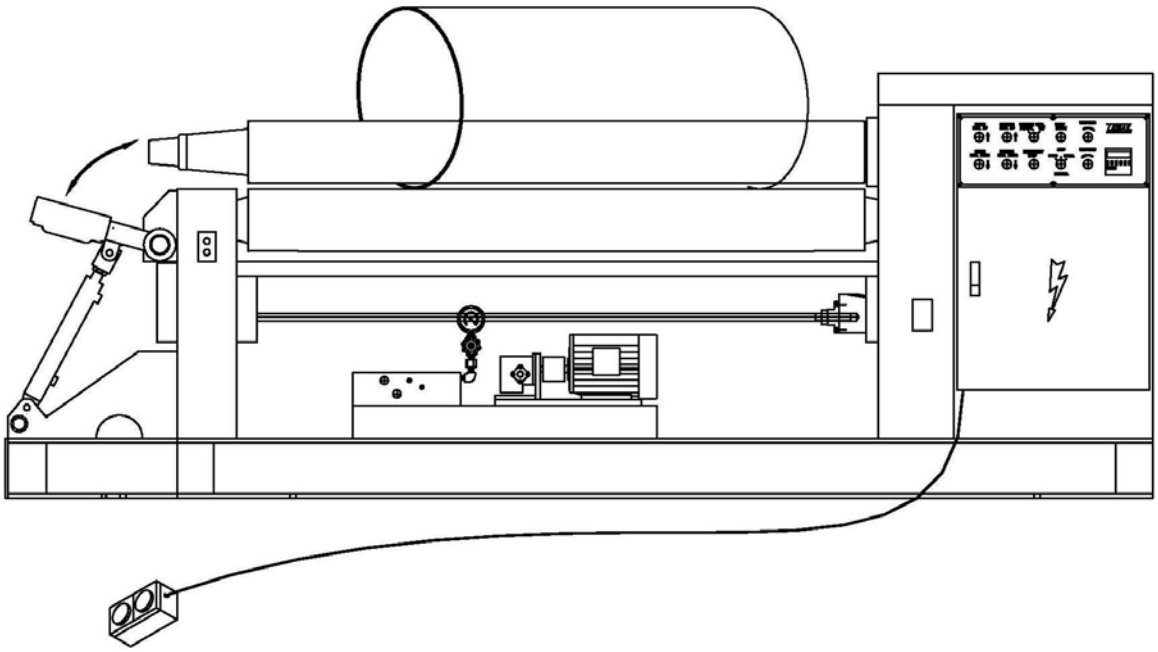
POWER DOUBLE PINCH ROLL (4-ROLL)

OPERATION MANUAL



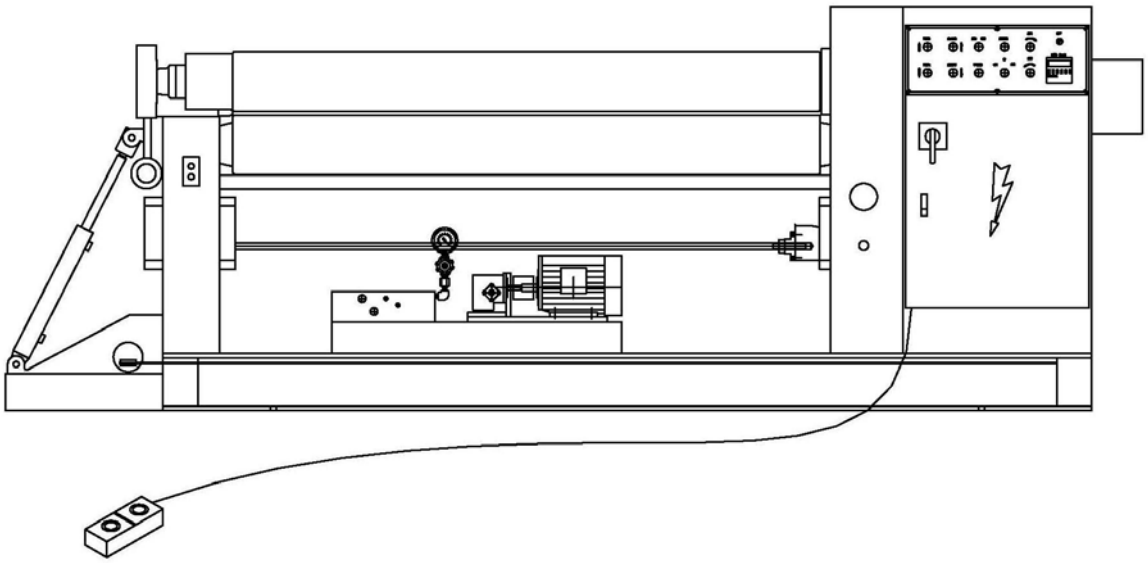
Power Machinery Pty Ltd

1 Dympna St., Dee Why West, NSW Australia
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INTERNET: www.powermachinery.com.au

POWER DOUBLE PINCH ROLL

(4-ROLL)

MODEL	LHF-6405E
CAPACITY	4.5 x 1850 mm
S/N NO.	3191244
MFG DATE	FEB., 2016



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I. FORWARDS

Lien Hsien Machinery Corporation is a well-known worldwide outstanding firm specializes in various type of metal fabrication machinery since 1950. For many decades, it's been indicated to product research and design to produce high quality and delicate machines. With the continuous efforts by all employee, we won the "BEST PRODUCT DESIGN AWARD" conferred by China External Trade Development Council (CETRA) in 1987. By the spirit of winning the award, we shall make every endeavor to present quality machines & service to our clients worldwide.

In addition to the Power Roll, we also produce Hydraulic Plate Bending Rolls, Hydraulic Section Bending Rolls, Hydraulic Notcher, Hydraulic Brakes, Hydraulic Shears, as well as special purpose machinery to meet the demands for different sheet metal industries.

Since this is a sophisticated machine which shall be operated with care. An improper operation will cause operator serious injury. To ensure the machine to be used properly and efficiently, the operator and maintenance person shall receive a special training and have a thorough understanding on the features, characteristics, mechanism, operating procedures and safety rules of the machine.

To have the machine work in good condition, a periodical maintenance and proper operation is essential, so as to increase working efficiency and to extend machine life, meanwhile, to cut the producing cost?

In case the user considers the machine is having safety problems, stop using it and contact the manufacturer, whose address shown as below, or its nearest distributors immediately for prompt service.

A. SAFETY RULES

The machine is equipped with multilevel safety device in design and production, however, an improper operation and maintenance may cause the user serious injury, therefore, the operator and maintenance person shall read and understand this manual thoroughly before working, and follow the safety rules as below:

1. To prevent any injury on eyes & feet, it is mandatory to wear goggles and safety shoes during operations.

2. Wearing gloves may prevent the hands from injury caused by sharp edge of metal plate. Cottons-made or other materials-made clothes which are likely to be scrolled by the machine are strictly prohibited.

3. To avoid any injury by the machine or profiles, it is strictly prohibited to wear clothes with baggy sleeves or a cloak.

4. It is forbidden to operate the machine while feeling uncomfortable, nor taking drugs or alcoholic before operation.

5. In case there's a need to approach or maintain the machine, all power led to the electrical box must be entirely shut off.

6. The machine shall be installed in a place where is clean, dry and has a sufficient lighting and free from barriers. Clean the chips instantly, if any, after work. Store the profiles, after work, in proper position to avoid any interference with machine.

7. It is recommended to wear a helmet during operation that may prevent any injury on head, particularly while bending a larger diameter profile.

8. Persons other than operator or maintenance personnel standing in the working area are prohibited.

Should there be any other queries about the safety problems or operations, please contact us or our nearest distributors immediately, who will do the best to serve you.

B. CAUTIONS

1. Personnel must keep out of the working area while lifting the machine.

2. Ensure all screws, nuts are tightly fastened before operations.

3. The thickness of profiles should not go excess the bending capacity of the machine.

4. Make sure that the working area is clear before operations. Keep the control panel out of contact with the profile and in place for easier operations.

5. Be sure to clean off the chips or dusts on the profiles before operation, so as to protect the rollers from damage.

6. Never place your fingers between rollers to guard against any injury. Persons other than operator should not be involved in the working area.

7. While the machine is running, the rollers move up & down and rotate forward & reverse frequently, thus it is a must to inspect the oil pipes every 3-7 days.

8. Clean the machine and apply oil to guard against rust after work. Lower the bottom rollers to the end position.

9. Keep a good work of periodical maintenance.

II. SPECIFICATIONS & ACCESSORIES

A. SPECIFICATIONS

Models	LHF-4402E	LHF-5401E	LHF-4403E
Bending capacity mm	2 x 1270	1.5 x 1270	3 x 1270
Top/Bottom roll diameter mm	80	80	100
Sides roll diameter mm	80	80	100
Min. bending diameter mm	110	110	130
Drive motor (Max. Amp 220V/440V)	2hp (8A/6A)	2hp (8A/6A)	2hp (8A/6A)
Hyd. Motor (Max. Amp 220V/440V)	1hp (4A/2.5A)	1hp (4A/2.5A)	1hp (4A/2.5A)
Weights (approx.) kg	1270	1320	1440
Machine size (L x W x H) mm	2720x1000x960	3020x1000x960	2720x1000x980

Models	LHF-5402E	LHF-4404E	LHF-5403E
Bending capacity mm	2 x 1550	4 x 1270	3 x 1550
Top/Bottom roll diameter mm	100	120	120
Sides roll diameter mm	100	120	120
Min. bending diameter mm	130	160	160
Drive motor (Max. Amp 220V/440V)	2hp (8A/6A)	2hp (8A/6A)	2hp (8A/6A)
Hyd. Motor (Max. Amp 220V/440V)	1hp (4A/2.5A)	1hp (4A/2.5A)	1hp (4A/2.5A)
Weights (approx.) kg	1560	1620	2100
Machine size (L x W x H) mm	3020x1000x980	2750x1000x1100	3050x1000x1100

Models	LHF-6402E	LHF-4407E	LHF-5406E
Bending capacity mm	2 x 1850	7 x 1270	6 x 1550
Top/Bottom roll diameter mm	120	160	160
Sides roll diameter mm	120	160	160
Min. bending diameter mm	160	210	210
Drive motor (Max. Amp 220V/440V)	2hp (8A/6A)	5hp (18A/9A)	5hp (18A/9A)
Hyd. Motor (Max. Amp 220V/440V)	1hp (4A/2.5A)	1hp (4A/2.5A)	1hp (4A/2.5A)
Weights (approx.) kg	2500	2590	2830
Machine size (L x W x H) mm	3550x1000x1100	3150x1150x1200	3450x1150x1200

Models	LHF-6405E	LHF-8403E	LHF-4409E
Bending capacity mm	4.5 x 1850	3 x 2450	9 x 1270
Top/Bottom roll diameter mm	160	160	180
Sides roll diameter mm	160	160	180
Min. bending diameter mm	210	210	240
Drive motor (Max. Amp 220V/440V)	5hp (18A/9A)	5hp (18A/9A)	5hp (18A/9A)
Hyd. Motor (Max. Amp 220V/440V)	1hp (4A/2.5A)	1hp (4A/2.5A)	2hp (8A/4A)
Weights (approx.) kg	3390	3460	2870
Machine size (L x W x H) mm	3950x1150x1200	4450x1150x1200	2940x1230x1200

Models	LHF-5408E	LHF-6407E	LHF-8405E
Bending capacity mm	8 x 1550	7 x 1850	5 x 2450
Top/Bottom roll diameter mm	180	180	180
Sides roll diameter mm	180	180	180
Min. bending diameter mm	240	240	240
Drive motor (Max. Amp 220V/440V)	5hp (18A/9A)	5hp (18A/9A)	5hp (18A/9A)
Hyd. Motor (Max. Amp 220V/440V)	2hp (8A/4A)	2hp (8A/4A)	2hp (8A/4A)
Weights (approx.) kg	3450	3930	4120
Machine size (L x W x H) mm	3440x1230x1200	3940x1230x1200	4440x1230x1200

Models	LHF-10404E	LHF-4414E	LHF-5412E
Bending capacity mm	4 x 3050	14 x1270	12 x 1550
Top/Bottom roll diameter mm	180	200	200
Sides roll diameter mm	180	200	200
Min. bending diameter mm	240	270	270
Drive motor (Max. Amp 220V/440V)	5hp (18A/9A)	5hp (18A/6A)	5hp (18A/6A)
Hyd. Motor (Max. Amp 220V/440V)	2hp (8A/4A)	3hp (9A/4.6A)	3hp (9A/4.6A)
Weights (approx.) kg	4400	3870	4300
Machine size (L x W x H) mm	5040x1230x1200	2940x1330x1300	3440x1330x1300

