

**NOBLIFT**

NOBLELIFT EQUIPMENT

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**Service & Maintenance Manual**  
**Power Sacker**  
**CG1646**

V-CG1646-01.00

Date: 2011-2-10

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## FOREWORD

Proper operation, maintenance, troubleshooting and repairs are necessary to preserve the performance of the stacker 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 stacker 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, for the most parts, 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 RESPONSIBIUTY 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.

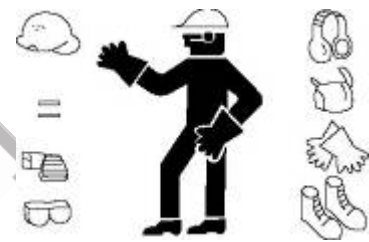
- Your safety, and that of others , is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of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



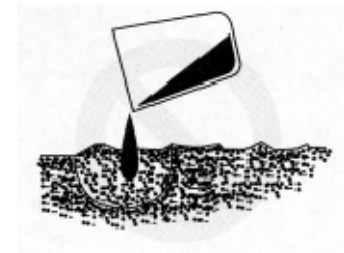
- Remove all rings, watches and jewelry when performing any maintenance.
- Wear well-fitting helmet, safety shoes and working clothes when drilling, grinding or hammering always. Wear protective goggles. Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do 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 naked 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 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.



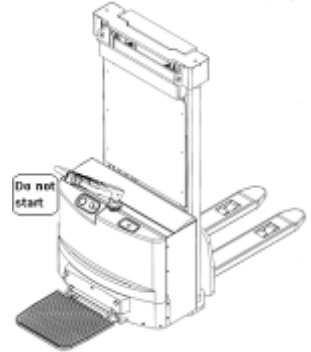
- Keep the battery away from fire hazards. The generated gases are explosive.
- Store all the oils in a specified place.
- Keep the flammable things away from the machine. Do not smoke in the working site.



- 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" or "Maintenance in progress"). This will prevent anyone from starting or moving the machine by mistake.

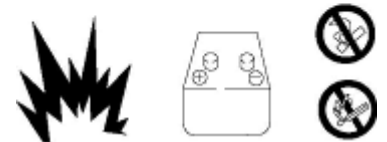
- When welding on the machine or working on the electrical system, ALWAYS turn the key switch OFF and remove the battery plug from the battery. Park the machine on firm, flat ground. Lower the fork to the min. height and stop the motor.



- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin and eat holes in clothing. If you spill acid on your clothes or skin, immediately flush 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.
- Keep sparks, lighted matches, and open flame away from the top of battery. Battery (hydrogen) gas can explode.



- When disassembling and assembling the battery, make sure that the battery terminals (+, -) are correctly connected.

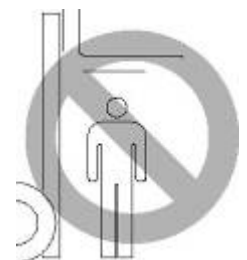
- If water gets into the electrical system, abnormal operation or failure can result. Do not use water or steam on sensors, connectors and instruments in the cab.



- 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 stacker 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 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 filter, 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.

- Do not allow anyone to stand or walk under the elevated forks or load.
- Never use the forks to lift people.



## 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, 1 $\mu$ m=0.001mm

### Area

Unit	cm <sub>2</sub>	m <sub>2</sub>	km <sub>2</sub>	a	ft <sub>2</sub>	yd <sub>2</sub>	in <sub>2</sub>
cm <sub>2</sub>	1	0.0001	–	0.000001	0.001076	0.000012	0.155000
m <sub>2</sub>	10000	1	0.000001	0.01	10.764	1.1958	1550.000
km <sub>2</sub>	–	1000000	1	10000	1076400	1195800	–
a	0.01	100	0.0001	1	1076.4	119.58	–
ft <sub>2</sub>	–	0.092903	–	0.000929	1	0.1111	144.000
yd <sub>2</sub>	–	0.83613	–	0.008361	9	1	1296.00
in <sub>2</sub>	6.4516	0.000645	–	–	0.006943	0.000771	1

1ha=100a, 1mile<sub>2</sub>=259ha=2.59km<sub>2</sub>

### Volume

Unit	cm <sub>3</sub> = cc	m <sub>3</sub>	l	in <sub>3</sub>	ft <sub>3</sub>	yd <sub>3</sub>
cm <sub>3</sub> = m l	1	0.000001	0.001	0.061024	0.000035	0.000001
m <sub>3</sub>	1000000	1	1000	61024	35.315	1.30796
l	1000	0.001	1	61.024	0.035315	0.001308
in <sub>3</sub>	16.387	0.000016	0.01638	1	0.000578	0.000021
ft <sub>3</sub>	28316.8	0.028317	28.317	1728	1	0.03704
yd <sub>3</sub>	764529.8	0.76453	764.53	46656	27	1

1gal(US)=3785.41 cm<sub>3</sub>=231 in<sub>3</sub>=0.83267gal(US)

### Weight

Unit	g	kg	t	oz	lb
g	1	0.001	0.000001	0.03527	0.0022
kg	1000	10	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 <sub>2</sub>	bar	Pa=N/m <sub>2</sub>	kPa	lbf/in <sub>2</sub>	lbf/ft <sub>2</sub>
kgf/cm <sub>2</sub>	1	0.98067	98066.5	98.0665	14.2233	2048.16
bar	1.01972	1	100000	100	14.5037	2088.6
Pa=N/m <sub>2</sub>	0.00001	0.001	1	0.001	0.00015	0.02086
kPa	0.01020	0.01	1000	1	0.14504	20.886
lbf/in <sub>2</sub>	0.07032	0.0689	6894.76	6.89476	1	144
lbf/ft <sub>2</sub>	0.00047	0.00047	47.88028	0.04788	0.00694	1


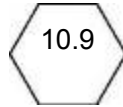
kgf/cm<sub>2</sub>=735.56 Torr(mmHg)=0.96784atm

## Standard tightening torque


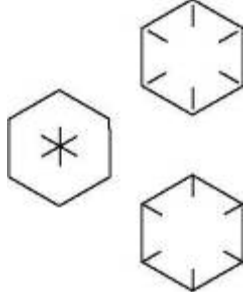
The following charts give the standard tightening torques of bolts and nuts.

Exceptions are given in 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 in above table shall not be applied to the bolts with nylon packings and nonferrous metal washers, or the ones with specially designated torque and standard.

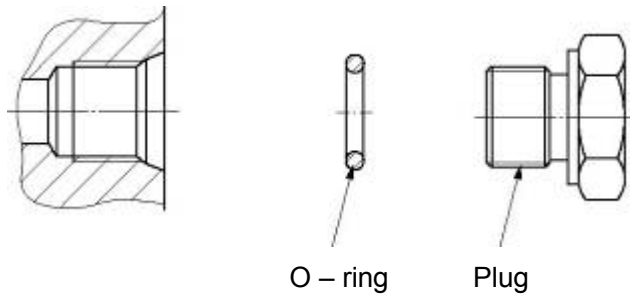
H Newton meter : 1 N·m = 0.1kgf·m

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

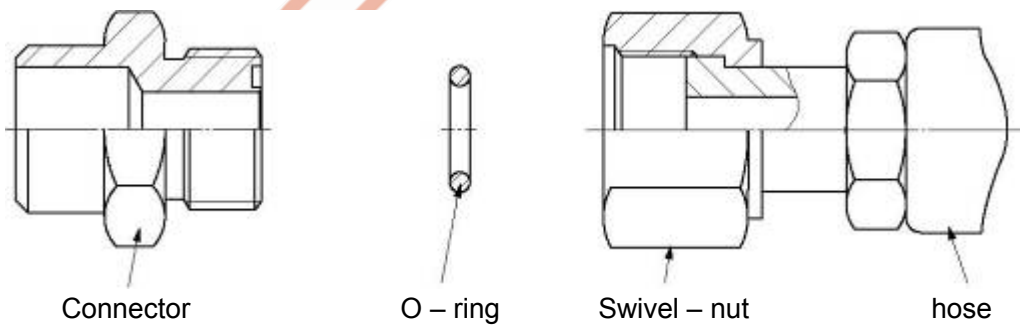
**TIGHTENING TORQUE FOR HYDRAULIC PLUGS WITH O-RING**



**PF THREAD**

Thread	Torque (kgf·m)
1/8	1.1 ± 0.1
1/4	2.6 ± 0.2
3/8	4.6 ± 0.3
1/2	8.5 ± 0.4
3/4	19 ± 1.0
1	33 ± 2.0

**TORQUE FOR SWIVEL NUT WITH O-RING**

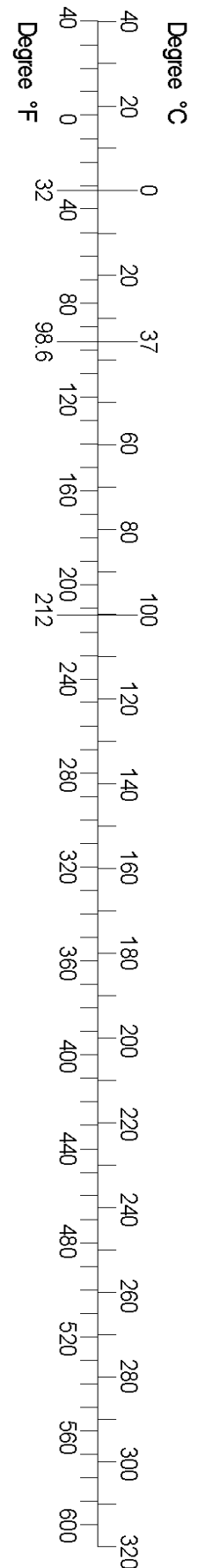


Tube O.D (inch)	Thread (in)	Torque (kgf·m)
1/2	UN 13/16 - 16	9.5 ± 0.95
3/4	UN 1 3/16 - 12	18 ± 1.8
1	UN 1 7/16 - 12	21 ± 2.1

APPROXIMATE CONVERSIONS

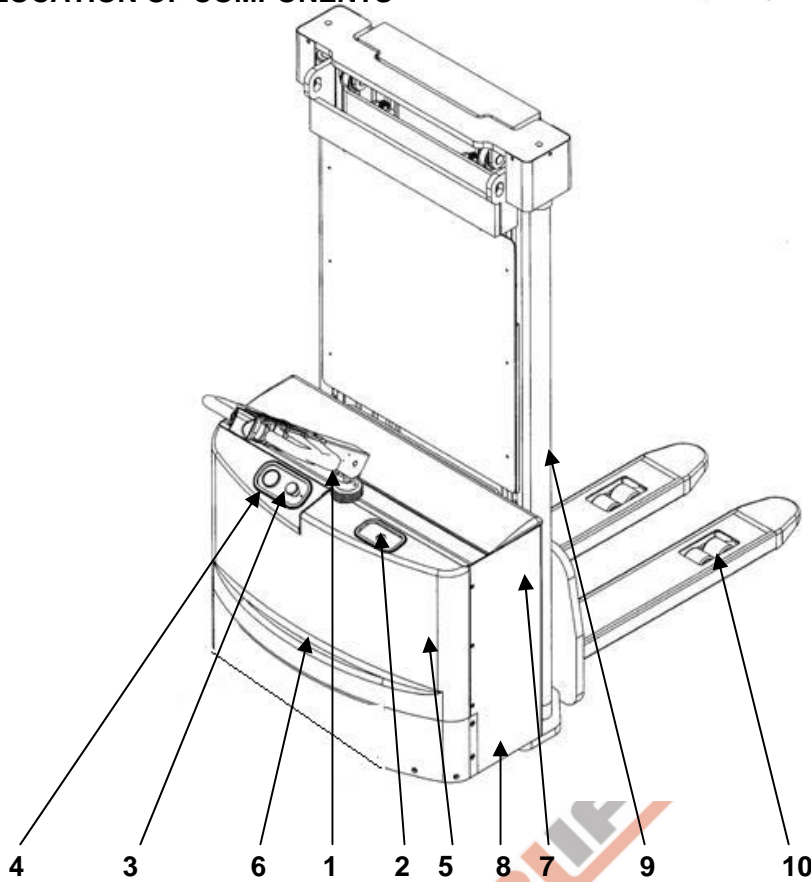
SI Unit	Conv Factor	Non-SI Unit	Conv Factor	SI Unit
Torque				
newton meter (N·m)	× 8.9	= in·in	× 0.113	= N·m
newton meter (N·m)	× 0.74	= lb·ft.	× 1.36	= N·m
newton meter (N·m)	× 0.102	= kg·m	× 7.22	= lb·ft.*
Pressure (Pa = N/m <sup>2</sup> )				
kilopascal (kPa)	× 4.0	= in. H <sub>2</sub> O	× 0.249	= 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 <sup>2</sup> )	× 14.22	= psi	× 0.070	= bar*
newton/mm <sup>2</sup>	× 145.04	= psi	× 0.069	= bar*
megapascal (MPa) (Pa=N·m <sup>2</sup> )	× 145	= psi	× 0.00689	= MPa
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) (W=J/s)	× 0.74	= ft·lb/s	× 1.36	= W
Energy (J = N·m)				
kilojoule (kJ)	× 0.948	= Btu	× 1.055	= kJ
joule (J) (J=N·m)	× 0.239	= calorie	× 4.19	= J
Velocity and Acceleration				
meter per sec <sup>2</sup> (m/s <sup>2</sup> )	× 3.28	= ft/s <sup>2</sup>	× 0.305	= m/s <sup>2</sup>
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 <sup>3</sup> /min)	× 0.264	= US gal/min	× 3.785	= l/min

Note : ( ) Non-SI Unit



## 2. SPECIFICATION

### 2.1 LOCATION OF COMPONENTS



- |                                 |                  |
|---------------------------------|------------------|
| 1. Control Handle               | 6. Drive Wheel   |
| 2. Start Key Switch             | 7. Battery       |
| 3. Emergency Button             | 8. Caster Wheel  |
| 4. Battery Indicator CURTIS 803 | 9. Lift Cylinder |
| 5. Pump Station                 | 10. Load Roller  |

#### CONTROL HANDLE(Tiller)



**1.FWD / BWD Turning Knob:** Control the speed of the stacker and moving direction: forward or backward

**2.Shifting Button for high speed and low speed:** Snail function takes light-touch switch, when touch the button once, the speed becomes low; Touch the button once again, the speed recovers to high.

