NOBLELIFT EQUIPMENT

Service & Maintenance Manual

LPT22 Power Pallet Truck

V-LPT22-01.00 Date: 2011-02-26

CONTENTS

FOREWORD

Proper operation, maintenance, troubleshooting and repairs are necessary to preserve the performance of the pallet truck over along period of time and ensure that fault and breakdowns do not occur. The object of this service manual is to provide the information necessary especially in connection with the performance of inspections and repairs mainly in the maintenance areas.

⚠ WARNING The majority of this pallet truck consists of steel, it can be completely recycled. Waste material in conjunction with repairs, maintenance, cleaning or scrapping, must be collected and disposed of in an environment-friendly way and in accordance with the directives of respective countries. Such work must be carried out in areas intended for this purpose. Recyclable material should be taken care of by specialized authorities. Environmentally hazardous waste, such as oil filters, batteries and electronics, will have a negative effect on the environment, or health, if handled incorrectly.

⚠ CAUTION All of the information reported herein is based on data available at the moment of printing. Our products are constantly being developed and renewed, we reserves the right to modify our own products at any moment without prior notice and incurring in any sanction. So, it is suggested to always verify possible updates.

1. GENERAL

1.1 INTRODUCTION – MAINTENANCE SAFETY PRECAUTIONS

Careless performing of the easy work may cause injuries. Take care to always perform work safely, at least observing the following. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others, or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate. The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are those that apply when servicing hydraulic and larger machine component parts.

⚠WARNING MODIFICATION OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.

⚠WARNING SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA RESPONSIBILITY OF THE OWNER OR OPERATOR.

⚠WARNING FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION MAY RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

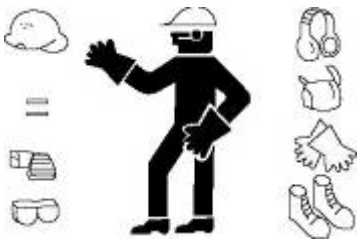
- When carrying out any operation or maintenance, have trained and experienced personnel carry out the work.
- When carrying out any operation or maintenance, carefully read out Operation and Maintenance Manual.
- Read all the precautions given on the decals which are fixed to the machine.
- Be sure you fully understand the contents of the operation. It is important to prepare necessary tools and parts and to keep the machine.

CAUTION HEAVY

- Your safety, and that of others , is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

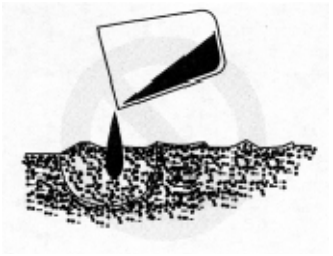
- It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system. Relieve system pressure by cycling the applicable control lowering button several times with the motor stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

- Remove all rings, watches and jewelery when performing any maintenance.
- Wear well-fitting helmet, safety shoes and working Clothes When drilling grinding or hammering always. Wear protective goggles. Always do up safety clothes properly so that they do. Not catch on protruding parts of machines. Do not wear oily clothes. When checking, always release battery plug. DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.



- During maintenance do not allow any unauthorized person, to stand near the machine.
- Flames should never be used instead of lamps. Never use a buring flame to check leaks or the level of oil or electrolyte.

- Immediately remove any oil or grease on the floor of the operator's compartment or on the handrail. It is very dangerous if someone slips while on the machine.



- Always use the recommended pure oil or grease, and be sure to use clean containers.

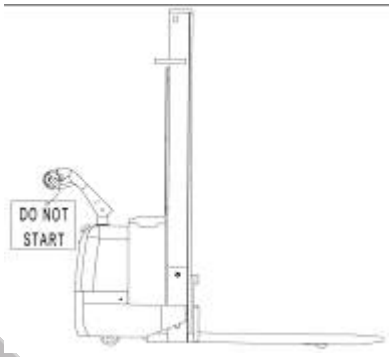
- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire or flame. As preparation for use of fire extinguishers and other fire- fighting equipment.
- Keep the battery away from fire hazards. The generated gases are explosive.
- Store all the oils in a specified place.
- Keep the flammable things away from the machine. Do not smoke in the working site.

- Battery should always be disconnected during replacement of electrical components.

- Always use the grades of grease and oil recommended by NOBLELIFT choose the viscosity specified for the ambient temperature.

- Exhaust gas is dangerous provide ventilation when working in a closed space.
- Avoid breathing dust that may be generated when handling components containing asbestos fibers. Wear a gas mask if necessary.

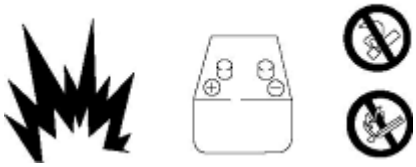
- When working on top of the machine, be careful not to lose your balance and fall.



- Hand a caution sign in the operator's compartment (for example "Do not start" of "Maintenance in progress"). This will prevent anyone from starting or moving the machine by mistake.

- When welding on the machine or working on the electical system, ALWAYS turn the key switch OFF and remove the battery plug from the battery. Park the machine on firm, flat ground. Lower the fork to the min. height and stop the motor.
- Sulfuric acid in battery electrolyte is poisonous. Ist is strong enough to burn skin and eat holes in clothing. If you spill acid on your clothes or skin, immediately flush it with large quantities of water.

- When working on the battery, wear goggles or safety glasses. If splashed into the eyes, flush with water and get medical attention immediately.
- Battery terminals touched by metal objects can cause short circuit and burn you. Keep tools away from the terminals.
- When disassembling and assembling the battery, make sure that the battery terminals (+, –) are correctly connected.



- If water gets into the electrical system, abnormal operation or failure can result. Do not use water or steam on sensors, connectors and instruments in the cab.

- Do not handle electrical equipment while wearing wet gloves, or in wet places, as this can cause electric shock.
- When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.

- Unless you have special instructions to the contrary, maintenance should always be carried out with the motor stopped. If maintenance is carried out with the motor running, there must be two men present : one operating the pallet truck and the other one performing the maintenance. In such a case, never touch any moving part.
- Before making adjustment, lubricating or performing any other maintenance, shut off all power controls.
- When removing parts containing O-ring Gaskets or seal. Make sure clean the mounting surface and replace with new sealing parts.
- Thoroughly clean the machine. In particular, be careful to clean the grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- Use only approved, nonflammable cleaning solvents.
- When changing the oil or fitter, check the drained oil and filter for any signs of excessive metal particles or other foreign materials.
- Always use NOBLELIFT genuine parts for replacement. ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- When checking an open gear case, there is a risk of dripping things in. Before removing the covers to inspect such cases, empty everything from your pockets. Be particularly careful to remove wrenches and nuts.

1.2 MEASUREMENT CONVERSIONS

Length

Unit	cm	m	km	in	ft	yd	mile
cm	1	0.01	0.00001	0.3937	0.03281	0.01094	0.000006
m	100	1	0.001	39.37	3.2808	1.0936	0.00062
km	100000	1000	1	39370.7	3280.8	1093.6	0.62137
in	2.54	0.0254	0.000025	1	0.08333	0.02777	0.000015
ft	30.48	0.3048	0.000304	12	1	0.3333	0.000189
yd	91.44	0.9144	0.000914	36	3	1	0.000568
mile	160930	1609.3	1.6093	63360	5280	1760	1

1mm=0.1cm, 1μm=0.001mm

Area

Unit	cm_2	m_2	km_2	a	ft_2	yd_2	in_2
cm_2	1	0.0001	–	0.000001	0.001076	0.000012	0.155000
m_2	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km_2	–	1000000	1	10000	1076400	1195800	–
a	0.01	100	0.0001	1	1076.4	119.58	–
ft_2	–	0.092903	–	0.000929	1	0.1111	144.000
yd_2	–	0.83613	–	0.008361	9	1	1296.00
in_2	6.4516	0.000645	–	–	0.006943	0.000771	1

1ha=100a, $1mile_2$=259ha=$2.59km_2$

Volume

Unit	cm_3 = cc	m_3	*l*	in_3	ft_3	yd_3
cm_3 = m *l*	1	0.000001	0.001	0.061024	0.000035	0.000001
m_3	1000000	1	1000	61024	35.315	1.30796
l	1000	0.001	1	61.024	0.035315	0.001308
in_3	16.387	0.000016	0.01638	1	0.000578	0.000021
ft_3	28316.8	0.028317	28.317	1728	1	0.03704
yd_3	764529.8	0.76453	764.53	46656	27	1

1gal(US)=3785.41 cm_3=231 in_3=0.83267gal(US)

Weight

Unit	g	kg	t	oz	lb
g	1	0.001	0.000001	0.03527	0.0022
kg	1000	1	0.001	35.273	2.20459
t	1000000	1000	1	35273	2204.59
oz	28.3495	0.02835	0.000028	1	0.0625
lb	453.592	0.45359	0.000454	16	1

1 tonne(metric)=1.1023 ton(US)=0.9842 ton(UK)

Pressure

Unit	kgf/cm$_2$	bar	Pa=N/m$_2$	kPa	lbf/in$_2$	lbf/ft$_2$
kgf/cm$_2$	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
Pa=N/m$_2$	0.00001	0.00001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in$_2$	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft$_2$	0.00047	0.00047	47.88028	0.04788	0.00694	1

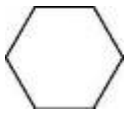
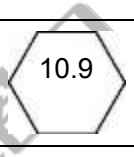
kgf/cm$_2$=735.56 Torr(mmHg)=0.96784atm

Standard torque

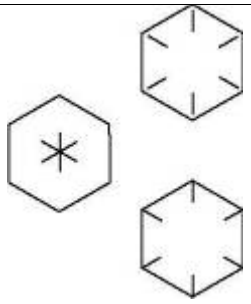
The following charts give the standard torque specification of bolts and nuts.

Exceptions are given in the sections of “Disassembly and Assembly”

METER TABLE

Classification	4T, 5T	10T
Bolt type		
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
M4	0.2 ± 0.02	0.4 ± 0.04
M5	0.3 ± 0.03	0.8 ± 0.08
M6	0.5 ± 0.05	1.4 ± 0.14
M8	1.2 ± 0.12	3.3 ± 0.3
M10	2.3 ± 0.23	6.5 ± 0.7
M12	4.0 ± 0.4	11.3 ± 1.1
M14	6.4 ± 0.6	17.9 ± 1.8
M16	9.5 ± 0.9	26.7 ± 2.7
M18	13.5 ± 1.4	38.0 ± 3.8
M20	18.6 ± 1.9	52.2 ± 5.2
M22	24.7 ± 2.5	69.4 ± 6.9
M24	32.1 ± 3.2	90.2 ± 9.0
M30	62.6 ± 6.3	176.1 ± 17.6
M36	108.2 ± 10.8	304.3 ± 30.4
M42	171.8 ± 17.2	483.2 ± 48.3
M45	211.3 ± 21.1	594.3 ± 50.4

INCH TABLE

	4T, 5T	10T
Classification Bolt type		
Bolt size	Torque kgf · m (lbf · ft)	Torque kgf · m (lbf · ft)
1/4	0.6 ± 0.06	1.7 ± 0.2
5/16	1.2 ± 0.12	3.0 ± 0.3
3/8	2.0 ± 0.20	5.6 ± 0.5
7/16	3.2 ± 0.32	8.9 ± 0.9
1/2	4.7 ± 0.47	13.4 ± 1.3
9/16	6.8 ± 0.68	19.0 ± 1.9
5/8	9.3 ± 0.93	26.1 ± 2.6
3/4	16.0 ± 1.60	45.1 ± 4.5
7/8	25.5 ± 2.55	71.6 ± 7.2
1	38.0 ± 3.80	106.9 ± 10.7
1-1/8	54.1 ± 5.41	152.2 ± 15.2
1-1/4	74.2 ± 7.42	208.9 ± 20.9
1-3/4	98.8 ± 9.88	277.8 ± 27.8
1-1/2	128.2 ± 12.82	360.7 ± 36.1

The torque specifications in above table shall not be applied to the bolts with nylon packings and nonferrous metal washers, or the ones with specifically designated torque and standard.

H Newton meter : 1 N·m = 0.1kgf·m

TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

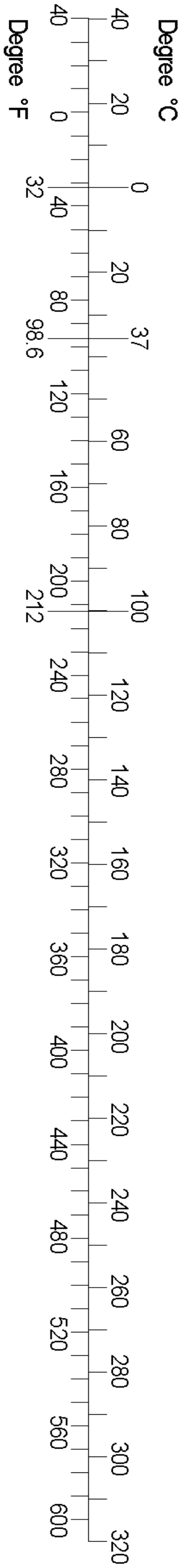
The following torque shall be applied to the split flange bolts.

Diameter (mm)	Flat width (mm)	Torque	
		kgf·m	N·m
10	14	6.7 ± 0.7	66.7 ± 6.8
12	17	11.5 ± 1	112 ± 9.8
16	22	28.5 ± 3	279 ± 29

APPROXIMATE CONVERSIONS

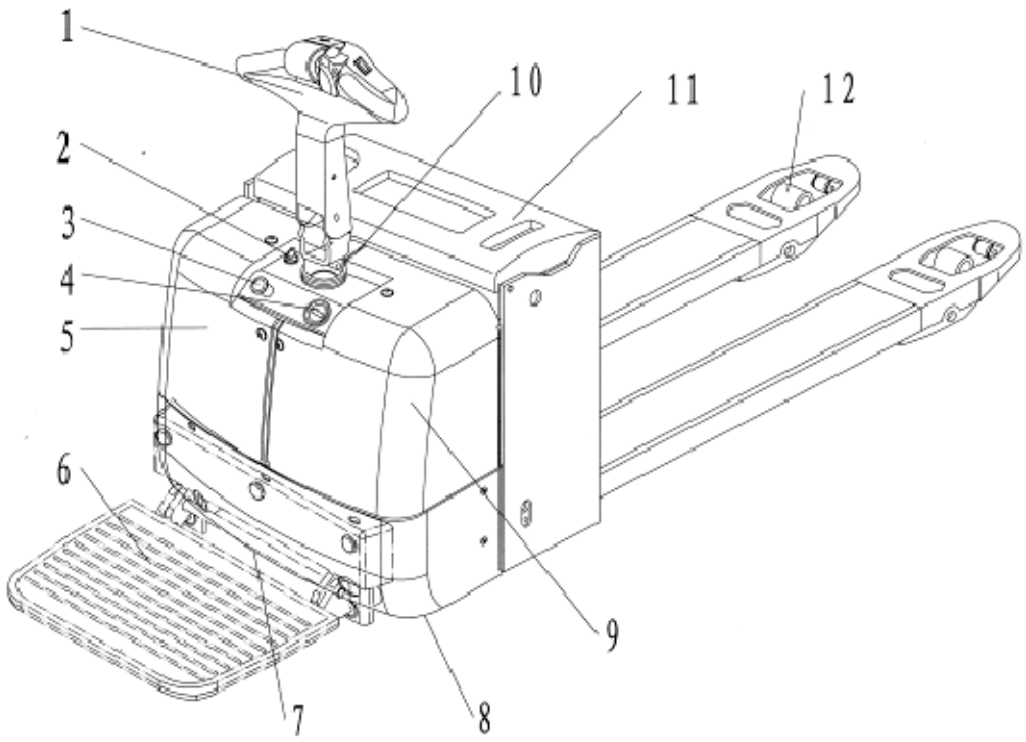
SI Unit		Conv Factor		Non–SI Unit		Conv Factor		SI Unit
				Torque				
newton meter (N·m)	×	8.9	=	In·in	×	0.113	=	N·m
newton meter (N·m)	×	0.74	=	lb·ft.	×	1.36	=	N·m
newton meter (N·m)	×	0.102	=	kg·m	×	7.22	=	lb·ft.*
				Pressure (Pa = N/m^2)				
kilopascal (kPa)	×	4.0	=	in. H_2O	×	0.249	=	kPa
kilopascal (kPa)	×	0.30	=	in. Hg	×	3.38	=	kPa
kilopascal (kPa)	×	0.145	=	psi	×	6.89	=	kPa
(bar)	×	14.5	=	psi	×	0.069	=	bar*
(kg/cm^2)	×	14.22	=	psi	×	0.070	=	[illegible]
newton/mm^2	×	145.04	=	psi	×	0.069	=	bar*
megapascal (MPa)	×	145	=	psi	×	0.00689	=	MPa
(Pa=N·m^2)								
				Power r (W = J/s)				
kilowatt (kW)	×	1.36	=	PS (cv)	×	0.736	=	kW
kilowatt (kW)	×	1.34	=	HP	×	0.746	=	kW
kilowatt (kW)	×	0.948	=	Btu/s	×	1.055	=	kW
watt (W)	×	0.74	=	ft·lb/s	×	1.36	=	W
(W=J/s)								
				Energy (J = N·m)				
kilojoule (kJ)	×	0.948	=	Btu	×	1.055	=	kJ
joule (J)	×	0.239	=	calorie	×	4.19	=	J
(J=N·m)								
				Velocity and Acceleration				
meter per sec^2 (m/s^2)	×	3.28	=	ft/s^2	×	0.305	=	m/s^2
meter per sec (m/s)	×	3.28	=	ft/s	×	0.305	=	m/s
kilometer per hour (km/h)	×	0.62	=	mph	×	1.61	=	km/h
				Horse Power/Torque				
BHP × 5252 R.P.M. = TQ (lb·ft)				TQ Z R.P.M. 5252 = B.H.P.				
				Temperature				
°C = (°F–32) ÷ 1.8				°F= (°C Z 1.8) + 32				
				Flow Rate				
liter/min (dm^3/min)	×	0.264	=	US gal/minZ3.785			=	l/min

Note : (   ) Non–SI Unit



2. SPECIFICATIONS

2.1 LOCATION OF COMPONENTS



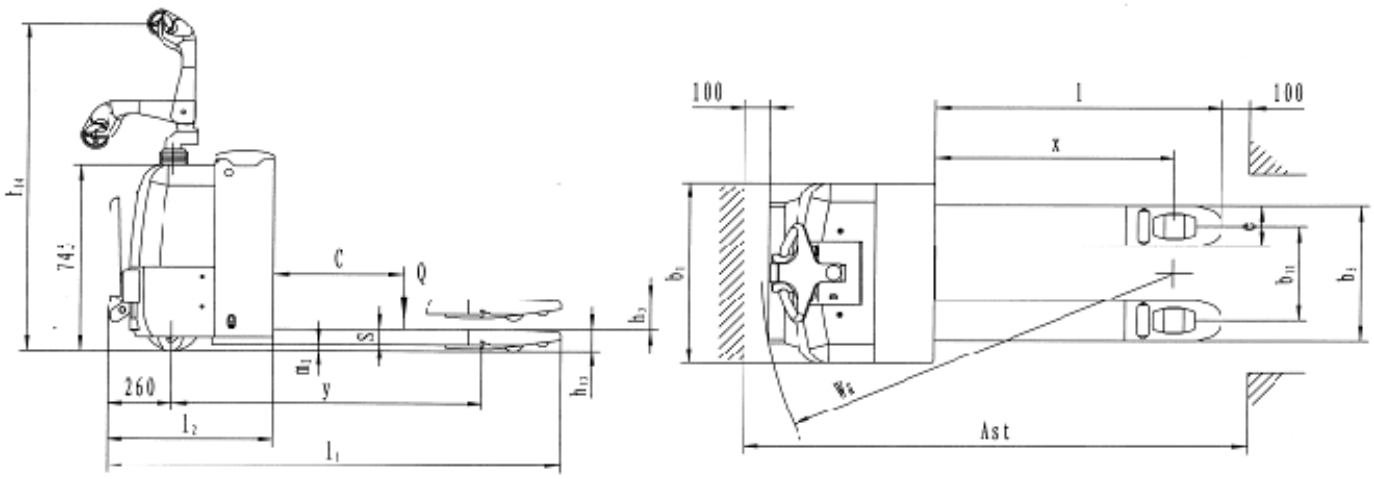
1. Control Handle
2. Key Switch (ON/ OFF)
3. Emergency Stop Button Or Kill Switch
4. Battery Indicator CURTIS 803
5. Controller assembly
6. Foot Pedal
7. Drive Wheel (Inside The Cover)
8. Stabilizing Caster (Inside The Cover)
9. Pump Unit (Inside The Cover)
10. Lift Cylinder
11. Battery (Inside The Cover)
12. Load Roller

CONTROL HANDLE

1. **Raise/Lower buttons** – Rocker switches adjusting fork height.
2. **FWD/BWD/REV travel button** –Control variable speed by turning knob
3. **Emergency Reverse button** – Emergency reverse button or commonly known as the belly button switch
4. **Horn button**
5. **Indicator light** – Indicates high/low speed status. Green indicates high speed, red indicates slow speed.
6. **Shift button** – Shift button for high speed and low speed

2.2 SPECIFICATION SHEETS

Characteristics	1.2	Model of manufacture			LPT22
	1.3	Power supply (electric, diesel, petrol, gas, mains			Electric
	1.4	Type of operation (hand, pedestrian, stand on, rider			Pedestrian
	1.5	Capacity / rated load	Q	KGs	2200
	1.6	Load center distance	C	mm	600
	1.8	Load distance	X	mm	963/1033
	1.9	Wheelbase	Y	mm	1368
Weight	2.1	Weight (including battery)		KGs	512
	2.2	Axle loadings laden drive end / load end		KGs	1082/1630
	2.3	Axle loadings unloaded drive end / load end		KGs	399/113
Wheels types	3.1	Tyres (rubber, Vulkollan, pneumatic, polyurethane)			Polyurethane
	3.2	Tyre size Dia. x width drive end		mm	Φ230x75
	3.3	Tyre size Dia. x width load end		mm	2 xΦ84x70/Φ84x93
	3.4	Castor wheels (dimensions)		mm	2xΦ100x40
	3.5	Wheels, number(x=drive wheel)			1x -2/ 2/ 1x -2/ 4
	3.6	Track width (front) drive end	b10	mm	500
	3.7	Track width (rear) load end	b11	mm	380/525
Dimensions	4.4	Lift height	h3	mm	120
	4.9	Tiller height in neutrality position	h14	mm	1323
	4.15	Fork height lowered	h13	mm	85
	4.19	Overall length	l1	mm	1815/1885
	4.20	Length to front face of fork	l2	mm	665
	4.21	Overall width	b1	mm	726
	4.22	Fork dimensions	s/e/l	mm	60/160/1150(1220)
	4.25	Overall fork width	b5	mm	540/685
	4.32	Floor clearance, center of wheelbase	m2	mm	25
	4.34	Working aisle with 800x1200 pallet lengthwise	Ast	mm	2305/2344
	4.35	turning radius	Wa	mm	1640/1710
Performance	5.1	Travel Speed laden / unloaded		mph	5.2 / 5.5
	5.2	Lifting speed laden / unloaded		mm/s	19 / 35
	5.3	Lowering speed laden / unloaded		mm/s	30 / 27
	5.8	Gradeability laden / unloaded		%	9/15
	5.10	Brakes			Electric-magnetic
Electric motor	6.1	Drive motor		kw	1.5(AC)
	6.2	Lifting motor		kw	0.8
	6.4	Battery voltage, normal capacity K5		V/Ah	24/210
	6.5	Battery weight +/-5%		KGs	185
	6.6	Battery dimensions l /w / h		mm	645/196/570
Other	8.1	Type of drive control			MOSFET Control
	8.4	Sound level at driver's ears		dB(A)	<70
		Turning angle		°	180



2.3 LUBRICATION

Hydraulic oil

⚠ CAUTION ***Hydraulic oil must have anti-wear qualities at least. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities.***

Name: Thickened hydraulic oil.

