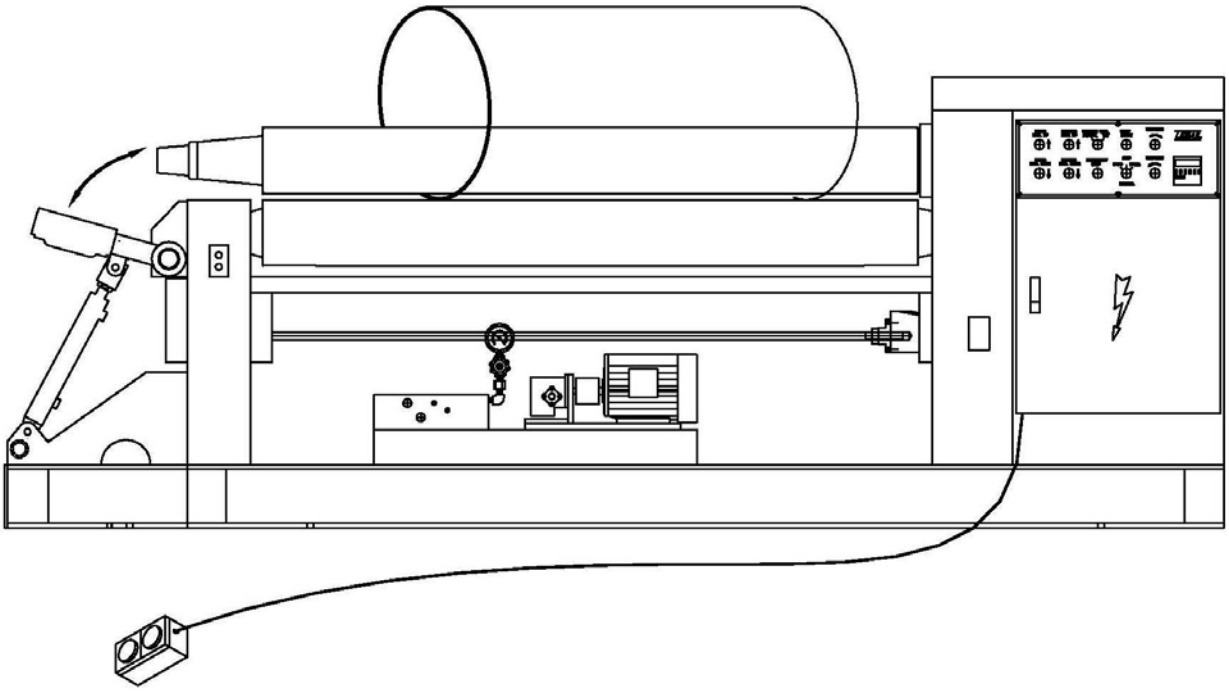
LEMAS®

INITIAL PINCH ROLL

OPERATION MANUAL

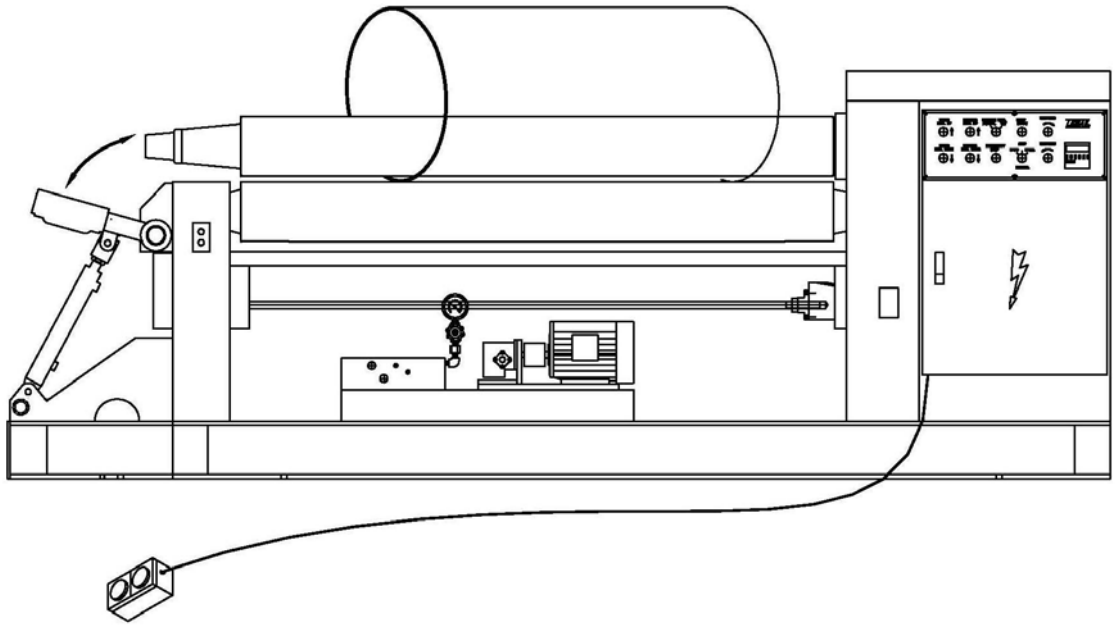


Power Machinery Pty Ltd

1 Dympna St., Dee Why West, NSW Australia
TEL: 02-99711755
FAX: 02-99710190
E-MAIL: info@powermachinery.com.au
INTERNET: www.powermachinery.com.au

INITIAL PINCH ROLLS

Model:	LHF-403E
Capacity:	3 x 1270 mm
Serial No.:	3191084
Mfg. Date:	Nov. 2013



INDEX

Chapter 1 - FORWARD 1-1

A. Safety Rules 1-2

B. Cautions 1-3

Chapter 2 - SPECIFICATION & ACCESSORIES 2-1

A. Specification 2-1

B. Accessories 2-4

C. Bending Capacity 2-4

Chapter 3 - INSTALLATION 3-1

A. Installation Area 3-1

B. Lifting 3-1

C. Leveling 3-2

Chapter 4 - PREPARATION FOR START-UP 4-1

A. Unloading 4-1

B. Cleaning 4-2

C. Filling Of Hydraulic Oil 4-2

D. Lubrication 4-2

E. Connect Main Power 4-3

Chapter 5 - MACHINE DESCRIPTION 5-1

Chapter 6 - CONTROL SYSTEM 6-1

A. Control Panel 6-1

B. Drop End 6-1

C. LED Readout 6-3

D. Safety Device 6-6

Chapter 7 - OPERATION 7-1
A. Pre-bending procedures of a profile edges: 7-1
B. Circular Rolling 7-2
C. Welding 7-3
D. Removal of profile 7-4
E. Tilt of rear bottom roll-- Cone Bending 7-4
F. Drop End Adjustment 7-6
Chapter 8 - LUBRICATION 8-1
A. Hydraulic Oil 8-1
B. Grease 8-2
C. Operation Oil 8-2
Chapter 9 - TROUBLE SHOOTING 9-1
Chapter 10 - WARRANTY 10-1
Chapter 11 - APPENDIX 11-1
A. Illustration & Part List 11-1
B. Hydraulic System Diagram & Part List 11-5
C. Electric System Diagram & Part List 11-9
D. Periodic Check 11-12

Chapter 1 - FORWARD

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 employees, 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.

Now we focus on the field of fabricating machinery; we manufacture Hydraulic Plate Bending Rolls, Hydraulic Section Bending Rolls, Power Plate Bending Rolls, Hydraulic Brakes, Hydraulic Shears, Hydraulic Notcher, 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 and 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.

Chapter 2 - SPECIFICATION & ACCESSORIES

A. Specification

unit: mm

Models	LHF-303E	LHF-402E	LHF-501E
Bending capacity mm	3 x 910	2 x 1270	1.5 x 1550
Top roll diameter mm	80	80	80
Bottom roll diameter mm	80	80	80
Min. bending diameter mm	135	135	135
Drive motor	2hp	2hp	2hp
Hyd. Motor	½hp	½hp	½hp
Machine weight kg	790	810	920
Machine size (L x W x H) mm	2760x1090x1160	2760x1090x1160	3060x1090x1200

Models	LHF-403E	LHF-502E	LHF-404E
Bending capacity mm	3 x 1270	2 x 1550	4 x 1270
Top roll diameter mm	100	100	120
Bottom roll diameter mm	100	100	120
Min. bending diameter mm	170	170	200
Drive motor	2hp	2hp	2hp
Hyd. Motor	½hp	½hp	1hp
Machine weight kg	1000	1100	1250
Machine size (L x W x H) mm	3060x1090x1200	3030x1100x1330	1770x900x1000

unit: mm

Models	LHF-503E	LHF-602E	LHF-407E
Bending capacity mm	4 x 1550	2 x 1850	7 x 1270
Top roll diameter mm	120	120	160
Bottom roll diameter mm	120	120	160
Min. bending diameter mm	200	200	270
Drive motor	2hp	2hp	3hp
Hyd. Motor	1hp	1hp	2hp
Machine weight kg	1400	1600	1750
Machine size (L x W x H) mm	2070x900x1000	2570x900x1000	2930x1000x1100

Models	LHF-506E	LHF-605E	LHF-803E
Bending capacity mm	6 x 1550	4.5 x 1850	3 x 2450
Top roll diameter mm	160	160	160
Bottom roll diameter mm	160	160	160
Min. bending diameter mm	270	270	270
Drive motor	3hp	3hp	3hp
Hyd. motor	2hp	2hp	2hp
Machine weight kg	1930	2180	2460
Machine size (L x W x H) mm	3080x1000x1100	3730x1000x1100	4230x1180x1500

Models	LHF-409E	LHF-508E	LHF-607E
Bending capacity mm	9 x 1270	8 x 1550	7 x 1850
Top roll diameter mm	180	180	180
Bottom roll diameter mm	180	180	180
Min. bending diameter mm	310	310	310
Drive motor	5hp	5hp	5hp
Hyd. motor	2hp	2hp	2hp
Machine weight kg	2090	2290	2680
Machine size (L x W x H) mm	2785x1050x1150	3085x1050x1150	3585x1050x1150

SPECIFICATION & ACCESSORIES

Models	LHF-805E	LHF-1004E	LHF-414E
Bending capacity mm	5 x 2450	4 x 3050	14 x 1270
Top roll diameter mm	180	180	200
Bottom roll diameter mm	180	180	200
Min. bending diameter mm	310	310	340
Drive motor	5hp	5hp	5hp
Hyd. Motor	2hp	2hp	3hp
Machine weight kg	2980	3500	2940
Machine size (L x W x H) mm	4085x1050x1150	4685x1050x1150	3000x1140x1240

Models	LHF-512E	LHF-610E	LHF-808E
Bending capacity mm	12 x 1550	10 x 1850	8 x 2450
Top roll diameter mm	200	200	200
Bottom roll diameter mm	200	200	200
Min. bending diameter mm	340	340	340
Drive motor	5hp	5hp	5hp
Hyd. motor	3hp	3hp	3hp
Machine weight kg	3220	3630	4050
Machine size (L x W x H) mm	3300x1140x1240	3850x1140x1240	4300x1140x1240

Models	LHF-1006E		
Bending capacity mm	6 x 3050		
Top roll diameter mm	200		
Bottom roll diameter mm	200		
Min. bending diameter mm	340		
Drive motor	5hp		
Hyd. motor	3hp		
Machine weight kg	4560		
Machine size (L x W x H) mm	4950x1140x1240		

