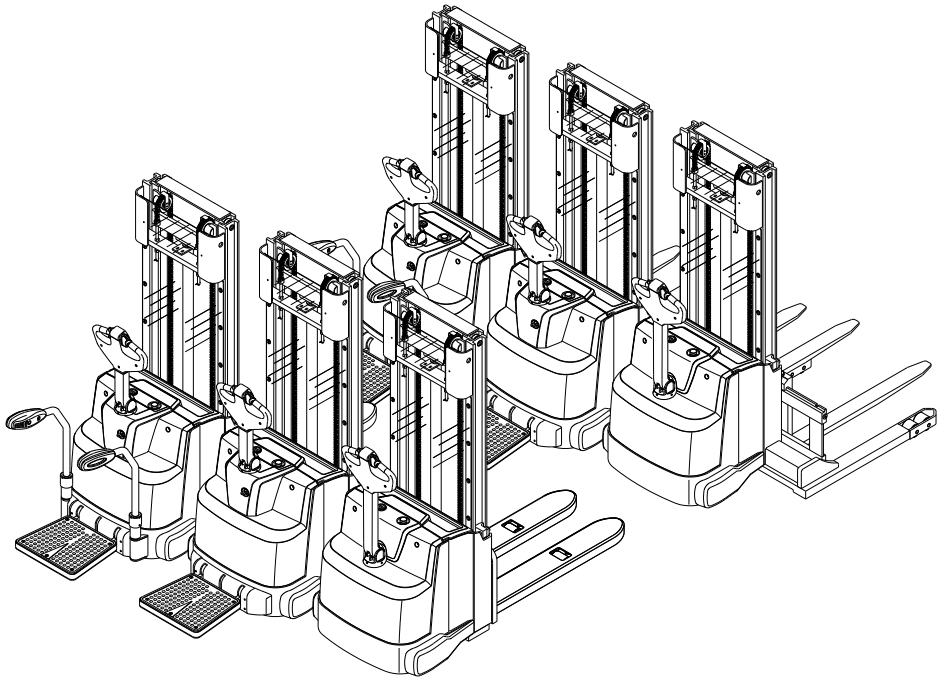
HANGCHA

Basic Range

ELECTRIC STACKER

CDD12/14/16-AEC1
CDD12/14/16-AEC1S
CDD12/14/16-AEC1-B
CDD12/14/16-AEC1S-B

OPERATION AND MAINTENANCE MANUAL



Original Instruction

HANGCHA GROUP CO., LTD.
10/2018

FOREWORD

Thank you very much for purchasing the A series basic range electric stacker of Hangcha Group .

A series basic range electric stacker is a newly developed product for warehouse logistic, it owns characteristics as advanced performance, comfort operation, safety and security, low maintenance cost, and is an ideal tool for handling goods in warehouse, supermarket and workshop.

Before use the truck, relative persons must read and understand the manual, get to know how to safely operate and maintain the truck.

Part one of this manual is about the brief introduction and correct operation of the basic range electric stacker, which will tell you how to operate safely and maintain preventively; part two will tell you the structure, working principle and maintenance of the electric pallet stacker.

Because of the update and improvements of our products, there may be some differences between this operation manual contents and your forklift truck.

If you have any questions, please contact Hangcha Group Co., Ltd. sales company or the agent.

Content

Part Ⅰ: Operation and maintenance

1 Truck Introduction

1.1 General

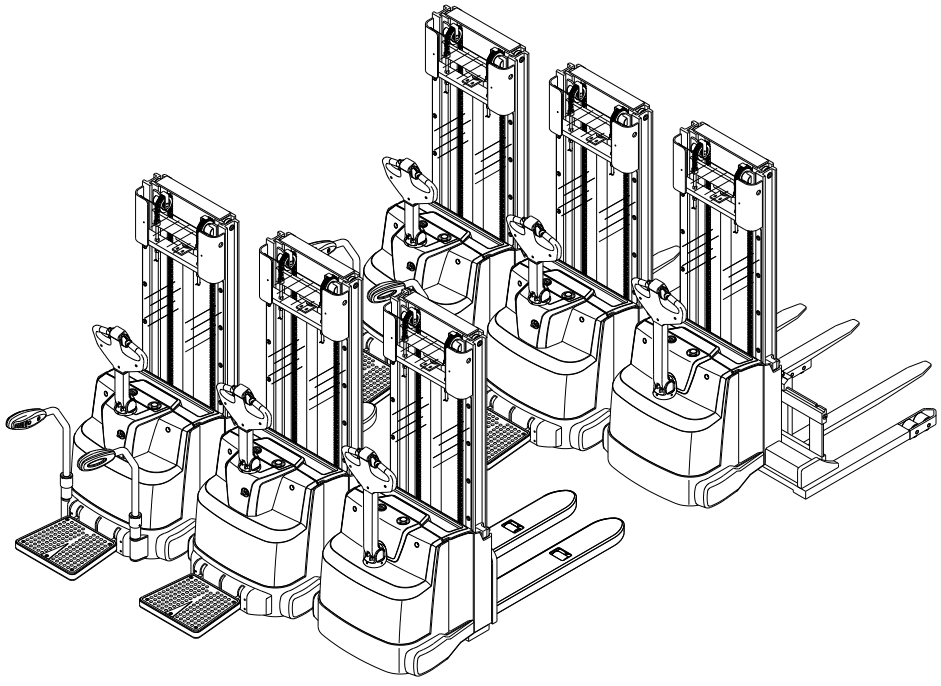
A series basic range electric stacker described in this manual should work under moderate intensity working strength.

According to different operation way, it has two types as pedestrian type and stand-on type.

Users can get relevant information as rated load from the product model. Model CDD16-AEC1S-B as an example:

CDD16-AEC1S-B	Mode
CDD	Electric stacker
16	Rated load capacity×100kg
A	Product serial number
E	Basic Range
C1	Controller type
S	Stand-on type
B	Straddle legs type

Rated capacity usually does not equal the allowable lifting capacity. Please refer to the load curve chart on the truck for approved lifting capacity.



Truck body system

- Beautiful and compact outline, concise and fluent line.
- Chassis welded by high-performance steel plate guarantees enough load capacity.
- Chassis adopts 5-wheel structure, auxiliary wheels fixed at two sides of the truck body guarantees the good stability.
- Hanging foldable damping pedal as optional

Driving system

- Adopted suspension design guarantees well wheel and ground contact, light turn and convenient operation.
- Adopted hub-type equips with 1.1kW maintenance free AC motor and high torque electromagnetic brake, integral structure is compact and performance is reliable.

Control system

- Newly designed ergonomics control handle owns functions like acceleration, reversing, horn, low speed, braking, lifting/lowering, emergency reversing light, thus make operation easier.
- Multifunction combination meter can display truck travelling time, battery capacity and fault message.
- Low speed travel function can move the truck slowly. It can stack goods even in very narrow place.
- Steering angle +/- 90°.

Hydraulic system

- Combined type hydraulic power unit, own compact structure, low noise, small pressure damage and good reliability.

Mast

- Good mast vision, easy installation and maintenance.
- Divide into single lifting cylinder and double lifting cylinders
- Mast lifting height is optional.

Electric system

- 24V Electric system.
- CURTIS latest AC controller.
- Emergency stop switch.
- Own electric lift limited and controller intelligent limited function.
- Electric wiring adopts waterproof connector.
- Multi-function instrument owns electric quantity display, time and fault diagnosis function.

1.2 Use occasion and condition

Truck in this manual is only for lifting and transporting loads.

It must be used, operated and maintained according to the information in this manual. Any other uses are outside the design envelope and can lead to injury to persons or damage to equipment or property.

Only used in specified place and condition：

- Use in specified rated load.
- Used in specified area as factory, tourist attraction and recreation place.
- Used on the flat ground, that is fixed and owns enough carrying capacity.
- It is prohibited to pass the bulge or cavity as the small wheel diameter may cause truck tipping over.
- Used on the road with good vision and equipment use license.
- Max. uphill grade when driving is 6%.
- It is prohibited to travel crosswise or obliquely. When go uphill with loads, keep the loads in front; when go downhill, keep people in front.

For truck operation, the following normal climatic conditions apply:

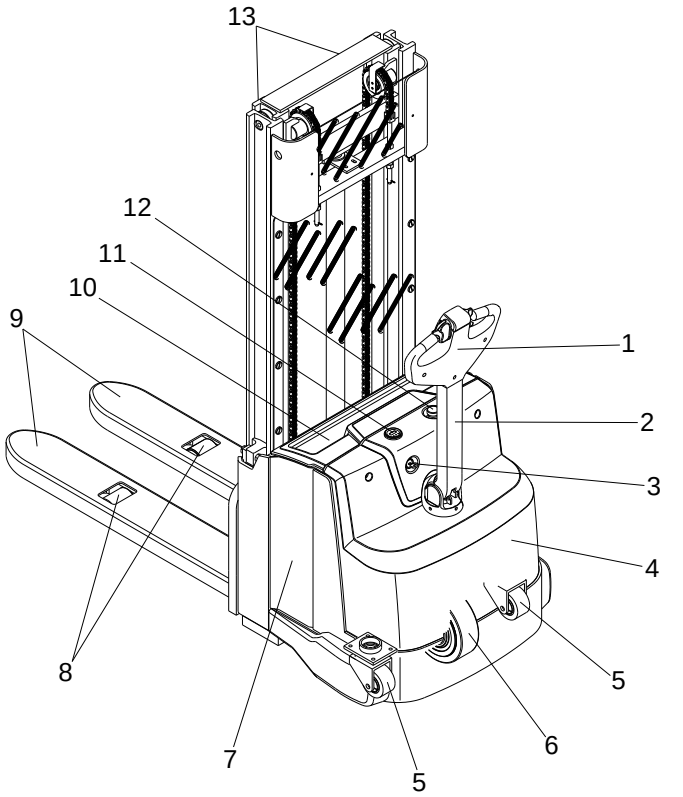
- Average ambient temperature for continuous duty: ＋25℃;
- Maximum ambient temperature, short term (up to 1h): ＋40℃;
- Lowest ambient temperature for trucks intended for use in normal indoor conditions:＋5℃;
- Lowest ambient temperature for trucks intended for use in normal outdoor conditions:－20℃;
- Altitude: up to 2000m.

Please read others safety rules in this manual, it is important to your personal safety, working staff and goods safety.

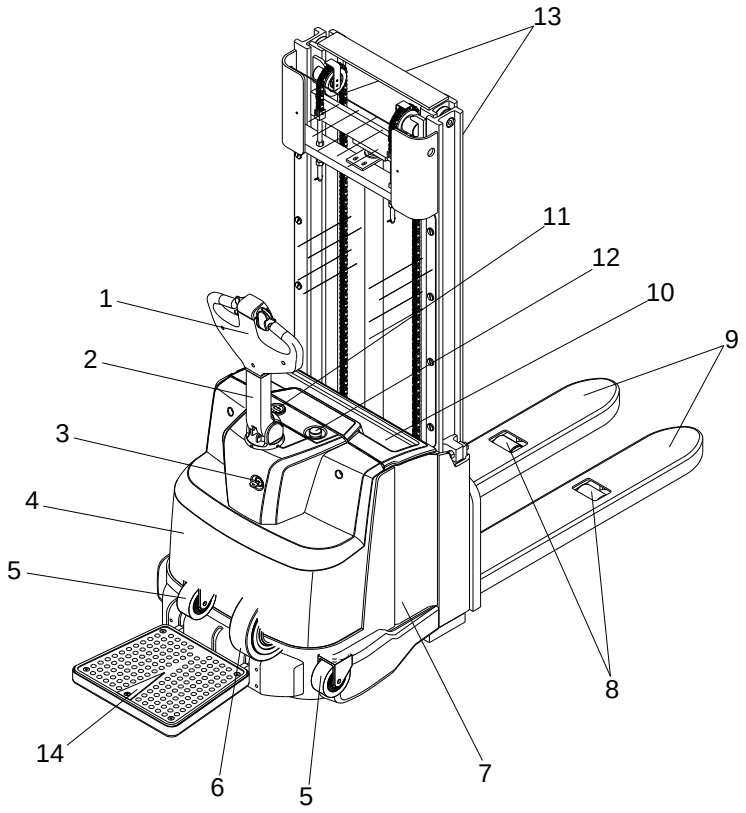
WARNING

- **Do not carry people.**
- **Do not over load.**
- **Do not push and pull loads.**

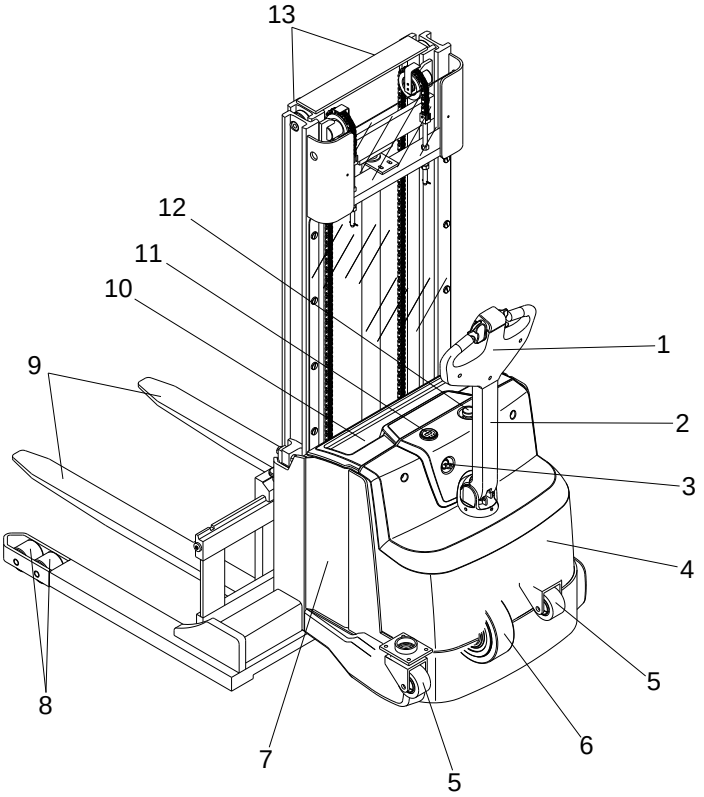
1.3 Main part name



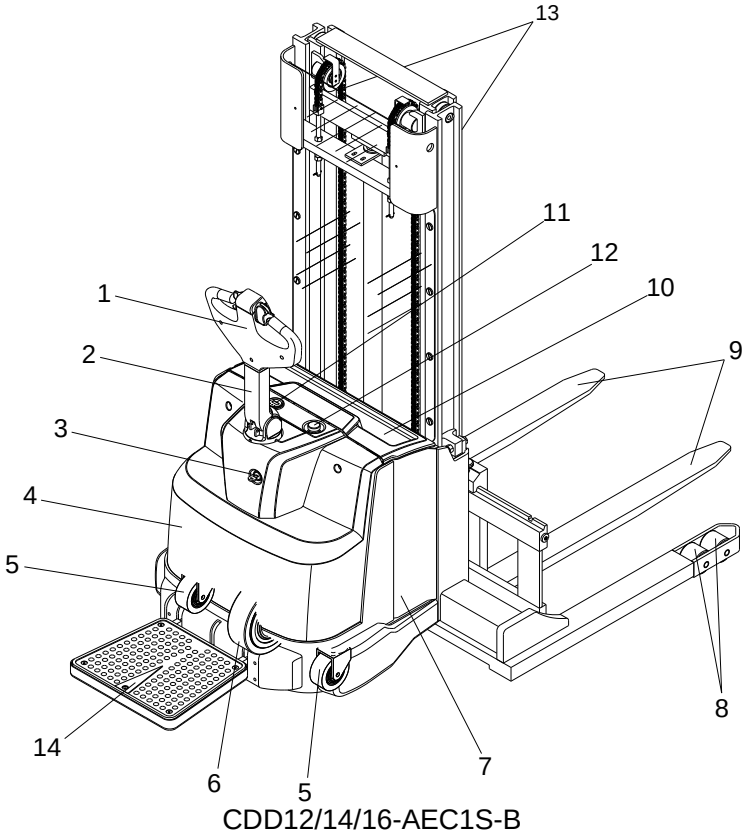
CDD12/14/16-AEC1



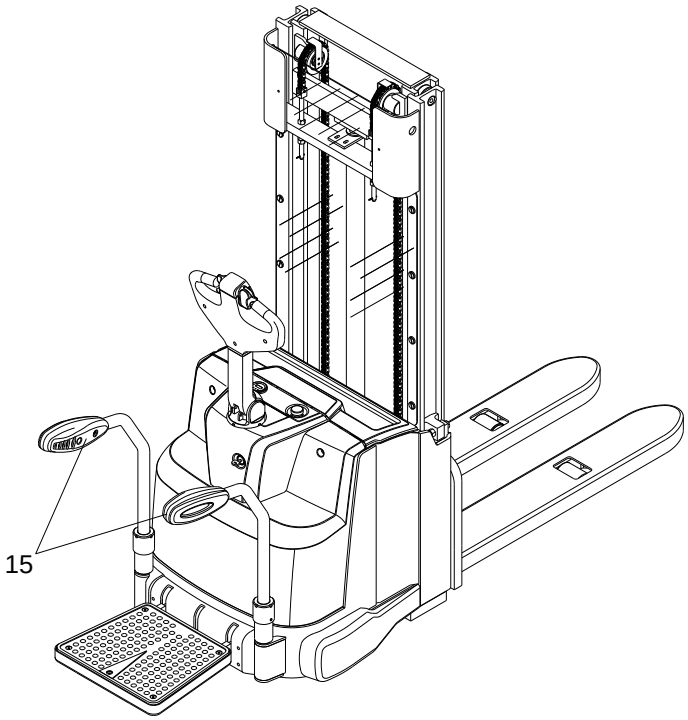
CDD12/14/16-AEC1S



CDD12/14/16-AEC1-B

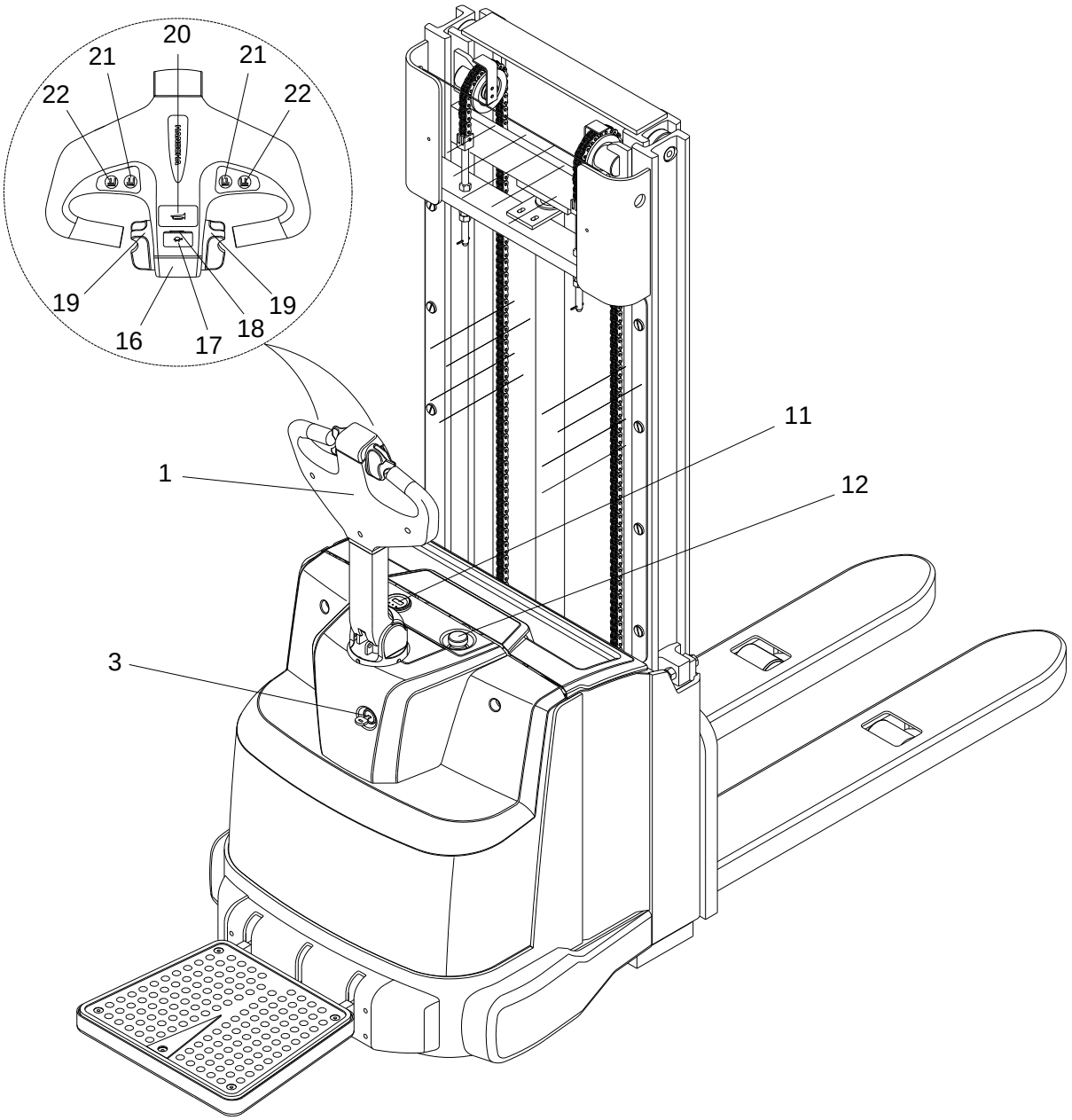


CDD12/14/16-AEC1S-B



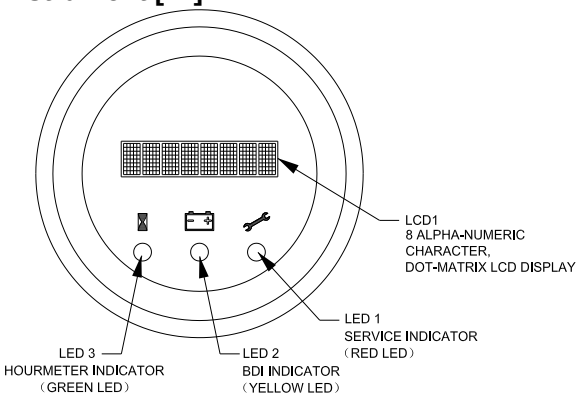
Item	Description	Item	Description
1	Control handle	9	Fork
2	Control lever	10	Battery cover
3	Key switch	11	Emergency stop switch
4	Hood	12	Instrument
5	Auxiliary wheel	13	Mast
6	Drive wheel	14	Pedal
7	Truck frame	15	Fence(Optional)
8	Load wheel		

1.4 Display and control

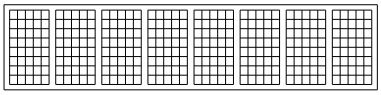


1.4.1 Display

Instrument [11]



Dot-matrix LCD display



The display screen is 8 alphanumeric characters, dot-matrix LCD liquid crystal display, can display vehicles fault code, battery soc and total running time.