Models	LHF-6410E	LHF-8408E	LHF-10406E
Bending capacity mm	10 x 1850	8 x 2450	6 x 3050
Top/Bottom roll diameter mm	200	200	200
Sides roll diameter mm	200	200	200
Min. bending diameter mm	270	270	270
Drive motor (Max. Amp 220V/440V)	5hp (18A/9A)	5hp (18A/9A)	5hp (18A/9A)
Hyd. Motor (Max. Amp 220V/440V)	3hp (9A/4.6A)	3hp (9A/4.6A)	3hp (9A/4.6A)
Weights (approx.) kg	4850	5550	6140
Machine size (L x W x H) mm	3940x1330x1300	4440x1330x1300	5040x1330x1300

B. ACCESSORIES:

Standard accessories:

- Electrical box
- Movable foot switch
- Tool box with adjusting tools
- LED display
- Hydraulic system
- Standard rolls
- Operation manual

C. BENDING CAPACITY

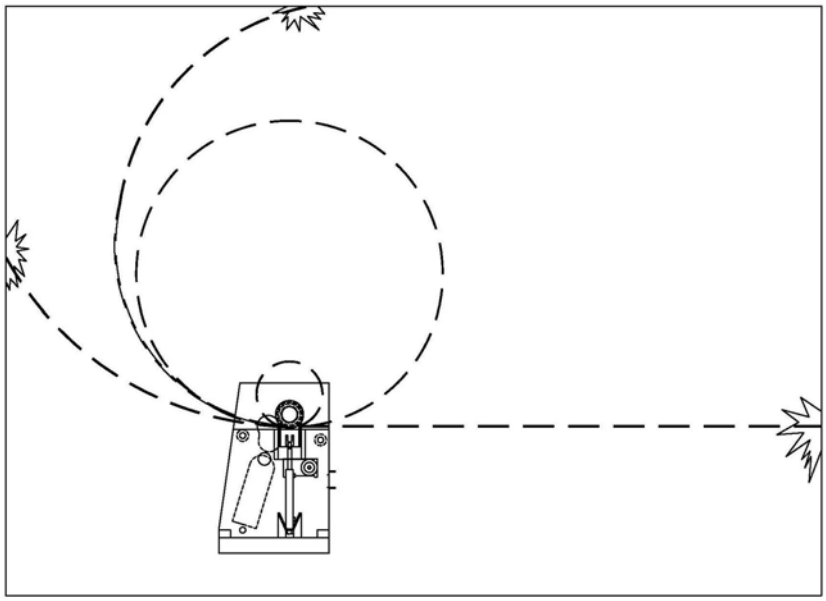
1. The pre-bending straight edge is of 2.5 times of the profile thickness.
2. The minimum bending diameter is of 1.3 times of the top roll diameter.
3. When bending diameter of a profile that is of 5 times of the top roll diameter, the bending capacity will increase as much as 1.35 times of the profile thickness.

III. MACHINE INSTALLATION, LIFTING

A. INSTALLATION AREA

An ideal foundation for machine must be solid enough. An even and leveled concrete floor is preferable. The machine shall be placed in a position has sufficient lighting and a surrounding clearance at least one meter above. During erection, the machine must be anchored & bolted properly. Level the machine with a spirit level.

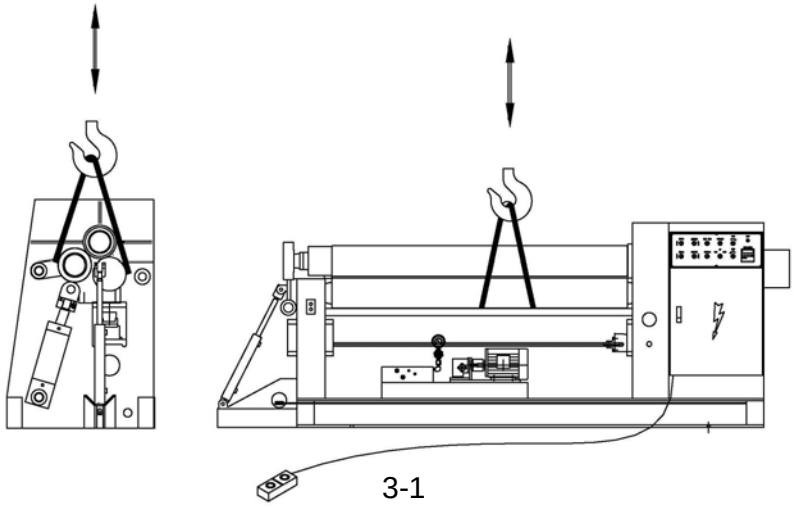
Fig. 3-1



B. LIFTING

This machine has a low center of gravity. Place a belt or wire thru the bottom of top roll in balance, and hooked upon a crane. Care must be taken while lifting, moving, and do not, under no circumstances, sway the machine. All persons shall keep out of the working and moving area while lifting is undergoing.

Fig. 3-2



NOTE:

1. *The lifting belt or wire must be strong enough to lift weight more than 5000 kg, and different type of machines may have different lifting principles*.
2. *The specifications, weight, dimension of machine can be found in this manual (see page.2-1). Refer to this info before erection is to be made.*

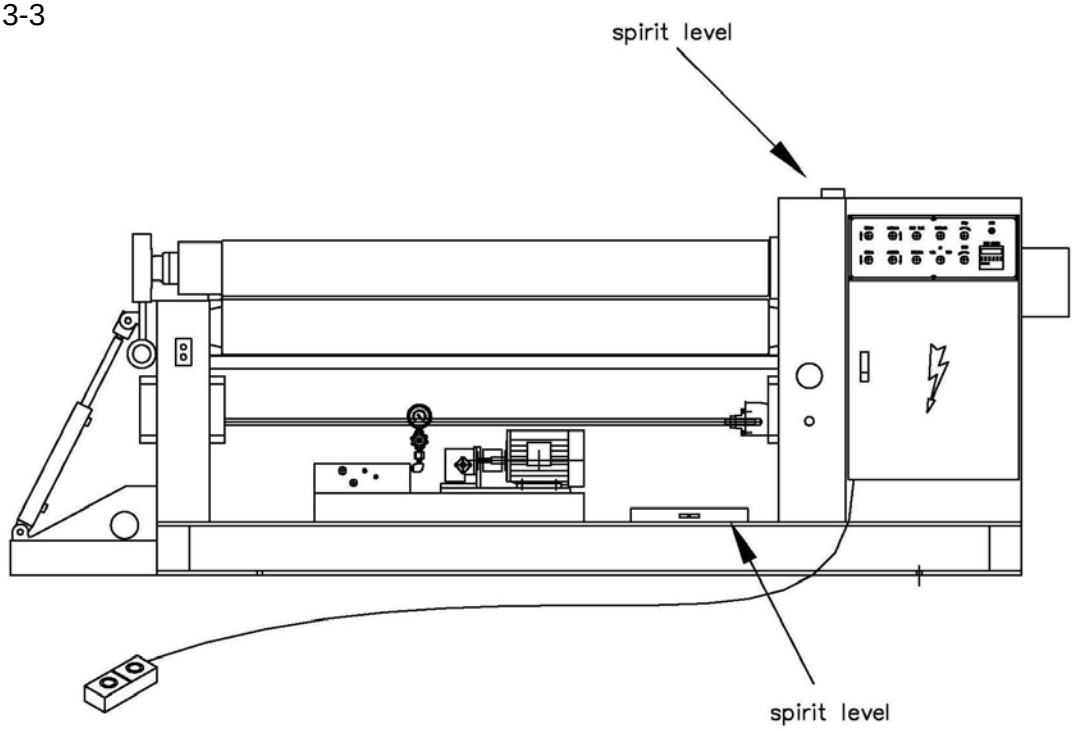
C. LEVELING

This machine must be positioned on an even and leveled concrete floor, or on a foundation, or into a pit.

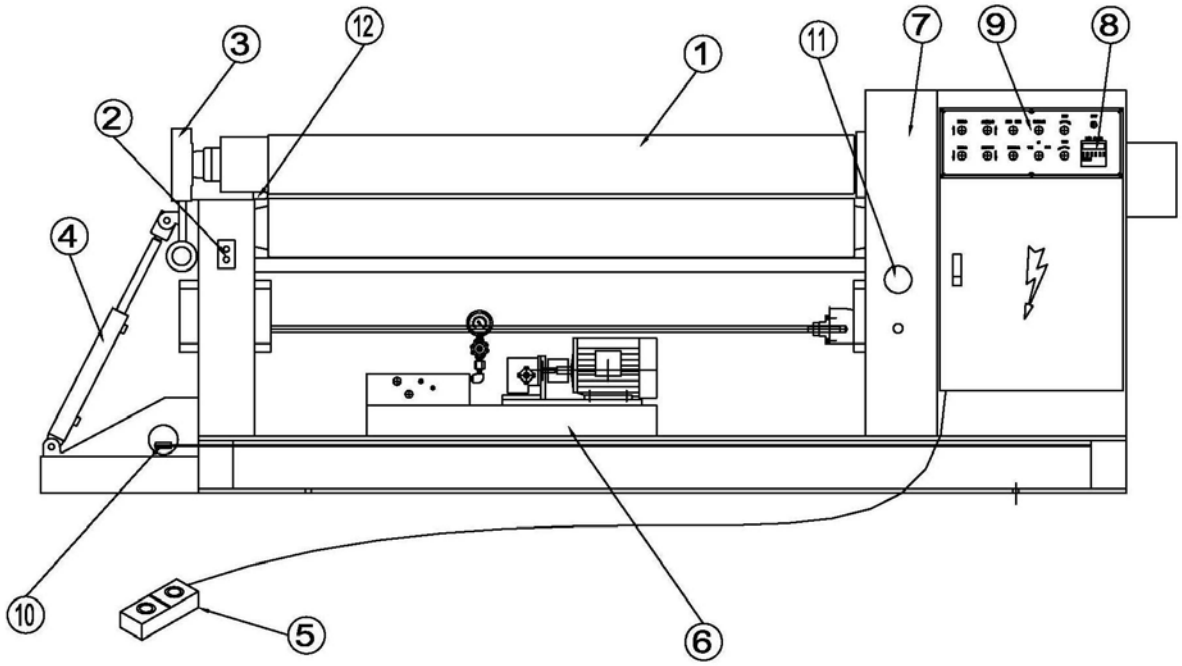
After installation, it is very important to level this machine in both horizontal and vertical directions with a spirit level.

Please note that it is very important that the machine is founded without any inclination.

Fig. 3-3



IV. DESCRIPTIONS OF MACHINE



No.	Part Name		No.	Part Name
1.	Rollers		7.	Driving mechanism
2.	Drop end switch		8.	LED readouts
3.	Drop end		9.	Control panel
4.	Drop end cylinder		10.	Cable for emergency stop
5.	Hand control switch		11.	Pressure adjustment
6.	Hydraulic tank		12.	Cone attachment

V. PREPARATION BEFORE START-UP

A proper maintenance and operation is the key element to enhance machine functions and efficiency. Follow the procedures as below for preparation before start-up.

A. UNLOADING

Unload and unpack the machine no later than machine has arrived at the user's premises. Check the machine if there's any damage occurred during transportation. Should there be any damage found, contact the manufacturer or its distributor, or the insurance company immediately.

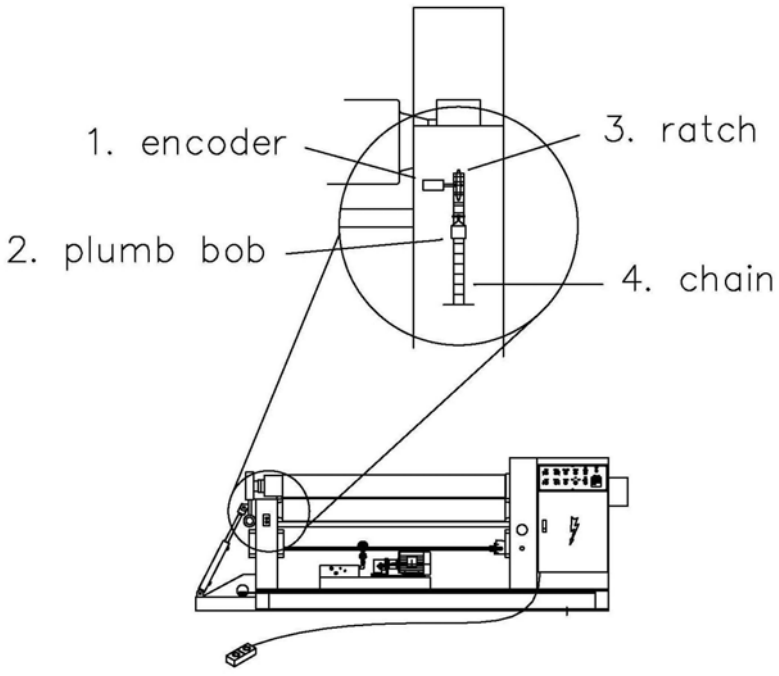
To facilitate space allocation during transportation, there may be some parts or accessories to be packed separately. Check each part carefully and notify the manufacturer or its distributor immediately should there be any parts missing. Connect and install parts as following procedures:

a. Check all the oil pipes and wirings are connecting properly.

b. There's a couple of encoding device fitted on cylinder at the drop end side. Each device consists of encoder, chain, ratch and plumb bob. (see Fig. 5-1.)