B. Accessories

Standard Accessories:

- Electrical box
- Remote hand switch
- LED readout
- Tool box with adjusting tools
- Hydraulic system
- Standard hardened rolls
- Operation manual

C. Bending Capacity

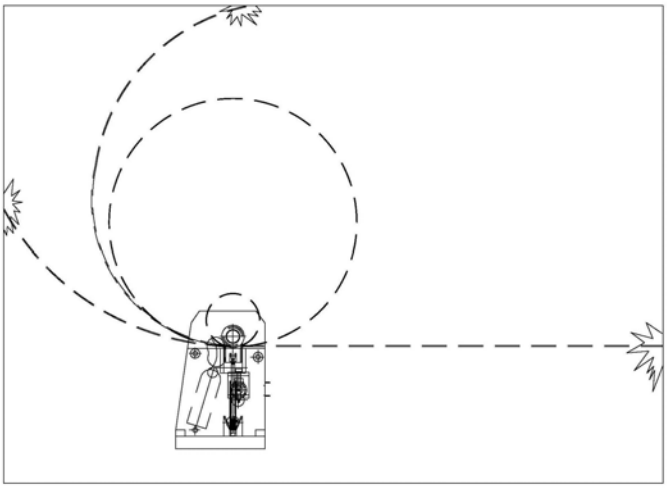
1. The pre-bending straight edge is of 2.5 times of the profile thickness.
2. The minimum bending diameter is of 1.7 times of the top roll diameter.
3. When bending diameter of a profile that is of 5 times of the top roll diameter, the bending capacity will increase as much as 1.35 times of the profile thickness.

Chapter 3 - INSTALLATION

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 that has sufficient lighting and surrounding clearance at least one meter above. During erection, the machine must be anchored & bolted properly. Level the machine with a spirit level.

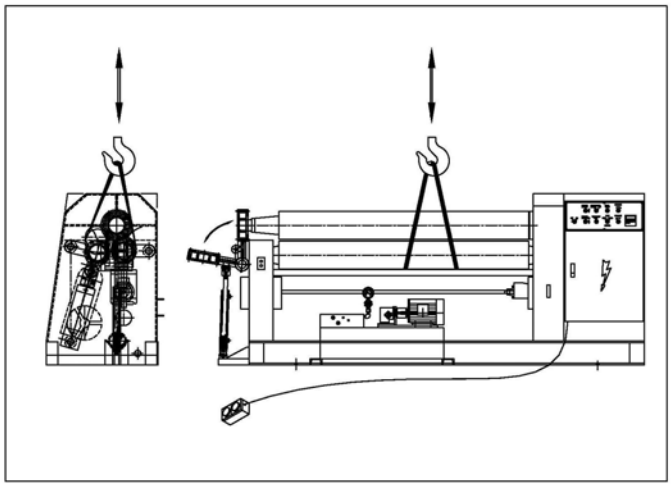
Fig. 3-1



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 kgs, 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 erection, level the machine in both directions with a spirit level.

Please note it is most important that the machine is erected without any inclination.

Chapter 4 - PREPARATION FOR 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.

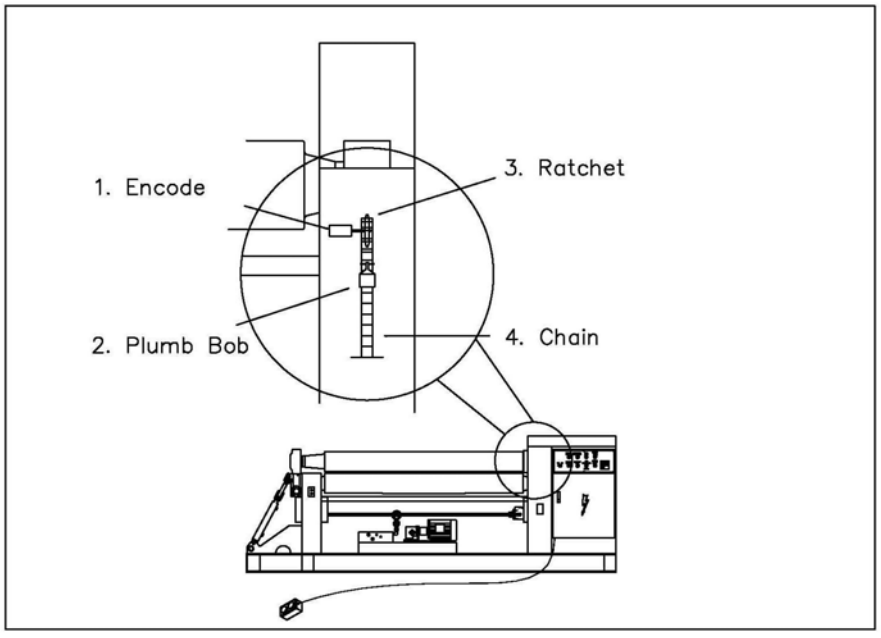
To facilitate space allocation during transportation, there may be some parts or accessories to be packed separately. Check each part carefully and notify the manufacturer or its distributor immediately should there be any parts missing. Connect and install parts as following procedures:

a. Connect the oil pipes to the machine, and motor wires to the elec. box.

b. There's a couple of encoding device fitted on cylinder inside the head stock. Each device consists of encoder, chain, ratchet, and plumb bob. (Details see below drawing.)

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, or the LED Display will function improperly.

Fig. 4-1



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 Of Hydraulic Oil

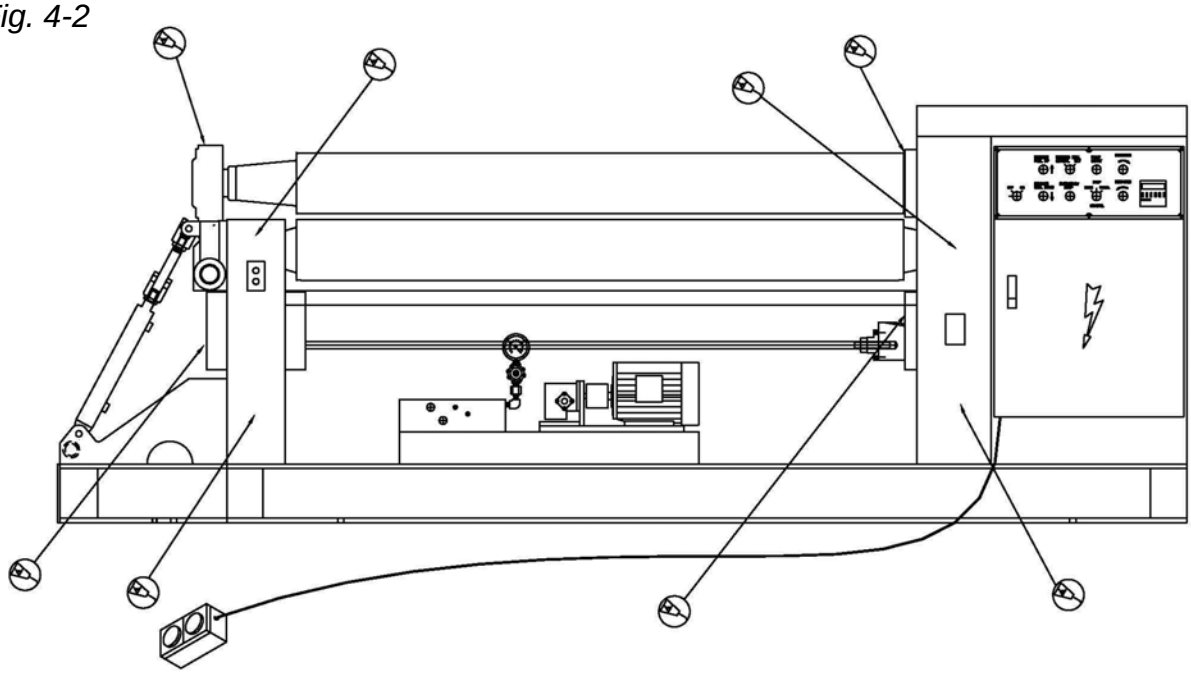
Fill the oil tank with hydraulic oil or its equivalent to the top level of the oil sight gage. Please refer to page 48 for the category of oils. In addition, the following oils are recommended for selections.

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

D. Lubrication

To ensure machine accuracy and to lengthen machine life, all turning or moving parts are lubricated or greased. Use appropriate grease or lubricant for sufficient lubrications.

Fig. 4-2



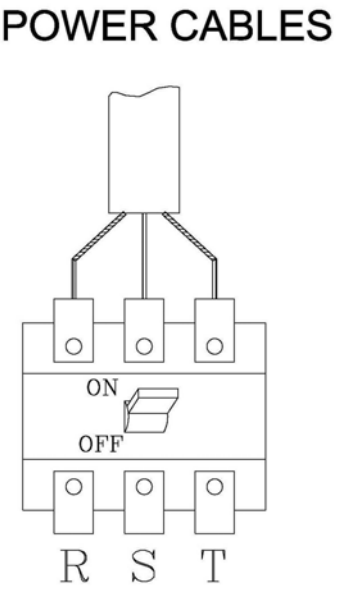
E. Connect Main Power

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.

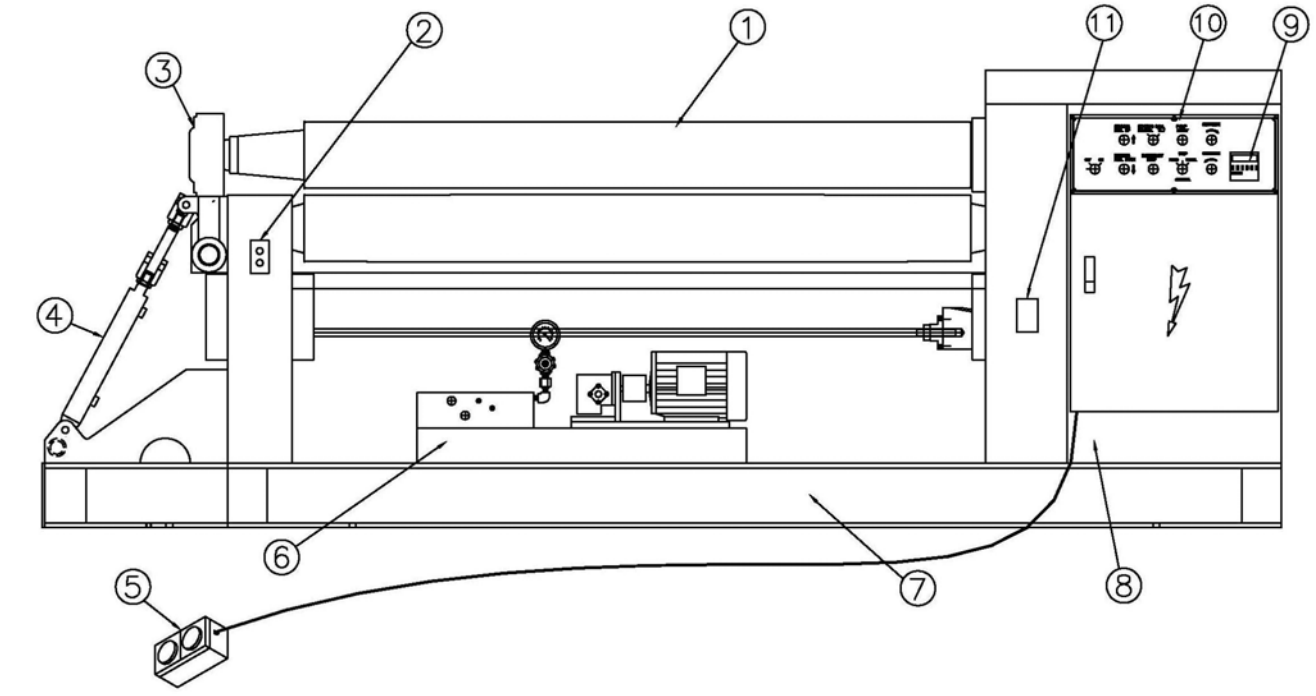
NOTE: ***In case the rotation of the motor is not correspondent to the mark indicated by a Red Arrow outside the motor case, switch any of the two power cables R.S.T. to change over the rotation*.**