Vehicles when the normal operation of the display shows the battery remaining power.

Service indicator(red LED)

When the controller to detect fault information, the red LED indicator light flashing, at the same time LCD display shows two digits of the fault code.When there are multiple fault fault code alternates between interval of 2 seconds.Fault code corresponding fault information to view in this paper, the fault code table.

BDI indicator(yellow LED)

When battery remaining power less than 20%, the yellow LED indicator lights flashing, warned "depleted", at the same time LCD display shows "20%" for 1 seconds after into "Low BDI".

When the yellow LED indicator lights flashing, vehicle lifting by automatic locking function, running speed is reduced.At this time should be immediately available for vehicles recharged.

Hourmeter indicator(green LED)

Said when the green LED light is normally on the timer is timing, the smallest unit of time for 0.1 hours.

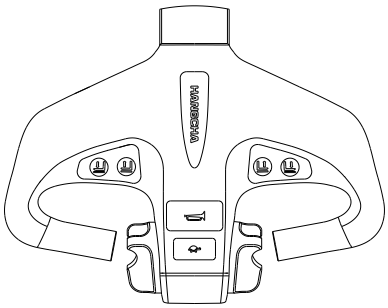
Every time when starting the vehicle LCD screen will display the vehicle's total run time, this time is for regular maintenance on the basis of the vehicle.

Low speed indicator [18]

When this light is on, the truck is in low speed mode.

1.4.2 Control

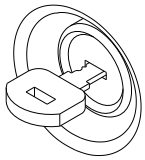
Control handle [1]



Control truck steering and braking.

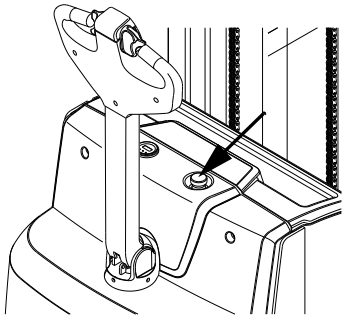
When turn the control handle right and left, it can realize the truck right and left turn. The max turning angle of this handle is about 175°. When press the handle to horizontal position or push up to vertical position, it can realize the truck brake. These two positions are set by brake inching switch. Normal is open circuit, working status is closed, brake inching switch at horizontal or vertical position is normal.

Key switch [3]



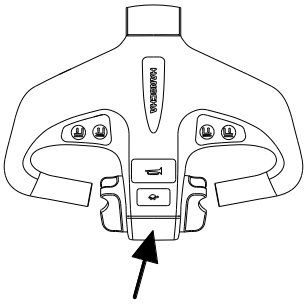
Turn on the key switch, and the power is on. Turn off the switch, and the power is off. Turn off the key switch before charging.

Emergency stop switch [12]



Press this switch, power is off. Press it when emergency or no use. If re-start needed, pull upward.

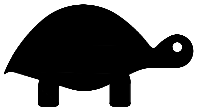
Emergency reversing switch [16]



This switch is at the head of control lever, once touch this button, the truck moves forward. It is used to protect people from being clamped by the control handle.

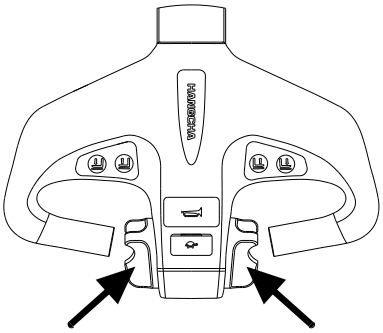
This switch is also called belly switch.

Low speed travel button [17]



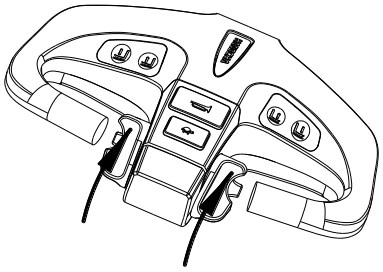
Press this button, the truck will travel in low speed, 40% of max. travelling speed. Release this button, the truck travels in normal speed

Direction and speed control button[[18]



This button is at both sides of control lever head, one linkage per left and right. It is to control travelling direction and travelling speed.

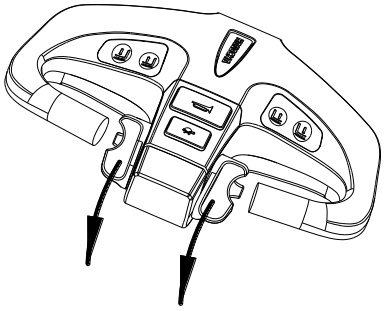
Truck travels to the fork side



- Press this control handle downwards.
- Turn this button from the side of body to outside gradually with thumb.

- Truck travels to the fork side.

Truck travels to the handle side(or pedal)



- Press this control handle downwards.
- Turn this button towards the side of body gradually with thumb.
- Truck travels to the handle side(or pedal).

> **CAUTION**
> **After the finger is released, the direction and speed button will reset itself and the truck will stop by brake. So do not loosen the knob when the truck is requested to continue driving.**

Horn button [20]

The button is located at the front surface of the control handle head. Press down the button, and the horn sounds.

Lifting button [21], lowering button [22]

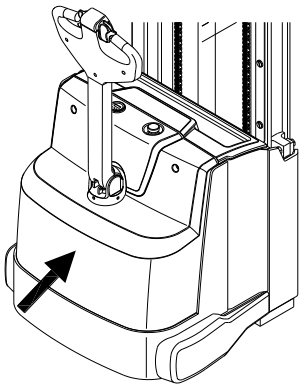
The lifting button and the lowering button are located on both side surface of the middle control handle. Press the lifting button, and the forks move up; press the lowering button, the forks go down.

When the capacity of batteries is consumed up to 80%, the lifting function will be locked.

1.4.3 Others

Hood [4]

There install main parts as hydraulic unit, main drive unit and electric system etc. under the hood. When check or maintain, please open the rear hood.



Load wheel [8]

There is one load wheel under each front outrigger to ensure longitudinal stability.

Check the load wheel to find if there is disrepair or abnormal wear according to necessity. If there is disrepair on the load wheel or its inner bearing, suspend the truck off the ground or jack the front outrigger off the ground, replace the worn load wheel or the worn bearing, and renew sufficient multi-purpose grease on the bearing.

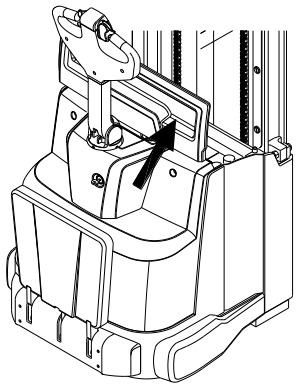
Fork [9]

Forks can be lifted or lowered to fetch goods. Because of four-bar mechanism, forks assembly will move horizontally a distance when forks lift or lower.

> ⚠ **CAUTION**
> - **It is forbidden to put hands, feet or any part of the body between lift assy. and truck frame when lifting or lowering.**

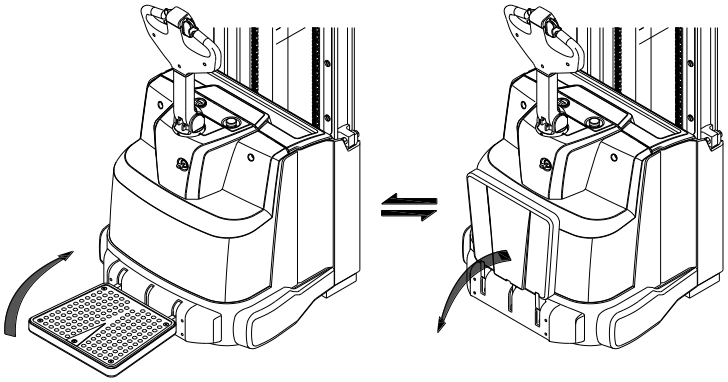
Battery cover [10]

When check battery, take out the plug, charge or replace the battery, you can easily open the battery cover.



> ⚠ **CAUTION**
> - **When closing the battery cover, protect your fingers from being clamped.**

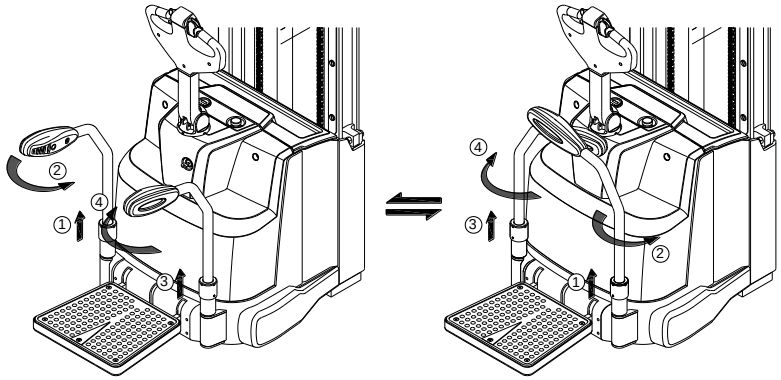
Pedal（Only for stand-on type）[14]



This pedal can be folded so that you can put down the pedal and stand on it when operating the truck for a long distance. When transporting at a narrow space, folding the pedal, stand on ground to operate the truck.

Fence [15]（Optional）

In order to further enhance the security of standing drive forklift, prevent the operator body out of balance was thrown, the user can optional fence.When open or put fence, need to first filed a guardrail slightly upward, then rotate to open or folded up barriers.



1.5 Standard technical data

The following technical data are all standard data. Our company reserves the right of alteration and extension.

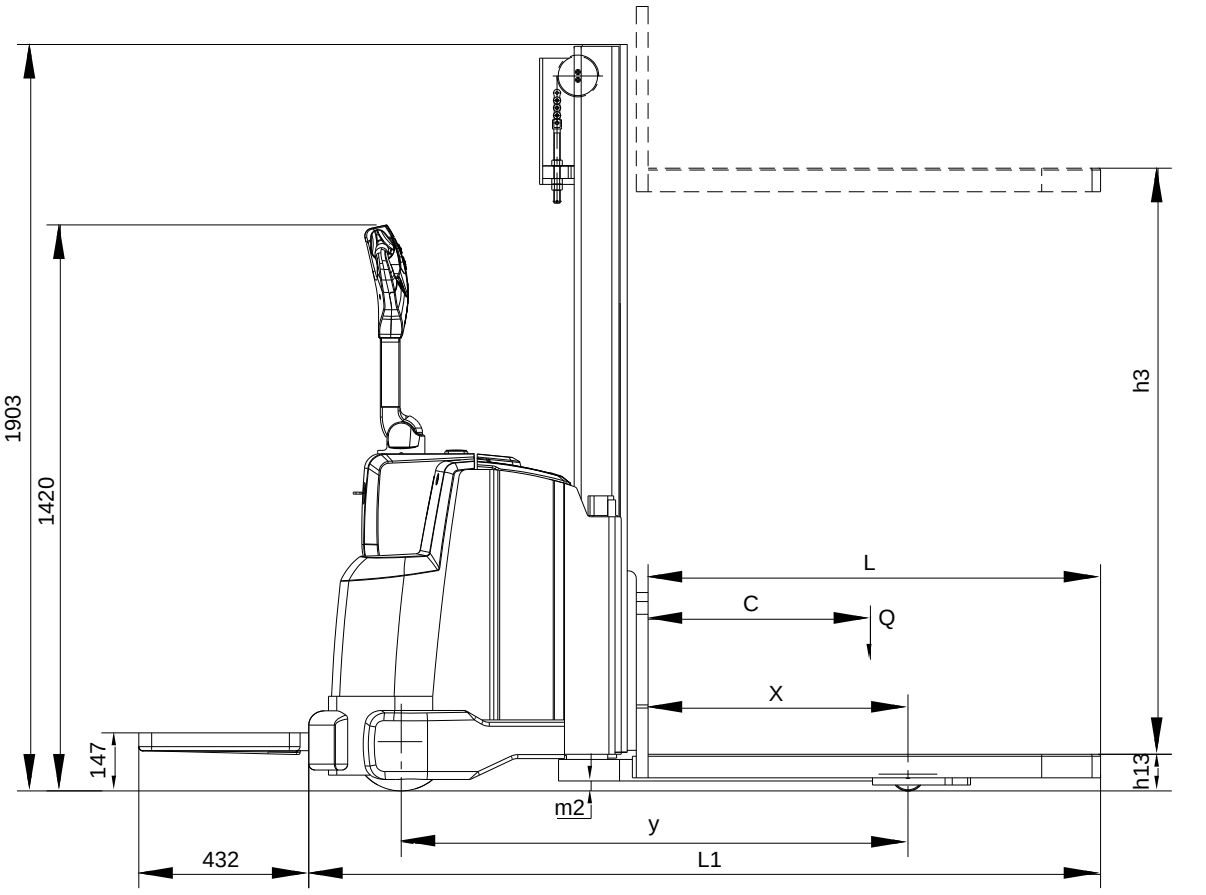
Characteristics	Model		CDD12-AEC1	CDD14-AEC1	CDD16-AEC1
	Operator type		Pedestrian	Pedestrian	Pedestrian
	Load capacity	Q (kg)	1200	1400	1600
	Load center	c(mm)	600	600	600
	Wheelbase	y(mm)	1378[1)]	1378[1)]	1378[1)]
Weight	Service weight with battery	kg	1010	1010	1030
Wheels & Tyres	Tyre type		PU	PU	PU
	Tyre size/Quantity,operator side	mm	Φ250×80/1	Φ250×80/1	Φ250×80/1
	Tyre size/Quantity,load side	mm	Φ85×70/4	Φ85×70/4	Φ85×70/4
	Auxiliary wheel size/Quantity	mm	Φ125×50/2	Φ125×50/2	Φ125×50/2
	Tread, operator side	b10(mm)	620	620	620
	Tread, load side	b11(mm)	385	385	385
Dimensions	Lift height	h3(mm)	2700	2700	2700
	Fork height, lowered	h13(mm)	90	90	90
	Overall length	L1(mm)	2013[2)]	2013[2)]	2013[2)]
	Overall width	b1(mm)	860	860	860
	Fork size	s/e/L(mm)	60×185×1150	60×185×1150	60×185×1150
	Outside fork width	b5(mm)	570/680	570/680	570/680
	Ground clearance, center of wheelbase, min	m2(mm)	30	30	30
	Min, right angle stacking aisle width1000×1200 across forks	Ast(mm)	2220[2)]	2220[2)]	2220[2)]
	Min, ringht angle stacking aisle width 800×1200 across forks	Ast(mm)	2270[2)]	2270[2)]	2270[2)]
	Outer turning radius, min	Wa(mm)	1570[1)]	1570[1)]	1570[1)]
Performance	Travel speed, laden/unladen	km/h	5/5	5/5	5/5
	Lift speed, laden/unladen	mm/s	100/160	100/160	120/180
	Lowering speed, laden/unladen	mm/s	130/140	130/140	140/150
	Max Gradeability, laden/unladen	%	6/10	6/10	6/10
Motor & Battery	Drive motor power	kW	1.1	1.1	1.1
	Lift motor power	kW	2.2	2.2/3.0[3)]	3.0
	Battery voltage, rated capacity	V/Ah	24/210	24/210	24/240
	Optional battery voltage, rated capacity	V/Ah	24/240	24/240	
	Controller mode		Curtis AC	Curtis AC	Curtis AC

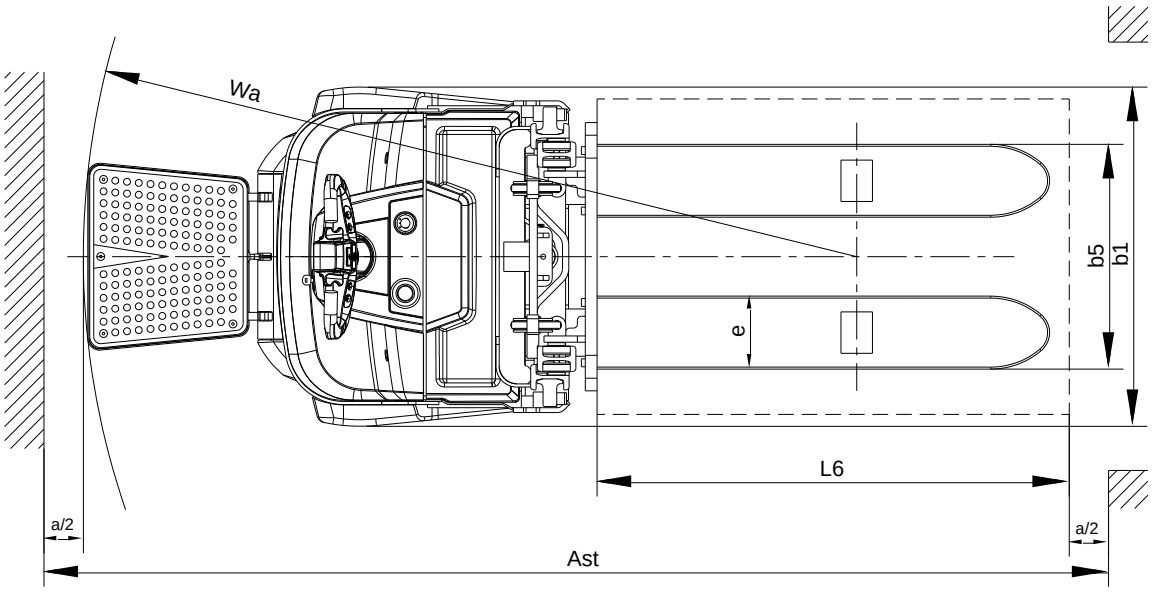
Characteristics	Model		CDD12-AEC1S	CDD14-AEC1S	CDD16-AEC1S
	Operator type		Stand-on	Stand-on	Stand-on
	Load capacity	Q (kg)	1200	1400	1600
	Load center	c(mm)	600	600	600
	Wheelbase	y(mm)	1378[1)]	1378[1)]	1378[1)]
Weight	Service weight with battery	kg	1050	1050	1070
Wheels & Tyres	Tyre type		PU	PU	PU
	Tyre size/Quantity,operator side	mm	Φ250×80/1	Φ250×80/1	Φ250×80/1
	Tyre size/Quantity,load side	mm	Φ85×70/4	Φ85×70/4	Φ85×70/4
	Auxiliary wheel size/Quantity	mm	Φ125×50/2	Φ125×50/2	Φ125×50/2
	Tread, operator side	b10(mm)	620	620	620
	Tread, load side	b11(mm)	385	385	385
Dimensions	Lift height	h3(mm)	2700	2700	2700
	Fork height, lowered	h13(mm)	90	90	90
	Overall length(fold the pedal)	L1(mm)	2074[2)]	2074[2)]	2074[2)]
	Overall length(unfold the pedal)	L1(mm)	2495[2)]	2495[2)]	2495[2)]
	Overall width	b1(mm)	860	860	860
	Fork size	s/e/L(mm)	60×185×1150	60×185×1150	60×185×1150
	Outside fork width	b5(mm)	570/680	570/680	570/680
	Ground clearance, center of wheelbase, min	m2(mm)	30	30	30
	Min, right angle stacking aisle width1000×1200 across forks	Ast(mm)	2280[2)]	2280[2)]	2280[2)]
	Min, ringht angle stacking aisle width 800×1200 across forks	Ast(mm)	2330[2)]	2330[2)]	2330[2)]
	Outer turning radius, min	Wa(mm)	1630[1)]	1630[1)]	1630[1)]
Performance	Travel speed, laden/unladen	km/h	5/5	5/5	5/5
	Lift speed, laden/unladen	mm/s	100/160	100/160	120/180
	Lowering speed, laden/unladen	mm/s	130/140	130/140	140/150
	Max Gradeability, laden/unladen	%	6/10	6/10	6/10
Motor & Battery	Drive motor power	kW	1.1	1.1	1.1
	Lift motor power	kW	2.2	2.2/3.0[3)]	3.0
	Battery voltage, rated capacity	V/Ah	24/210	24/210	24/240
	Optional battery voltage, rated capacity	V/Ah	24/240	24/240	
	Controller mode		Curtis AC	Curtis AC	Curtis AC

Note：1）Mast with double lifting cylinders(including triplex mast)+47mm.

2）Duplex mast with double lifting cylinders +47mm and triplex mast +68mm.

3）Mast with double lifting cylinders(including triplex mast).