The chain and plumb bob will be dismantled and secured aside to avoid any drop & missing during transportation. Put the items back in position after machine is installed, otherwise the LED readouts will function improperly.

Fig. 5-1



B. CLEANING

The machine is coated with grease or oil to guard against any rust before delivery. Clean the machine with kerosene or solvent agent.
(***Do not remove or dismantle any parts while cleaning is being made***.)

C. FILLING IN HYDRAULIC OIL

Fill the oil tank with hydraulic oil or its equivalent to the 80% ~ 90% level of the oil sight gauge. Please refer to page 8-1 for the category of oils. In addition, the following oils are recommended for selections.

a. Mobil No. 28 b. Shell Tellus No. 25

D. CONNECTION OF POWER

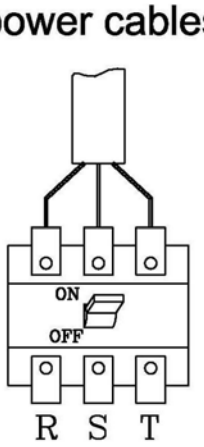
First of all, open the electrical box and check if any of the wires, terminals, and components has become loose during transportation.

Turn the main switch to "**OFF**" position, and then connect the cables **R.S.T.** and the ground wire to power source. Turn the main switch back to "**ON**" position when the Pilot Lamp lights up indicating the power cables have been connected properly.

Press the "START" button switch and then the "EMERGENCY STOP" switch to inspect if the rotation of motor is correspondent to the mark indicated by a Red Arrow outside the motor case, then try if all cylinders can be activated properly.

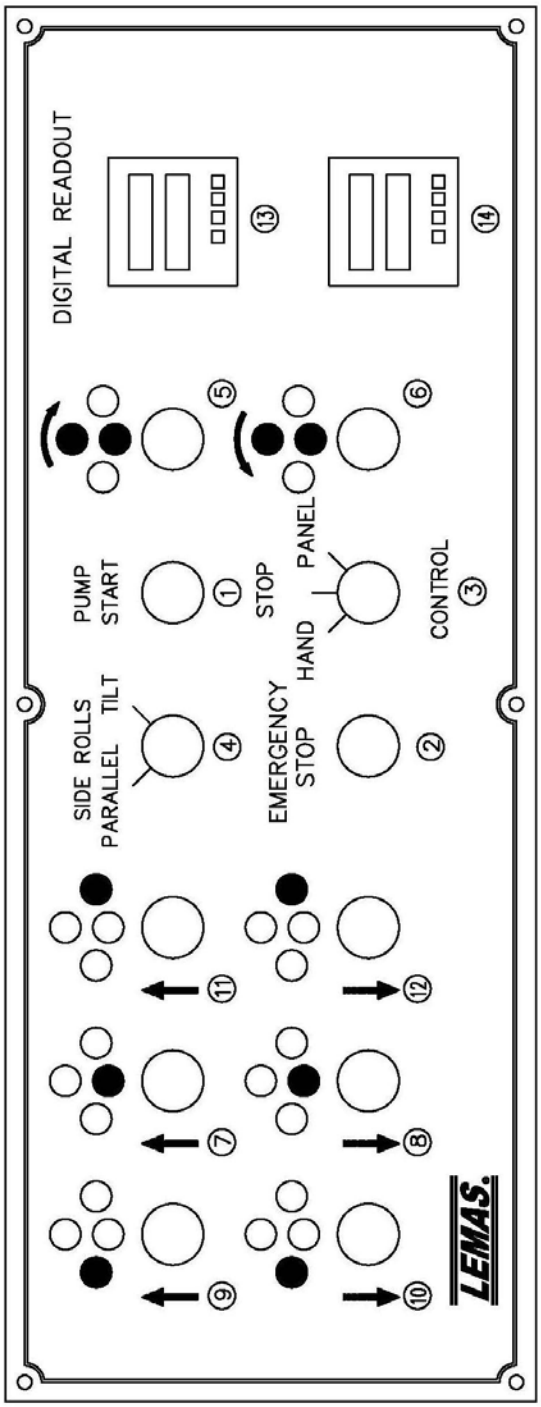
NOTE: ***In case the rotation of the motor is not correspondent to the mark indicated by a Red Arrow outside the motor case, switch any of the two power cables R.S.T. to change over the rotation*.**

Fig. 5-2

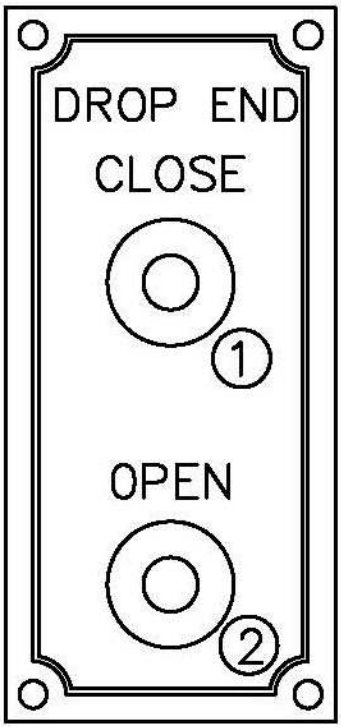


VI. CONTROL SYSTEM

A. CONTROL PANEL



B. END YOKE SWITCH



Control Panel

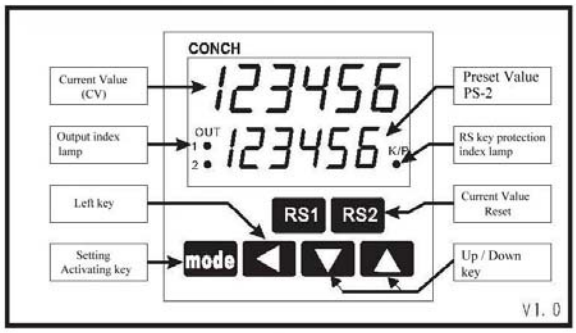
No.	Part Name	Functions
1.	Pump start	Push to start hydraulic system.
2.	Emergency stop	Press to stop all movements. Release before restart.
3.	Hand	Rolls rotation activated by hand control switch. Push to start and release to stop.
	Stop	No rotation function.
	Panel	Rolls rotate control on panel buttons. Push to start and release to stop.
4.	Side rolls (parallel)	Side rolls move up & down parallel.
	Side rolls (tilt)	One end of the side rolls can be tilted; using for conical bending.
5.	Roll rotation CW	Rolls rotate in clockwise direction.
6.	Roll rotation CCW	Rolls rotate in counterclockwise direction.
7.	Bottom roll up	Press to move bottom roll up.
8.	Bottom roll down	Press to move bottom roll down.
9.	Back side roll up	Press to move the back side roll up.
10.	Back side roll down	Press to move the back side roll down.
11.	Front side roll up	Press to move the front side roll up.
12.	Front side roll down	Press to move the front side roll down.
13.	LED readout	To show the back side roll position with a reference value.
14.	LED readout	To show the front side roll position with a reference value.

Drop End Switches

No.	Part Name	Functions
1.	CLOSE	Push to close the drop end after profile is removed from the top roll.
2.	OPEN	Push to open the drop end to remove the profile from the top roll.

C. LED READOUT

NCD-61K/62K User's Manual



■ Parameter Setting 1 (Press mode to activate)

Display	Function Discription	Level
PS-1	Prewarning Value PS-1: (Not available for NCD-61K) To set OUT1 prewarning value. For multiple comparing output types, please see section "output type". Range: 0-999999.	1
PS-2	Preset Value PS-2: To set OUT2 value. For multiple comparing output types, please see section "output type". Range: 0-999999.	
tr	OUT2 Hold Time PS-2: (tr) To set the hold time OUT2 when output type is set as R,C or D. Range: 00.01 ~ 99.99.	2
SCALE	Scaling: (SCALE) Formula: CV - PULSE x SCALE. Range: 0.00001 - 9.99999. (preset: 1.00000)	
Pnt	Decimal Place: (Pnt) To change the decimal place of CV (non-related to the accuracy of CV). Range: 0 ~ 5 (Preset: 0)	
Cnt F	Input Frequency Limit: (Cnt F) To limit max. input speed of CP1 and CP2 tp fit the characteristic of different signal. Options: 20, 100, 300, 500, 2k, 10k Hz	
oUtPUt	Output Type: (OUTPUT) Options of multiple types of comparing output. NCD-62K: N, R, C, D, HH, LL, HL NCD-61K: N, R, C, D, H, L	
Cnt in	Counting Type: (Cnt IN) UD: Count up/down. The input of CP1 and CP2 is 90 degree pressure (signals from the encoder) UP: CP1 input (count up). CP2 disabled. DN: CP1 input (count down). CP2 disabled.	

■ Parameter Setting 2 (Hold mode for 5 sec. to activate)

Display	Function Discription	Level
rS	Initial Value of manual Return: (rs) To set the initial CV when reset. Press RS2 on the panel or external RS terminal. Range: 0 ~ 999999. (Preset: 000000)	3
GAtE	Gater: (GATE) To disable or activate counting when OUT2 out. Optional Yes / No. (Preset: No)	
rS LCH	Lock RS2 Key: (RS LCK) To lock RS2 key to avoid from pressed accidentally. Yes = RS2 disabled. K/P index lamp light. No = RS2 activated for reseting CV manually.	

■ Parameter Protecting Level 2 (Press mode + ▲ to activate)

Display	Function Discription
ProtEC	Parameter Protecting Setting: (PROTECT) 0: Disables all settings of parameter. 1: PS-1 and PS-2 are adjustable. 2: Parameters from PS-1 to OUTPUT are adjustable. 3: Opens "Parameter Setting 2" for adjustment. (Preset)

Note 1: To finish setting, hold mode for 2 sec. It will also finish automatically after 15 sec.

Note 2: If the output mode (OUTPUT) is set as HH, LL or HL, the counting mode will change into up/down counting mode (UD).

■ Specification

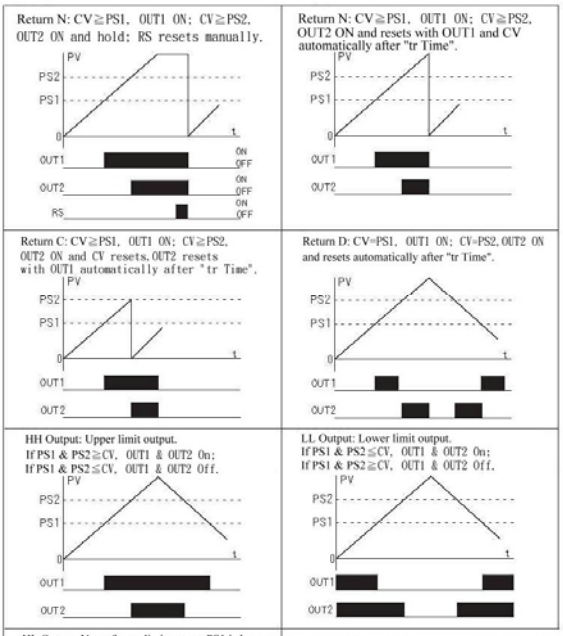
Power Supply	AC100 ~ 240V, 50/60Hz
Power Consumption	11W Max.
Aux. Power	11mA @ +12V Max.
Input Frequency	10KHz Max. (multiple levels available)
Input Signal	Non-voltage contact or NPN pen collector input
Input Level	Residual voltage, Hi: 7.2V; Lo: 8.5V (approx.)
Input Imedance	4.7 KΩ
Display	2 rows of 6-digit red LED display
Output	Relay contact(s), 3A/250V (resistive load)
Dimension	48x48mm; Cut-out: 45x45mm
Memory	EEPROM, lasts 10 years Min.
Operating Temp.	-10 ~ +50 ℃
Relative Humidity	35% ~ 85%
Storage Temp.	-25 ~ +65 ℃

■ Reset

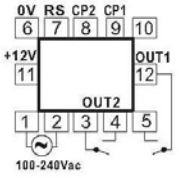
Press RS2 , input NPN signal at Terminal RS, or Auto Reset under Return R or C mode, and CV will load value.

If counting mode is set as DN (count Down), CV will load the set value PS-2.