**3.Universal Reversing Button:** the emergency directional reverse button

**4. RAISE Button**

**5. LOWER Button**

**6. Horn Button**  
ped.

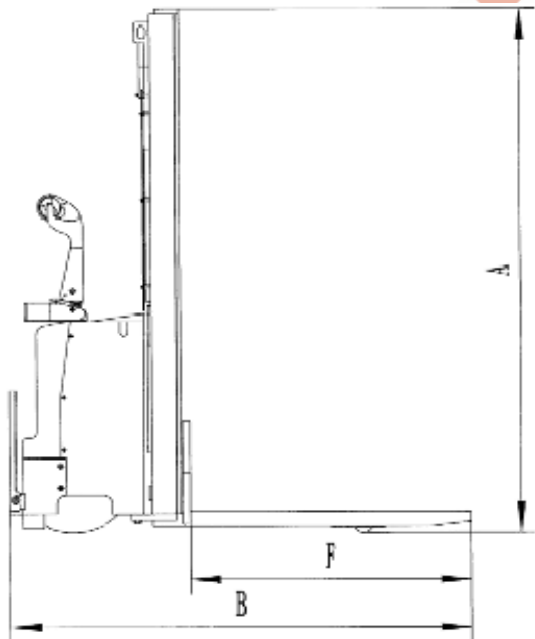
## 2.2 SPECIFICATION SHEETS

### 2.2.1 Technical Features

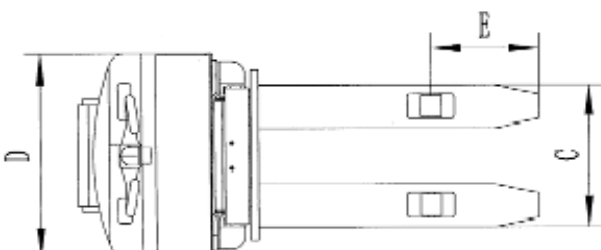
Manufacturer's type		CG1646
Rated load	Q(kg)	1600
Load centre distance	c(mm)	600
Lift height	mm	4600
Travel speed, unladen	km/h	5.4
Travel speed, laden	km/h	5.1
Gradient performance, laden	%	6
Turning radius	Wa(mm)	1605
Tyre size, front		250×78
Drive motor rating	kw	1.2
Lift motor rating	kw	3.0
Sound level at driver's ear acc.to EN 12053 B(A)		70

### 2.2.2 Residual Capacity at different lifting height

Up to TOP mm	ACTUAL CAPACITY ( Q ) kg	
2500	1600	1000
3700	1000	600
4600	800	500
Load centre distance ( C ) mm	600	700



	CG1646
A	2098mm
B	1950mm
C	570 or 695mm
D	1050mm
E	355mm
F	1140mm

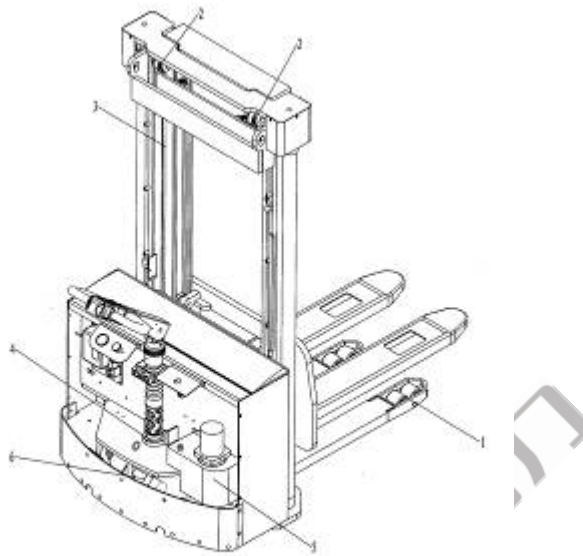


## Hydraulic oil

**⚠ 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.

### Oil and Lubrication

#### 6.5.4 Oil and Lubricant



#### Lubrication chart

No.	Service point	Interval/Running hours			
		500 h	1000 h	2000h	
1	Wheel bearings	L			A
2	Mast beam	L			B
3	chains	L			C
4	Hydraulic system	C		O	D
5	bearings		L		E
6	Drive gear			O	F

L=Lubrication      C=Check      O=Oil change

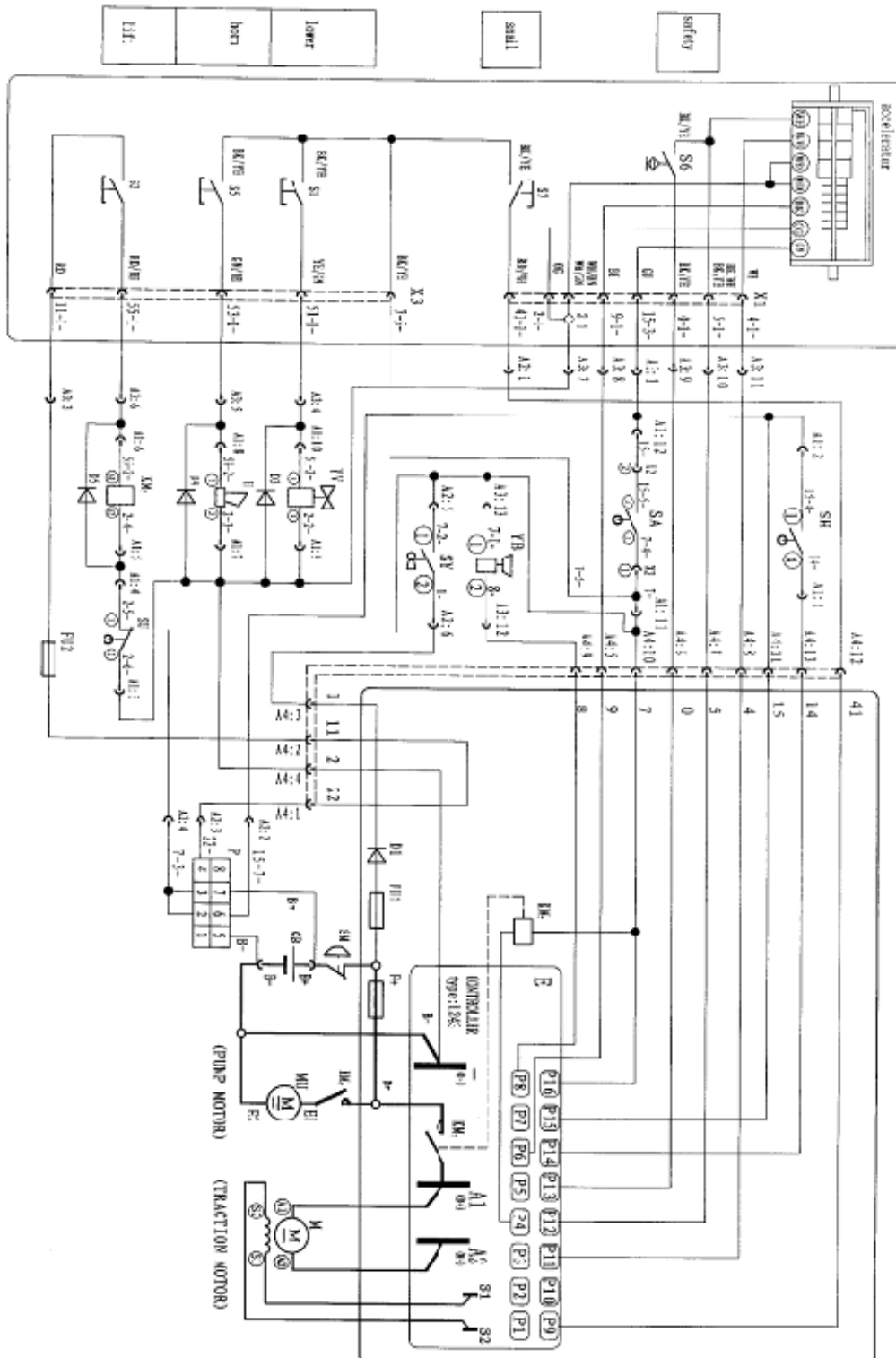
#### Oil and grease specification

Lubricant		Specification		Application area
		>-15°C	<-15°C	
A	Grease	2# Grease	2# Grease	Bearings, Bushings, Joint
B	Grease	2# Grease	2# Grease	Side shift forks
C	Grease	2# Grease	2# Grease	Chains and wires
D	Hydraulic Oil	40#Hydraulic Oil	30# Hydraulic Oil	Hydraulic system
E	Grease	2# Grease	2# Grease	Steering bearings
F	Grease	1# ALVANIA EP	1# ALVANIA EP	Gears