CDD12/14/16-AEC1

CDD12/14/16-AEC1S

Characteristics	Model		CDD12-AEC1-B	CDD14-AEC1-B	CDD16-AEC1-B
	Operator type		Pedestrian	Pedestrian	Pedestrian
	Load capacity	Q (kg)	1200	1400	1600
	Load center	c(mm)	600	600	600
	Wheelbase	y(mm)	1378[1)]	1378[1)]	1378[1)]
Weight	Service weight with battery	kg	1080	1080	1100
Wheels & Tyres	Tyre type		PU	PU	PU
	Tyre size/Quantity,operator side	mm	Φ250×80/1	Φ250×80/1	Φ250×80/1
	Tyre size/Quantity,load side	mm	Φ85×70/4	Φ85×70/4	Φ85×70/4
	Auxiliary wheel size/Quantity	mm	Φ125×50/2	Φ125×50/2	Φ125×50/2
	Tread, operator side	b10(mm)	620	620	620
	Tread, load side	b11(mm)	1000/1170/1370	1000/1170/1370	1000/1170/1370
Dimensions	Lift height	h3(mm)	2700	2700	2700
	Fork height, lowered	h13(mm)	50	50	50
	Overall length	L1(mm)	1963[2)]	1963[2)]	1963[2)]
	Overall width	b1(mm)	1100/1270/1470	1100/1270/1470	1100/1270/1470
	Fork size	s/e/L(mm)	35×100×1070	35×100×1070	35×100×1070
	Outside fork width	b5(mm)	210～790	210～790	210～790
	Ground clearance, center of wheelbase, min	m2(mm)	40	40	40
	Min, right angle stacking aisle width1000×1200 across forks	Ast(mm)	2250[2)]	2250[2)]	2250[2)]
	Min, ringht angle stacking aisle width 800×1200 across forks	Ast(mm)	2300[2)]	2300[2)]	2300[2)]
	Outer turning radius, min	Wa(mm)	1570[1)]	1570[1)]	1570[1)]
Performance	Travel speed, laden/unladen	km/h	5/5	5/5	5/5
	Lift speed, laden/unladen	mm/s	100/160	100/160	120/180
	Lowering speed, laden/unladen	mm/s	130/140	130/140	140/150
	Max Gradeability, laden/unladen	%	6/10	6/10	6/10
Motor & Battery	Drive motor power	kW	1.1	1.1	1.1
	Lift motor power	kW	2.2	2.2/3.0[3)]	3.0
	Battery voltage, rated capacity	V/Ah	24/210	24/210	24/240
	Optional battery voltage, rated capacity	V/Ah	24/240	24/240	
	Controller mode		Curtis AC	Curtis AC	Curtis AC

Note：1）Mast with double lifting cylinders(including triplex mast)+47mm.

2）Duplex mast with double lifting cylinders +47mm and triplex mast +68mm.

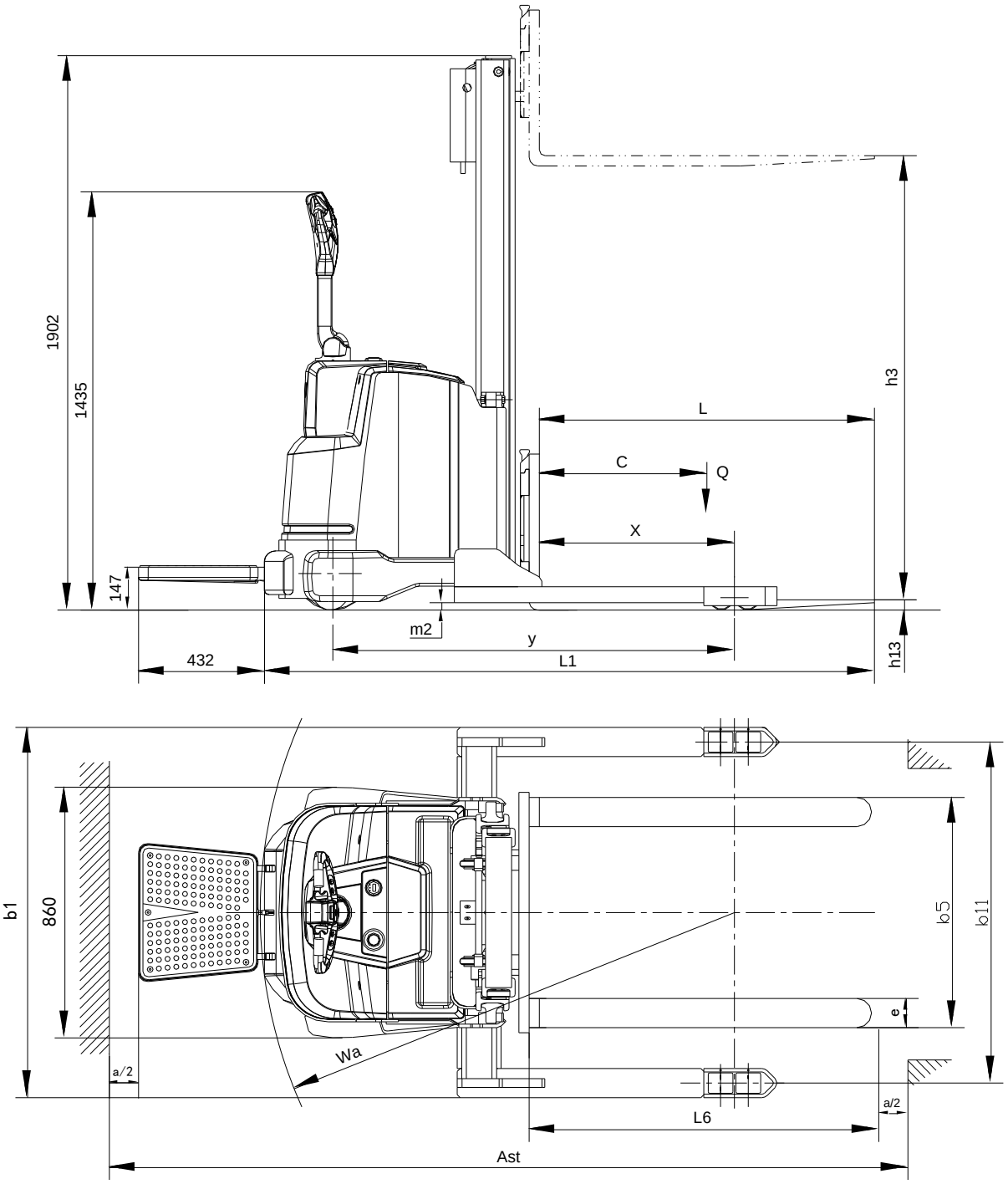
3）Mast with double lifting cylinders(including triplex mast).

Characteristics	Model		CDD12-AEC1S-B	CDD14-AEC1S-B	CDD16-AEC1S-B
	Operator type		Stand-on	Stand-on	Stand-on
	Load capacity	Q (kg)	1200	1400	1600
	Load center	c(mm)	600	600	600
	Wheelbase	y(mm)	1378[1)]	1378[1)]	1378[1)]
Weight	Service weight with battery	kg	1120	1120	1140
Wheels & Tyres	Tyre type		PU	PU	PU
	Tyre size/Quantity,operator side	mm	Φ250×80/1	Φ250×80/1	Φ250×80/1
	Tyre size/Quantity,load side	mm	Φ85×70/4	Φ85×70/4	Φ85×70/4
	Auxiliary wheel size/Quantity	mm	Φ125×50/2	Φ125×50/2	Φ125×50/2
	Tread, operator side	b10(mm)	620	620	620
	Tread, load side	b11(mm)	1000/1170/1370	1000/1170/1370	1000/1170/1370
Dimensions	Lift height	h3(mm)	2700	2700	2700
	Fork height, lowered	h13(mm)	50	50	50
	Overall length(fold the pedal)	L1(mm)	2024[2)]	2024[2)]	2024[2)]
	Overall length(unfold the pedal)	L1(mm)	2445[2)]	2445[2)]	2445[2)]
	Overall width	b1(mm)	1100/1270/1470	1100/1270/1470	1100/1270/1470
	Fork size	s/e/L(mm)	35×100×1070	35×100×1070	35×100×1070
	Outside fork width	b5(mm)	210～790	210～790	210～790
	Ground clearance, center of wheelbase, min	m2(mm)	40	40	40
	Min, right angle stacking aisle width1000×1200 across forks	Ast(mm)	2310[2)]	2310[2)]	2310[2)]
	Min, ringht angle stacking aisle width 800×1200 across forks	Ast(mm)	2360[2)]	2360[2)]	2360[2)]
	Outer turning radius, min	Wa(mm)	1630[1)]	1630[1)]	1630[1)]
Performance	Travel speed, laden/unladen	km/h	5/5	5/5	5/5
	Lift speed, laden/unladen	mm/s	100/160	100/160	120/180
	Lowering speed, laden/unladen	mm/s	130/140	130/140	140/150
	Max Gradeability, laden/unladen	%	6/10	6/10	6/10
Motor & Battery	Drive motor power	kW	1.1	1.1	1.1
	Lift motor power	kW	2.2	2.2/3.0[3)]	3.0
	Battery voltage, rated capacity	V/Ah	24/210	24/210	24/240
	Optional battery voltage, rated capacity	V/Ah	24/240	24/240	
	Controller mode		Curtis AC	Curtis AC	Curtis AC

Note：1）Mast with double lifting cylinders(including triplex mast)+47mm.

2）Duplex mast with double lifting cylinders +47mm and triplex mast +68mm.

3）Mast with double lifting cylinders(including triplex mast).



CDD12/14/16-AEC1-B

CDD12/14/16-AEC1S-B

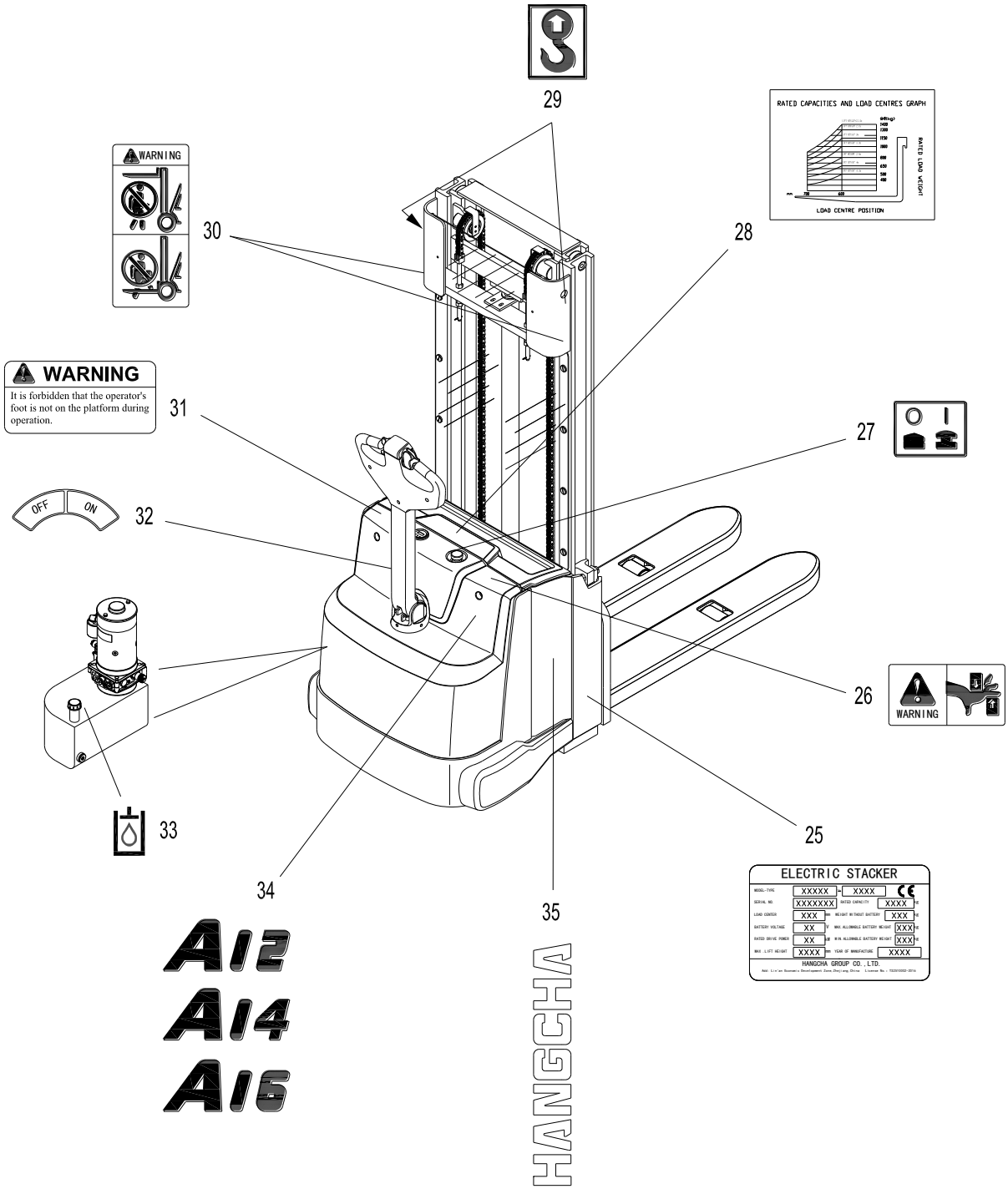
Mast Specification

Mast type	Max Lifting Height h3	Ground clearance fork (h3+h13)	Lowered Height h1	Extended Height h4	Free lift	Load Capacity (Load center at 600mm)		
						1.2t	1.4t	1.6t
	mm	mm	mm	mm	mm	kg	kg	kg
Single cylinder duplex wide view	2000	2090	1553	2553	90	1200	1400	1600
	2500	2590	1803	3053	90	1200	1400	1600
	2700	2790	1902	3253	90	1200	1400	1450
	3000	3090	2053	3553	90	1200	1250	1300
	3300	3390	2203	3853	90	1100	1100	1150
	3500	3590	2388	4138	90	950	950	1000
	3600	3690	2438	4238	90	950	950	1000
Double cylinders duplex wide view	2000	2090	1542	2542	90	1200	1400	1600
	2500	2590	1792	3042	90	1200	1400	1600
	2700	2790	1892	3242	90	1200	1400	1450
	3000	3090	2042	3542	90	1200	1250	1300
	3300	3390	2192	3842	90	1100	1100	1150
	3500	3590	2292	4042	90	950	950	1000
	3600	3690	2342	4142	90	950	950	1000
	3800	3890	2442	4342	90	850	850	900
	4000	4090	2642	4642	90	750	750	800
	4300	4390	2792	4942	90	600	600	650
	4500	4590	2892	5142	90	500	500	550
Duplex full-free wide view	2000	2090	1595	2595	1090	1200	1400	1600
	2500	2590	1845	3095	1340	1200	1400	1600
	2700	2790	1945	3295	1440	1200	1400	1450
	3000	3090	2095	3595	1590	1200	1250	1300
	3300	3390	2245	3895	1740	1100	1100	1150
	3500	3590	2345	4095	1840	950	950	1000
	3600	3690	2395	4195	1890	950	950	1000
Triplex full-free wide view	3500	3590	1844	4214	1220	950	950	1000
	3700	3790	1909	4409	1290	850	850	900
	4000	4090	2009	4709	1390	750	750	800
	4300	4390	2109	5009	1490	600	600	650
	4500	4590	2159	5159	1590	500	500	550

1.6 Product plates and warning labels location

Plates and labels, such as nameplate, load curve plate, warning labels must be legible, if identification is unclear, and must be replaced.

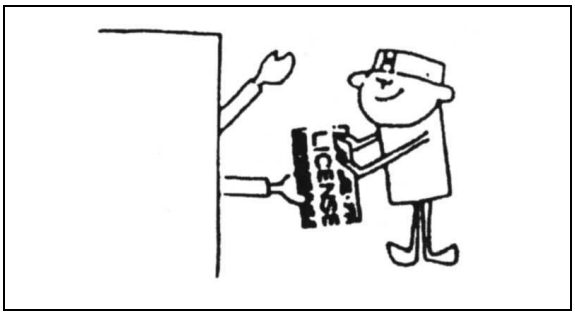
The figure below shows the approximate location of the various identity resides. Before operating the truck, please understand the meaning of the various identities.



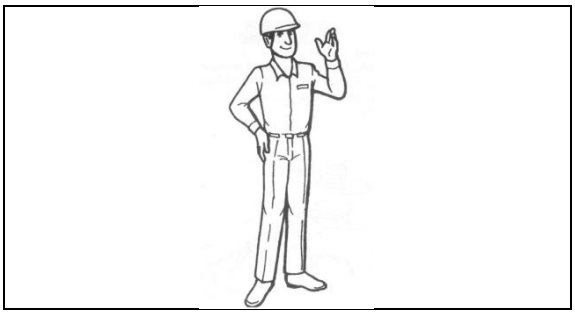
Item	Description
25	Nameplate: The rated capacity on the nameplate is the max. load capacity by the label listed equipment. Any change to the forklift or other equipment may change rated capacity.
26	Hazard label: Risk of trapping when mast extended.
27	Emergency stop label: press this button when in emergency, thus the truck power is off.
28	Rated capacities and load centers graph
29	Hoist label: Fixed point when using the crane to handle equipment.
30	Warning label：Do not step onto or beneath the load
31	Warning label: It is forbidden that the operator’s foot is not on the platform during operation.
33	Key switch：“OFF”position is off，“ON”position is on.
34	Hydraulic oil label: Add hydraulic oil.
35	Series tonnage label: A series 1.4 T
	Manufacturer’s logo

2 Safety Rules

1) Only trained and authorized operator shall be permitted to operate the forklift.



2) Operator must wear helmet, working shoes and uniform.



3) It is not allowed to reconfigure the truck without manufacturer's permission.

4) Do not work in flammable and combustible environment.

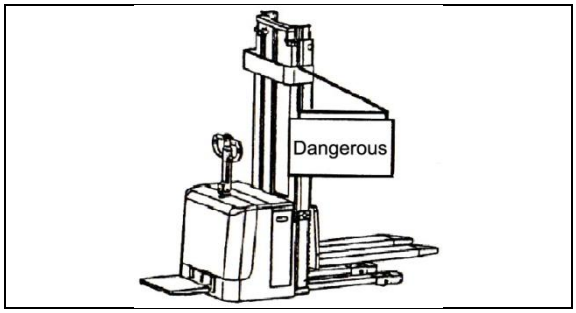
5) Check the oil, fluid leakage, deformation, flexibility in certain time. If neglected, service life of forklift will be shorter and in serious condition there will be accident.

- Make sure change the "safety parts" during the schedule maintenance.
- Wipe off the oil, grease or water on the soleplate, foot pedal and control stick.
- No smoking or any spark, smoke near the battery when checking.
- Be careful of scald when checking motor and controller.

6) The controller equips with energy accumulator, do not touch between B+ and B- to avoid electric injury. If you need check or clean the controller, first cut off the truck power, then connect load(like contactor coil or horn) between controller B+ and B- to discharge the controller capacity.

7) Whenever you find the forklift abnormal, stop the truck, put on the DANGEROUS or FAULT sign to the truck, remove the key, and report to the managing person. Only after eliminating the fault can you use the truck.

- If there occurs to fault, battery electrolyte, hydraulic oil or brake fluid leakage when lifting loads, going up and down the slope, please organize staff to repair.



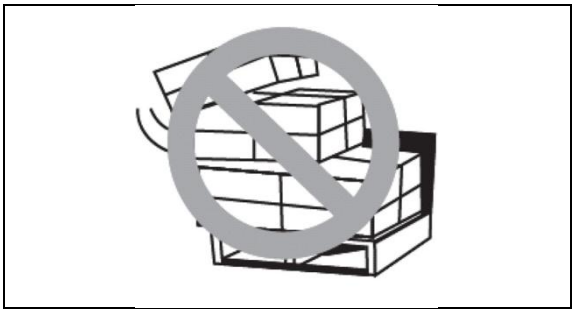
8) Internal battery may generate explosive gas, it's prohibited any flame close the battery. Never allow the tools close two poles of the battery to avoid spark or short circuit.

9) The work ground of forklift shall be solid and smooth concrete surface or similar ones. Pre-check the ground condition of working site. Tidy the working site, clean obstacle, sweep macadam, muddy sand and wipe off greasy dirt.

10) Do not overload. Before operation, first know the curve chart on the load curve plate well, which indicates the relation between rated load and load center.

11) Before start, press the horn and make sure no people around.

12) Goods are not allowed to deviate the fork center, when goods is deviating the fork center, turn or pass uneven road, you are easily to fall. Meanwhile, possibility of turnover will increase.



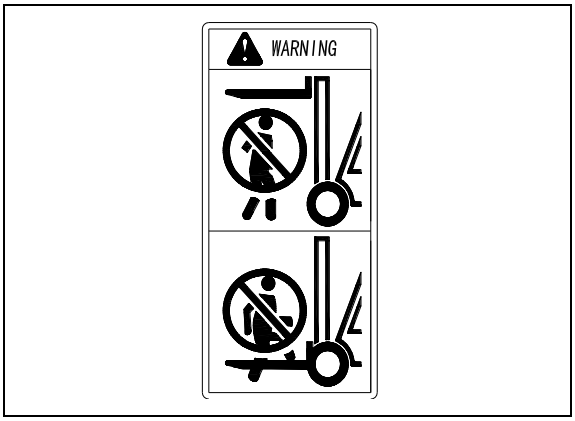
13) Avoid sudden drive, stop or turn.

14) Do not drive the truck when the forks in high position.

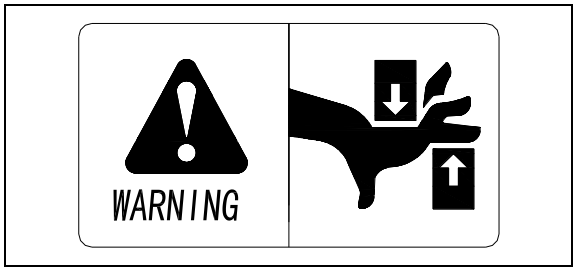
15) When handling bulky loads, which restrict your vision, please operate the machine in reverse or have a guide.

16) Cause the wheels of pallet truck is small, it is not allowed to run on the street, and only for driving in specified stacking place.

17) It's forbidden to put the head, hand, foot or body under the forks. Never stand on the fork.



18) It's forbidden to put the head, hand, foot or body into the space between the chassis and lifting component, once clipped, it is dangerous to your life. It's forbidden to put the head, hand, foot or body into the space between fork and link mechanism.