ISO Viscosity Grade			#40	#30
Characteristics		unit		
Viscosity	At 40^{O}C	mm^2/s	57	48
	At 50^{O}C		40	30
Viscosity index			⩾150	⩾150
Flash point, Cleveland open cup		^{O}C	⩾160	⩾160
Pour point, Max		^{O}C	⩽-35	⩽-35
Density at 15 ^{O}C		kg/m^3		861.5
Copper corrosion(100^{O}C, 3h)		degree	⩽1	⩽1
Foaming (93.5 ^{O}C)		ml / ml	⩽30/0	⩽30/0
Vickers vane pump test, loss of mass (on vanes after 100h)		mg	⩽100	15.3
Diameter of wear spot, 1200 r/min, 294N, 30min, 75 ^{O}C		mm	⩽0.5	⩽0.5

The oil for gear box

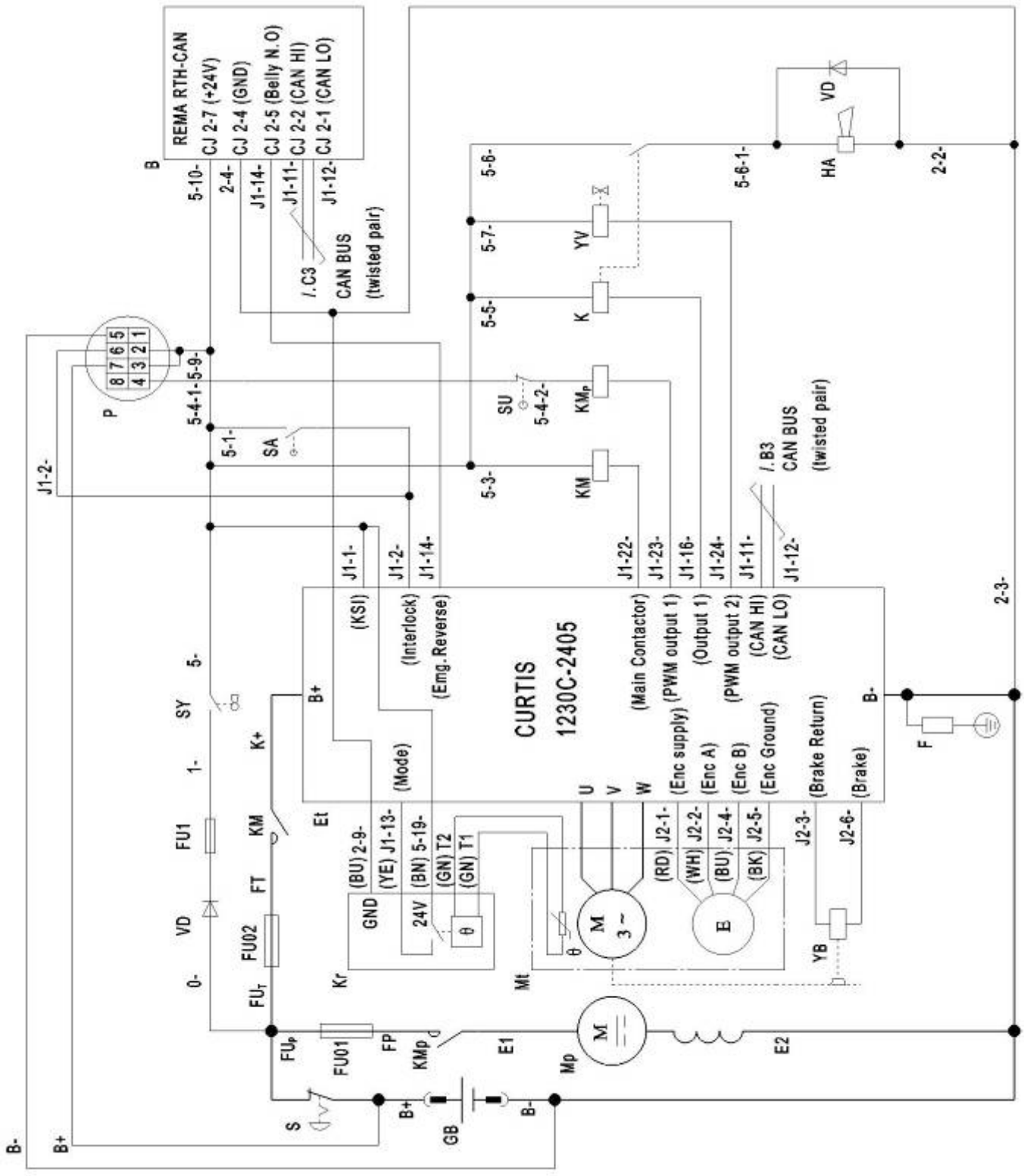
Name: Extreme pressure lithium-based grease, 1#.

Characteristics	unit	
Worked Penetration, 0.1mm		310--340
Dropping point,	^{O}C	⩾170
Extreme pressure (Timken OK)	N	⩾177
Similar viscosity (-10 ^{O}C, $10s^{-1}$)	Pa. s	⩽250
Corrosion preventive properties (52 ^{O}C, 48h)	Grade	1
Wire points oil (100 ^{O}C, 24h)	%	⩽10

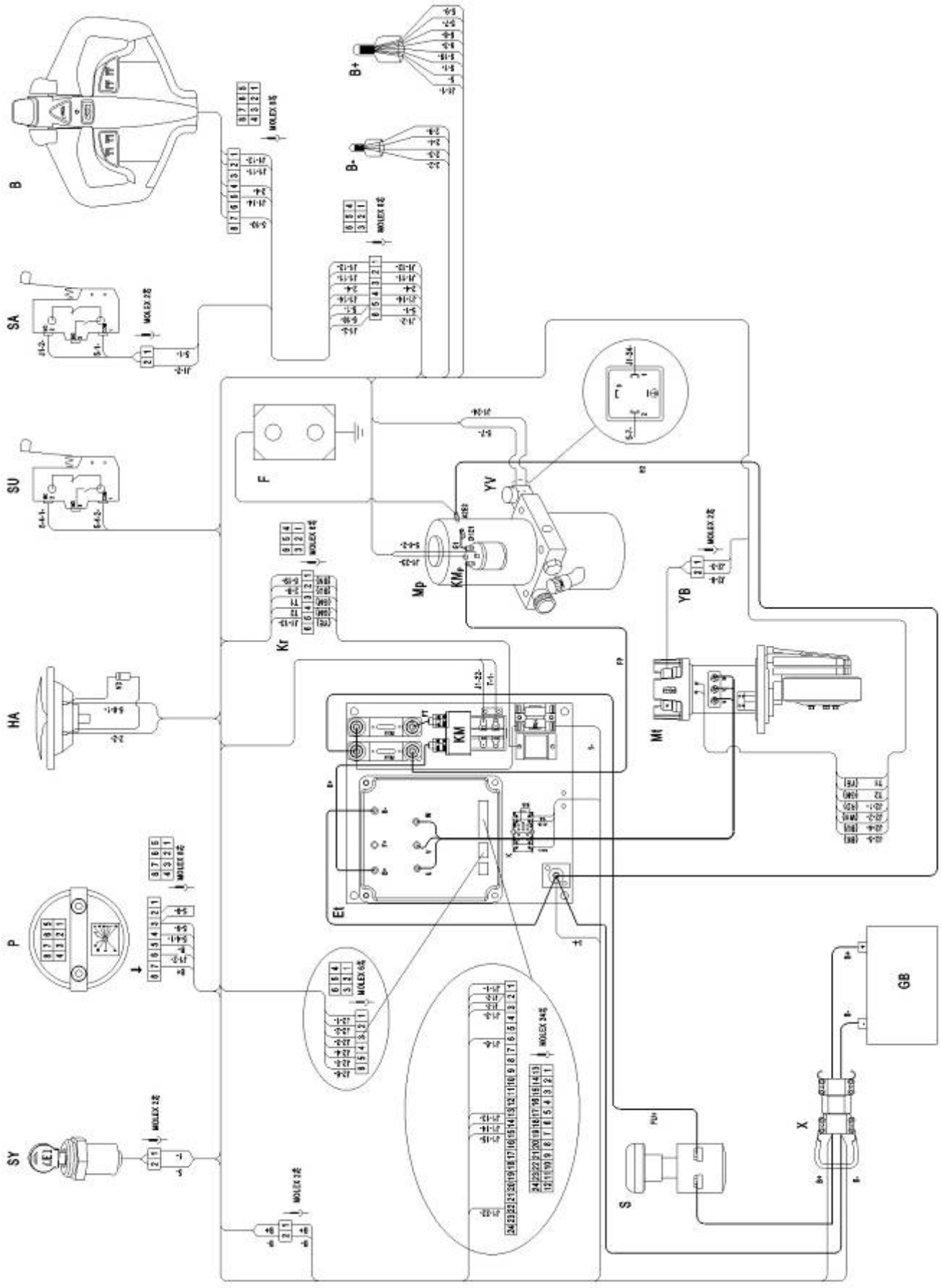
3. ELECTRICAL SYSTEM

3.1 ELECTRICAL DIAGRAM

WIRING DIAGRAM

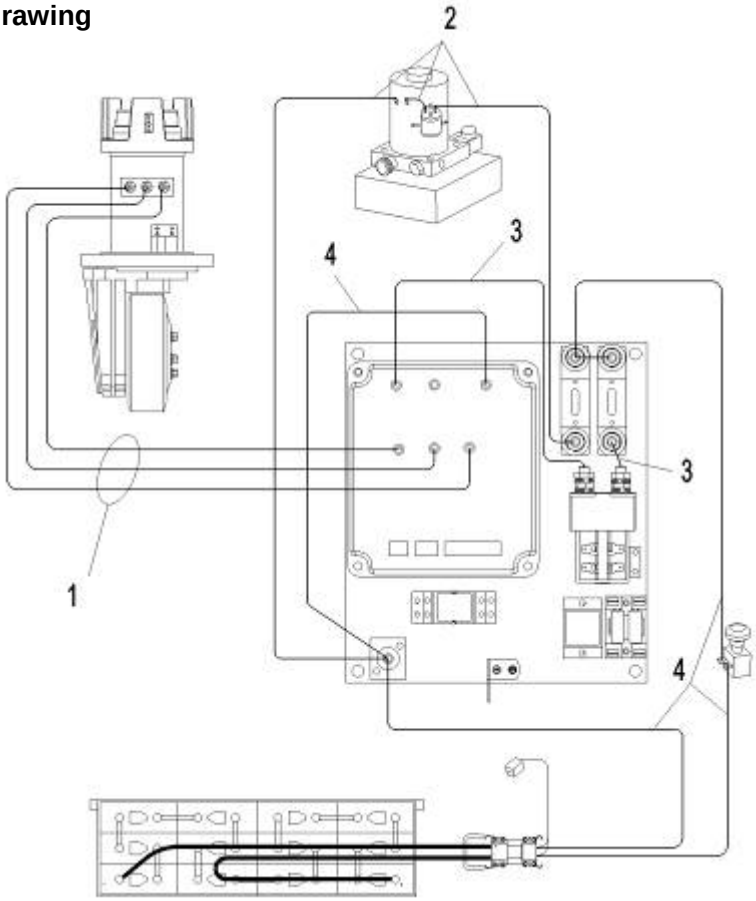


CONNECTION DIAGRAM



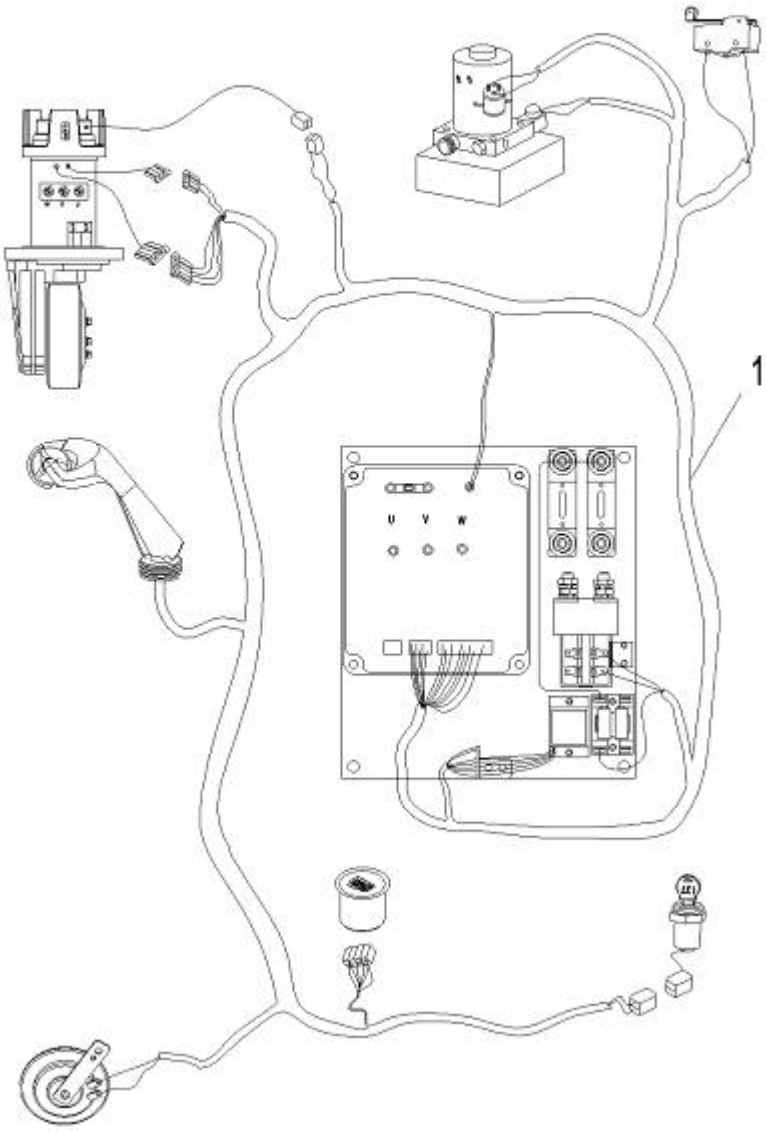
No.	Code	NL. Drawing No.	Description	Qty.
1	GB	CS1232.6.1	Battery – 24V/210Ah	1
2	FU01	DQ-38	Fuse, 80A	1
3	Mp	WG-19-1	Motor for pump, DC24V/0.8kw	1
4	KMp	WG-19-2	Relay for motor of pump, DC24V	1
5	YV	WG-19-3	Lower magnet valve, DC24V	1
6	Mt	WG-54-1	Motor for traction, DC16V/1.3kw	1
7	YB	WG-55-1	Brake, DC24V	1
8	KM	DQ-3	Main relay C100/120 DC24V	1
9	Kr	DQ-2-1	Thermal protection BD-W135/110	1
10	FU02	DQ-17	Fuse, 150A	1
11	Et	DQ-19	Controller CURTIS 1243C-2405	1
12	VD	DQ-10	Diodes 1N5408	1
13	FU1	DQ-9	Fuse,10A	1
14	S	DQ-48	Emergency button ZDK31-250	1
15	SY	DQ-26-1	Lock LKS-101A	1
16	P	DQ-27	Battery Indicator CURTIS 803	1
17	B	WG-5	Control handle （94300-00）	1
18	SA, SU	DQ-23	Micro switch Z-15GW2	1
19	K	DQ-14	Relay ARL2F DC24V	1
20	HA	DQ-22	Horn DC24V	1
21	VD	DQ-10	Diodes 1N5408	1
22	F	DQ-34-2	Discharger protection, PC802	1

Master cable system drawing



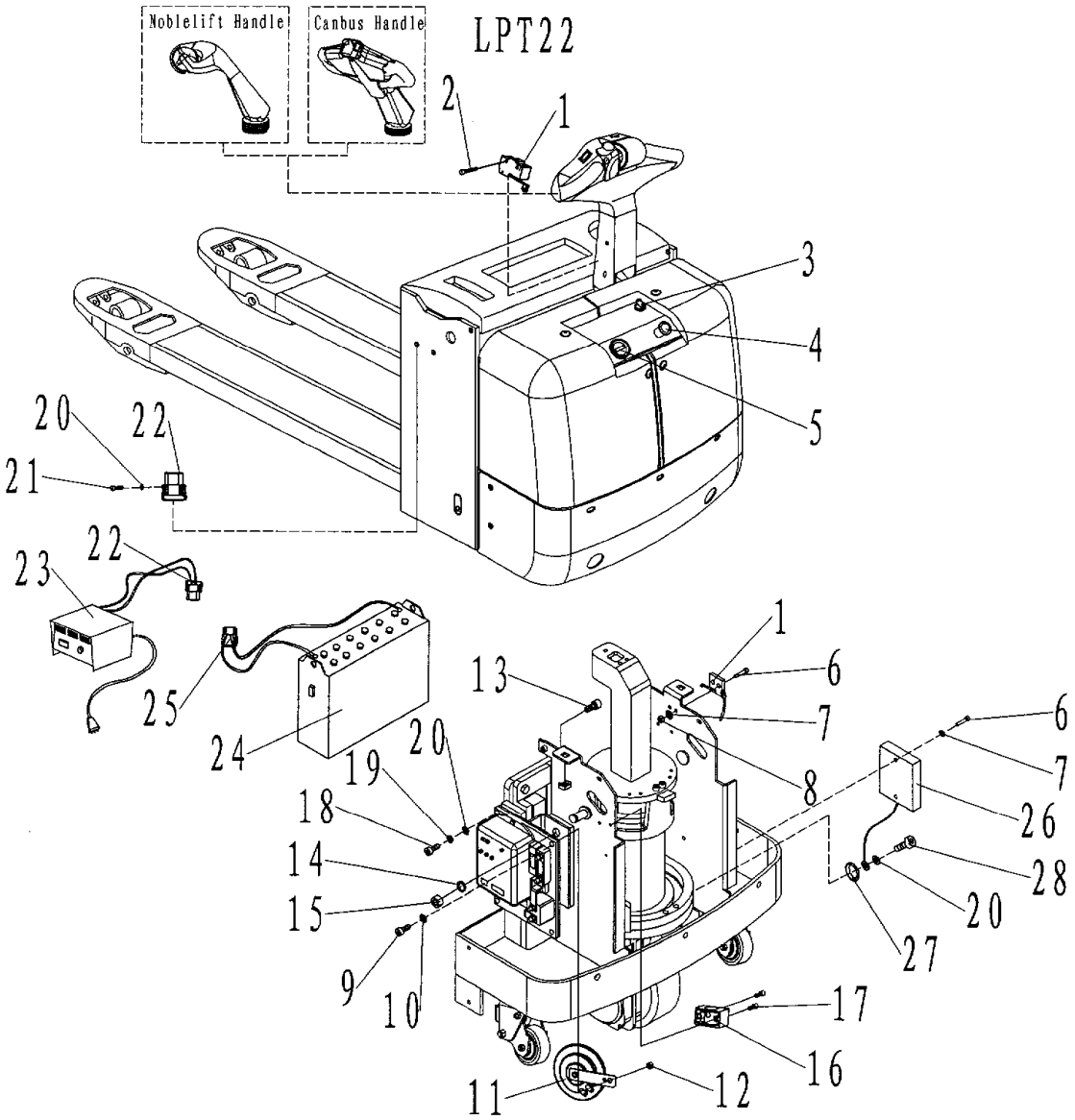
Serial	Part No	NL. Drawing No.	Description	Quantity
1	102043301	DQ-LPT22-X1	Drive motor cable	1
2	102043301	DQ-LPT22-X2	Pump motor cable	1
3	102043301	DQ-LPT22-X3	Main contactor cable	1
4	102043301	DQ-LPT22-X4	Controller power cable	1