Fig. 4-3



Chapter 5 - MACHINE DESCRIPTION

Fig. 5-1

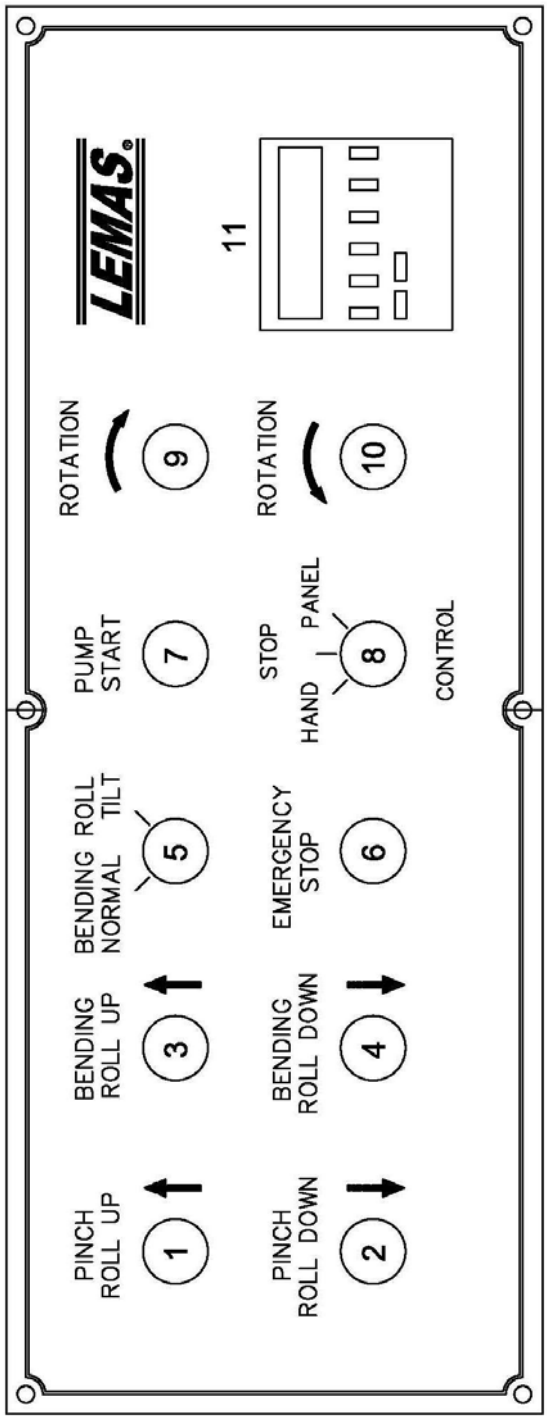


ITEM	DESCRIPTIONS		ITEM	DESCRIPTIONS
1.	Roll		7.	Machine base
2.	Drop end switch		8.	Chain drive assembly
3.	Drop end		9.	LED readouts
4.	Drop end cylinder		10.	Emergency stop button
5.	Hand controller		11.	Thickness gage
6.	Hydraulic system			

Chapter 6 - CONTROL SYSTEM

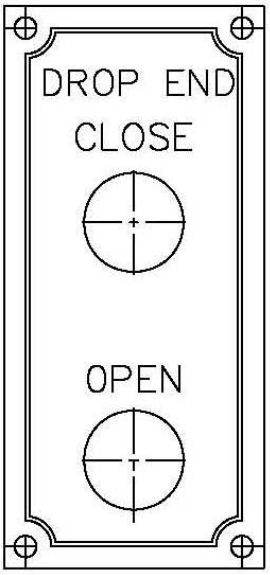
A. Control Panel

Fig. 6-1



B. Drop End

Fig. 6-2



Control Panel

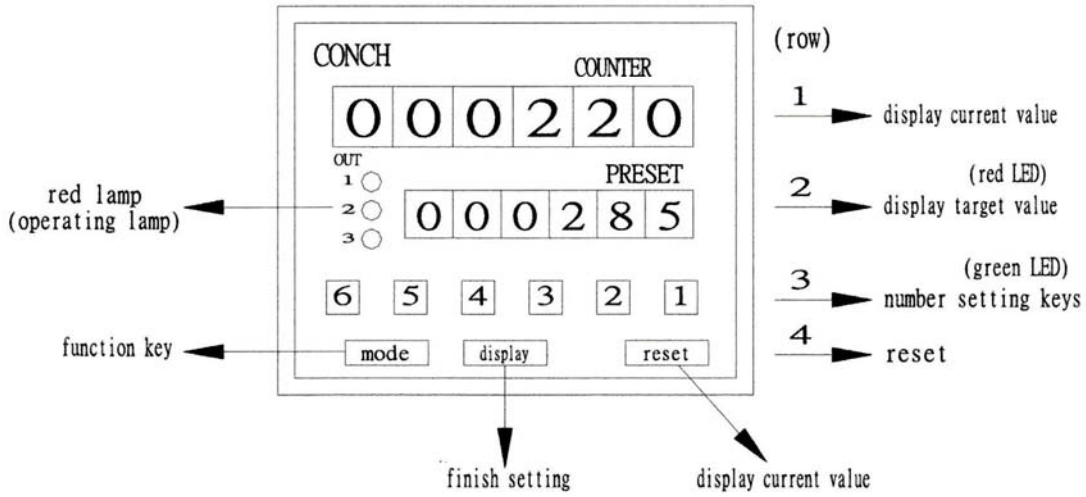
NO.	PART	DESCRIPTION
1.	Pinch roll up	Press to move the pinch roll up.
2.	Pinch roll down	Press to move the pinch roll down.
3.	Bending roll up	Press to move the bending roll up.
4.	Bending roll down	Press to move the bending roll down.
5.	Bending roll (normal)	Bending roll moves parallel up / down.
	Bending roll (tilt)	Move one side of the bending roll to get tilted for conical bending.
6.	E.M. stop switch	Press to stop all movements. Release before restart.
7.	Pump start	Push to start hydraulic system.
8.	Hand	Rolls rotation activated by hand control switch. Push to start and release to stop.
	Stop	Rolls stop rotation.
	Panel	Rolls rotates constantly till switch turned to stop position
9.	Roll rotation CW	Rolls rotate clockwise.
10.	Roll rotation CCW	Rolls rotate counterclockwise.
11.	LED readouts	To display the bending roll position, and the preset value is its highest limit position.

Drop End

NO.	PART	DESCRIPTION
1.	CLOSE (OFF)	Push to close the end yoke after profile is removed from the top roll.
2.	OPEN (ON)	Push to open the end yoke to remove the profile from the top roll.

C. LED Readout

This display unit is fitted to indicate the position of the back bottom roll, and to present its highest position.



Red lamp: When the present value is reached, the red lights up. (When the digital numbers on the display stop jumping, the low shaft can be raised no more, but is possible to go downward.)

The setting procedures for LED Display Unit:

Procedures	LED displays	Remarks
Current setting values	0 0 0 2 2 0	The digits on the display jump when we' re going to change the target value.
1. Press number setting keys dividedly (the 3rd row)	2 8 5	After pressing keys, the target value shows (value becomes blinking)
2. Release key (the 3rd row)	3 9 6	The digits input are saved after 3 seconds. (the 2nd row) (3 9 6 target value)

Notes:

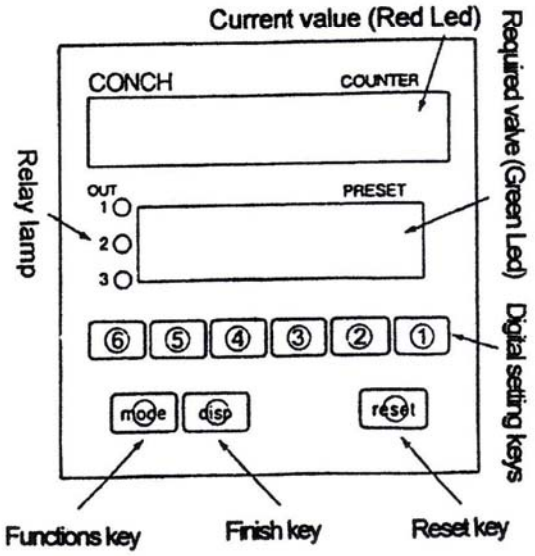
a. The highest position setting; base on a principle of not spoiling the upper roll. (1 point equals to about 0.48mm)
b. The front 3 number is "0" are not used.
c. The present values are only for reference.
d. The machine can be operated under the target value is bigger than the current value. (If the target value is 0 or less than current value, the rolls could not go upward.)

INSTRUCTION OF LED DISPLAY

■ Specifications:

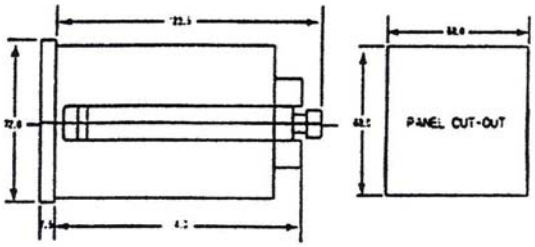
Model No.	CA-61K
Display range	-99999 - 99999
Setting range	1-999999
Display size	Count LED 0.4" Preset LED 0.3"
Input signal mode	Contact input:25hz Non-contact input:3khz
Output system	1 relay output
Output hold time	0.1-9.9 seconds (variable)
Reset system	External, Manual, Auto
Input signal	High level 4-30V Low level 0-3V
Power failure memory	EP Rom valid 10 years
Signal power source	12VDC
Power supply	110V / 220V / 50C / 60C
Power consump	5.5VA
Operating temperature humidity	-10 - 50℃, 35-85% RH
Size	72 x 72 x 145mm

■ Panel descriptions:



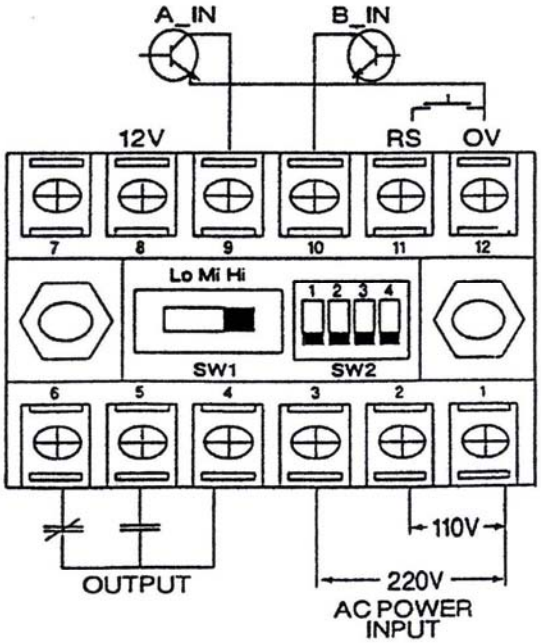
■ Digital setting key:
There are 6 keys at the bottom of the panel representing respectively ones, tens, hundreds, thousands, ten thousands, hundred thousands. Press the keys to set the required value. The number displayed will blinks for 3 sec to signal the finish of setting. The number jumps if the key is pressed constantly.