19) Make the loads in front when climbing the slope. It's prohibited to turn on the slope, or there's danger of tipping over. Avoid working on the slope.

20) Do not use truck under the weather of sand, snow, thunder, storm, typhoon, etc. Avoid using the truck when the wind speed is larger than 5m/s.

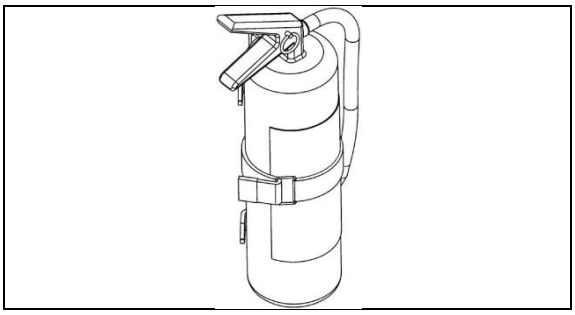
– The weather condition: temperature: -5℃～40℃, wind speed: less than 5m/s; air relative humidity: less than 90%（20℃）. Altitude should not exceed 2000m.

21) After power off, brake works and the truck can not be towed(dragged).

22) As to stand-on truck, stand on firmly and hold the handle tightly. When turning, the speed should be lower than 3km/h.

23) There's warning and operation method on truck label. Please obey the requirement in this manual and the truck label when operation. Check label, identification plate, replace damaged or fallen ones.

24) Fire extinguisher shall be equipped at the work site. Users can choose truck equipped with fire extinguisher. Driver and manger should be familiar with the fire extinguisher position and application method.



25) Use tray when carrying small items, do not place on the fork directly.

26) Do wash the inner of the truck, do not place the truck outdoors and exposed to the rain.

27) Before dismantle or repair the truck, take down the battery plug firstly.

28) Steering operation is prohibited when loading in the highest position.

29) Only in the event that the truck manufacturer is no longer in business and there is no other company to take over the business, the user can modify or remould the truck, however, the user also has to do the following points:

- Hand the modification or alteration to engineers from professional forklift manufacturer for design, test and application；
- Keep the modification records of the design, test and application permanently;
- Update and make appropriate changes to the capacity plates, tags and operation manual;
- Make a permanently and showy tag for the change way, change date as well as name and address of unit that finishes the change, and stick to the forklift.

3 Transport

The forklift truck is designed for short-distance lifting,lowering and transporting load units, not suitable for long-distance travel. If needed, the forklift truck must be transported by using lifting device or platform to place on truck or trailer.

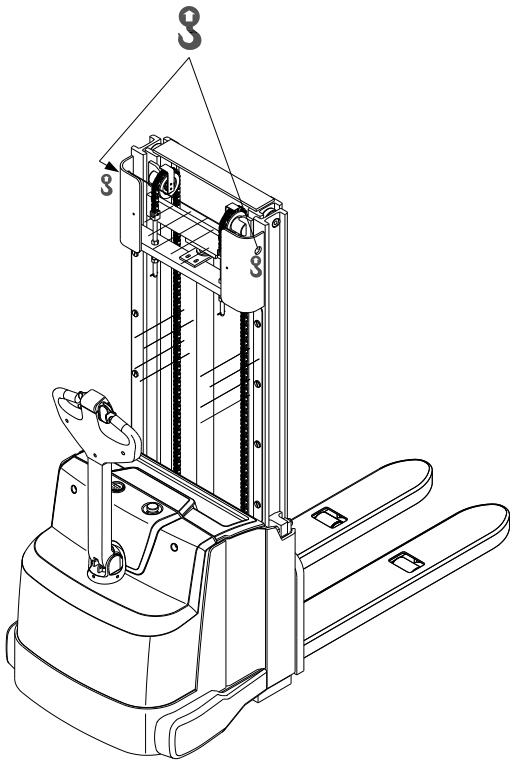
3.1 Lifting by crane

WARNING

- **Only use lifting gear with sufficient capacity (for truck weight see truck nameplate).**
- **Do not stay under the truck when hoisting the truck.**
- **When hoisting or laying down, it should be stable and slow to avoid collision or accident.**

Procedure:

- Park the truck securely.
- Secure the lifting slings to the strap point, and prevent them from slipping. Crane slings should be fastened in such a way that they do not come into contact with any attachments when lifting.
- Load the truck and park it securely at its destination.

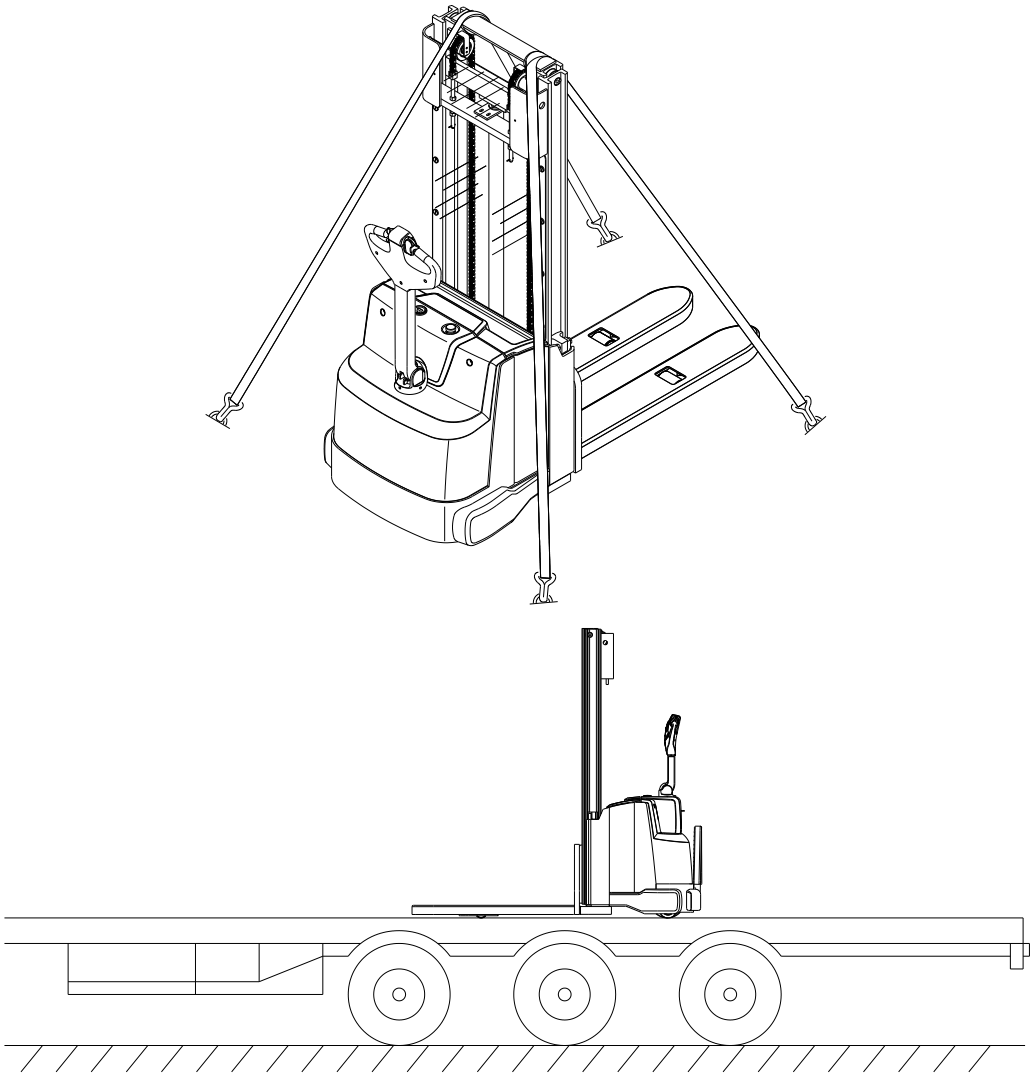


3.2 Securing the truck during transport

Correctly fix the forklift truck to avoid move when using truck or trailer.

Procedure:

- Park the truck securely.
- Sling the tensioning belt around the truck and attach it to the fastening rings of the transporting vehicle.
- Use wedges to prevent the truck from moving.
- Tighten the tensioning belt with the tensioner.

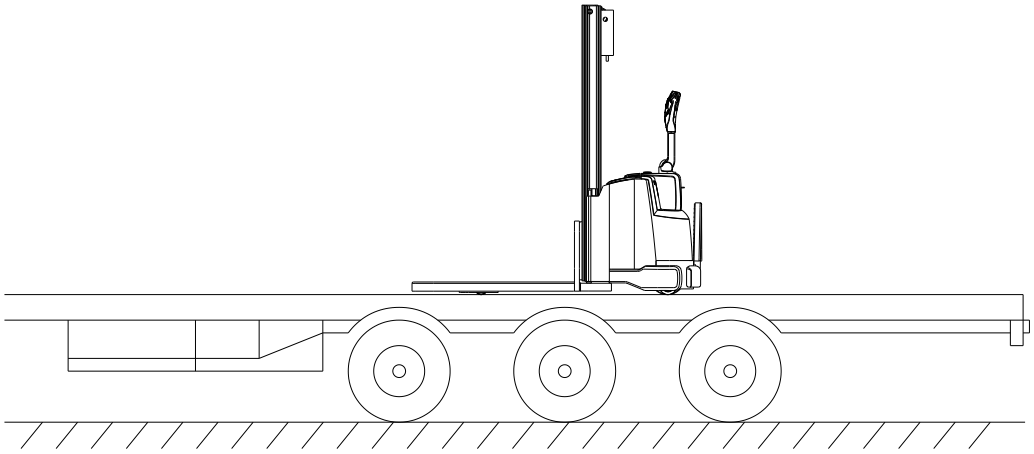


WARNING

- **The truck or trailer must have fastening rings.**
- **Use wedges to prevent the truck.**
- **Only use tension belt or fastening belt of good nominal strength.**

3.3 How to remove a broken truck

It's not allowed to tow the forklift truck on the ground directly when the truck is broken down or damaged since the brake of the truck is closed under normal circumstances. Appropriate vehicles should be used to remove the broken trucks.



WARNING

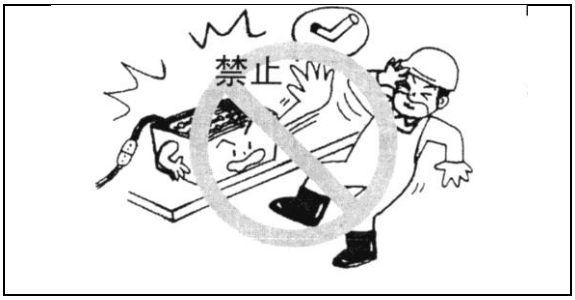
- **Do not tow the broken trucks on the ground directly, or else the braking system would be damaged.**

4 Battery

4.1 Attention for using battery

1) No firing

Explosive gas can be produced in the internal of storage battery, smoking, flame and sparkle can easily cause storage battery explosion.



2) Protection against electric shock

CAUTION

- **Storage battery has high voltage and energy.**
- **Do not bring short circuit.**
- **Do not approach tools to the two poles of the storage battery, which can cause the sparkle or short circuit.**

3) Correct wire connection

Never allow wrong connect of battery anode and cathode, otherwise it may cause sparkle, burning or explosion.

4) Do not over-discharge

- Never charge only when the forklift can't move, this will shorten the battery working hours.
- When two flashing lights of the power indicator flash, please charge immediately.

5) Inspection for electrolyte

- It is forbidden to use the stacker when the electrolyte is in shortage.
- Inspect electrolyte level every week. When electrolyte level is low, you must add distilled water to the level appointed.

WARNING

- **The shortage of the electrolyte will cause the storage battery overheated, even cause the system part of storage battery and electric combustion.**
- **Vitriol include in the electrolyte can create burns, see doctor for emergency treatment quickly if touch it un-carefully.**

  Splashing to the skin or eyes：wash with water 15~20 minutes;

  Splashing to the clothes：take it off immediately.

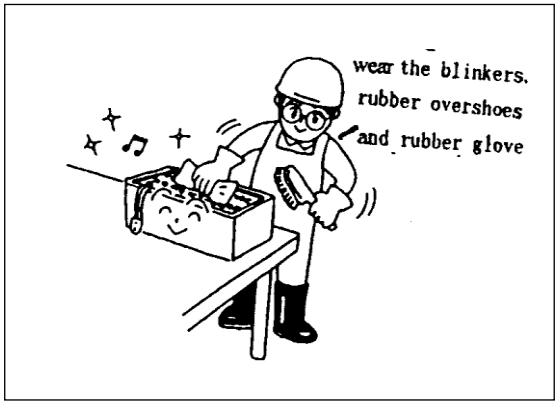
  Careless drinking：drink plenty of water and milk.
- **Wearing glasses, rubber overshoes and rubber glove.**

Keep battery clean

Keep dryness and cleanness on the surface of storage battery. The poles for connection are also dry and clean. Operator must screw down the vent-cover of storage battery.

CAUTION

- **Do not use dry cloth or fiber cloth to clean the storage battery, avoid static to cause the explosion.**
- **Pull out storage battery plug.**
- **Clean with wet cloth.**
- **Wearing glasses, rubber overshoes and rubber glove.**



Measures in summer

In summer, water in the electrolyte is easy to evaporate, therefore, electrolyte must often be inspected if electrolyte is low, you must add distilled water to the level appointed.

CAUTION

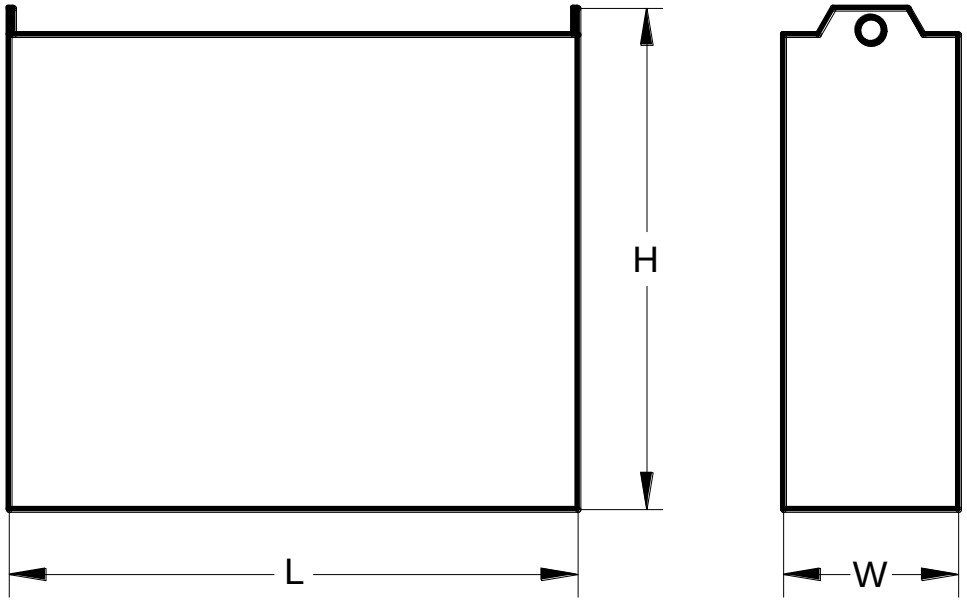
- **Do not over fill distilled water. Spilt electrolyte will cause corrosion and electricity leakage.**

Measures in winter

- Keep effective and good surrounding for charging.
- When it is cold, pull out the storage battery pin to prevent discharging.
- Take measures such as covering storage battery for warmth.
- Don’t park the truck in cold outdoor or cold storage for a long time.
- Charge in time after work.

4.2 Dimension/Service Weight

Item		CDD12/14-AEC1 CDD12/14-AEC1S	CDD16-AEC1 CDD16-AEC1S
Length（L）	mm	650	650
Width（W）	mm	201	201
Height（H）	mm	570	570
Allowable lightest	kg	190	190
Allowable heaviest	kg	270	280



WARNING

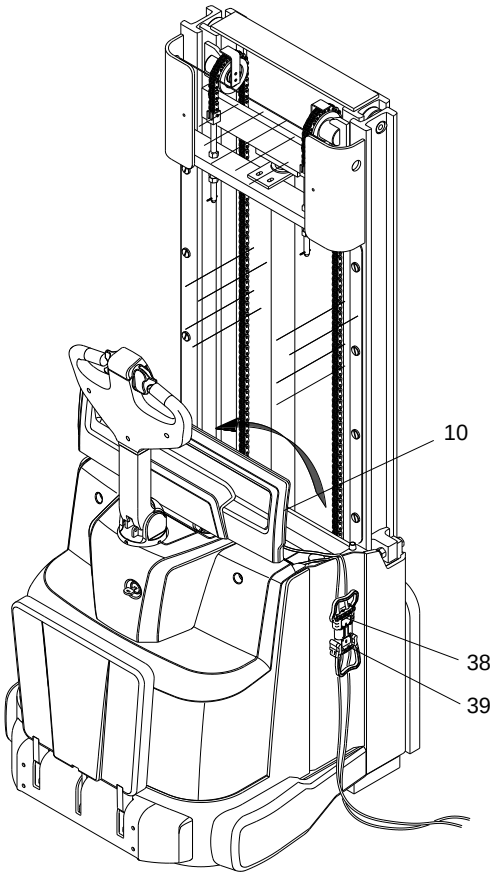
- **Battery weight and dimensions have considerable influence on operational safety of the truck.**
- **When installing or replacing battery, be sure that battery in the fixed position.**

4.3 Charging the battery

Charging steps

- Drive the truck to appointed charging place, park the truck and render if safe.
- Open the battery cover (10).
- Remove the battery plug from the truck socket （38）.
- Connect the charging plug (39) to battery plug (38).
- Plug the charger plug into proper power socket.
- Start the charging procedure according to the charger operation instructions.
- End charging according to the charger operation instructions after the battery fully charged.
- Remove the battery plug (38) from the charger.
- Connect the battery plug（38）with truck socket and cover the battery hood(10).

After charging, the truck can be used.



WARNING

- **Please charge in the well-ventilated and appointed site.**
- **Mark 'No smoking' when charging and prepare extinguisher.**
- **Before charging, please examine wire and electrical outlet for damage, otherwise do not charge.**
- **Open the hood and storage battery lid to release the explosive gas when charging.**
- **Never place metal object on the battery.**
- **In the progress of charging, do not pull out power switch and battery plug, otherwise it may damage plug and electrical units. Generally press down the stopping button firstly, and then take out the plug.**

Daily charging

·The storage battery that has been made first charging and used in normal condition, then charged again, it is named daily charging.

·Its way is almost same as the first charging.

·The recharging volume is 1.2 times than the last electric discharging. But the new storage battery's former five times' charging volume should be 1.5 times than the last electric discharging.

·During any charge, the temperature of electrode should not exceed 45^0C, otherwise it should be taken measures such as reducing artificially charging current or lowing the temperature. If the temperature still does not drop, you should stop charging till the temperature drops down.

Adopt intelligent charging to do daily charge, the former five times of new battery should do equalizing charging according to operation instructions of intelligent charger.

Equalizing charging

·During using of the storage battery, it often occurs to disequilibrium among the voltage, density and capacity.

·Compared to most of the batteries, several storage battery's proportion of voltage and electrolyte rises slowly during the course of charge and discharge, its storage battery's proportion of voltage and electrolyte declines faster than most of other batteries.

·Make equalizing charging in the following case：

a. discharge voltage often drop down final voltage；
b. discharge current is often larger；
c. not charge in time after discharge;
d. the electrolyte is mixed with impurity with a little harm;
e. It often be charged deficient or has not been used for a long time;
f. After taking out the storage battery group for checking or cleaning settling.

The way of equalizing charging：

（ PCA Automatic Charger Operation Instruction）

① Firstly, charge the storage battery normally, and then rest for 1 hour after the end of charge.

② Charge it again with the second phase current of normally charge until the electrolyte gives off a large number of bubbles, and then stop charging for 1 hour.

③ Do it several times as mentioned above until the voltage and the density keep invariable and the storage battery gives off a large number of bubbles immediately when charge again.

Additional charge

·If one day's work cannot be fulfilled in one charge, carry out additional charge during breaks.

·When the temperature of circumstance is low, carry out additional charge.

Charge for long-term storage

·Carry out equalizing charging before storing.

·Carry out equalizing charging once every 15 to 30 days during the storage period.

The proportion and level of electrolyte

WARNING

- If the level of the electrolyte is low, using the storage battery will cause the storage battery over-heat and shorten

the storage battery's service life.

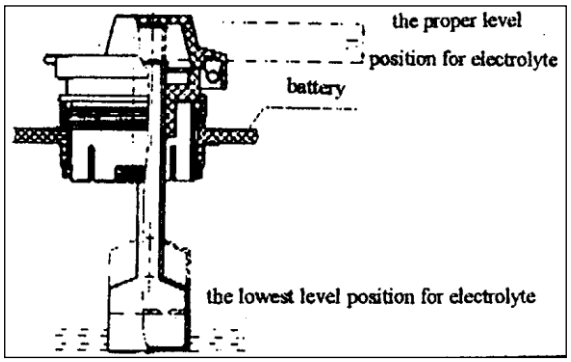
1. Inspect electrolyte

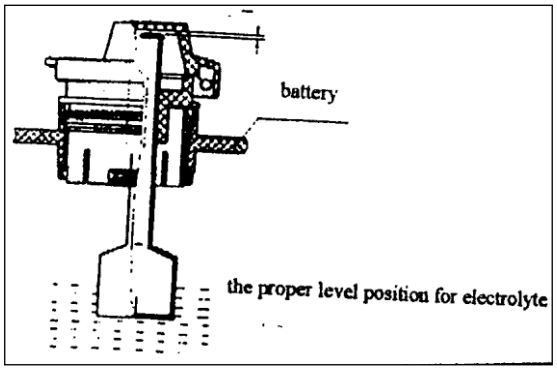
The storage battery without a dobber

It is proper to pour the electrolyte 15-20mm above the electrode plate.

The storage battery with a dobber

According to the dobber of the ventilation cover, read the level position of the electrolyte.





2. Replenish the distilled water

·Wear the blinkers, rubber shoes and rubber glove.