CANBUS handle cable drawing



Serial No	Part No	NL. Drawing No.	Description	Quantity
1	1020433019	DQ-LPT22-X6	Controller cable	1

3.2 INSTALLATION OF ELECTRIC



1.	Micro switch	10.	Washer Φ8	19.	Elastic washer 6
2.	Screw M4×20	11.	Horn 125 24V	20.	Washer Φ6
3.	Key switch	12.	Locking nut M8	21.	Screw M6×30
4.	Emergency button	13.	Screw M10X25	22.	Plug
5.	Battery indicator 803	14.	Elastic washer 10	23.	Charger 24V/30A
6.	Screw M4×25	15.	Nut M10	24.	Battery
7.	Washer Φ4	16.	Cable clip	25.	Socket
8.	Locking nut M4	17.	screw M6X30		
9.	Screw M8X25	18.	Screw M6X16		

3.3 DRIVE WHEEL

Type: 3EL-DC-0.75

Drive Motor	
Model	YDQ1.3-4BT
Rate voltage	16V AC
R.P.M	3200rpm
Rate output	1.3kw
Rate hour	60min.
Rated current	76.2A
Amperager rating- max	110.7HZ
Amperager rating- min	H class
Insulation class	YDQ1.3-4BT
Electromagnetic Brake	
Model	G072-REB0510(20)P-R
Rate voltage	DC 24V
Rate Power	30W
Output Torque	16N·M
Gear Box	
transmission ratio	i=1:30

3.4 PUMP UNIT

Type: MR2-B-V1B-F4.5-PCMAV1Y-TK05C-F2

Item	Specification
Rated voltage	24V
Rated output	0.8 kw
R.P.M	2500 rpm
Rated current	60 A
Rated hour	1.8 min.
Insulation class	F class
IP Code	IP54
Displacement	0.7cc/rec
Max. operating pressure	250bar

3.5 BATTERY

Rate	Specification
Rated voltage	24V
Capacity (5 hours)	210Ah
Overall size (L*W*H)	677mm*196mm*555mm

Initial charge

- When the battery is charged for the first time, you should prepare the exclusive sulfuric acid and exclusive water of lead acids (If no excusive water is present in local areas, distilled water can be

used).

Slowly pour sulphuric acid into a container containing exclusive water(or distilled water), and churn it up with an acid-resistant stick. Keep it still until the fluid temperature drops to 35°C, then it can be poured into cells. The concentration of confected electrolyte is 1.280±0.005 (25 ^{0}C).

The conversion forrnula of electrolyte is: $S_{25}=S_t+0.0007*(t - 25)$

which:

S_{25}: The concentration of electrolyte in standard temperature of 25°C

S_t: The actually measured concentration of electrolyte.

T: Actually measured temperature.

When confecting electrolyte, avoid pouring water into concentrated sulphuric acid, for fear that sulphuric acid splashes and leads to physical injury. In addition, please wear protective appliance.

- Wipe up the cells, check the nuts be tight for reliable connection.
- Pour configured electrolyte into grouped batteries, with fluid level 15-20mm higher than protective slice. Keep it still for 4-6 hours (maximum duration no more than 12 hours). Only when the cells temperature drops below 35^{0}C can it be connercted to DC and charge. If cell's temperature exceeds 35℃, it should be taken to cool it down.
- Check the cells in the battery for reverse polarity with DC voltmeter to assure proper polarity.Connect the anode of the power supply to "+ "of the battery, the cathode of the power supply to "-" of the battery. Avoid reverse polarity for fear of reverse charging. The voltage of the charge power supply should be higher than 1.5 times of the charged battery. When all the work is properly done, the cells can be charged according to parameters outlined in the list below:

Model	Charging current (A)			
	initial charge		common charge	
	Phase 1 (0.5 I_5A)	Phase 2 (0.25 I_5A)	Phase 3 (0.7I_5A)	Phase 4 (0.35 I_5A)
210Ah	21	10.5	29	14.5
280Ah	28	14	39	19
350Ah	35	17	49	24

- Initial charges are conducted in 2 phases: in phase1, when terminal voltages of the cells rise to 2.4V, the current should be converted into phase2, and continue to charge until air bubbles come out from the electrolyte, keep cell voltage(under constant current) steady for 3 hours. When the concentration of confected electrolyte reaches 1.280 ± 0.005, it should remain unchanged within 3 hours. At this moment, the total quantity of electric charge should be 4-5 times the rated capacity, and the charging duration will be 70 hours.
- If the concentration of the electrolyte is not 1.280 ± 0.005, it should be adjusted. The method is: if the concentration is too high, draw out some electrolyte and add some water or distilled water, until the concentration equals to the prescribed value; if the concentration is too low, draw out some electrolyte and add some pre-confected dilute sulfuric acid with a concentration of 1.400g/cm^3, until the concentration equals to the prescribed value. When the concentration of electrolyte is adjusted, it should be charged for 1 hour for consistency. The density-ratio of electrolyte is as follows:

Concentration of electrolyte	Volumeratio of water to sulfuric acid	Capacity ratio of water to sulfuric acid
1.100	9.80:1	5.84:1
1.200	4.33:1	2.36:1
1.270	2.80:1	1.57:1
1.280	2.75:1	1.49:1
1.400	1.90:1	1.00:1

- After charging, close the vent plug , and it only can be put into use after its surface is cleaned clear.

Balanced charge

When in use, nonuniformity of voltage capacity, electrolyte and concentration may occur. Through balanced charge, such nonuniformity can be eliminated, and all cells in the battery can be of uniform conditions. Balanced charge is essential monthly for the batteries in use or following situation:

- Cells whose discharge voltages are usually below the final voltage (1.7V/cell).
- Cells with heavy discharge current (in circumstances where the drive motor and lift motor operate synchronously with heavy load), or in circumstance with steep slope.
- Cells not timely recharged after discharged.
- Undercharged cells of cells not used for along time.

METHODS OF BALANCED CHARGE:

Normally charge the cells, when it is fully charged, shut off the charge power supply, keep it still for half an hour, then switch on the power supply and continue to charge with the current of phase 2. When air bubbles come out, convert to 1/2 of the current of phase 2 and continue to charge the cells, when air bubbles are produced, shut off the charge power supply, keep is still for half an hour, then switch on the power supply and continue to charge with 1/2 of the current of phase 2, until air bubbles are produced, stop charging and left it still. Repeat the procedure for several times, until air bubbles are produced as soon as power supply is connected. In balanced charge, voltage of each cell as well as the electrolyte concentration should be measured and recorded. Before the charge is completed, the electrolyte concentration and height should be adjusted to the prescribed parameters.

SULFURIC ACID FOR CELLS

Index name		Index
Sulphuric acid (H_2S0_4)	%	⩾92
Ignition residue	%	⩽0.03
Manganese (Mn)	%	⩽0.0005
Ferrum(Fe)	%	⩽0.005
Arsenic(As)	%	⩽0.00005
Chlorine(Cl)	%	⩽0.0005
Nitrogenoxides(calculatedby N)	%	⩽0.0001
Ammonia salt (NH_4)	%	⩽0.001
Sulfur dioxide($S0_2$)	%	⩽0.004
Copper (Cu)	%	⩽0.0005
Deoxidized potassium permanganate (0)	%	⩽0.001
Chorma	ml	⩽1.0
Transparency	mm	⩾160

WATER FOR LEAD ACID CELLS

Index name		Index	
		%	Mg / l
Appearance		Achromatic, transparent	
Residue content	⩽	0.01	100
Manganese (Mn) content	⩽	0.00001	0.1
Ferrum(Fe) content	⩽	0.0004	4

Chlorine(Cl) content	≤	0.0005	5
Ammonia salt content	≤	0.0003	3
Ammonia (NH_4) content	≤	0.0008	8
Deoxidized potassium permanganate (0) content	≤	0.0002	2
Solonetz meatal oxide(CaO) content	≤	0.005	50
Resustivity(25^0C) Ω.cm	≥	$10x10^4$	

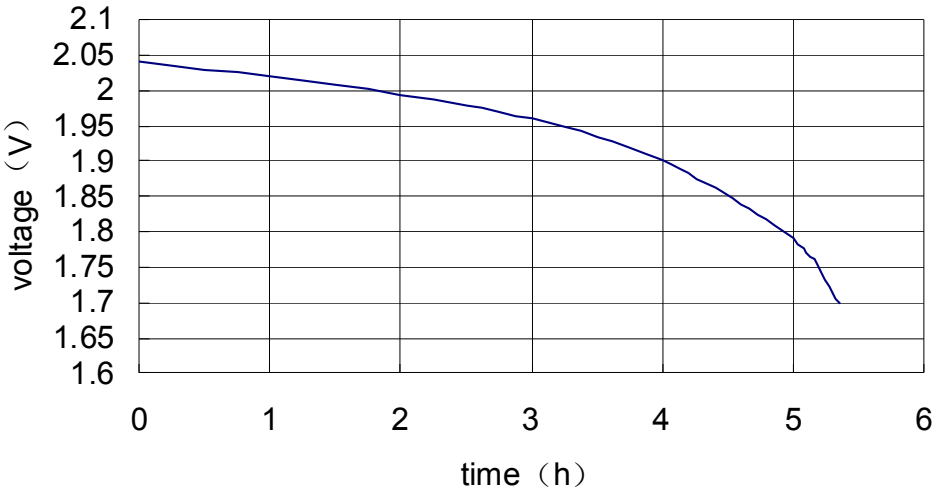
ELECTROLYTRE FOR LEAD ACID CELLS

Index name		Index	
		%	Mg / l
Appearance		Achromatic, transparent	
Sulphuric acid (H_2S0_4) content		15~40	180~480
Concentration 50^0C, g/cm^3		1.1~1.3	
Ignition residue content	≤	0.02	0.24
Manganese (Mn) content	≤	0.00004	0.00048
Ferrum(Fe) content	≤	0.004	0.048
Arsenic(As) content	≤	0.00003	0.00036
Chlorine(Cl) content	≤	0.0007	0.0084
Ammonia salt content (N)	≤	0.0005	0.006
Copper (Cu) content	≤	0.002	0.024
Deoxidized potassium permanganate content	≤	0.0008	0.01
Content calculated by $KMn0_4$	≤	0.0032	0.038

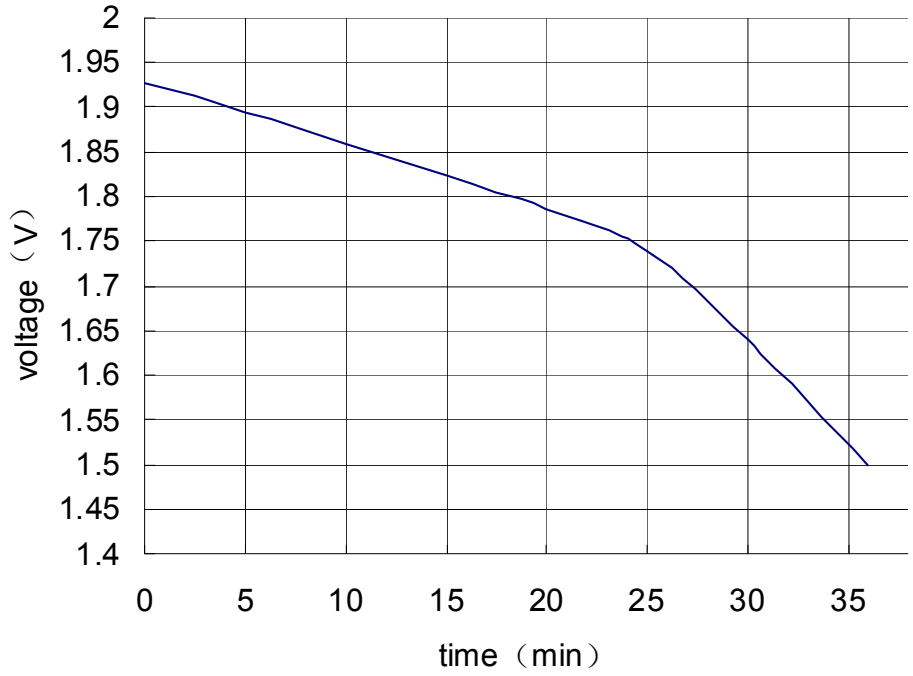
⚠WARNING Don't spatter electrolyte or water into the batteries otherwise the battery tank will be eroded and the battery will automatically discharge, which will lead to low performance of battery and even shorter life. If electrolyte or water are spattered into the unintentionally, please discharge with the exclusively equipped plastic pipes.

DISCHARGE CURVE

5hr discharge curve



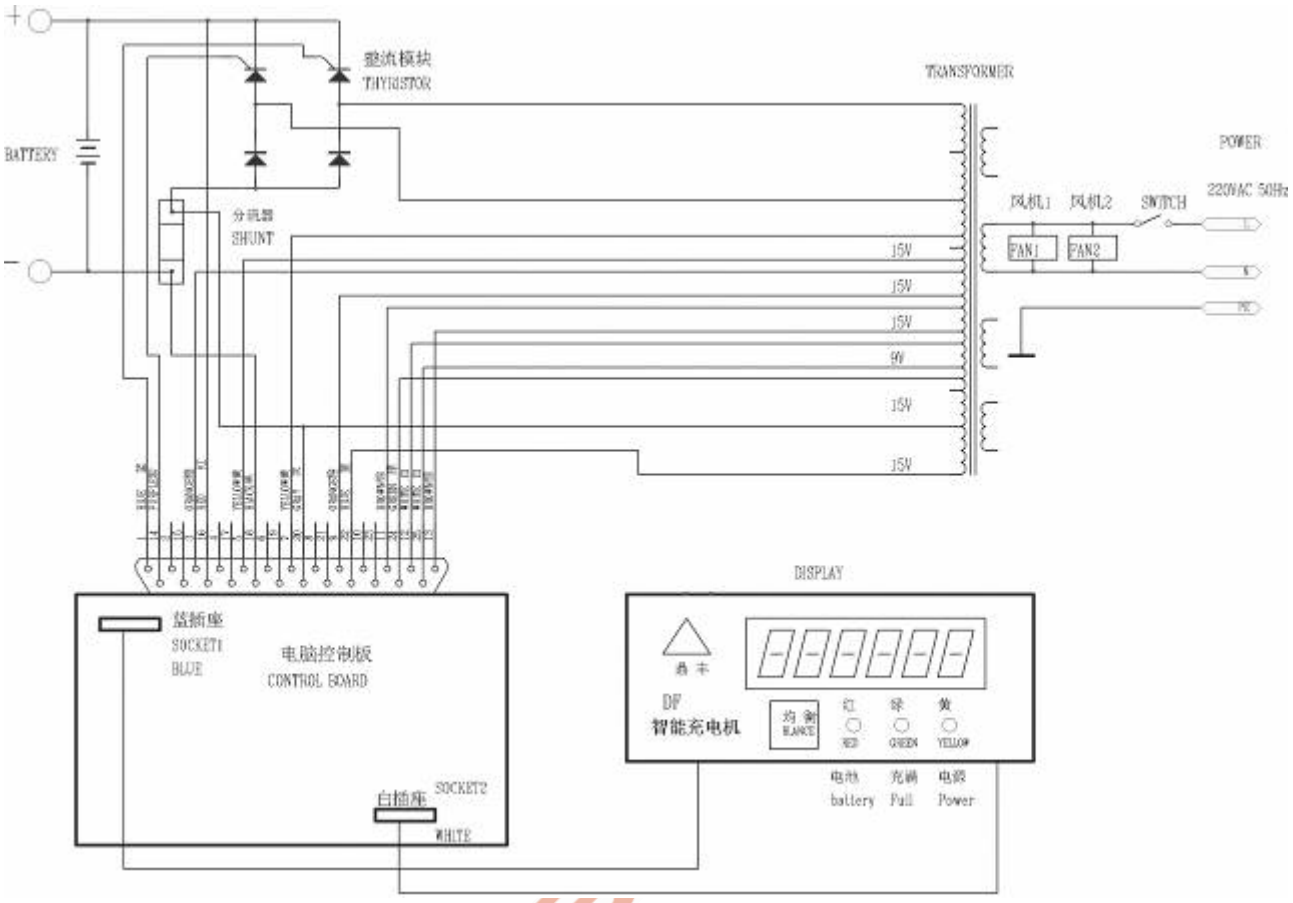
0.5hr disvharge curve



3.6 CHARGER

Type: DF2430 (for 24V/210Ah battery)

WIRING DIAGRAM FOR CHARGER



⚠WARNING The battery generates flammable and explosive gases during charge, so excellent ventilation is required. Open the liquid refilling cap or seal cap. Do not smoke around the battery during charge. Any fire and spark is forbidden.

MAIN PRODUCT SPECIFICATION

Type	Input power	Battery capacity	Input voltage	Output voltage	Output current range
DF2430	1.4KVA	200-220	220v	31.2	30A

ENVIRONMENTAL CONDITION

No.	Item	Technical specification	Unit	Remark
1	Humidity	5%-80%		With package
2	Altitude	≦2000	m	Work normally
3	Cooling	Fan convection cooling		Working under full load

ELECTRICAL CHARACTERISTICS

1	Input characteristics			
No.	Item	Technical specification	Unit	Remark
1.1	Rated input voltage	220	Vac	220Vac
1.2	Input voltage range	209-231	Vac	
1.3	AC input voltage frequency	50—60	Hz	
1.4	Max input current	DF2430：7	A	
1.5	Fan function	When input is on,voltage for fan,When input voltage is off,there is no output voltage for fan		
2	Output characteristics			
No.	Item	Technical requirements	Unit	Remark
2.1	Fast charge voltage	28.8	Vdc	
2.2	Floating voltage	31.2	Vdc	
2.3	Maintain voltage	28.8	Vdc	
2.4	Constant current	DF2430：30	A	
2.5	Power efficiency	≥80%		
3	Protection characteristics			
No.	Item	Technical requirements	Unit	Remark
3.1	Output over voltage protection	32	V	
3.2	Thermal protection	When the transformer temperature is higher than 125 ℃ -130 ℃, the charger automatically protect, stop charging.		
3.3	Output current limiting protection	DF2430：30	A	
3.4	Output short circuit protection	If a short circuit load, the charger will be protected and will not work.		
3.5	Electronic reverse battery protection	The charger is electronically protected against permanent revers battery connection		
4	Charger(LED) indicator			
No.	Item	Status LED		Remark
1	Power on	Power LED on (Yellow)		
2	Power off	Power LED OFF		
3	Fast Charge	Full LED ON (RED)		
4	Floating Charge	Full LED ON (RED)		
5	Full Charging	LED ON (GREEN)		
6	Fault LED	Battery LED (RED)		

DF2430 charger

BEFORE CHARGING

- The charger shall be installed in a special, ventilated, dry, no dust, no corrosive gas, no interference from high electromagnetic field place. The shell of the charger should be earthed (the ground bolts are equipped at the lower part of the case).
- The charger is only available for indoors, off-board charger. No water should be in the charger.
- The input power supply is 1- phases, 220V±5%～230V±5%, 50Hz or 110V±5%, 50Hz.The lead section shall be no less than 4 mm², while the capacity of mains switch shall be no less than 30A.You are recommended to use the dynamic mains switch.
- Appropriate cables may be employed according to the distance between power supply and the charger, which makes the voltage drop no more than 5%.
- Applicable environmental temperature for the charger is from -10℃ to 40℃ and the height less than 1000 meters. During use, the stumbling block that affects heat radiation of the charger shall be 0.6 meter away from it. Please check the blower is running normally or not regularly.
- In case of failure of microcomputer controller, please inform the service engineer or maintenance staff.
- Check height of electrolyte in the battery in accordance with the manufacturer's instructions.