### 3 ELECTRIC SYSTEM

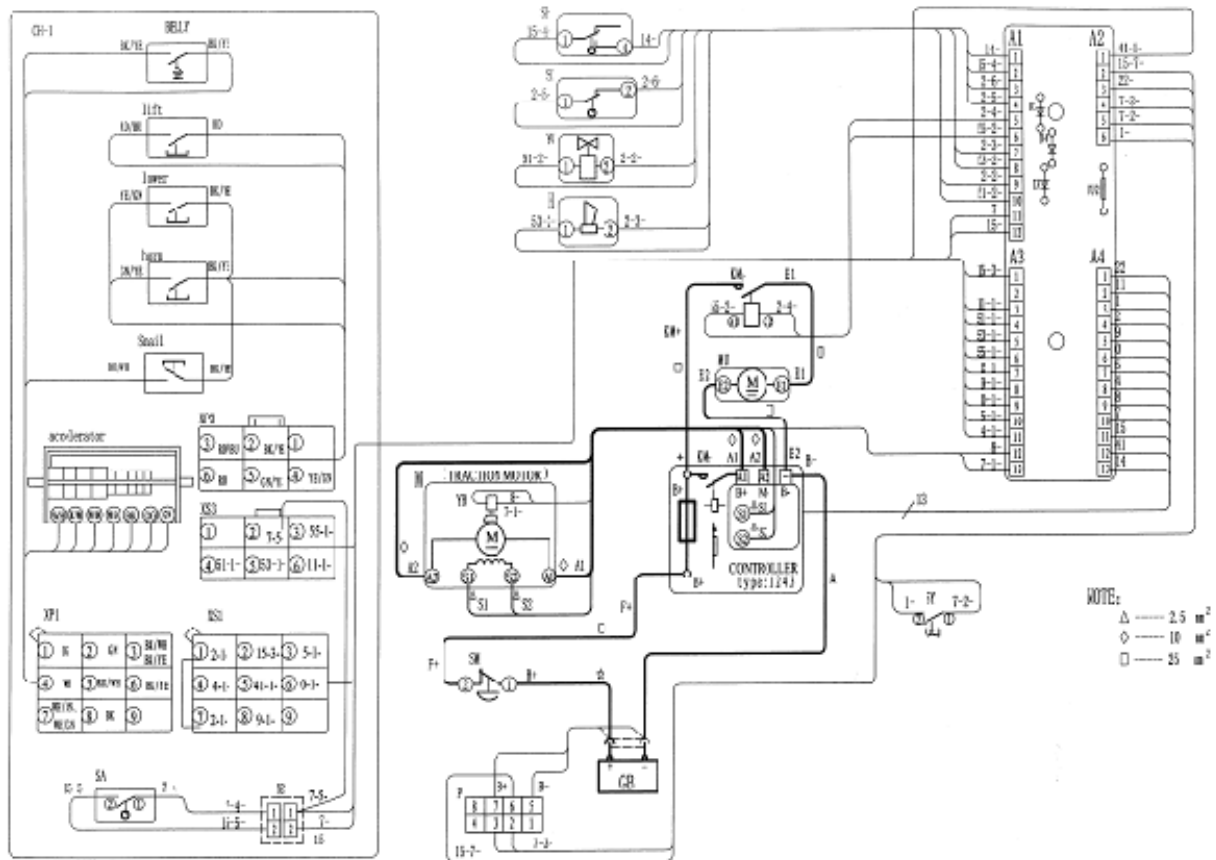
#### 3.1 ELECTRIC DIAGRAM

W





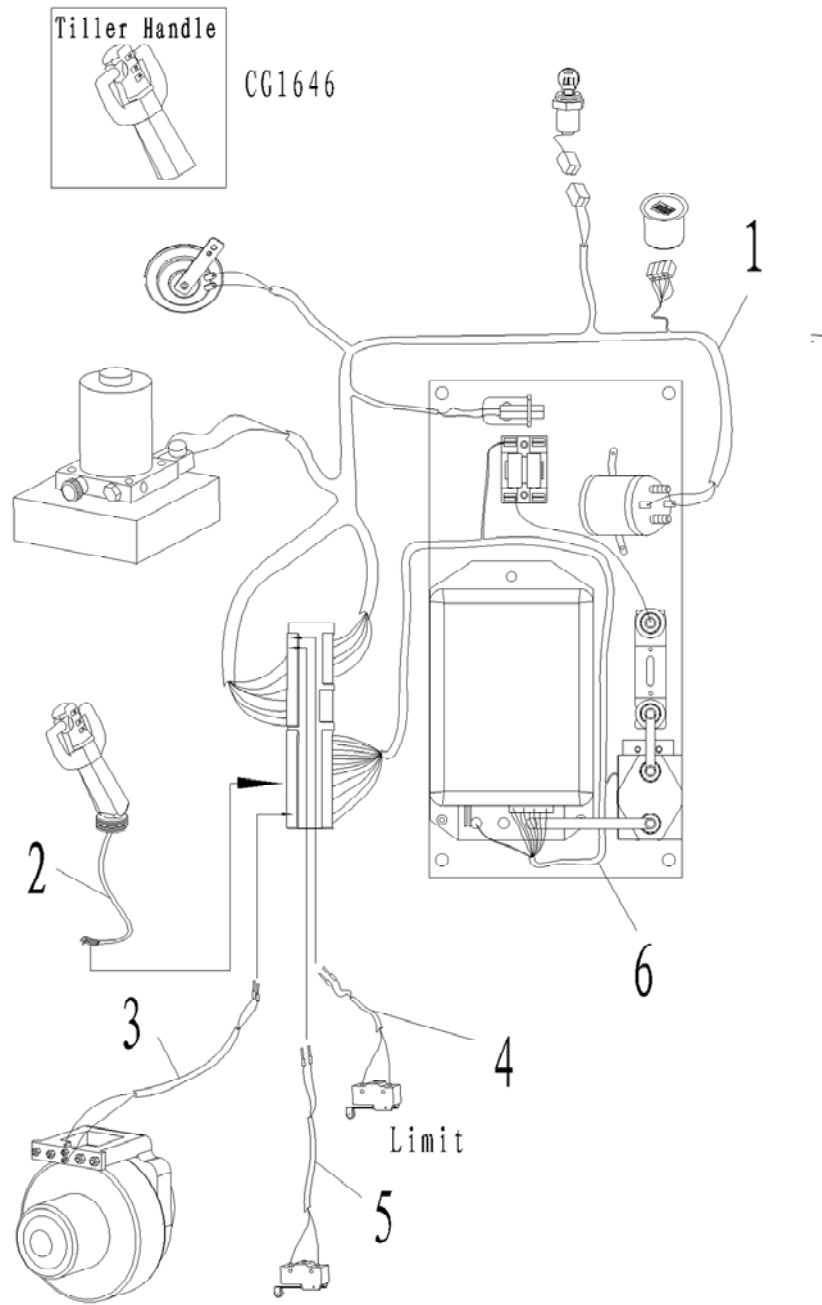
## CONNECTION DIAGRAM



No.	Code	NL. Drawing No.	Description	Qty.
1	GB		Battery, 280Ah	1
2	FU01		Fuse, 150A	1
3	Mp		Motor for pump, 3.0kw	1
4	KMp		Relay for motor of pump, DC24V	1
5	YV		Lower magnet valve, DC24V	1
6	Mt		Motor for traction, DC24V/1.2kw	1
7	YB		Brake, DC24V	1
8	KM	DQ-3	Main relay C100/120 DC24V	1
9	Et	DQ-13	Controller CURTIS 1243-4220	1
10	VD	DQ-10	Diodes 1N5408	2
11	FU	DQ-9	Fuse, 10A	1
12	S	DQ-48	Emergency button ZDK31-250	1
13	SY	DQ-26-1	Lock LKS-101A	1
14	P	DQ-27	Battery Indicator CURTIS 803	1
15	SA	DQ-23	Micro switch Z-15GW2	1
16	K	DQ-14	Relay ARL2F DC24V	1
17	Kr	DQ-2-1	Protect module BD-W135/110	1
18	HA	DQ-22	Horn DC24V	1
20	B	WG-5	Control handle (CH-1	1
21	SH	DQ-45	Magnetic switch HWK23	1
22	AP	DQ-53-1	-	1
23	SU	DQ-55	Micro switch Z-15GW22-B	
24	FU02		Fuse, 200A	1

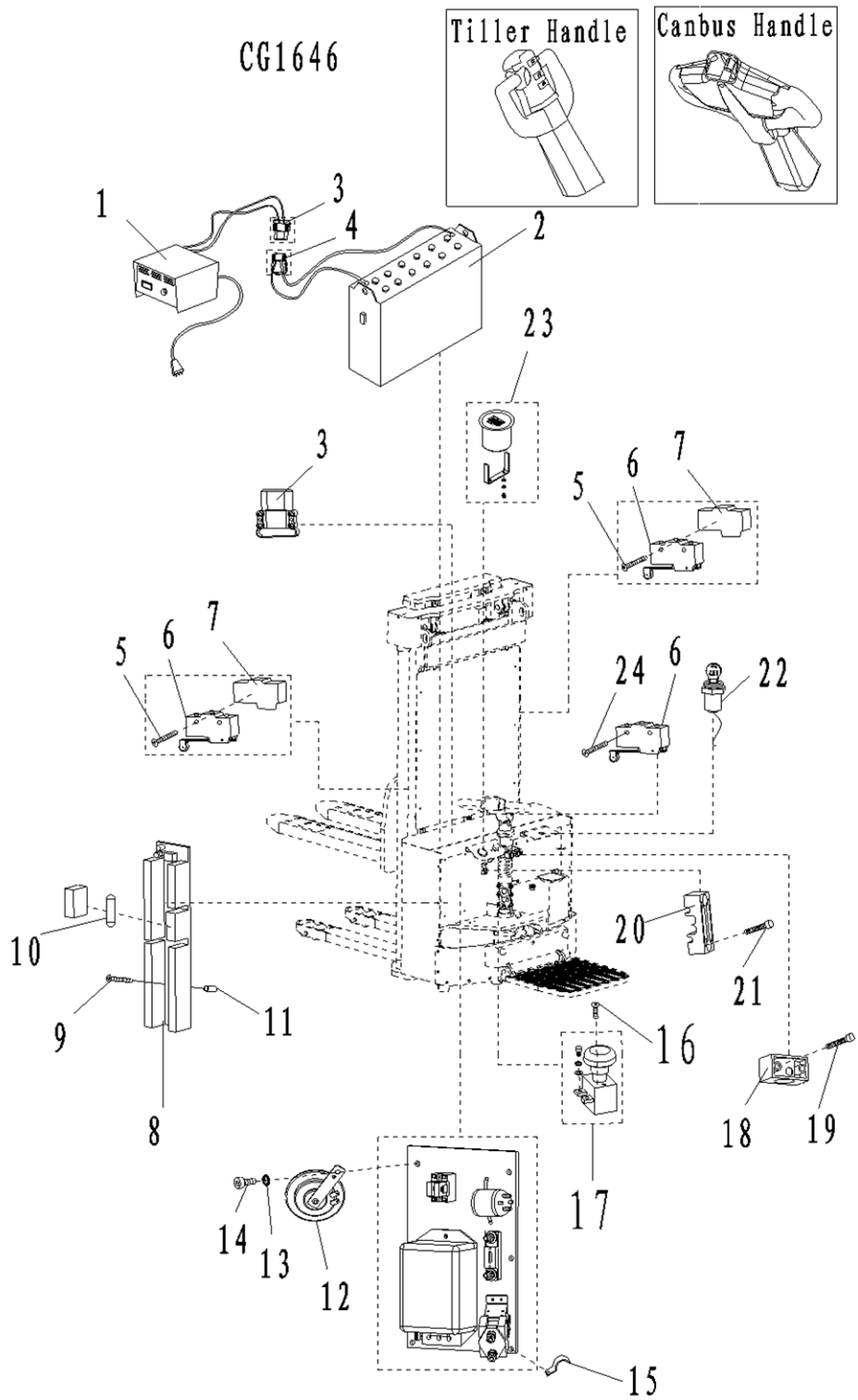
### 3.2 CABLE SYSTEM

#### CG1646 Controlling Circuit (TILLER Handle)



Serial No	Part No	Description	Note
1	30914100030	Cable of Control Circuit	
2	30914900016	Cable of Handle	
3	30914800037	Cable of Electromagnetic Brake	European Driving Wheel
4	30914800038	Cable of Speed Limiting Switch	
5	30914800039	Cable of Micro Switch	
6	L2501008	Controlling Cables	Circuit Board A4

CG1646 Universal Electric Parts List



Serial No	Part No	Description	Quantity	Note
1	30910100006	Charger	1	Asian(English)
1	30910100007	Charger	1	Asian(Chinese)
1	30910100001	Charger	1	European
1	30910100037	Charger	1	American
1	30910100041	Charger	1	Australian
2	30901200004	Battery 280Ah	1	
3	30909100009	Connector (Male) 95199-00	1	
4	30909100010	Connector (Female) 95342-01	1	
5	5010404025C0	Socket Head Screw M4×25	4	
6	30906300004	Micro Switch RZ-15GW2-B3	3	
7	30906300023	Cover of Micro Switch	2	
8	30902700001	Controlling Board CL-0	1	
9	5010504020C0	Phillips Screw M4×20	2	
10	30911100026	6A Fuse	1	
11	30913300001	White Polar 8*10	2	
12	30906600006	Horn 125 24V	1	
13	503020023	Elastic Washer Φ8	4	
14	5010408016C0	Socket Head Screw M8*16	4	
15	422420032	Cable Clip	2	
16	5010605012CB	Phillips Screw M5*12	2	
17	30906100001	Power Switch(New Type)	1	
18	30913300003	CL Plastic Cable Clip A	2	
19	5010406030C0	Socket Head Screw M6*30	4	
20	30913300004	CL Plastic Cable Clip B	2	
21	5010406016C0	Socket Head Screw M6X16	4	
22	30906200003	Key Switch LKS-101A	1	
23	30905100028	Battery Indicator 803	1	
24	5010504020C0	Phillips Screw 4*20	2	

### 3.3 DRIVE WHEEL

Type: FR250 for TypeCG1646

Drive Motor	
Model	MR250
Rate voltage	DC 24V
R.P.M	3000rpm
Rate output	1.2kw
Rate hour	60 min.
Rated current	70 A
Rated Exciting current	8A
Insulation class	F class
Electromagnetic Brake	
Model	SECOR1020241405METAL
Rate voltage	DC 24V
Rate Power	25W
Output Torque	15N.M
Gear Box	
transmission ratio	1:32

### 3.4 PUMP STATION

Type: MS2-Q-V1C-F7.5-R1-PM7-MFP1F-T08C-F0 for Type CG1646

Item	Specification
Rated voltage	24V
Rated output	3.0kw
R.P.M	3300 rpm
Rated current	200 A
Rated hour	4.0 min.
Insulation class	F class
IP Code	IP43
Displacement	3.2cc/rec
Max. operating pressure	200bar

### 3.5 BATTERY

The size of battery is according to English BS standard.

Rate	Specification
	CG1646
Rated voltage	24V
Capacity (5 hours)	280Ah
Box size (L*W*H)(mm)	645X244X570
Cell size (L*W*H)(mm)	77x158x525

### 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 exclusive 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  $1.280 \pm 0.005$  (25 °C ).

The conversion formula 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°C can it be connected to DC and charge. If cell's temperature exceeds 35°C, 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 <sub>5</sub> A)	Phase 2 (0.25 I <sub>5</sub> A)	Phase 3 (0.7I <sub>5</sub> A)	Phase 4 (0.35 I <sub>5</sub> A)
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  $1.280 \pm 0.005$ , 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  $1.280 \pm 0.005$ , 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  $1.400\text{g/cm}^3$ , 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 <sub>2</sub> SO <sub>4</sub> )	%	≥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 <sub>4</sub> )	%	≤0.001
Sulfur dioxide(SO <sub>2</sub> )	%	≤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 $\leq$	0.01	100
Manganese (Mn) content $\leq$	0.00001	0.1
Ferrum(Fe) content $\leq$	0.0004	4
Chlorine(Cl) content $\leq$	0.0005	5
Ammonia salt content $\leq$	0.0003	3
Ammonia (NH <sub>4</sub> ) content $\leq$	0.0008	8
Deoxidized potassium permanganate (O) content $\leq$	0.0002	2
Solonetz meatal oxide(CaO) content $\leq$	0.005	50
Resustivity(25 <sup>0</sup> C) $\Omega$ .cm $\geq$	10x10 <sup>4</sup>	

## ELECTROLYTRE FOR LEAD ACID CELLS

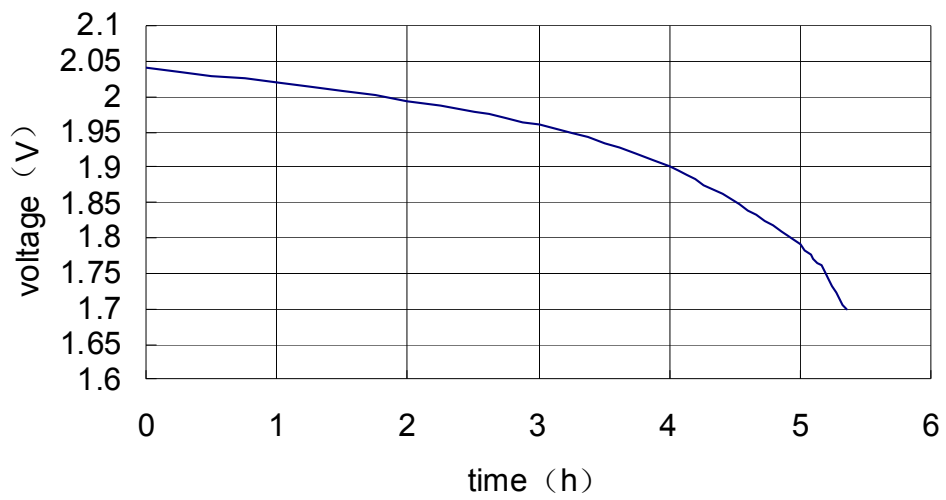
Index name	Index	
	%	Mg / l
Appearance	Achromatic, transparent	
Sulphuric acid (H <sub>2</sub> SO <sub>4</sub> ) content	15~40	180~480
Concentration 50 <sup>0</sup> C, g/cm <sup>3</sup>	1.1~1.3	
Ignition residue content $\leq$	0.02	0.24
Manganese (Mn) content $\leq$	0.00004	0.00048
Ferrum(Fe) content $\leq$	0.004	0.048
Arsenic(As) content $\leq$	0.00003	0.00036
Chlorine(Cl) content $\leq$	0.0007	0.0084
Ammonia salt content (N) $\leq$	0.0005	0.006
Copper (Cu) content $\leq$	0.002	0.024
Deoxidized potassium permanganate content $\leq$	0.0008	0.01
Content calculated by KMnO <sub>4</sub> $\leq$	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.

