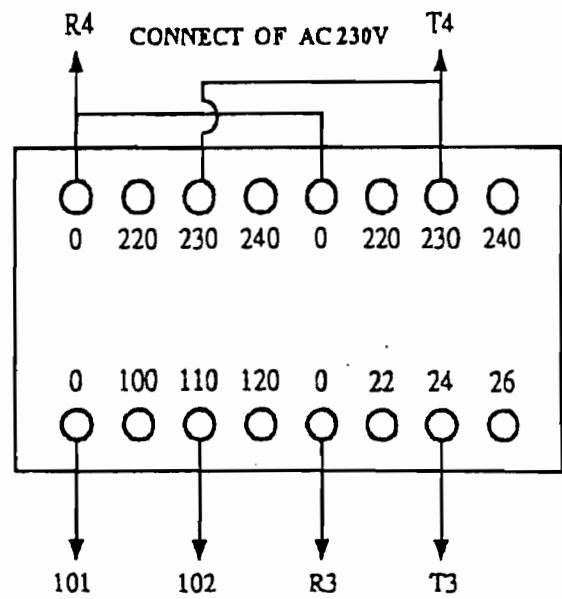
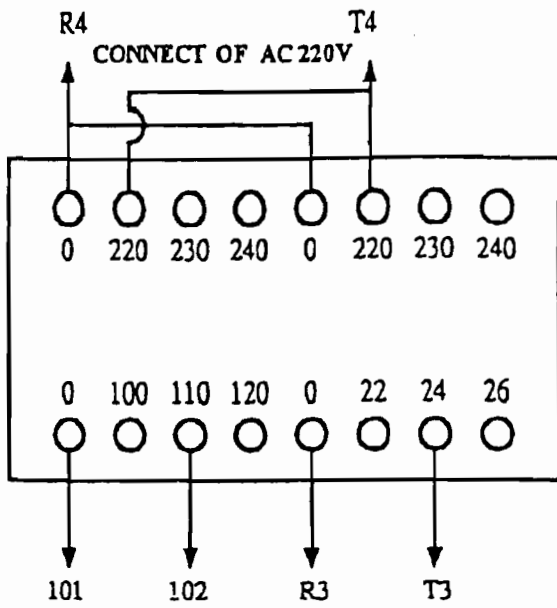
I.L	INDICATE LAMP OF POWER SOURCE.
PBa	PUSH BUTTON "ON" OF CONTROL CIRCUIT SOURCE WITH INDICATE LAMP (IL0).
PBb	PUSH BUTTON "OFF" OF CONTROL CIRCUIT SOURCE.(ALSO AS A EMERGENCY STOP).
S1	SWITCH OF HYDRAULIC MOTOR .
S2	SWITCH OF SPINDLE MOTOR.
S3	SWITCH OF HYDRAULIC PARALLEL DRESSER PUMP .(OPTION ACCESSORY)
S4	SWITCH OF COOLANT PUMP.
S5	SWITCH OF CROSS-FEED MANUAL OR AUTO MODE.
S6	RETURN SWITCH OF CROSS-FEED.
S7	SELECT SWITCH OF SURFACE OR PLUNGE MODE.
VR	VARIABLE STEP SPEED OF AUTO CROSS-FEED MODE.
PB1	INDICATOR OF AUTO CROSS-FEED STORKE SETTING CONDITION.
CPBa	PUSH BUTTON "ON" OF MICROCOMPUTER CONTROL.
CPBb	PUSH BUTTON "OFF" OF MICROCOMPUTER CONTROL.
OPB	PUSH BUTTON OF ORIGIN RETURN ( TO SET THE WHEEL HEAD RETURN TO REFERENTIAL
RPB.	PUSH BUTTON OF ZERO RESET (TO SET THE L.D.D0 TO REFERENTIAL ZERO POINT).
CPB1	PUSH BUTTON OF MANUAL CONTROL MODE WITH INDICATE LAMP( IT IS A NORMAL TURN ON CONDICTION TILL PUSHING THE "PB5". (REM.1)
L.D.D0	LED DISPLAY OF GRINDING WHEEL REFERENTIAL POSITION.
L.D.D1	LED DISPLAY OF FEEDS SETTING (SETTING NUMERAL UNIT).
L.D.D2	LED DISPLAY OF FEEDING TIMES ( AUTO MODE).
L.D.D3	LED DISPLAY OF SPARK OUT TIMES ( AUTO MODE).
CPS1	DIP SWITCH OF FEEDS SETTING.
CPS2	DIP SWITCH OF FEEDING TIMES.
CPS3	DIP SWITCH OF SPARK OUT TIMES.
CPB5	PUSH BUTTON OF AUTO CONTROL MODE WITH INDICATE LAMP.(AS SOON AS PUSH THE "PB1" THE CONTROL CONDICTION WILL CHANGE TO THE MANUAL MODE) .
PB2-1	PUSH BUTTON OF DRIVING THE WHEEL HEAD RAPID TRAVERSE UP.
PB2-2	PUSH BUTTON OF DRIVING THE WHEEL HEAD RAPID TRAVERSE DOWN.
PB3-1	PUSH BUTTON OF DRIVING THE WHEEL HEAD SLOW TRAVERSE UP.
PB3-2	PUSH BUTTON OF DRIVING THE WHEEL HEAD SLOW TRAVERSE DOWN.
PB4-1	PUSH BUTTON OF DRIVING THE WHEEL HEAD STEP UP ( THE QUANTITY IS SETTING BY "PS1".
PB4-2	PUSH BUTTON OF DRIVING THE WHEEL HEAD STEP DOWN ( THE QUANTITY IS SETTING BY "PS1".
CS1	SELECT SWITCH OF MICROCOMPUTER OR ROTARY HANDLE CONTROL. (C:MICROCOMPUTER CONTROL. P:ROTARY HANDLE CONTROL).
CS2	SELECT SWITCH OF MULTIPLE OF 1, 2, 8 UNIT OF ROTARY HANDLE CONTROL.
P.G.H	ROTARY HANDLE OF PULSE GENERATOR.

REM1:IT IS ALSO A INTERRUPTER, WHEN SOMETIME THE "PB" IS PRESSED,THE USER CAN INTERRUPT THE FUCTION ANYTIME BY PRESSING THE "PB1".

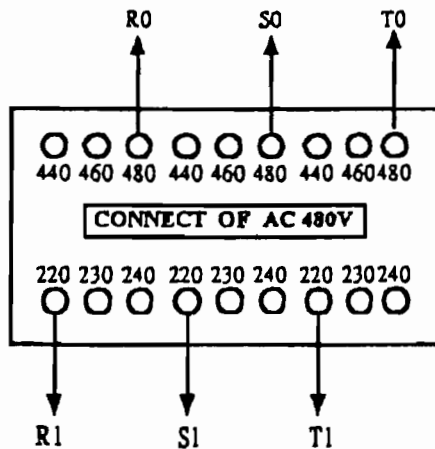
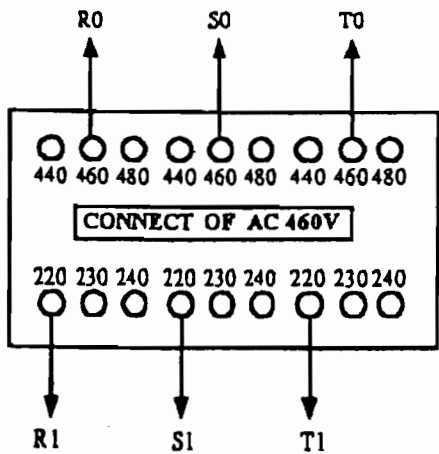
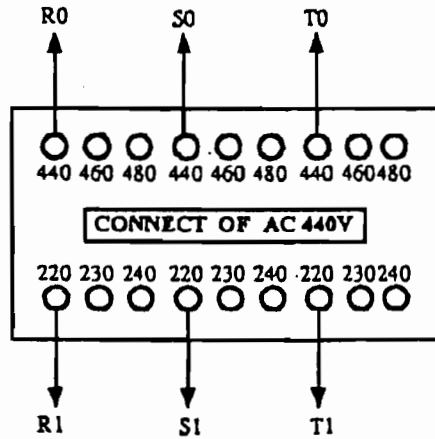
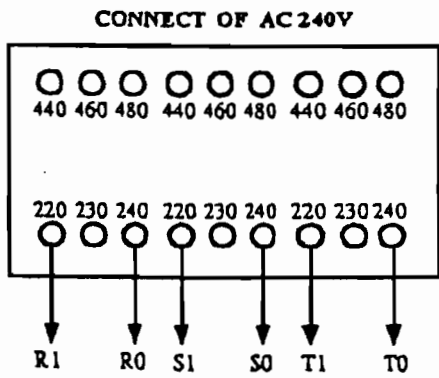
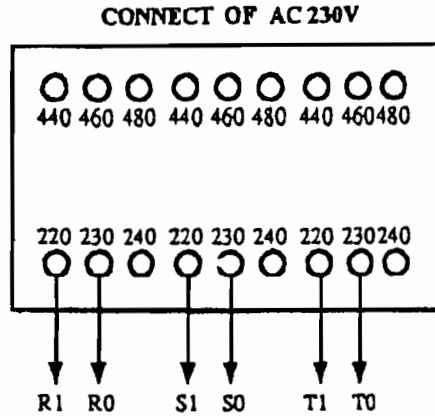
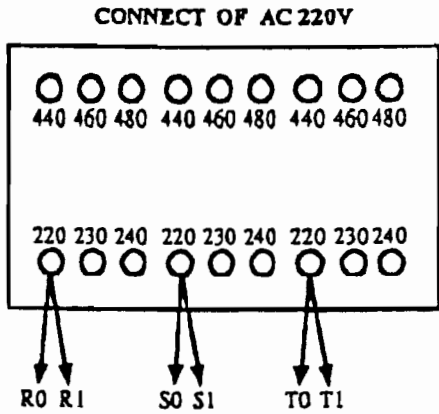
## 48" SERUES CONTROL PANEL & ELECTRIC PARTS DESCRIPTION 2/2

MS0	MAGNETIC CONTACTOR FOR CIRCUIT CONTROL SOURCE.
MS1	MAGNETIC CONTACTOR FOR HYDRAULIC PUMP MOTOR.
MS2	MAGNETIC CONTACTOR FOR SPINDLE MOTOR.
MS3 MS4	MAGNETIC CONTACTOR FOR SPINDLE SEAT CROSS-FEED MOTOR.
MS5	MAGNETIC CONTACTOR FOR COOLANT.
MS6	MAGNETIC CONTACTOR FOR LUBRICANT PUMP.
MS7	MAGNETIC CONTACTOR FOR HYDRAULIC PARALLEL DRESSER PUMP.
MS9	MAGNETIC CONTACTOR FOR POWER OF SERVO DRIVER & NC CONTROLLER.
MS10 MS11	MAGNETIC CONTACTOR OF Y- $\Delta$ STARTING&RUNNING CONNECT FOR HYDRAULIC PUMP MOTOR IS OVER 20 HP.
MS12 MS13	MAGNETIC CONTACTOR OF Y- $\Delta$ STARTING&RUNNING CONNECT FOR SPINDLE MOTOR IS OVER 20 HP.
R1,R2,R3	AUXILIARY RELAY FOR NC. CONTROL SYSTEM.
NFB	NO FUSE BREAKER FOR MAIN POWER SUPPLY.
NFB1	NO FUSE BREAKER FOR POWER OF MICROCOMPUTER.
NFB2	NO FUSE BREAKER FOR POWER OF ELECTRIC MAGNETIC CHUCK.
NFB3	NO FUSE BREAKER FOR POWER OF SERVO DRIVER.
M1	HYDRAULIC PUMP MOTOR.
M2	SPINDLE MOTOR.
M3	SPINDLE SEAT FORWARD&BACKWARD CONTROL MOTOR.
M6	COOLANT PUMP MOTOR.
M6	LUBRICANT PUMP
LS1	APPROXIMATE SWITCH FOR AUTO CROSS-FEED TRIGGER SIGNAL.
PXS1 PXS2	APPROXIMATE SWITCH FOR SETTING STROKE OF AUTO CROSS-FEED
LS4 LS5	LIMIT SWITCH FOR MAX. TRAVEL OF SPINDLE SEAT.
OL1,OL2 OL3,OL4 OL5,OL6	CURRENT OVERLOAD.
F1,F2,F3 F4,F5,F6,F7	FUSES
1PH tr1.	1 PHASE TR.(FOR CONTROL CIRCUIT &EM.CHUCK POWER SUPPLY. AND POWER OF FAULT SIGNAL OF SERVO DRIVER ).
3PH tr2.	3 PHASE TR.(FOR SPINDLE SEAT RAPID UP&DOWN AND CROSS-FEED.LUBRICANT PUMP.PAPER FILTER MOTOR).
1PH tr3.	1 PHASE TR.(FOR SERVO MOTOR DRIVER)..
S.S.R UNIT	CROSS-FEED MOTOR CONTROL UNIT.

# CONNECTION OF SINGLE PHASE TRANSFORMER



# CONNECTION OF THREE PHASE TRANSFORMER



## **10. OPERATION OF THE MACHINE**

When preparing the operation, user must be familiar with the operation procedure. In order to get the best working condition, please follow the following procedures:

### **A. Please reconfirm the following conditions:**

- A-1. The machine must locate on a vibration-proof foundation.**
- A-2. Level of the machine must be within specification.**
- A-3. Lubricate the slideways and screws with waylube oil at first use.**
- A-4. The power supply must match to the machine's requirement.**
- A-5. Before installing the grinding wheel, please confirm the spindle rotation is counterclockwise.**
- A-6. Do not install the grinding wheel until you have already balanced it.**
- A-7. Make sure the flow control lever is at stop position.**
- A-8. Make sure the moving area for the grinder is cleared.**

### **B. Table longitudinal movement**

- B-1. Adjust the travel stroke adjuster (L & R) to required position.**
- B-2. Start the electric control circuit by pressing the push button PBa.**
- B-3. Start the hydraulic system by turning the S1 to the right side.**
- B-4. Turn the flow control lever slowly toward clockwise direction until the table speed is suited for your need. Then the table will travel reciprocating between the L & R travel adjuster.**
- B-5. When the table is moving, operator can vary the table speed by turning the flow control lever clockwise or counterclockwise.**

### **C. Column's crossfeed movement**

#### **C-1. Manual rapid cross travel operation:**

- 1. Turn the S7 onto surface grinding mode (left side).**
- 2. Turn the S5 onto manual feed mode (left side).**
- 3. Turn and hold the S6 to the right side to make the column to go  
↑ DIR. Release S6 when it reaches desired position.**
- 4. Turn and hold the S6 to the left side to make the column to go  
↓ DIR. Release S6 when it reaches desired position.**

**C-2. Auto crossfeed operation:**

1. Turn the S7 onto surface grinding mode (left side).
2. Turn the S5 onto auto crossfeed mode (right side).
3. Setting the crossfeed travel of the spindle housing movement at horizontal column. (See the description of procedure next page)
4. Turn the S6 switch to right or left once to activate the spindle housing to move ↑DIR. or ↓DIR. This will put the crossfeed in automatic cycle.
5. Adjusting the VR to control the crossfeed increment.  
(Clockwise is to increase, counterclockwise is to decrease the incremental amount)
6. Activate the table longitudinal movement by open the fluid control valve.

**D. Micro-computer controller system (for downfeed) operation:**

**D-1. Pressing the CPBa button once to turn on the micro-computer controller.**

(To shut down the micro-computer controller, you must press the CPBb button once to do so.)

**D-2. Manual downfeed operation:**

1. Turn the select switch CS1 to "C" position (right side).
2. When the micro-computer controller powers on, the LED display of LDD0, LDD1, LDD2, LDD3, and indicator light inside CPB1 button will light up at the same time. The LED field of LDD0, LDD2, and LDD3 will display "0". The field on LDD1 will display some number. The number is set by the dip switches on CPS1. At this point, the machine is ready to work manually on downfeed.
3. LDD0 is showing a reference position of wheel head relative to zero reference point. This zero reference point is set by user pushing R.P.B button. Whenever R.P.B button is pushed, the LED field of LDD0 is reset to zero. Thus a new reference zero point is set.
4. Whenever the wheel head is not at reference zero point, you may press OPB button to set the wheel head back to original

position (reference zero point). **Note: It is dangerous to operate the wheel head this way, so please be extra careful when using this function.**

5. When the function of “original position return” is activated, i.e., OPB button is pushed. User may interrupt the function by pressing push button CPB1 once.
6. Push down the button PB2-1 will rapid travel the wheel head upward.
7. Push down the button PB2-2 will rapid travel the wheel head downward.
8. Push down the button PB3-1 will slow travel the wheel head upward.
9. Push down the button PB3-2 will slow travel the wheel head downward.
10. Push down the button PB4-1 once will jog the wheel head up one step.
11. Push down the button PB4-2 once will jog the wheel head down one step.