COMMON CHARGE

- Connect cable plug of the battery to corresponding output plug of the charger firmly. Connect the battery firstly, then connect it to the power supply and finally start it. If the output plug is connected to the electric control terminal of the vehicle mistakenly, the charger fails to work, the indicator light for "failure" is on, please correct it timely.
- Connect the charger to power supply first, then turn on the power air switch and the charger starts after the power is connected. The indicator light for power supply is on and the charger is under self-examination condition. The display indicates current system version, chargeable battery voltage, current battery voltage, maximum chargeable current and other data.
- After the self-examination process is completed, the charger begins charging. The display indicates voltage[**.*V], charge current [**.*A], charge time[H**.**] (shows ** Hour, ** Minute) and charged electric quantity [***AH].
- When the display indicates "Charge completion" and the indicator light is on, the battery finishes

charge. The charger enters floating charge, with current of 1-3 amperes. Please check electrolyte height in the battery frequently and fill distilled water timely as required.

- Disconnect the power switch, and disconnect the output cable plug of the charger and plug of battery and the charge is completed.

EQUALIZING CHARGE

When the battery group has been used for some time, the performance parameters of the batteries may vary differently, so equilibrium (constant current) charge is required.

If equalizing charge is required, press the key for “Balance” charge, turn on the power switch, then the indicator light for “Balance” is on. The charger enters into equalizing charge status, the current value reduces from the rated value to a constant current value during charge, meanwhile, the display indicates “-FC-“. When the equalizing charge is completed, manual turning off is required (note: the output current of the charger under equalizing charge is constant without stop, manual turning off is necessary). Press the key for “Balance” charge after turning off the charger to make it return to normal charge.

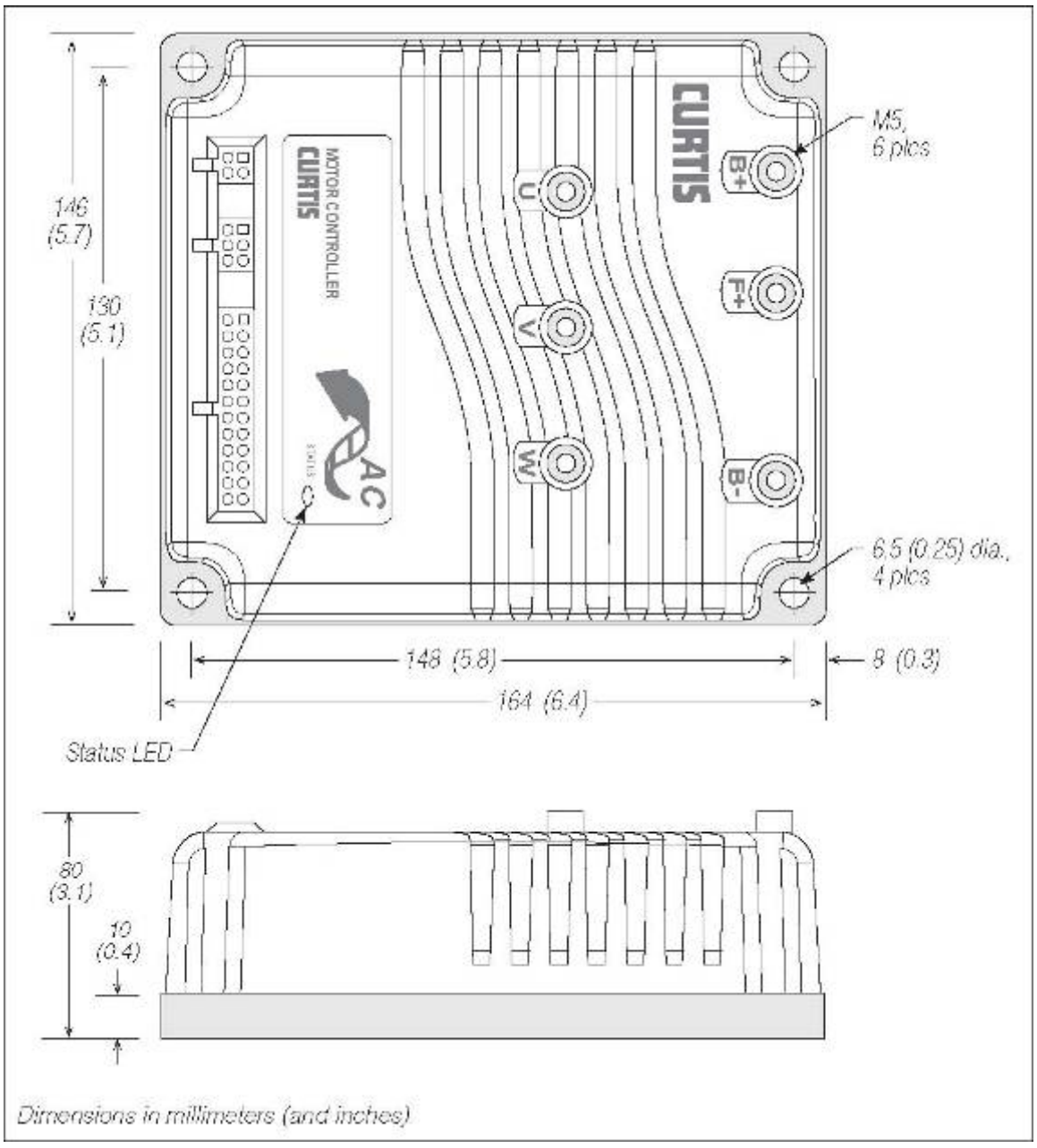
⚠WARNING The equalizing charge is a manual operation. Appointed personnel are required to observe and check voltage and specific gravity of the batteries and determine charge time, manual power off and charge stop as required.

TROUBLESHOOTING

Failures	Causes	Troubleshooting
The indicator light for power is on, the indicator light for failure is on, the blower is on, the charger can not start and charge and the monitor is not display .	The battery is not connected, or the output plug of the charger is inserted into the controller plug of the electric vehicle.	Connection of the battery should be corrected.
The indicator light for power is on, the indicator light for failure is on, the blower is on, the charger can not start and charge and the monitor is not display .	① Although the charger and battery is connected, however, some part of which is disconnected. ②The battery is aging, becomes invalid and low voltage. ③The battery is connected oppositely.	① Check each connection bolt and wiring. ② Check total voltage of battery and each single voltage of the battery. In case of open circuit, aging, invalid, low voltage of the battery, please change a new one. ③ Correct the incorrect connection.
The indicator light for power is on, the indicator light for failure is on, the blower is on, the charger can not start and charge and the display.	Failure of DC output fuser.	Open the side door to check the fuser. If the fuser is broken, please change a new one.
Instable charge current, more or less.	Long-term heating, poor contact or loose by the output plugs.	Check the copper plates, if it is unavailable, please change a

		new one.
Instable charge current, not reaching the rated current value.	① Low power voltage. ② Small section area of lead for power input.	① The power voltage may not lower than 95% of the rated voltage. If the voltage is too low, please change a new power supply. ② The section area of input lead of power supply may not less than the stipulated section area in the manual.
Air switch of the charger does not trip, and the preceding stage switch trips.	① Failure of the preceding air switch. ② Incorrect matching of air switch. ③ Small capacity of the air switch.	Rated current of the preceding stage air switch is more than that of the air switch of the charger. The air switch must be type D (dynamic type),type C (illumination type) is unavailable.
Excessive overcharge for the battery.	Internal short circuit of single battery of the group.	Check each terminal voltage of every single battery. If some of the voltages are lower than their nominal voltages, the internal polar plates suffers from short circuit, please remove them and change new ones.
The display signals of the display face rolling, deadlock and clobber.	Failure of microcomputer or control power.	Please inform the service engineers.

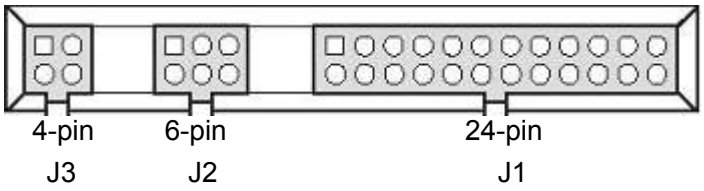
3.7 CURTIS CONTROLLER



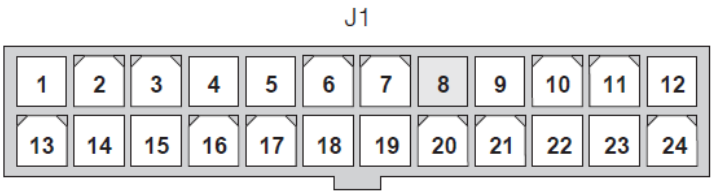
CONNECTIONS

Low Current Connections

Three low current connectors (J1, J2, J3) are built into the 1230 controller. They are located in a row on the top of the controller:

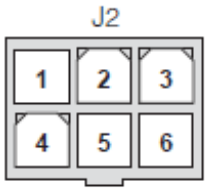


The 24-pin connector (J1) provides the logic control connections for the contactor drivers and switches that are wired directly to the vehicle. The mating connector is a 24-pin Molex Mini-Fit Jr. connector part number 39-01-2245 using type 5556 terminals.



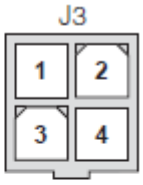
Pin 1	Keyswitch input(KSI)
Pin 2	interlok
Pin 3	Not used
Pin 4	Not used
Pin 5	Not used
Pin 6	Not used
Pin 7	Not used
Pin 8	Not used
Pin 9	Not used
Pin 10	Not used
Pin 11	CAN HI
Pin 12	CAN Lo
Pin 13	Mode switch input
Pin 14	emergency reverse
Pin 15	Not used
Pin 16	Output 1(horn relay)
Pin 17	Output 2
Pin 18	Output 3
Pin 19	Not used
Pin 20	Not used
Pin 21	Not used
Pin 22	main contactor driver output
Pin 23	Pwm output 1(lift contactor)
Pin 24	Pwm output 2(lowering valve)

A 6-pin low power Molex connector (J2) is provided for the speed encoder and electromagnetic brake connections. The mating connector is a Molex Mini-FitJr. p/n 39-01-2065 using type 5556 terminals.



J2 **Pin 1**	encoder power output
J2 **Pin 2**	encoder A
J2 **Pin 3**	E-M brake coil return
J2 **Pin 4**	encoder B
J2 **Pin 5**	encoder ground reference output
J2 **Pin 6**	E-M brake driver output

Note: In some applications using a tiller multiplexer, J2 Pins 3 and 6 are used for a proportional valve instead of an electromagnetic brake.



J3 **Pin 1** receive data (+5V)
J3 **Pin 2** ground (B-)
J3 **Pin 3** transmit data (+5V)
J3 **Pin 4** +15V supply (100mA)

A 4-pin low power connector (J3) is provided for the 13XX programmer. A complete programmer kit, including the appropriate connecting cable, can be ordered; see Curtis programmer manual for further information on the various programmers available for programming Curtis controllers.
J3 can also be used for the Curtis Model 840 Spyglass display. Although the display is typically wired directly into Pins 19, 20, and 21 of the 24-pin connector (J1), it can alternatively be plugged into J3 and unplugged when the programmer is used. Only Pins 2, 3, and 4 of J3 are needed for the display.

High Current Connections

Six round tin-plated brass studs are provided for the high current connections to the battery (B+ and B-), the fuse (F+), and the three motor phases (U, V, W), located as shown in Figure 2.
The studs are threaded to accept M5 bolts. This simplifies the assembly and reduces the mounting hardware necessary for the power connections. Appropriate screws, washers, and cable lugs should be used to provide secure vibration-resistant connections on all power terminals.
The tightening torque applied to the bolts should not exceed 10 N·m (7.4 ft-lbs). Exceeding this limit could damage the studs' internal threads, resulting in loose connections.

Text	Readaccess	Writeaccess	Unit	Type	Value	Min.	Max.
Vehicle	User						
Rates	User						
M1 Accel Rate	User	User	Seconds	TI_UINT8	2	0.1	5
M2 Accel Rate	User	User	Seconds	TI_UINT8	2	0.1	5
M3 Accel Rate	User	User	Seconds	TI_UINT8	2	0.1	5
M4 Accel Rate	User	User	Seconds	TI_UINT8	2	0.1	5
M1 Decel Rate	User	User	Seconds	TI_UINT8	1.2	0.1	20
M2 Decel Rate	User	User	Seconds	TI_UINT8	1.2	0.1	20
M3 Decel Rate	User	User	Seconds	TI_UINT8	1.2	0.1	20
M4 Decel Rate	User	User	Seconds	TI_UINT8	1.2	0.1	20
M1 Brake Rate	User	User	Seconds	TI_UINT8	1	0.1	5
M2 Brake Rate	User	User	Seconds	TI_UINT8	1	0.1	5
M3 Brake Rate	User	User	Seconds	TI_UINT8	1	0.1	5
M4 Brake Rate	User	User	Seconds	TI_UINT8	1	0.1	5
Fast Stop Rate	OEM	OEM	Seconds	TI_UINT8	1	0.1	5
Accel Release Rate	OEM	OEM	Seconds	TI_UINT8	0	0	1
Speeds	User						
M1 Min Speed	User	User	%	TI_UINT8	10	0	50
M2 Min Speed	User	User	%	TI_UINT8	10	0	50
M3 Min Speed	User	User	%	TI_UINT8	10	0	50
M4 Min Speed	User	User	%	TI_UINT8	10	0	50
M1 Forward Max Speed	User	User	%	TI_UINT8	50	10	100
M2 Forward Max Speed	User	User	%	TI_UINT8	100	10	100
M3 Forward Max Speed	User	User	%	TI_UINT8	50	10	100
M4 Forward Max Speed	User	User	%	TI_UINT8	50	10	100
M1 Reverse Max Speed	User	User	%	TI_UINT8	50	10	100
M2 Reverse Max Speed	User	User	%	TI_UINT8	100	10	100
M3 Reverse Max Speed	User	User	%	TI_UINT8	50	10	100
M4 Reverse Max Speed	User	User	%	TI_UINT8	50	10	100
Speed Limit Type	OEM	OEM		TI_UINT8	0	0	1
Multi Mode	User						
Anti Tiedown	OEM	OEM		TI_ENUM8	0	0	1
Throttle	User						
Throttle Deadband	OEM	OEM	%	TI_UINT8	10	0	30
Throttle Max	User	User	%	TI_UINT8	90	40	100
Throttle Map	User	User	%	TI_UINT8	50	5	90
Sequencing	User						
Sequencing Delay	OEM	OEM	Seconds	TI_UINT8	0.2	0	3
SRO	OEM	OEM		TI_UINT8	2	0	3
HPD	OEM	OEM		TI_UINT8	1	0	2
Main Contactor Interlock e	OEM	OEM		TI_UINT8	1	0	1
Main Contactor Open Delay	OEM	OEM	Seconds	TI_UINT8	60	0	60

Main Contactor Check	OEM	OEM		TI_ENUM8	0	0	1
Brake	User						
Brake Fault Check	OEM	OEM		TI_ENUM8	1	0	1
Brake Delay	OEM	OEM	Seconds	TI_UINT8	1	0	10
Brake Hold Voltage	OEM	OEM	%	TI_UINT8	100	0	100
Brake Driver Type	OEM	OEM		TI_UINT8	0	0	2
Anti Rollback Time	OEM	OEM	ms	TI_UINT16	100	0	1000
Emergency Reverse	User						
Speed	OEM	OEM	%	TI_UINT8	70	10	100
Direction Interlock	OEM	OEM		TI_ENUM8	0	0	1
Time Limit	OEM	OEM	Seconds	TI_UINT8	1.5	0	10
Accel Rate	OEM	OEM	Seconds	TI_UINT8	1	0.1	5
Motor	User						
Min Motor Voltage	OEM	OEM	Volt	TI_UINT16	0.1	0	6
Nominal Motor Voltage	OEM	OEM	Volt	TI_UINT16	16	7	30
Nominal Motor Frequency	OEM	OEM	Hz	TI_UINT16	111	20	400
Max Motor Speed	OEM	OEM	rpm	TI_UINT16	3800	1000	10000
Current Limit	OEM	OEM	Ampere	TI_UINT16	190	100	250
Current Limit PGain	OEM	OEM	%	TI_UINT16	25	0	100
Current Limit IGain	OEM	OEM	%	TI_UINT16	10	0	100
Number of Motor Poles	OEM	OEM		TI_UINT8	4	2	8
Encoder Pulses per Rev.	OEM	OEM		TI_UINT8	64	32	128
Swap Encoder Direction	OEM	OEM		TI_ENUM8	0	0	1
Failsafe Delay	OEM	OEM	Seconds	TI_UINT16	5	2	20
Control	User						
P Gain	OEM	OEM		TI_UINT16	0.1	0	1
I Gain	OEM	OEM		TI_UINT16	0.1	0	1.5
Accel Slip	OEM	OEM	Hz	TI_UINT16	5	1	5
Regen Slip	OEM	OEM	Hz	TI_UINT16	4	1	5
Slip Boost	OEM	OEM		TI_UINT8	1	0	10
Pull-Out Slip	OEM	OEM	Hz	TI_UINT16	10	3.5	50
Accel Slip Voltage	OEM	OEM	Volt	TI_UINT8	4	0	10
Accel Comp	OEM	OEM		TI_UINT8	0.4	0	5
Regen Slip Voltage	OEM	OEM	Volt	TI_UINT8	1	0	5
Regen Comp	OEM	OEM		TI_UINT8	3	0	5
Regen Voltage Offset	OEM	OEM	Volt	TI_UINT8	0	0	5
System	User						
Battery	User						
Full Battery Voltage	OEM	OEM	Volt	TI_UINT16	2.04	1.71	2.08
Empty Battery Voltage	OEM	OEM	Volt	TI_UINT16	1.73	0.9	2.01
BDI Reset Battery Voltage	OEM	OEM	Volt	TI_UINT16	2.09	2.03	3
Low Voltage Level	OEM	OEM	Volt	TI_INT16	1.5	1.33	2
Hourmeter	User						
Enable Total Service Hours	OEM	OEM		TI_ENUM8	0	0	1
Enable Drive Service Hours	OEM	OEM		TI_ENUM8	0	0	1

Adjust Hours	OEM	OEM	Hours	TI_UINT32	0	0	999999
Set Total Hours	OEM	OEM		TI_ENUM8	0	0	1
Set Drive Hours	OEM	OEM		TI_ENUM8	0	0	1
Total Service Hours	OEM	OEM	Hours	TI_UINT16	5000	100	5000
Drive Service Hours	OEM	OEM	Hours	TI_UINT16	5000	100	5000
Total Disable Hours	OEM	OEM	Hours	TI_UINT16	10	0	500
Drive Disable Hours	OEM	OEM	Hours	TI_UINT16	10	0	500
Drive Disable Speed	OEM	OEM	%	TI_UINT8	20	0	100
Service Total Expired	Service	Service		TI_ENUM8	0	0	1
Service Drive Expired	Service	Service		TI_ENUM8	0	0	1
Nodes 2.0	User						
Module ID	OEM	OEM		TI_UINT8	5	1	31
Master ID	OEM	OEM		TI_UINT8	0	0	3
Bitrate	OEM	OEM		TI_UINT8	0	0	2
Manufacturing Date	OEM	Factory		TI_UINT16	0	0	65535
OEM Fingerprint	OEM	OEM		TI_UINT16	0	0	65535
PDO-MISO COB	OEM	Development		TI_UINT16	33157	0	65535
PDO-MISO Data Length	OEM	OEM		TI_UINT8	8	0	8
PDO-MISO Index 1	OEM	OEM		TI_UINT16	8318	0	65535
PDO-MISO Index 2	OEM	OEM		TI_UINT16	8319	0	65535
PDO-MISO Index 3	OEM	OEM		TI_UINT16	8318	0	65535
PDO-MISO Index 4	OEM	OEM		TI_UINT16	8319	0	65535
PDO-MISO Index 5	OEM	OEM		TI_UINT16	8318	0	65535
PDO-MISO Index 6	OEM	OEM		TI_UINT16	8319	0	65535
PDO-MISO Index 7	OEM	OEM		TI_UINT16	8320	0	65535
PDO-MISO Index 8	OEM	OEM		TI_UINT16	8322	0	65535
PDO-MISO Event Control	OEM	OEM		TI_UINT8	0	0	2
PDO-MOSI COB	OEM	Development		TI_UINT16	517	0	65535
PDO-MOSI Data Length	OEM	OEM		TI_UINT8	8	0	8
PDO-MOSI Index 1	OEM	OEM		TI_UINT16	8296	0	65535
PDO-MOSI Index 2	OEM	OEM		TI_UINT16	8297	0	65535
PDO-MOSI Index 3	OEM	OEM		TI_UINT16	8320	0	65535
PDO-MOSI Index 4	OEM	OEM		TI_UINT16	8324	0	65535
PDO-MOSI Index 5	OEM	OEM		TI_UINT16	8323	0	65535
PDO-MOSI Index 6	OEM	OEM		TI_UINT16	8321	0	65535
PDO-MOSI Index 7	OEM	OEM		TI_UINT16	8298	0	65535
PDO-MOSI Index 8	OEM	OEM		TI_UINT16	8299	0	65535
PDO-MOSI Event Control	OEM	OEM		TI_UINT8	2	0	2

NOTE: for “standard parameter”, 1=on, 0=off

TROUBLESHOOTING CHART

A Status LED is built into the controller. It is visible through a window in the label on top of the controller. This Status LED displays fault codes when there is a problem with the controller or with the inputs to the controller. During normal operation, with no faults present, the Status LED flashes steadily on and off. If the controller detects a fault, a 2-digit fault identification code is flashed continuously until the fault is corrected.