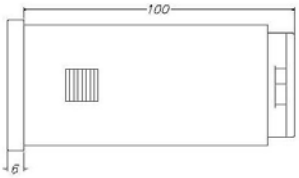
■ Output Modes



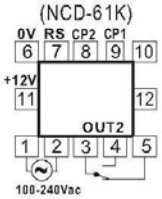
■ Wiring Diagram (NCD-62K)



■ Dimension

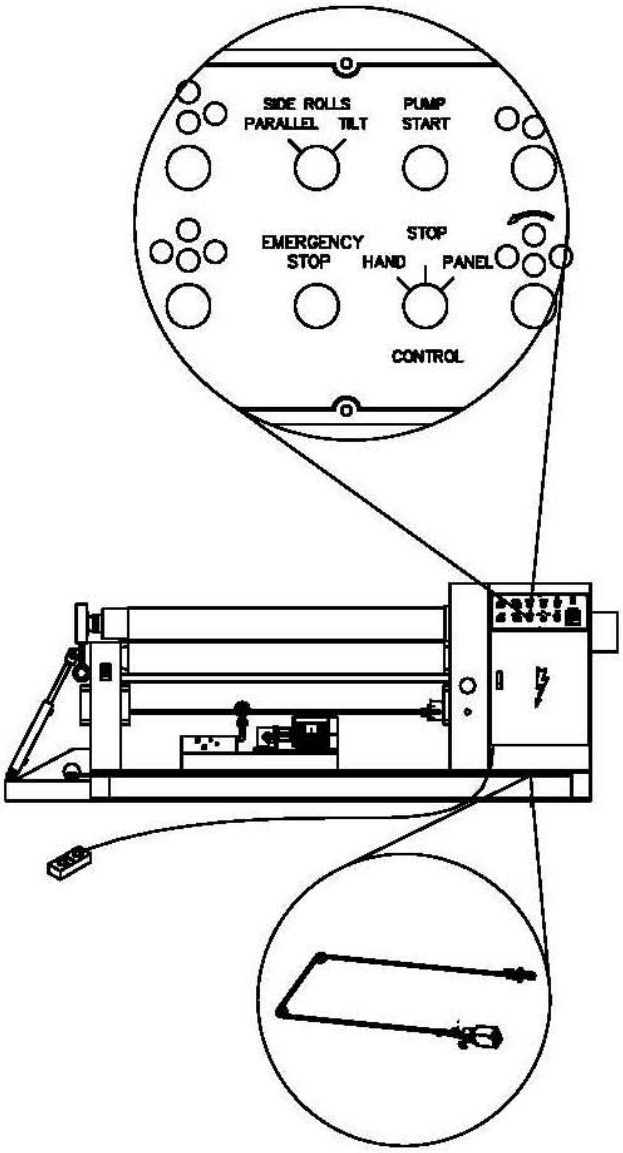


(NCD-61K)



D. SAFETY DEVICE

An emergency stop button switch is furnished as standard to guard against any possible rolling of operator's body. All movements and hydraulic system will be shut off once the device is depressed. Release to restart operation.



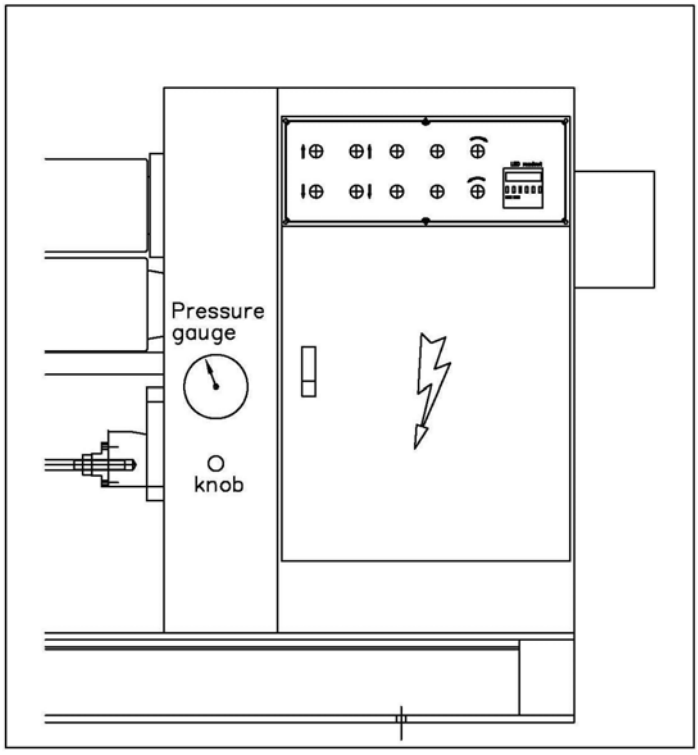
VII. OPERATIONS

1. Before operations, the user must understand and test functions of all switches on the control panel, and prepare a batten for profile inspection after bending.
2. Connect the power source to the electrical box and turn the switch to “on” position.
3. Place the foot switch at an adequate position where the bottom rolls can be seen for their movements. Press the PUMP start button switch to start the hydraulic system.
4. Check if the Drop End is secured, or all rolls will not rotate.

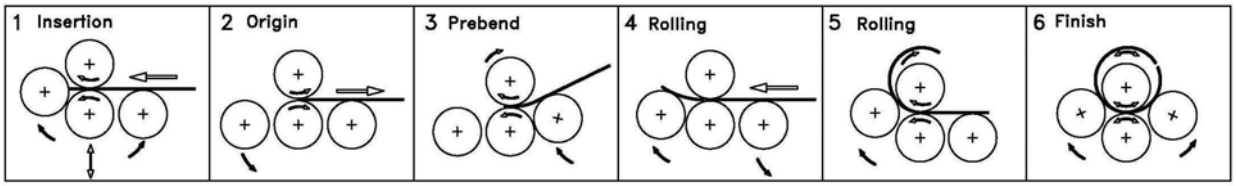
Pinching Pressure Adjustment

The **Pressure Adjustment** locates left side next to the electric box. After the middle roll clamps the working plate; this Pressure adjustment is using for adjusting the middle roll pressure individually. As we put different kind of materials or different thickness, you will need to have a proper clamping pressure with the roll to prevent over or weak clamping and to get the best bending result.

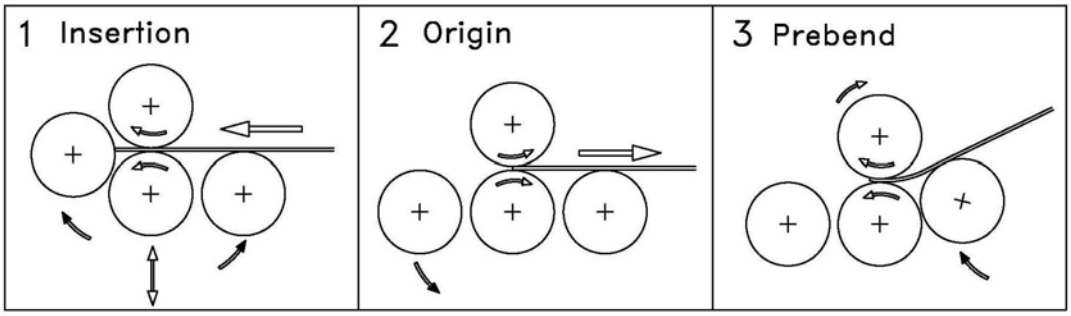
Fig. 7-1



A. Rolling Process

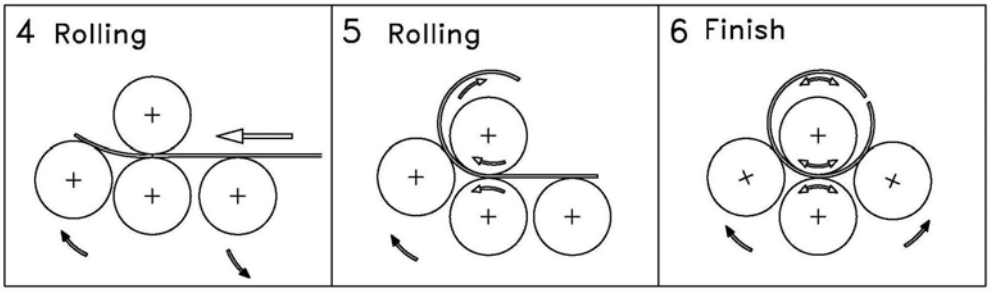


▶ Pre-bending procedures of a profile edges



1. Insert a sheet and clamp it by middle roll. Adjust proper pressure, if necessary. Move the back side roll up to align.
2. Move the sheet back to “Origin position” and move down the back side roll as well.
3. Move up the front side roll to do the pre-bending; here you may need to roll forward and back ward several times to get a perfect arc. Also, please prepare a template to check the arc.

▶ Finish a rolling procedure



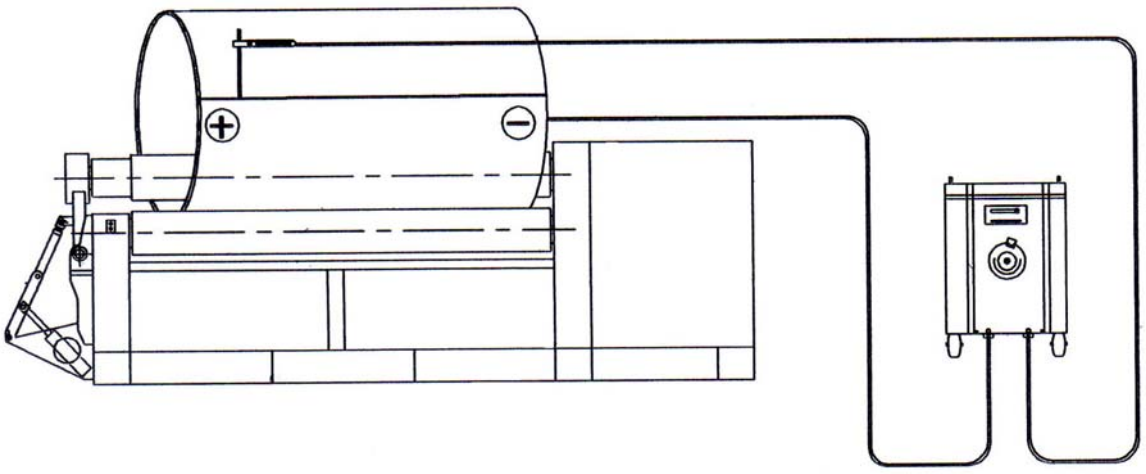
4. Move the back side roll up to roll the correct diameter circle.
5. Move the front side roll up to roll the correct diameter circle.
   ※This machine equips with 2 sets of LED readouts for positioning 2 side rolls; it can speed up your adjustment to get the correct rolling radius and finish your job quickly.
6. Adjust the 2 side rolls at the proper position to get perfect circle.
7. Fix the connected ends of profile firmly by welding.
8. Move down all 3 bottom rolls and open the drop end to remove the cylinder.

B. Welding

To avoid any damage on the LED readouts, ball bearings, and other sensitive electrical components, connect the “negative” line to the profile before welding is made.--***It is strictly prohibited to connect the “negative” line to the machine.***

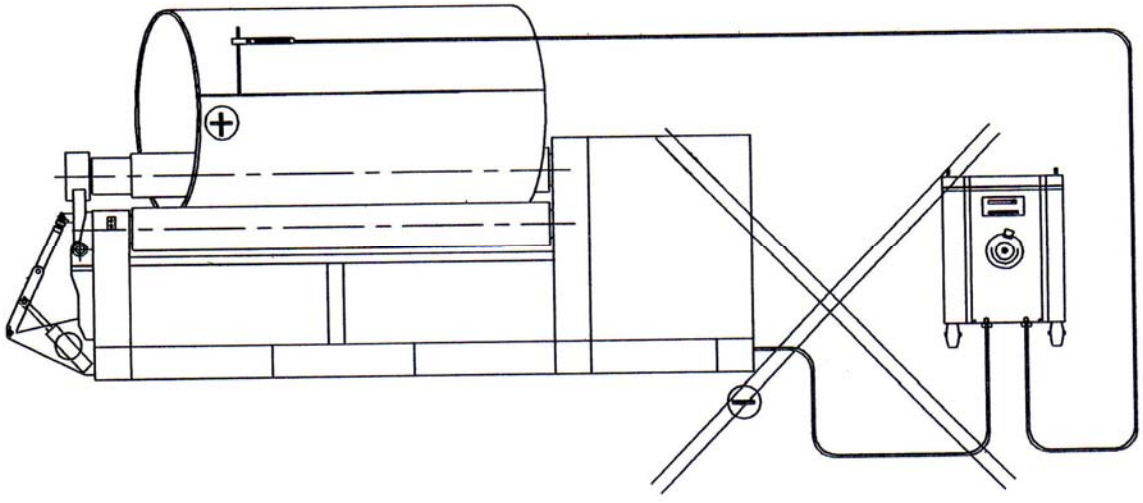
【CORRECT】

Fig. 7-2



【WRONG】

Fig. 7-3

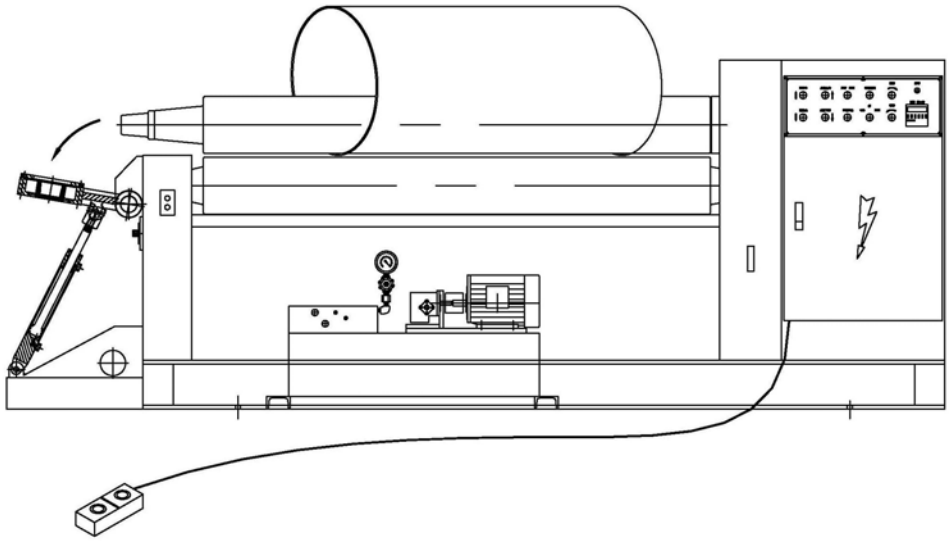


C. Removal of profile:

a. Press the Drop End switch “open” to open the Drop End.
b. Remove the profile from the top roll.
c. Press the Drop End switch “close” to close the Drop End.