Rem. 1. The amount of jog feed is set by dip switches CPS1.  
(Jog amount=CPS1 x .0002”)

### **D-3. Auto downfeed cycle operation**

#### **a. Surface grinding mode:**

1. Set the select switch CS1 to “C” position (right side).
2. Adjust the dip switches of CPS1 to set the amount of each automatic downfeed step.
3. Adjust the dip switches of CPS2 to set the auto downfeed path. One time down equals to one path. (LDD2’s number counts upward.)
4. Adjust the dip switch of CPS3 to set spark out times. (LDD3’s number counts upward)
5. Do the procedure of C-2 ( auto crossfeed cycle operation).
6. Push the CPB5 (auto start) on time to start the auto downfeed cycle. At this point, the indicator of CPB5 will light up and the indicator of CPB1 will go out.
7. When the auto downfeed cycle finishes, the wheel head

will raise upward a little bit. To make the wheel head stay at the final grinding position, user can set switch S8, which locates in the electric cabinet, to the left side. This will disable the wheel head auto raise-up function. Then the controller will reset the downfeed system to manual mode.

**b. Plunge grinding mode**

1. Move the select switch CS1 to “C” position (right side)
2. Turn the select switch S7 to plunge grinding mode (right side), then the function of automatic crossfeed system will be disabled.
3. Adjust the dip switches of CPS1 to set the amount of each automatic downfeed step.
4. Adjust the dip switches of CPS2 to set the auto downfeed path. One time down equals to one path. (LDD2’s number counts upward.)
5. Adjust the dip switch of CPS3 to set spark out times. (LDD3’s number counts upward)
6. Do the procedure shown on section B for table movement.
7. Push the CPB5 (auto start) on time to start the auto downfeed cycle. At this point, the indicator of CPB5 will light up and the indicator of CPB1 will go out.
8. When the auto downfeed cycle finishes, the wheel head will raise upward a little bit. To make the wheel head stay at the final grinding position, user can set switch S8, which locates in the electric cabinet, to the left side. This will disable the wheel head auto raise-up function. Then the controller will reset the downfeed system to manual mode.

**c. Pulse generator hand-wheel operation:**

1. Turn the select switch CS1 to “P” position (left side). At this position, the function of manual downfeed and auto downfeed cycle will be disabled.
2. Move the select switch CS2 to desired range (x1, x2 or x8)  
The per step amount= selected range x graduation on



hand wheel.



3. Rotating the P.G.H clockwise to drive wheel head downward.
4. Rotating the P.H.G anti-clockwise to drive wheel head upward.
5. Do not operate the P.H.G too fast.

**Rem2:** Before starting the power of controller, if the switches of spindle motor, hydraulic motor, and coolant motor are not at off position, after the controller has power, the user then can not start the spindle motor, hydraulic motor and coolant motor.

**Rem3:** The auto downfeed triggering signal is at the front and back end of the auto crossfeed stroke. (only for surface grinding mode)

**Rem4:** The downfeed triggering signal is at the right end of the table movement. (only for plunge grinding mode)

## 7. PROCEDURE FOR OPERATING 48" SERIES' AUTOMATIC CROSSFEED

- a. At first, select the S7 switch to surface mode (  ). Then choose S5 switch to the manual operating mode (  ). After that, use S6 switch (for rapid forward or backward) to move column to the first grinding edge of work piece-- "A" (please refer to FIG.1).

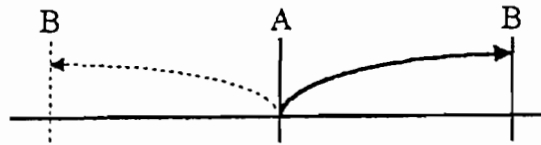




FIG.1

After the above procedures, press push button PB1 (position setting button with condition indicator PL1) once to memorize the first edge, then the indicator light of PL1 will flash continuously with one second interval. Next use S6 to sent the column to the second edge of the work piece-- "B".

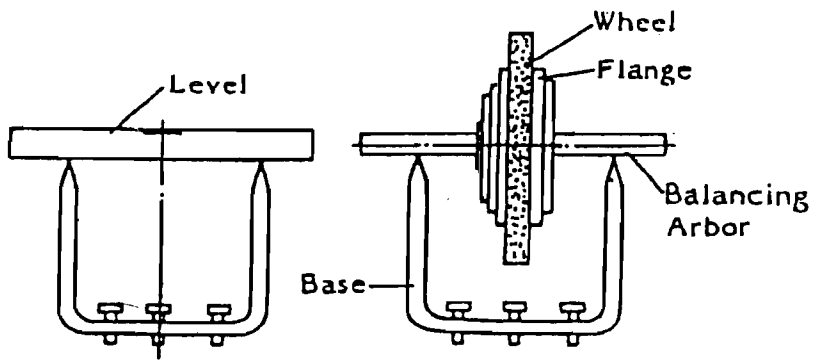
Then once more, press the PB1 and PL1 will stop flashing, and keep lighting until S5 switch is change over to auto crossfeed mode (  ). With the indicating light of PL1 turned off, the procedure is complete.

- b. If the setting procedure is not correct: Setting point A & B too close together, or just setting only point A, then switch S5 to the auto crossfeed mode (  ), will cause indicator light of PL1 to flash with 0.1 second interval. This means the setting procedure is not correct, 0.2 and please repeat procedure 'a' again.
- c. This system has an automatic memory function, i.e., when the machine is operating and a sudden power failure occurs, or the emergency stop button is pushed to interrupt the operation, the previous setting will not change unless the user turn the crossfeed handwheel manually before restarting the power supply.

## **11. BALANCING THE GRINDING WHEEL**

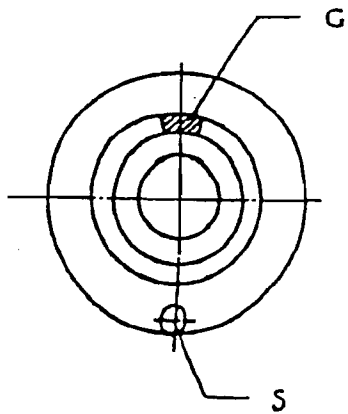
**Effectively balancing the grinding wheel will relieve stress inside the grinding wheel and help you attain the maximum quality. Degree of grinding precision and grinding surfaces as well as the life spans of the grinding wheel, spindle assembly and bearings are closely linked to whether or not grinding wheel is precision balanced. To achieve this objective, static balancing is generally sufficient.**

- a. After the grinding wheel, wheel flange and balancing arbor are precisely installed, the following method is used to balance the grinding wheel:**
  - 1. The level of the balancing stand must be calibrated to within one grid.**
  - 2. Rotate the grinding wheel on the balancing stand and mark its lowermost position (heaviest area) with a 'S' using chalk (see figure 11-6, 11-7).**
  - 3. Then take the first balancing piece 'G' and attach it opposite to the 'G' mark. Caution: The 'G' mark cannot be moved hereafter (see Figure 11-8).**
  - 4. After this take the other two balancing pieces 'K' and attach to any position of equivalent distance 'a' (see figure 11-9).**
  - 5. Rotate the grinding wheel 90 degree repeatedly and inspect each time whether the grinding wheel is balanced. If it is not balanced, adjust the positions of the balance pieces 'K' until the grinding wheel can be balanced (see figure 11-10).**
  - 6. After balancing the grinding wheel, test it by rotating it at normal grinding speed for at least five minutes.**

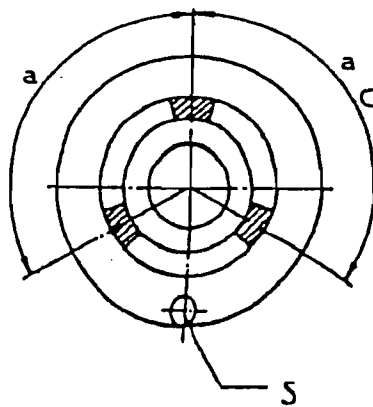


11-6

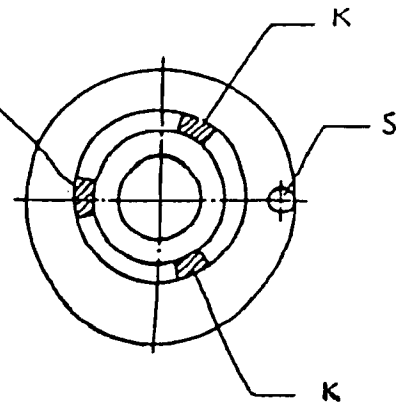
11-7 5



11-8

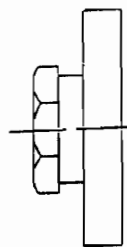


11-9

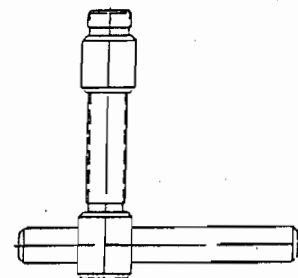


11-10

- b. After the first time you balance the grinding wheel, it must then be mounted on the wheel spindle. Use the parallel dresser on the spindle housing of the spindle or the grinding wheel dresser on the table to finish the grinding wheel.
- Note: When using the diamond dresser on the table, first set the work or travel direction and then rotate the handwheel.
- c. The grinding wheel must be finished to complete precision. This can be established by looking at the grinding surface. By using the above procedure to balance the wheel, you must remove it from the spindle and position the grinding wheel on the balancing stand and then carefully balance it. After this, you can mount it on the spindle, dress the grinding wheel, repeating this procedure until it is perfectly balanced. Even a well balanced grinding wheel can lose its balance through wear. Therefore, it is necessary to frequently inspect the grinding wheel and re-balance it when necessary.
- d. Since the grinding wheel will absorb coolant, when the grinding wheel is stationary, do not turn on the coolant or it will become off balance by absorbing water on one side. If the grinding wheel is left idle for long period of time, the moisture inside will concentrate at its lowest point causing it to become off balance. Therefore, if the wheel is not allowed to spin for a period, it will become off balance. If you let the spindle spin and use centrifugal force to draw off the moisture, the grinding wheel will regain its balanced state.
- e. Before mounting the grinding wheel on the spindle, first wipe the taper portion of the wheel flange and taper of the spindle clean, and then use your hand to push the grinding wheel onto the spindle taper. After that, screw in the spindle nut and tighten it (see figure 11-11). To detach the wheel flange, use the grinding wheel extractor (see figure 11-12).



11-11



11-12

**Note:** If you want to grind different materials, the grinding wheel has to be changed as well. This is not very economical if you change and balance the wheels all the time. We suggest that you dedicate a single wheel flange for each grinding wheel. This way, you can save time and trouble for balancing different wheels.

## **12.GENERAL COMMENTS OF GRINDING**

The quality of a resulting grinding surface depends on both choosing the right grinding wheel and correct operational method.

### **1. Stock removal efficiency**

For intensive stock removal of a material, the coarse grid wheel (about 30~36) is dressed by passing the diamond over quickly, so that the surface of the wheel is rough and sharp.

### **2. Surface finish required**

If a fine finish is required, a finer grid of wheel is required (about 40~80). The diamond in this case is passed slowly over the wheel. This is done to break up the grains within the wheel.

### **3. Distortion of the work piece**

If the work piece shows too much distortion when being ground, this means that the stock removal rate is too great, and the longitudinal and cross movements of the table is too slow, or in another word, the grinding wheel is being “clogged” by the work piece.

### **4. Undesirable burns and grinding cracks**

If burn marks and grinding cracks appear, that means the wheel is too hard or the wheel is “clogged”.

## **13.WHEEL INSPECTION**

The following safety rules must be rigorously obeyed. Their purpose is to protect workers from potential injury.

**Wheel inspection and installation:**

**Before mounting the grinding wheel, please carefully inspect it!**

**Generally, this can be done by making a sound of the grinding wheel.**

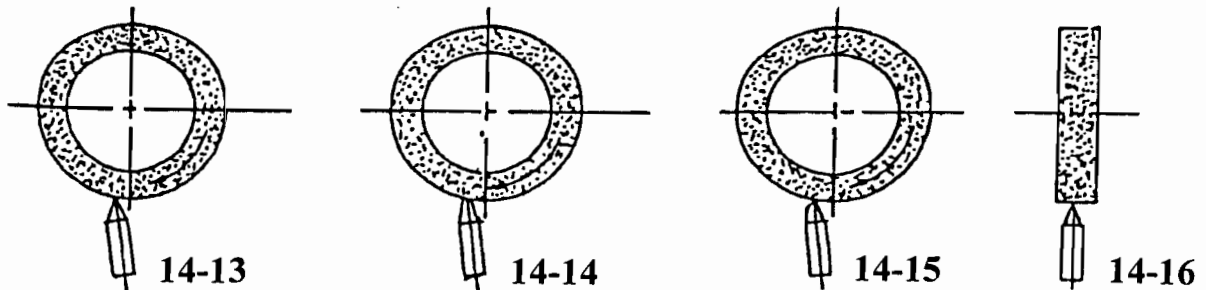
Use a supporting bar passing through the axle hole of the grinding wheel, then take a wooden hammer to lightly tap the wheel, so that it would make a sound. Cracks that can not be seen physically are revealed by the different sounds that they make. A flawless wheel makes a distinctive crystal sound. Do not use a wheel that is very poor in quality!

The two surfaces of the wheel have two sheets of absorbent paper. They are used as flexible pads between the wheel and the flange. When installing the wheel, do not tear off these papers. Then gently take your hand and slip the grinding wheel onto the flange. Don't use too much force! The wheel must be wiped clean, especially the two orienting and positioning surfaces.

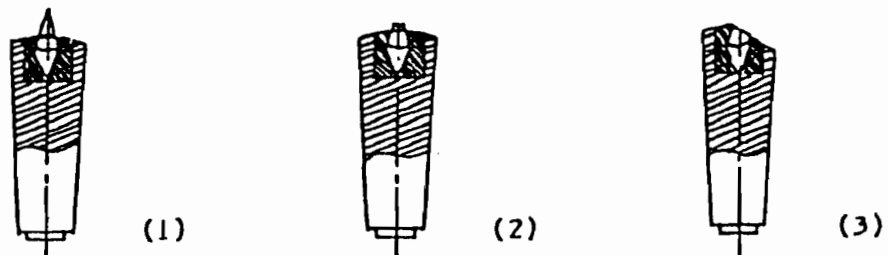
#### **14. DRESSING THE WHEEL AND CORRECT TREATMENT OF DRESSING DIAMOND**

- a. The complete grinding wheel can be dressed by the diamond, which is based on the electro-magnetic chuck (before dressing, use your hand to see if it is firmly in place), or the dressing device which is called over head parallel dresser. The diamonds in both cases have been designed to dress the grinding wheel at an angle of approximately 5 degree. The reason being, the portion of wheel that has been dressing by the diamond should be along the rotating direction of the grinding wheel. In this manner, the diamond tip can maintain its sharpness through out the dressing process.
- b. Changing the feed rate of dressing the wheel will enable you to change the coarseness of the grinding wheel. If you want to grind a depth between 0.1~0.2mm, then a rough dressing of the grinding wheel is all that is necessary. To do so, all you need to do is to turn the crossfeed handwheel quickly, and you can make the diamond dresser passes through the wheel quickly. In this case, you can get a greater rate of stock removal from the wheel. If you want to do precision grinding with the same wheel, then dresses it again. This time do it slowly two-to-three time again, and dress it with a depth of 0.01mm per path.

- c. Generally, light dressing is the best solution for elongating the life span of the wheel and the diamond tip.
- d. Diamonds, being excessively brittle and hard, are susceptible to slight impact. They are in another word easily cracked.
- e. When dressing the wheel, you must start from the center, because the outer edges tend to wear more. If you begin dressing from the outer edge, this will put more pressure on the diamond. It might possibly crack the diamond.
- f. Grinding wheel dressing diagrams and precautions:



1. Form a correct angle between the new diamond dresser and the wheel (approx. 5 degree) (see figure 14-13).
  2. When the diamond is being worn by grinding, turn it over to preserve its sharpness (see figure 14-14).
  3. Dresser, which has been turned over, should be placed back at the exact dressing position of the grinding wheel (see figure 14-15).
  4. Diamond dressing of the grinding wheel must begin from the center of the grinding wheel (see figure 14-16)
- g. After a period of time, the diamond must change its tip, i.e. it must be reset to ensure economical operation. This resetting process should be taken before any of the tips has been ground off. Otherwise, there is a danger of breaking it, losing it or becoming too small to be reset. This then could cause a fortune to the user.





1. The new diamond with tip.
2. The diamond now must be reset.
3. Too late! The diamond can no longer be reset, as it has no more tip. Resetting should be done by specialists only.

## 15.STORAGE OF GRINDING WHEEL

1. Grinding wheels must be stored in a dry wheel shelf (as shown in figure 15-17). That is protected from impact and vibration. When moving the grinding wheel, please take extra precautions.
2. The golden rule when storing grinding wheels is that they must be stored in a upright position. Thin grinding wheels and wheel with sharp edges must be stored horizontally.
3. Cautions:
  - a. Do not let oil or grease come into contact with the grinding wheel. Oil soaked grinding wheel will lose their grinding edge and glide during grinding. Also this will significantly shorten the wheels' life span.
  - b. Do not stack the grinding wheels flat as shown in figure 15-18.