CURTIS 1230 CONTROLLER TROUBLESHOOTING CHART			
LED CODE	**PROGRAMMER LCD DISPLAY**	**EXPLANATION**	**POSSIBLE CAUSE**
1, 2	Motor speed encoder	Motor speed encoder pulses are not correct.	1. Incorrect encoder wiring.
			2. Controller defective.
	Motor Failsafe	Motor stalled, or motor turning faster than desired.	1. Incorrect encoder wiring.
			2. Motor blocked.
			3. Insufficient braking torque.
			4. Motor control P Gain and I Gain settings too low.
			5. Failsafe delay too short.
1, 3	Motor Overcurrent	Motor phase overcurrent.	1. Incorrect motor wiring.
			2. Controller defective.
	Motor Output Fault	Motor output protection feature has been triggered.	1. Incorrect motor wiring.
			2. Controller defective.
1，4	Static Return To Off	SRO sequencing error.	1. Improper sequence of KSI, interlock,and direction inputs.
			2. Wrong SRO type selected.
			3. Misadjusted throttle pot.
			4. Direction switch open.
			5. Sequencing delay too short.
			6. Wrong throttle type selected.
2，1	Throttle Wiper High	Throttle wiper voltage is too high.	1. Throttle input wire shorted to B+.
			2. Defective throttle pot.
			3. Wrong throttle type selected.
			4. Incorrect speed limit pot wiring.
2，2	EMR Wiring Open	Emergency reverse wiring fault.	1. Emerg. Rev. wire or check wire broken.
2，3	High Pedal Disable	HPD sequencing error.	1. Improper sequence of KSI, interlock,
			and throttle inputs.
			2. Wrong HPD type selected.
			3. Misadjusted throttle pot.
			4. Interlock switch open.
			5. Sequencing delay too short.
			6. Wrong throttle type selected.
2，4	Throttle Wiper Low	Throttle wiper voltage is too low.	1. Throttle input wire shorted to B-.
			2. Defective throttle pot.
			3. Wrong throttle type selected.
3，1	Multiplexer Fault	Tiller multiplexer error.	1. MUX card not plugged in.
			2. MUX not wired properly.
			3. MUX card defective.
3，2	Main Contactor	Missing or welded main contactor.	1. Main contactor coil open.
			2. Main contactor missing.

			3. Wire to main contactor missing.
			4. Main contactor stuck closed.
			5. Main contactor driver shorted.
	Precharge	Precharge fault.	1. Controller defective.
			2. Low battery voltage.
3，3	Brake Fault	Brake wiring or driver fault.	1. Brake coil open.
			2. Brake missing.
			3. Wire to brake missing.
			4. Brake driver shorted.
4，1	Service Total Disable	Total disable timer has expired.	1. Expired total disable timer.
	Service Driver Disable	Drive disable timer has expired.	1. Expired drive disable timer.
	Service Total Expired	Total maintenance timer has expired.	1. Expired total maintenance timer.
	Service Driver Expired	Drive maintenance timer has expired.	1. Expired drive maintenance timer.
4，2	Battery Overvoltage	Battery voltage is too high.	1. Battery voltage >overvoltage cutback limit.
			2. Operation with charger attached.
	Battery Undervoltage	Battery voltage is too low.	1. Battery voltage <undervoltage cutback limit.
			2. Corroded battery terminal.
			3. Loose battery or controller terminal.
4，3	Temperature Cutback	Controller heatsink is too hot or too cold.	1. Temperature >85 C or <-25 C.
			2. Excessive load on vehicle.
			3. Improper mounting of controller.
			4. Operation in extreme environment.
4，4	Anti Tiedown	Mode switch activated at startup.	1. Mode switch shorted to B+.
			2. Mode switch “tied down” to select M2 permanently.
5，1	Hardware Failure	Hardware failure.	1. Controller defective.
5，2	Software Failure	Software failure.	1. Controller defective.
5，3	Parameters Corrupt	Parameters corrupt.	1. Controller defective.

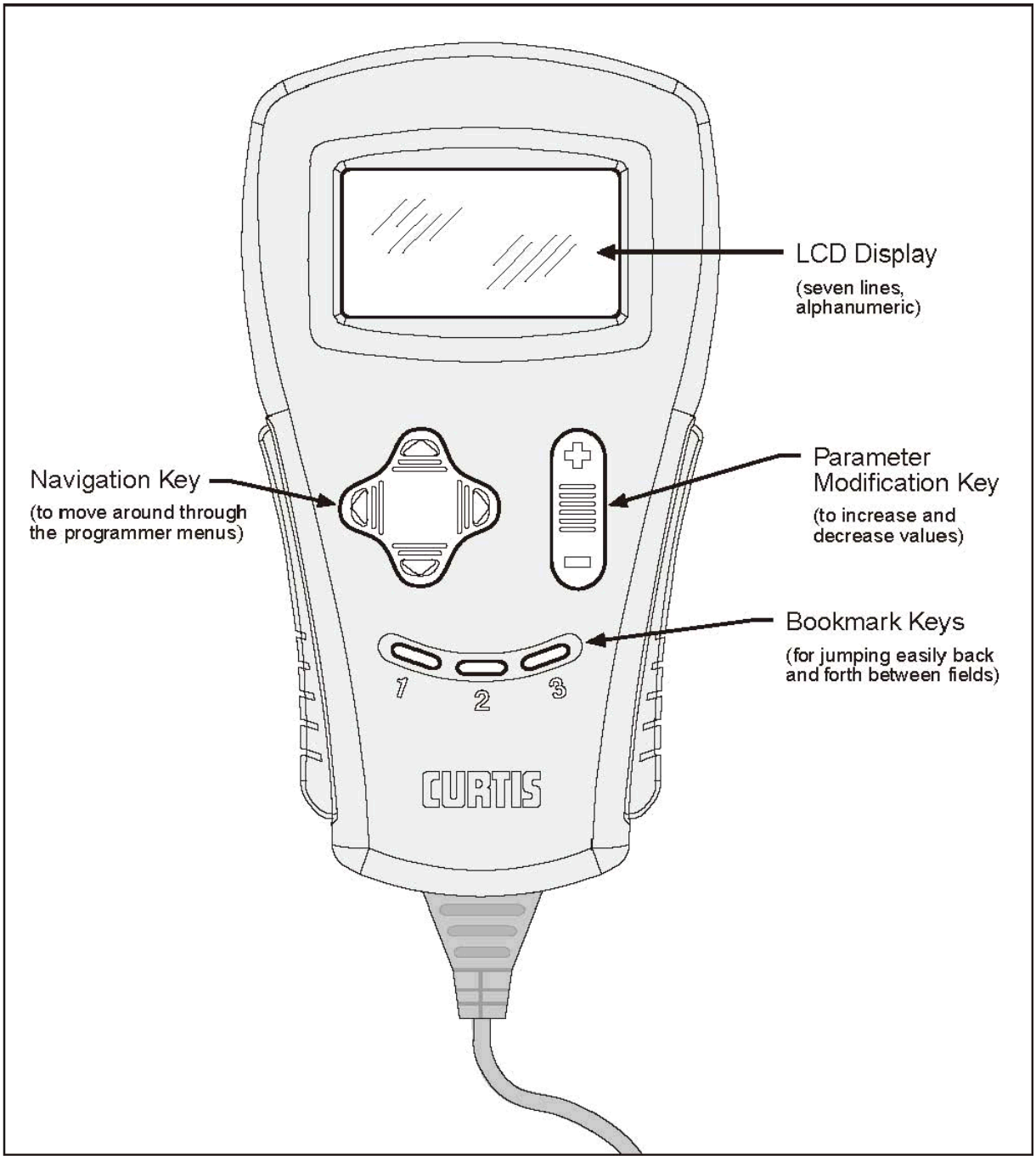
CURTIS 1311 HANDHELD PROGRAMMER

The Curtis 1311 handheld programmer provides programming, diagnostic, and test capabilities for the controller. The power for operating the programmer is supplied by the host controller via a 4-pin Molex connector.

The programmer includes a 7-line alphanumeric LCD display, rockertype keys for navigating through the display and for modifying parameters (+/-), and three keys that can be used as bookmarks.

The 1311 programmer is easy to use, with self-explanatory functions. After plugging in the programmer, wait a few seconds for it to boot up and gather information from the controller.

For experimenting with settings, the programmer can be left plugged in while the vehicle is driven.



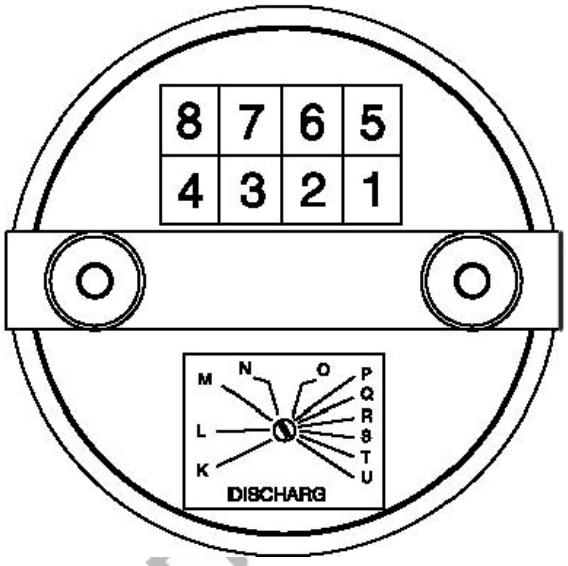
The bookmark keys allow you to quickly go back to up to three selected items without having to navigate back through the menu structure. To set a bookmark, press one of the bookmark keys for about three seconds, until the Bookmark Set screen is displayed. To jump to a set bookmark location, quickly press the appropriate bookmark key (1, 2, or 3). Note that the bookmarks are not permanently stored in the programmer. They are cleared when the programmer is unplugged.

The bookmark keys can be used to make parameter adjustment easier. For example, in adjusting the throttle deadband, you might set a bookmark at the Throttle % readout [Monitor > THROTTLE %] and another at the Throttle Deadband parameter [Program > THROTTLE DB]; this way you can easily toggle between the readout and the parameter.

3.8 BATTERY INDICATOR

Type: CURTIS 803RB2448BCJ3010

Front View



Rear View

TERMINAL ASSIGNMENT

Pin 7 or 8 = Battery +. **Single voltage models**: Pin 8 to battery +; Pin 7, open. **Dual voltage models**: When vehicle voltage is the higher voltage of the 2 operating voltages, Pin 8 connects to battery +; Pin 7, open. When vehicle voltage is the lower of the 2 operating voltages, Pin 7 connects to battery +, Pin 8, open.

The discharge indicator uses Pin 7 or 8 for its battery state-of-charge measurements. Connection are to be made as close as possible to battery to prevent voltage drops that will cause errors in discharge indicator readings. The connection is not to be switched by the vehicle's keyswitch.

Pin 5 = Battery –

Connect to battery ground as close to battery

as possible.

Pin 2 = Keyswitch. The keyswitch turns on and off the LED display of the battery discharge indicator. Monitoring of the battery continues when Pin 2 is turned off and the display is not lit. The hour meter display is unaffected by Pin 2, although it cannot accumulate more time as long as the keyswitch pin is not energized. The control inputs HRM (+) and HRM (–) are enabled by the keyswitch. Pin 2 is connected to the vehicle's keyswitch.

Pins 1 & 6 = Hour Meter Control. In normal operation, Pin 1 or 6 is connected and the other is left open. Only one of these pins is connected when using normal hour meter function. It is possible to or the hour meter between the two inputs so that it accumulates the total time either system is on. Hour meter control logic is detailed in Table 2.

Pin 6 = Hour Meter +. HRM (+) (for use with a switched positive voltage). Pin 6 connects to a high voltage as defined in Table 1. to activate the hour meter. Leaving Pin 6 open or connecting it to a low voltage gives control of the hour meter to the Hour Meter (–) input. See Table 2.

Pin 1 = Hour Meter –. HRM (–) (for use with a switched ground). Pin 1 connects to a low voltage level as defined in Table 1 to activate the hour meter. Leaving Pin 1 openor connecting it to high voltage gives control of the hour meter to the Hour Meter (+) input.

Pin 3 = Relay. Pin 3 connects in series with the lift coil circuit (or the circuit to be switched at empty). For

holding relay (J), Pin 3 must be electrically closer to battery + than Pin 4

Pin 4 = Relay. Pin 4 also connects in series with the circuit to be switched at empty.

HOUR METER CONTROL LINES & IMPEDANCE SPECIFICATIONS

Low Voltage (max.)	Hight Voltage (min.)	Min. Impedance	
		HRM+	HRM-
5.0VDC	15.0VDC	80k Ω	20 k Ω

HOUR METER CONTROL LOGIC

Pin 1 (HRM-)	Pin 6 (HRM+)	Hour Meter Status
High	Low	Off
High	Open	Off
Open	Low	Off
Open	Open	Off
Low	High	On
Low	Low	On
Low	Open	On
High	High	On
Open	High	On

DISCHARGE ADJUSTMENTS

The followed table lists the voltages per cell under load that correspond to an empty indication on the gauge (lockout point).

Setting	K	L	M	N	O	P	Q	R	S	T	U
Volt/Cell at Empty	1.57	1.63	1.68	**1.73***	1.78	1.82	1.84	1.86	1.89	1.91	1.93

NOTE: "*" – factory setting

RESET TYPE/LEVEL (AFTER OR DURING RECHARGE)

CTR = Charge Tracking Reset: If the gage is connected to the battery during recharge, the gage will track the battery charge level.

OCR = Open Circuit Reset: If the gage is disconnected from the battery during recharge, the gage will retain the last indication. It will advance to full when reconnected only if the battery voltage is above the OCR level. For standard ("B") reset, OCR = 2.09 VPC (VPC = volts per cell.)

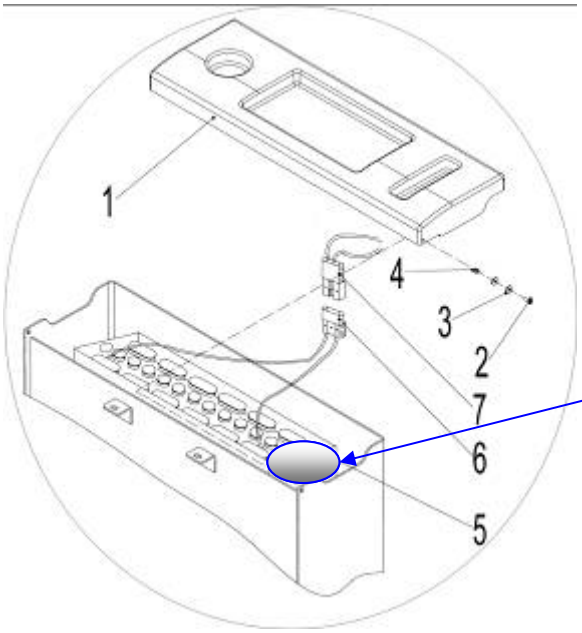
TROUBLESHOOTING

Problem	**Possible Causes**
No display	Terminals not connected or improper voltage
Stays at FULL	Instrument voltage does not match battery voltage, B+ connected to the wrong terminal
Will not reset	Instrument voltage does not match battery voltage, or battery not fully charged
Resets w/o charging battery	Not connected directly to battery terminals
EMPTY too soon	B+ connected to wrong terminal, or instrument voltage does not

	match battery voltage, or terminals not directly connected to battery

3.9 REPLACING THE ELECTRICAL PARTS

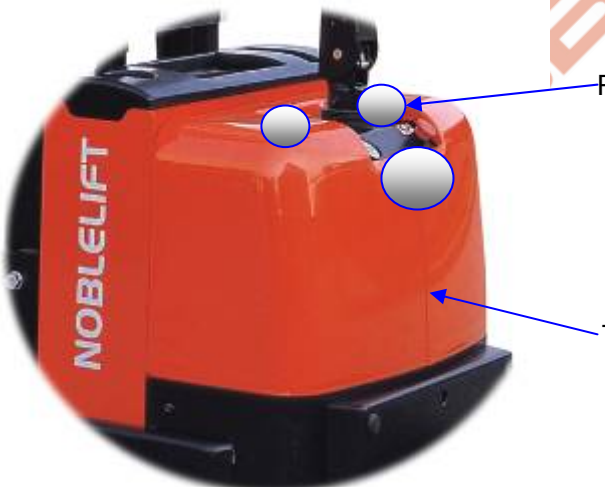
REPLACING THE BATTERY



Step 1: Remove 2 screws (No.2), loosen nuts (No.4) and washers (No.3).
Step 2: Remove the battery cover (No.1)
Step 3: Separate the plugs (No. 6 and 7)
Step 4: Use two lifting hook to hook the hole of the battery box.

Then you can use a crane to take away the battery and replace it

REPLACING THE CONTROLLER, BATTERY INDICATOR, ETC.



Remove screws.

Then remove the right cover and left cover.

You will see the appearance as the following three pictures when you remove the cover:

REPLACING THE POWER UNIT

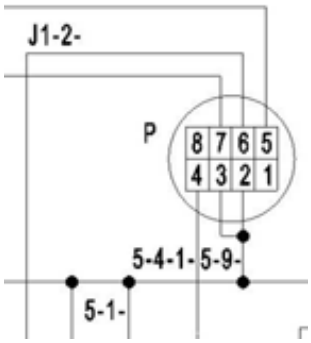
Remove the relay cable.

Remove the pipe.

Remove 2 screws.

Then you can remove the power unit and replace it.

REPLACING THE BATTERY INDICATOR



Remove two plastic nuts (under the mounting board), remove the “U” clamp, disconnect the 8 - pins plug.

Then you can remove the battery indicator and replace it.

REPLACINGTHE FUSE

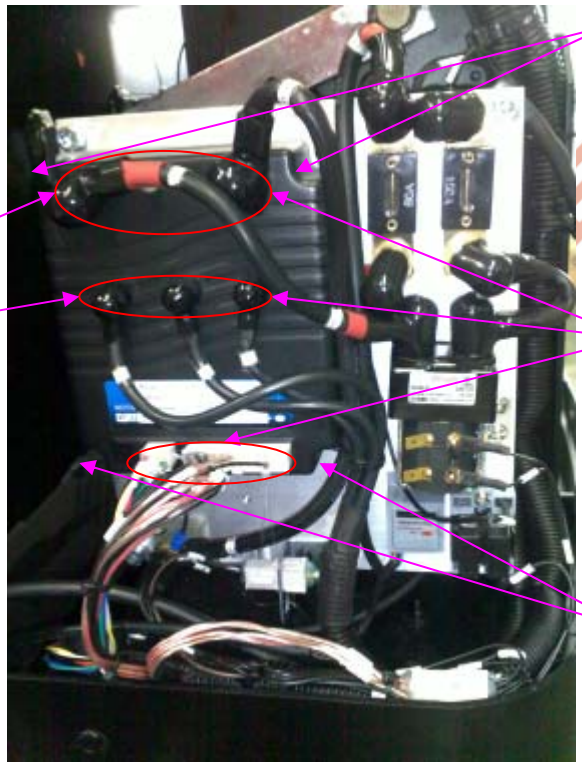
Open the black cover of the fuse seat, then you can remove the fuse and replace it.

REPLACING THE MAIN RELAY

Remove cables
Remove two screws

Remove the cables.
Then you can remove the main relay and replace it.

REPLACING THE CONTROLLER



A

B

Step2: Remove two screws

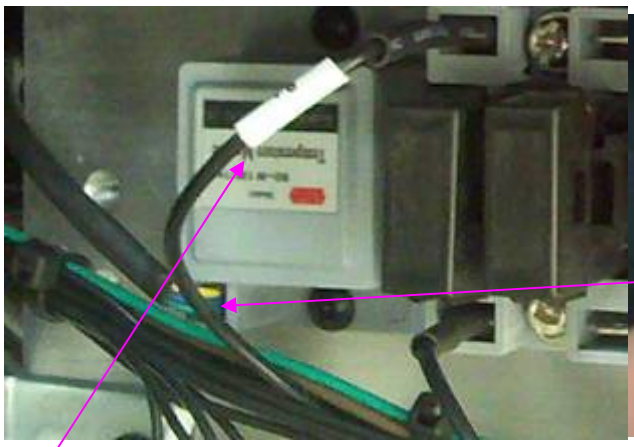
Step1: Remove all cables

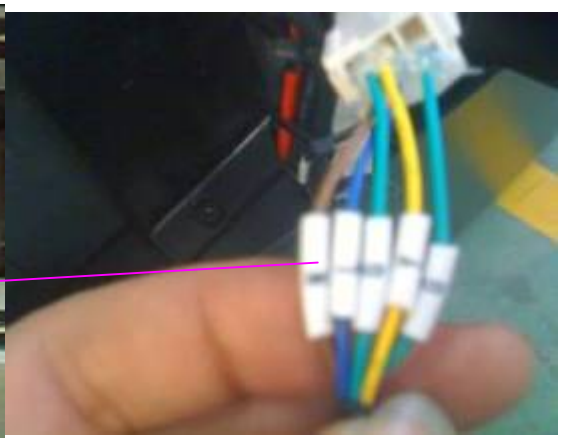
Step2: Remove two screws.