■ External dimension:



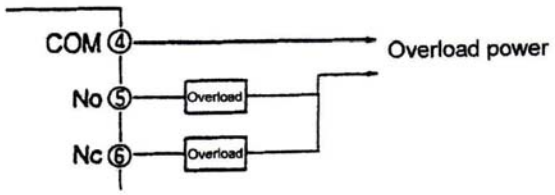
Unit: mm

■ Terminal connection:



■ Signal input:
Terminal A-in, B-in, Rs input are of NPN input. (no voltage input)

■ Relay connection:



■ Mode key:

mode: selecting functions

(1) tr : relay action, hold time ranging 0.1-9.9 secs.

(2) SCL : magnification setting ranging 0.0001-99.9999

(3) Pnt : decimal point setting

■ Disp key:

Press this key to end setting. Auto end setting will be executed if no further keys are pressed within 3 seconds.

Setting	
Required value	888888 (6 5 4 3 2 1)
tr	mode → tr → 0 0 (2 1)
SCL	mode → mode → tr → SCL → 00.0000 (6 5 4 3 2 1)
Pnt	mode → mode → mode → tr → SCL → Pnt

■ Reset key:

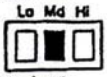
Press this key to clear all settings.

■ SW1 Input frequency switch:

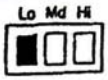
SW1-Hi:signal w/o wave capacitor. Frequency can be high up to 3khz.



SW1-Md:signal with wave capacitor. Frequency can be high up to 300hz.



SW1-Lo:signal with wave capacitor. Frequency can be high up to 25 hz.



■ SW2 switch:

1. Mode key will not work when the switch SW_2-1 is on which will work only when SW_2-1 is off. Keep the SW_2-1 "on" after setting to prevent any human error.

2. Relay return N.R.C.

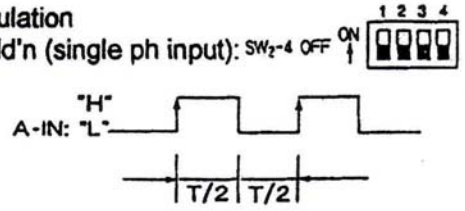
a. N: MANUAL
The relay is "on" when the calculating value is same as setting valve. The calculating value jumps till manual return when the relay return and the calculating valve become "0".

b. R: RETURN
The relay is "on" when the calculating value is same as setting valve. The calculating value jumps till T time is set when the relay returns and calculating value become "0".

c. C: CONTINUE
The replay is "on" when the calculating valve equals the setting value. The calculating value jumps till T time is set when the relay returns.

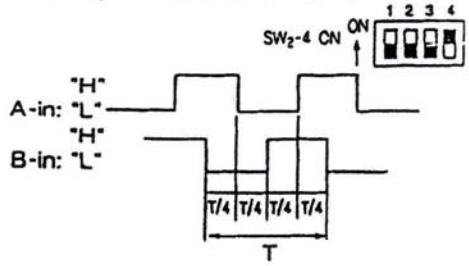
3. Calculation

a. Add'n (single ph input): SW_2-4 OFF ON



B-in: function as GATE (Signal input hold)

b. Add & sub (90° differential input)



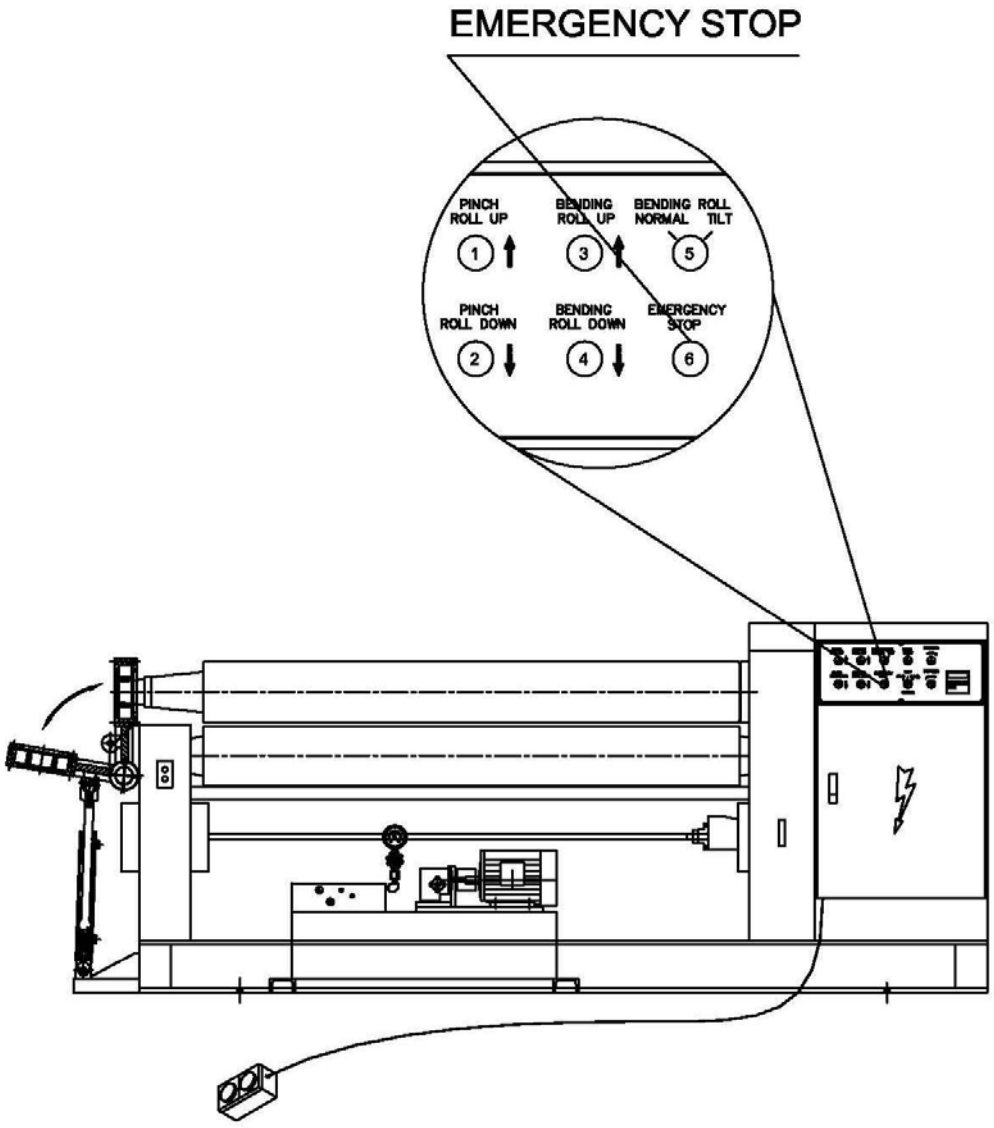
This calculation usually goes with an encoder, or with two sensors. Please note the differential must be 90°

NOTE: To change calculation mode, power must be restarted.

D. Safety Device

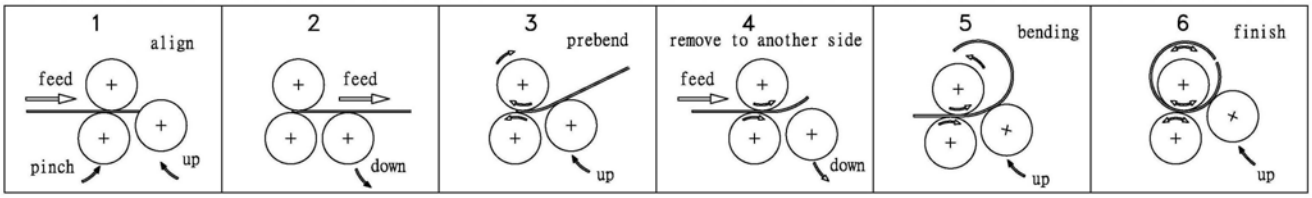
An emergency stop button switch is furnished as standard to guard against any possible rolling of operator's body. All movements and hydraulic system will be shut off once the device is depressed. Releases to restart operation.

Fig. 6-4



Chapter 7 - OPERATION

a. Before operating this machine, the operator must understand and test all functions of the switches on the control panel, and prepare a template for profile inspection after bending.
b. Connect the power source to the electrical box and turn the switch to “on” position.
c. Place the hand remote 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.
d. Check the End Yoke is secured; if not, all rolls will not rotate.



A. Pre-bending procedures of a profile edges:

1. Adjust the pinch between the top roll and bottom roll with thickness gage which is supplied as standard to facilitate pre-bending.
2. Place the profile edge in horizon to the rolls. (Fig. 7-1)

Fig. 7-1

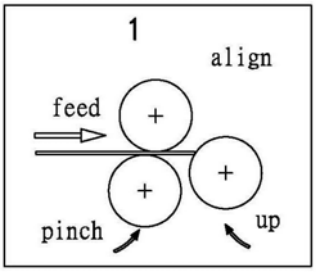
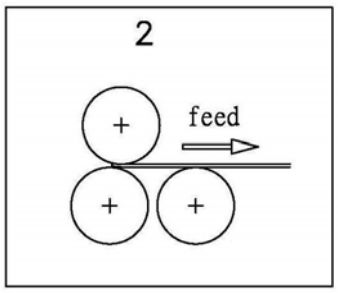


Fig. 7-2



3. Turn the selection switch “hand-stop-panel” to “panel” position.
4. Press the “pinch roll up” switch to move the pinch roll up to pinch one end of the profile (Fig. 7-1). Then press the “bending roll up” switch to move the bending roll up to act as a gauge for parallel alignment (Fig. 7-1) and press rotation for feeding the profile (Fig. 7-2).
5. Push the “rotate c.w.” button switch to feed the profile.
6. Push the “rotate c.c.w.” button switch to extract the profile.
7. Push the “bending roll up/down” button switches to control the bending diameter.

Fig. 7-3

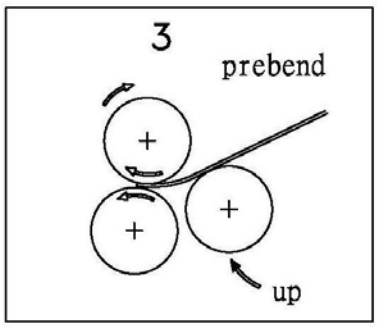
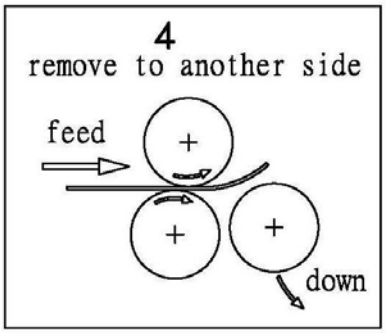


Fig. 7-4



◎ The LED readout on the control panel can be used during pre-bending or bending, which will give an approximately position for the bending roll. Jog down the positions for future reference.