1. Straight grinding wheels
2. Dish grinding wheels
3. Straight cup grinding wheels
4. Straight grinding wheels
5. Sawing plate shaped grinding wheels
6. Taper cup grinding wheels
7. Cutting-off grinding wheels
8. Wave shaped thick paper
9. Thick and high binding strength cylinder grinding wheels.
10. Large straight grinding wheels
11. Large rounded edge grinding wheels
12. Sloped surface to prevent sliding
13. Board to prevent falling
14. Two supporting pieces placed on both sides of the grinding wheels.
15. Thin cylinder grind wheel or low binding strength grinding wheels
16. Medium straight grinding wheels.

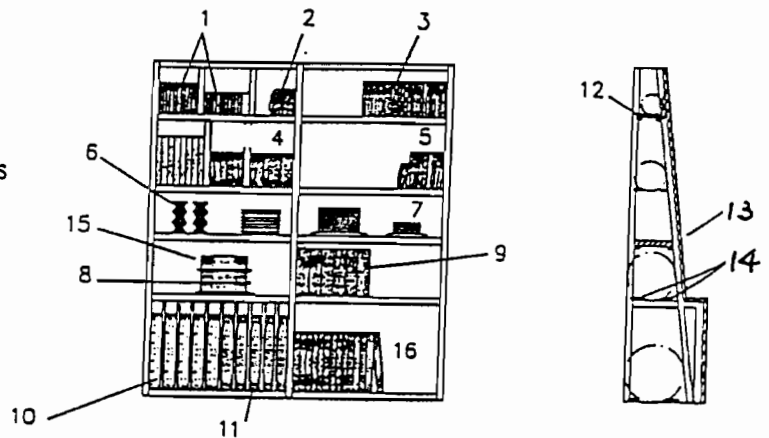


Fig.15-17 Grinding wheel finishing shelf



Fig. 15-18 Do not stack grinding wheels flat.

## 16. SELECTION OF SUITABLE GRINDING WHEELS

**Grinding wheel markings:** For instance WA 46K8V

**WA:** kind of abrasive

**46:** grain size

**K:** grade

**8:** structure

**V:** bond type

### A. Kinds of abrasive

**A:** for common steel grinding

**WA:** for higher hardness material grinding, such as heat-treated steel, alloy, etc.

**H:** suitable for higher hardness material, particular high speed steel

**C:** for cast iron and non-ferrous grinding

**GC:** for super hard grinding such as tungsten carbide steel

### B. Grain size

**Coarse:** 10, 12, 14, 16, 20, 24

**Medium:** 30, 36, 46, 54, 60

**Fine:** 70, 80, 90, 100, 120, 150, 180

Grinding condition \ Grain	Coarse	Fine
Stock removal	much	little
Surface roughness	coarse	fine
works hardness	soft	hard
Surface contacted	wide	narrow
Dia. of the wheel	big	small

**C. Grade:** It indicates the strength of the bond which hold abrasive together.

**Soft:** A to H

**Medium:** I to P

**Hard:** Q to Z

Grinding condition \ Grade	Soft	Hard
Works hardness	hard	soft
Surface be contacted	wide	narrow
Movement of work	slow	quick
Wheel speed	quick	slow

**D. Structure:** The structure number of a wheel refers to the relative spacing of the grains of the abrasive; the larger the number, the wider the grain spacing.

**Close: 0, 2, 3, 4, 5.**  
**Medium: 6, 7, 8, 9.**  
**Wide: 10, 11, 12.**

Structure Grinding condition	Wide	Close
Surface roughness	coarse	fine
Surface be contacted	wide	narrow
Works hardness	soft	hard

**E. Bond:**

**V: vitrified**

**S: silicate**

**B: resinoid**

**R: rubber**

**E: shellac**

## 17. WHEEL SELECTION TABLE

Material Being Ground			Hardness (Rockwell HRC)	Wheel Flange Specs
S T E E L	Carbon Steel	Steel Plates	HRC 25 and below	WA 46H
		Carbon Steel		WA 46J
		Carbon Steel Tubing	HRC 25 and above	WA 46J
		Carbon Steel Tubing		
	Alloy Steel	Nickel-Chromium Steel	HRC 55 and below	WA 46J
		Nickel-Chromium Alloy Steel		
		Chromium Steel	HRC 55 and above	WA 46I
		Chrome-Moly Steel		
	Aluminum Chrome-Moly Alloy Steel			
	High-Carbon Chromium Alloy Bearings			
Stainless Steel Alloy				
Tool Carbon Steel				
Tool Steel	High Speed Tool Steel	HRC 60 and below	WA 46I	
	Steel Alloy Tool Steel	HRC 60 and above	WA 46H	
Stainless Steel	Stainless Steel		WA 46I	
	Heat Resistant Steel		WA 36J	
I R O N	Cast Iron	Gray Cast Iron		C46J
		Special Cast Iron		GC461
		Cold Forged Cast Iron		....
		Malleable Cast Iron		WA46K
	Non-Ferrous Metals	Brass		C30J
		Bronze		A46K
		Aluminum Alloy		C30J
		Sintered Carbide		GC60 - 100HI

## 18. REFERENCE FOR GRINDING CONDITON

### A. Downfeed of grinding wheel

Work material Finish	Down feed			Cross feed
	Cast iron, Soft steel, Hardened steel	Stainless & Heat resistant steel	Tool steel	
Fine	0.0002-0.0004" 0.005-0.01mm		0.0002-0.0006" 0.005-0.015mm	under $\frac{1}{4}$ of wheel thickness
Rough	0.0006-0.0012" 0.015-0.03mm	0.0008-0.0012" 0.02-0.03mm	0.0008-0.0012" 0.02-0.03mm	under $\frac{1}{2}$ of wheel thickness

Down feed	Great	Small
Grinding resistance	great	small
Heat produced	much	less
Surface finish	rough	fine
Wheel worn out	much	little

### B. Crossfeed

Cross feed	Great	Small
Grinding resistance	great	small
Heat produced	much	less
Surface finish	rough	fine
Wheel worn out	much	little

### C. Table longitudinal traverse

Table traverse	Quick	Slow
Grinding resistance	great	small
Heat produced	less	much
Surface finish	rough	fine
Wheel worn out	much	little

### Suitable speeds of the table traverse

Work material	Soft steel	Heat treated steel	Tool steel	Cast iron
Speed: M/Min.	6-15	20-25	6-25	16-20

**D. Suitable peripheral speeds of the wheel: 1200~1800 M/min**

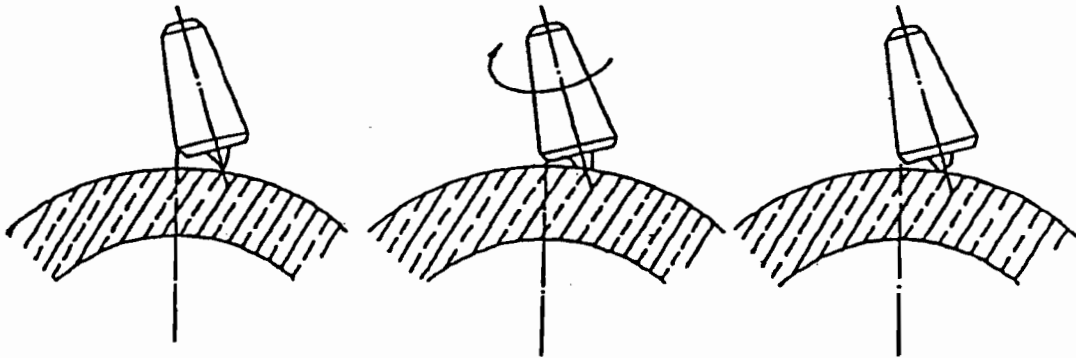
Wheel speed Condition	Quick	Slow
Grinding resistance	small	great
Heat produced	much	less
Surface finish	fine	rough
Wheel worn out	small	great
Safety	bad	better

Material	Peripheral speed
Steel	20-30M/Min.
Cast iron	18-20M/Min.
Tungsten Carbide	8-18M/Min.
Zinc alloy and light metal	25-30M/Min.

## 19.USAGE OF THE OPTIONAL ACCESSORIES

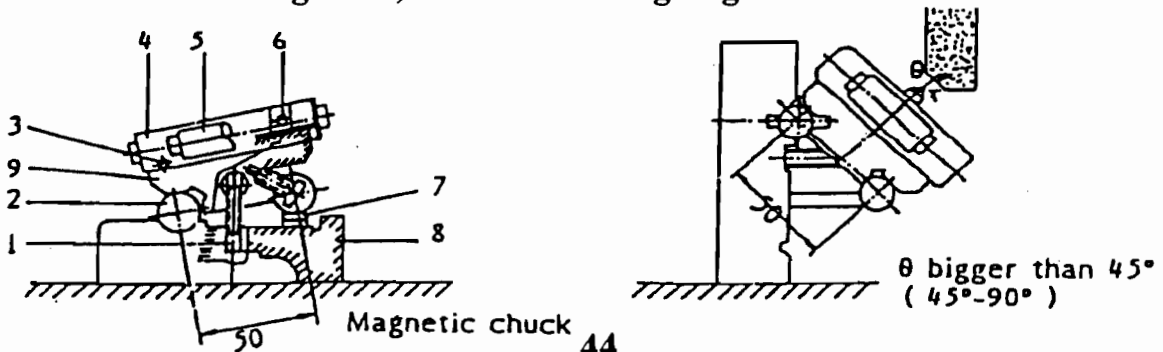
### A. Parallel dresser

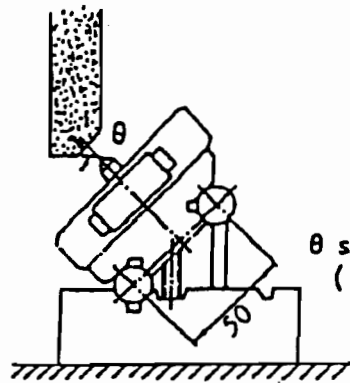
The wheel can be dressed either by diamond on the chuck or parallel dresser, which is mounted on top of the spindle housing. The diamond is arranged at an angle to the center of the line of the wheel (as shown on figure 19.1), so that when the diamond loses its sharpness, it can be turned to another angle. This is to make sure there is always a sharp diamond edge available to dress the wheel. The dressing method and the principle of over head parallel dresser are the same to the table-top dresser. Experience has shown that, for high precision grinding, dressing from the table top is better than the over head parallel dresser. The reason being the former is more stable than the latter, and the latter will cause a slight undulation on the surface of the wheel.



### B. Angle forming attachment

1. Let the attachment be attracted to the magnetic chuck, and keep a 90 degrees right angle between the attachment and the wheel. The magnetic chuck should be kept level.
2. The value in question will be the Sine of angle times 50. That is  $B = \sin\theta \times 50$ .
3. Get a block gauge under the base of the Sine bar stand. Fix it with the fastening bolts, and the forming angle is done.





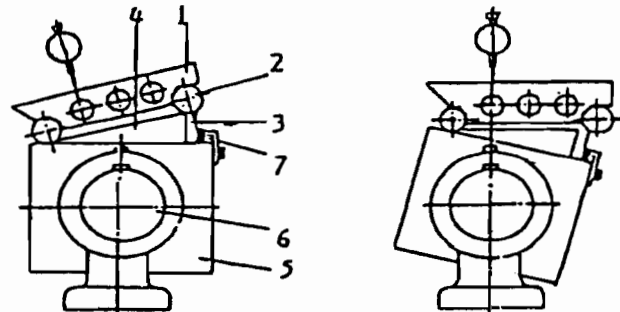
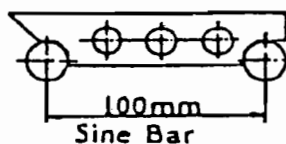
1. Fastening bolt
2. Mandrel
3. Slide adjustment bolt
4. Slide base
5. Handle
6. Diamond fixed hole
7. Block gauge
8. Build-in base
9. Sine Bar stand

### C. Sine bar

The sine bar is used to form the inclined angle of the magnetic chuck, when the forming angle of the surface is large.

1. The value in question equals the Sine of the angle times 100, i.e.  
 $B = \sin \theta \times 100$ .
2. Get a block gauge, which has the thickness equals to B.
3. Put this gauge at one end of the sine bar and let it be attached to the inclinable magnetic chuck. This sine bar shall be kept parallel to the longitudinal direction of the grinder.
4. Press the dial gauge against the surface of the sine bar, and meanwhile turn the crossfeed handwheel, so that the saddle moves back and forth to check the angle accuracy of the magnetic chuck.

1. Mandrel
2. Sine Bar
3. Block Gauge
4. Application of the trigonometry
5. Inclinable Magnetic Chuck
6. Mandrel of the Magnetic Chuck
7. Stop Block

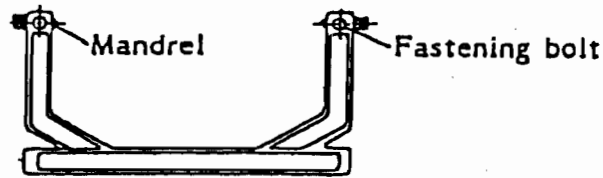


### D. Radius forming attachment

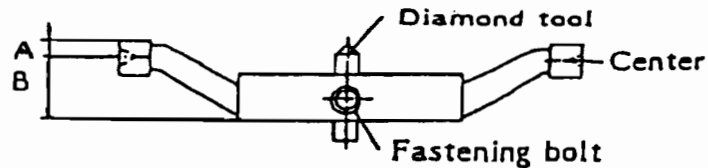


The radius forming attachment is composed of a main stand, several swing rods and a diamond tool.

1. Main stand



2. Swing rod and diamond tool



A name plate, with A and B, is attached to the swing rod. They mean:

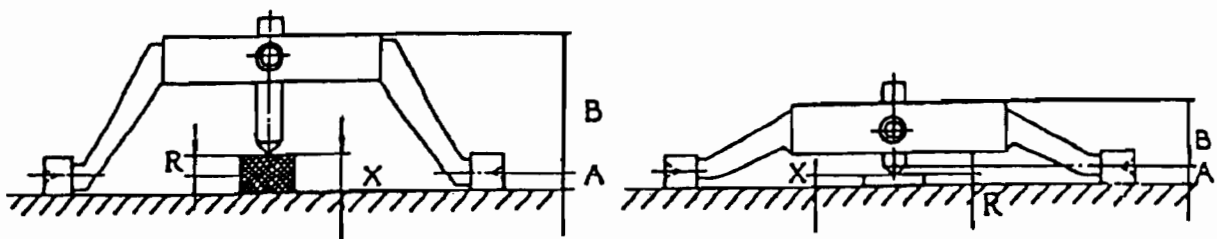
A: The distance between the upper rim and the center

B: The distance between the bottom rim and the center

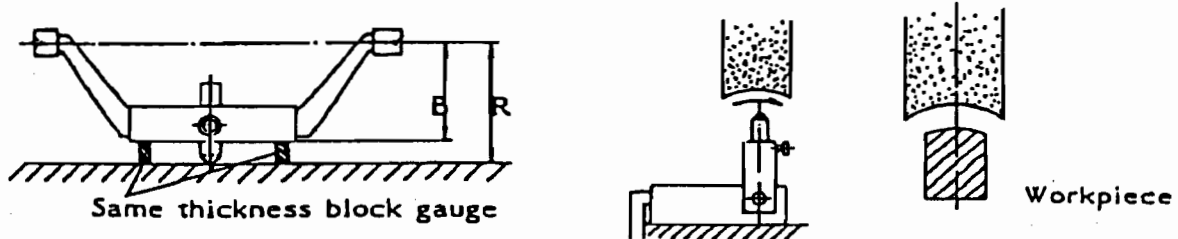
The R forming is the adjustment of the distance between the diamond tool and the swing rod center.

3. To determine the concave and convex R:

- a. If the tool is parallel to the center line, it equal OR.
- b. To determine the convex R: Put the swing rod on a place disk. Put a block gauge of certain thickness under the diamond tool. Then  $R=X-A$ .
- c. To determine the small concave R.



d. To determine the big concave R:  $R=B+X$ .

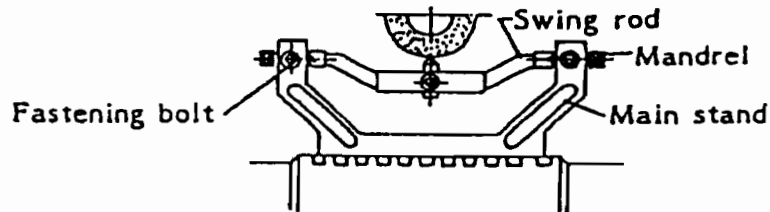


e. Note:

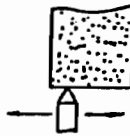
1. The base and side of the grinding wheel shall be well dressed.
2. The radius forming attachment shall be parallel to the grinding wheel.
3. The diamond tool shall be parallel to the radius forming attachment.