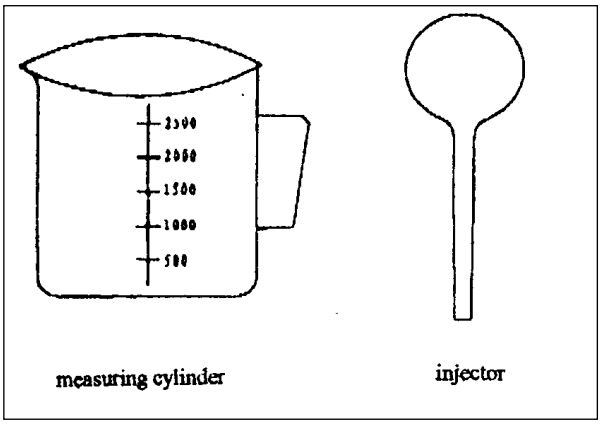
① Use the measuring cylinder to take out the distilled water with a certain quantity.

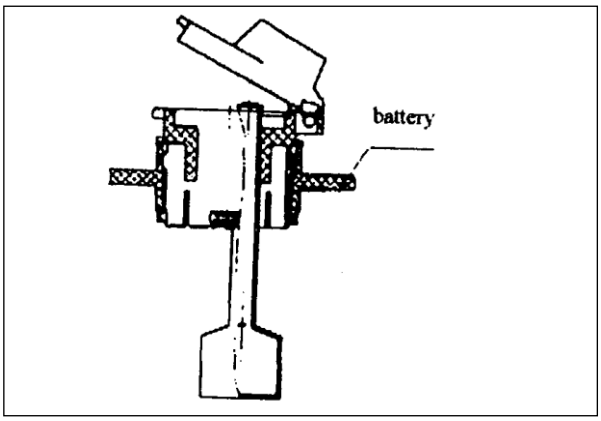
② Open the battery ventilation cover or fill cap.

③ Imbibe distilled water with injector and then supply it into the storage battery.

The storage battery with a dobber

When the red dobber rises, the white line appears, please stop replenishing.





The storage battery without a dobber

When the electrolyte is above 15-20mm of the electrode plate, stop replenishing

④After replenishing the distilled water, close the ventilation cover and box cap.

⑤Use the damp cloth to clean the surface of storage battery cell.

WARNING

- **It is not permitted to exceed the appointed top level when replenishing the distilled water. Adding too much will result in leakage of electrolyte, and it will damage the truck when charging or discharging.**

- **Draw it out with injector if adding too much.**

3. Reading the specific gravity

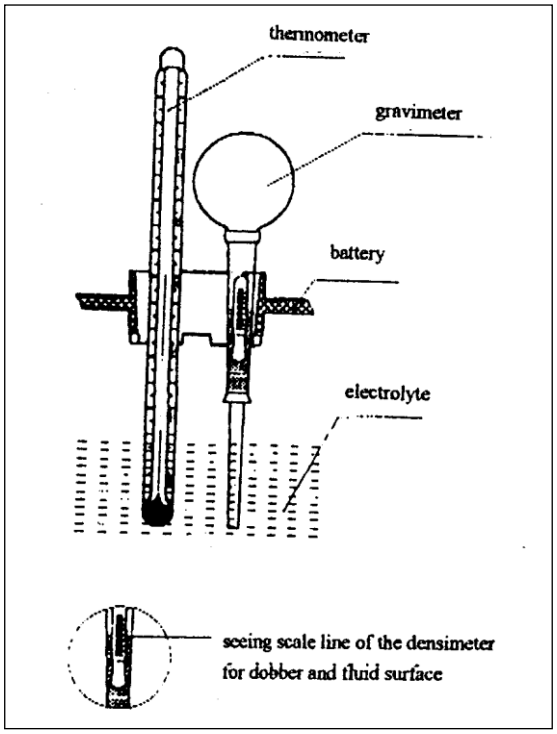
1）The specific gravity of the electrolyte will change as the temperature changes.

① Use thermometer to measure the temperature for electrolyte.

② Put the straw of densimeter into electrolyte uprightly, extrude rubber tube with hand and the electrolyte will be sucked into the glasses tube and then the floater of the densimeter will float.

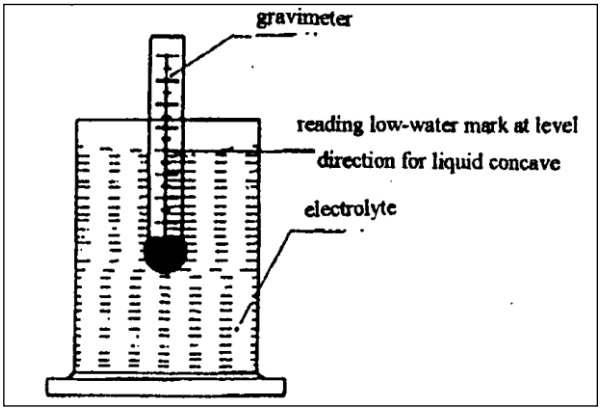
③ Numerate the reading of the densimeter.

Caution：The dobber of densimeter must rise uprightly without depending on the glass pipe.



2）Measuring the proportion

Use gravimeter to calculate the electrolyte proportion.



3）Conversion of the specific gravity

The specific gravity at the standard temperature of 30^0C should be converted as follow:

D30= Dt + 0.0007(t - 30)

Therein to：D30 ——the specific gravity at the standard temperature of 30^0C

Dt ——the specific gravity at the temperature of t0C.

t ——the temperature of the distilled water during convert.

·The specific gravity referred in this book is measured all at the temperature of 30℃.

Charger：

Storage battery of this truck equips with PCA Automatic Charger Operation Instruction.

1. The charger is automatic high frequency charger. The capacity voltage is 220V AC. The input current is not less than 15A. The output voltage is DC 36V. Maximum charge current is 35A. The total charge procedure is automatic. For more information please refer to charger manual.
2. Connection with earth wire for using.
3. Replacement fuse, first plug out the plug.
4. Non-specialized person can't open the hood to check or repair.
5. Do not rebuild or disassembly charger.
6. Prevent charger overheat in high

temperature seasons, that will hurt charger, if necessary can pause charge.

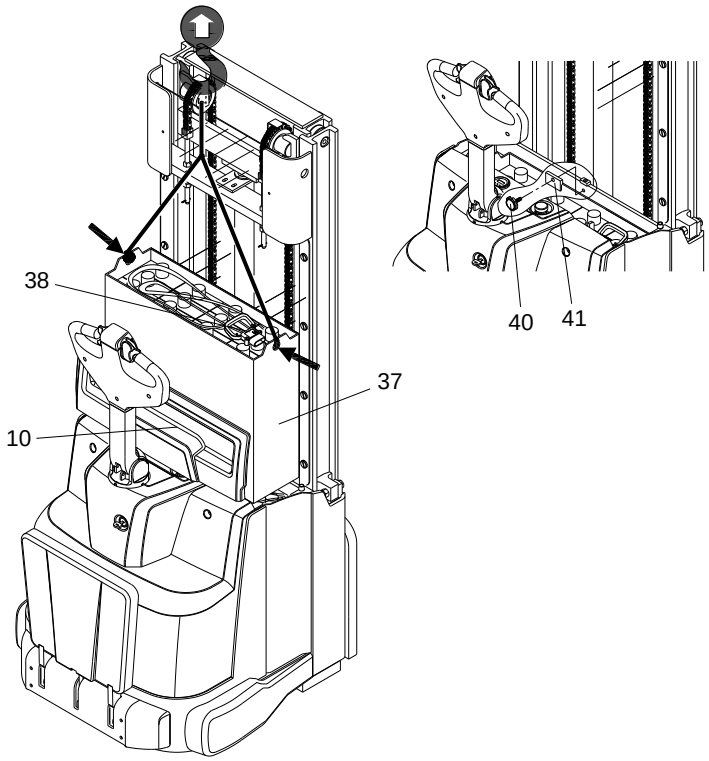
If you don’t want use automatic option, you should adjust the charge current, charge voltage, charge time and etc. manually. And you should measure the specific gravity of electrolyte on time to assure the battery can be charge at best state. To adjust the parameter of charger, please see the following battery charging.

4.4 Replacing the battery

Battery replacing steps：

- Park the truck and render it safe.
- Open the battery cover（10）.
- Remove the battery plug(38) from truck socket, and place the battery plug and cable into the battery tank(37), ensure that it does not scratch cable when removing the battery.
- Remove the flat head screw (40) and a fixed block (41).
- Hang the hoisting tool to the two hoisting hole of the battery tank(37) and fix it.
- Use the crane to hoist the battery vertically.

Installation is in the reverse order of operations. Check for correct mounting position and connection of the battery.



WARNING

- **Battery box is very heavy, be careful to avoid damage.**
- **Make sure the lifting capacity of the crane is larger than battery weight.**
- **Disposal to the waste battery should accord with local environment regulation.**
- **When replacing the battery, ensure that the battery of the same specification, dimension and weight is fitted.**

5 New Truck running-in

We recommended operating the truck under light load conditions for the first stage of operation to get the most from it. Especially the requirements given below should be observed while the truck is in a stage of 100 hours of operation：

- Avoid the new battery over discharging in early period.
- Perform specified preventive maintenance services completely.
- Avoid sudden stop, start or turn.
- Limited load is 70～80% of the rated load.
- Often check and fasten the fasteners of each joint part in running-in period
- After running-in finished, replace hydraulic oil and gear oil.

6 Operation

6.1 Check before operation

In order for the safety truck operation and keep the truck in good condition, before starting the truck, you must check it carefully.

1) Oil leak and liquid leak check

Park the truck, and Check the truck for hydraulic oil, gear oil or electrolyte leak.

2) Fork check

Check the fork and see whether bending or crazed.

3) Front/rear wheel and balance wheel check

Check the wheel and see whether there is any crazed, damaged, or abnormal wearing. Check the wheel fasteners for looseness. Inspect whether there is rope on the wheel.

4) Check front fork and linkage mechanism

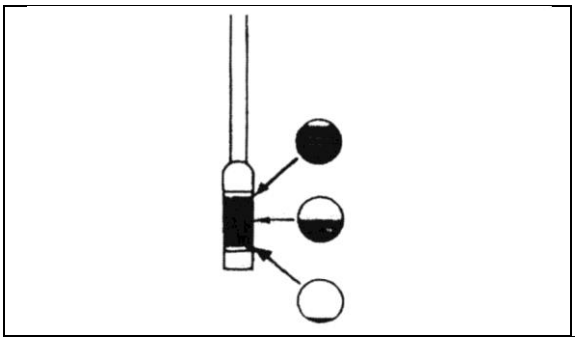
Check the fork and linkage mechanism, see whether bending or crazed.

Whether appear interfere when move, movement point wear whether severe.

5) Hydraulic oil check

Open the hood

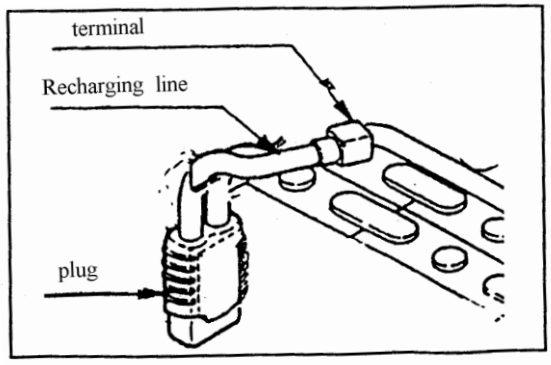
Loosen the hydraulic oil filler cap, pull out dipstick, and check if the oil level within the scales. Add oil when insufficient.



Close the hood, and open the battery cover

6) Battery check

- Check the battery cover board. See whether the battery fixed reliably.
- Check proportion of electrolyte. Refer to “battery” section.
- Check the terminal for loose or damage. Otherwise it will be adjust or replace



Plug in and turn on the key switch.

7) Instrument display check

Refer to instrument part.

8) Lifting and lowering button

Press the lifting button and check the fork lifting condition. Press the lowering button, check the fork lowering condition. Check if the lifting system has abnormal sound.

9) Forward and reverse running condition

Tilt the handle to some degree, gradually press the accelerator button to the outside of the body with thumb, and inspect the forward running condition; gradually press the accelerator button to the inside of the body with thumb, and inspect the reverse running condition.

10) Brake system

When the truck run forward or backward, push the handle to vertical position or press to level position to check the brake condition.

11) Steering system

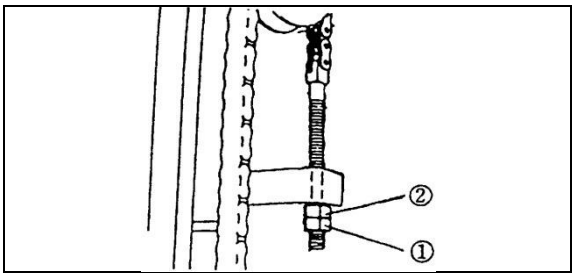
Left or right turn the handle to make the truck

run around 3 turns, and then check if the steering system is normal.

12) Check chain tensity

- Lift forks up 10～15cm.
- Press the middle of the chain and see if the left & right tensity is the same.

Tensity adjustment：screw off the nut①, adjust nut ② to keep the same tensity of the two chains, and then tighten the nut ①.



13) Horn

Press the horn button to check sound.

14) Appearance

Check the truck appearance for clean, rust or paint spalling.

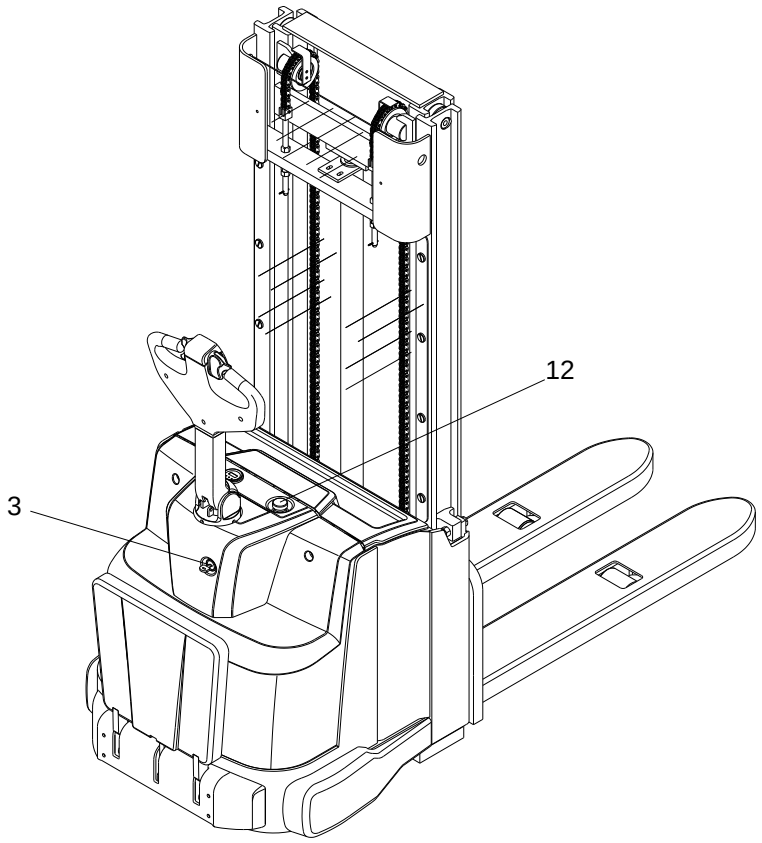
15) Others

Check whether there is any abnormal noise, whether wiring is regular or fastner loosens etc.

6.2 Starting up

Procedure:

- Plug into the plug.
- Turn on the key switch（3）.
- Pull up the emergency disconnect switch（12）.
- If you need to stand on the pedal to operate for the stand-on type truck, you need open the pedal



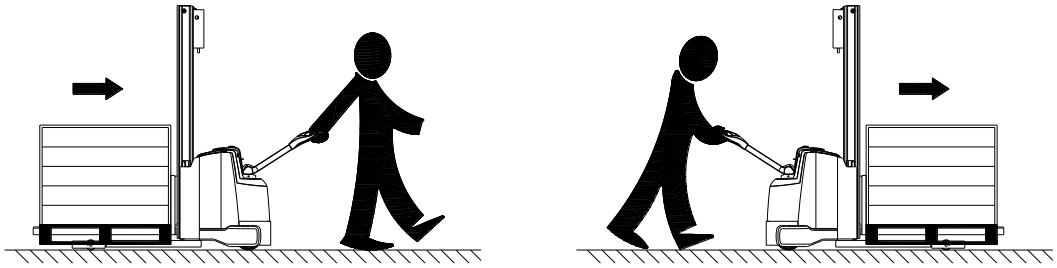
CAUTION

- **Make sure the work ground is hard enough to support the truck.**
- **Be careful to control the truck's speed.**

6.3 Travelling

Pedestrian-type

Driver should walk in front of the truck and keep at the side front of the truck when travelling. One hand holds the handle, and operate travel switch with thumb. Always watch moving direction and guide truck. Or hold the handle with both hands and push the truck go forward.

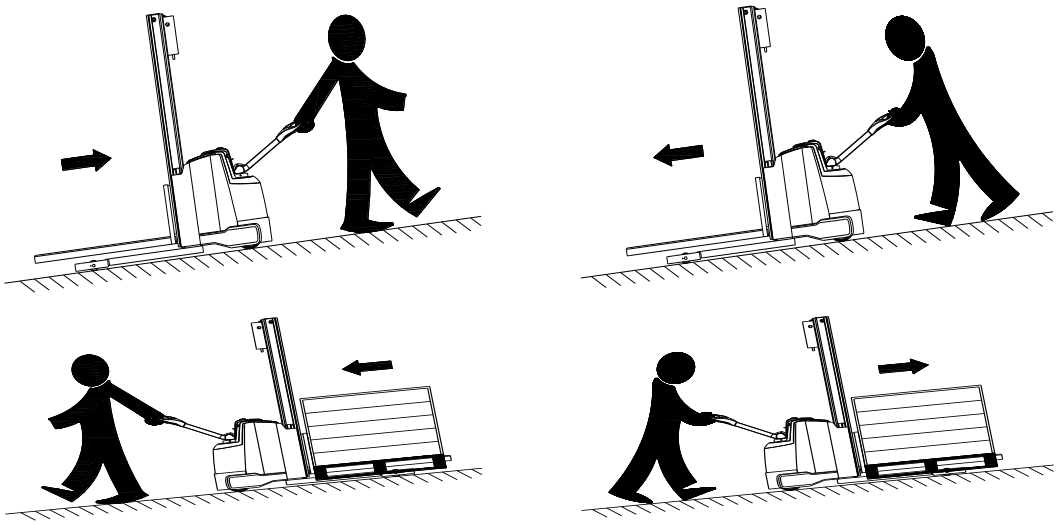


CAUTION

- **Operator must wear protective boots.**
- **When enter narrow area as lift, first get fork go.**
- **Keep road clean and wipe greasy dirt, water or other easily causes slipping dirty.**

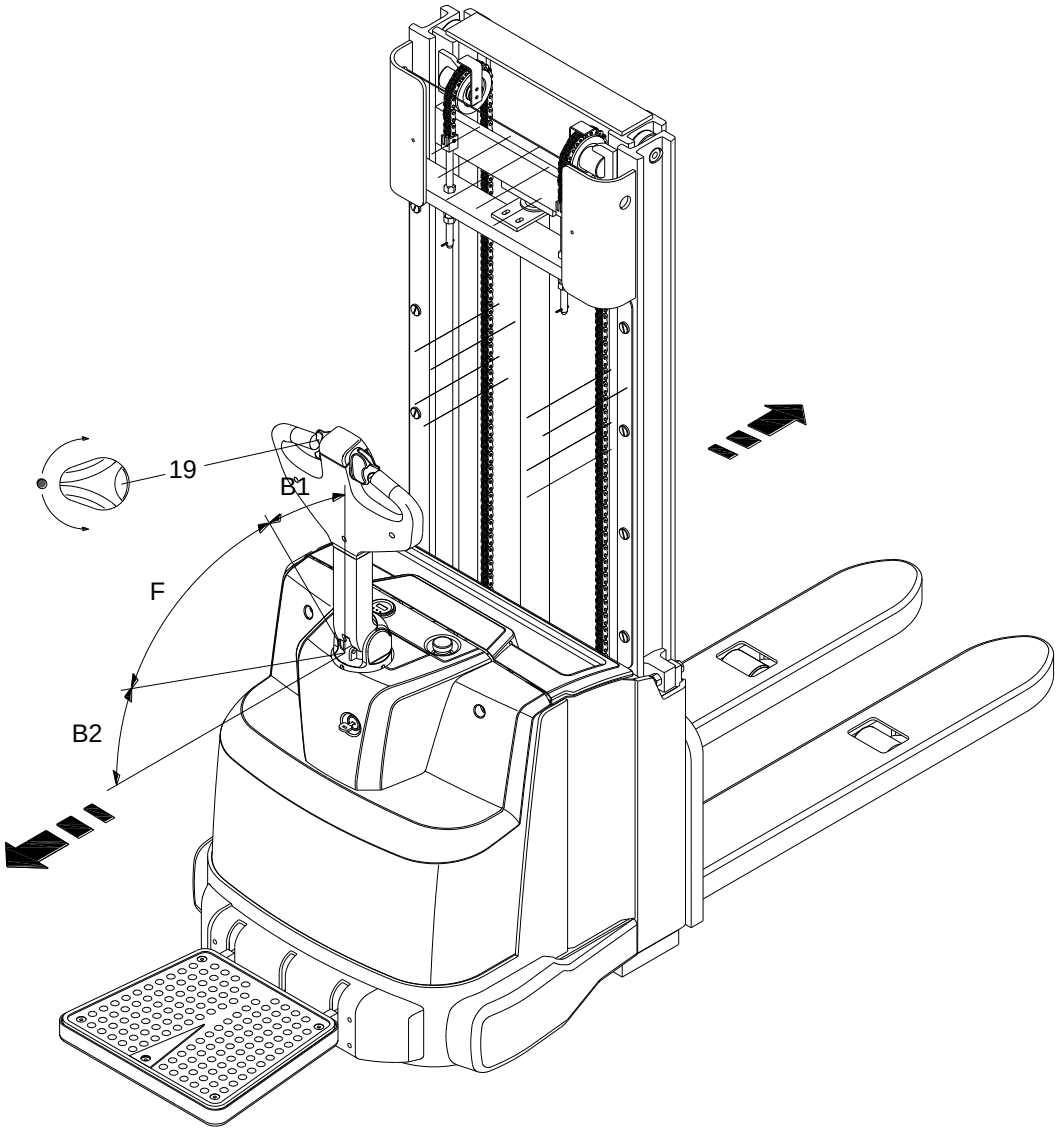
Travelling on the slope：

When going uphill and downhill without load, keep the fork to downhill direction; when going uphill and downhill with load, keep the fork to uphill direction.