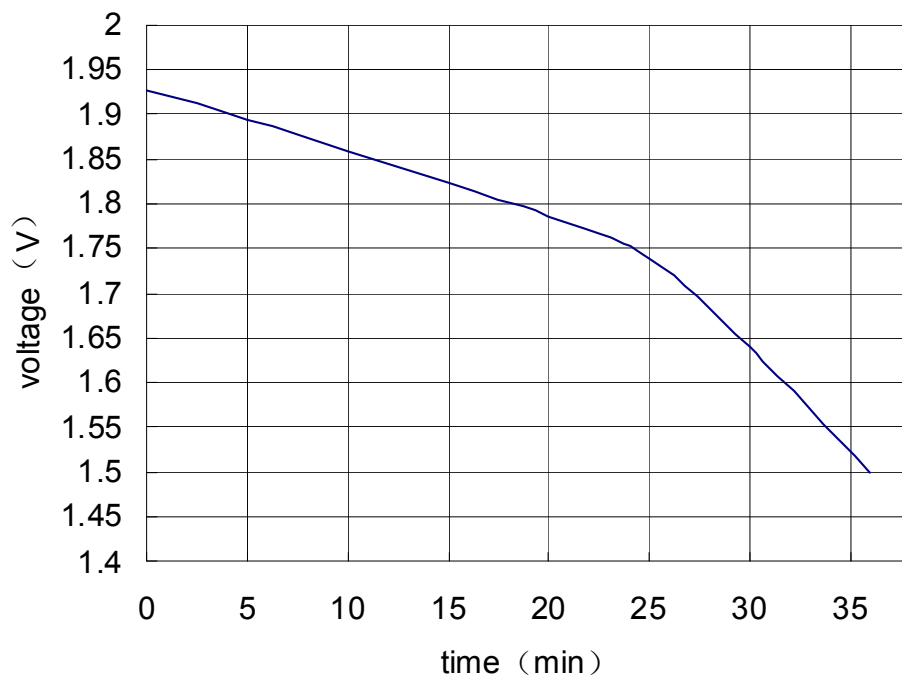


# DISCHARGE CURVE

## 5hr discharge curve



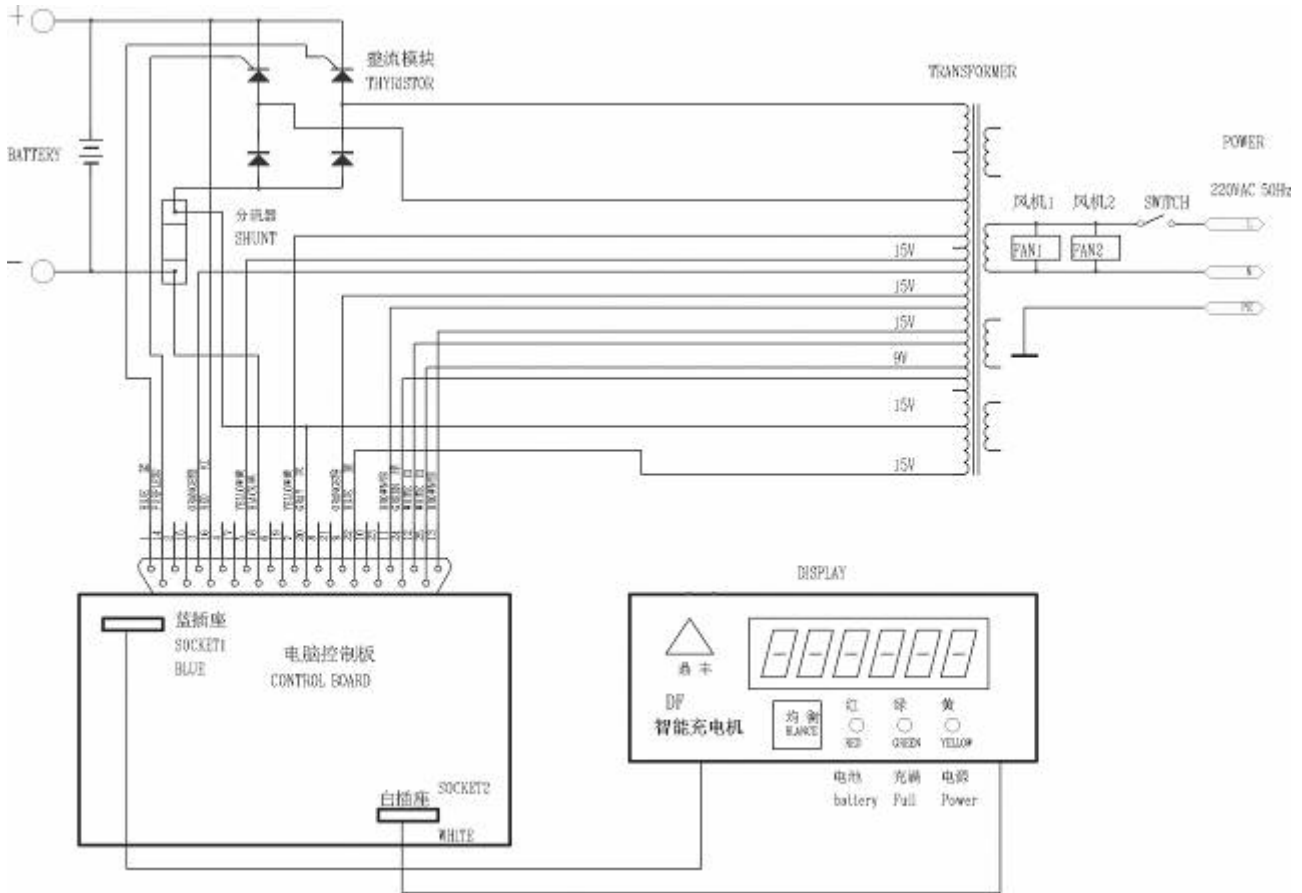
## 0.5hr discharge curve



### 3.6 CHARGER

Type: DF2440 for 24V/280Ah

#### 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
DF2440	1.9KVA	270-300	220v	31.2	40A

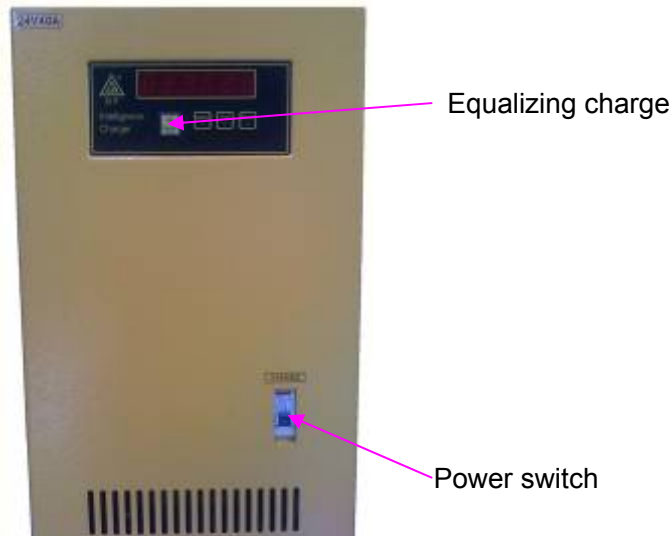
#### ENVIRONMENTAL CONDITION

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	DF2440: 8	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	DF2440: 40	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	DF2440: 40	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)		

## DF2440 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,  $220V \pm 5\% \sim 230V \pm 5\%$ , 50Hz or  $110V \pm 5\%$ , 50Hz. The lead section shall be no less than  $4 \text{ mm}^2$ , 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  $-10^\circ\text{C}$  to  $40^\circ\text{C}$  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.

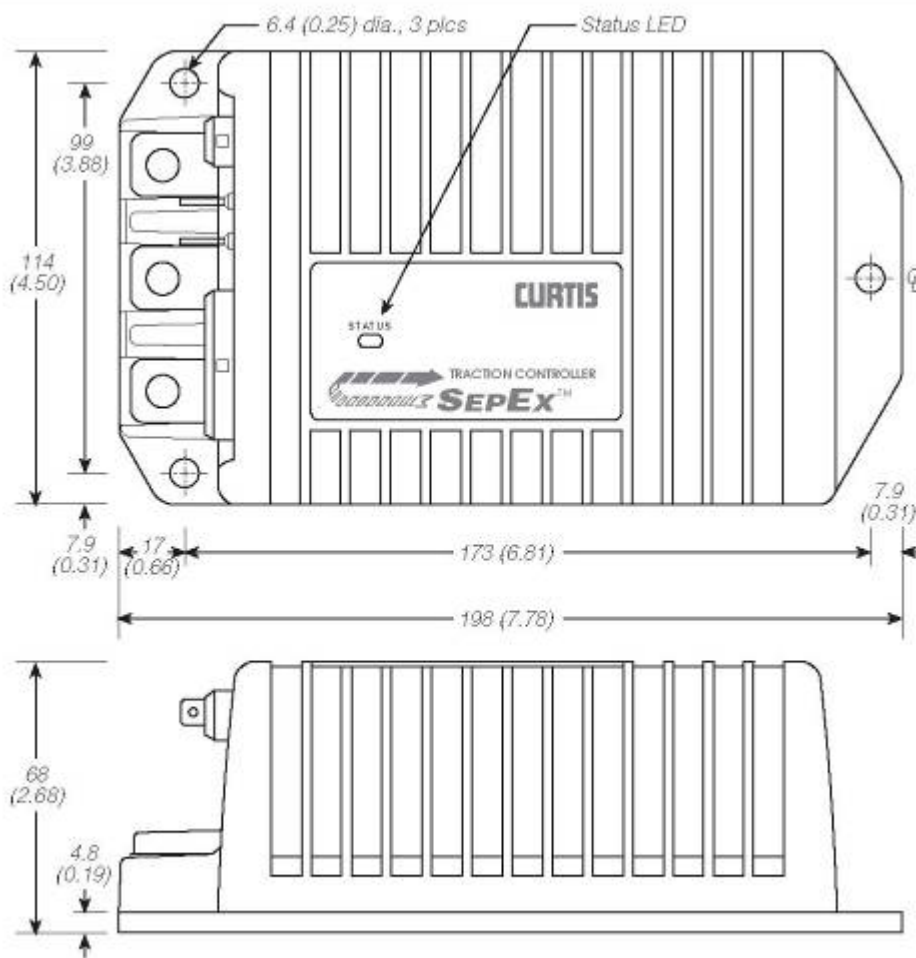
**⚠ WARNING** The equalizing charge is a manual operation. Appointed personnel are required to observe and check voltage and specific gravity of the batteries and determine charge time, manual power off and charge stop as required.

### 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	Long-term heating, poor contact	Check the copper plates, if it is

or less.	or loose by the output plugs.	unavailable, please change a new one.
Instable charge current, not reaching the rated current value.	<p>① Low power voltage.</p> <p>② Small section area of lead for power input.</p>	<p>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.</p> <p>② The section area of input lead of power supply may not less than the stipulated section area in the manual.</p>
Air switch of the charger does not trip, and the preceding stage switch trips.	<p>① Failure of the preceding air switch.</p> <p>② Incorrect matching of air switch.</p> <p>③ Small capacity of the air switch.</p>	<p>Rated current of the preceding stage air switch is more than that of the air switch of the charger.</p> <p>The air switch must be type D (dynamic type), type C (illumination type) is unavailable.</p>
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



Dimensions in millimeters (and inches)

## CONNECTIONS

### Low Current Connections

A 16-pin Molex low current connector in the controller provides the low current logic control connections:

16	15	14	13	12	11	10	9
8	7	6	5	4	3	2	1

<b>Pin 1</b>	load sensor input [optional]
<b>Pin 2</b>	Fault 1 output / pump input
<b>Pin 3</b>	Fault 2 output
<b>Pin 4</b>	main contactor driver output
<b>Pin 5</b>	throttle: 3-wire pot high
<b>Pin 6</b>	throttle: 0–5V; pot wiper
<b>Pin 7</b>	throttle: pot low
<b>Pin 8</b>	auxiliary driver output (typically used for an electromagnetic brake)
<b>Pin 9</b>	Mode Select 2 input
<b>Pin 10</b>	emerg. reverse check output [optional]
<b>Pin 11</b>	reverse input
<b>Pin 12</b>	forward input
<b>Pin 13</b>	emergency reverse input
<b>Pin 14</b>	Mode Select 1 input
<b>Pin 15</b>	interlock input
<b>Pin 16</b>	keyswitch input (KSI)

The mating connector is a 16-pin Molex Mini-Fit Jr. connector p/n 39-01-2165 using type 5556 terminals.

<b>Pin 1</b>	receive data (+5V)
<b>Pin 2</b>	ground (B-)
<b>Pin 3</b>	transmit data (+5V)
<b>Pin 4</b>	+15V supply (100mA)



A 4-pin low power connector is provided for the handheld programmer. A complete 1311 programmer kit, including the appropriate connecting cable, can be ordered from Curtis. The 4-pin connector can also be used for the Spyglass display. The display is unplugged when the programmer is used.

### High Current Connections

Three tin-plated solid copper bus bars are provided for high current connections to the battery (B+ and B-) and the motor armature (M-). Cables are fastened to the bus bars by M8 bolts. The 1243C case provides the capture nuts required for the M8 bolts. The maximum bolt insertion depth below the surface of the bus bar is 1.3 cm (1/2"). Bolt shafts exceeding this length may damage the controller. The torque applied to the bolts should not exceed 16.3 N·m (12 ft-lbs). Two 1/4" quick connect terminals (S1 and S2) are provided for the connections to the motor field winding.