4. Operation of the radius forming attachment:

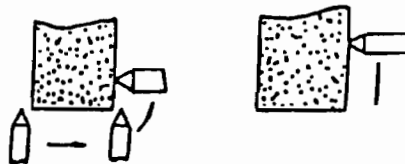
- a. Find the center of the grinding wheel. Then fix the work table.



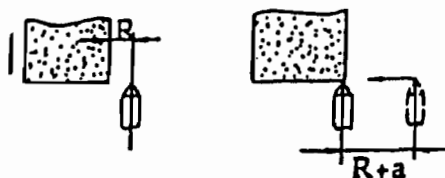
- b. Turn the downfeed handwheel at  $\frac{1}{3}$  on the width of the wheel so the wheel cuts into 0.02mm of the diamond tool. Now turn crossfeed handwheel to dress the grinding wheel, and turn calibration reading on the downfeed back to zero.



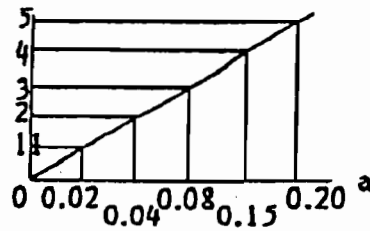
- c. Turn the diamond tool over an angle 90 degrees and elevate it into a proper position (greater than R size in question).



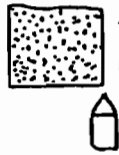
- d. Elevate the grinding wheel so that it goes away from the diamond tool and the wheel in such position that the distance between the side of the wheel and the center of the diamond tool is just R.



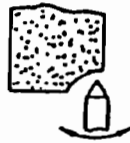
- e. Move the diamond tool ( $R+a$ ) left ward, with “a” found in the following table.



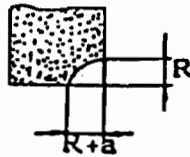
- f. Turn the downfeed handwheel so that the grinding wheel approaches the diamond tool.



- g. Turn the swing rods 90 degrees each time, inching 0.05mm until the R is determined.



- h. The wheel finally becomes the following shape.



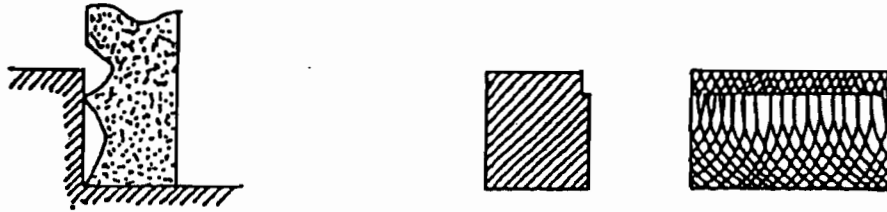
## E. Common cases in side grinding

1.



In the case shown in the figure above, the side grinding wheel and the work piece have a smaller contact surface, in which case the efficiency is higher and the surface roughness is better.

2.



In the figure above, the wheel and the work piece have two sections of contact, and the surface of grinding is bad. The surface has to be corrected into the shown in (1).

3.



The wheel did not cut to “relief angle”, thus it contacts the whole face of the work piece, causing the surface of processing rough and rugged. Also the greater face of contact will cause burns and cracks.

4.



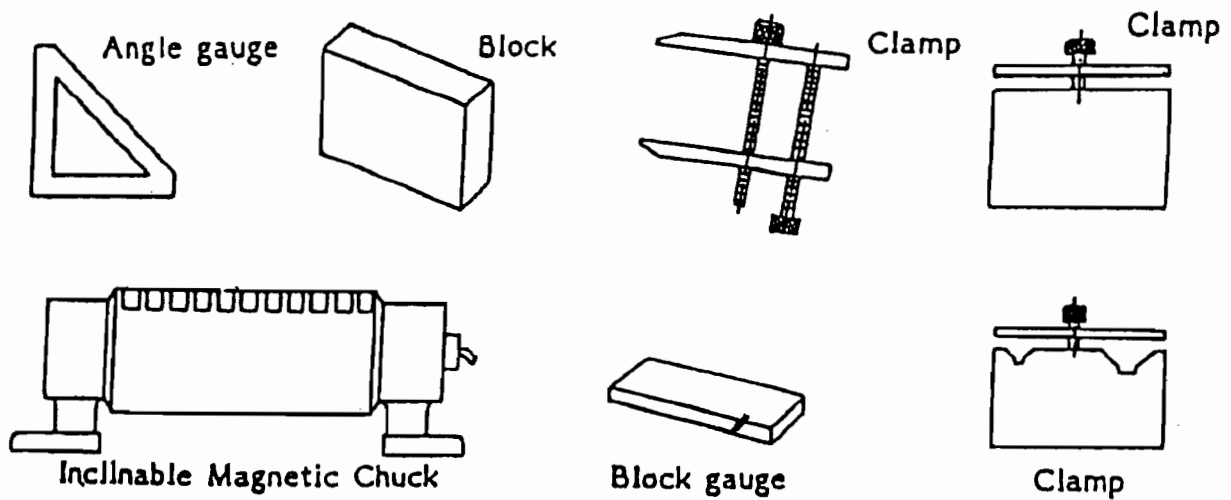
The “relief angle” of the wheel is lower than the surface of the work piece, so the grinding face of the work piece becomes two sections, the upper section resembling that in (3) and the lower section in (1). Now it is necessary to enlarge the “relief angle” part so it will be higher than the face of the work piece.

5. If the spindle does not constitute a right angle with the work table surface, the side faces will turn out to be shown:



## F. Right angle grinding

### 1. Tools



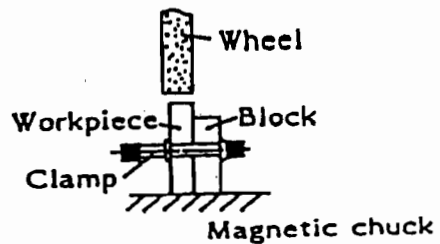
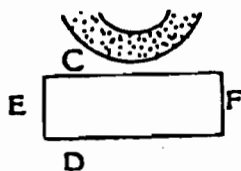
2. Use of the jigs and tools: Take the grinding block of six faces A, B, C, D, E, F, for example:

a. Under 200mm:

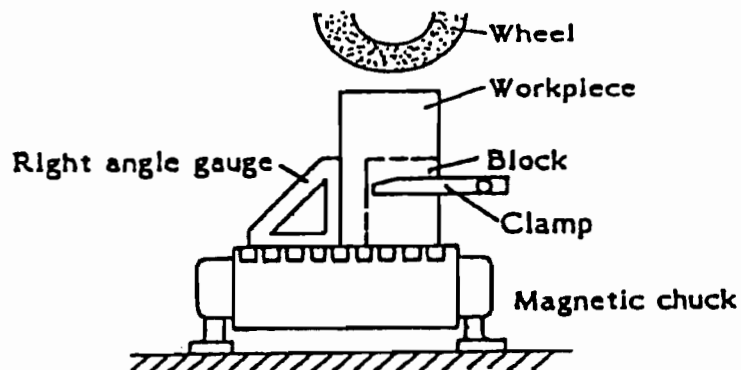
\*Grinding of the first basic face, or the surface grinding of A and B,



\*Grinding of C and D,



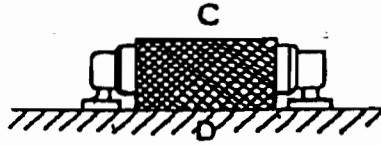
\*Grinding of E and F.



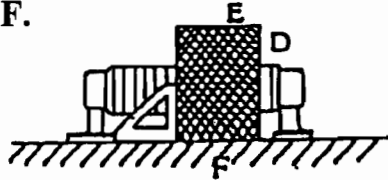
b. Over 200mm:

**\*Grinding of the first basic face or A.**

**\*Grinding of C and D: Turn the inclinable magnetic chuck into 90 degrees.**



**\*Grinding of E and F.**



- 3. Precaution:** The grinding wheel of right angle depends on the patience and clever mind of the operator for its precision. For instance, whether the burrs after grinding is done well, whether the tools are kept clean, whether the work table are kept clean, the accuracy of the angle gauge, etc., all have a direct influence over the precision of the product.

## 20. COMPLETE MECHANICAL PARTS LIST AND DRAWING

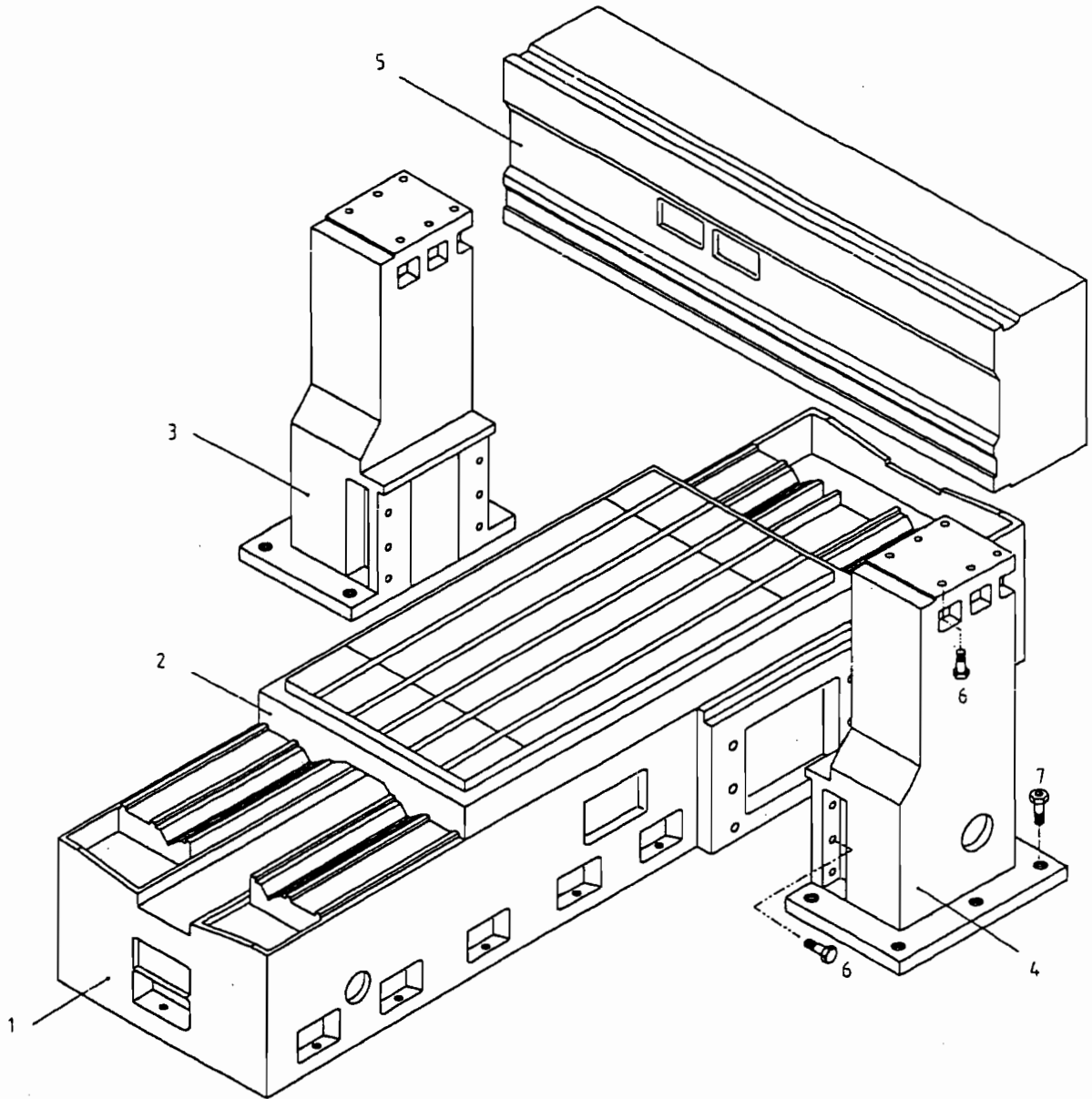
Main Casting Assembly.....	53
Lateral Beam Assembly.....	55
Spindle Housing Assembly.....	57
Motor & Spindle Drive Assembly.....	59
Z axis Assembly.....	61
Crossfeed Assembly.....	63
Lubrication System Assembly.....	65
Lubrication System Assembly.....	67
Lateral Beam Connect Component Assembly....	69
Back Supporting Component Assembly.....	71
Front Supporting Component Assembly.....	73
Cylinder Assembly.....	75
Valve Unit Assembly.....	77
Hydraulic Pump Unit Assembly.....	79

### **!NOTE!**

**To order parts, please have the following information ready:**

- 1. Machine model & serial number**
- 2. Index number**
- 3. Part number and name**
- 4. Year of production**
- 5. Quantity**

# MAIN CASTINGS ASS'Y

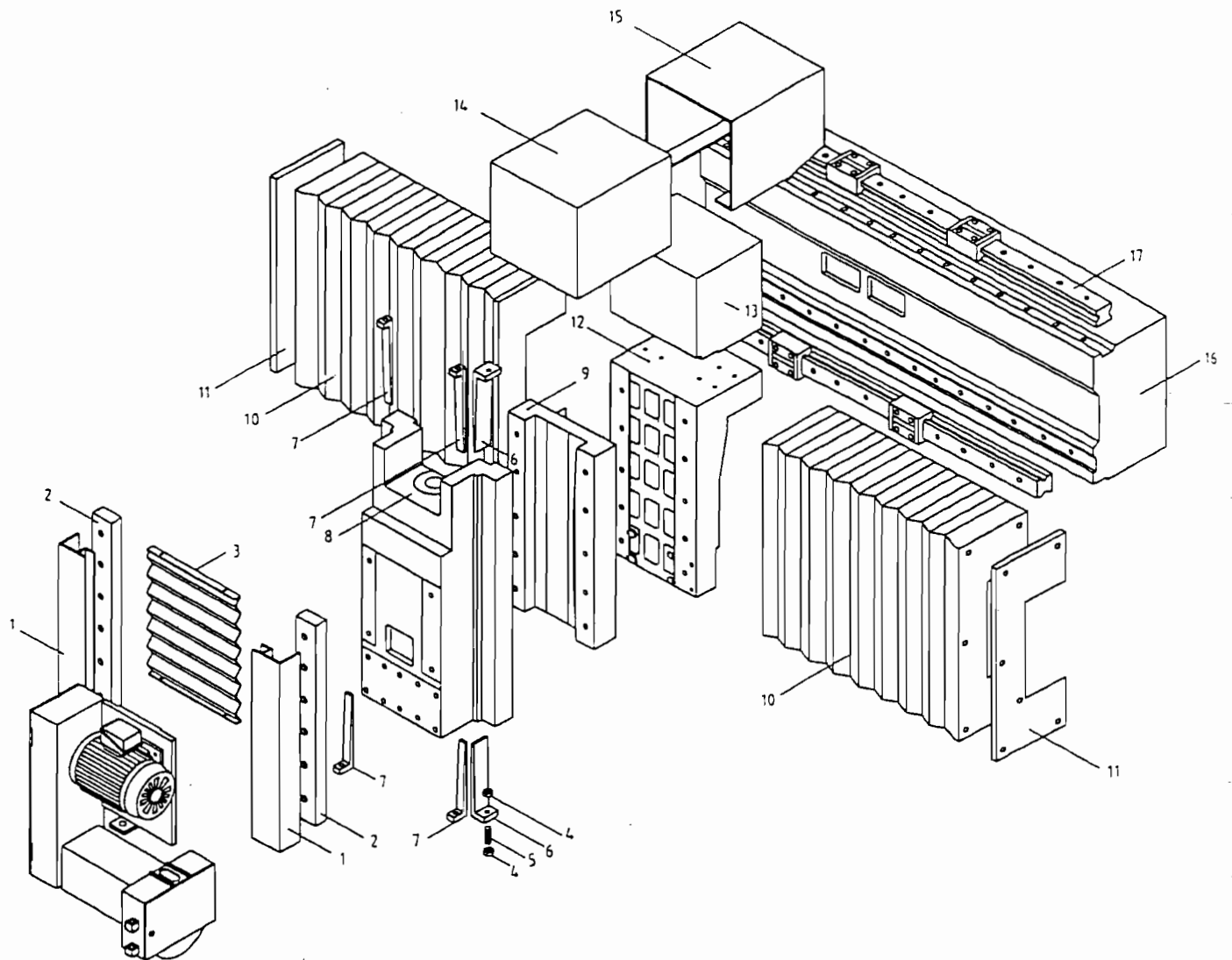




## MAIN CASTINGS ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	1512-201	Machine Base	1
2.	1512-301	Working Table	1
3.	1512-202	Left Column	1
4.	1512-202-1	Right Column	1
5.	1512-401A	Lateral Beam	1
6.	W 1" x 2-1/2" L	Hex Head Screw	24
7.	1512-204	Leveling	Vary De. Length