★***Be sure not to hit the top roll while removing the profile.***
The Drop End must be secured firmly; otherwise all rolls will not rotate.

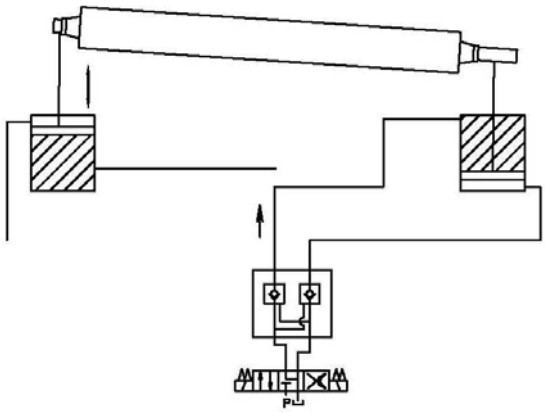
Fig. 7-4



D. Tilt of rear bottom roll--cone bending:

The way to roll a conical cylinder on this machine is that install the cone attachment on top roll and tilts the all 3 bottom rolls; when plate is rolling, it is blocked by the cone attachment to get the rolling speed difference under this way; the small diameter part is on the drop end side.

Fig. 7-5



i. Adjustments:

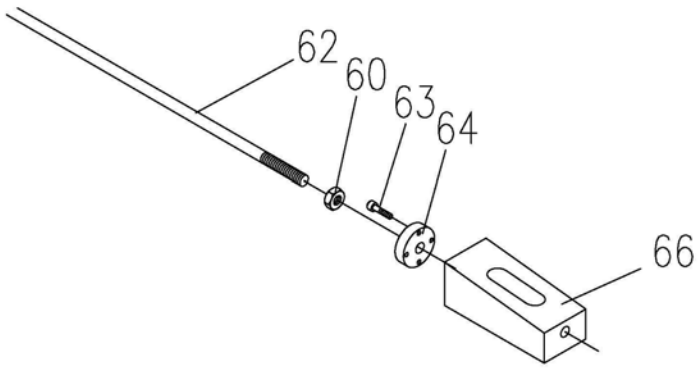
1. Adjust two side rolls in decline or horizon.
2. To tilt the end of the 2 side rolls, turn the switch to “TILT”, press the “roll up” button and refer to the LED readout value.
3. Press the “roll down” button to move the side rolls down at horizon position.
4. Check the positions of the side rolls with a caliper or thickness gauge if an equal pinch is obtained. If not, move the rolls respectively up & down till and equal pinch is gained.

ii. Remarks:

1. For cone bending, install the cone bending attachment before adjusting the bottom roll pitch. The gap between the top roll and bottom roll should be 0.9mm or so. Adjust both ends of the roll to the same position.
2. Tilt of bottom roll: remove the side cover (Item no. 85 of page 11-1), and unscrew the nut (No.60). Remove the four screws (No.63) and to turn counterclockwise the coupler (No.64) for two circles, then tighten the four screws (No.63) and the nut (No.60).--the bottom roll can be up-adjusted for 0.9mm or so.

   To bend in a normal way, reverse the aforesaid procedures and turn the coupler (No.64) clockwise for two circles.

Fig. 7-6

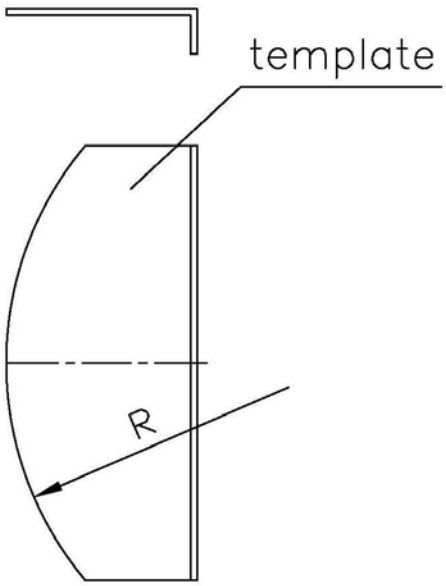


3. For conical bending, the procedures are described as above. Feed the profile thru the top roll and bottom rolls to perform bending and ends welding.

4. Prepare a batten made out to the radius shape of profile (Fig.13) to check the profile during bending.

5. Based on the cone center, draw 12 equal lines on the profile for inspection during bending which will allow a faster processing.

Fig. 7-7



E. Drop End Adjustment:

1. The drop end is activated by a hydraulic cylinder to support the top roll during bending. It'd generate a warp to shorten the roll life, and produce an inaccurate profile, if the drop end is not firmly secured. Nevertheless, a safety device (limit switch) is equipped to ensure the drop end is firmly closed.

   Note: The rolls fail to rotate in case the drop end is not firmly closed.

2. Press the switch "close" to close the drop end and see if the limit switch, fitted below the drop end is touched. If not touch properly, just adjust the screw till the switch is touched and rolls turn.

3. The hand control switch is good for testing operation. For safety concern, both hand control and panel buttons are without continue rolling function.

VIII. LUBRICANT & GREASE

In order to increase working efficiency and lengthen machine life, the user must perform routine lubrications in accordance with the instructions herein stated.

Lubricant must be derived from mineral oil. Never use plant oil or animal oil for lubrication purpose. In case any of the oils are used on bearings, for instance, which will easily become overheat during roll rotation.

Characters of lubricants

- an ideal lubricant should have character unchangeable during storage.
- an ideal lubricant should have surface which are not misty.
- an ideal lubricant should have a reaction of neutrality.
- an ideal lubricant should not be mixed with water and emulsified.
- an ideal lubricant should have viscosity which are not much influenced when the temperature is rising.
- an ideal lubricant should have a tendency of low-carbonization.

The following lubricants are recommended:

A. HYDRAULIC OIL

Before connecting the power source, fill the hydraulic tank with the recommended oil up to a level of 2/3 of the tank capacity. Connect the power and check the motor if it is running in the same direction as the arrow marked outside the motor case. In case the motor runs in wrong direction, turn off the power, and change any two of the 3 power cables (R.S.T.). Remember to place the machine in an area with constant temperature.

ITEM / MAKES	**A**	**B**	**C**	**D**
Mobil	D.T.E. OIL NO. 11	D.T.E. OIL LIGHT	VACTRA OIL NO.2	VACTA OIL NO. 4
Shell	TELLUS OIL T15	TELLUS OIL T32	TONNA OIL T68	TONNA OIL T68
Esso	NUTO H15	TERESSO 32	FEBIS K68	FEBIS K220

※Use oils adequately according to the indoors temperature. (item A-D)

B. GREASE

Use grease which is heat resisting, oil proof and acid-free for parts lubrications. Use a grease gun to transmit the grease thru nipples around machine. For ideal greases, the followings are recommended.

MAKES / OIL	ESSO	MOBIL	SHELL
GREASE	BEACON 2	MOBILUX 2	ALVANIA 2

C. OPERATION OIL

Check all rotating parts and apply operation oil to facilitate operations.
Use the oils recommended as below:

MAKES / OIL	ESSO	MOBIL	SHELL
OPERATION OIL	TERESSO 32	D.T.E. OIL	TELLUS 2

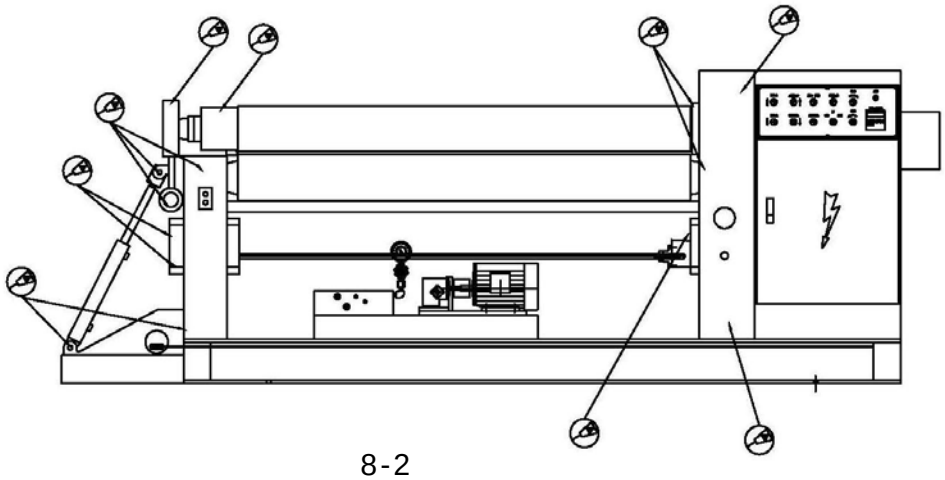
※An ideal operation oil should have viscosity at 32 CST / 48 SSU /40℃.

※Change the operation oil after 200 to 250 work hours for the first use, and then every 2000 work hours or annually afterwards.

D. LUBRICANT POINT

To ensure machine working accuracy and extend machine life, it is very important to lubricate or grease all the turning or moving parts. Please use appropriate grease or lubricant for sufficient lubrications. All the lubricant point on this machine has a yellow circle tape. We suggest doing the lubrication at least once a month.

Fig. 8-1



IX. TROUBLE SHOOTINGS

A. An abnormal sound is raised during operation: stop operation immediately and check if there's any leakage. Screw the pipes tightly and refill the tank to an appropriate level.

B. An abnormal sound is raised from the pump: stop using machine immediately and check if the pump all oil tanks are obstructed.

C. When bottom roll can't be moved up & down, check the taper block assembly. It could be too dry to moving.

D. Side rolls can't be elevated: check the LED readout on control panel for the position of the side rolls and check if oil pipes are obstructed.

E. When bottom roll fails to elevate: check if the direction valve is obstructed.

F. Bottom rolls fail to stop or go down after elevating: inspect the check valve and see if it is obstructed. Clean it with compressed air if it is.

G. In case the machine is immersed or flooded, stop using it and clean it as per the following procedures:

1. discharge & clean the oil tank. Refill it with new oil to an appropriate level.
2. dismount oil pump and release the remaining oil inside. Clean it and refill with new oil.
3. clean oil pipe and let it dry before putting every part back.
4. clean and dry the electrical box.

In case the machine fails to run after all, please contact us immediately for prompt service.

X. WARRANTY

All machines manufactured by us are precisely designed with AUTO CAD system, and must be tested thru a strict quality control and inspection before delivery.