Step3: then you can remove the controller and replace it.

When reconnecting the controller, be careful to check the tightness of the power connection nut, Be sure to check the terminal connections. Taking part A and B for example:
part A: It includes anode terminal and cathode terminal, if you connect by mistake, the circuit will be short out and the controller will be damaged.
Part B: there are three terminals marked U,V,W. If you connect by mistake, the drive motor polarity will be reversed and will be demage the unit.

REPLACING THE THERMAL PROTECTION

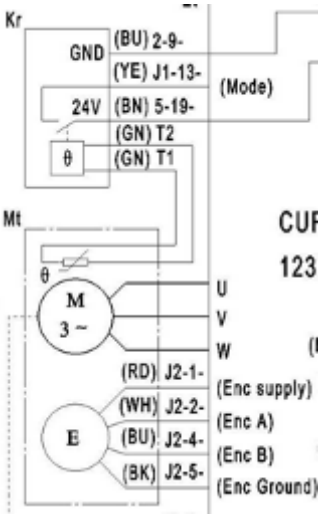




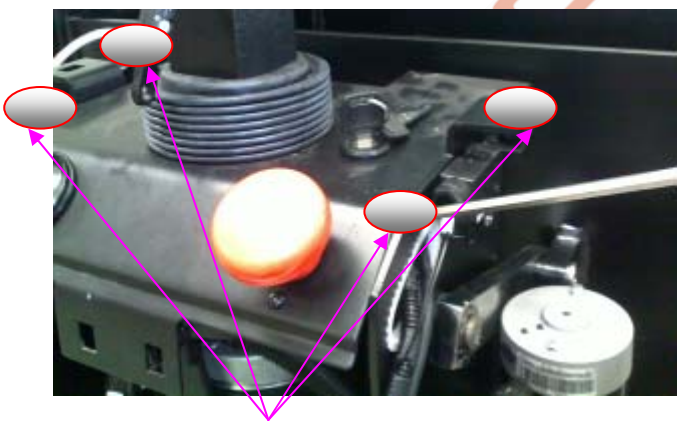
When the temperature of the motor is more than 130^{O}C, the module will give a signal to the controller, then driving speed will automatically change to low-speed mode. After the temperature reduces to 110^{O}C, the unit will change back to nomal speed.

If one line of the cable open circuit, the driving speed will remain slow.

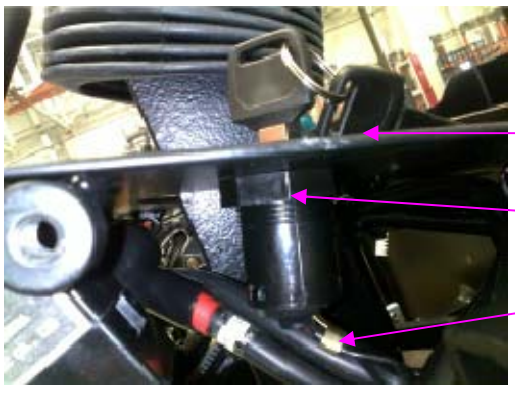
Remove the screw and the plug, then you can remove the module and replace it.



REPLACING THE LOCK (KEY SWITCH) LKS-101A



Remove **four screws** that fix the plate into vehcle frame



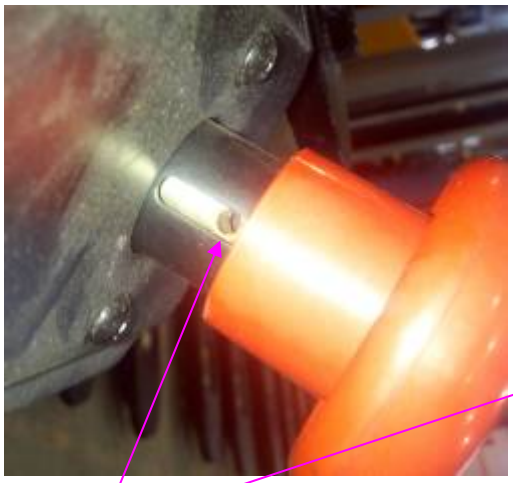
Lift the mounting plate.

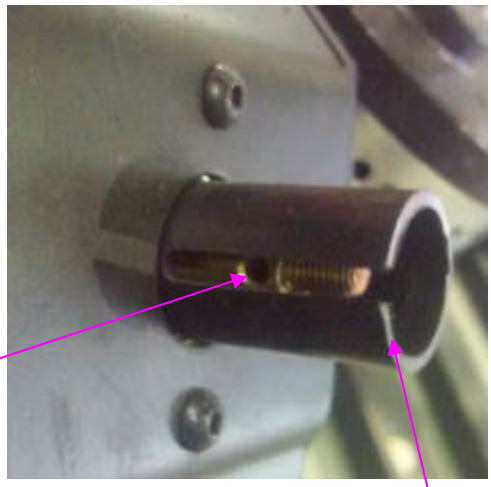
Remove the nut of the key switch.

remove the cable of the key switch.

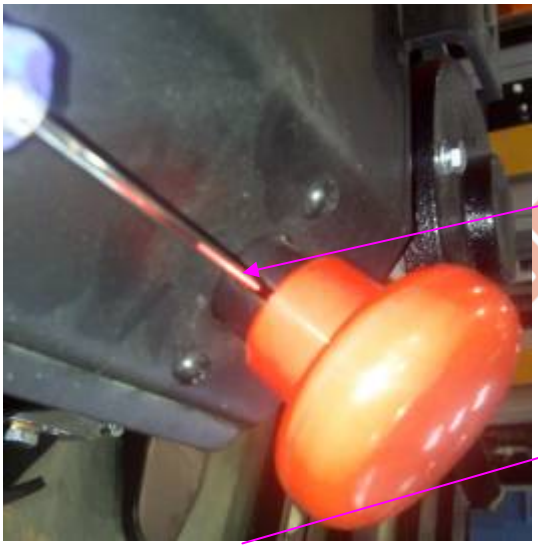
Then you can remove the key switch and replace it.

REPLACING THE EMERGENCY BUTTON

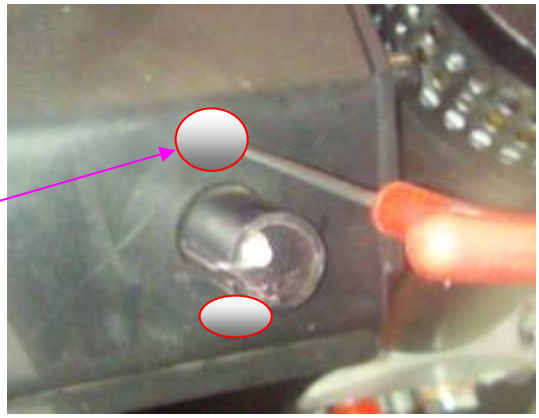




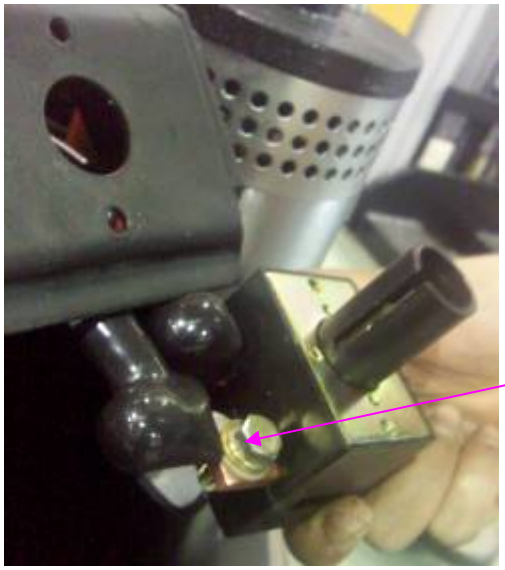
Turn the mushroom head of the emergency button in order to make the hole of the mandril and the groove of the sleeve be in the same line.



Insert the hole with a small screwdriver, then turn counter-clockwise the mushroom head to remove it.

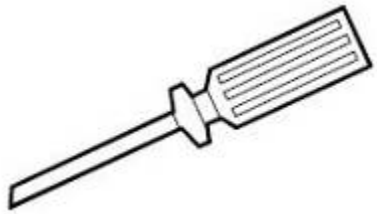
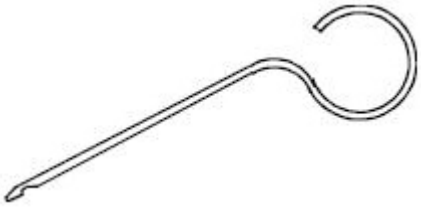
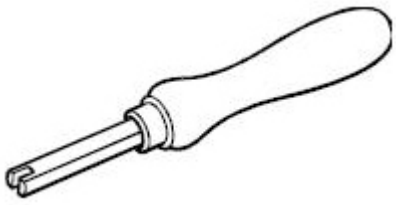
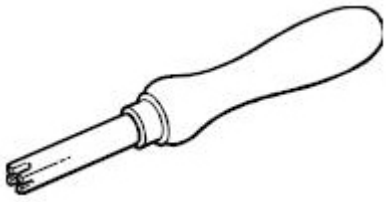
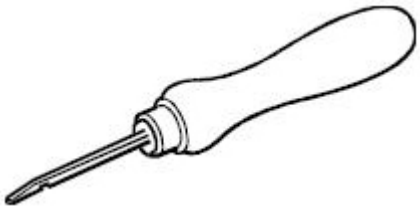


Remove two screws.



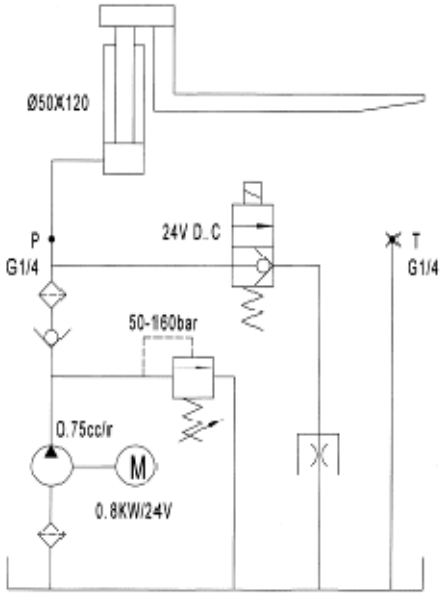
Take out the emergency button, remove two bolts and then remove the cable, then you can remove the emergency button and replace it.

3.10 TOOL FOR REPAIRING THE PIN OF ELECTRICAL PLUG

No.	Figure	Application
1		Tool for removal of pins / sleeves.
2		Tool for application of pins / sleeves
3		Tool for release of lock
4		Tool for application of secondary locking 2 – pole
5		Tool for application of secondary locking 4 – pole
6		Tool for removal of pins / sleeves

4. HYDRAULIC SYSTEM

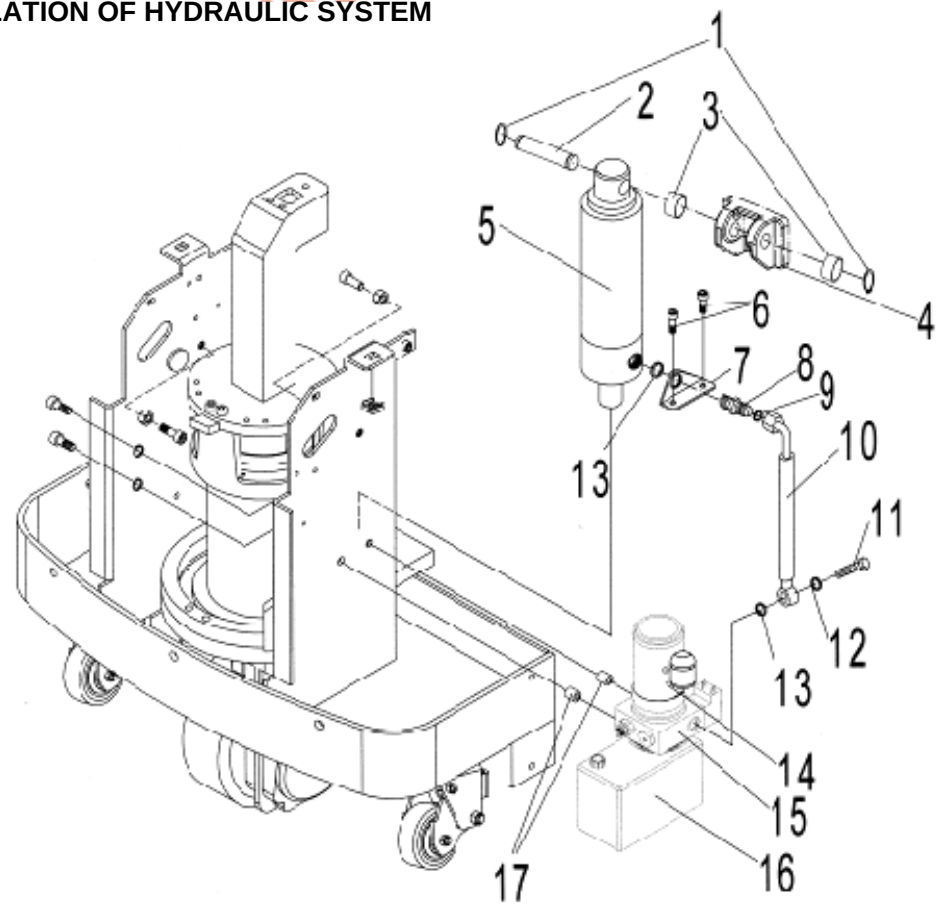
4.1 HYDRAULIC FLOW DIAGRAM



INSPECTION OF HYDRAULIC OIL

External appearance	Smell	Condition	Countermeasure
Clear and no discoloration	Fine	Fine	Possible to use
Clear but the color becames bright	Fine	Mixed with other oil	Inspect the viscosity and if fine it can be continuously used
Color changed like milk.	Fine	Mixed with air and water	Separate water or replace oil.
Color changed into dark brown	Bad	Oxidized	Replace oil.
Clear but there are small black spots	Fine	Mixed with other particles	Use after filtering.

4.2 INSTALLATION OF HYDRAULIC SYSTEM



1.	Elastic washer	7.	Mounting bracket	13.	Combination washer
2.	Shaft	8.	Joint seat	14.	Pump motor
3.	Bush	9.	O-ring	15.	Mounting plate for valve
4.	Holding bracket	10.	Rubber oil pipe	16.	Oil tank
5	cylinder	11.	bolt	17.	Bush
6.	Bolt	12.	Combination washer	18.	

4.3 REPLACING THE POWER UNIT

Remove the relay cable.

Remove the pipe.

Remove 2 screws.
Then you can remove the power unit and replace it.

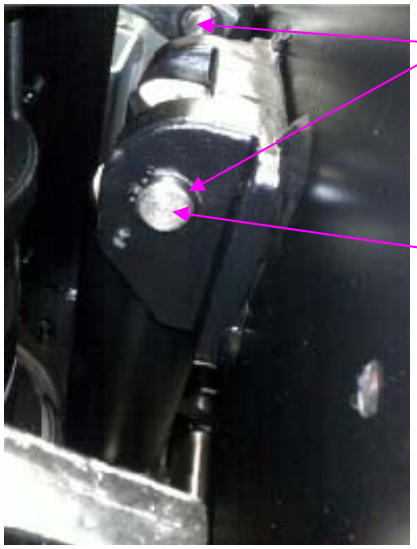
WARNING Collapse the forks to the loweredd position. Then drain the hydraulic oil from the power unit.

4.4 REPLACIING THE CYLINDER

Disconnect two bolts and the other bolts in the other side

Remove two screws.

Remove the oil pipe

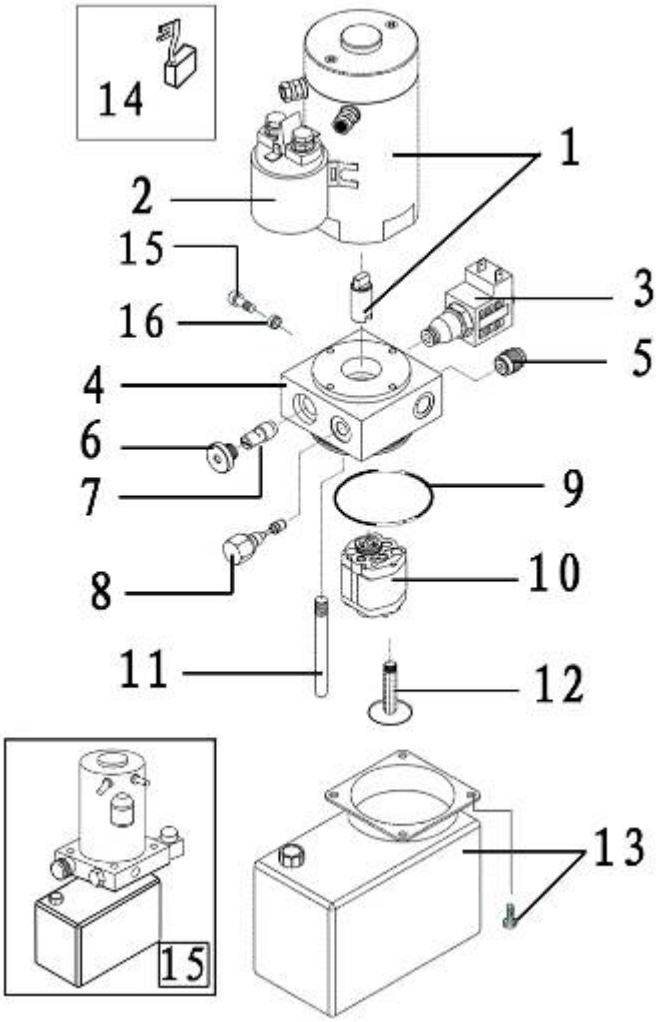


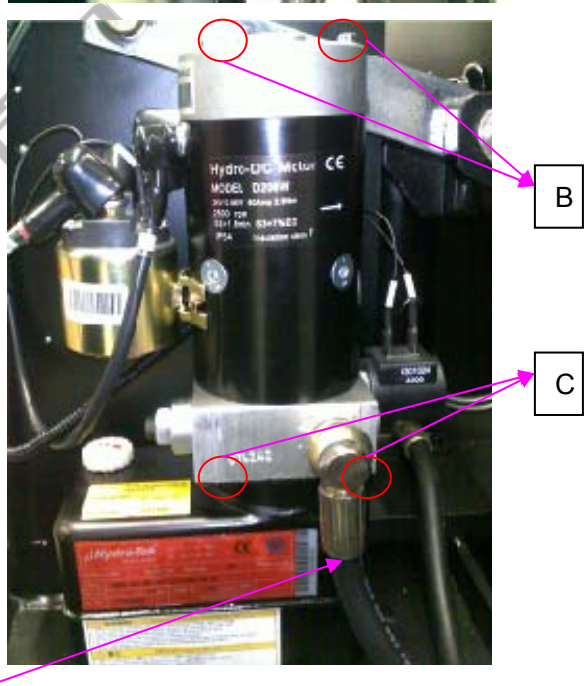
Remove two elastic washers

Remove the shaft which pass through the cylinder, then you can remove the cylinder and replace it.

4.5 CLEANING OIL TANK AND FILTER

⚠WARNING Collapse the forks to the loweredd position. Then drain the hydraulic oil from the power unit.





- Loosen two screws marked A, remove all cables and the **oli pipe**, then you can take out the power unit
- Loosen four screws marked C and two screws markd B, then you can separate the power unit into the motor(No.1), the mounting plate of vavle (No.4), the suction filter (No. 12), the oil tank (No.13).
- Clean up the mounting plate for valve (No.4), etc.
- Clean up the filter by compressed air , then inspect to check if the filter is blocked or damaged. And If the filter is blocked or damaged, it need be replaced .
- Cleaning up the oil tank, remove dust or foreign material form the oli tank
- Finally, assemble all parts.

4.6 TROUBLE DIAGNOSTICS

Symptom	Abnormality and cause	Countermeasure
Bubble in hydraulic oil	Mixed with air	Check if there is any place where air can be enteted. Tighten the loosened part again.
Discoloration	Mixed with air and water	Replace the oil.
	Became inferior in quality by oxidizing or mixed with other particles.	Replace the oil.

⚠ CAUTION The **Plug Screw of port** for adding oil is ventilate. When lower, the air will come out from the tank, it might take out little oil vapour. So, it might appear phenomena that a little oil stains on the plug after some time. This aphenomena is not caused by leaking.