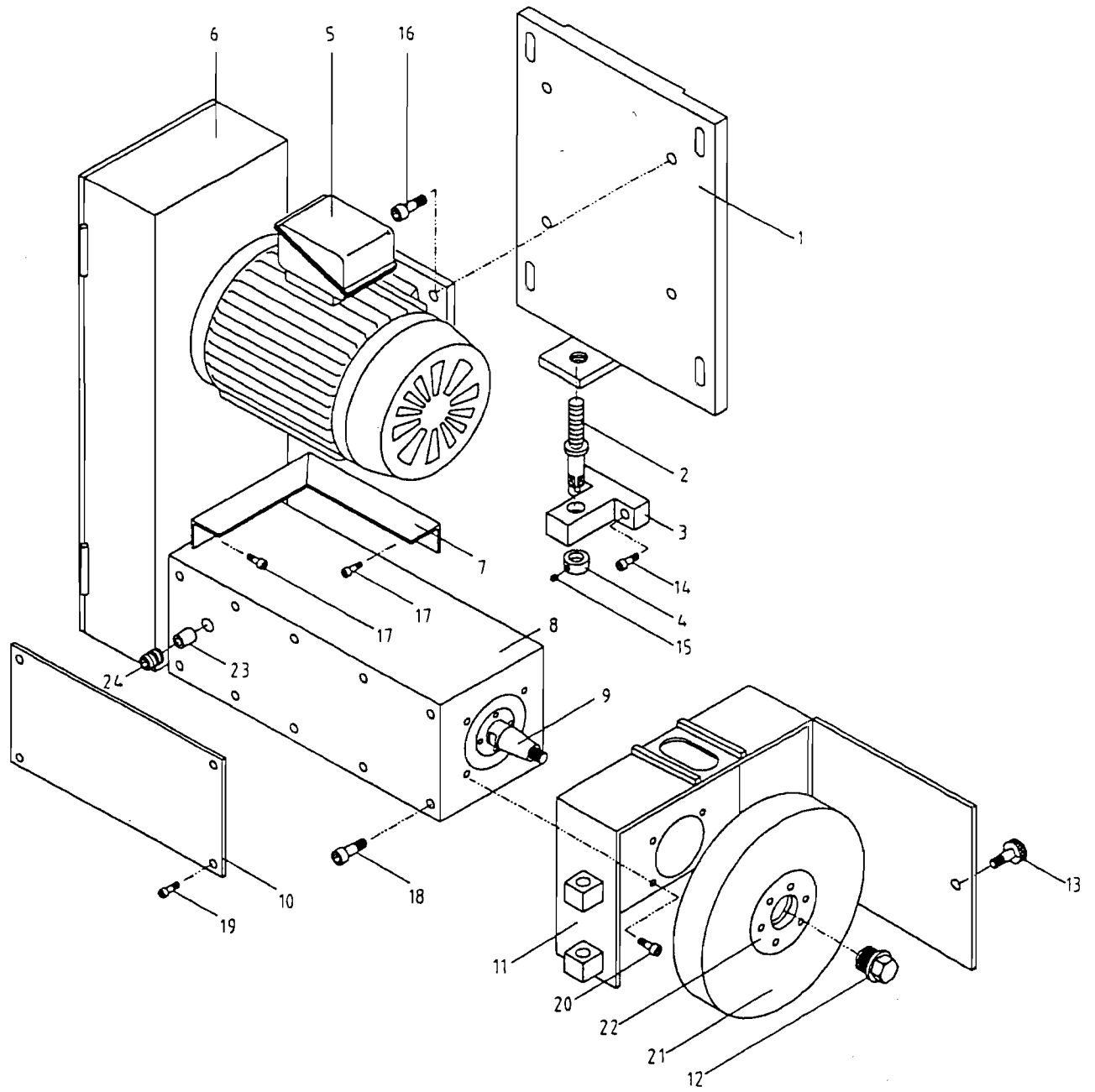
# LATERAL BEAM ASSEMBLY ASS'Y



## LATERAL BEAM ASSEMBLY ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	T2512-529A	Dust Cover Guide	2
2.	T2512-515A	Up&Down Guide Way	2
3.	T2512-530	Dust Cover	1
4.	W 5/16"	Hex Nut	12
5.	W 5/16" x 3" L	Set Screw	6
6.	T2512-508A-1	Taper Gib	2
7.	T2512-508A	Taper Gib	4
8.	T2512-509A	Housing Sliding Plate	1
9.	T2512-535A	S.Housing Adapting Plate	1
10.	1512-428B	Accordion Cover	2
11.	1512-423B	Cover End Plate	2
12.	T2512-536A	Housing Back Plate	1
13.	T2512-526A	Beam/House Connect. Plate	1
14.	T2512-525A	Front Cover	1
15.	T2512-524A	Back Cover	1
16.	1512-401A	Lateral Beam	1
17.	THK SHS55	V Linear Guide Way	2

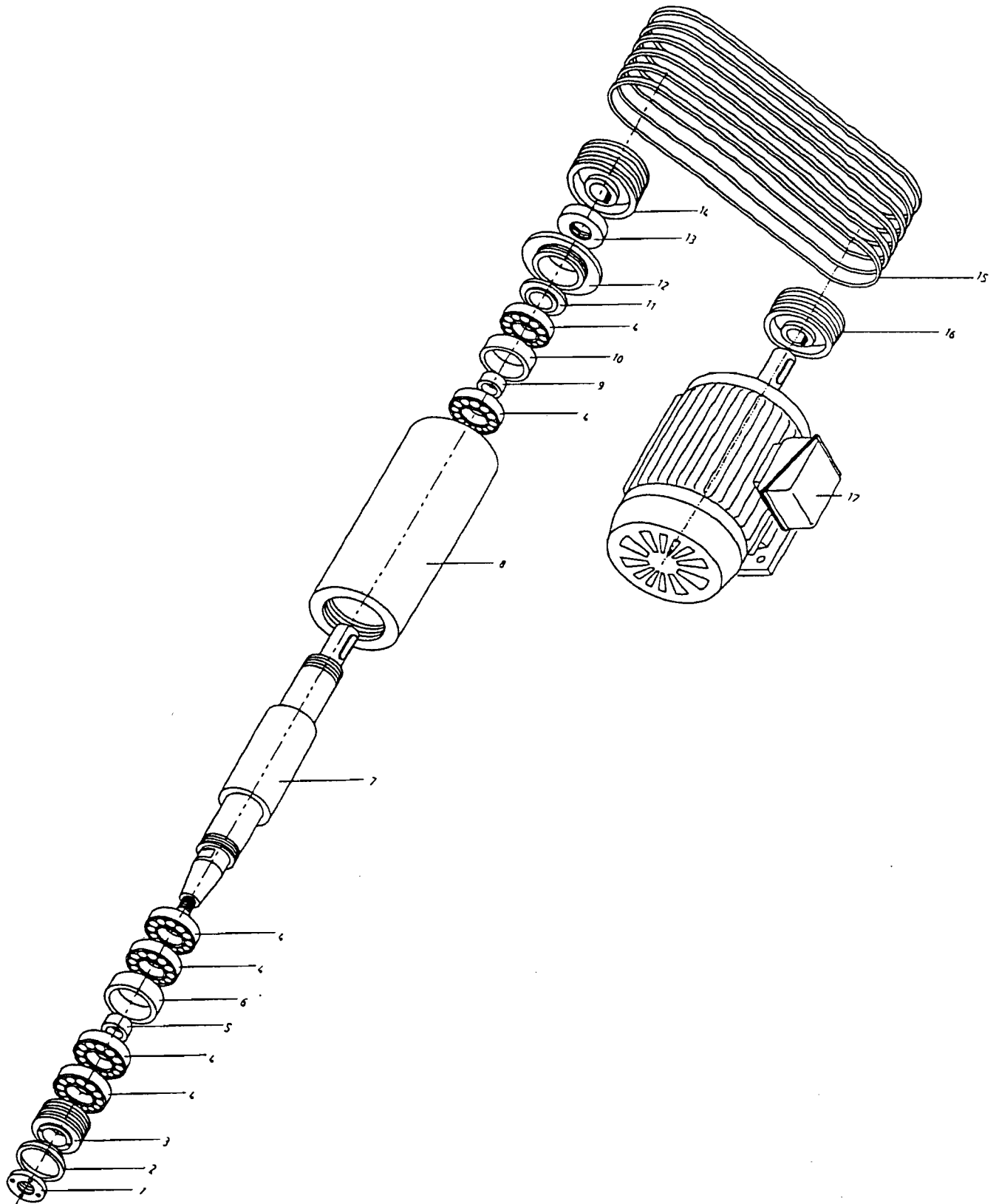
# SPINDLE HOUSING ASSEMBLY



## SPINDLE HOUSING ASSEMBLY

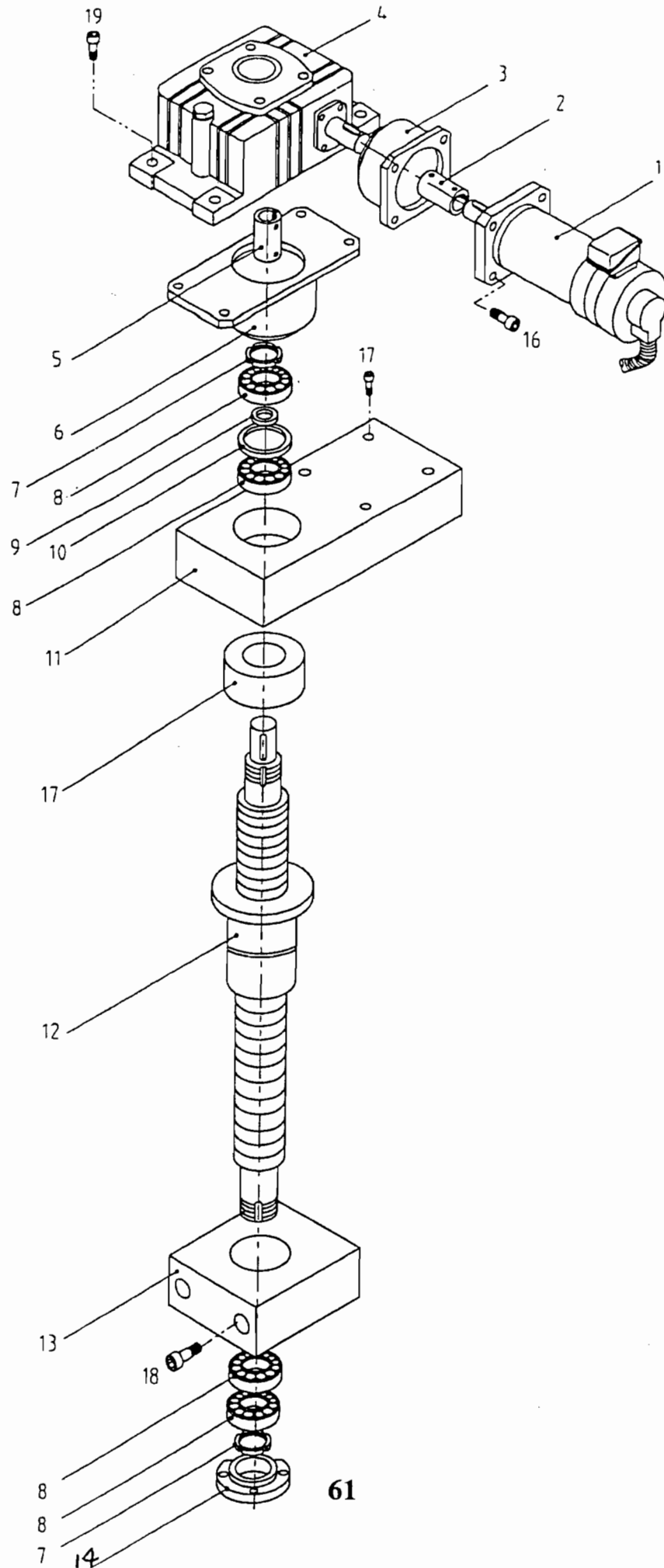
Index No.	Parts No.	Parts Name	Q'ty
1.	T2512-101	Motor Back Plate	1
2.	T2512-122	Adjusting Screw Rod	1
3.	T2512-124	Adjusting Plate	1
4.	T2512-123	Plate Spacer	1
5.	20HP*4P (30HP*4P optional)	Spindle Motor Spindle Motor	1
6.	T2512-106A	V Belt Pulley Cover	1
7.	T2512-106A-1	Locating L Bracket	1
8.	T2512-510A	Spindle Housing	1
9.	∅ 170*693L	Spindle Assembly	1
10.	T2512-516-1	Spindle Housing Cover	1
11.	T2512-105-1	Wheel Guard	1
12.	2448-302	Spindle Nut	1
13.	1224-116	Wheel Guard Lock Knob	1
14.	W 3/8" * 1-1/2" L	Socket HD Cap Screw	2
15.	W 1/4" * 3/8" L	Set Screw	1
16.	W 3/8" * 1-3/4" L	Hex. HD Screw	4
17.	W 1/4" * 3/4" L	Socket HD Cap Screw	4
18.	W 5/8" * 4" L	Socket HD Cap Screw	10
19.	W 1/4" * 3/4" L	Socket HD Cap Screw	4
20.	W 5/16" * 1" L	Socket HD Cap Screw	4
21.	∅ 510 * 50 * 203	Grinding Wheel	1
22.	1512-107	Wheel Flange	1
23.	2040-312	Spindle Locking Spacer	2
24.	W 3/4" * 3" L	Socket HD Cap Screw	2

# MOTOR/SPINDLE DRIVE ASS'Y



## MOTOR/SPINDLE DRIVE ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	T2512-154	Front Spindle Lock Nut	1
2.	T2512-153	Front Dust Cover	1
3.	T2512-155	Front Dust Cover Ring	1
4.	7215	Angular Contact Ball Bearing	6
5.	T2512-156	Front Inner Spacer	1
6.	T2512-157	Front Outer Spacer	1
7.	T1512-152	Spindle	1
8.	T1512-151	Spindle Quill	1
9.	T1512-161	Back Inner Spacer	1
10.	T1512-162	Back Outer Spacer	1
11.	T2512-158	Back Dust Cover Ring	1
12.	T1512-160	Back Dust Cover	1
13.	T2512-159	Back Spindle Lock Nut	1
14.	T1512-102-2	Spindle Pulley	1
15.	SZ1937	3V Belt	6
16.	1512-102-1	Motor Pulley	1
17.	30HP*4P	Spindle Motor	1



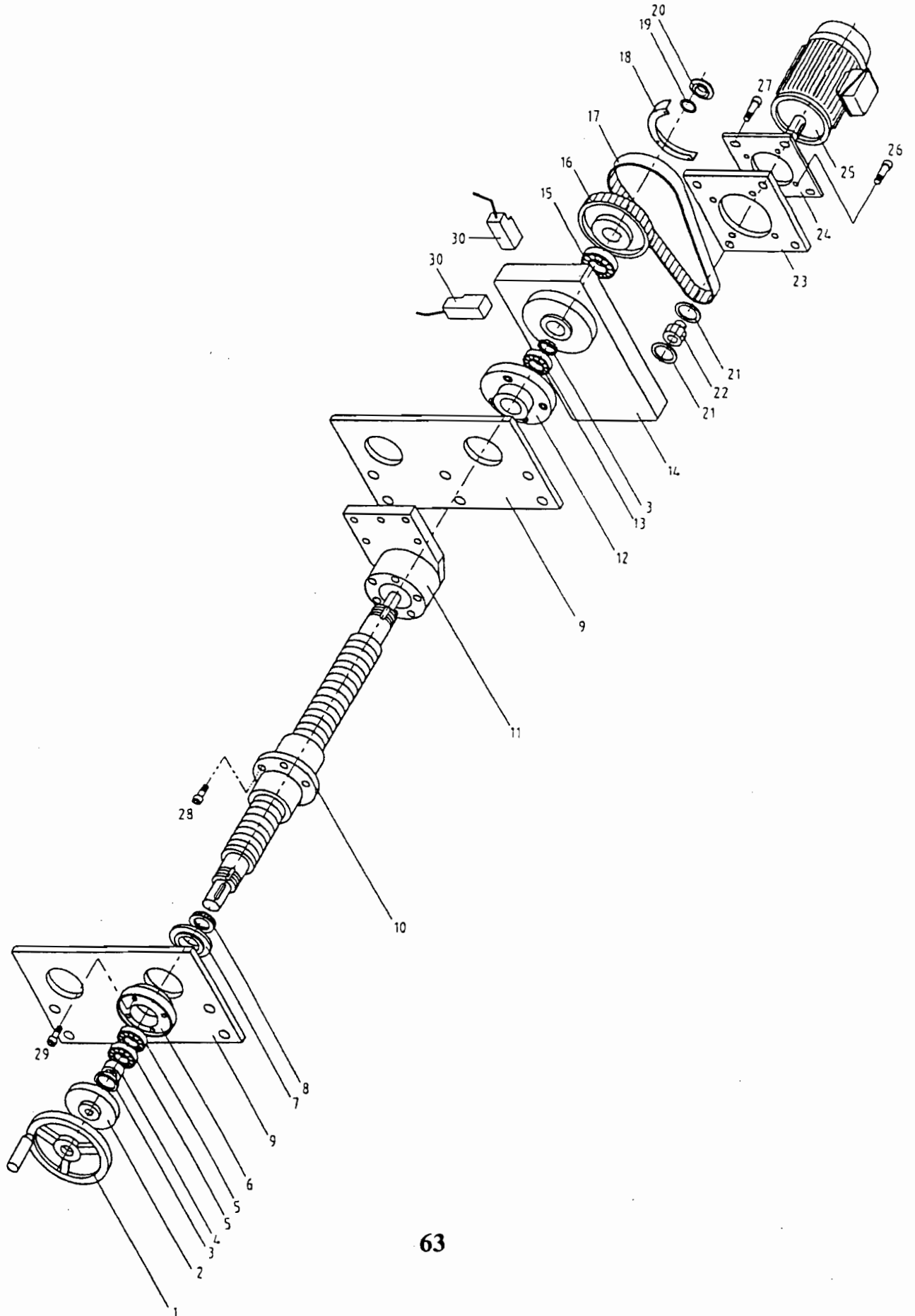
**Z AXIS DRIVE ASSEMBLY ASS'Y**



## Z AXIS DRIVE ASSEMBLY ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	DC 850W	Servo Motor	1
2.	1512-520	Motor Coupler	1
3.	1512-519	Bearing Cover	1
4.	TK-70 1/20	Speed Reducing Box	1
5.	1512-521	Screw Coupler	1
6.	1512-518	Worm Gear Seat	1
7.	YSRM40*P1.5	Screw Lock Nut	2
8.	7208	Angular Contact Ball Bearing	4
9.	1512-523	Inner Spacer	1
10.	1512-522	Outer Spacer	1
11.	1512-502	Ball Screw Base	1
12.	T2512-504	Ball Screw Assembly	1
13.	T2512-506	Bearing Seat	1
14.	T2512-507	Bearing Cover	1
15.	T2512-542	Spacer	1
16.	W 3/8" * 1-1/4" L	Socket HD Cap Screw	4
17.	W 5/8" * 2-1/2" L	Socket HD Cap Screw	4
18.	W 3/8" * 4" L	Socket HD Cap Screw	2
19.	W 1/2" * 1-1/4" L	Socket HD Cap Screw	4