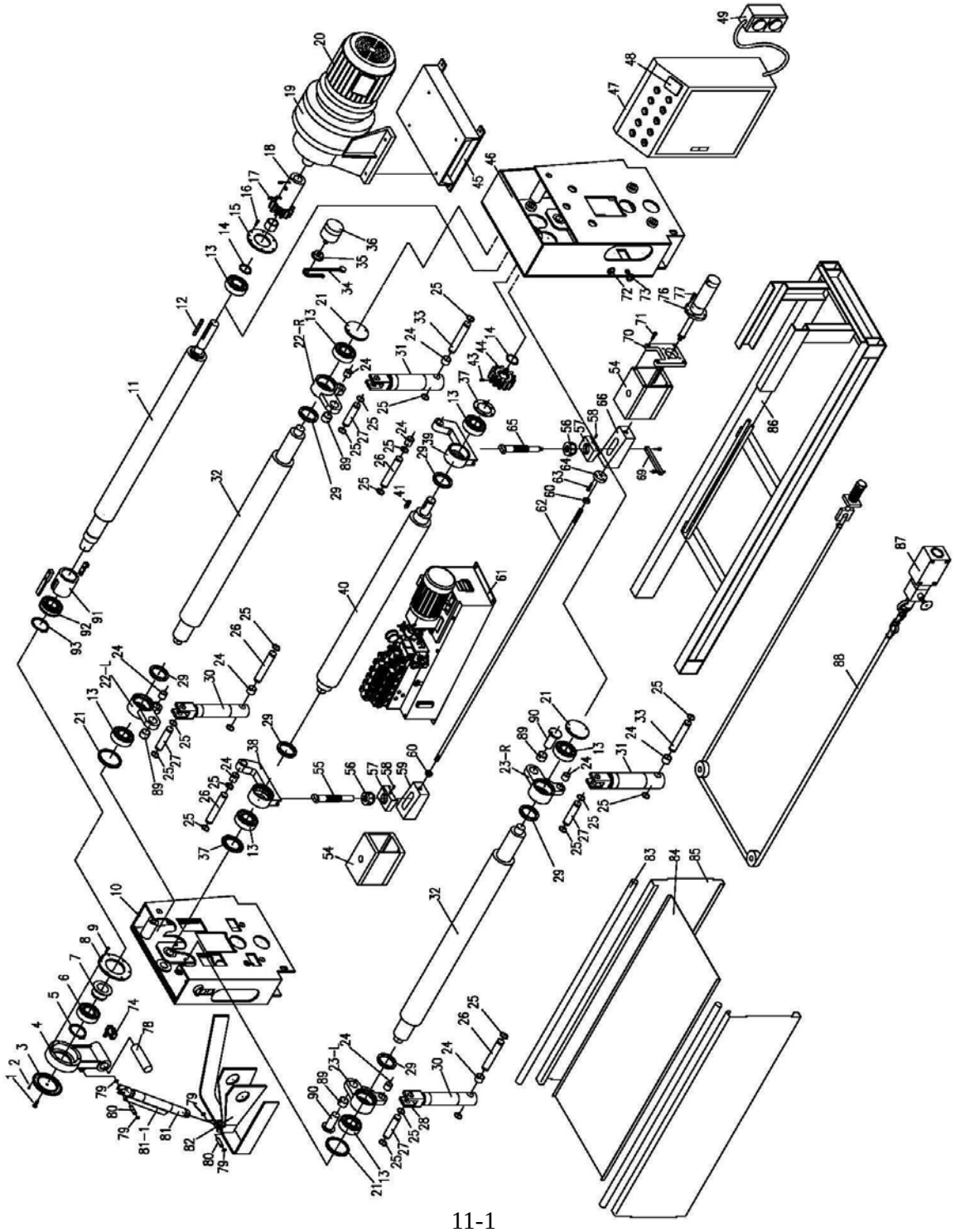
All machines are built with one year warranty which commences from the date of installation or 14 months from the date of shipment. All parts will be supplied free of charge if the problem is occurred due to manufacturing defects.

Nevertheless, in the event of the following situations, the warranty shall not be valid and some cost shall be charged.

a. out of warranty.
b. removed or forged the name plate, serial number and / or manufacturing date.
c. machine runs over capacity, or modified or operated by mistake, or in short of routine maintenance.
d. incorrect operation, or any other operator's errors.
e. other causes such as power outrage, improper hydraulic oil etc.
f. other causes effected by act of God or force majeure.

XI. APPENDIX

A. ASSEMBLY DRAWING



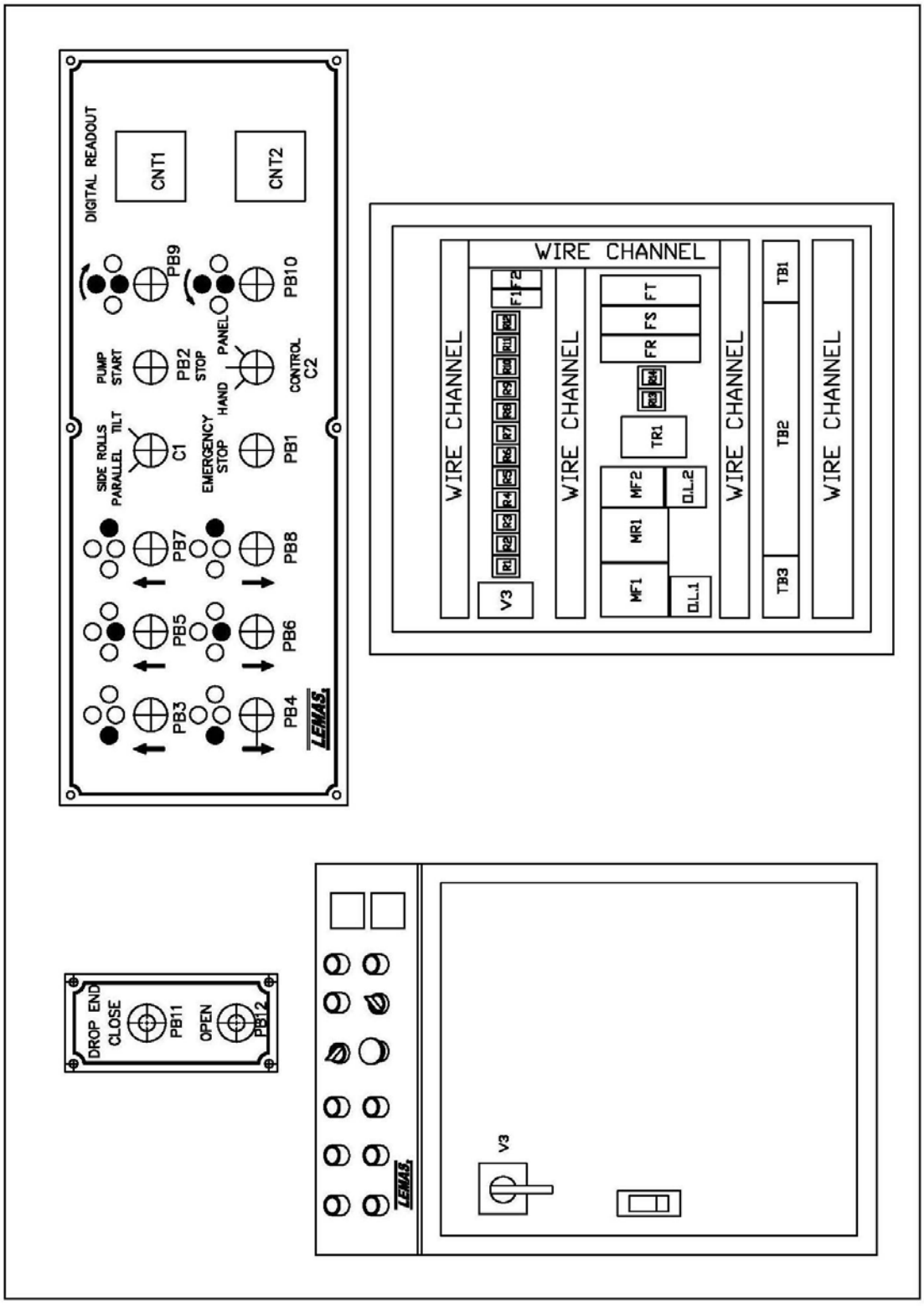
A. PARTS LIST

No.	PART NAME	SPECIFICATION	Q'TY	REMARKS
1.	Hex head screw	M12 x 1.75 x 30	1	
2.	Socket head screw	M6 x 1 x 10	3	
3.	External cover	LHF-506E-105-00	1	
4.	Drop end	LHF-503E-108-00	1	
5.	Snap ring	S-90	1	
6.	Ball Bearing	#22218	1	
7.	Front cover bushing	LHF-506E-109-00	1	
8.	Bushing cover	LHF-506E-105-00	1	
9.	Socket head screw	M8 x 1.25 x 20	6	
10.	Left support	LHF-4404E-102-00	1	
11.	Top roll	LHF-4404E-101-00	1	
12.	Key	16 x 6 x 125	1	
13.	Bearing	#22310	7	
14.	Snap ring	S-65	2	
15.	Bushing cover	LHF-4404E-104-00	1	
16.	Socket head screw	M5 x 0.8	6	
17.	Headless screw	M12 x 1.75	1	
18.	Driving gear	LHF-4404E-112-00	1	
19.	Speed reducer	HM2-21310-1/121	1	Sumitomo
20.	Brake motor	2hp-4p	1	Tatung
21.	Housing cover	LHF-4404E-107-00	4	
22.	Bearing housing (L/R)	LHF-4404E-107-00	1	
23.	Bearing housing (L/R)	LHF-4404E-107-00	1	
24.	Collar	LHF-4404E-107-00	4	
25.	Snap ring	S-38	12	
26.	Pivot	LHF-4404E-117-00	3	
27.	Coupling pivot	LHF-4404E-117-00	4	
29.	O-ring	Ø90 x Ø 115 x 13	6	
30.	Elevating cylinder	LHF-503E-201-0B	2	
31.	Elevating cylinder	LHF-503E-201-0A	2	
32.	Rear roll	LHF-4404E-101-00	2	

No.	PART NAME	SPECIFICATION	Q'TY	REMARKS
33.	Pivot	LHF-4404E-117-00	2	
34.	Driving chain	P1/4 " x 21	1	
35.	Sprocket	P1/4" x 15T	1	
36.	Encoder	OSS-020-2HC 200	1	
37.	Housing cover	LHF-4404E-106-00	2	
38.	Bearing housing (L)	LHF-4404E-106-00	1	
39.	Bearing housing (R)	LHF-4404E-106-00	1	
40.	Bottom roll	LHF-4404E-101-00	1	
41.	Key	16 x 6 x 54	1	
43.	Headless screw	M10 x 1.5 x 10	2	
44.	Driving gear	LHF-4404E-111-00	1	
45.	Motor seat	LHF-4404E-113-00	1	
46.	Right support	LHF-4404E-103-00	1	
47.	Control box	LHF-407E-000-0A	1	
48.	LED readout	NCD-61K-N	2	
49.	Hand control unit	EOB61	1	
54.	Gib box	LHF-407E-116-00	2	
55.	Link screw	LHF-407E-114-1B	1	
56.	Screw nut	LHF-407E-114-02	2	
57.	Screw seat	LHF-407E-114-01	2	
58.	Headless screw	M8 x 1.25 x 10	2	
59.	Taper block	LHF-407E-114-061	1	
60.	Lock nut	3 / 4-10UNC	2	
61.	Hydraulic tank	LHF-4404E-hyd-box	1	
62.	Connecting rod	LHF-407E-115-02	1	
63.	Socket head screw	M8 x 1.25 x 15	4	
64.	Coupling	LHF-407E-115-01	1	
65.	Link screw	LHF-407E-114-1A	1	
66.	Taper block	LHF-407E-114-062	1	
69.	Limit block	LHF-4404E-114-02	1	
70.	Cylinder bracket	LHF-407E-114-07	1	

No.	PART NAME	SPECIFICATION	Q'TY	REMARKS
71.	Socket head screw	M10 x 1.5 X 45	4	
72.	Pressure gauge	DT-63-250K	1	
73.	Adjustable valve	DT-02H	1	
76.	Cylinder	LHF-407E-114-07	1	
77.	Socket head screw	M10 x 1.5 x 40	4	
78.	Pivot	LHF-503E-120-00	1	
79.	Snap ring	S-16	4	
80.	Cylinder pivot	LHF-4404E-117-00	2	
81.	End yoke cylinder	LHF-503E-202-00	1	
82.	Cylinder seat	LHF-4404E-121-00	1	
83.	Connecting rod	LHF-4404E-113-00	2	
84.	Dust guard	LHF-503E-123-00	1	
85.	Side cover	LHF-503E-124-00	2	
86.	Beams	LHF-4404E-113-00	1	
87.	Emergency switch	E400-07-TBM	1	
88.	Cable	Ø 3 x 6400	1	
89.	Collar	LHF-4404E-107-00	4	
90.	Pivot	LHF-4404E-107-01	2	
91.	Cone attachment	LHF-4428E-101-02	1	
92.	Bearing	51117	1	
93.	Snap ring	S-85	1	