WARNING

- **No turn, inclines when going uphill and downhill.**
- **Never park on the slope.**
- **Slow down when going downhill and ready for braking.**
- **Travel according to regulated route.**
- **The road should keep clean, no slipping**
- **Steering operation is prohibited when loading in the highest position.**



Slow down

- Slowly loosen the thumb, the direction speed control button will return automatically and the truck slows down.

Stand-on type

- Start up the truck
- Open the pedal
- Step on the pedal
- Swivel the control handle to driving range (F).
- Adjust the direction speed control button (19) to the desired direction
- Control truck speed by direction speed control button (19). Speed is controlled by rotating the driving switch, and the maximum rotation can get fast speed.

Others refer to pedestrian-type contents.

6.4 Braking

- When the thumb off the direction speed control button, pull the handle to braking range (B1 or B2) position or vertical position, the truck brakes.

> ⚠ **CAUTION**
>
> - **When release the control handle, the handle swivel into the braking range slowly or nor enter braking range, do check the reason and eliminate the fault. Replace gas spring if necessary.**

6.5 Steering

- Hold the left and right handle of control handle with both hands, and decline to some degree, move the handle to left or right to release truck steering.
  When turn to left, the truck turns left.
  When turn to right, the truck turns right.

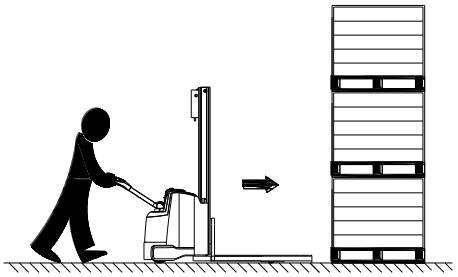
6.6 Stopping

- Release the direction-speed knob. Decrease the speed.
- Return the control handle to vertical position.
- Drop the fork to the lowest position.
- Turn off the switch to “OFF” position, press down the emergency disconnect switch, pull out the battery plug, and take off the key.
- Fold up.

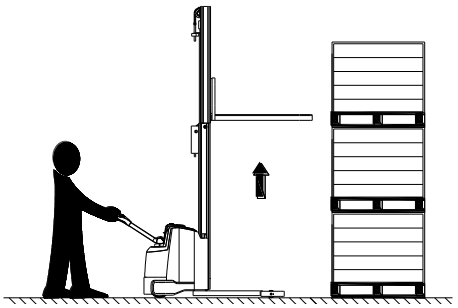
6.6 Loading

Procedure:

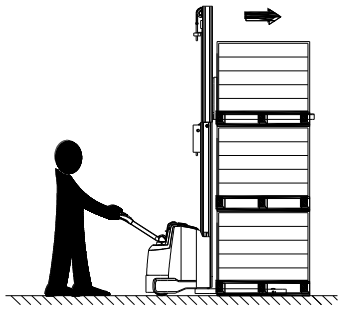
- Drive the truck carefully up to the loads.



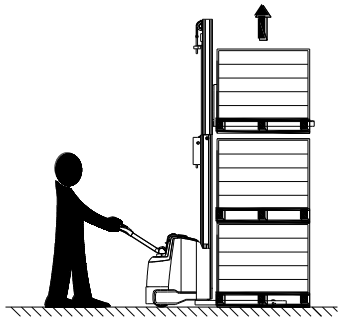
- Adjust fork height to make the forks in the tray.



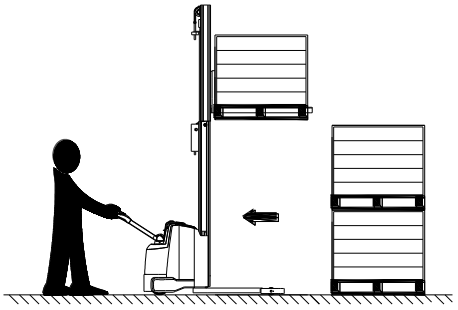
- Go forward and make the forks in the tray.



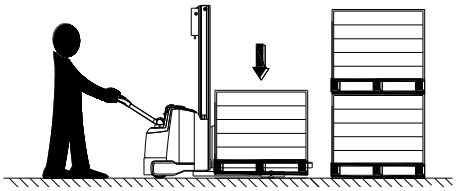
- Raise the loads several centimeters to make sure if the loads are firm.



- Travel the truck off the area.



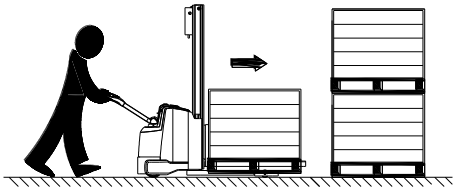
- Drop the load to lower position



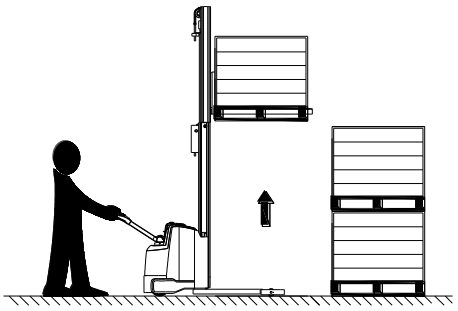
6.8 Unloading

Procedure:

- Approach the deposit area.

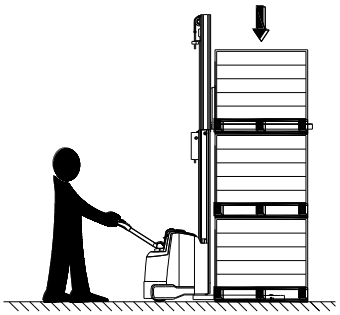


- Raise the loads to correct height.

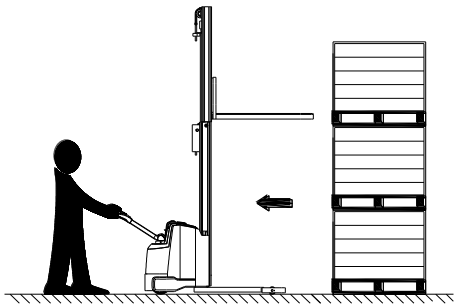


- Travel forward, put the load on the unloading position and then stop.

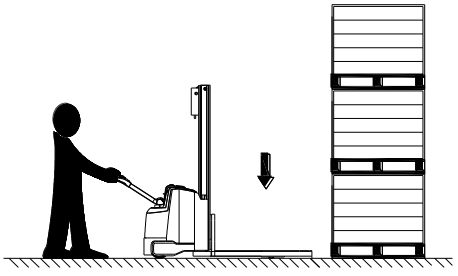
- Make sure the loads are right above, drop the forks slowly until the forks are out of the load.



- Travel backward and make the fork out of the load.



- Drop down the forks to proper position.

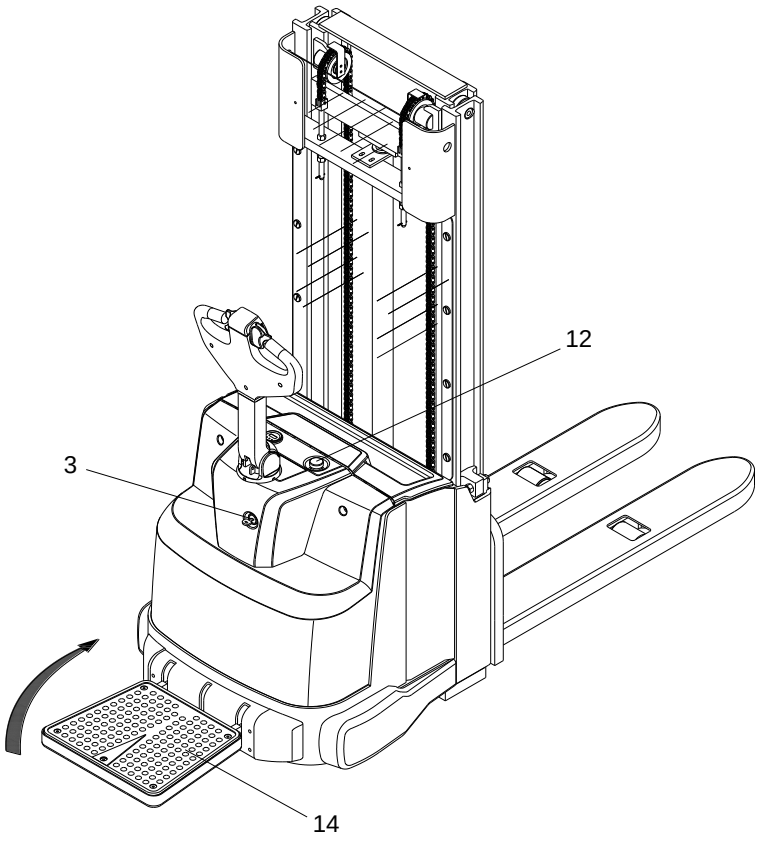


6.9 Parking

After daily work, park the truck according to the following steps.

- Drive the truck to safe area or appointed area.
- Fully lower the forks.
- Turn off the key switch(3), and remove the key.
- Press the emergency stop switch(12).
- Fold pedal(14) .

If park for long time, remove the battery plug.



7 Deposit the truck

7.1 Deposit the truck for long time

- Fully check the truck, especially check the wheel damage.
- Check fluid oil and electrolyte for leakage.
- Apply lubrication grease.
- Check the joint face of cylinder piston rod for looseness, and if scratch on the piston rod surface. Apply anti-rust oil to piston rod or easily rusty axle.
- Cover the whole truck.
- Check specific gravity of electrolyte and liquid level once a month.
- Do equalizing charge to the battery once a month.

7.2 Start running after deposit for a long time

- Remove rust preventive oil on exposed parts.
- Clean impurity and water of the hydraulic oil tank.
- Recharge battery, fit on truck and connect.
- Carefully check before start. Inspect starting, travelling, slowing down, steering, braking and parking etc. function.

8 Maintenance

8.1 Maintenance general

- The forklift truck needs inspection and maintenance periodically, to make it in good working condition.
- Inspection and maintenance are usually ignored, you'd better find the problems early and solve it in time.
- Use authentic parts of Hangcha Group.
- Don't use different oil when changing or adding oil. Don't rave about oil and electrolyte used at will, and carry on handling according to the local environmental protection laws and regulations.
- Draw up complete maintenance plan.
- After you make maintenance, you'd better make a record.
- Forbid to repair the forklift truck if you haven't been trained.

CAUTION

- **No fire.**
- **You should shut off key switch and pull off the plug before service.（except some trouble shooting）.**
- **Clean the electric part with compress air, and do not with water.**
- **Do not stretch your hands, feet or any part of body into the gap between the lifting assembly.**
- **When the working environment is severe, maintain in advance.**

8.2 Periodic maintenance schedule

D= work every 8 hours(or per day)

W= work every 40 hours(or per week)

M= work every166 hours(or per month)

T= work every 500 hours(or 3 months)

S= work every 1000hours(or 6 months)

○ —Check, revise, adjust

× —Replace

Battery

Service item	Service required	Tool	D	W	M	T	S
Storage battery	Electrolyte level	Eyeballing		○	○	○	○
	Electrolyte proportion	Areometer		○	○	○	○
	Battery quantity		○	○	○	○	○
	Terminal looseness		○	○	○	○	○
	Looseness of connecting wire		○	○	○	○	○
	Cleanness of the battery surface			○	○	○	○
	If there are tools on the battery		○	○	○	○	○
	The tightness and smoothness of air cap			○	○	○	○
	Far away from firing		○	○	○	○	○

Controller

Service item	Service required	Tool	D	W	M	T	S
Controller	Check wear condition of contact					○	○
	Check the running condition of contactor					○	○
	Check interlock inching switch for running			○	○	○	○
	Check the connection among motor, battery and power unit					○	○

Motor

Service item	Service required	Tool	D	W	M	T	S
DC motor	Clean the foreign body on the motor			○	○	○	○
	Clean or replace the bearing						○
	Check the carbon brush and commutator for worn, whether spring is normal				○	○or×	○or×
	Whether the connection is correct and firm.				○	○	○
	Brush carbon powder on commutator segment groove and commutator surface.					○	○
AC motor	Clean the foreign body on the motor			○	○	○	○
	Clean or replace the bearing						○
	Check vibration and noise, if the base is firm.				○	○or×	○or×
	Whether the connection is correct and firm.				○	○	○
	If temperature is normal and current is normal.				○		○

Driving system

Service item	Service required	Tool	D	W	M	T	S
Reduction box	Check for noise		○	○	○	○	○
	Check for oil leakage		○	○	○	○	○
	Replace gear oil						×
Steering mechanism	Bearing lubrication			○	○	○	○
	Check if the steering flexible		○	○	○	○	○
	Check for noise		○	○	○	○	○
	Control handle swivel angle		○	○	○	○	○

Wheel（Drive wheel, auxiliary wheel, load wheel）

Service item	Service required	Tool	D	W	M	T	S
Wheel	Check for abrasion or cracks	Eyeballing	○	○	○	○	○
	Check for bolt fastening and re-tighten.			○	○	○	○
	Check if there is foreign body like rope on the wheel		○	○	○	○	○

Brake system

Service item	Service required	Tool	D	W	M	T	S
Brake inching switch	Check for brake condition when the control handle on horizontal position and vertical position.		○	○	○	○	○
	Check the inching switch for looseness or damage.				○	○	○
Electromagnetic brake	Check the installation for fastening.				○	○	○
	Check the surface abrasion for equality.					○	○
	Check if the clearance is proper and adjust, if necessary.					○	○
	Check the brake for flexibility and effective.		○	○	○	○	○

Hydraulic system

Service item	Service required	Tool	D	W	M	T	S
Hydraulic reservoir	Check for oil level, change oil		○	○	○	○	×
	Clean suction strainer						○
	Clean foreign matter						○
solenoid valve	Check for block, return spring stuck or damage				○	○	○
	Check for wiring looseness.				○	○	○
Safety valve	Check for oil leakage		○	○	○	○	○
	Check for safety valve operation condition.				○	○	○
	Measure safety valve pressure	Oil pressure gauge					○
Piping, joint	Check for oil leak, looseness, collapse, deformation and damage				○	○	○
	Replace hoses.						× 1-2years
Hydrauli c pump	Check hydraulic pump for oil leakage or noise		○	○	○	○	○
	Check pump drive gear for wear						○
Lifting inching switch	Check for inching switch work condition.				○	○	○
	Check inching switch for looseness or damage.				○	○	○

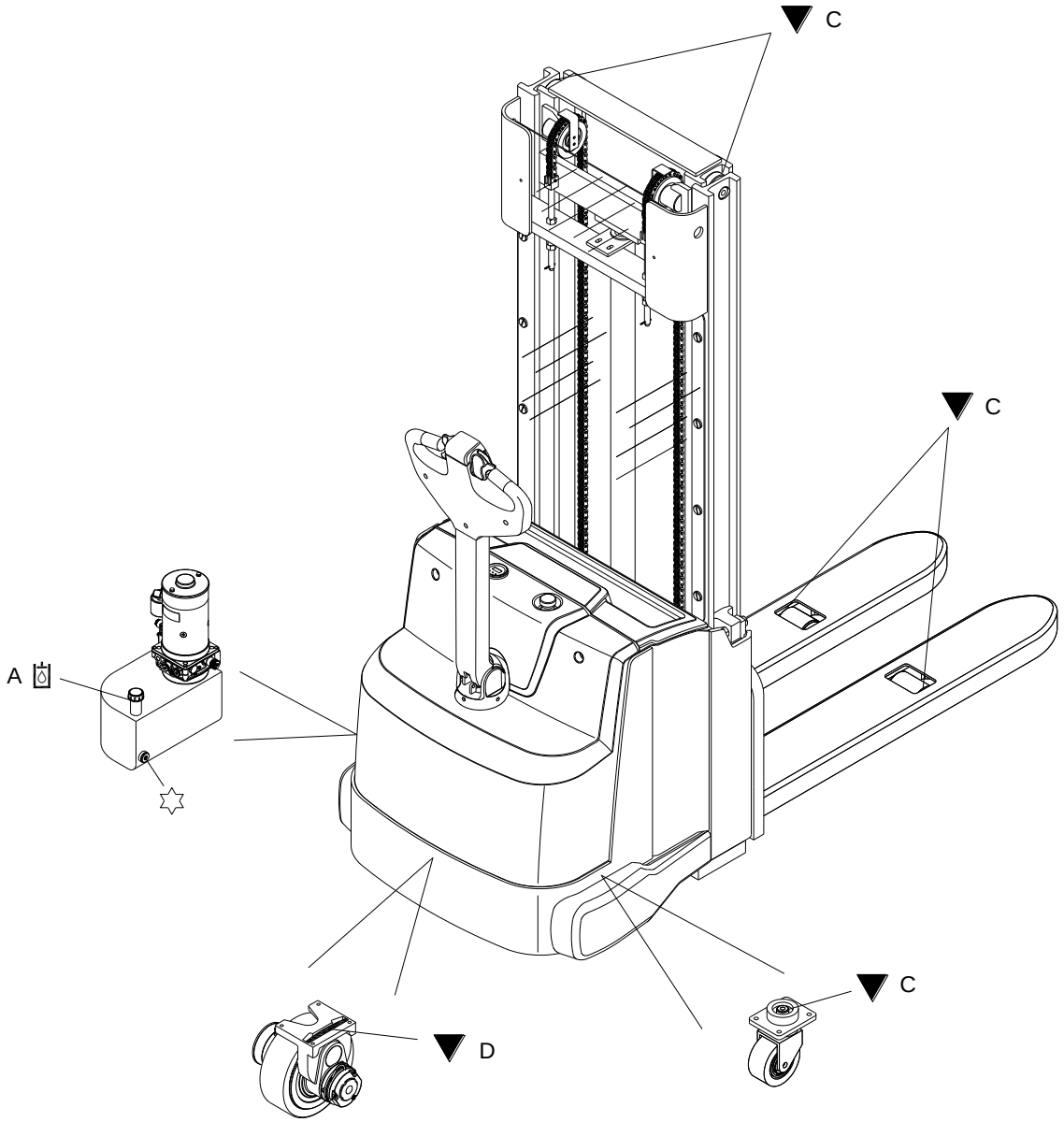
Lifting assembly

Service item	Service required	Tool	D	W	M	T	S
Link mechanism	Check link mechanism for tension, damage or rust		○	○	○	○	○
	Check if there is abrasion between shaft and bearing of front and rear fork.				○	○	○
	Check if there is deformation or fracture on the upper and down connecting rod.				○	○	○
	Check if there is crack or fracture on front fork or rear fork.		○	○	○	○	○
	Check for looseness of each joint.				○	○	○
	Add lubricating grease to the pin roll.				○	○	○
Lifting cylinder	Check piston rod, rod screw and connection for looseness, deformation or damage	Test hammer	○	○	○	○	○
	Check for operation		○	○	○	○	○
	Check for oil leak		○	○	○	○	○
	Check lifting cylinder fixed bolt for looseness.					○	○
Fork	Check forks for damage, deformation or wear				○	○	○
	Check fork base and hook welding for defective cracks or wear				○	○	○

Others

Service item	Service required	Tool	D	W	M	T	S
Wire	Wire damage or looseness			○	○	○	○
	Looseness of electric circuit joint				○	○	○
Emergency disconnect switch	Check for work condition		○	○	○	○	○
Direction and speed control button	Check for work condition		○	○	○	○	○
Lifting, lowering switch	Check for work condition		○	○	○	○	○
Horn	Check for work and installation condition		○	○	○	○	○
Instrument	Check for work condition		○	○	○	○	○
Pedal(only for stand-on type)	Check if pedal fold or unfold normally		○	○	○	○	○
Arm guard(only for stand-on type)	Check if arm guard fold or unfold normally		○	○	○	○	○

8.3 Truck used oil and lubrication



Filler plug for hydraulic oil

Drive mechanism

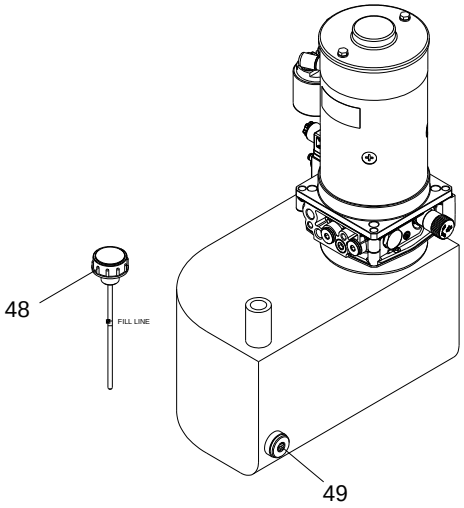
Drain plug

Code	Designation	Mark, code	Remark
A	Hydraulic oil	Normally：L- HM32 High and cold environment：L-HV32	Hydraulic system
C	Grease	Automobile general 3 # lithium base lubricant	Nozzle and lubrication
D	Grease	SHELL ALVANIA R3	Reduction box

8.4 Replace Hydraulic Oil

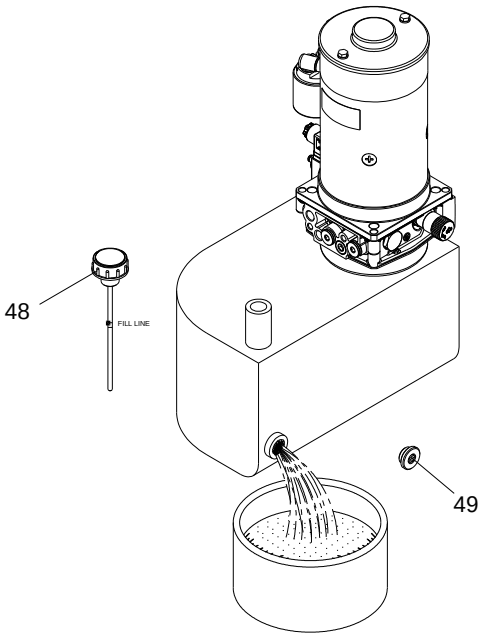
Procedure:

- Open the fuel tank cap（48）.