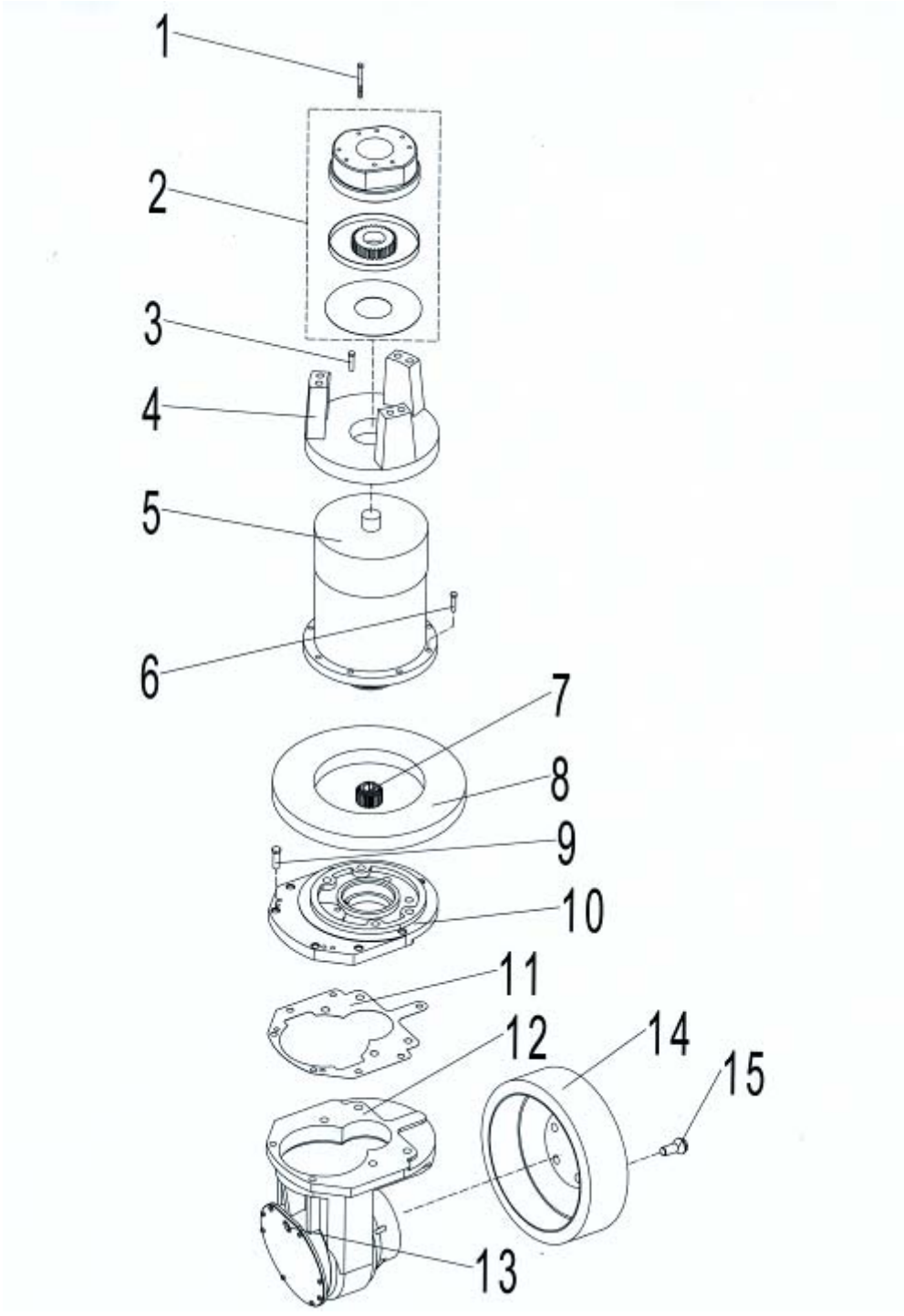
⚠ CAUTION Because the electric current of the **Relay** for the lifting motor is very big, and work continually hourly, the contact terminal of the relay is easy damaged. Please check it continually.

⚠ CAUTION The **Magnet valve** is a wearing parts. If the forks automatically lower after lifting, the magnet valve may be blocked or damaged, remove and clear it or repalce it.

HYDRAULIC PIPE

⚠ CAUTION For shocking, the **joint** of the **hydraulic pipe** and hydraulic pipe might be loosed and leak oil, so usually check it and tighten it.

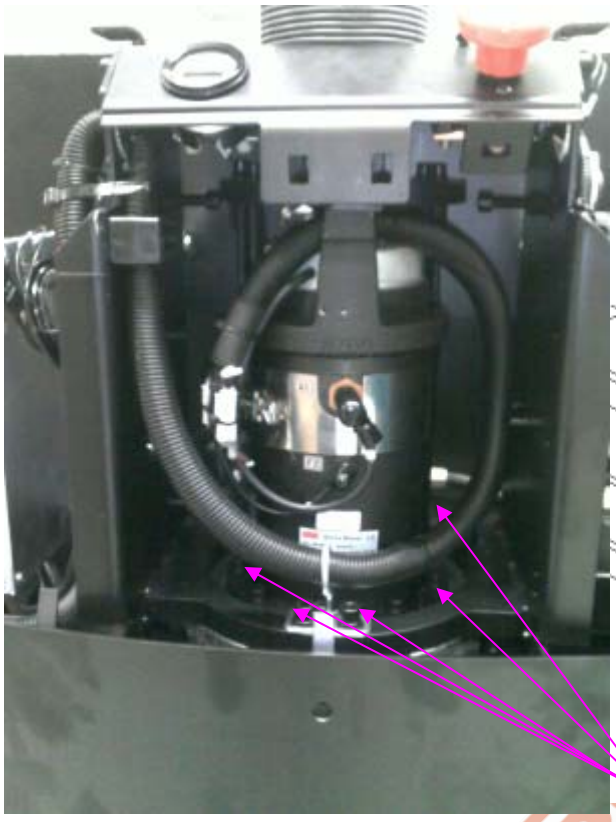
5. 5. DRIVE WHEEL

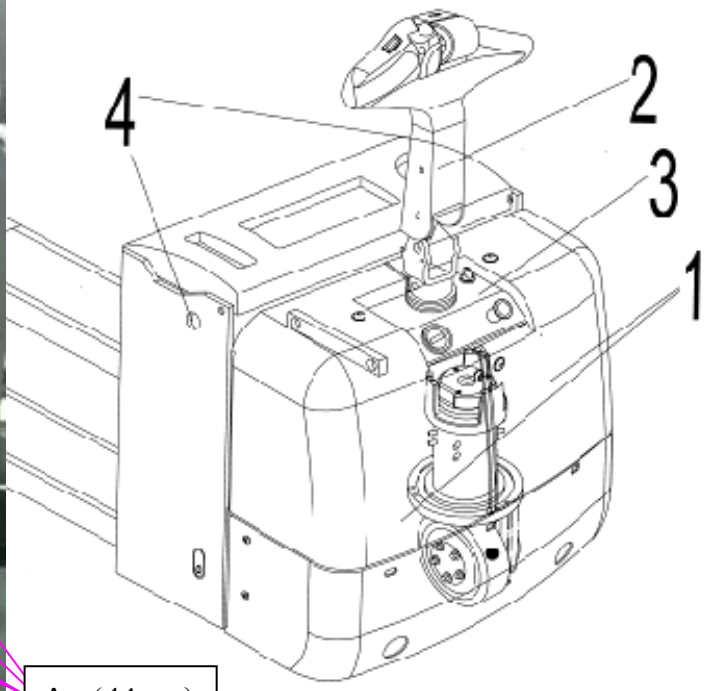


No.	Part name	No.	Part name
1	Bolt	9	Bolt
2	Brake	10	Upper cover
3	Bolt	11	Seal washer
4	Tiller bar plate	12	Bolt
5	Motor	13	Wheel

6	Bolt	14	Bolt, for adding oil
7	Gear	15	Gear-box
8	Holding bearing		

5.1 REPLACING THE DRIVE SYSTEM AND WHEEL





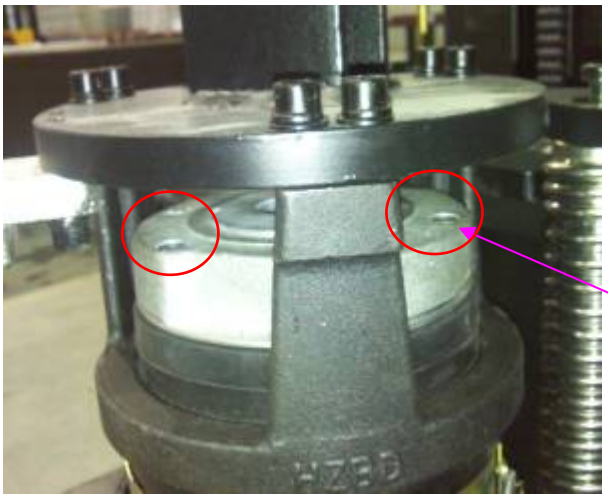
A （14pcs）

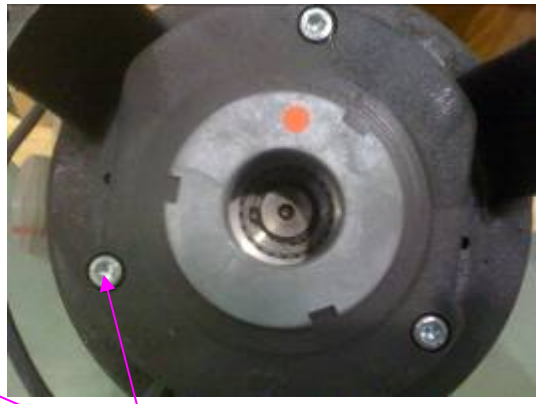
Step1: Remove the cover marked 1 as above right picture.
Step2: Remove the handle marked 2 as above right picture.
Step3: Remove the mounting plate marked 3 as above right picture.
Step4: Loosen the screws marked A as the right picture.
Step5: Remove all the cables that fixed in the motor.
Step6: Hoist the vehicle through the hole marked 4 as bove picture.
Step7: Then you can remove the drive motor from chassis and replace it. Or you can directly replace the wheel

⚠WARNING Cut off the power before operating.

Remove 5 nuts with the spanner.
Then you can remove the drive wheel and replace it.

5.2 REPLACING THE BRAKE





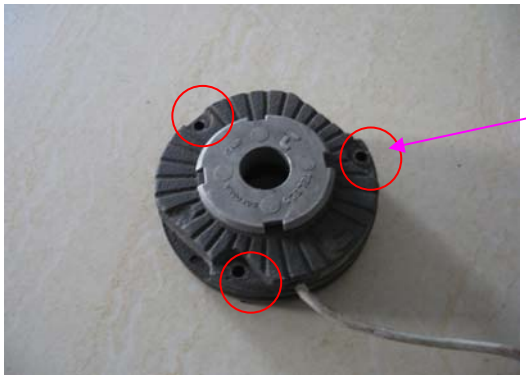
Remove 3 screws, remove the connector, then you can remove the brake and replace it.

5.3 BRAKE CLEARANCE ADJUSTMENT

Brake coil must always be connected to the power (+24v), when energized the brake will dis engage. If the brake system loose power, while unit is use, the unit may lose speed, and motor may reduce excessive heat

Step 1: Measure the resistance by multimeter（200Ω）, and The Winding resistance: 25Ω normal (+1,-1Ω)

Step 2:



Loosen the three bolts that hold the brake

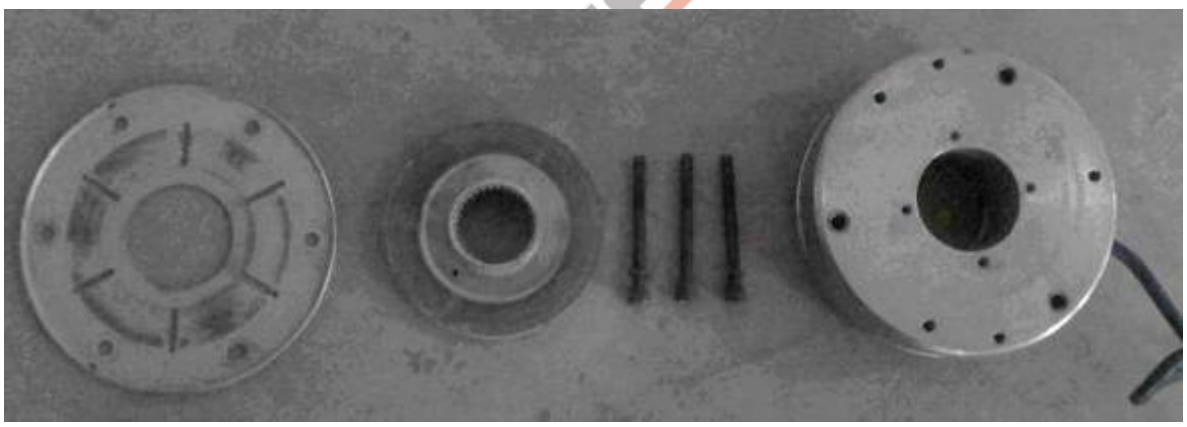
Step 3:

Adjust the brake spacer plate bolts in or out to adjust the Clearance of the brake plate.

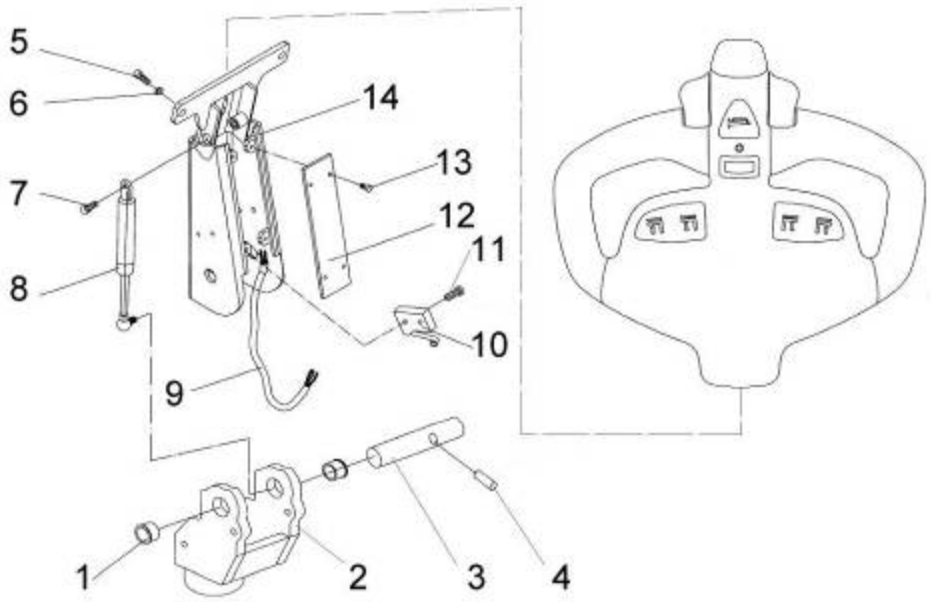
Be sure not to over tighten the bolts

Step 4: Adjust the above-mentioned bolts counter clockwise. adjust 2-3 revolutions to reduce the spring tension.

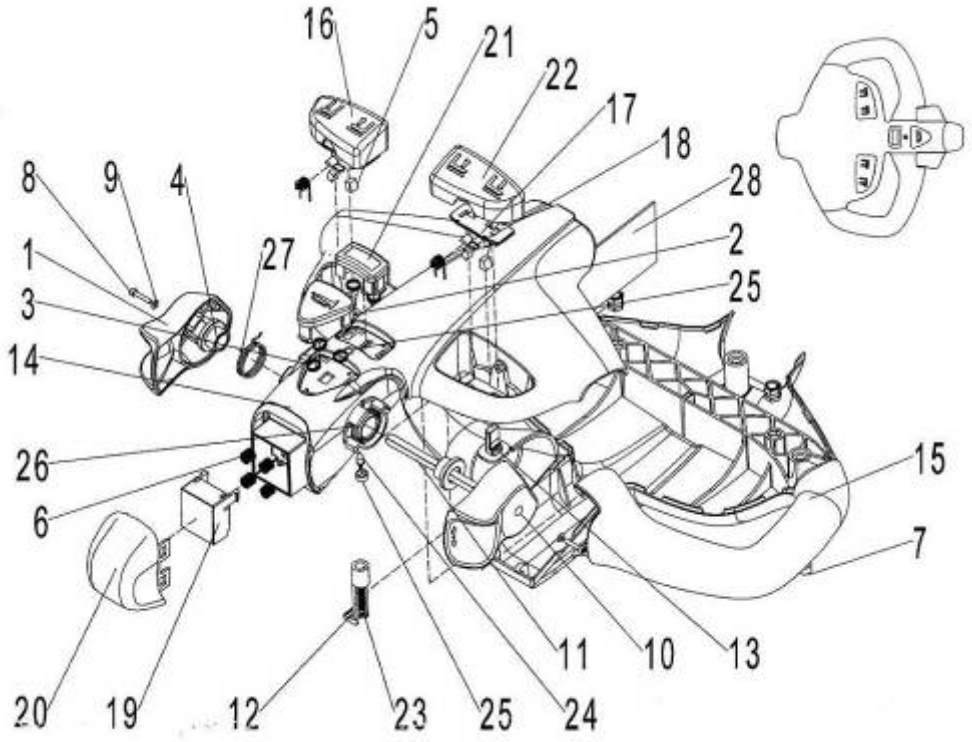
⚠ CAUTION Ensure brake disk is clean free of dust. Also ensure the plug is firmly connected



6. CONTROL HANDLE



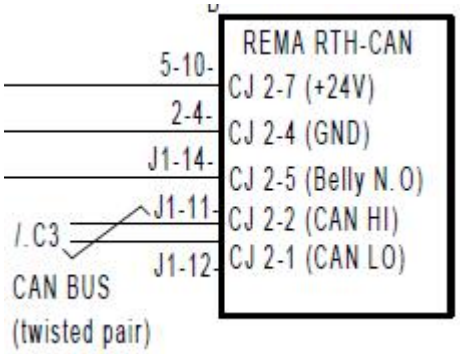
No.	Part name	No.	Part name
1	Bushing, 23/19*17*10	8	Air spring
2	Handle mounting bracket	9	Handle cable
3	Shaft, ϕ17	10	Micro switch Z-15GW2
4	Roll pin, ϕ4x24	11	Screw, M4x25
5	Socket hex bolts M8x25	12	Cover
6	Elastic washer 8	13	Screw, M4x10
7	Socket hexa bolts M8X16	14	Tillerarm



No.	Part name	No.	Part name
1	Butterfly left or throttle switch left	16	Seesaw-left or toggle button left
2	Button for horn	17	Magnet holder for seesaw
3	Spring	18	Hinge spring
4	Bearing for camshaft	19	Contact base
5	Magnet	20	Belly switch cover
6	Spring for belly botton switch	21	Optional cover
7	Socket hexagonal Screw, M6X10	22	Seesaw right or toggle button right
8	Socket hexagonal Screw, M3X16	23	Tapping screw, ST4.2X25
9	Washer, 3	24	LED bicolor
10	Butterfly right	25	Housing for LED two parts
11	Edge Shaft	26	Spring RH throttle torsion
12	PCB-clip	27	Spring LH throttle torsion
13	Sensor for rocker lever	28	Printed board
14	Upper-part		
15	Lower-part		

6.1 REPLACING THE CONTROL HANDLE

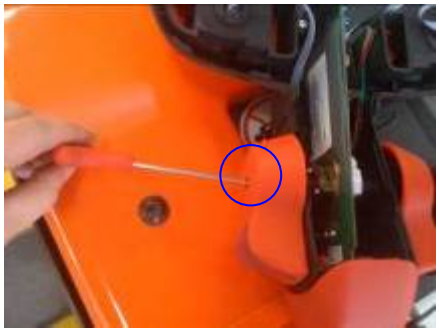
Remove 3 bolts which are behind the handle.



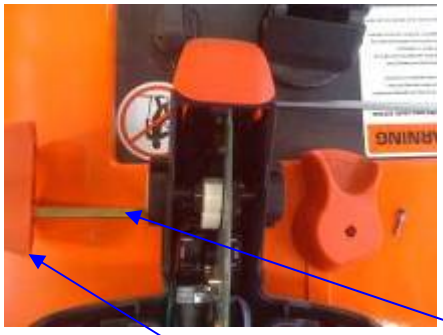
Push slightly the upper cover about 10mm, then open it. The electric parts in the handle will be exposed

6 pin plug, must be firmly connected to the controller.

Remove the screw to remove the circuit board

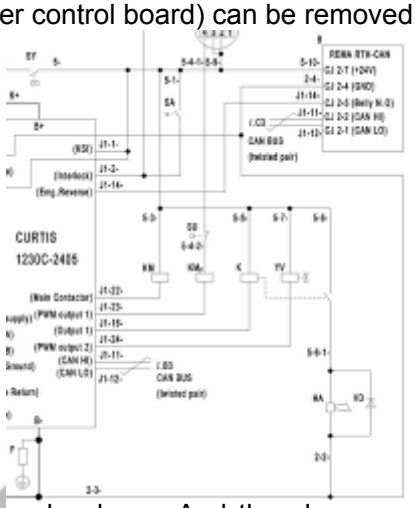


Remove the bolt to remove the throttle lever



once the bolt is removed from the throttle lever the opposing throttle lever and throttle shaft can be pulled out through the oppsoing side of the handle.