STANDARD\_PARAMETER

Parameter Software	APPLICATION PARAMETERS	standard parameter	RANGE	Unit	DESCRIPTION
Voltage	BATTERY VOLTAGE	2	24 (2), 36 (3), 48 (4)		Nominal Battery Voltage.
M1 DRIVE C/L	M1 DRIVE CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 1 Drive current limit
M2 DRIVE C/L	M2 DRIVE CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 2 Drive current limit
M3 DRIVE C/L	M3 DRIVE CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 3 Drive current limit
M4 DRIVE C/L	M4 DRIVE CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 4 Drive current limit
M1 BRAKE C/L	M1 BRAKING CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 1 Braking current limit
M2 BRAKE C/L	M2 BRAKING CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 2 Braking current limit
M3 BRAKE C/L	M3 BRAKING CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 3 Braking current limit
M4 BRAKE C/L	M4 BRAKING CURRENT LIMIT	150	50A to Rated	A	Maximum Mode 4 Braking current limit
M1 ACCEL RATE	M1 ACCELERATION RATE	1	0.1 to 3	s	Time to reach full drive output from zero output in Mode 1
M2 ACCEL RATE	M2 ACCELERATION RATE	1	0.1 to 3	s	Time to reach full drive output from zero output in Mode 2
M3 ACCEL RATE	M3 ACCELERATION RATE	1	0.1 to 3	s	Time to reach full drive output from zero output in Mode 3
M4 ACCEL RATE	M4 ACCELERATION RATE	1	0.1 to 3	s	Time to reach full drive output from zero output in Mode 4
M1 DECEL RATE	M1 DECELERATION RATE	5.9	0.1 to 10	s	Defines the rate at which the vehicle decelerates to zero speed in Mode 1 when the throttle is released to neutral
M2 DECEL RATE	M2 DECELERATION RATE	1.2	0.1 to 10	s	Defines the rate at which the vehicle decelerates to zero speed in Mode 1 when the throttle is released to neutral
M3 DECEL RATE	M3 DECELERATION RATE	5.9	0.1 to 10	s	Defines the rate at which the vehicle decelerates to zero speed in Mode 1 when the throttle is released to neutral
M4 DECEL RATE	M4 DECELERATION RATE	5.9	0.1 to 10	s	Defines the rate at which the vehicle decelerates to zero speed in Mode 1 when the throttle is released to neutral
THROTTLE DECEL	THROTTLE DECEL	0.5	0.1 to 1.0	s	Transition rate from drive to throttle off braking.
M1 BRAKE RATE	M1 BRAKING RATE	1.2	0.1 to 3	s	Time to reach full braking current limit in Mode 1 when a direction change is made
M2 BRAKE RATE	M2 BRAKING RATE	0.8	0.1 to 3	s	Time to reach full braking current limit in Mode 2 when a direction change is made
M3 BRAKE RATE	M3 BRAKING RATE	1.2	0.1 to 3	s	Time to reach full braking current limit in Mode 3 when a direction change is made
M4 BRAKE RATE	M4 BRAKING RATE	1.2	0.1 to 3	s	Time to reach full braking current limit in Mode 4 when a direction change is made
QUICK START	QUICK START	0	0 to 10	s	Defines throttle response to the rate of throttle change. Higher values will "liven" the vehicle response to fast throttle movements
TAPER RATE	TAPER RATE	10	1 to 20		Sets the rate of regen current roll off as the vehicle approaches zero speed. This parameter controls the transition smoothness from braking to drive mode
M1 MAX SPEED	M1 MAX. SPEED LIMIT	50	0% to 100%	%	Maximum Mode 1 speed
M2 MAX SPEED	M2 MAX. SPEED LIMIT	100	0% to 100%	%	Maximum Mode 2 speed
M3 MAX SPEED	M3 MAX. SPEED LIMIT	50	0% to 100%	%	Maximum Mode 3 speed
M4 MAX SPEED	M4 MAX. SPEED LIMIT	50	0% to 100%	%	Maximum Mode 4 speed

CREEP SPEED	CREEP SPEED LIMIT	0	0% to 25%	%	Defines a minimum speed (duty factor) output from the controller. The controller output will jump to this speed when a direction has been selected
THROTTLE TYPE		5			
THRTL DEADBAND	THROTTLE DEADBAND	10	0 to 40	%	Percentage of throttle movement which represents the neutral deadband
THROTTLE MAX	THROTTLE MAX. OUTPUT POINT	95	60 to 100	%	Percentage of throttle movement at which full controller output duty cycle is attained
THROTTLE MAP	THROTTLE MAP	50	20% to 80%	%	Adjusts desired PWM output at 50% throttle to vary throttle sensitivity at low speeds
FIELD MIN	MINIMUM FIELD CURRENT LIMIT	5.4	1.6A to Max Field C/L	A	Minimum allowed current in the field winding. Sets max vehicle speed
FIELD MAX	MAXIMUM FIELD CURRENT LIMIT	15	Min Field C/L to Rated	A	Maximum allowed current in the field winding. Limits power dissipation in low impedance field windings.
FLD MAP START	FIELD MAP START	40	25 A to Full Drive Current		Adjusts the minimum armature current at which the field current may begin increasing. This parameter is used to adjust the vehicle's maximum full load speed.
FIELD MAP	FIELD MAP	50	0% to 100%		Adjusts desired field current at 50% Armature current. Affects speed characteristic under different load conditions
CURRENT RATIO	CURRENT RATIO	1	1, 2, 3, 4		Adjusts the rate of current increase as a function of throttle
RESTRAINT	RESTRAINT	10	Off (0), Brake (1), KSI (2)	A	Adjusts the braking strength applied to the motor when throttle request is decreased or the if the vehicle is moving when zero throttle is requested
LOAD COMP	LOAD COMPENSATION	5	Off (0), Brk(1), KSI (2), KSI, Brk & Fwd only (3)		Adjusts the controller's response to increasing motor loads at a fixed throttle request
HPD	HIGH PEDAL DISABLE (HPD)	2	Off (0), Brake (1), KSI (2)		Disables controller if >25% throttle is applied before the KSI and/or brake inputs.
SRO	STATIC RETURN TO OFF (SRO)	2	Off (0), Brk(1), KSI (2), KSI, Brk & Fwd only (3)		Requires sequencing of KSI and Brake before Fwd and Rev or KSI and Brake before only Fwd is selected
SEQUENCING DLY	SEQUENCING DELAY	0.2	0 to 3	s	Delay time before HPD and SRO faults are registered after the brake input is disengaged
MAIN CONT INTR	MAIN CONTACTOR INTERLOCK	1	On/Off		Turns on main contactor with interlock(ON) or with KSI (OFF).
MAIN OPEN DLY	MAIN CONTACTOR DROPOUT DELAY	3	0-40	s	Enables or disables a 40 sec. delay time between brake switch and main contactor drop out.
CONT DIAG	CONTACTOR DIAGNOSTICS	1	On/Off		When "ON", enables the missing and welded contactor fault checks on the main contactor only.
AUX TYPE	AUXILIARY DRIVER TYPE	5	Types 0 - 5		A low side driver that can be programmed to drive a variety of E-M brake options, hourmeter, pump or brush motor contactor. This driver is short circuit protected
AUX DELAY	AUXILIARY DRIVER TURN OFF DELAY	0.6	0-30	s	Programmable time delay between throttle release to neutral (no direction selected) and Auxiliary Driver turn off.
EMR REV ENABLE	EMERGENCY REVERSE ENABLE	1	On/Off		Defines whether the Emergency Reverse function is active or disabled.
EMR REV C/L	EMERGENCY REVERSE CURRENT LIMIT	80	50A to Rated	A	Maximum allowed armature current during braking in emergency reverse

EMR DIR INTR	EMERGENCY REVERSE DIRECTION INTERLOCK	0	On/Off		Dictates controller response after the emr rev switch has been activated. When "ON", the controller becomes active if either the throttle is returned to neutral or the Interlock switch is cycled. When "OFF", the Interlock switch must be cycled.
EMR TIME LIMIT	EMERGENCY TIME LIMIT	1	On/Off		Enables / disables EMR to operate for a specific time
EMR TIMEOUT	EMERGENCY REVERSE TIMEOUT	2.5	0.1 - 3.0	s	Emergency reverse operates for the specified time.
VARIABLE BRAKE	VARIABLE BRAKING	1	On/Off		Defines whether braking current limit is dependent upon throttle position or is fixed
ANTI-TIEDOWN	ANTI TIEDOWN	0	On/Off		Prevents vehicle operation in Modes 2 or 4 if the Modes 2, or 4 are active when the brake is first released
MODULE ID	MODULE ID	5	0-15		CAN bus module identification address.
RX COB	RX COB	1	0-128		CAN bus transmit communication object. This defines the value of the identifier type for a PDO SYSTEM message for transmission.
TX COB	TX COB	1	0-128		CAN bus receive communication object. This defines the value of the identifier type for a PDO SYSTEM message for reception.
CAN TMO ENABLE	CAN TMO ENABLE	1	On/Off		Enables or disables a CAN bus communications watchdog. Loss of PDO messages once started will generate ERROR frames.

**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.

LED CODE	Programmer LED Display	Possible Cause	Fault Clearance
0,1	NO KNOWN FAULTS	No	No
1,1	CURRENT SHUNT FAULT	1.Controller failure.	Cycle KSI .If problem persists,replace controller.
1,2	HW FAIL SAFE	1.Controller failure.	
1,3	M-SHORTED	1.Controller failure.	
1,4	SRO	1.Improper sequence of KSI,interlock,and direction inputs. 2.Wrong SRO type selected. 3.Interlock or direction switch circuit open. 4.Sequencing delay too short.	Follow proper sequence;adjust throttle if necessary;adjust programmable if necessary.
2,1	THROTTLE FAULT 1	1.Throttle input wire open. 2.Throttle input wire shorted to B+ or B-. 3.Defective throttle pot.	When Throttle Wiper High input returns to valid range.

		4.Wrong throttle type selected.	
2,2	EMR REV WIRING	1.Emergency reverse wire or check wire fault.	Re-apple emergency reverse or cycle interlock.
2,3	HPD	1.Improper sequence of KSI,interlock,and throttle inputs.	Follow proper sequence;adjust throttle if necessary;adjust programmable if necessary.
		2.Wrong HPD type selected.	
		3.Misadjusted throttle pot.	
		4.Sequencing delay too short.	
2,4	THROTTLE FAULT2	1.Defective throttle pot.	When Throttle Wiper Low input returns to valid range.
		2.Wrong throttle type selected.	
3,1	CONT COIL/FLD SHORT	1.Main contactor coil shorted.	Check contactor coil and field winding;cycle KSI.
		2.Field winding shorted to B+ or B-.	
3,2	MAIN CONT WELDED	1.Main contactor coil closed.	Check wiring and contactor;cycle KSI .
		2.Main contactor drive shorted.	
3,3	FIELD OPEN	1.Field winding connection open.	
		2.Field winding open.	
3,4	MISSING CONTACTOR	1.Main contactor coil open.	Check wiring and cycle KSI .
		2.Main contactor missing .	
		3.Wire to main contactor open.	
4,1	LOW BATTERY VOLTAGE	1.Battery voltage <16.8V	When voltage rises above undervoltage cutoff point .
		2.Corroded battery terminal.	
		3.Loose battery or controller terminal.	
4,2	OVERVOLTAGE	1.Battery voltage > 33V	When voltage falls below overvoltage cutoff point.
		2.Vehicle operating with charge attached.	
4,3	THERMAL CUTBACK	1.Temperature > 85°C or < -25°C.	Clears when heatsink temperature returns to within acceptable range.
		2.Excessive load on vehicle.	
		3.Improper mounting of controller.	
		4.Working limit environment.	
4,4	ANTI-TIEDOWN	1.Mode switches shorted to B+.	Release Mode Select 1.
		2.Mode Select 1"tied down"to select Mode 2 or Mode 4 permanently.	

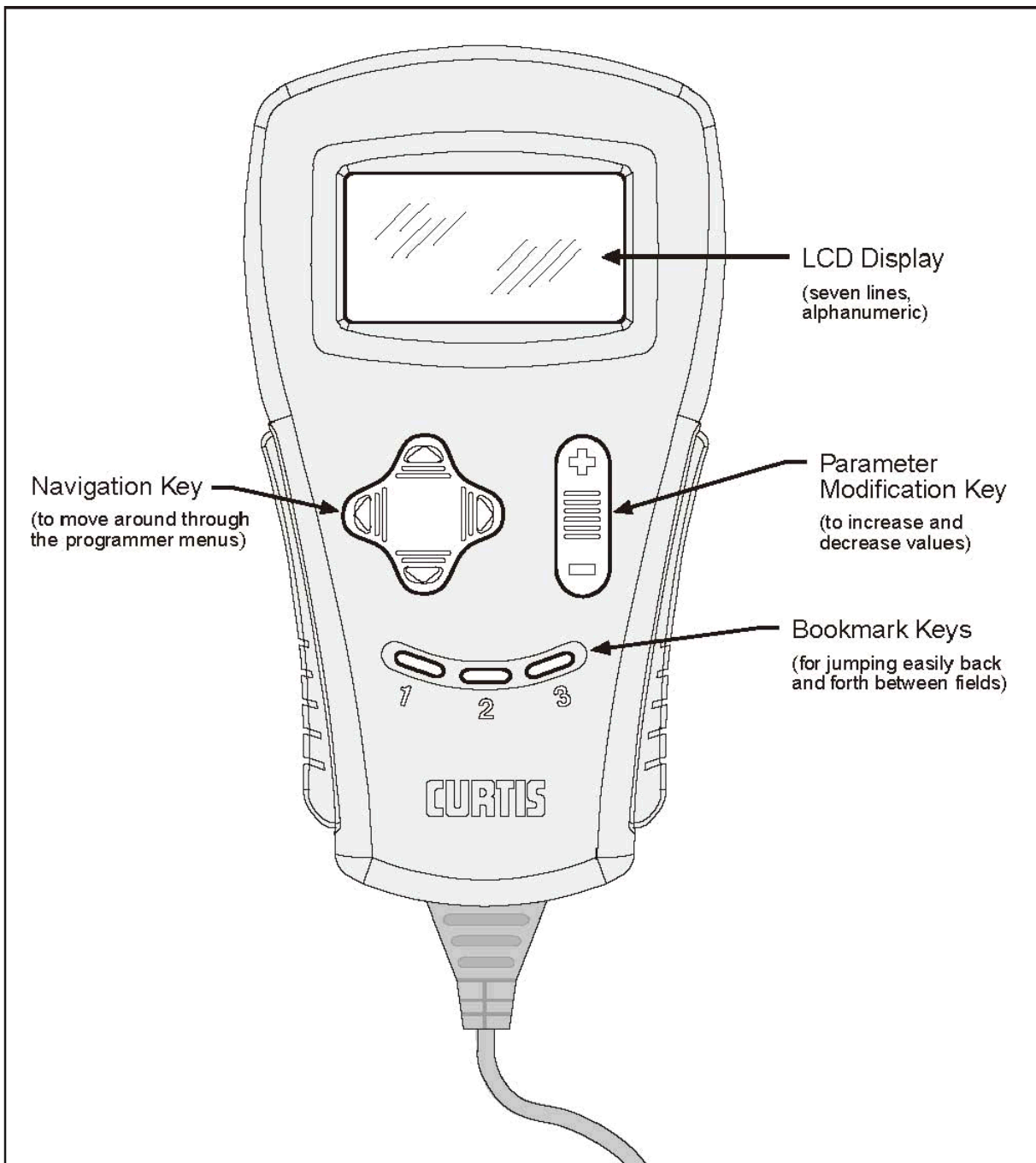
### CURTIS 1311 HANDHELD PROGRAMMER

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.