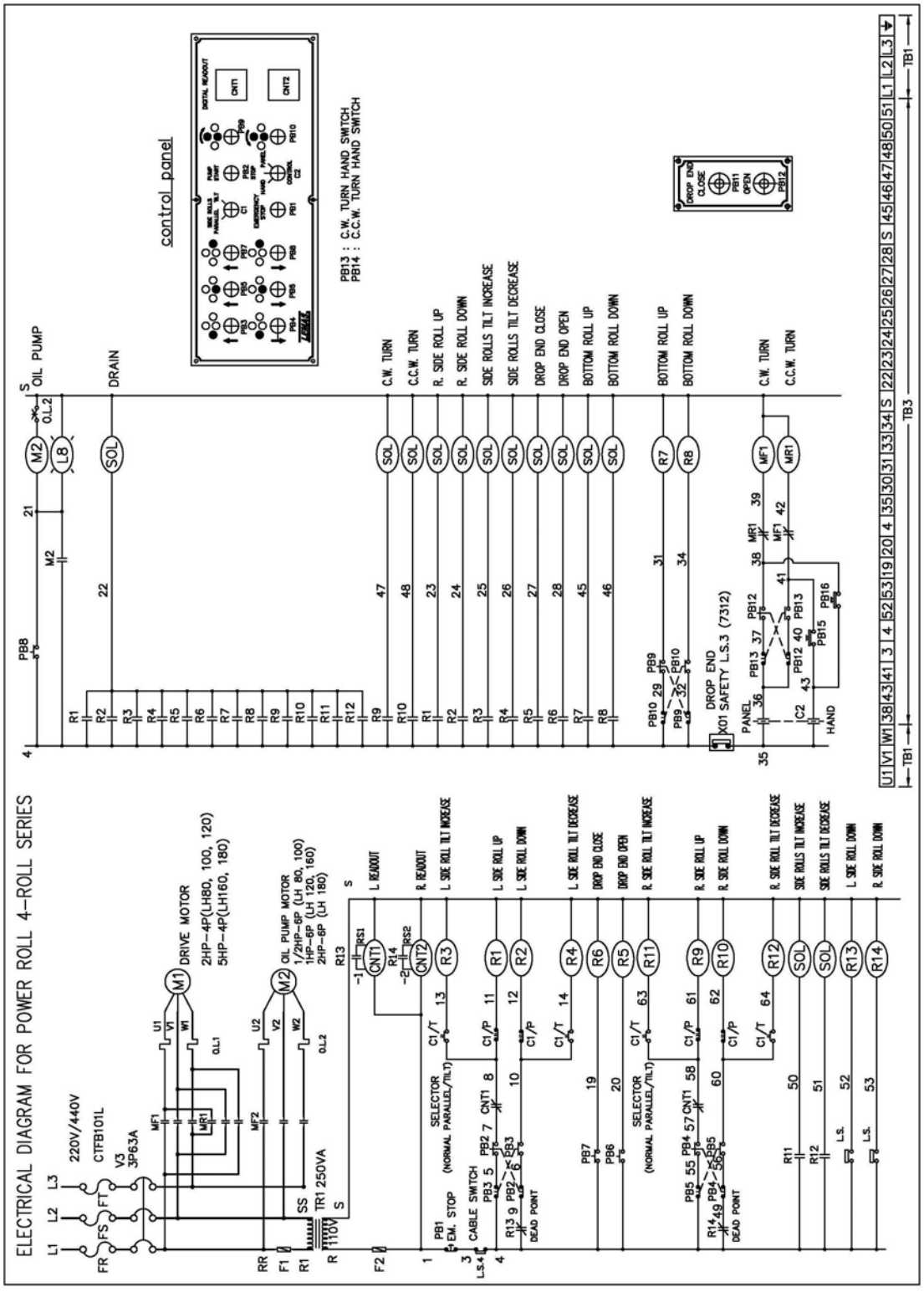
B. ELECTRICAL BOX & DIAGRAM



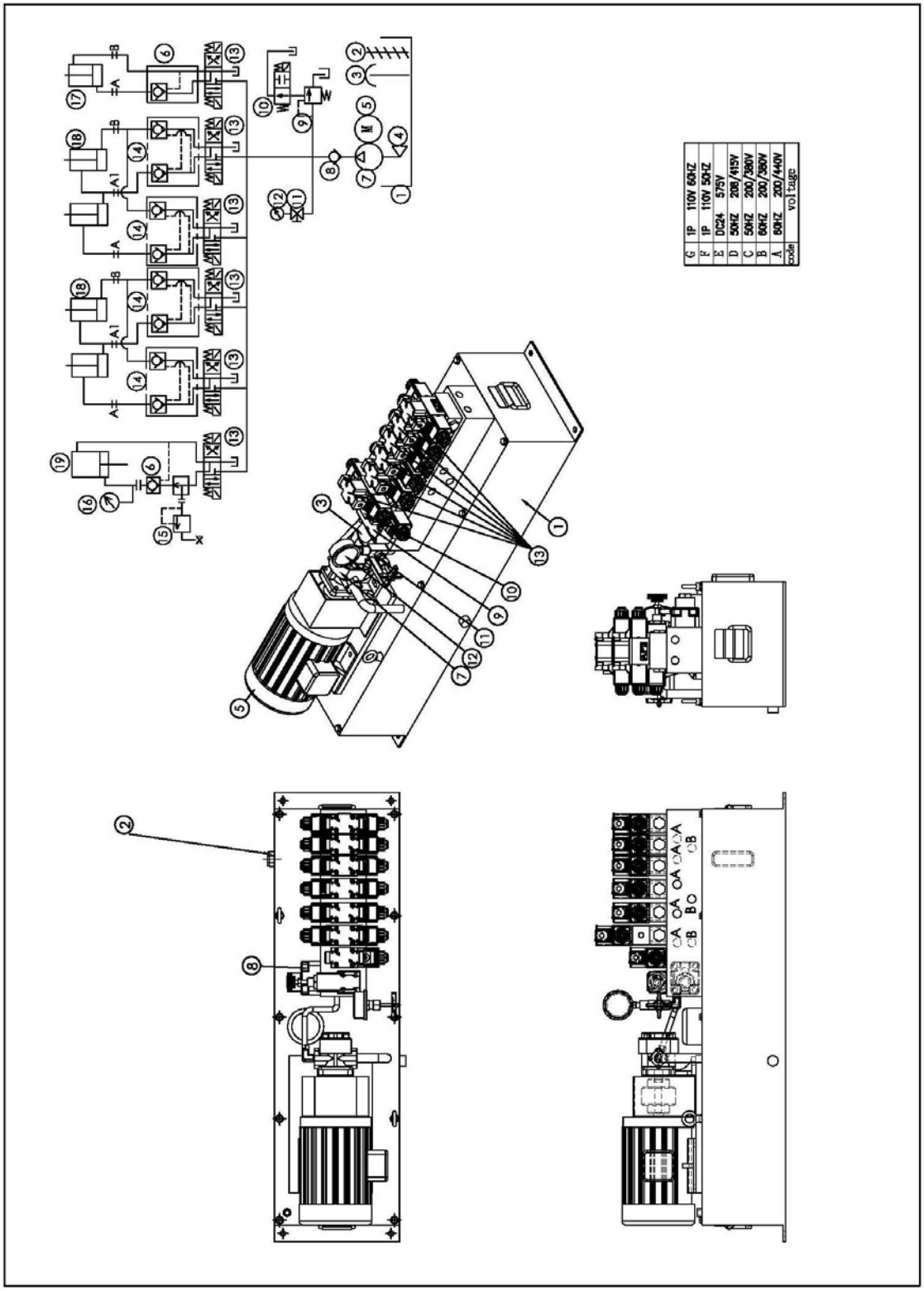
PARTS LIST

ITEM	DESCRIPTIONS	PART NO.	Q'TY	BRAND
V3	Non-fuse circuit breaker	VZ31 KCF3P2	1	Telemecanique
MF1/MR1	Magnetic contactor	LC1 D09	2	Telemecanique
O.L.1	Magnetic contactor	LR3D 12	1	Telemecanique
MF2	Magnetic contactor	LC1 D09	1	Telemecanique
O.L.2	Magnetic contactor	LR3D 08	1	Telemecanique
PB1	Emergency stop button	ZB4-BS54	1	Telemecanique
PB2	Push button (light)	ZB4-BW31	1	Telemecanique
PB3～12	Push button	ZB4-BA2	10	Telemecanique
PB13～14	Hand control	KOB61	1	E-TEN
C1	Key switch	XB4-BD2	1	Telemecanique
C2	Key switch	XB4-BD3	1	Telemecanique
LS4	Cable emergency switch	E400-07-TBM	1	ERSCE
TB1	Terminal seat	TBR-30	7	TEND
TB3	Terminal seat	TBC-10	30	TEND
LS1 / LS2	Limit switch	7311	2	TEND
LS3	Limit switch	7312	1	TEND
R1～R14	Relay	RH2B-U AC110V	14	IDEC
TR1	Transformer	1P 250VA	1	CELL POWER
CNT1 CNT2	LED readout	NCD-61K-N	2	CONCH
F1 / F2	Fuse	SF112 (5A)	2	SHYANG YIN
FR/FS/FT	Antiknock fuse	CT-FB101L (32A)	3	CHYOU DIAN
M1	Brake motor	LH-80, 100, 120: 2 hp LH-160, 180: 5 hp	1	TATUNG
M2	Oil pump motor	LH-80, 100: 1/2hp LH-120, 160: 1 hp LH-180: 2 hp	1	TATUNG

ELECTRICAL DIAGRAM



C. HYDRAULIC DIAGRAM



PARTS LIST

No.	PART NAME	DESCRIPTION	Q'TY	MAKES
1.	Oil tank	300 x 790 x 500 cm	1	Kompass
2.	Oil thermometer	KP-3"	1	Kompass
3.	Oil inlet	TOYO-50-PR	1	Kompass
4.	Oil filter	SFN-06	1	Kompass
5.	Hydraulic motor	LH 80 ~ 160: 1 HP - 6P LH 180: 2 HP - 6P	1	Tatung
6.	Pilot check valve	MPA-02-AN	2	Kompass
7.	Pump	0530CPSS	1	KYB
8.	Check valve	CRG-03-A1	1	Kompass
9.	Pressure adjust valve	DG-02H	1	Kompass
10.	Solenoid valve	D4-2B2-02-A1	1	Kompass
11.	Koke	GCT-02	1	Kompass
12.	Pressure gauge	AT 63 x 250k	1	Kompass
13.	Solenoid valve	D4-3C4-02-A16	8	Kompass
14.	Pilot check valve	MPW-02-AN	4	Kompass
15.	Pressure adjust valve	DT-02	1	Kompass
16.	Pressure gauge	DT 63 x 250k	1	Kompass
17.	Drop end cylinder	LHF-503E-202-00 (LH-80 ~120) LHF-506E-202-00 (LH-160) LHF-606E-202-00 (LH-180)	1	Lemas
18.	Side roll cylinders	LHF-428E-201-0A (LH-80,100) LHF-503E-201-0A (LH-120) LHF-407E-201-0A (LH-160) LHF-606E-105-0A (LH-180)	2	Lemas
		LHF-428E-201-0B (LH-80,100) LHF-503E-201-0B (LH-120) LHF-407E-201-0B (LH-160) LHF-606E-105-0B (LH-180)	2	
19.	Bottom roll cylinder	LHF-428E-114-07 (LH-80,100) LHF-407E-114-07 (LH-120,160) LHF-606E-114-07 (LH-180)	1	Lemas

D. PERIODICAL CHECKS

PARTS	POINTS	PERIODS	CHECKS
Oil tank	oil leakage	weekly	visually
	oil volume	weekly	thru oil sight gage
Pump	property & purity of oil	seasonally	with instruments
	oil temperature	weekly	with thermometer (oil temperature shall not exceed 65℃)
	oil output	seasonally	with instruments
	oil pressure	seasonally	with oil pressure gauge
	noise	seasonally	thru hearing or with noise detector
	surface temperature	seasonally	thru feeling or with thermometer
Coupling	oil filling / wearing	annually	visually
Pressure control valve	setting value	seasonally	conditions of oil gage and brakes
Oil flow control valve	setting value	seasonally	speed test of brakes
Directional valve	working condition	seasonally	working test of brakes
	inside leakage	annually	working condition of brakes in neutral position.
	isolation resistance of coils	annually	with a 500MV meter
Filter	cleanness	monthly	visually
Filter	cleanness	monthly	visually
Cooling unit	cooling capacity	monthly	thru feeling or with thermometer
	water leakage	seasonally	visually
Pipings	oil leakage	seasonally	visually
	tightness	weekly	visually or feeling
Hydraulic cylinder	working time	weekly	with a stop watch
	vibration	weekly	visually
	oil leakage	weekly	visually

E. TROUBLE SHOOTINGS

1. PUMP

I T E M S	C A U S E S	R E M E D I E S
A: Oil DIS-CHARGE FAILS	1. wrong rotation 2. pump shaft fails to turn 3. rotor doesn't turn due to broken shaft 4. inlet tube obstructed 5. oil filter on the hyd. tank obstructed 6. low oil filtering capacity 7. high oil viscosity 8. insufficient revolution 9. inlet tube is not air tight 10. oil filter is above oil level 11. vane fails to slip out from the rotor	1. stop machine and alter the rotation 2. repair or replace coupling 3. repair or replace coupling 4. clear the tube 5. clear or replace the filter 6. use a filter with larger capacity 7. use appropriate oils or a heater. 8. check the voltage & cycle of power 9. tight or replace the tube7 10. fill the oil up to the min. level 11. repair or replace the pump
B: BIG NOISE	1. small inlet tube and obstructed. 2. oil filter obstructed. 3. low oil filtering capacity 4. high oil viscosity 5. wrong pipe connection 6. air sucked into the tube 7. air sucked thru pump oil seal 8. air sucked thru pump cover 9. bubble in the oil tank 10. low oil level 11. vane fails to slip out from the rotor 12. noise from the coupling 13. insufficient oil or air holes blocked 14. excess revolution 15. excess oil pressure 16. bearing wearing 17. cam ring wearing 18. pump cover tighten improperly 19. pump broken	1. suction vacuum should below 200mmhg. 2. clear the filter 3. use a filter with larger capacity. 4. use appropriate oils or a heater. 5. switch the connection 6. tight or replace the tube 7. check the alignment of the pump shaft 8. tight or replace the pump cover 9. check piping arrangements 10. fill oil tank up to min. level 11. repair or replace pump 12. repair or replace coupling 13. fill oil up or clear air holes 14. check the voltage & cycle of power 15. down-adjust oil pressure 16. repair or check pump shaft alignment 17. use new oil 18. tight the cover properly with a spanner 19. repair or replace pump
C: INSUFFI-CIENT OIL	1. no output 2. big suction vacuum causing cavitations 3. cartridge wearing, oil leaking inside 4. pump cover tighten improperly 5. low oil viscosity	1. refer to item A 2. refer to item B 3. repair or replace pump 4. tight the cover properly with a spanner 5. use adequate oil or a heater
D: OIL SEAL LEAKAGE	1. oil seal broken 2. large oil leaking inside	1. replace oil seal 2. repair or replace pump.