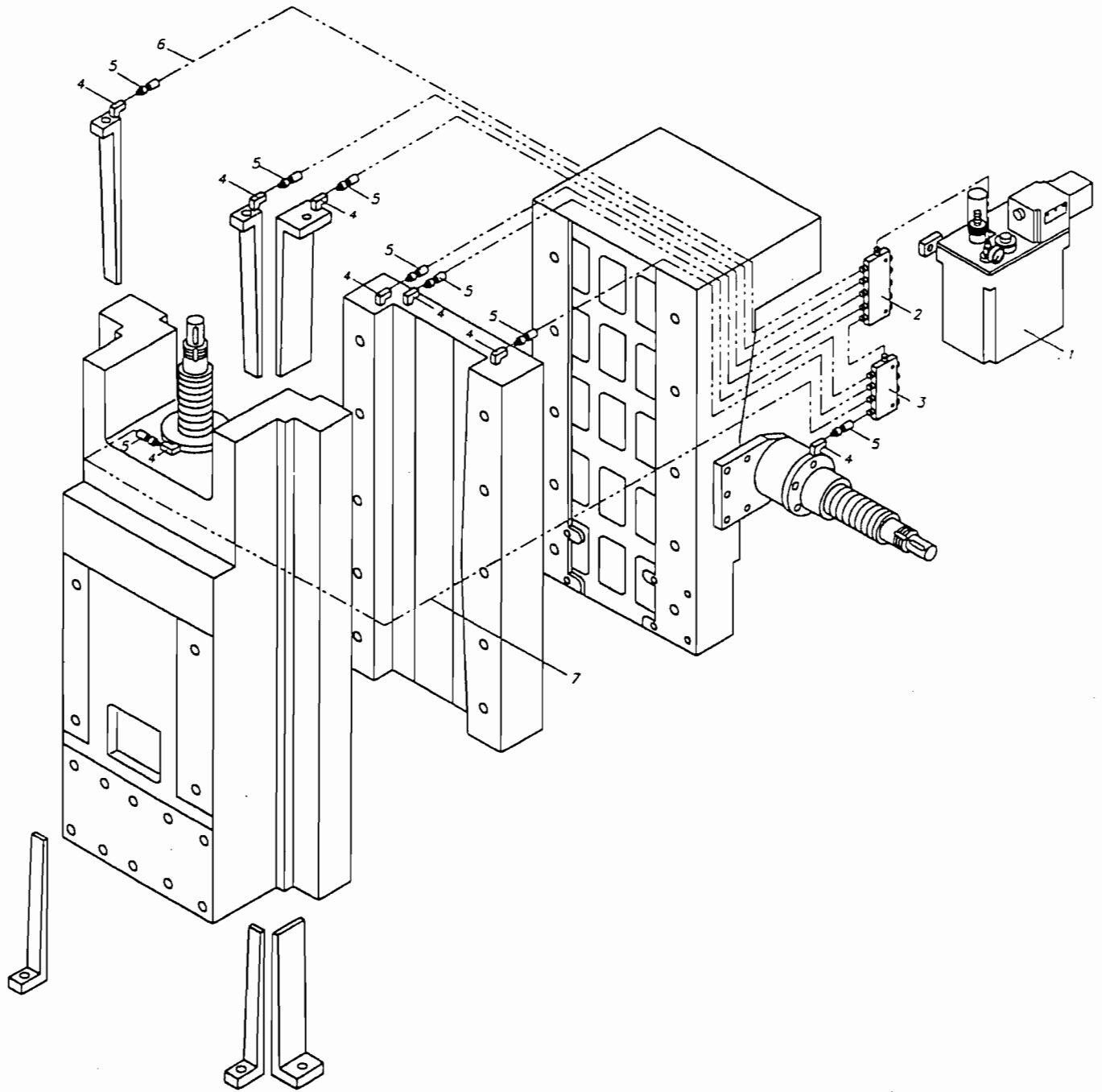
# CROSSFEED ASSEMBLY



## CROSSFEED ASSEMBLY

Index No.	Parts No.	Parts Name	Q'ty
1.	1020-714	Hand Wheel With Handle	1
2.	1512-405	Dial Ring	1
3.	AN05	Position Lock Nut	2
4.	2040-409	Spacer	1
5.	7205	Ball Bearing	2
6.	1512-406A	Right Bearing Base	1
7.	1512-459	Bearing Cap	1
8.	51205	Linear Bearing	1
9.	T2512-419	Bearing Locating Plate	2
10.	1512-408A	Ball Screw	1
11.	2512-NC409A	Ball Screw Base	1
12.	T1512-410	Left Bearing Base	1
13.	1305	Ball Bearing	1
14.	1512-412	Gear Reducing Box	1
15.	6204	Ball Bearing	1
16.	1512-411	Timing Belt Pulley	1
17.	270H	Timing Belt	1
18.	2040-443	Sensor Acting Ring	1
19.	ϕ 20 × ϕ 25 × 6.3	Keyless Locking Ring	2
20.	1512-434	Locking Cover	1
21.	1512-414	Pulley Guide Plate	2
22.	1512-413	Motor Pulley	1
23.	1512-416	Reducing Box Cover	1
24.	1512-417	Motor Locating Plate	1
25.	AC-1/4HP × 6P	Crossfeed Motor	1
26.	W 5/16" × 5/8" L	Hex. HD Screw	4
27.	W 1/4" × 5/8" L	Socket HD Cap Screw	4
28.	W 5/16" × 1" L	Socket HD Cap Screw	4
29.	W 5/16" × 1-1/4" L	Socket HD Cap Screw	8
30.	PS-05P	Sensor	2

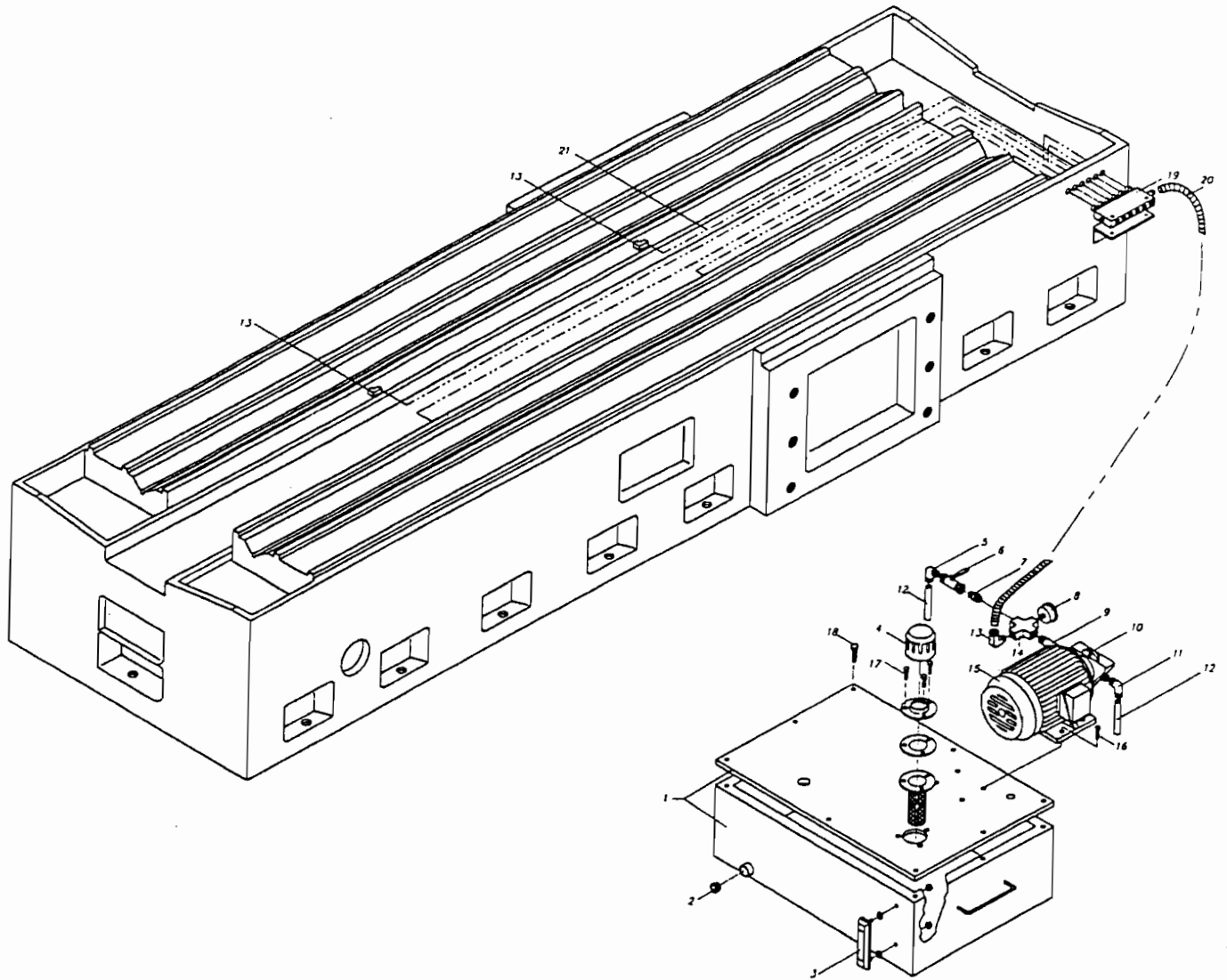
# LUBRICATION SYSTEM ASS'Y( I )



## LUBRICATION SYSTEM ASS'Y( I )

Index No.	Parts No.	Parts Name	Q'ty
1.	CEN TYPE	Lubrication Pump	1
2.	B-5	5 Way Valve Distributor	1
3.	B-4	4 Way Valve Distributor	1
4.	M4 x 1/8"PT	90 ° Angle Oil Connector	1
5.	M4 x 1/8"PT	Reverse Straight Oil Fitting	1
6.	ϕ 4	Aluminum Tube	1
7.	ϕ 3/8"	Oil Tube	1

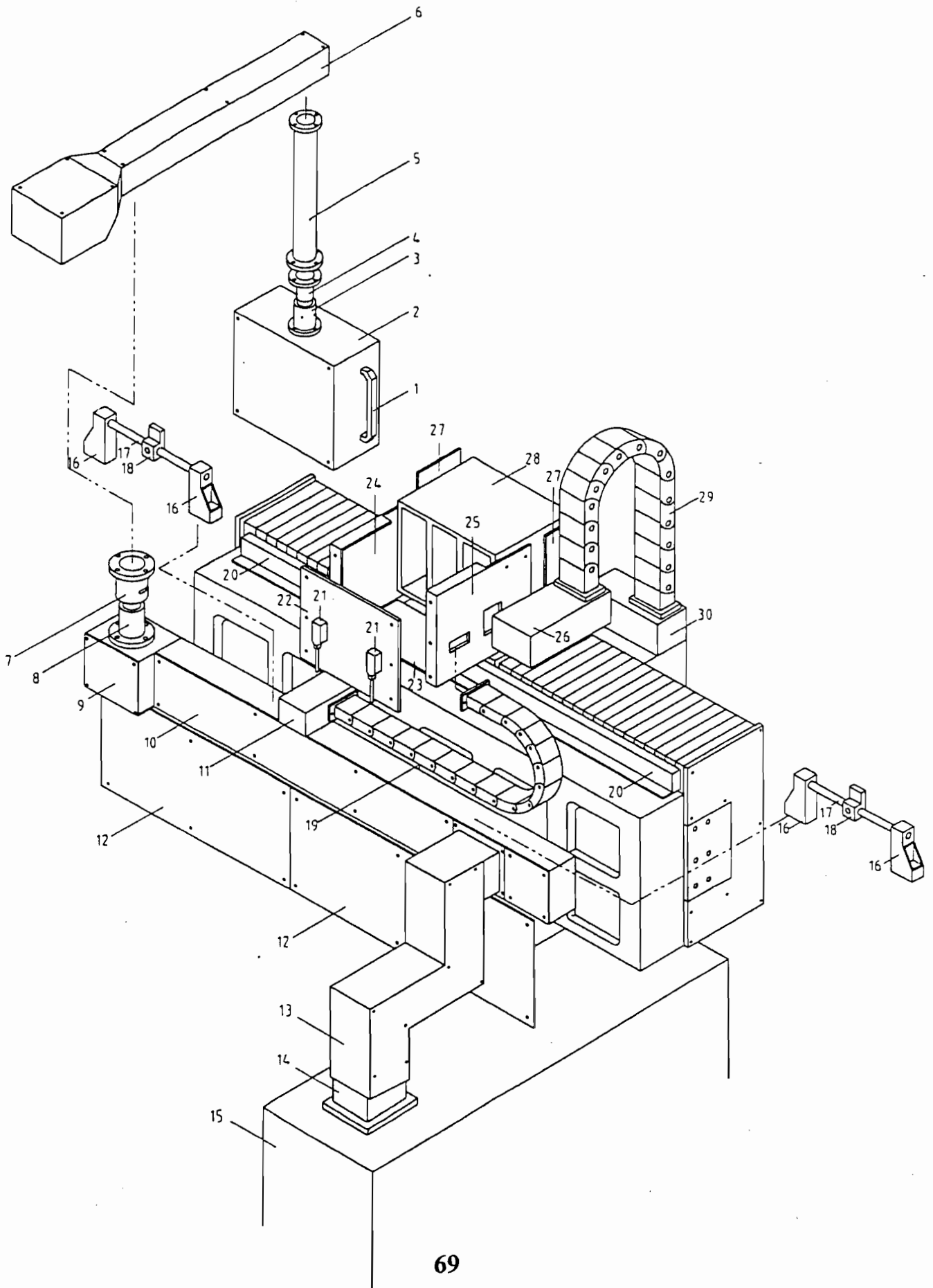
# LUBRICATION SYSTEM ASS'Y(II)



## LUBRICATION SYSTEM ASS'Y( II )

Index No.	Parts No.	Parts Name	Q'ty
1.	4012-208	Lubrication Tank	1set
2.	3/4"	Taper Oil Plug	1
3.	KS-5"	Oil Gauge	1set
4.	AB-1163	Oil Cap	1set
5.	1/4"PT x 1/4"PT	90 ° Angle Oil Connector	1
6.	1/4"PT	Water Valve	1
7.	1/8"PT x 1/4"PT	Straight Pipe Reducer	1
8.	OP 40AD	Pressure Gauge	1
9.	1/8"PT x 50L	Straight Pipe Connector	1
10.	TOP-10A	Oil Pump	1
11.	1/8"PT x 1/4"PT	90 ° Angle Pipe Connector	1
12.	ϕ 11	Water Hose	1
13.	M6 x 1/8"PT	Angel Connector	1
14.	1/8"PT	4 Way Distributor	1
15.	1/4HP x 4P	Pump Motor	1
16.	W 1/4"	Socket HD Cap Screw	4
17.	W 3/16"	Round HD Cap Screw	3
18.	W 1/4"	Hex. HD Cap Screw	8
19.	B-7	6 Way Distributor	1
20.	ϕ 3/8"	Oil Tube	1
21.	ϕ 6	Aluminum Tube	1