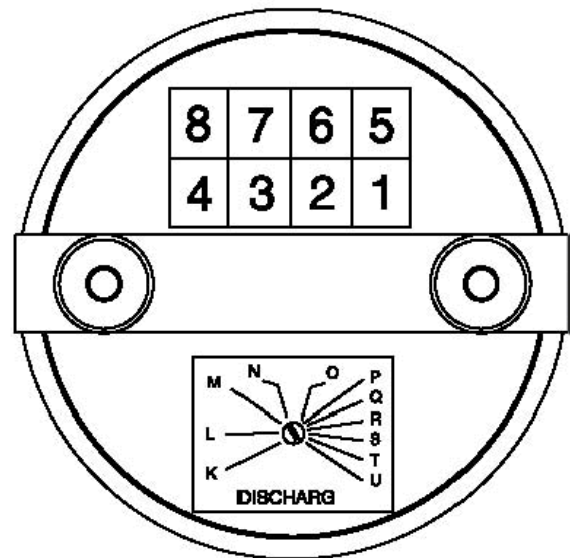
The bookmark keys can be used to make parameter adjustment easier. For example, in adjusting the throttle deadband, you might set a bookmark at the Throttle % readout [Monitor > THROTTLE %] and another at the Throttle Deadband parameter [Program > THROTTLE DB]; this way you can easily toggle between 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 open or 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.)	High Voltage (min.)	Min. Impedance	
		HRM+	HRM-
5.0VDC	15.0VDC	80k $\Omega$	20 k $\Omega$

## 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 following 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	<b>1.73*</b>	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.

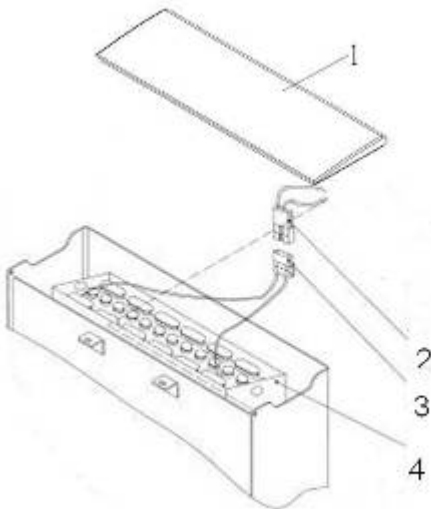
OCR = Open Circuit Reset: If the gage is disconnected from the battery during recharge, the gage will retain the last indication. It will advance to full when reconnected only if the battery voltage is above the OCR level. For standard ("B") reset, OCR = 2.09 VPC (VPC = volts per cell.)

## 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 REPLACE THE ELECTRIC PARTS

#### REPLACE THE BATTERY



Step 1: Take away the battery cover (No.1)

Step 2: Dismantle the plugs (No. 2 and 3)

Step 3: 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

#### REPLACE THE CONTROLLER, BATTERY INDICATOR, ETC.



Remove 6 pcs the screws.  
Then remove the right cover and left cover.





### REPLACE THE PUMP STATION



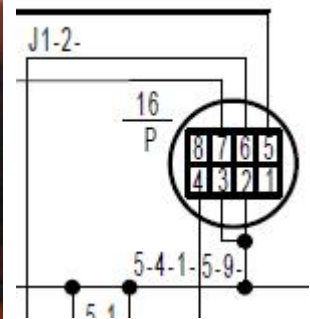
Dismantle the cables

Remove 4pcs screws.

Dismantle the pipe.

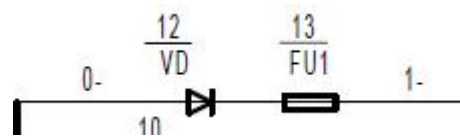
Then you can dismantle the pump station and replace it.

### REPLACE THE BATTERY INDICATOR



take away the “U” clamp, dismaantle the 8 - pins plug. Then you can dismantle the battery indicator and replace it.

### REPLACE THE FUSE



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

## REPLACE THE MAIN RELAY



Dismantle two screws.

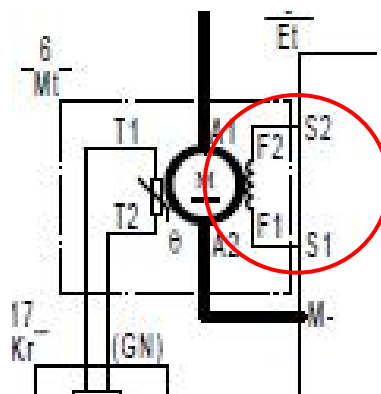
Dismantle the cables.

Then you can dsimantle the main relay and replace it.

## OPERATION OF THE CONTROLLER



When replacing the controller, be carefully tto check the tightness of the nut, specially note the cathode pillar



Two 1/4" quick connect terminals (S1 and S2) are provided for the connections to the motor field winding. Do not allowed to access anti-line, otherwise the mortor will be reversed.

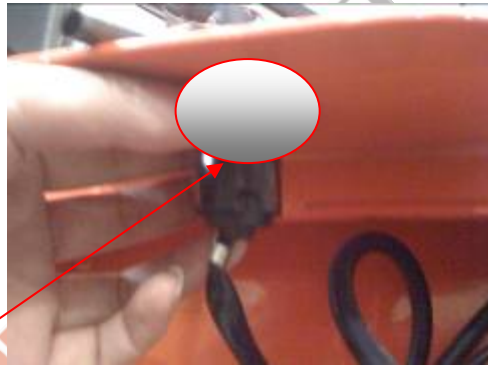
### REPLACE THE LOGIC BOARD FOR LIFING CL-1



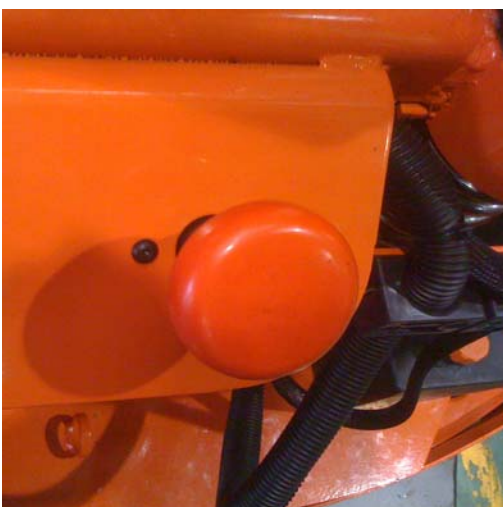
When the fork's height is more than about 800mm (12"), the max. drive speed will automatically be reduced to 50% of normal speed. This is the function of the Micro switch to change the speed mode

Remove the screw and the plastic cover. with a screwdriver remove the two cables on the micro switch  
Then you can dismantle the micro switch and replace it.

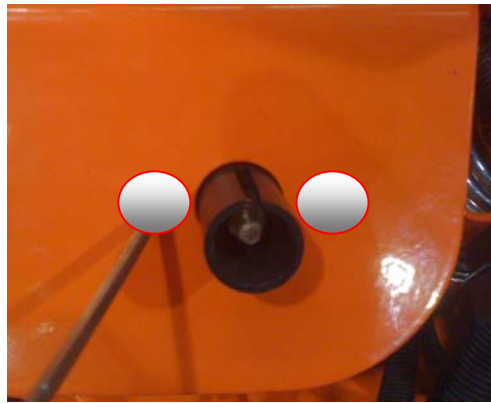
### REPLACE THE LOCK (KEY SWITCH) LKS-101A



Remove the nut of the key switch.  
Dismantle the cable of the key switch  
Then you can dismantle the key switch and replace it  
REPLACE THE EMERGENCY BUTTON



Turn the mushroom head of the emergency button, let the hole of the mandril be line with the groove of the sleeve.



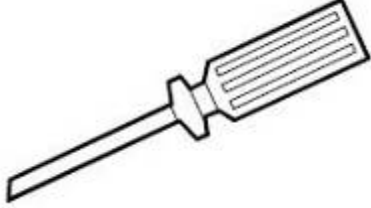

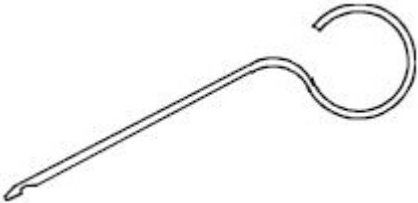
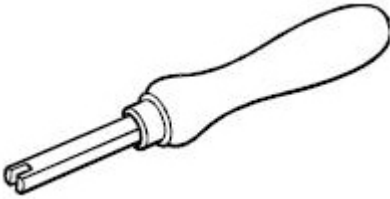
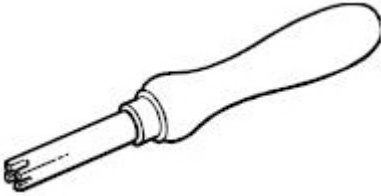

Use a small screwdriver to insert the hole, then turn counter-clockwise the mushroom head to remove the mushroom head.



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

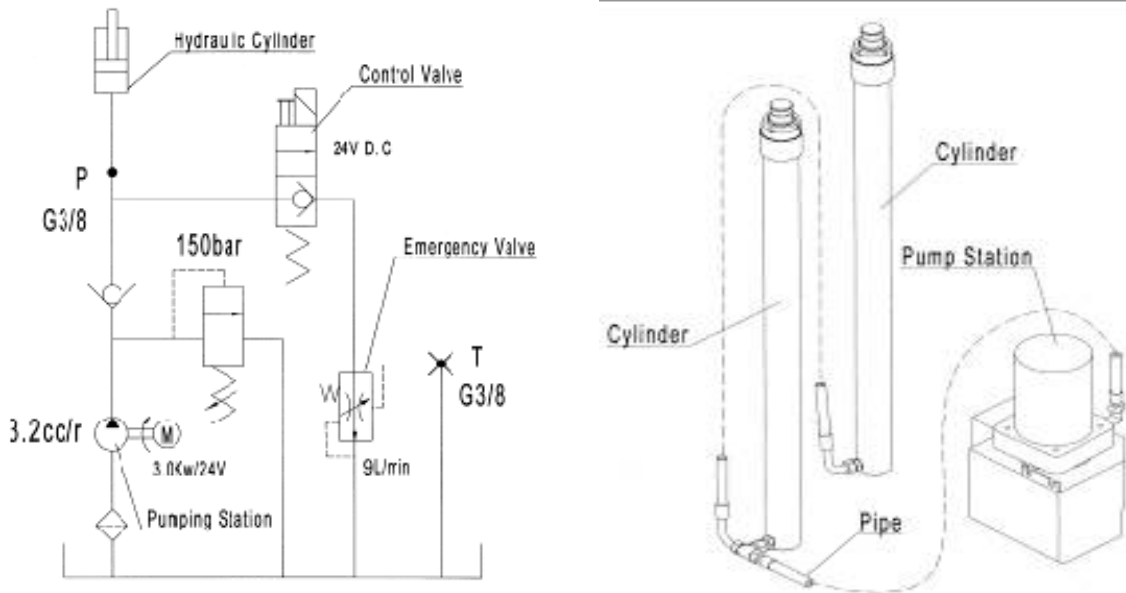
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### 3.10 TOOL FOR REPAIRING THE PIN OF ELECTRIC PLUG

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

### 3. HYDRAULIC SYSTEM

#### HYDRAULIC FLOW DIAGRAM



### CG1646

#### INSPECTION OF HYDRAULIC OIL

External appearance	Smell	Condition	Countermeasure
Clear and no discoloration	Fine	Fine	Possible to use
Clear but the color becomes brighte	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.

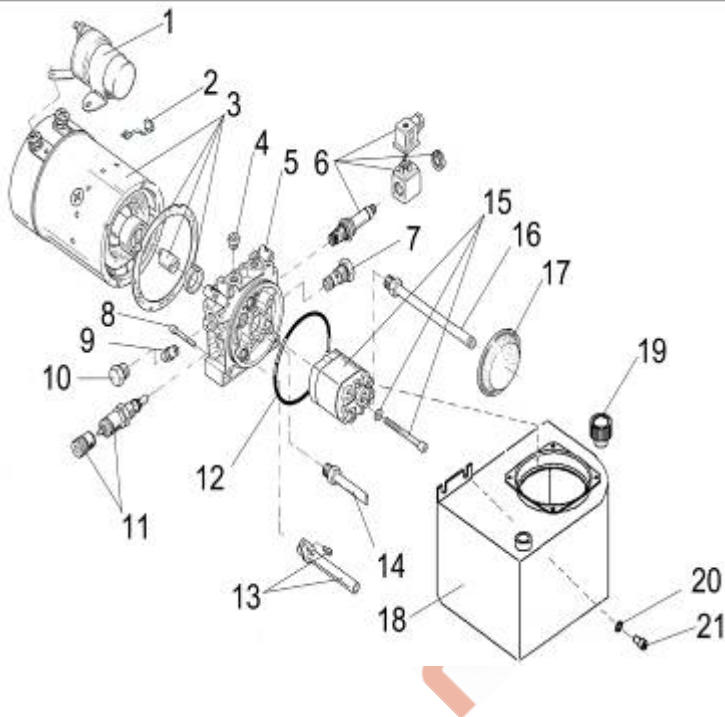
#### 4.1 OPERATION OF PUMP STATION

##### REPLACE THE PUMP STATION

**⚠ WARNING** Put the fork of the ground and drain out the hydraulic oil.

##### CLEANING OIL TANK AND FILTER

**⚠ WARNING** Put the fork of the ground and drain out the hydraulic oil.



- Remove out the pump station
- Take away two screws (No.21)
- Remove the suction filter (No. 16 & 17).
- Clearing of oil tank and filter.
- Clean the Fix plate for valve (No.5), etc.
- Clean up with compressed air and inspect if the filter is stopped or damaged. If the filter is stopped or damaged, replace it.
- Remove dust or foreign material from the tank.
- Then assemble them.