B. Circular Rolling

1. Adjust the three rolls in triangle position after pre-bending. Feed the profile thru the top roll or bottom rolls for bending and ends connection (Fig. 7-6).
2. The "roll rotate c.w." or "roll rotate c.c.w." switches allow the profile go thru the rolls back & forth. Press the "roll up" switch simultaneously to elevate the rear bottom roll for bending till both ends of profile are met (Fig. 7-8). Overlap connection is prohibited.
3. Fix the connected ends of profile firmly by welding.

Fig. 7-5

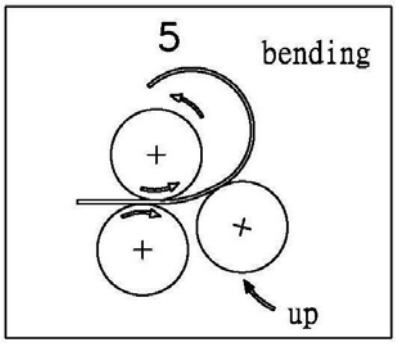
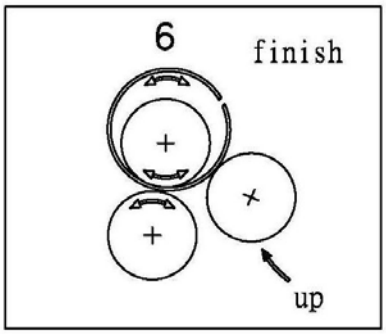


Fig. 7-6



C. Welding

To avoid any damage on the LED display, ball bearings, and other sensitive electrical components, connect the “negative” line to the profile (Fig. 7-7) before welding is made.--*It is strictly prohibited to connect the “negative” line to the machine (Fig. 7-8).*

Fig. 7-7

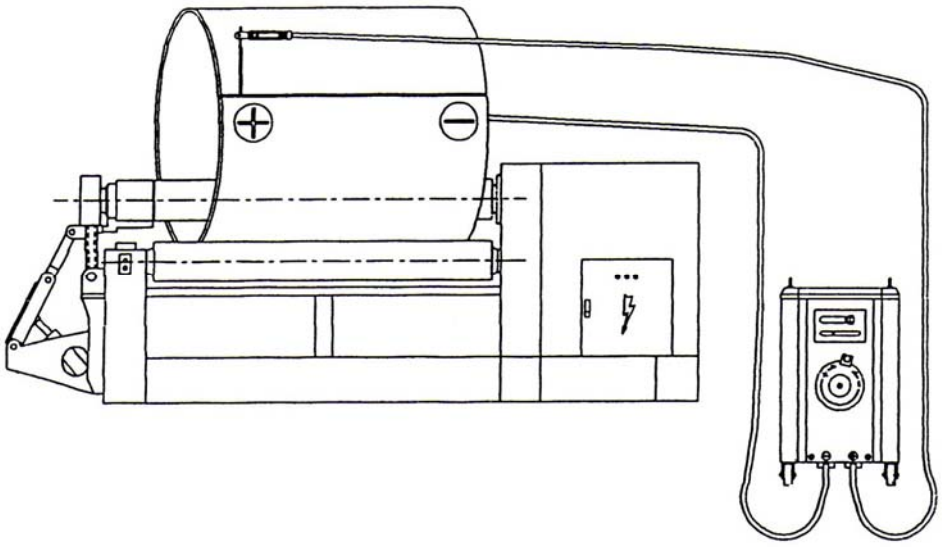
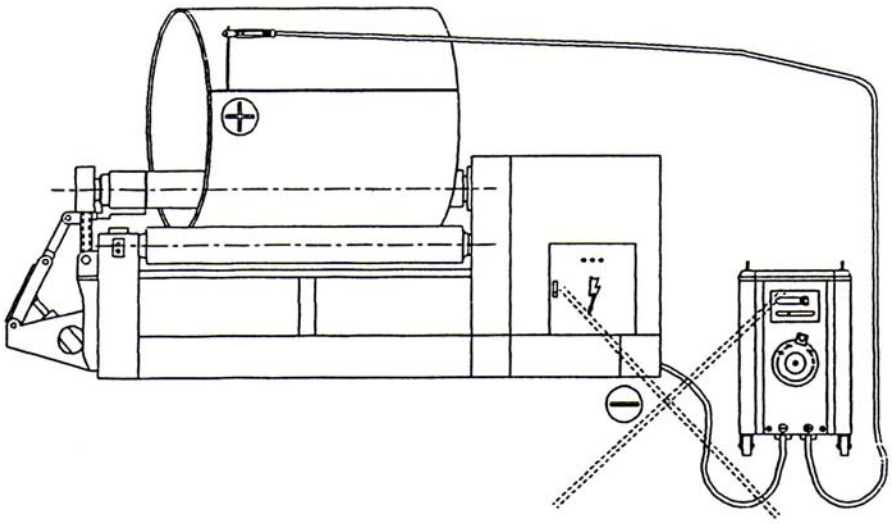


Fig. 7-8



D. Removal of profile

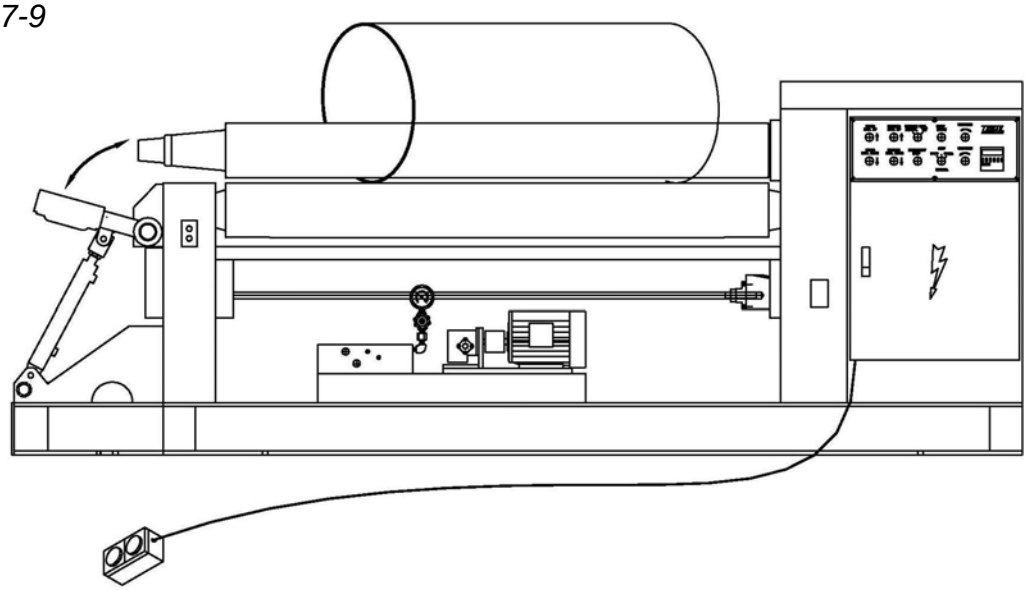
a. Press the drop end switch “open” to open the drop end.

b. Remove the profile from the top roll.

c. Press the drop end switch “close” to close the drop end.

◎ ***Be alert not to hit the top roll while removing the profile. The drop end must be secured firmly, or all rolls will not rotate.***

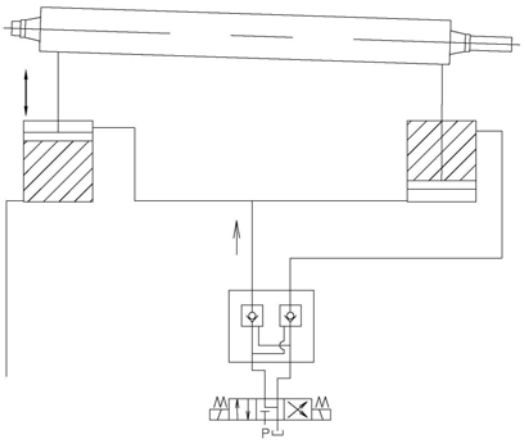
Fig. 7-9



E. Tilt of rear bottom roll-- Cone Bending

Working principle: by pressing “rear bottom roll up & down” switches to start hydraulic pump which will supply oil to the oil tank of elevating cylinder. Move the roll up to perform conical bending or adjustment.

Fig. 7-10



i. Adjustments

1. Adjust the rear bottom roll in decline or horizon.
2. If you want the end of the rear bottom roll to be tilted, press the “roll up” switch to pump more hydraulic oil to the oil tank of cylinder. Press the “roll down” switch to move the bottom roll in horizon position when the hydraulic oil flows back to the hydraulic tank.
3. Check the positions of all rolls with a caliper or thickness gage if an equal pinch is obtained. If not, move the rolls respectively up & down till and equal pinch is gained.

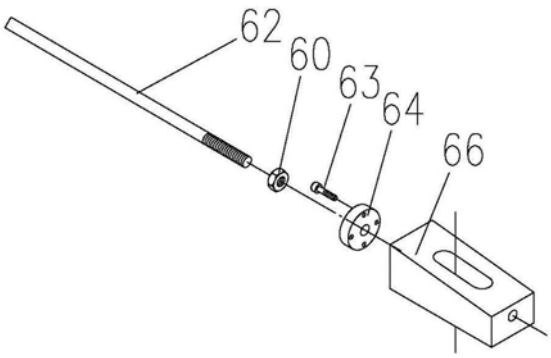
ii. Remarks

For cone bending, install the cone bending attachment before adjusting the bottom roll pinch. 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.

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.

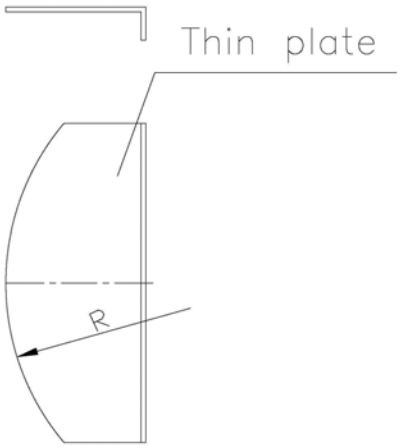
To bend in a normal way, reverse the aforesaid procedures and turn the coupler (No.64) clockwise for two circles.

Fig. 7-11



4. 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.
5. Prepare a batten made out to the radius shape of profile (Fig. 7-12) to check the profile during bending.
6. Based on the cone center, draw 12 equal lines on the profile for inspection during bending which will allow a faster processing.

Fig. 7-12



F. 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.--The rolls fail to rotate in case the drop end is not firmly closed.
2. Press the switch "close" to close the end yoke and see if the limit switch, fitted below the drop end, is touched. If not touched, just adjust the screw till the switch is touched and rolls turn.
3. The hand control switch is good only for intermittent turning while the manual push button switch is available for continuous turning and jogging.