# LATERAL BEAM CONNECT COMPONENT ASS'Y

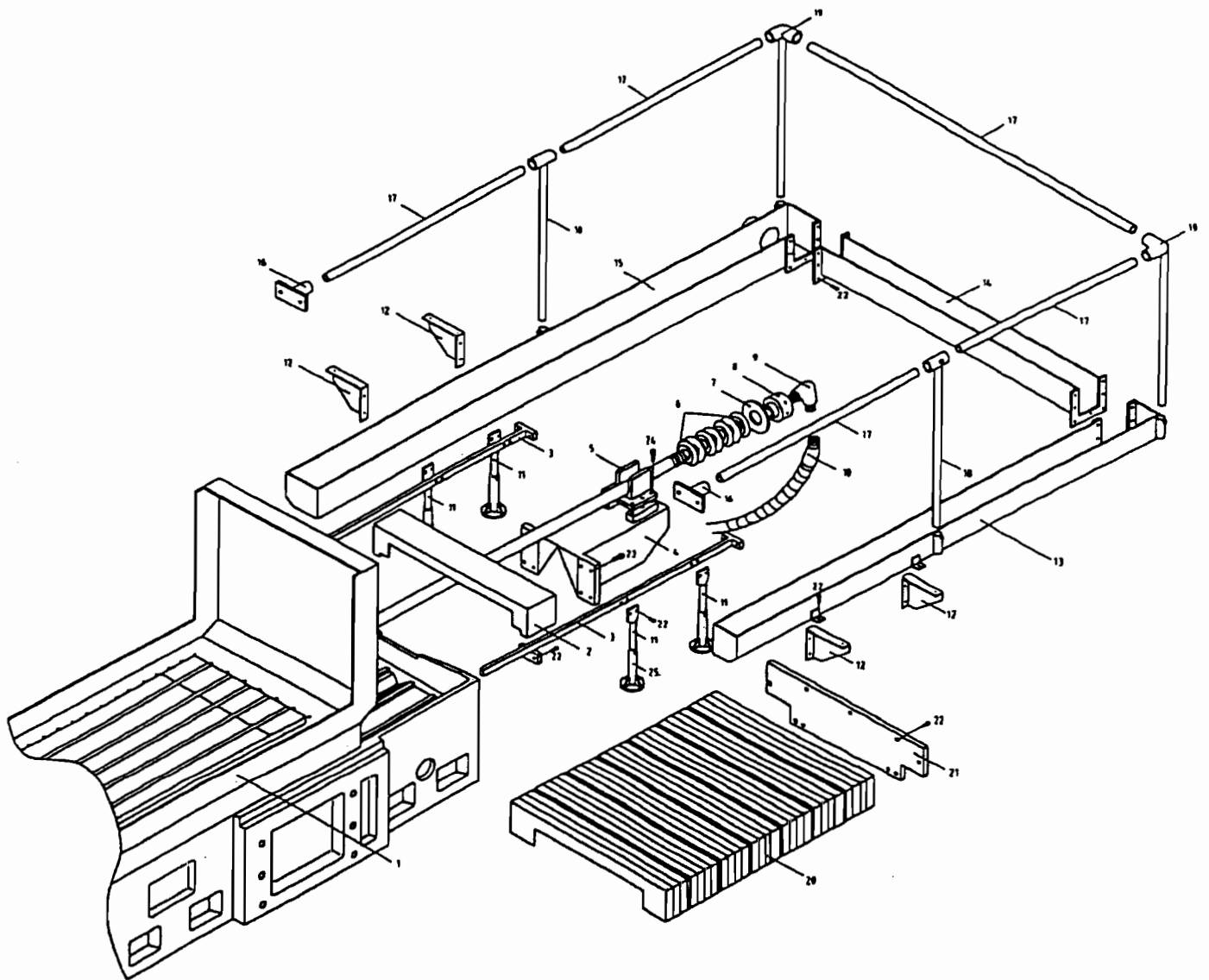




## LATERAL BEAM CONNECT COMPONENT ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	E69300	∟ Type Handle	3
2.	T1512-212	Operation Panel Box	1
3.	2448-134-8	Lower Sleeve	1
4.	2448-134-7	Upper Sleeve	1
5.	1512-214A-1	Connect Tube	1
6.	1512-214A	Suspensory Arm Component	1Set
7.	2448-134-2	Swivel Sleeve A	1
8.	2448-134-3	Swivel Sleeve B	1
9.	1512-223A-1	Supporting Case	1Set
10.	1512-223A-2	Guiding Trough	1Set
11.	1512-222A-1	Electric Wires Terminal Box	1
12.	1512-223A-5	Rear Cover Of Lateral Beam	1Set
13.	1512-223A-3	Veering Tube	1Set
14.	1512-223A-4	Veering Tube Guider	1
15.	1512-209	Electric Equipment Box	1
16.	T1512-422	Sliding Stick holding stand	2
17.	2512-420	Sliding Stick	2
18.	1512-421	Veering Block	2
19.	R150,1800mm	Protect Bellows	1
20.	1512-517A-1	Upper Anti-Dust Cover	2
21.	NJ-7106	Limit Switch	2
22.	T2512-517A-9	Rear Cover For Limit Switch	1
23.	T2512-517A-10	Bottom Cover	1
24.	T2512-517A-8	Side Cover	1
25.	T2512-517A-4	Side Cover	1
26.	T2512-541B	Protect Bellows Stand(R)	1
27.	T2512-517A-6	Side Cover	2
28.	T2512-526A	Steady Stand	1
29.	R150,1300mm	Protect Bellows	1
30.	T2512-540B	Protect Bellows Stand(L)	1

# BACK SUPPORTING COMPONNET ASS'Y



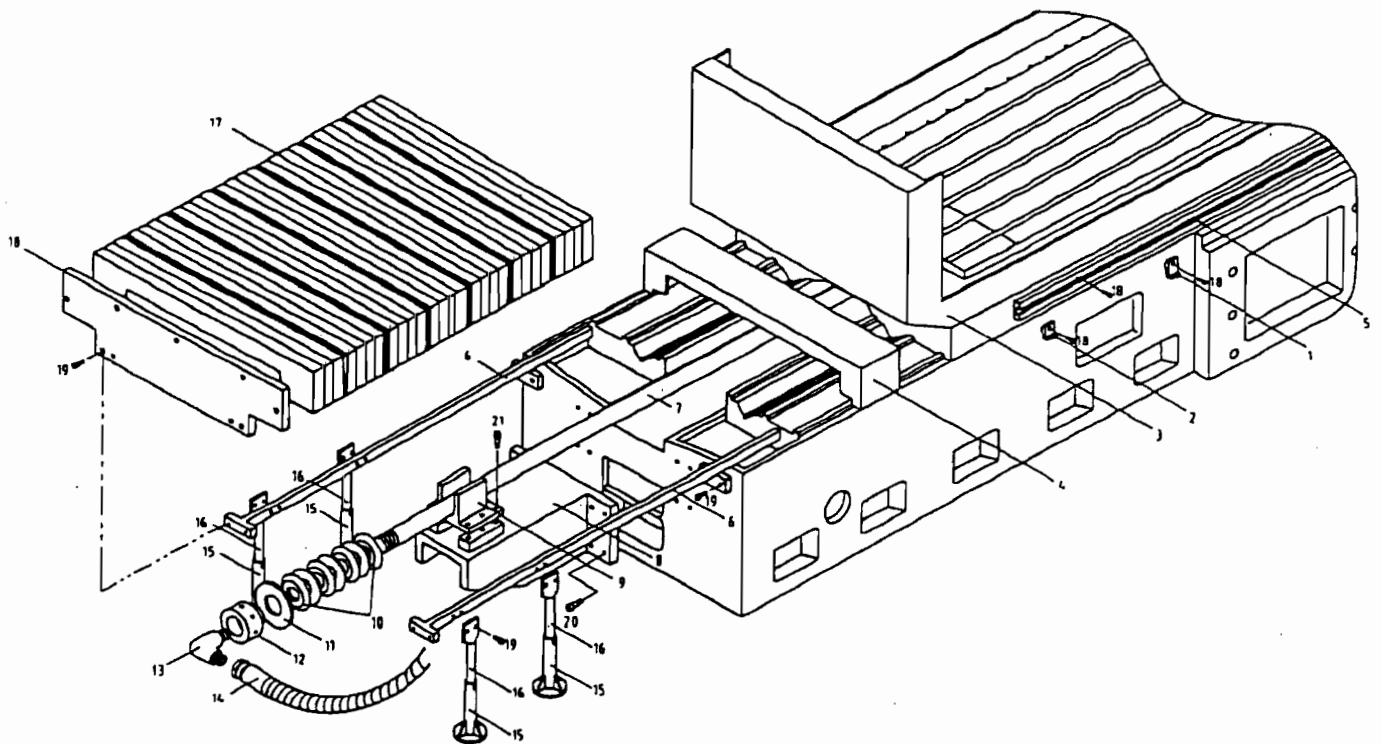
## BACK SUPPORTING COMPONNET ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	1512-303A	Splash Guard	1
2.	1512-312	Splash Guard adapter Plate	1
3.	1512-338A	Way Cover Guide Way	2
4.	1512-337A	Cylinder Supporting Bracket	1
5.	1512-328A	Piston Locating Bracket	1
6.	φ 125 × φ 71 × 6'	Cushion Spring	10
7.	T1512-326	Cushion Spacer	1
8.	1512-325	Adjusting Nut	1
9.	W 1-1/4"	L-Oil Adapter	1
10.	φ 1-1/4"	Hydraulic Hose	vary
11.	1512-340	Adjusting Rod	De.Len
12.	1512-353A-1	Supporting Bracket	4
13.	1512-350A	Right Coolant Collect Plate	4
14.	1512-352A	Middle Coolant Collect Plate	1
15.	1512-351A	Left Coolant Collect Plate	1
16.	1512-353A-2	Beam Connecting Bracket	1
17.	1512-353A-3	Metal Rod	2
18.	1512-353A-4	T-Supporting Rod	4
19.	1512-353A-5	Y-Supporting Rod	2
20.	1512-313C	Accordion Cover	2
21.	1512-342A	Cover Adapting plate	1
22.	W 1/4" × 1" L	Socket HD Cap Screw	1
23.	W 1/2" × 1-1/2" L	Socket HD Cap Screw	26
24.	W 5/8" × 1-1/2" L	Socket HD Cap Screw	8
25.	1512-339	Supporting Base	6
			4

## BACK SUPPORTING COMPONNET ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	1512-303A	Splash Guard	1
2.	1512-312	Splash Guard adapter Plate	1
3.	1512-338A	Way Cover Guide Way	2
4.	1512-337A	Cylinder Supporting Bracket	1
5.	1512-328A	Piston Locating Bracket	1
6.	φ 125 × φ 71 × 6'	Cushion Spring	10
7.	T1512-326	Cushion Spacer	1
8.	1512-325	Adjusting Nut	1
9.	W 1-1/4"	L-Oil Adapter	1
10.	φ 1-1/4"	Hydraulic Hose	vary
11.	1512-340	Adjusting Rod	De.Len
12.	1512-353A-1	Supporting Bracket	4
13.	1512-350A	Right Coolant Collect Plate	4
14.	1512-352A	Middle Coolant Collect Plate	1
15.	1512-351A	Left Coolant Collect Plate	1
16.	1512-353A-2	Beam Connecting Bracket	1
17.	1512-353A-3	Metal Rod	2
18.	1512-353A-4	T-Supporting Rod	4
19.	1512-353A-5	Y-Supporting Rod	2
20.	1512-313C	Accordion Cover	2
21.	1512-342A	Cover Adapting plate	1
22.	W 1/4" × 1" L	Socket HD Cap Screw	1
23.	W 1/2" × 1-1/2" L	Socket HD Cap Screw	26
24.	W 5/8" × 1-1/2" L	Socket HD Cap Screw	8
25.	1512-339	Supporting Base	6
			4

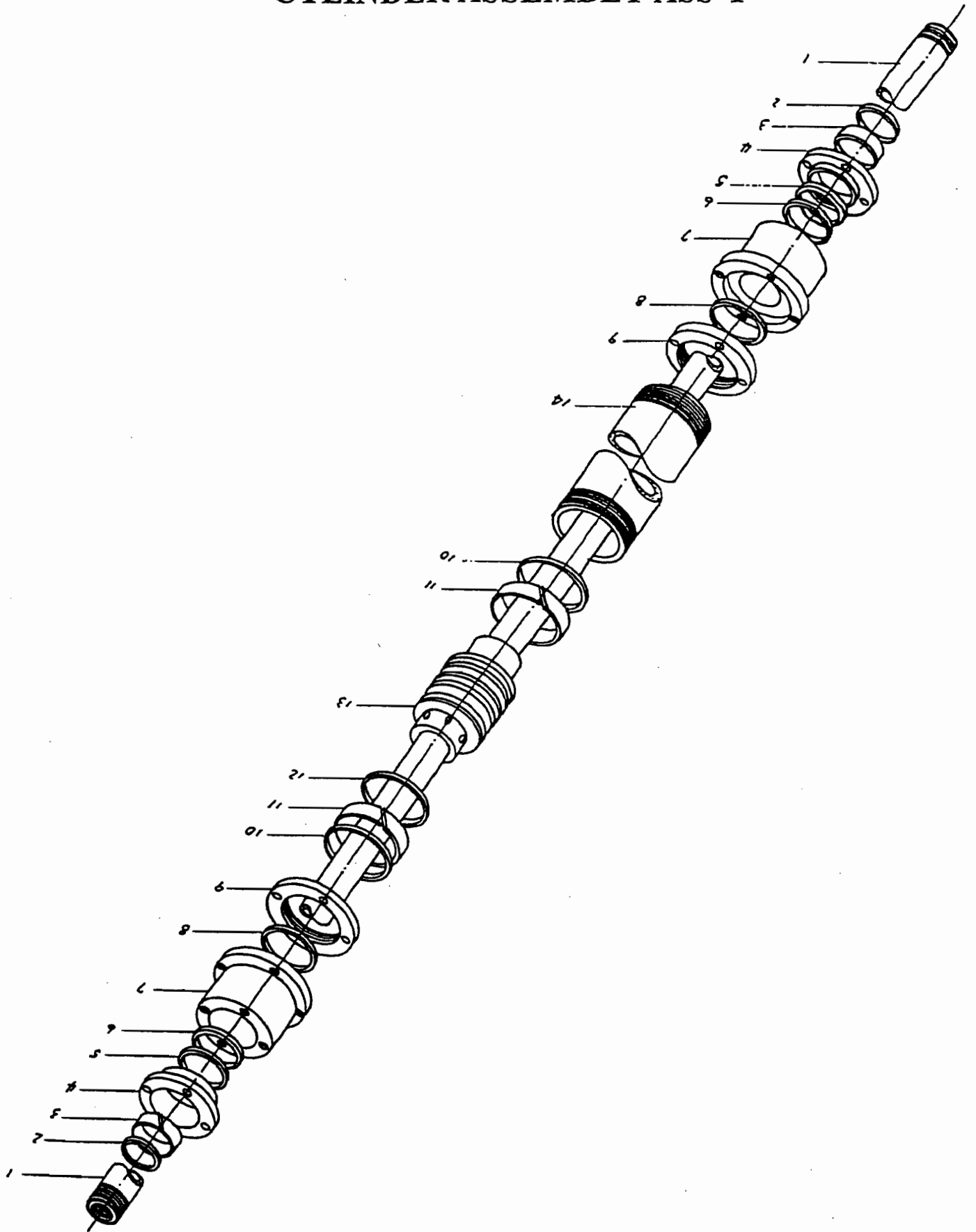
# FRONT SUPPORTING COMPONNET ASS'Y



## FRONT SUPPORTING COMPONNET ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	2448-120	Left Adjusting Bracket (L)	1
2.	2448-119	Right Adjusting Bracket (S)	1
3.	1512-303A	Splash Guard	1
4.	1512-312	Splash Guard Adapter Plate	1
5.	1512-307	Linear Guide Plate	vary De.Len
6.	1512-338A	Way Cover Guide Way	2
7.	T1512-331--335	Cylinder Assembly	1 Set
8.	1512-337A	Cylinder Supporting Bracket	1
9.	1512-328A	Piston Locating Bracket	1
10.	ϕ 125 × ϕ 71 × 6'	Cushion Spring	10
11.	T1512-326	Cushion Spacer	1
12.	T1512-325	Adjusting Nut	1
13.	W 1-1/4"	L-Oil Adapter	1
14.	W 1-1/4"	Hydraulic Hose	vary De.Len
15.	1512-339	Supporting Base	4
16.	1512-340	Adjusting Rod	4
17.	1512-313C	Accordion Cover	1
18.	1512-342A	Cover Adapting plate	1
19.	W 1/4" × 1" L	Socket HD Cap Screw	16
20.	W 1/2" × 1-1/2" L	Socket HD Cap Screw	8
21.	W 5/8" × 1-1/2" L	Socket HD Cap Screw	6