#### 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 little oil stains on the plug ahter some tome. It is not leak.

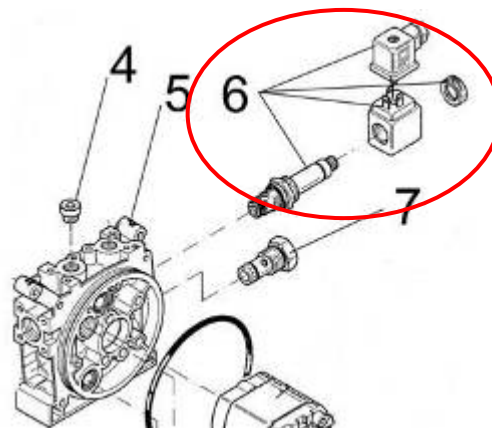


**CAUTION**

For the electric current of the **Relay** (No.1) 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 it to clear or replace.





## HYDRAULIC PIPE



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

### 4.2 REPLACE THE CYLINDER



Remove three plastic bolts

Take away the Fix board



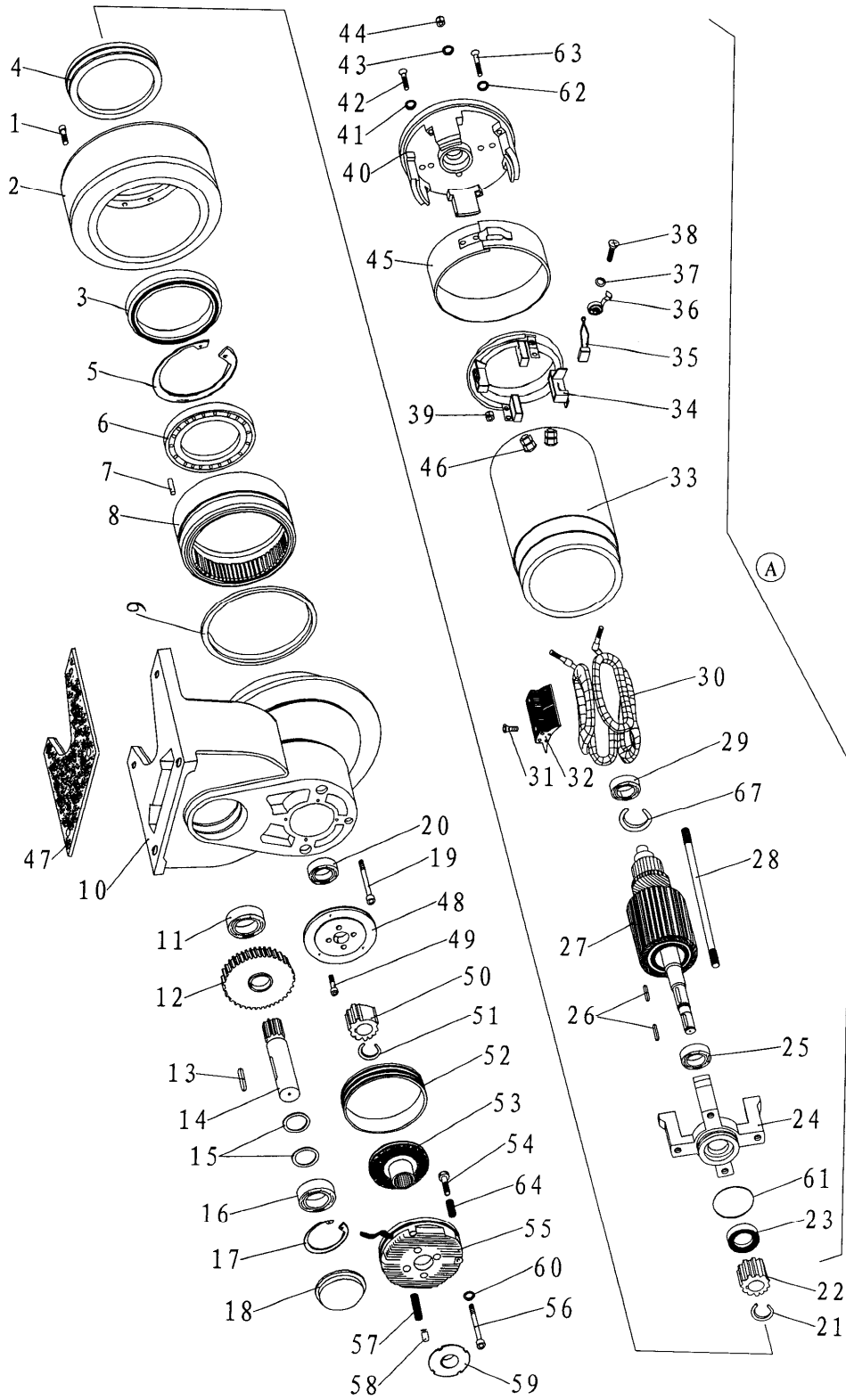
- Remove the joint.
- Remove two screw, then take

then you can dismantle the cylinder and replace it.

## 5. DRIVE WHEEL

### 5.1 THE DRIVE WHEEL

Driving Wheel (MR250FR)



Serial No	Part No	Description	Quantity	Note
1	5010406014C0	Socket Head Screw 8.8 M6 x	10	
2	G250402001	Wheel	1	
3	501990109	Seal 140 x 180 x 12	1	
4	G250402002	Braking Circle	1	
5	504040034	Ø180 Locking clip	1	
6	349010118	16024 C2 Bearing	1	
7	505020047	Ø5 x 20 Pin	2	
8	G250402003	Inner Gear Z=99	1	
9	G250402004	Washer	1	
10	G250402005	Outer Cover	1	
11	349010100	6006 Bearing	1	
12	G250402006	Speed-changing Gear Z=80	1	
13	G250402007	Flat Key 10 x 8 x 18	1	
14	G250402008	Gear Z=14	1	
15	G250402009	Bearing Washer Ø30 x 42		
16	349010100	Bearing 6006	1	
17	504040026	Locking clip Ø55	1	
18	G250402010	Cap Ø55 x 4	1	
19	5010406060C0	Socket Head Screw 8.8 M6 x	3	
20	349010096	Bearing 6002 2RS	1	
21	G250402011	Locking clip Ø15 E	1	
22	G250402012	Motor Gear Axle Z=18	1	
23	G250402013	Seal Ø20 x 32 x 7	1	
24	G250402014	Motor Flange	1	
25	349010098	Bearing 6004 ZZCM	1	
26	G250402015	Flat Key 5 x 5 x 18	2	
27	G250402016	Motor Rotor	1	
28	G26040001	Supporting Screw M6 x 168	3	
29	G26040002	Bearing 6204 DDUCM	1	
30	G250402018	Field Winding	1	▲
31	5010408016C0	Socket Head Screw 10.9 M8x	8	
32	G250402019	Pole shoe	4	▲
33	G250402020	Driving Motor Case	1	
34	G250402021	Electric Brush Fixing Board	1	

35	G26040003	Electric Brush 10 x 20 x 26 M19	4	
36	G250402023	Spring of Electric Brush	4	
37	G250402024	Split Retaining Ring Ø4	4	
38	5010604010C0	Split Retaining Ring 8.8 M4x	4	
39	502030023	Nut 6S M5	4	
40	G250402025	Electric Brush Fixing Cap	1	
41	G250402026	Socket Washer Ø5	4	
42	5010405018C0	Socket Head Screw 8.8 M5x	4	
43	504060001	Split Retaining Ring Ø6	3	
44	502030025	Nut 6S M6	3	
45	G250402027	Protective Cover	1	
46	G250402028	Polar End	4	
47	G250402029	Washer	1	
48	G250402030	Flange of Brake	1	
49	50101005010	Hexagonal Head Screw 8.8	4	
50	G250402031	Wheel Hub	1	
51	G250402032	Locking Clip Ø14 E	1	
52	G250402033	Bearing Disk	1	
53	G250402034	Brake Disk	1	
54	G250402035	Adjusting Screw	3	
55	G250402036	Electromagnetic Coil	1	
56	50101005045	Hexagonal Head Screw 8.8	3	
57	G250402037	Spring	4	
58	G250402038	Pin	4	
59	G250402039	Disc-like Screw	1	
60	504060005	Split Retaining Ring Ø5	3	
61	504070105	O-ring 47,30 X 2,62 2-134	1	
62	504060005	Split Washer Ø5	4	
63	G26040004	Socket Head Screw 8.8 M5x	4	
64	G250402037	Spring	3	
67	G26040005	Locking Clip Ø20 E	1	
A	G250402040	DC Motor	1	
	G250402041	E/m Brake Block 10N-M	1	

Remarks: Those with ▲ can not be provided alone

**CAUTION**

The oil for gear box should be changed per 8 – 12 months.

**5.2 REPLACE THE DRIVE WHEEL**



Step 1: Dismantle the plastic cover

Step 2: Dismantle the platform for standing on remove the screw and nut.

Step 3: Remove 6pcs screws, take out the cover plate.

Step 4: Remove 4pcs bolts, dismantle the Box body .  
The drive wheel appears.

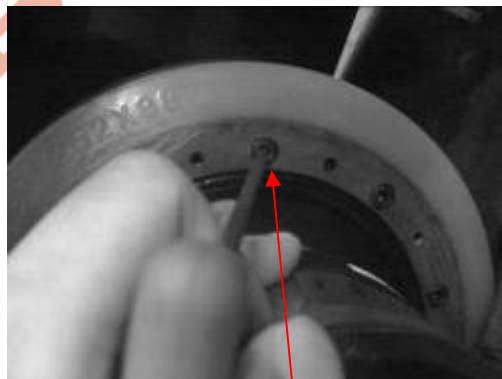


**WARNING**

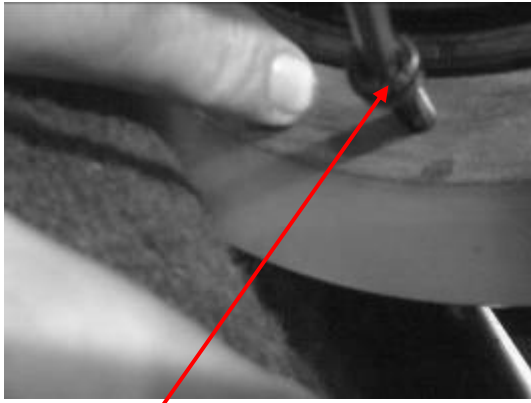
Cut off the power before operating.



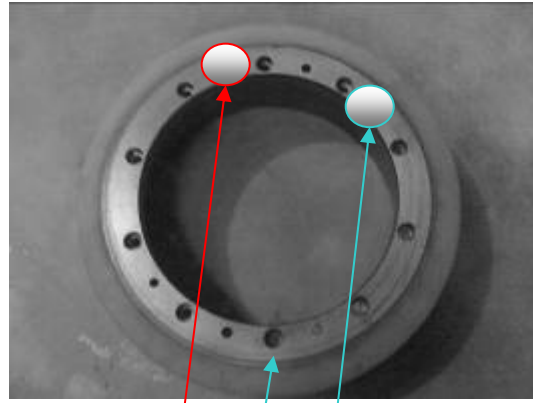
Dismantle the plug for the baeke and temperature senso



Remove 10 pcs screws.



Use four screws (8.8T or more better) to screw in four “technologic screw holes”, so that eject the wheel.



2 pcs guide pin holes  
10 pcs screw holes  
4 pcs technologic screw holes

### 5.3 REPLACE THE CARBON BRUSH KIT



Dismantle the steel shield which wrapped the motor, the carbon brush appears.



Remove the screw which fixing the carbon brush, tilt the pressure spring of the carbon brush with a screwdriver, then take out the carbon brush.

#### 5.4 REPLACE THE BRAKE

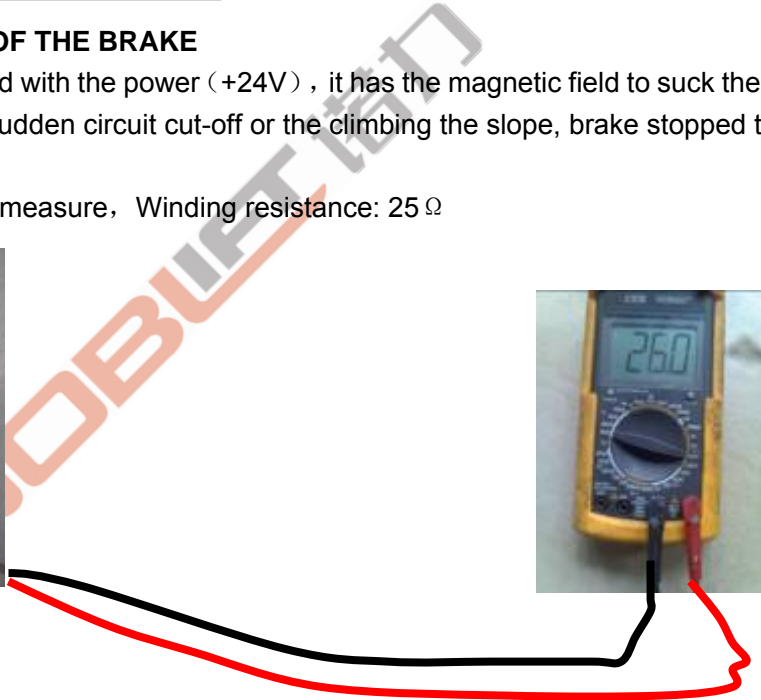
Remove 3 pcs screws, dismantle the connector, then you can dismantle the brake and replace it.



#### 5.5 ADJUST THE CLEARANCE OF THE BRAKE

When the brake winding is connected with the power (+24V), it has the magnetic field to suck the brake plate to start the brake. During the sudden circuit cut-off or the climbing the slope, brake stopped the motor to drive.