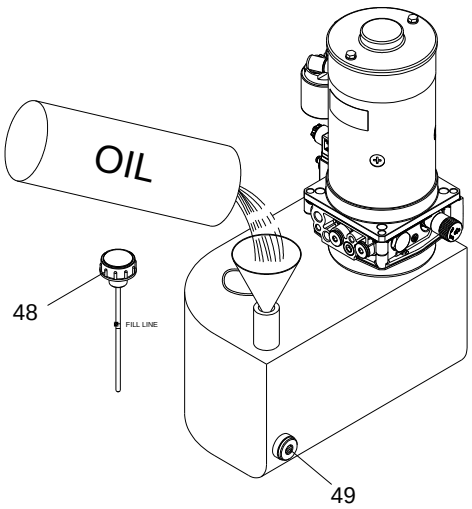
- Put the drain plug (49) into a container for holding the hydraulic oil.

- Unscrew the oil drain plug (49) and empty the hydraulic oil.



- Screw the oil drain plug (49) back and fasten it.

- Fill the tank with new hydraulic oil to a standard level by using of funnel or other tools.



- Remount the fuel tank cap (48) and clean the oil stains over the cap with a duster.

8.5 Replacing the wheels

8.5.1 Replace drive wheel

Procedure:

- Dismantle the drive unit from the truck.（Refer to part of ”dismantle the drive unit from the truck”）
- Remove the 12 socket hexagon screws which is used to fix the driving wheels with a S=5mm hex wrench.

CAUTION

- **Use equal strength to unscrew the bolts. Do not overexert which might do damage on the thread.**
- **Loosen the bolts in a symmetrical way when unscrewing the bolts and remove the bolts respectively.**

- Remove the fixation clamp of the motor signal wire.

- Strike the edge of the driving wheels with a rubber hammer and remove the old driving wheels from the drive unit.

CAUTION

- **Strike the edge of the driving wheels evenly and symmetrically.**
- **Do not scratch the outer surface of inner ring gearbox and the inner surface of the driving wheels.**

- Install new driving wheels. Apply lubricating oil to the outer surface of inner ring gearbox and the inner surface of the driving wheels in favor of fast installment.

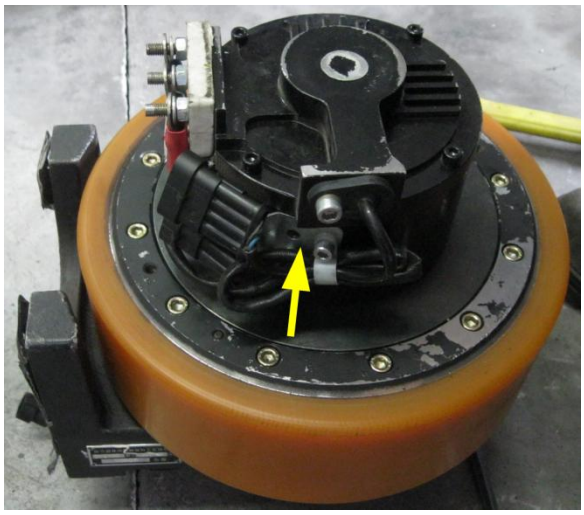
- Locate the installing holes and Strike the edge of the driving wheels evenly and symmetrically to the perfect match of the new driving wheels.

- Screw the 12 socket hexagon screws which is used to fix the driving wheels with a S=5mm hex wrench.

CAUTION

- **Screw up the bolts in a symmetrical way by 2 times.**
- **Apply appropriate torque to screw up the bolts. Do not overexert which might do damage on the thread or lead to future removing problem.**

- Apply the fixation clamp of the motor signal wire back and fix it.



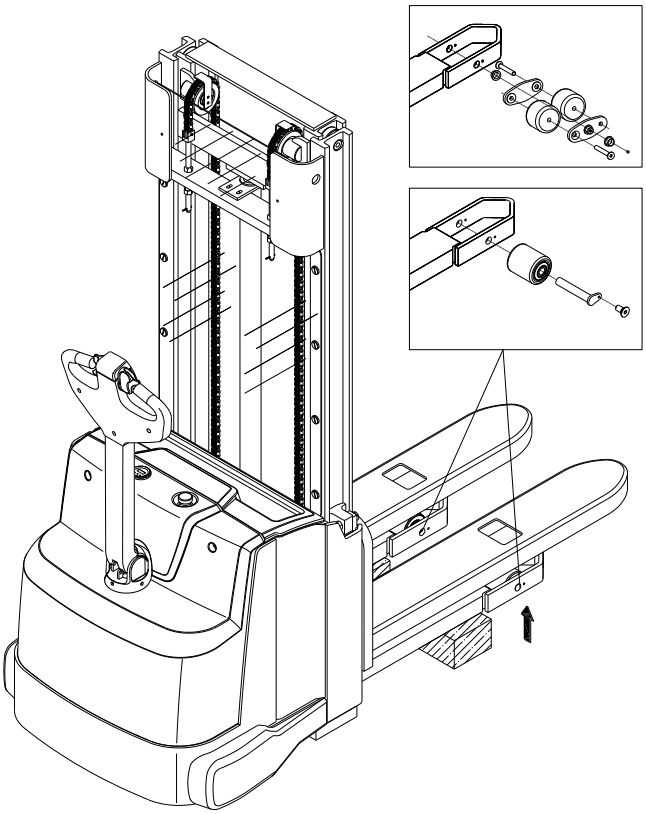
The replacement of driving wheels is completed.

8.5.2 Replace load wheel

Procedure:

- Lift the fork to certain height.
- Hoist the truck frame to certain height safely or place the truck on firm iron stand.
- Screw out the bolt.
- Take out axle.
- Take out wheel.

Install new wheel in the opposite sequence.

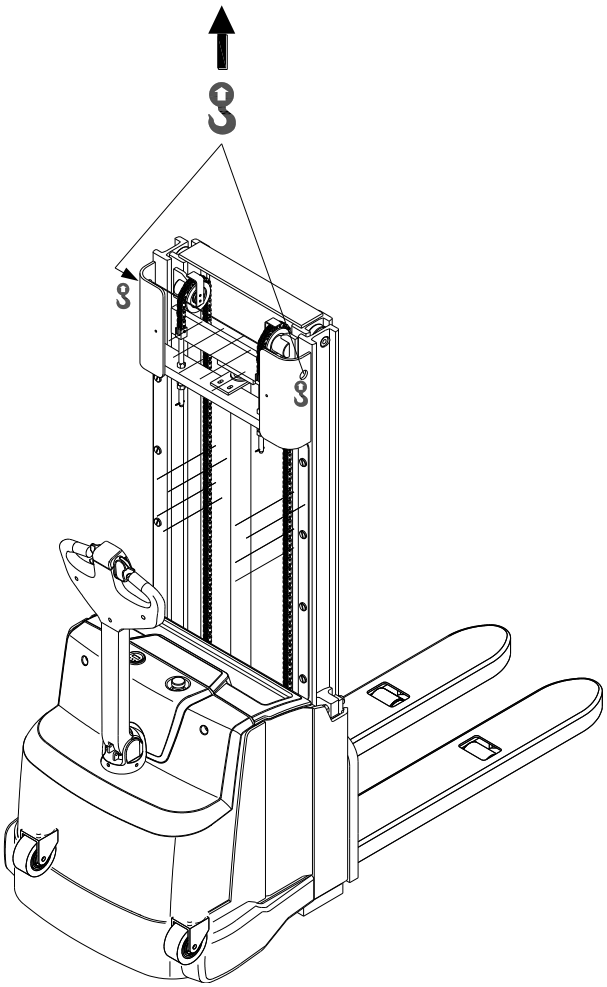


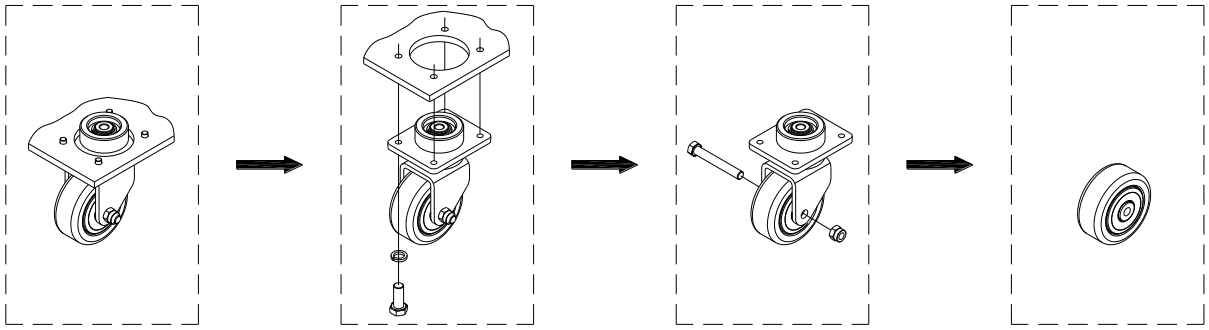
8.5.3 Replace auxiliary wheel

Procedure:

- Hoist the truck frame to certain height safely or place the truck on firm iron stand.
- Screw down nut.
- Take out bolt.
- Take out wheel.

Install new wheel in the opposite sequence.





8.6 Replace the key safe parts periodically

Users should replace the parts periodically according to the following table. If the part is abnormal before the replacing time, it should be replaced immediately.

Key safe part's description	**Term of using (year)**
Hydraulic hose for lifting system	1-2
High-pressure hose, hose for hydraulic system	2
Inner sealing element, rubber matter of the hydrulic system	2

9 Relevant safety directive or standard (CE)

After CE certificated , the truck meets the following directive and standard:

- 2006/42/EC machinery directive（namely *Directive of the council of the laws of the member states concerning machinery* ）, 2000/14/EC Noise Directive（Namely *Directive of the council of the laws of the member states concerning noise radiation of outdoor equipment*）;
- EN ISO3691-1:2012（Industrial trucks -- Safety requirements and verification -- Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks）、EN16307-1:2013（Industrial trucks. Safety requirements and verification. Supplementary requirements for self-propelled industrial trucks,other than driverless trucks,variable-reach trucks and burden-carrier trucks）.
- EN1175-1:1998+A1:2010（Safety of industrial trucks - Electrical requirements - Part 1: General requirements for battery powered trucks）、EN1726-1:1998（*Safety standard for machinery industrial vehicle*）, EN12053:2001, EN1175-1:1998, EN13059:2002, EN1757-2：2001 harmonized standard;
- Main safety elements are in accordance with 2006/42/EC machinery directive as well as EN1175-1:1998+A1:2010, EN1726-1:1998,EN1757-2：2001 standard;

Electronic components design and manufacture meet low-voltage apparatus directive 2006/95/EC;

Noise is calculated according to EN12053:2001+A1:2008: pallet truck noise, sound pressure value

Lifting: right ear73.8 dB(A), left ear73.4 dB(A)

Going forward: right ear72.1 dB(A), left ear71.2 dB(A)

- Vibration data are calculated according to the EN13059:2002+A1:2008（Safety of industrial trucks - Test methods for measuring vibration）,ISO5349-2:2001 and ISO2631-1:1997 standard, meet 2002/44/EC directive: handle vibration amplitude is 0.102m/s^2, Platform vibration amplitude is 0.028m/s^2.
- Electromagnetic compatibility is calculated according to EN12895:2000 and meet 2004/108/EC directive.

DECLARATION OF CONFORMITY
EG-KONFORMITÄTSERKLÄRUNG

Business name of the manufacturer: **HANGCHA GROUP CO., LTD.**
Firmenbezeichnung des Herstellers:

Full address of the manufacturer: **88 Donghuan Road, Lin'an Economic Development Zone Zhejiang 311305, P.R. China**
Vollständige Adresse des Herstellers:

Name and address of the person (established in the Community) compiled the technical file:
Name und Adresse der Person (innerhalb der Gemeinschaft), die das technische Datenblatt erstellt hat
NAME: Samuk Lift Trucks Ltd. ADDRESS: Toddington, Bedfordshire, LU5 6HJ, U.K

We declare that the machinery
Wir erklären hiermit, dass die Maschine

product name: **Electric Stacker**
Produktbezeichnung:

commercial name:
Handelsbezeichnung:

function:
Funktion:

model: **CDD12/14/16-AEC1, CDD12/14/16-AEC1S**
Modell:

type:
Typ:

serial number:
Seriennummer:

fulfills all the relevant provisions of Directives
entspricht allen relevanten Anforderungen folgender Richtlinien

2006/42/EC

tested in accordance with below standards
wurde gemäß folgender Normen geprüft

EN ISO 3691-1:2012
EN 16307-1:2013
EN 1175-1:1998+A1:2010

place and date of the declaration:
Ausstellungsort und Datum der Erklärung

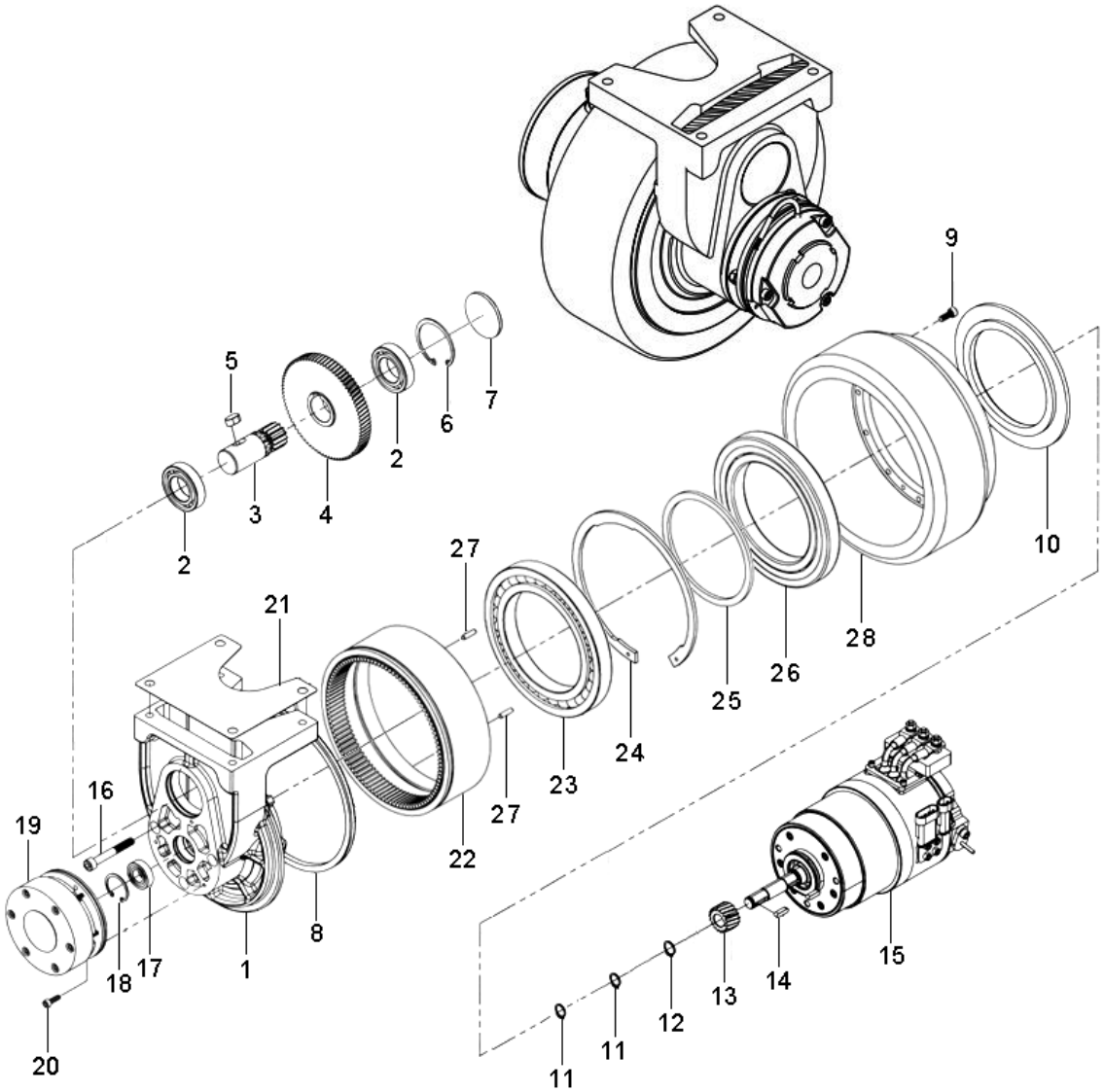
signature of the person:
Unterschrift des Ausstellers

Part Ⅱ: Structure, Principle and Maintenance

1 Drive unit

1.1 Drive unit structure and principle

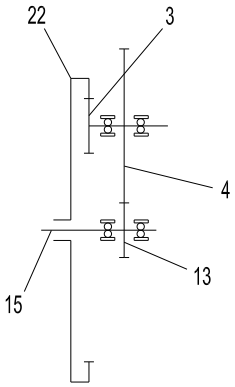
This truck adopts hub-type drive unit(see fig.2-1). This structure owns high efficiency, large drive ratio range, compact structure and small volume.



1.Housing	2.Bearing 6006	3.Gear shaft	4.Driven gear
5.Flat key	6.Circlip for hole 55	7.End cap	8.Oil seal
9.Screw M6×16	10.Baffle	11.Circlip for shaft 14	12.Circlip for shaft
13.Driving gear	14.Flat key	15.Driving motor	16.Bolt M8×60
17.Bearing 6002-2RS	18.Circlip for hole 32	19.Electromagnetic brake	20.Bolt M5×16
21.Paper washer	22.Annular gear	23.Bearing	24.Check ring
25.Space ring	26.Bearing	27.Round pin	28.Drive wheel

Fig.2-1 Drive unit structure

Drive unit deliver route(see fig.2-2): drive unit directly drives by driving the driving gear directly through motor. Delivery sequence is from 15(drive motor) to 13(driving gear) to 4(driven gear) to 3(gear shaft) to 22(annular gear), and then drive the driving wheel output. Drive system does not need gear shift, and reversing operation directly relies on positive inversion of motor to realize forward or reverse shifting.



3. Gear shaft
4. Driven gear
13.Driving gear
15.Drive motor
22.Annular gear
Fig.2-2 Drive diagram of drive unit

Data

Speed ratio of reduction gear box			31.4
Max. wheel torque		N•m	300
Max. wheel load		kg	1000
Grease			SHELL ALVANIA R3
Weight		kg	37
Drive motor	Rated voltage	V	16
	Rated power	kW	1.1
	Rated current	A	64
	Rated speed	r/min	3395
	Working system		S2=60min
	Insulation grade		F
	Protection grade		IP54
Brake	Rated voltage	V	24
	Rated braking torque	N•m	8
	Max. braking torque	N•m	12
	Insulation grade		F

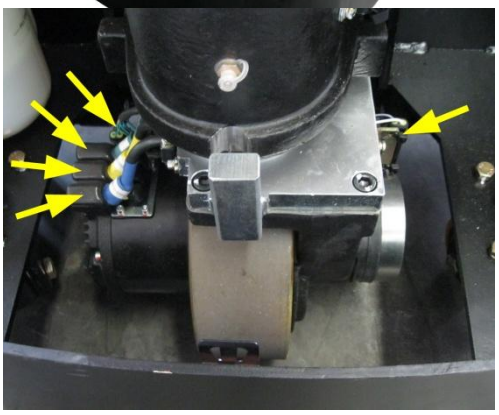
1.2 Dismantle drive unit from the truck

Procedure:

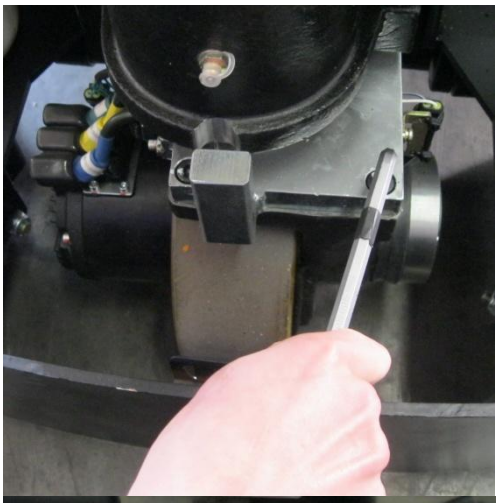
- Park the truck.
- Take out the battery plug.

- Take down the hood.

- Remove motor wiring(Notice each wiring mounting position) and dismantle brake wiring plug.



- Dismantle four bolts from drive unit.



- Hoist the truck body and take out drive unit.

Assembling order is opposite to the disassembling order.

1.3 Assemble and use notice

- When assemble, scrub the oil seal on the product. Avoid product damage, no disassemble at will.
- Avoid each fitting surface and exposed gear impact, thus influence installation.
- Normal working oil temperature is ≤70℃.
- Drive wheel is maintenance free drive device, if need grease, dismantle the drive unit, add from the top.
- Added amount of grease(SHELL ALVANIA R3) is 2/5-2/3 space of the inner chamber.