# CYLINDER ASSEMBLY ASS'Y

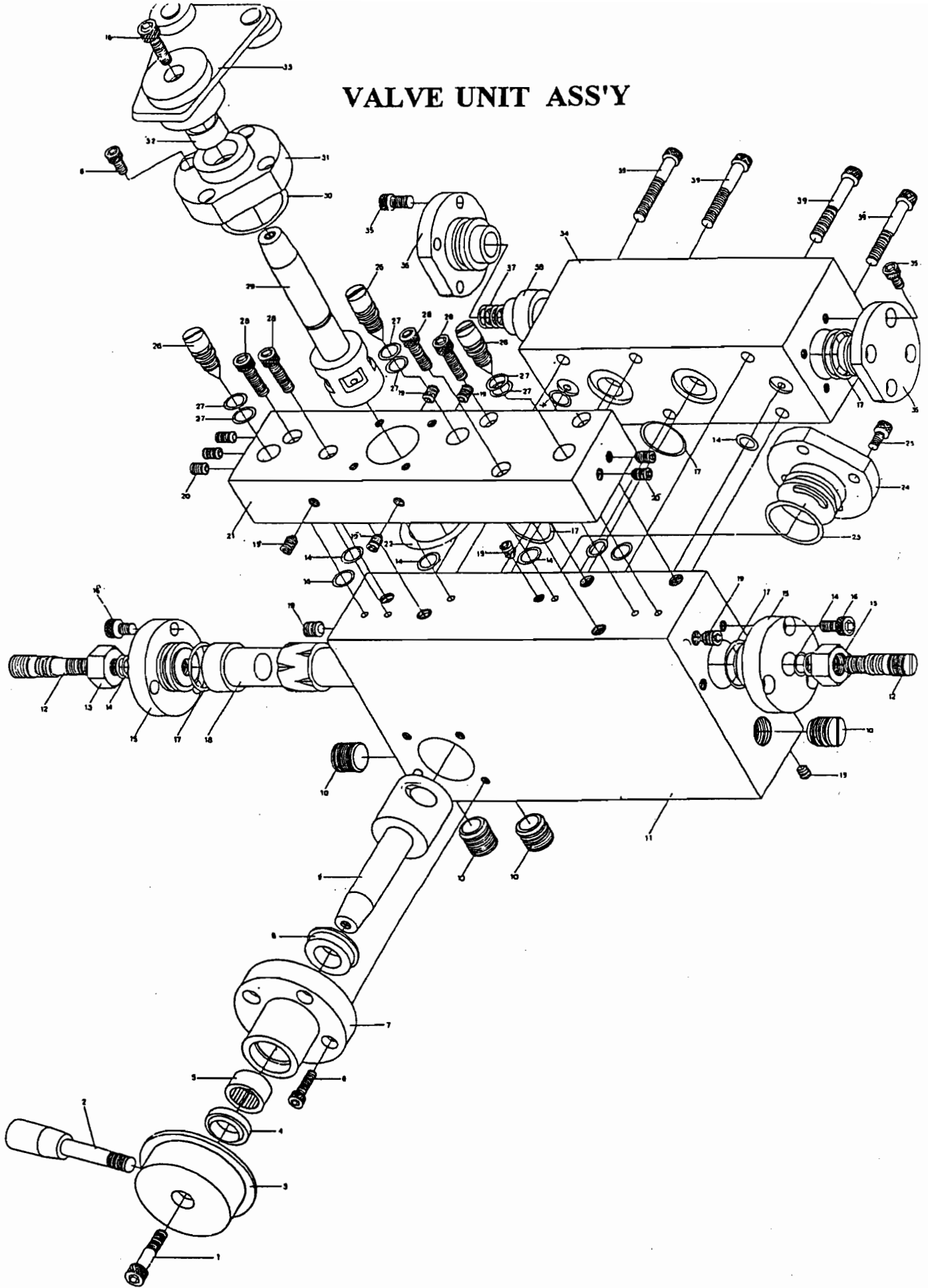


## CYLINDER ASSEMBLY ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	T1512-331	Piston Rod	2
2.	LBH 70	Dust Seal	2
3.	φ 70 × φ 75 × 15W	Wearing Ring	2
4.	T1512-329	Dust Cover	2
5.	USH 70 × 80 × 6	U Packing	2
6.	OSR 70	OS Ring	2
7.	T1512-332	Cylinder End Cover	2
8.	G95+BU	O Ring	2
9.	T1512-333	Cylinder End Nut	2
10.	φ 85 × φ 100 × 9	U Packing	2
11.	φ 85 × φ 100 × 15W	Wearing Ring	2
12.	OSP 100	OS Ring	1
13.	1512-335	Piston	1
14.	1512-334	Cylinder	1



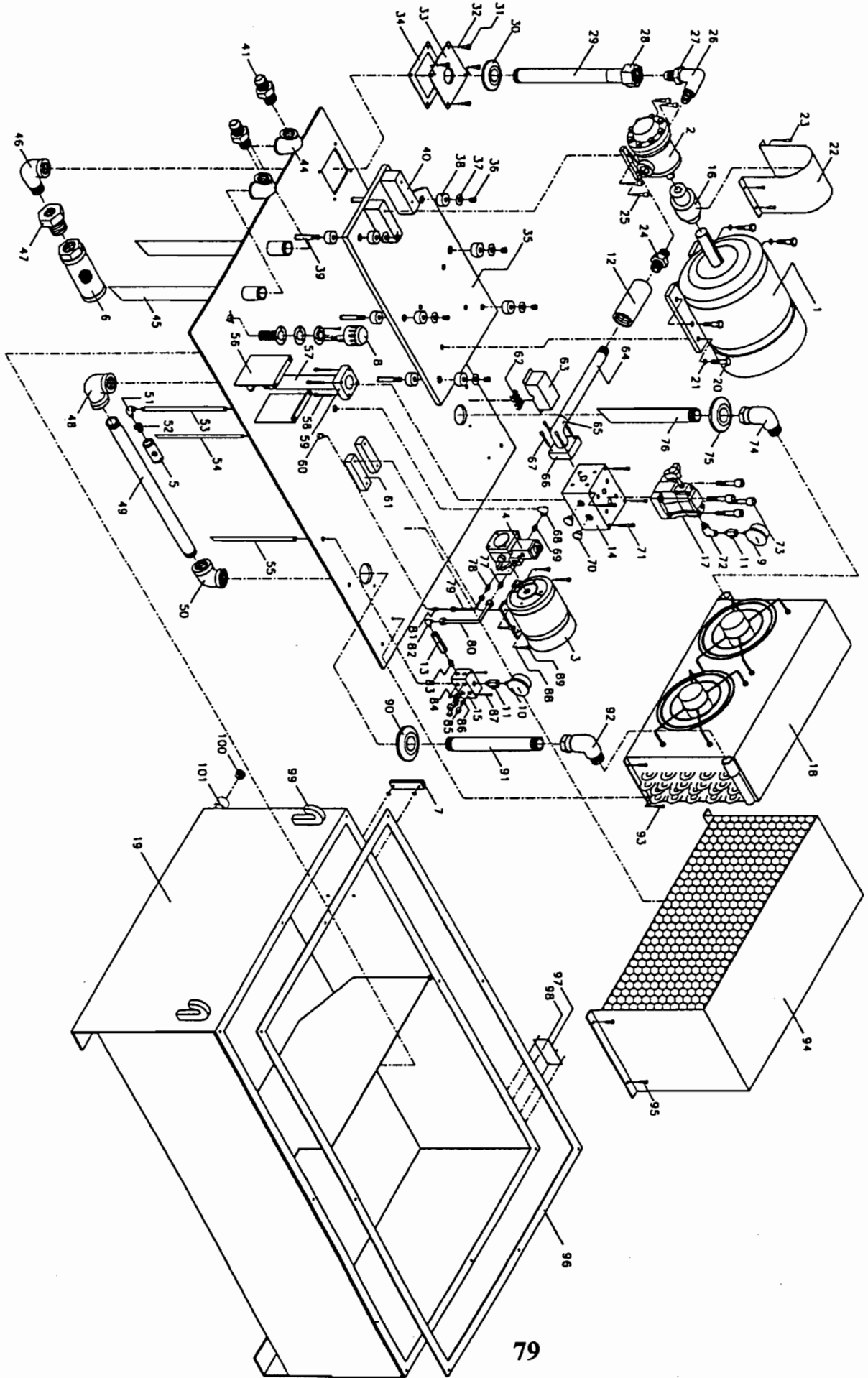
# VALVE UNIT ASS'Y



## VALVE UNIT ASS'Y

Index No.	Parts No.	Parts Name	Q'ty
1.	W 1/4" x 3/4" L	Socket Head Cap Screw	1
2.	1020-627	Flow Control Lever	1
3.	1020-620	Flow Control Knob	1
4.	UN20	U Ring	1
5.	6004	Bearing	1
6.	W 1/4" x 1/2 "L	Socket Head Cap Screw	8
7.	1512-625A	Cover Of Valve Shaft	1
8.	P42	O Ring	1
9.	1512-626B	Flow Control Shaft	1
10.	ϕ 3/8" PT	Pluge	4
11.	1512-612A	Flow Control Valve Body	1
12.	1512-617A	Valve Shaft Adjust Screw	2
13.	W 3/8"	Nut	2
14.	P8	O Ring	10
15.	1512-616A	Side Cover Of Valve Shaft	2
16.	W 1/4" x 1/2 "L	Socket Head Cap Screw	7
17.	P30, P38, P28	O Ring	Each 2
18.	1512-615B	Tip Of Valve	1
19.	ϕ 5mm x 6mm L	Socket Head Cap Screw	7
20.	W 1/16" PT	Plug	5
21.	1512-614A	Bearing Cover Of Dir. Shaft	1
22.	P41	O Ring	1
23.	P42	O Ring	1
24.	1512-627A	Rear Cover of Flow Valve	1
25.	W 1/4" x 1/2" L	Socket Head Cap Screw	4
26.	1512-609A	Adjusting Screw	3
27.	P8	O Ring	6
28.	W 1/4" x 2" L	Socket Head Cap Screw	4
29.	2448-624B	Dir. Valve Shaft	1
30.	P41	O Ring	1
31.	1512-623B	Bearing Cover Of Dir. Shaft	1
32.	UN18	U-Packing	1
33.	1512-322	Direction Control Arm	1
34.	15122-614A	Relief Valve	1
35.	W 1/4" x 1/2 " L	Socket Head Cap Screw	8
36.	1512-620A	Cover Of Relief Valve	2
37.	1512-622A	Constriction Spring Of Relief	1
38.	1512-621B	Sliding Piston Of Relief Valve	1
39.	W 1/4" x 3 1/4 "L	Socket Head Cap Screw	6

# HYDRAULIC PUMP UNIT ASS'Y



# HYDRAULIC PUMP UNIT ASS'Y

P. 10F3

Index No.	Parts No.	Parts Name	Q'ty
1.	10HP*6P	Motor (1512-2512)	1
	15HP*6P	Motor (3012)	1
	20HP*6P	Motor (4012)	1
	25HP*6P	Motor (5012-6012)	1
2.	VPNE-116-30	Pump (1512-3012)	1
	35V-38-I	Pump (4012)	1
	45V-50-I	Pump (5012-6012)	1
3.	1HP*4P	Motor	1
4.	VPVC-F12-A2-02	Pump	1
5.	SS-2-100	Oil Filter	1
6.	PS-06	Oil Filter	1
7.	LS-7"	Oil Level Indicator	1
8.	AB-1163	Cover Of Oil Fill Cover	1
9.	2-1/2"*100KG	Pressure Gauge	1
10.	2-1/2"*35KG	Pressure Gauge	1
11.	1/4"PT	Gauge Cock	2
12.	CIT-15-05-10	Check Valve	1
13.	CIT-03-05-10	Check Valve	1
14.	EM-372	Manifold Board	1
15.	EM-374	Manifold Board	1
16.	E-97	Coupling	1
17.	HRF-G06-1-10	Relief	1
18.	EM-373	Oil Cooler	1
19.	1200*900*520	Tank	1
20.	M12*40L	Hexagonal Head Screw	4
21.	SWM12	Spring Washer	4
22.		Cover Of Coupling	1
23.	M5*12L	Round Head Cap Screw	4
24.	1-1/4"PT*1-1/4"PT	Connector	1
25.	M12*30L	Socket Head Cap Screw	4
26.	1-1/2"PT*1-1/2"PT	Connector ( 90° )	1
27.	1-1/2"PS	Bushing	1
28.	1-1/2"PS	Nut	1
29.	1-1/2"PS	Zine-Plate Pipe	1
30.	ST-12	Dust Rubber	1
31.	M8*20L	Hexagonal Head Screw	4
32.	SWM8	Spring Washer	4
33.	CP-2448-1-1	Cover Nut	1

# HYDRAULIC PUMP UNIT ASS'Y

P.20F3

Index No.	Parts No.	Parts Name	Q'ty
34.	SS-1512-1-1	Asbestos Packing	1
35.	AEP-1512-1	Auxiliary Enhance Plate	1
36.	M16	Nut	12
37.	WM16	Washer	6
38.	φ 50* φ 16*25H	Rubber Pad	12
39.	M16*110L	Hexagonal Head Screw	6
40.	EM-375	Plate Pad	2
41.	1-1/4"PT*1-1/4PH	Asbestos Packing	2
42.	M12*45L	Round Head Screw	8
43.	1-1/4" with Oring-G40	Flange	2
44.	1-1/4"PT*1-1/4PT"	Connector	2
45.	1-1/4"PT*300L(Slope)	Zine-Plate Pipe	2
46.	1-1/2"PT(F)*1-1/2PT"(M)	Connector (90° )	1
47.	1-1/2"PT(F)*2PT"(M)	Bushing	1
48.	1"PT*1"PT	Connector	1
49.	1"PT	Zine-Plate Pipe	1
50.	1"PT*1"PT	Connector	1
51.	1/2"PT(F)*1/2PT"(M)	Connector (90° )	1
52.	1/2"PT(F)*3/4PT"(M)	Bushing	1
53.	1/2"PT*1/2"PT	Zine-Plate Pipe	1
54.	1/4"PT*300L(slope)	Zine-Plate Pipe	1
55.	3/8"PT*300L(slope)	Zine-Plate Pipe	1
56.	1512-HP1	Holding Plate	2
57.	1"PT	Zine-Plate Pipe	1
58.	M12*45L	Round Head Socket Cap Screw	4
59.	1-1/4" with Oring-G40	Flange	1
60.	1/4"PT*1/4"PT	Socket	1
61.	1512-MP1	Pad Of Motor	2
62.	SJT-15-3P	Terminal broad	1
63.	1512-TB1	Cover Of Terminal broad	1
64.	1-1/4"PT	Steel Pipe	1
65.		90° Pipe	1
66.	1-1/4" with Oring-G40	Flange	1
67.	M12*45L	Round Head Socket Cap Screw	4
68.	1/2"PT(F)*1/2"PT(F)	Connector (90° )	1
69.	1/2"PT*1/2"PT	Connector	1
70.	1"PT	PT Plug	2

## HYDRAULIC PUMP UNIT ASS'Y

P.30F3

Index No.	Parts No.	Parts Name	Q'ty
71.	M8*110L	Round Head Socket Cap Screw	4
72.	1/2"PT(F)*1/2"PT(M)	Connector (90° )	1
73.	M16*50L	Universal Connector (90° )	1
74.	1"PT(M)*1"PS(F)	Round Head Socket Cap Screw	4
75.	ST-08	Dust-Rubber	1
76.	1"PT*300L(Slope)	Zine-Plate Pipe	1
77.	3/4"PT* $\varphi$ 22mm	LE Connector (90° )	1
78.	1/4"PT* $\varphi$ 5/16 "	LE Copper Connector	1
79.	$\varphi$ 5/16"	Copper Pipe	1
80.	$\varphi$ 12	Zine-Plate Pipe	1
81.	1/4"PT* $\varphi$ 5/16 "	LE Copper Connector	1
82.	3/8"PT* $\varphi$ 12	LE Connector (90° )	1
83.	3/8"PT*1/4"PT	Connector	1
84.	1/4"PT	PT Plug	1
85.	1/4"PS	Plug Screw	3
86.	1/4"PT*1/4"PS	Connector	3
87.	M5*65L	Socket Head Cap Screw	2
88.	SWM8	Spring washer	4
89.	M8*20L	Hexagonal Head Screw	4
90.	ST-08	Dust Rubber	1
91.	1"PT	Zine-Plate Pipe	1
92.	1"PT(F)*1"PS(M)	Universal Connector (90° )	1
93.	M5*12L	PT Plug	4
94.	2448C1	Cover Of Cooler	1
95.	M5*12L	Round head Screw	4
96.	2448-AP1	Asbestos Packing	1
97.	2448-NP1	Name Plate	1
98.	$\varphi$ 2.5mm	Rivet	4
99.	2448-HB	Hang Bar	4
100.	1/2PT"	PT Plug	1
101.	1/2PT"	Socket	1