Step 1: Use multimeter (200  $\Omega$ ) to measure, Winding resistance: 25  $\Omega$



Step 2:



Loose the three screw that fix the brake

Step 3:



Un-tight the corresponding three screws

Keep the same clearance as showing

Step 4: Adjust the above-mentioned screws anticlockwise ( adjust 2-3 circle is okay) to reduce the spring strength.

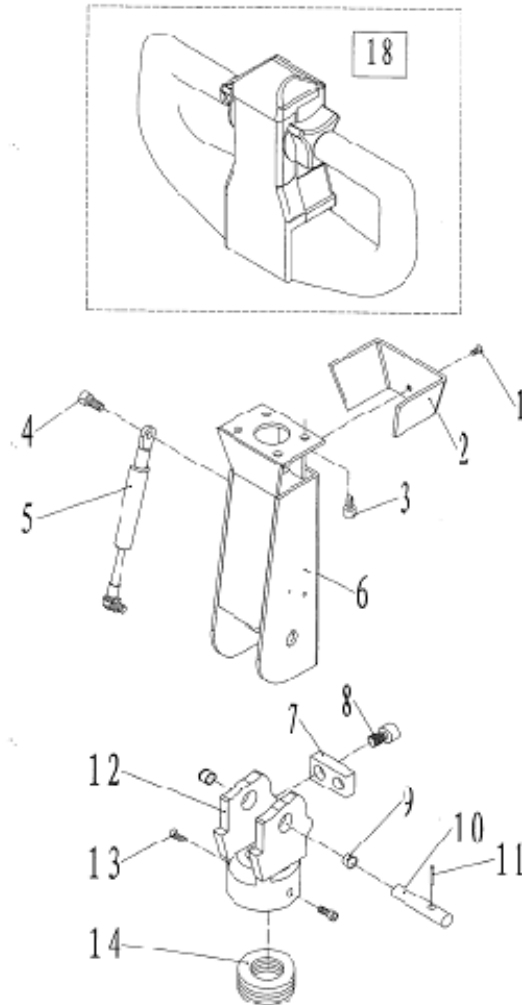
**CAUTION**

Brake slide should not contain grease, and nothing is blocked inside. Connected with plug connection, should connected firmly.



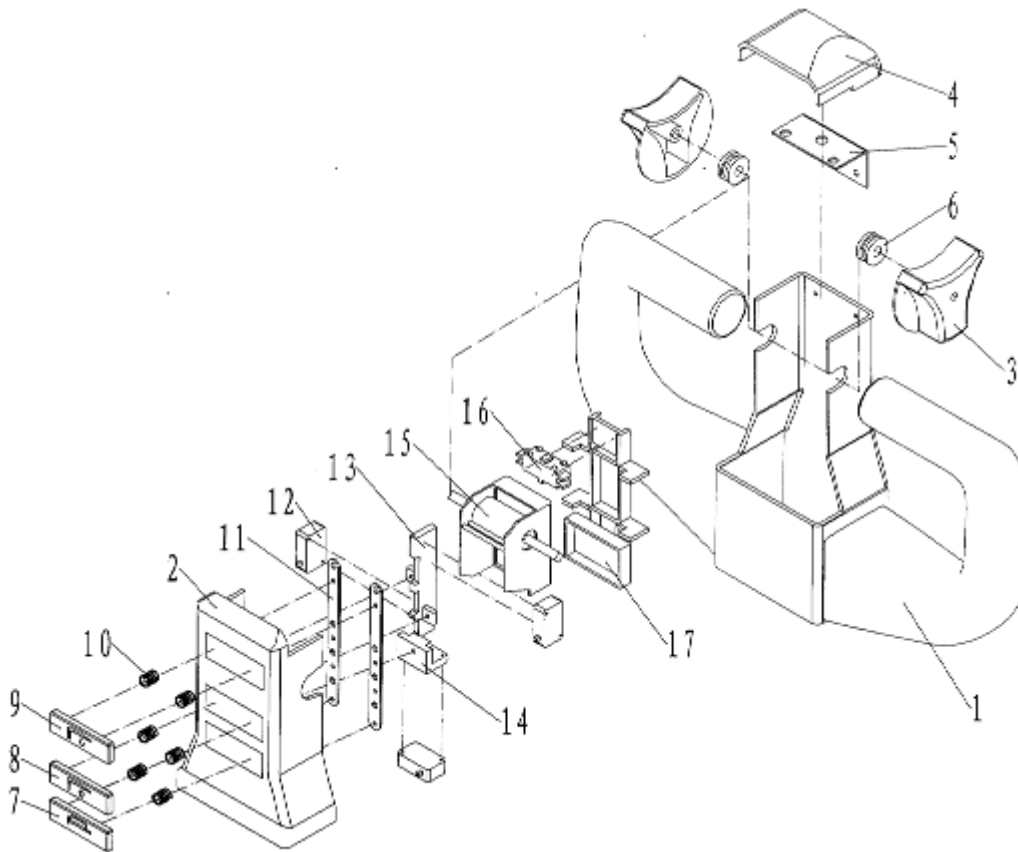


## 6. CONTROL HANDLE



Serial No	Part No	Description	Quantity	Note
1	5010605010C1	Screw M5×10	1	
2	D06080086	Cover	1	
3	5010408012C0	Socket Head Screw M8×12	4	
4	5010408020C0	Socket Head Screw M8×20	1	
5	302990018	Air Spring (550N×210)	1	
6	422120192	Handle Arm	1	
7	506030031	Anti-vibration Pad	1	
8	5010406010C0	Screw M6×10	2	
9	339010038	Bushing 23/19×17×10	2	
10	301703006	Axle φ17×71	1	
11	505020005	Elastic Pin φ4×24	1	
12	D01180001	Joint of Handle	1	
13	5010410016C0	Screw M10×16	2	
14	506030021	Dust Ring	1	
18	G28010001	Control Handle Kit	1	

## TILLER Control Handle

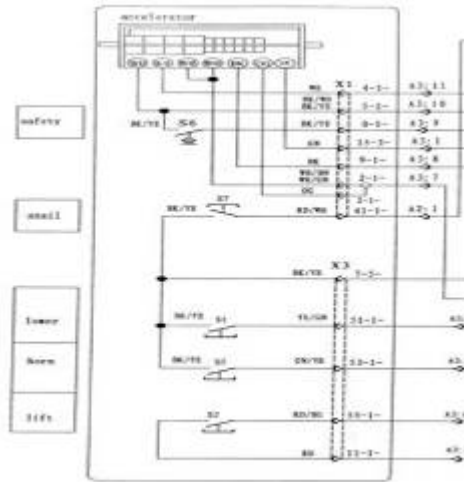


Serial No	Part No	Description	Quantity	Note
1	G28010002	Handle Body	1	Black
2	G28010003	Handle Cover	1	Black
3	G28010004	Speed Control Button	2	Red
4	G28010005	Emergency Reversing	1	Red
5	G28010006	Plate for Emergence	1	
6	G28010007	Bushing for Accelerator	2	
7	G28010008	Horn Button	1	White
8	G28010009	Lowering Button	1	White
9	G28010010	Lifting Button	1	White
10	G28010011	Spring for Button	6	
11	G28010012	Spring Bearer Plate	2	
12	G28010013	Micro Switch (Button)	3	
13	G28010014	Micro Switch Support1	1	Black
14	G28010015	Micro Switch Support 2	1	Black
15	G28010016	Accelerator	1	
16	G28010017	Micro Switch (Belly Button)	1	
17	G28010018	Accelerator Support	1	Black

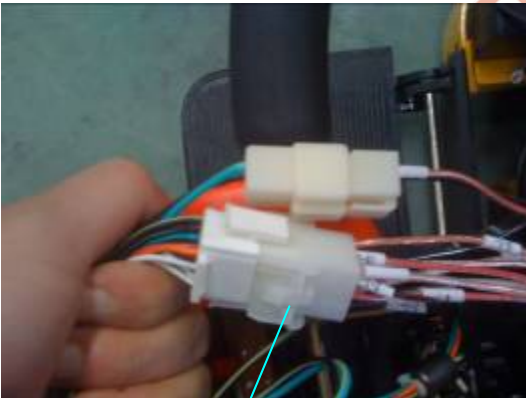
### 6.1 OPERATION OF THE CONTROL HANDLE



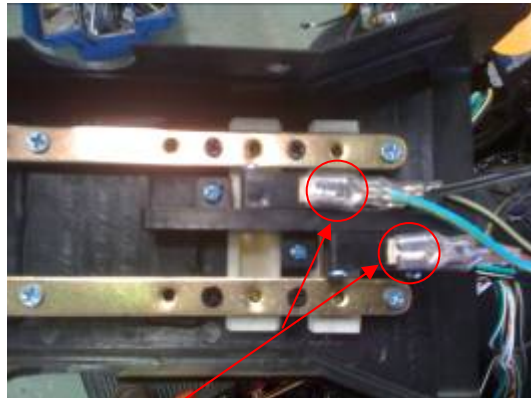
Remove 4 pcs screws which is behind the handle.



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



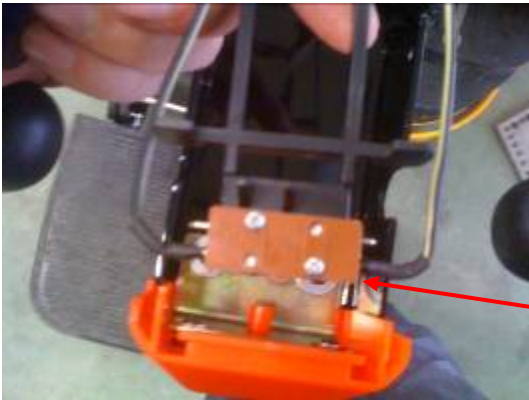
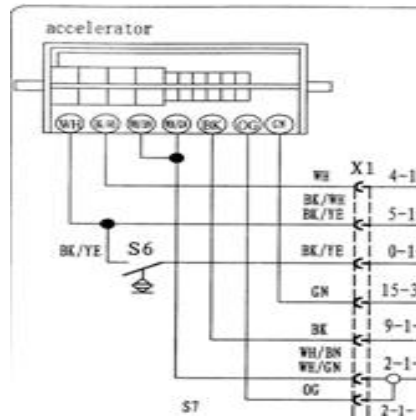
9 cores plug, which connect to the controller.



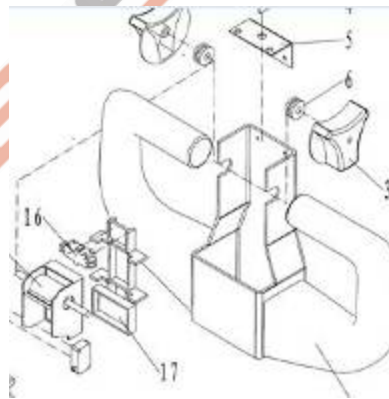
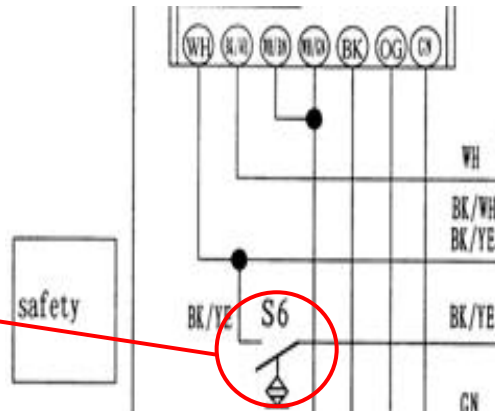
Check the button on the connector contacts



Take out the Accelerator



Specially attend the Micro switch for safety



Remove the Screws and Butterfly (left & right) and the Edge Shaft

## 6.2 OPERATION OF THE AIR SPRING AND MICRO SWITCH



Remove the pin



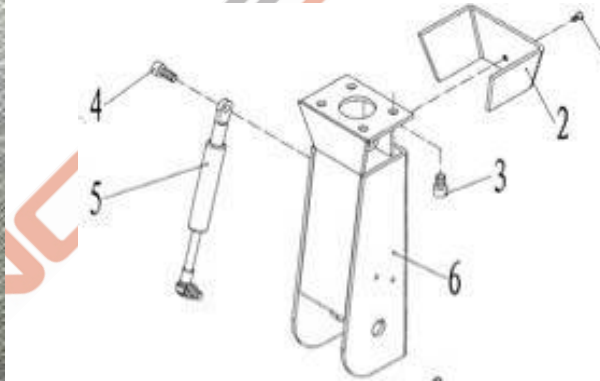
Take out Axis of the handle bar



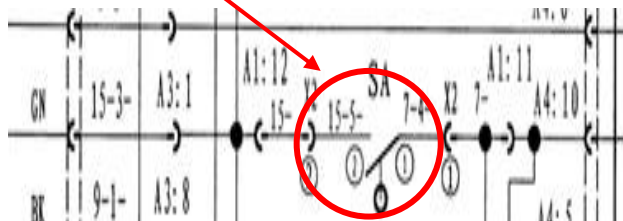
Use a Phillips screwdriver to remove this screw,  
then you take out the Fixed plate



Remove this screw.( NO.4) and Global screw.(on the air spring).Then you can dismantle the air spring and replace it.



Check the Micro Switch



**WARNING** Specially attend the Micro Switch, it is a safety component.

## 7. CASTER WHEEL



Step 1: Use a crane or other tool to hoist the stacker

Step 2: Remove 4pcs screw.

Then you can dismantle the caster wheel and replace it.



WHEEL replace: Remove the nut and bolt, then you can dismantle it and replace it.

## 8. OPERATION OF THE INTERNAL MAST

### 8.1 DISMANTLE THE INTERNAL MAST



**WARNING** Put the fork of the ground and drain out the hydraulic oil.



Step 1: Dismantle the hydraulic pipe to the pump station.



Step 2: Dismantle the connector of the Micro switch Z-15GW22-B which limiting the max. height of the fork.



Step 3: use a crane or other tool to hoist the mast.

## 9. TROUBLE DIAGNOSTICS

### 9.1 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 by sight of any block of loading wheel		●		
	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 commutator		#	●	
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.

## 9.2 TROUBLE SHOOT