Chapter 8 - LUBRICATION

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 switch any two of the 3 power cables (R.S.T.). Remember to place the machine in an area

Item / Brand	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.

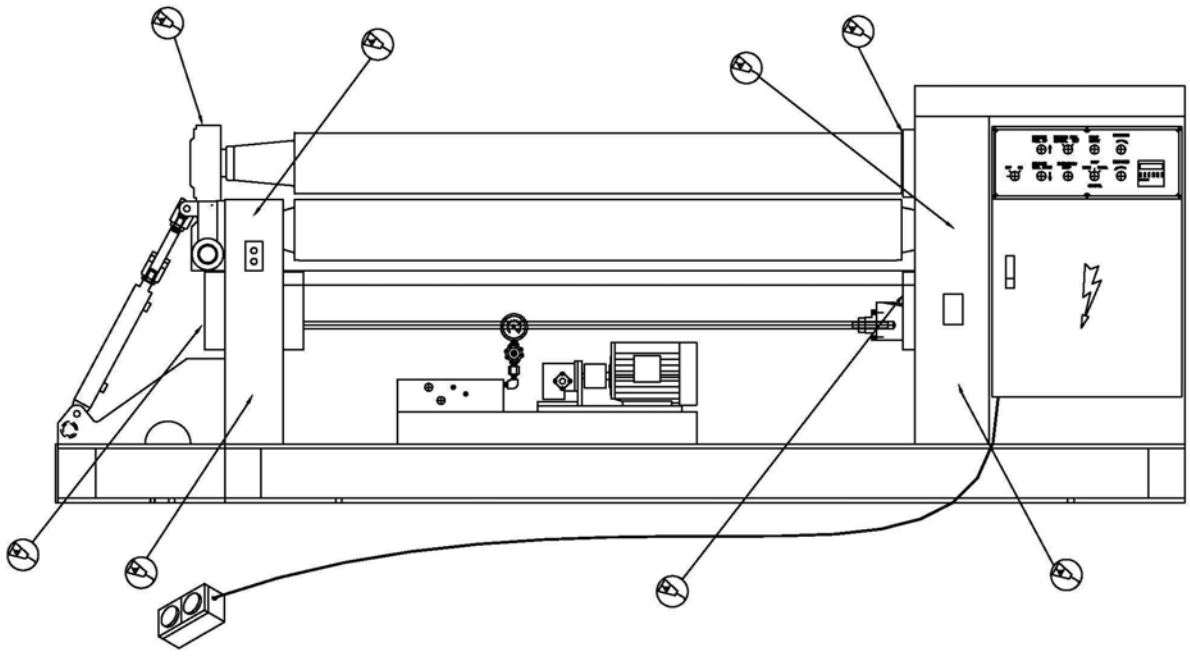
Brand / Oil	ESSO	MOBIL	SHELL
GREASE	BEACON 2	MOBILUX 2	ALVANIA 2

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.



Chapter 9 - TROUBLE SHOOTING

A. An abnormal sound is raised during operation: stop operation immediately and check if there's any oil-leaky. 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, turn the hex bolt located at the end yoke to lower the bottom roll and to remove the profile (P.10-1, Fig. 14). Or the drive belt of motor (1/4hp) is loosened. Tighten it.

D. Bottom rolls can't be elevated: check the LED display on control panel for the position of the bottom rollers, 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.

Chapter 10 - 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.

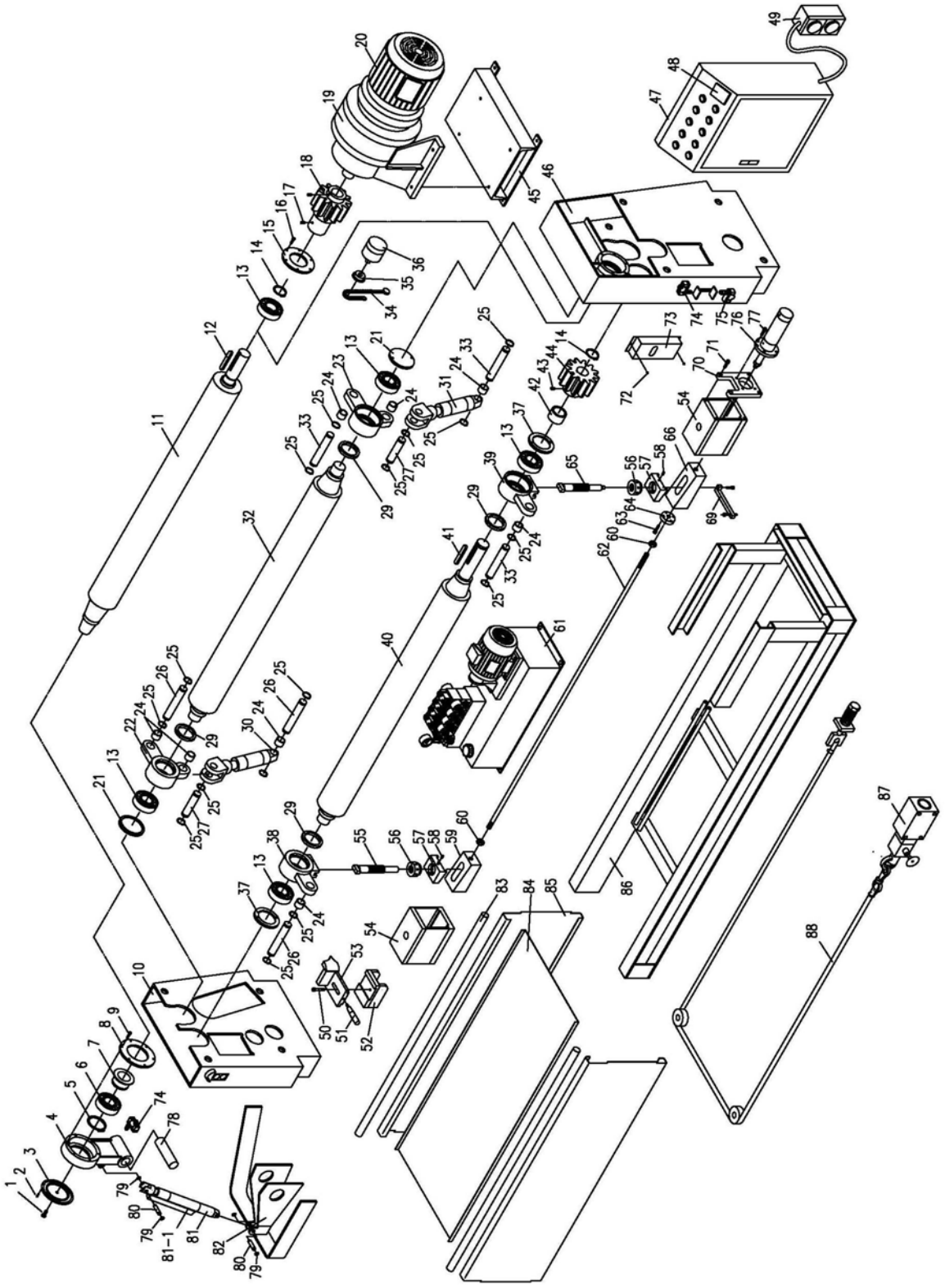
All machines are built with one year warranty which commences from the date of installation or 14 months from the date of shipment. All parts will be supplied free of charge if the problem is occurred due to manufacturing defects.

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 affected by act of God or force damage.

Chapter 11 - APPENDIX

A. Illustration & Part List



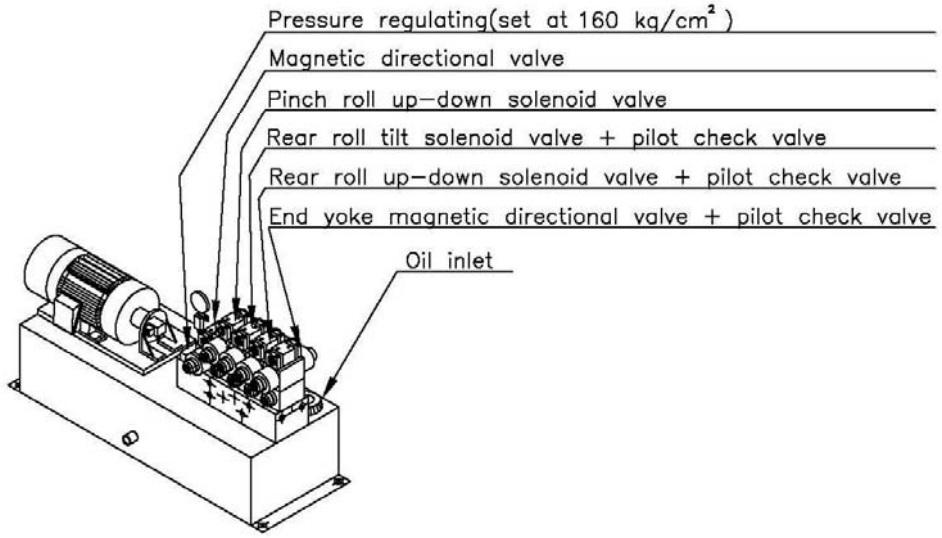
PARTS LIST

ITEM	PARTS	Q'TY	REMARKS
1.	Hex head screw	1	
2.	Socket head screw	3	
3.	External cover	1	
4.	Front cover	1	
5.	Snap ring	1	
6.	Ball bearing	1	
7.	Front cover bushing	1	
8.	Bushing cover	1	
9.	Socket head screw	6	
10.	Left support	1	
11.	Top roll	1	
12.	Key	1	
13.	Bearing	5	
14.	Snap ring	2	
15.	Bushing cover	1	
16.	Socket head screw	6	
17.	Headless screw	1	
18.	Driving gear	1	
19.	Speed reducer	1	
20.	Brake motor	1	
21.	Bushing cover	2	
22.	Bushing	1	
23.	Bushing	1	
24.	Collar	6	
25.	Snap ring	16	
26.	Pivot	3	
27.	Coupling pivot	2	
29.	O-ring	4	
30.	Elevating cylinder	1	
31.	Elevating cylinder	1	
32.	Rear roll	1	