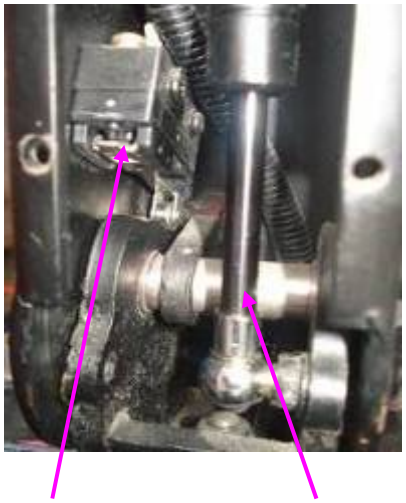
Once the throttle levers are removed , the PCB (power control board) can be removed.



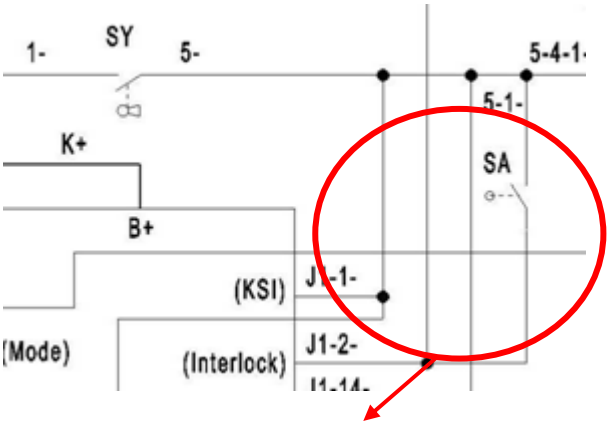
When inspection the PCB ensure the micro switch rocker lever. And the plug connections are firmly connected to the cirsuit board and are servicable.

6.2 REPLACING THE AIR SPRING AND MICRO SWITCH

Remove 4 bolts.



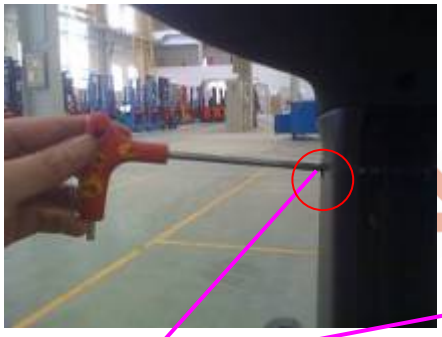
Micro Switch and Air Spring



The signal to the #2 pin of CURTIS1230C

⚠WARNING Ensure the micro switch is mounted in the correct position. The switch may require adjustment upon re-installation.

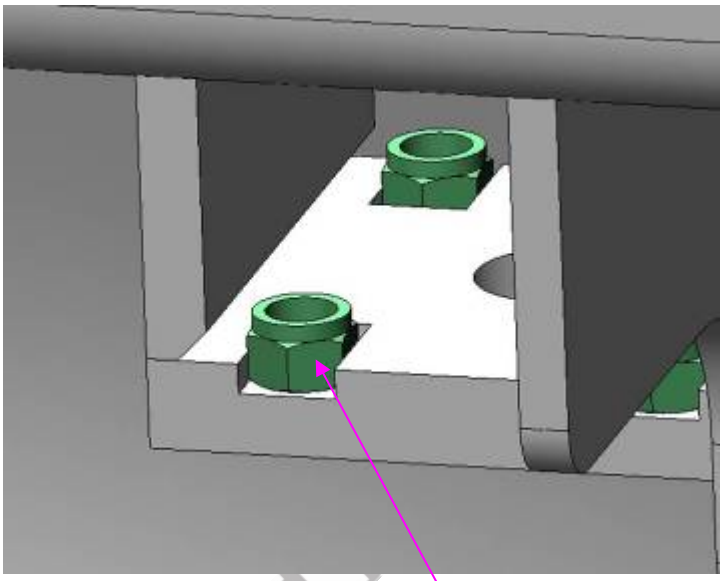
Use a Phillps screwdriver to remove two screws, then you can dismantle the air spring and replace it.



Remove this bolt. Then you can remove the micro switch and replace it.

7. CASTER WHEEL

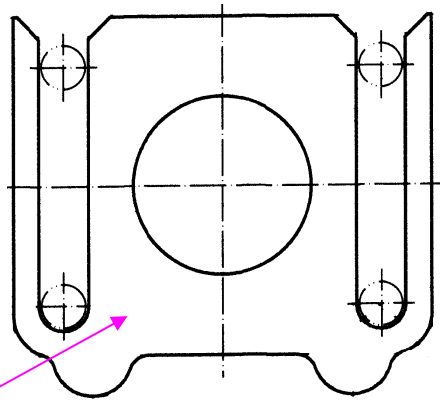
7.1 REMOVING OF THE CASTER WHEEL



First, let the pallet truck to be slanting, then dismantle four screws. Note to help the nut when turning the screws. Then you can dismaantle the caster and replace it.

7.2 ADJUSTING THE PRESSURE FOR THE DRIVE WHEEL

After using some time, the drive wheel might wear off, the pressure for the drive wheel will not be enough, and drive wheel can not bit into the ground and slip.
You can adjust it according to following steps:



Step 1: Loose the four bolts (do not need to dismantle them)
Step 2: Take away one or two piece washer.

8. TROUBLE DIAGNOSTICS

8.1 MAINTENANCE LIST

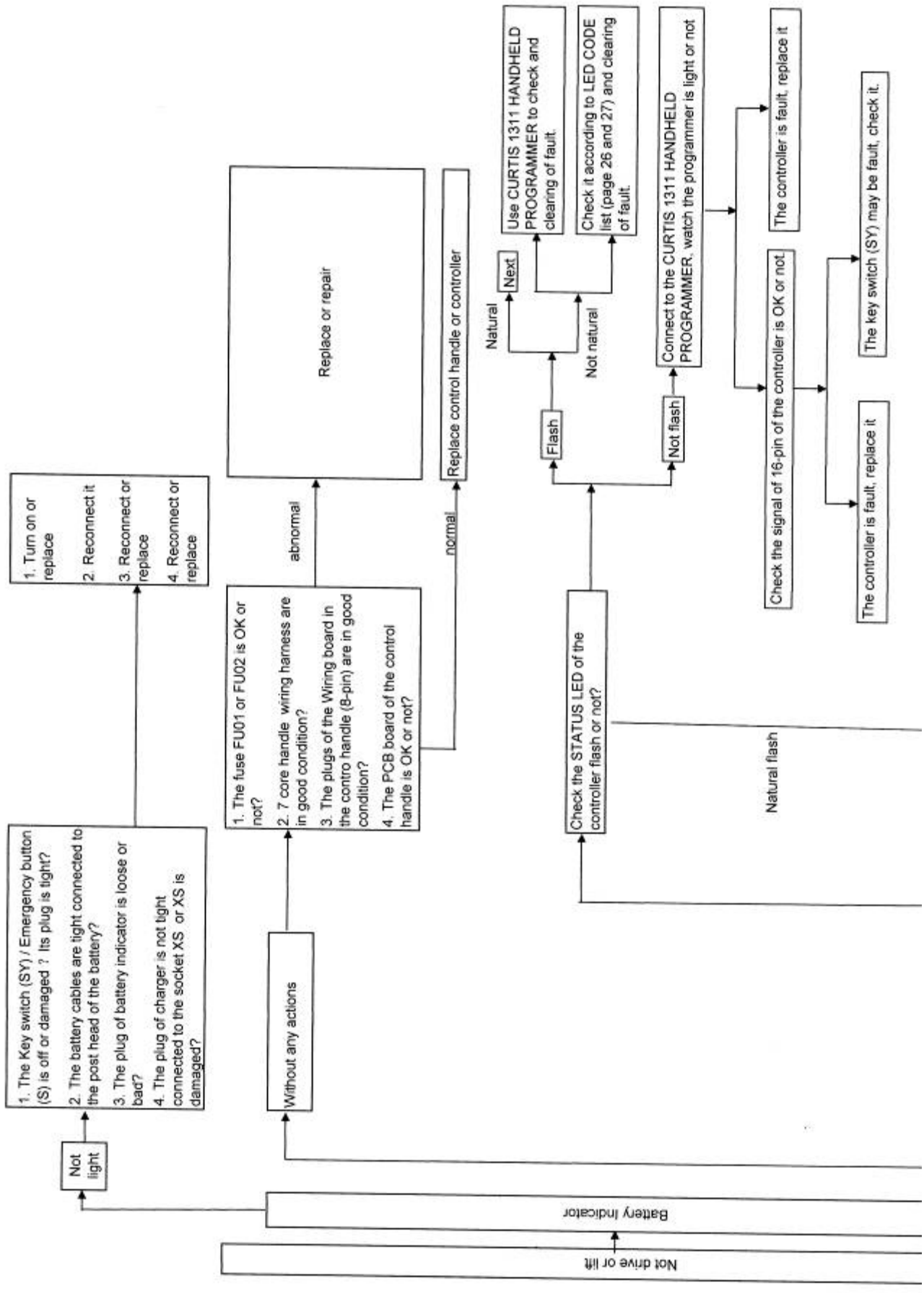
			Maintenance Time Interval			
			Standard=●	W	M	M	M
			Refrigerating house=#	1	3	6	12
Chassis and truck frame	1.1	Inspection of any damage of bearing parts		●		
	1.2	Inspection of all joints of bolts		●		
Driving part	2.1	Inspection of noise and leakage of driving system		●		
	2.2	Inspection of oil level of driving system		●		
	2.3	Replace lubrication			#	●
Wheel part	3.1	Inspection of wearing and damage state		●		
	3.2	Inspection of bearings inside wheels and ensure compact fit with wheels a)		●		
Steering system	4.1	Inspection of steering operation motion		●		
Braking system	5.1	Inspection of performance and adjust it	#	●		
	5.2	Inspection of reset function of gas spring and any leakage or damage		●		
	5.3	Inspection of wearing state of brake wheel		●		
	5.4	Inspection of brake connection and adjust it if necessary		●		
Lifting equipment	6.1	Inspection of performance, wearing and adjust it		●		
	6.2	Inspection t of any block of loading wheel by sight		●		
	6.3	Inspection of any wearing or damage of edge of forks and pallet	#	●		
Hydraulic system	7.1	Inspection of performance	#	●		
	7.2	Inspection of any leakage or damage of all joints b)	#	●		
	7.3	Inspection of any leakage or damage of hydraulic cylinder, safety and reliability of attachment	#	●		
	7.4	Inspection of oil capacity	#	●		
	7.5	Replace hydraulic oil and filter d）			#	●
	7.6	Inspection of adjustment function of pressure regulator			#	●
Electrical system	8.1	Inspection of performance		●		
	8.2	Inspection of safety and reliability of connection of all cables, and if any damage		●		
	8.3	Inspection of Amperage of fuse				
	8.4	Inspection of safety, reliability and function of switches and unlocking cam equipment		●		
	8.5	Inspection of connector, replace the worn part if necessary				
	8.6	Inspection of function of alarm equipment	#	●		
Motor	9.1	Inspection of wearing state of carbon brush		●		
	9.2	Inspection of safety of motor attachment		●		
	9.3	Clean motor frame with vacuum cleaner, inspection of wearing state of commutor		#	●	
Battery	10.1	Inspection of density and capacity of acid, voltage of battery	#	●		
	10.2	Inspection of safety device of connection terminal, applicability of grease	#	●		
	10.3	Clean connector of battery, inspection of compactness of fit	#	●		
	10.4	Inspection of damage of battery cable, replace it if necessary		●		
Lubrication	11.1	Paint grease to the truck according to the time schedule of lubrication feeding	#	●		
Integrated measurement	12.1	Inspection of the fault in grounding of electrical system				●
	12.2	Inspection of driving speed and braking distance				●
	12.3	Inspection of lifting and lowering speed				●
	12.4	Inspection of safety device and closing device		●		
Demonstration	13.1	Commissioning under load rating		●		
	13.2	After above maintenance, the truck is certificated to be reliable for operator	#	●		

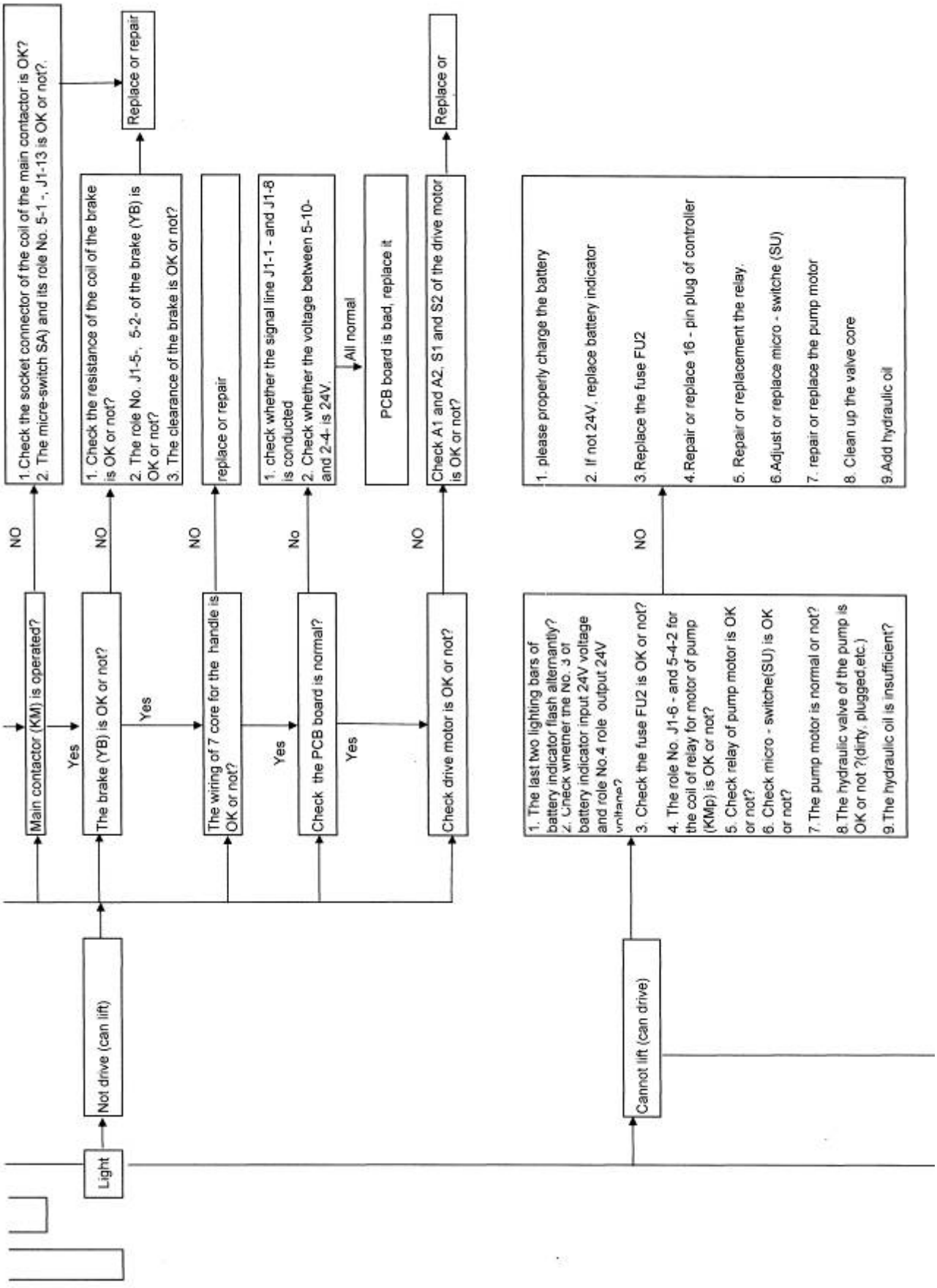
a）About 100 hours after initial operation, check if any loose nuts on wheels and tighten them if necessary.

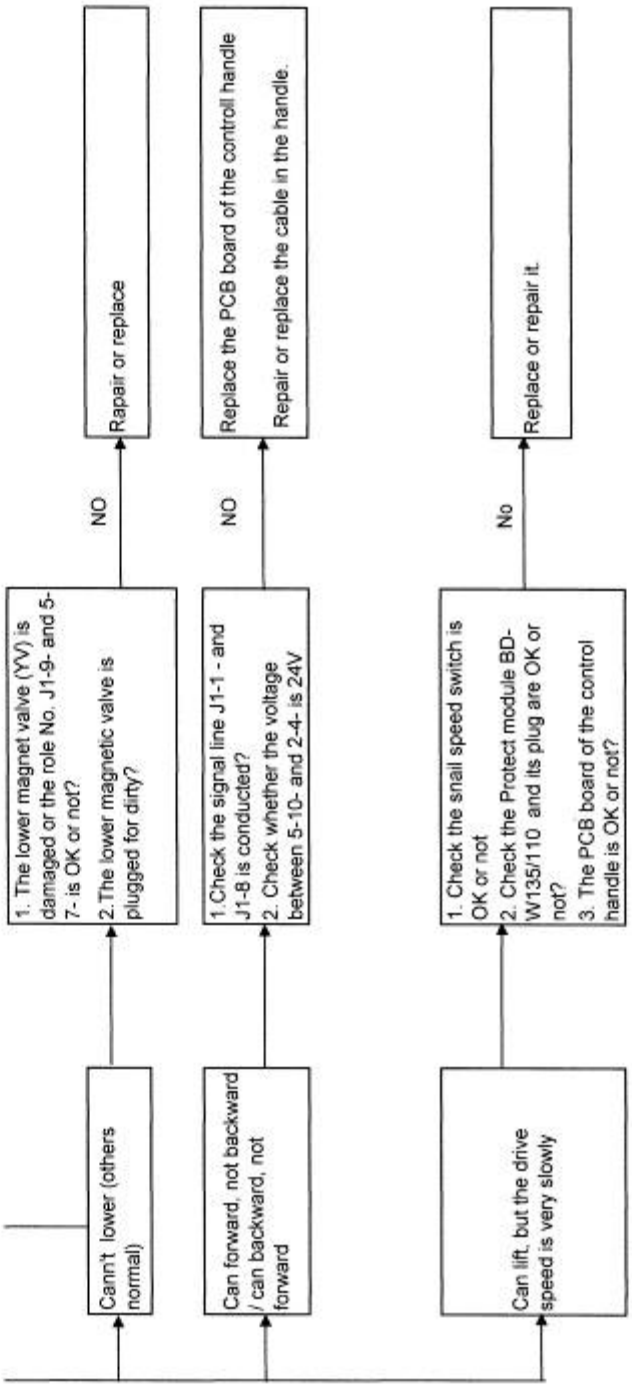
b）About 100 hours after initial operation, check if any leakage of hydraulic parts and tighten them if required.

c) 500 hours after initial operation.

8.2 TROUBLE SHOOT




Light
Not drive (can lift)
Main contactor (KM) is operated?
NO
1.Check the socket connector of the coil of the main contactor is OK?
2. The micre-switch SA) and its role No. 5-1 -, J1-13 is OK or not?.
Replace or repair
Yes
The brake (YB) is OK or not?
NO
1. Check the resistance of the coil of the brake is OK or not?
2. The role No. J1-5-, 5-2- of the brake (YB) is OK or not?
3. The clearance of the brake is OK or not?
Yes
The wiring of 7 core for the handle is OK or not?
NO
replace or repair
Yes
Check the PCB board is normal?
No
1. check whether the signal line J1-1 - and J1-8 is conducted
2. Check whether the voltage between 5-10- and 2-4- is 24V.
All normal
PCB board is bad, replace it
Yes
Check drive motor is OK or not?
NO
Check A1 and A2, S1 and S2 of the drive motor is OK or not?
Replace or
Cannot lift (can drive)
1. The last two lighting bars of battery indicator flash alternantly?
2. Check whether the No. 3 of battery indicator input 24V voltage and role No.4 role output 24V voltage?
NO
1. please properly charge the battery
2. If not 24V, replace battery indicator
3. Check the fuse FU2 is OK or not?
3.Replace the fuse FU2
4. The role No. J1-6 - and 5-4-2 for the coil of relay for motor of pump (KMp) is OK or not?
4.Repair or replace 16 - pin plug of controller
5. Check relay of pump motor is OK or not?
5. Repair or replacement the relay.
6. Check micro - switche(SU) is OK or not?
6.Adjust or replace micro - switche (SU)
7. The pump motor is normal or not?
7. repair or replace the pump motor
8. The hydraulic valve of the pump is OK or not ?(dirty, plugged,etc.)
8. Clean up the valve core
9. The hydraulic oil is insufficient?
9.Add hydraulic oil


Cann't lower (others normal)
1. The lower magnet valve (YV) is damaged or the role No. J1-9- and 5-7- is OK or not?
2.The lower magnetic valve is plugged for dirty?
NO
Rapair or replace
Can forward, not backward / can backward, not forward
1.Check the signal line J1-1 - and J1-8 is conducted?
2. Check whether the voltage between 5-10- and 2-4- is 24V
NO
Replace the PCB board of the controll handle
Repair or replace the cable in the handle.
Can lift, but the drive speed is very slowly
1. Check the snail speed switch is OK or not
2. Check the Protect module BD-W135/110 and its plug are OK or not?
3. The PCB board of the control handle is OK or not?
No
Replace or repair it.