2. OIL PRESSURE REGULATOR

I T E M S	C A U S E S	R E M I D I E S
A: EXCESS OR INSUFFICIENT PRESSURE	1. pressure setting inadequate 2. pressure out of control 3. puppet valve seated improperly 4. balance piston malfunctioning 5. spring slacken 6. seats of valve and piston wearing	1. reset adequately 2. inspect pressure gage 3. adjust the spring inside the bolt 4. clear the piston hole 5. replace with a new one 6. replace with a new one
B: UNSTABLE PRESSURE	1. balance piston malfunctioning 2. unstable puppet valve 3. puppet valve wearing abnormally 4. oil immersed with air 5. seat of valve with dust	1. clear the piston hole 2. fix by pressing the guide pin 3. replace with a new valve 4. draw air out 5. refer to item (10)
C: MINOR PRESSURE VIBRATION	1. puppet valve wearing abnormally 2. discharging with air 3. co-oscillating with other valves 4. improper piping on oil tank 5. high oil flow 6. back pressure at outlet	1. replace with a new valve 2. draw air out 3. refer to item (6) 4. repiping 5. replace with a bigger valve 6. use a balance piston

3. REDUCING VALVE

I T E M S	C A U S E S	R E M I D I E S
A: EXCESS OR INSUFFICIENT PRESSURE	1. piston malfunctioning	1. clear the piston hole
B: UNSTABLE PRESSURE	1. piston malfunctioning 2. unstable puppet valve 3. valve wearing abnormally 4. oil immersed with air 5. variation of back pressure during draining	1. clear the piston hole 2. refer to item (2) 3. refer to item (2) 4. draw air out 5. separate oil pipes between valves

4. FLOW VALVE

I T E M S	C A U S E S	R E M I D I E S
A: PRESSURE OFFSET MALFUNCTION	1. piston with dust 2. piston sleeve with dust 3. small difference pressure at inlet & outlet	1. clear the piston hole 2. clear the sleeve 3. min difference should be 10 kg / cm^2
B: TIGHTNESS OF FLOW REGULATING SHAFT	1. regulating shaft with dust 2. high secondary pressure 3. high primary pressure	1. clear the shaft 2. adjust after reducing pressure 3. adjust after reducing pressure

5. DIRECTIONAL VALVE

I T E M S	C A U S E S	R E M I D I E S
A: OIL LEAKING FROM OIL SEAL	1. oil seal broken 2. back pressure at the outlet	1. replace with a new seal 2. the back pressure should be below 0.4 kg / cm^2
B: SLIDING POST MALFUNCTION	1. back pressure at the outlet 2. big angle at the slide post 3. wrong piping between the inlet and outlet	1. ditto to above item 2 2. the angle should be below 30° 3. re-piping
C: SOLENOID VALVE BURNT OUT	1. poor isolation on the coils 2. mag. coils are too high or too low 3. high or low voltage 4. converting pressure too big 5. converting flow too big 6. back pressure at the connecting area of oil tank	1. replace with a new one 2. replace with a new one 3. reset the transformer 4. decrease pressure 5. use a valve with smaller cap. 6. low pressure is 1.0 kg / cm^2 high pressure should be below 7.0 kg / cm^2
D: GUIDE VALVE MALFUNCTION	1. guiding pressure insufficient 2. sliding shaft sticky 3. covered with dust	1. pressure should be above 3.5 kg / cm^2 , & use a check valve 2. clear the shaft 3. clean off the dust

6. CO-OSCILLATION / VIBRATION / NOISE

I T E M S	C A U S E S	R E M I D I E S
A:COOSCILLATION AMONG SPRINGS	1. More than 2 units of valve springs oscillating (such as regulating valve & order valve, regulating valve & check valve)	1. separate the pressure settings 2. change one spring tightness 3. use a remote regulating valve
B:COOSCILLATION BETWEEN SPRING & PIPE	1. Valve spring & pipe oscillating (such as regulating valve, inner tube of pressure gage & pipe, etc)	1. change the spring tightness 2. change the tube length, size, & material. 3. use support for pipes. 4. use resistance on some pipe
C:COOSCILLATION BETWEEN SPRING & AIR	1. Valve spring & air oscillating (such as air in regulating valve & check valve)	1. exhaust air from all pipes
D: VIBRATION ON CYLINDER	1. Air inside cylinder	1. exhaust air 2. packing on cylinder should be coated with grease
E: SOUND OF OIL FLOW	1. Oil flow noise, oil tank & piping oscillating, such as: a. Oil flow from the pressure adjusting valve hit the tank. b. Oil flow impact at a bended area. c. Sound of oil conjunction.	1. replace oil piping. 2. use elbow joint in conjunction. 3. stabilizing oil flow before conjunction.
F:RESONANCE ON OIL TANK	Resonating on oil tank.	1. top of oil tank use a thicker sheet metal. 2. use a rubber pad between the top cover and motor seat. 3. Separate the pump or motor from the oil tank.
G: VALVES SWITCHING SOUND	Switching sound occurred when valves are activated.	1. lower guiding pressure. 2. use throttle valve.
H: PIPING IMPACT SOUND	An impact sound occurred from pipings when valves are activated.	1. replace control valves or pipings, and to low the rapid change of pressure.
I: HITTING SOUND FROM CHECK VALVE	Hitting sound occurred due to back pressure in the secondary of pilot check valve.	1. Eliminate the back pressure of the secondary. 2. Increase the guiding pressure. 3. Use a external relief pilot check valve.

7. INSUFFICIENT OIL FLOW AND PRESSURE

ITEMS	C A U S E S	R E M I D I E S
1.	Pump fails to drain oil.	See item A of 1 (P. 54)
2.	Air is sucked in the pump.	See item C of 1 (P. 54)
3.	Oil pump leaking.	See item A & C of 1 (P.54)
4.	Low pressure was set at the regulating valve and reducing valve.	See item A of 2 (P. 55)
5.	Regulating valve is open.	Close the regulating valve to increase pressure.
6.	Oil pressure in the control valve flow back to the oil tank.	Check all control valves.
7.	Control valve & cylinder leaky.	1. Check all control valves. 2. Check oil viscosity and temperature.
8.	Control valve, cylinder, pump & piping leaky.	See above item G
9.	Wrong setting at the regulating valve.	Correct the settings.
10.	Setting changed at the regulating valve.	Lock the valve tightly.
11.	Malfunction at the regulating valve.	See item A of 2 (P. 55)
12.	Less load & resistance after continuous running.	Decrease valve setting.
13.	Alternation of oil viscosity.	Use a temperature control valve.

8. IRREGULAR MOTION OF HYDRAULIC CYLINDER AND MOTOR

ITEMS	C A U S E S	R E M I D I E S
1.	Air inside oil pipes.	See item 10. (P.59). Drill a ventilation hole at higher position of pipings to exhaust air.
2.	Oil seals of cylinder are too tight.	Loosen oil seals.
3.	Off center between oil seals.	Check the friction resistance under free load condition and align the centers.
4.	Defects inside cylinder due to dust.	Check the friction resistance under free load condition and align the centers.
5.	Slide surface of guiding plate too tight.	Dismantle cylinder and check all items.
6.	Sluggish action due to heavy load.	More lubrication to decrease slide surface.
7.	Malfunction with regulating valve due to dust	See above item 4.
8.	Oscillation between pressure regulating valve and flow regulating valve.	See above item 6.
9.	Large drainage in cylinder and hyd. motor.	Decrease oil drainage and increase pump volume.
10.	Too close setting among valves.	Setting of pressure regulating valve should be 10-15 kgf/cm^2 higher.

9. RISING OF OIL TEMPERATURE

ITEMS	C A U S E S	R E M I D I E S
1.	High pressure in pressure regulating valve.	The appropriate pressure should be set at 10 kgf / cm^2. Setting should not be too high.
2.	Drainage of volume from pressure regulating valve due to high pressure.	Inspect oil pipings.
3.	High drainage of oil due to low oil viscosity or broken pump.	Fix or replace pump and change hydraulic oil.
4.	Insufficient oil inside the oil tank.	Fill up oil tank or use a larger oil tank.

10. INSPECTION OF CONTAMINATED HYD. OILS & TREATMENT

A: AIR (a blurry status will appear when oils merged with air.)		
1.	Joint of oil pipings. (inlet or outlet)	Infuse oil into oil pipe, during pump is running, to check defect area.
2.	From oil seal of pump.	
3.	From side washer of pump.	More air will be sucked in if the suction pressure is too low which should be set below 200 mm / hg.
4.	From external housing of pump.	
5.	From oil seal of piston rod in hyd. cylinder.	
6.	From washer of cylinder cover.	Replace washers.
7.	From air bag of pressure accumulator.	Replace washers.
8.	From washers of all elements.	Use check valve and put all elements below oil surface.
9.	Low level of oil in oil tank.	Fill up oil tank to a higher level.
10.	Oil returning pipe above oil surface.	Put returning pipe below oil surface.
11.	No isolation plate is used to suck air inside oil tank.	Use a isolation plate to avoid air suction.
12.	Wrong hydraulic oil.	Use an appropriate hydraulic oil.
B: WATER (a milky color will appear when oil emerged with water.)		
1.	From the ventilation hole of oil tank.	Replace oil when a milky color appear on the oil surface.
2.	From the piping of coolant unit.	Fix or replace the coolant unit.
3.	From the oil tank cover.	The oil tank cover must be airtight.
C: SOLID MATERIALS		
1.	Metal ships or dust during assembly.	Clean oil tank thoroughly after assembly.
2.	Oil seal or rubber dust in piping.	Check the fitting of the oil seals.
3.	From the gap of tank cover.	The oil tank cover must be air tight.
4.	From the ventilation hole of oil tank.	Use an air filter on the ventilation holes.
5.	Wearing of pump and valves.	Use a magnetic plug to magnetize metal chips or carbon materials.
6.	Detachment of inside coating of oil tank.	Use an oil resistance paint.
D: GLUE OR STICKY MATERIALS		
1.	Washers resolved in oil.	Use a high quality washers instead.
2.	Inside coating of oil tank.	Use an oil resistance paint.
3.	Oil seal from the piping.	Notice the fitting of oil seals.
4.	Deterioration of oil.	Use anti-oxidation oil which temperature should be below 55℃.

11. SOLENOID VALVES

ITEMS	C A U S E S	R E M I D I E S
MALFUNCTIONING.	1. Slide shaft fails to return to the original position due to poor spring. 2. Malfunctioning of slide shaft and sluggish motion. 3. Nut was over tighten, or valve body is deformed. 4. Malfunction in electrical system.	1. Replace springs. 2. Clean the inside of valves and oil tank. Check and replace oil filter, oil and slide shaft if necessary. 3. Loosen the nut slightly. 4. Poor connection in the terminal. Replace the valve in case of burnout.
COILS NOISE & BURN	1. Wrong overload voltage. 2. Covered with dust. 3. Coils defective, wearing or burnt out.	1. Check the voltage and use an adequate coils. 2. Clean off the dust. 3. Fix or replace coils.
INTERNAL LEAKAGE	Oil seals damaged.	Replace oil seals.
EXTERNAL LEAKAGE	Nut loosened.	Tight the nut. (Replace oil when it appears with milky color.)

12. ADEQUATE & LIMIT TEMPERATURE

100℃	Harmful temperature.	Strictly prohibited to use.
80℃		
65℃	Limit temperature.	May shorten oil life. Use an coolant unit to maintain low temperature.
55℃	Careful temperature.	
45℃	Safety temperature.	The most appropriate temperature when oil has the best performance and longest life.
30℃	Ideal temperature.	
20℃	Normal temperature.	Workable but low efficiency.
0℃	Low temperature	High viscosity that may cause slow oil flow.