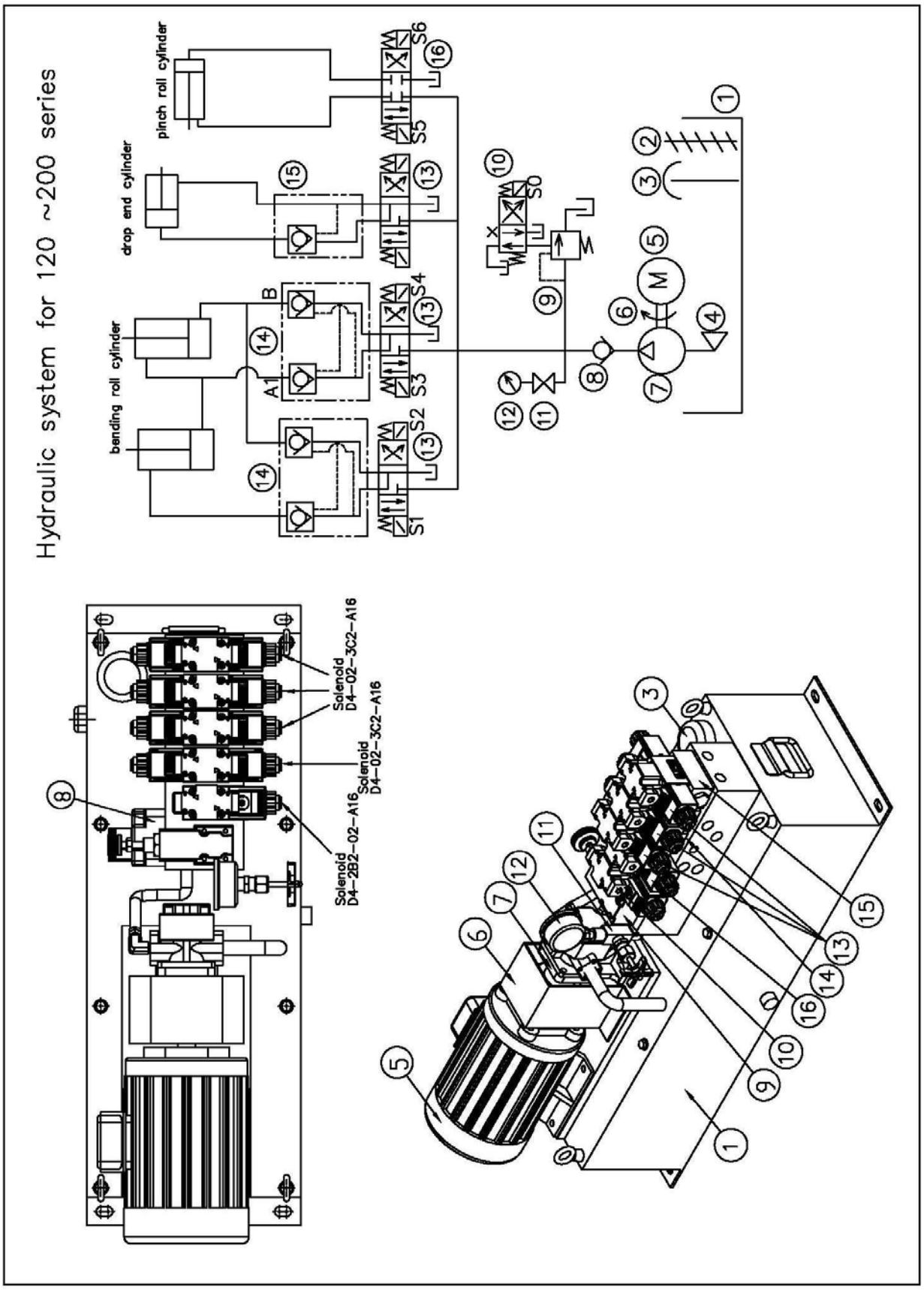
ITEM	PARTS	Q'TY	REMARKS
33.	Pivot	3	
34.	Driving chain	1	
35.	Sprocket	1	
36.	Encoder	1	
37.	Bushing cover	1	
38.	Bushing	1	
39.	Bushing	1	
40.	Bottom roll	1	
41.	Key	1	
42.	Collar	1	
43.	Headless screw	2	
44.	Driving gear	1	
45.	Motor seat	1	
46.	Right support	1	
47.	Control box	1	
48.	LED readout	1	
49.	Hand control unit	1	
50.	Socket head screw	1	
51.	Handle	1	
52.	Bracket	1	
53.	Thrust plate	1	
54.	Gib box	2	
55.	Link screw	1	
56.	Screw nut	2	
57.	Screw seat	2	
58.	Headless screw	2	
59.	Taper block	1	
60.	Lock nut	2	
61.	Hydraulic tank	1	
62.	Connecting rod	1	
63.	Socket head screw	4	

ITEM	PARTS	Q'TY	REMARKS
64.	Coupling	1	
65.	Link screw	1	
66.	Taper block	1	
69.	Switch bracket	1	
70.	Cylinder bracket	1	
71.	Socket head screw	4	
72.	Socket head screw	2	
73.	Limit switch cover	1	
74.	Limit switch	2	
75.	Limit switch	1	
76.	Cylinder	1	
77.	Socket head screw	4	
78.	Pivot	2	
79.	Snap ring	4	
80.	Cylinder pivot	2	
81.	Drop end cylinder	1	
81-1	Drop end cylinder cover	1	
82.	Cylinder seat	1	
83.	Connecting rod	1	
84.	Dust guard	1	
85.	Side cover	1	
86.	Beams	1	
87.	Emergency switch	1	
88.	Cable	1	

B. Hydraulic System Diagram & Part List

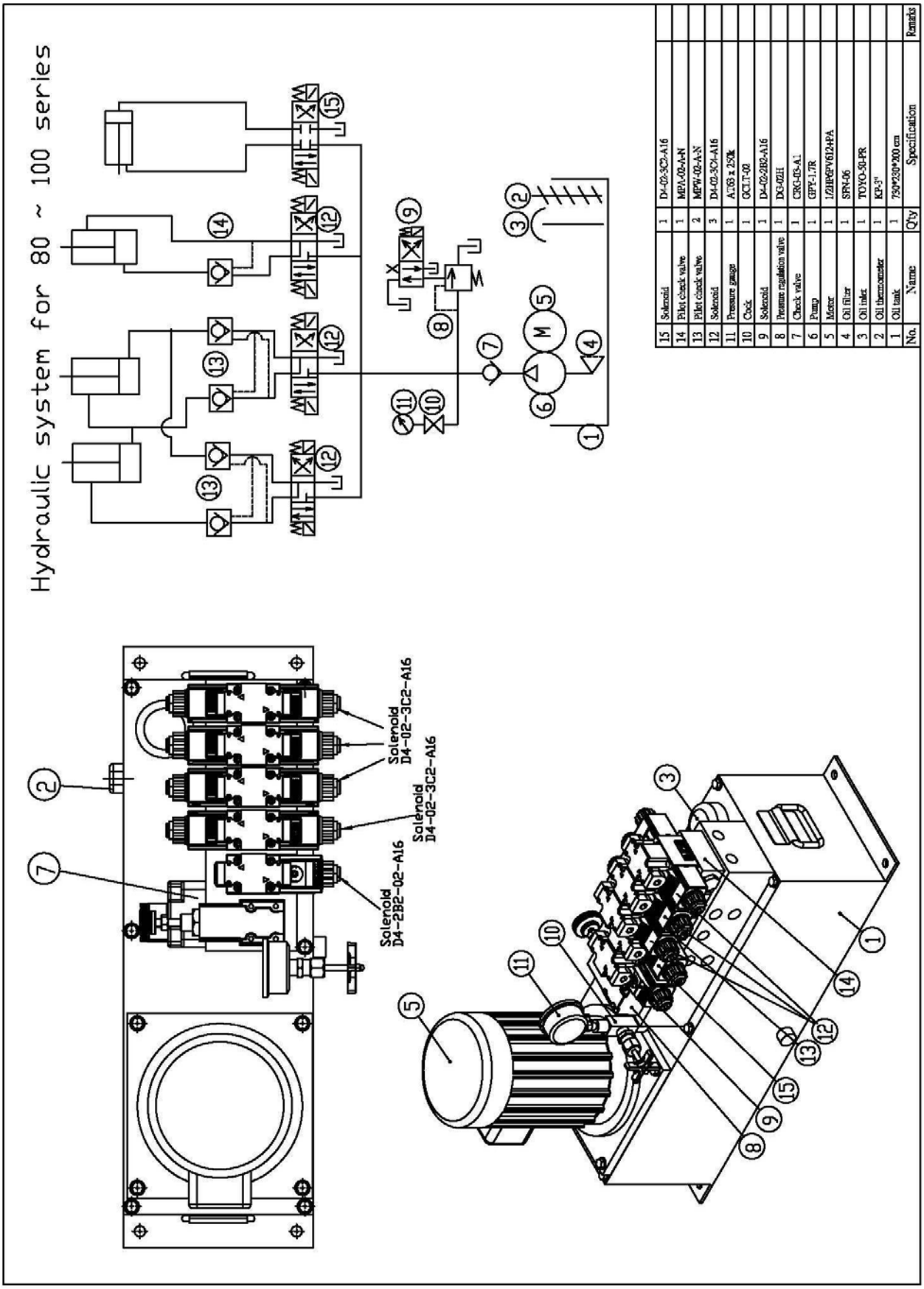


Remarks:
The capacity of the hydraulic oiltank is of 38 liters.
Replace with new oil every 3000 working hours.


Hydraulic system for 120 ~200 series
pinch roll cylinder
drop end cylinder
bending roll cylinder
Solenoid D4-02-3C2-A16
Solenoid D4-02-3C2-A16
Solenoid D4-2B2-02-A16

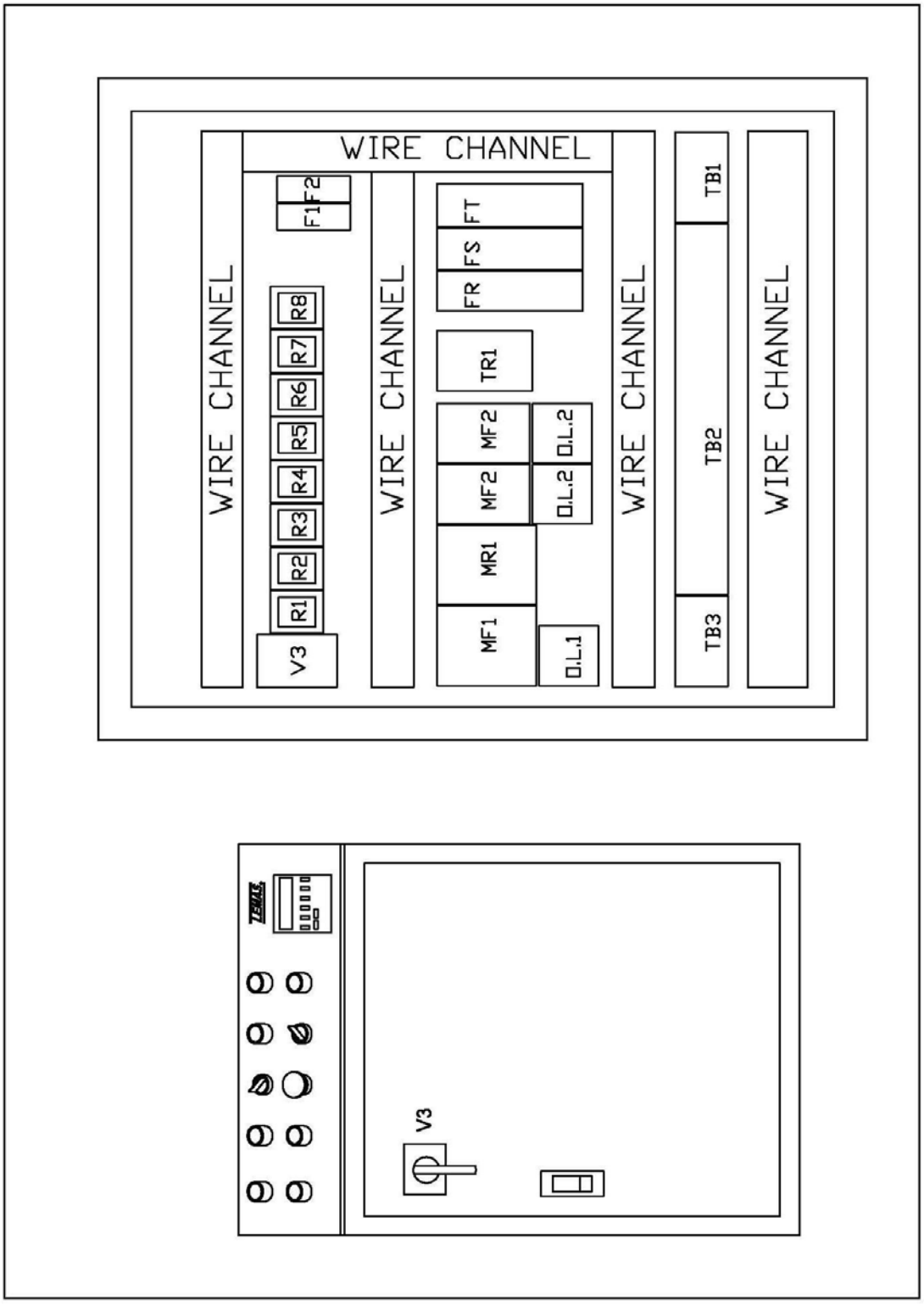
HYDRAULIC PARTS LIST

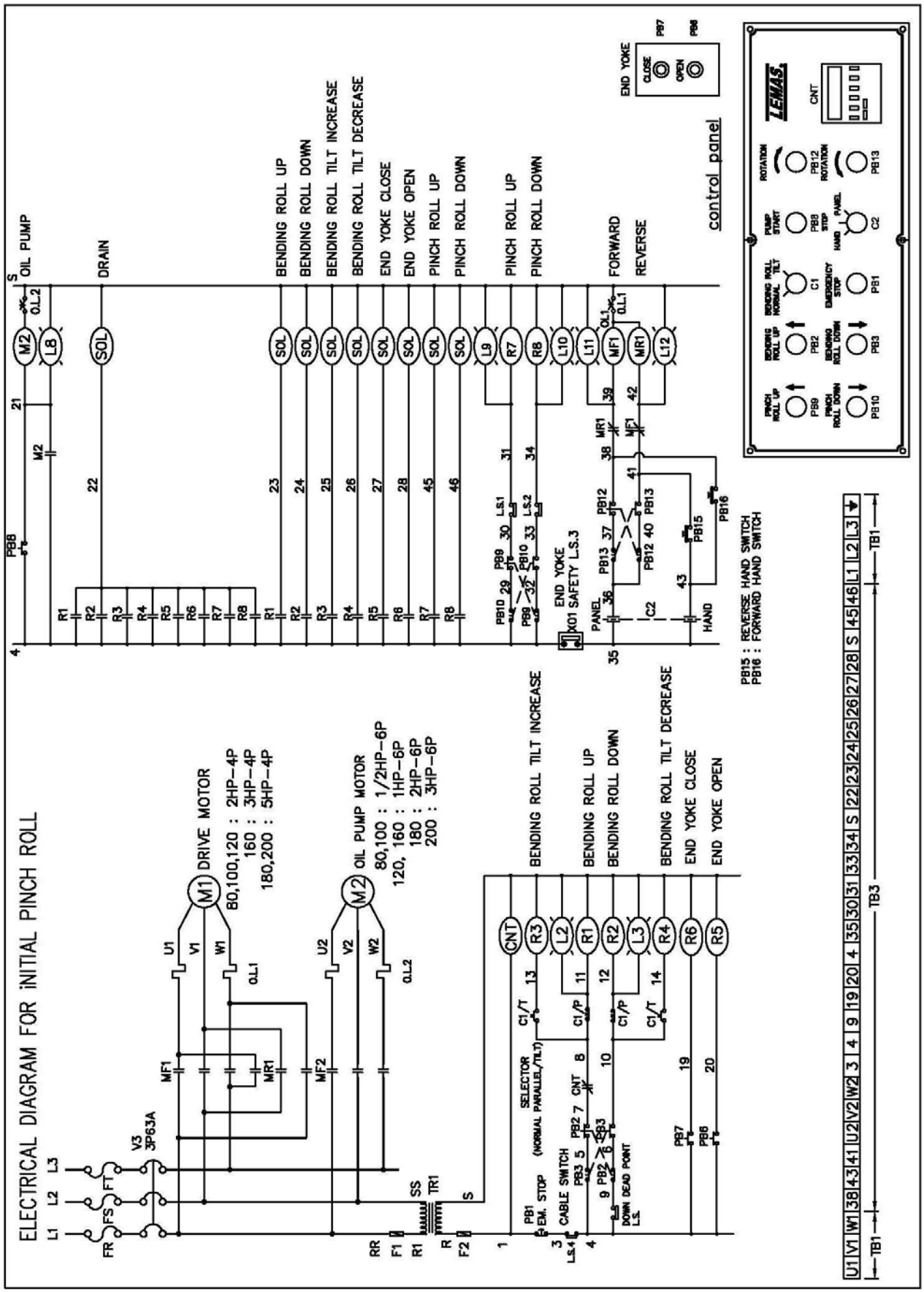
ITEM	PARTS	DESCRIPTIONS	Q'TY	MAKES
1.	Oil tank	300 x 790 x 200 cm	1	Kompass
2.	Oil thermometer	KP-3"	1	Kompass
3.	Oil inlet	TOYO-50-PR	1	Kompass
4.	Oil filter	SFN-06	1	Kompass
5.	Motor	80/100 : 1/2 hp x 6P 120/160 : 1 hp x 6P 180 : 2 hp x 6P 200 : 3 hp x 6P	1	Tatung
6.	Coupling	NM-82	1	Kompass
7.	Hydraulic pump	120/160 : KP-0530 180 : KP-0540 200 : KP-0560	1	Spindle
8.	Check valve	CRG-03-A1	1	Kompass
9.	Pressure regulation valve	DG-02H	1	Kompass
10.	Solenoid valve	D4-2B2-02-A1	1	Kompass
11.	Cock	GCLT-02	1	Kompass
12.	Pressure gage	AT63 x 250k	1	Kompass
13.	Solenoid valve	D4-3C4-02-A16	4	Kompass
14.	Pilot check valve	MPW-02-AN	2	Kompass
15.	Pilot check valve	MPA-02-AN	1	Kompass
16.	Solenoid valve	D4-02-3C2-02-A16	1	Kompass



No.	Name	Qty	Specification	Remarks
15	Solenoid	1	D4-02-3C2-A16	
14	Pilot check valve	1	MPA-02-A-N	
13	Pilot check valve	2	MPW-02-A-N	
12	Solenoid	3	D4-02-3C4-A16	
11	Pressure gauge	1	A:0~25 x 250k	
10	Cock	1	GCLT-02	
9	Solenoid	1	D4-02-2B2-A16	
8	Pressure regulation valve	1	DG-02H	
7	Check valve	1	CRG-03-A1	
6	Pump	1	GPY-1-7R	
5	Motor	1	1/2HP6PV6I2+PA	
4	Oil filter	1	SFN-06	
3	Oil inlet	1	TOYO-50-PR	
2	Oil thermometer	1	KP-3"	
1	Oil tank	1	750*230*200 cm	

Electric System Diagram & Part List




ELECTRICAL DIAGRAM FOR INITIAL PINCH ROLL
control panel
OIL PUMP
DRAIN
BENDING ROLL UP
BENDING ROLL DOWN
BENDING ROLL TILT INCREASE
BENDING ROLL TILT DECREASE
END YOKE CLOSE
END YOKE OPEN
PINCH ROLL UP
PINCH ROLL DOWN
FORWARD
REVERSE
DRIVE MOTOR
80,100,120 : 2HP-4P
160 : 3HP-4P
180,200 : 5HP-4P
OIL PUMP MOTOR
80,100 : 1/2HP-6P
120, 160 : 1HP-6P
180 : 2HP-6P
200 : 3HP-6P
SELECTOR (NORMAL PARALLEL/TILT)
CABLE SWITCH
DOWN DEAD POINT LS
END YOKE SAFETY LS.3
PB15 : REVERSE HAND SWITCH
PB16 : FORWARD HAND SWITCH
PINCH ROLL UP
PINCH ROLL DOWN
BENDING ROLL UP
BENDING ROLL DOWN
BENDING ROLL TILT
EMERGENCY STOP
PUMP START
ROTATION
CNT
END YOKE
CLOSE
OPEN
LEMAS

PARTS LIST

ITEM	DESCRIPTIONS	PARTS	Q'TY	BRAND
V3	Non-fuse circuit breaker	VZ31 KCF3P2	1	Telemecanique
MF1/MR1	Magnetic contactor	LC1 D32 10 5HP	2	Telemecanique
O.L.1	Magnetic contactor	LR2 D13 22	1	Telemecanique
M2	Magnetic contactor	LC1 D09 10 1HP	1	Telemecanique
O.L.2	Magnetic contactor	LR2 D13 08	1	Telemecanique
PB1	Emergency stop button	ZB2BS54	1	Telemecanique
L2 / L3 L8～L10	Push button switches	ZB2BW3	5	Telemecanique
PB8～10 PB2～3	Push button switches	ZB2BW3	5	Telemecanique
PB6～7 PB12～13	Push button switches	ZB2BL	4	Telemecanique
C1	Key switch	XB2-BD25	1	Telemecanique
C2	Key switch	XB2-BD33	1	Telemecanique
LS4	Cable emergency switch	ZCK-M1 XY2-CD01	1	Telemecanique
TB1	Terminal seat	TB 3P 30A	4	TEND
TB2	Terminal seat	SR-2.5	28	TEND
TB3	Terminal seat	TB 3P 20A	3	TEND
LS / LS2	Limit switch	7311	2	TEND
LS1 / LS2	Limit switch	7312	2	TEND
PB15～16	Buckle switch	KOB61	1	E-TEN
R1～R8	Overload relay	RH2B	8	IDEC
TR1	Transformer	1P 250VA	1	CELL POWER
CNT	LED display	CA-61K-N	1	CONCH
PB14	Reset button	P16PMR	1	DECA
F1 / F2	Fuse	SF112 (5A)	2	SHYANG YIN
FR/FS/FT	Antiknock fuse	CT-FB101L (32A)	3	CHYOU DIAN
M1	Brake motor	Roll 120: 2 hp Roll 160: 5 hp	1	TATUNG
M2	Oil pump motor	1 hp	1	TATUNG

C. Periodic Check

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
Pipes	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

TROUBLE SHOOTINGS

1. PUMP

ITEMS	CAUSES	REMEDIES
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

ITEMS	CAUSES	REMIDIES
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

ITEMS	CAUSES	REMIDIES
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

ITEMS	CAUSES	REMIDIES
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

ITEMS	CAUSES	REMIDIES
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

ITEMS	CAUSES	REMIDIES
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	CAUSES	REMIDIES
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	CAUSES	REMIDIES
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	CAUSES	REMIDIES
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	CAUSES	REMIDIES
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 OUT	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 a coolant unit to maintain low temperature.
55℃	Careful temperature.	The most appropriate temperature when oil has the best performance and longest life.
45℃	Safety temperature.	
30℃	Ideal temperature.	
20℃	Normal temperature.	Workable but low efficiency.
0℃	Low temperature	High viscosity that may cause slow oil flow.