1.4 Fault and troubleshooting

Fault	Probable cause	Corrective action
Abnormal gear noise when travelling	Over large gear clearance	Adjust
	Lack grease	Replenish
	Over large gear wear	Replace
Abnormal noise when turning	Rotary rolling bearing damage	Replace
	Insufficient rotary rolling bearing grease	Add grease
Brake ineffective or invalid	Inching switch loosen or damage	Fasten or replace
	Over large brake clearance	Adjust
	Brake disc over wear	Replace
	Brake loosen	Fasten
	Circuit damage	Repair
Large vehicle vibration	Damper assembly damage	Replace

1.5 Drive motor

Traction motor is three phase AC motor, maintenance free, but need check and clean periodically. It needs dismantle motor wiring board when replace drive wheel. Tightening torque of lower nut of wiring board is T=4.05～4.95N.m, while the upper nut is T=10.2～12.4N.m. When fastening the upper nut, lock the lower nut to avoid looseness.

Motor use notice

- Keep clean and dry around the motor, place no other material on its inner or outer.
- It's prohibited to use with overload.
- It's prohibited to coexist with strong magnetic object.
- Make sure the correct of input voltage grade.
- If there is abnormal odor in use, park to check immediately.
- The cabling between motor and controller should be as short as possible.
- During motor travelling, if there happen electric leakage, speed drops suddenly, severely vibrate, too hot with smoke, or electric contact sparking smoke, turn off the power immediately for check.
- Often check if the motor over heats.
- Often check motor wiring contact screw for looseness, sparking smoke or insulation aging.

Motor fault diagnosis

Fault	Probable cause
After power is on, the motor does not rotate, but without noise, odor or smoke.	①Power is not on(at least two phase off)
	②Fuse fusing(at least two phase fusing)
	③Overcurrent relay adjusts too small
	④Wiring error of control equipment
After power is on, the motor does not rotate and fuse burnout.	①Lack one phase power, or reverse connection of stator coil one phase
	②Short circuit of stator winding；
	③Grounding of stator winding
	④Wiring error of stator winding
	⑤Fuse section too small.
After power is on, the motor does not rotate but with buzzing noise.	①Open circuit of stator, rotor winding(one phase disconnection) or one phase power is off.
	②Start and end of the winding outgoing line wrongly connect or internal winding oppositely connect.
	③Power return contact loosens and contact resistance is large.
	④Motor load too large or rotator locks.
	⑤Power voltage too low.
	⑥Small motor assembles too tight or bearing grease too hard.
	⑦Bearing seizing-up.
Motor starts hard, and the motor speed is much lower than rated speed with rated load.	①Power voltage too low.
	②△ Motor wrongly connected to Y
	③Cage rotor open weld or crack
	④Local coil of stator and rotor wrongly or oppositely connected.
	⑤Add too much number of windings when repair motor winding.
	⑥Motor overload.
Current is unbalance when motor without load and three phases differ a lot.	①When rewind, numbers of stator three-phase winding is not equal.
	②Two ends of winding wrongly connected
	③Unbalance power voltage.
	④There is interturn short circuit or coil oppositely connected in the winding.
Motor without load, while loaded, ammeter indicator is unstable and swings.	①Guide bar of cage rotor open weld or crack
	②Wound rotor fault(one phase open circuit) or bad brush and collecting ring short circuiting device contact.
Motor without load, current is	①Reduce too much number of stator windings when

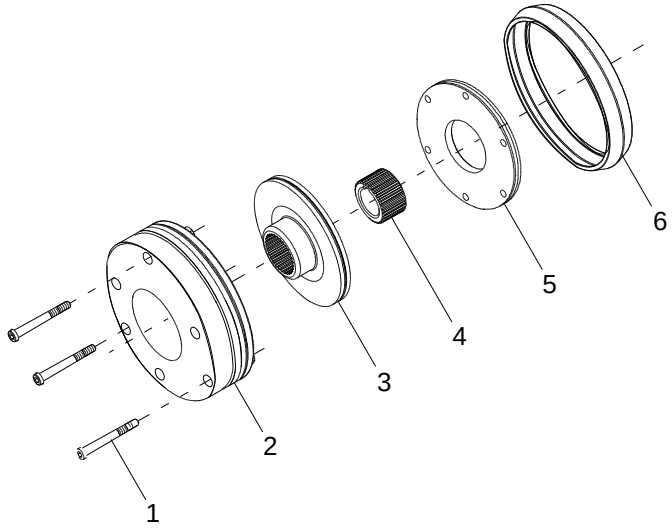
Fault	Probable cause
balance, but the value is large	repair motor winding.
	②Power voltage too high.
	③Y connected motor wrongly connect to Δ
	④During motor assemble, rotor oppositely connects, make stator core unaligned, effective length shortens.
	⑤Air gap over large or uneven.
	⑥When remove old winding for overhaul, use improper way that burn the iron core.

Fault	Probable cause
Abnormal noise when motor runs	①Insulation paper of rotor and stator or slot wedge rubs.
	②There is foreign body as sand in oil or bearing wear.
	③Stator and rotor core loosen.
	④Bearing lack oil.
	⑤Air duct stuffing or fan rubs the fan housing.
	⑥Stator and rotor core rub.
	⑦Power voltage too high or imbalance.
	⑧Wrongly stator winding or short circuit.
Big motor vibration during running	①Too big wear bearing clearance
	②Uneven air gap
	③Rotor imbalance
	④Revolving shaft bend.
	⑤Iron core deforms or loosens.
	⑥Housing or basic capacity is insufficient.
	⑦Motor foot screw loosen
	⑧Open circuit of cage rotor open welding, open circuit of wound rotor, or winding fault with stator.
Bearing overheat.	①Over much or few grease
	②Bad oil quantity and contains impurity.
	③Mismatch between bearing and journal or end cap(too loose or too tight)
	④Eccentricity of bearing bore, rub with the axle.
	⑤Motor end cap or bearing cap not even assembled
	⑥Coupling between motor and load not adjust
	⑦Too large or too small bearing clearance

	⑧Motor axle bend.
Motor overheating or smoking	①Too high power voltage, greatly increase the core heating.
	②Too low power voltage, the motor drives rated load, over large current heats the winding.
	③When remove winding for overhaul, use improper way that burn the iron core.
	④Rotor and stator core rub.
	⑤Motor overloads or start up frequently.
	⑥Cage rotor break.
	⑦Motor lacks phase, two phases run.
	⑧After rewinding, dipping paint of stator winding is improper.
	⑨In high temperature, much dirt on the motor surface or ventilation duct block.

1.6 Electromagnetic brake

The spring-loaded electromagnetic brake is applied in the truck which is a single disk brake with double friction surfaces. By use of the pressure spring, powerful braking torque would be generated when power off. The brake could be released by the electromagnetic effect.

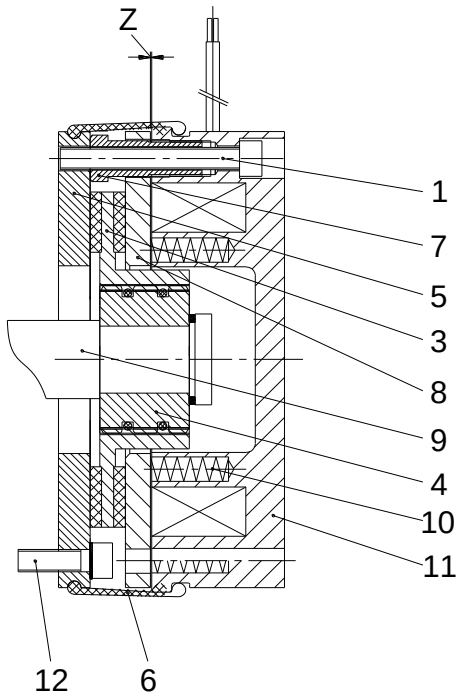


1.Mounting Bolt of the Brake 2.Stator Module
3.Brake Pad 4.Shaft Sleeve
5.Friction Disk 6.Dustproof Cover

Fig. 2-3 Electromagnetic brake parts

1.6.1 Electromagnetic brake working principle

Motor shaft (9) is connected with shaft sleeve (4) by passing through the flat key. And shaft sleeve (4) is connected with brake pad (3) by passing through the splines. When the stator (11) is block out, the force produced by the pressure spring (10) would act on the armature (8) which makes rotated the brake pad (3) driven by the motor shaft connected closely between the armature (8) and cover plate (5). As a result the braking torque is created. There will be a air gap Z between the armature and the stator at that moment. When the brake needs to be relaxed, the stator is applied with direct current and the magnetic field would attract the armature (8) to move towards the stator. The movement of armature compresses the pressure spring (10) which cause the loosening of the brake pad (3) by that time and the brake is released.



1.Mounting Bolt of the Brake

3. Brake Pad

4. Shaft Sleeve

5. Friction Disk

6. Dustproof Cover

7. Hollow Screw

8. Armature

9. Motor Shaft

10.Pressure Spring

11.Stator

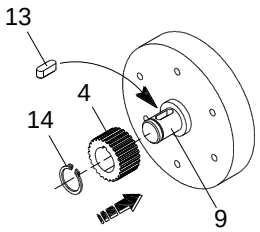
12.Mounting Bolt of Friction Disk

Z. Air Gap

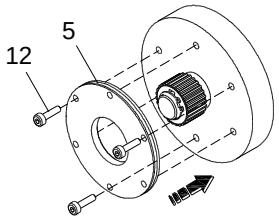
Fig.2-4 Electromagnetic Brake Structure

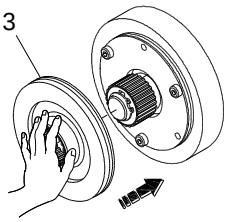
1.6.2 Electromagnetic brake installation

- Put the flat key (13) into the key groove of the motor shaft (9). Press the shaft sleeve (4) to the motor shaft (9) and fasten it with the inner spring.

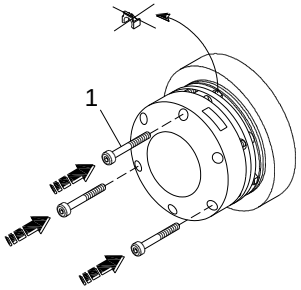


- Install the friction disk (5) to the end face of the motor by using three mounting bolts of the friction bolts (12).



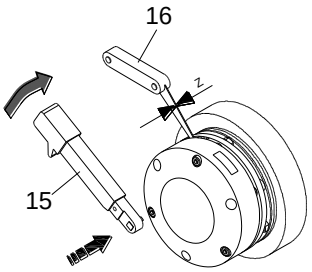


- Cover the shaft sleeve with the friction disk (3).

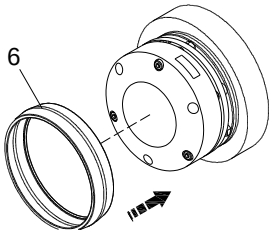


- Install the stator module (2) to the friction disk (5) with three mounting bolts of the brake (1).

Note: Remove the three rubber mats of the stator module which is for stable transportation.



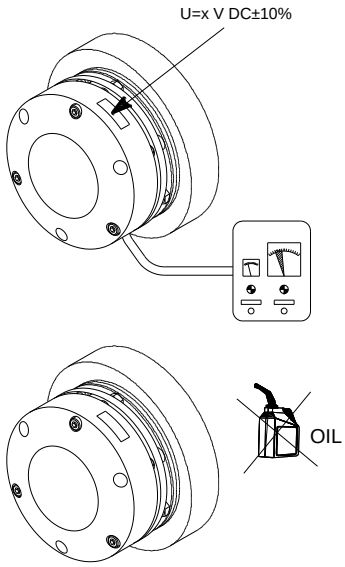
- Screw down the three mounting bolts (1) with a torque wrench (15) and check the air gap (Z) of the brake with a feeler gauge (16).



- Put on the dustproof cover(6).
- Connect the brake wiring.

WARNING

- **No broken wire sheath, or else the circuit might be damaged.**
- **Do not process the locating surface or the holes of the production without authorization, or else the magnet loop would be influenced.**
- **Do not over press when fitting the motor shaft. Make sure no damage on the friction surface and wipe off the burr of the mounting holes and surfaces. Put the shaft sleeve on the motor shaft and fasten the axial clamp spring.**
- **Measure the direct voltage of the connecting brake and compare the value to the rated voltage on the nameplate. Deviation should not be more than 10%.**
- **Make sure it is free from oil and dirt when installing and using the brake.**



1.6.3 Maintenance

- Avoid rusting When truck is used in a high temperature for a long time. The actuation side with rust would affect the performance.
- Do not touch the friction surface with your hand directly. Make sure it is free from oil and dirt, or else the maximum torque could not be achieved.
- Generally the working environment temperature is around -10℃～+40℃.

Conduct a periodical inspection. It concludes the items as follow. Is it smooth to switch? Is there any noise or any abnormal heating? Is there any dirt or grease that came to the section of friction and rotation? Whether the gap is appropriate between the frictions? Any problem with the exciting voltage ?

1.6.4 Adjust the Air Gap of the Brake

Rated air gap Z grows with the friction. In order to there is sufficient braking torque, the air gap must be set before it reaches to the maximum value. The air gap can be adjusted by several times. When the thickness of brake pad becomes the minimum value(see the specification table below), the brake pad must be replaced.

Once the air gap reaches the top value, the brake might not be released and the brake pad would be burn out. It will also cause the decrease of braking force and the retention and the noise increase and even big accidents. It is prominent to do the periodical inspection and adjust the air gap. Disconnect the power. Through adjusting 3 hollow bolts (8) and the mounting bolts of stator (9), set the air gap between stator (1) and armature (2) to the rated Z by a feeler gauge.Ensure air gap at all directions are same.

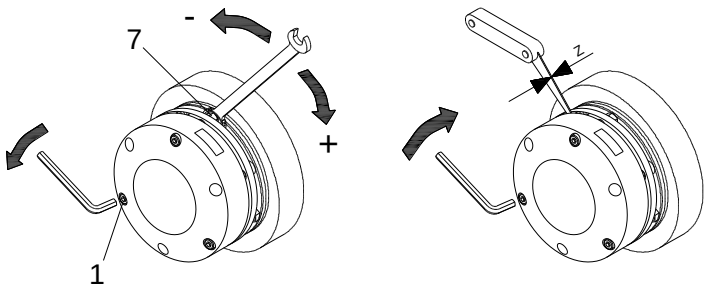
Specification Table

Rated Torque	Rated Power	Rated Air Gap	Maximum Air Gap	Minimum Thickness of Rotor	Pre-tension Torque of the Mounting Bolt
8 N.m	25 W	0.2mm	0.5 mm	6.4 mm	5.5 N.m

On the condition of power disconnected, through adjusting 3 mounting bolts of brake (1) and the hollow bolts (7), set the air gap between stator (11) and armature (8) to the rated Z by a feeler gauge. Ensure air gap at all directions are same.

Set the air gap in the following sequence:

- Unscrew the mounting bolts of brake (1) with a hex wrench.
- Adjust the hollow bolts (7) with a spanner.
- Screw up the three mounting bolts of brake (1).
- Check if the air gap Z is within the standard range with a feeler gauge.
- Adjust the mounting bolts and hollow bolts respectively according to the following figures. Set the air gap and screw up the mounting bolts of brake.



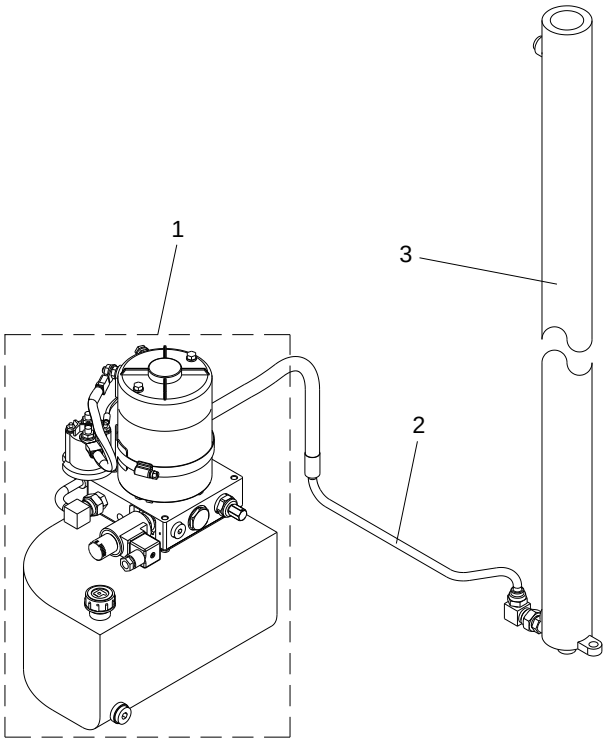
Under the general operating conditions, the first set of the air gap is usually after 1500 to 2000 hours service of the brake and it is suggested to adjust the air gap every 6 months. If it comes to a poor working condition, such as frequent use of brake and repeated emergency stops，the air gap should be set when the brake the shorten the adjustment interval for the first time.

Common fault and troubleshooting

Fault	Probable cause	Corrective action
Brake does not work	Power is obstructed	Connect
	Too low exciting voltage	Check voltage and adjust.
	Improper air gap	Adjust air gap
	Stator coil breaks	Replace stator
	Oil dirt mixed in	Clean oil dirt
Long brake time	Switch installed to AC circuit	Install the switch to the DC circuit after rectifying
	Improper air gap	Adjust air gap
	Oil dirt mixed in	Clean oil dirt
Slipping	Unstable operation in previous use	Running-in for a while
	Oil dirt mixed in	Clean oil dirt
	Large load	Reduce load or replace large specification
	Large load change	Adjust load peak or large the specification
High temperature	Too high exciting voltage	Check voltage and adjust.
	Clutch or motor interfere to the brake	Check control circuit, eliminate interference
	High environment temperature	Set ventilation
	High operating frequency	Adjust to proper frequency
	Over large load	Reduce load
Large noise	Product service environment needs silence	Silence design
	Impurity mixed in.	Clear away the impurity
	Bad mounting	Replace mounting surface or shaft
	Large rotational inertia or dynamic unbalance value	Reduce rotational inertia or dynamic unbalance value

2 Hydraulic system

Hydraulic system is mainly composed of hydraulic unit, rubber tube and lifting cylinder.



1. Hydraulic unit
2. Rubber tube
3. Lifting cylinder

Fig.2-5 Hydraulic system

2.1 Hydraulic system working principle

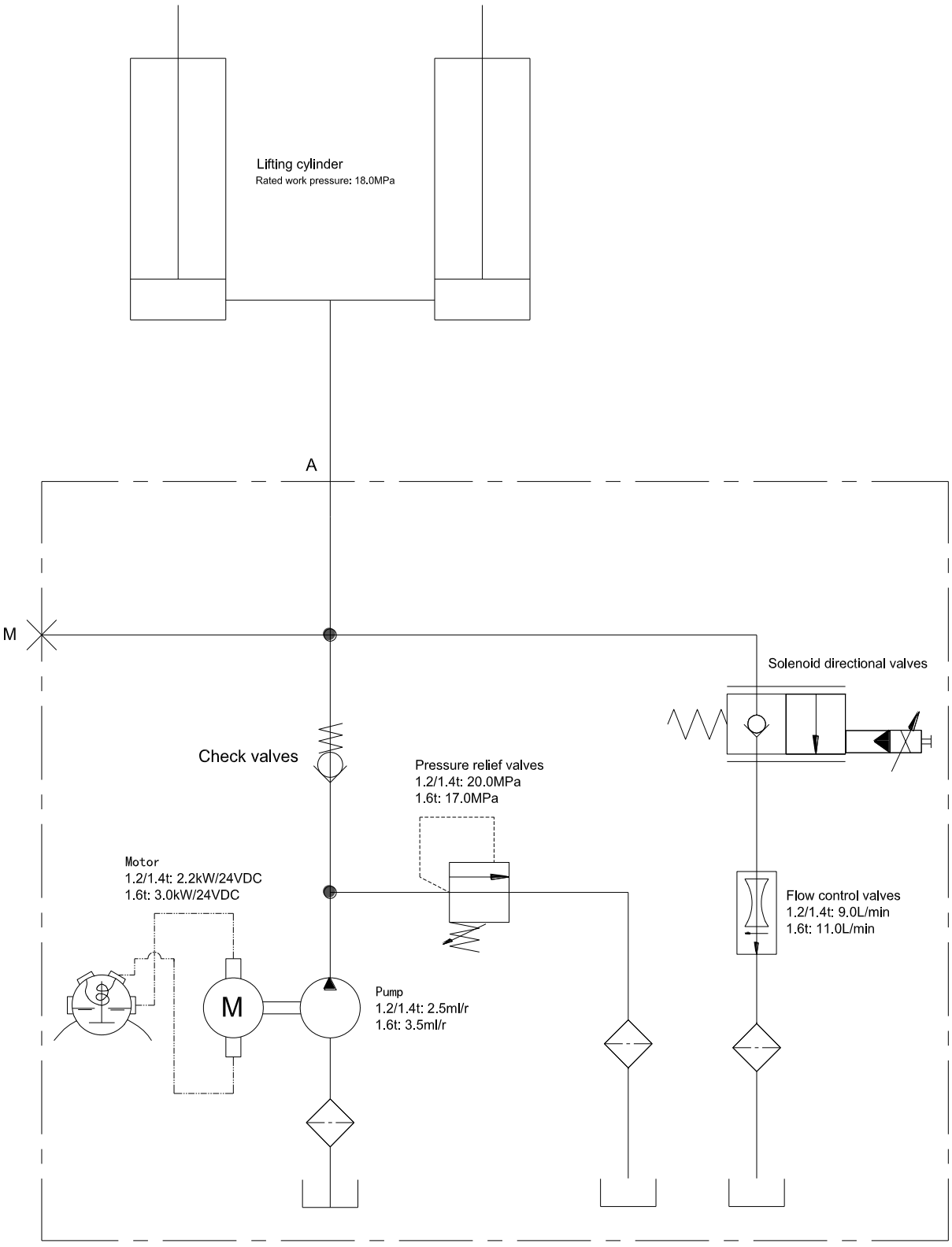
Lifting the Loading

Press the lifting button of the control lever and the oil pump motor starts. It passed the torque from motor to gear pump through the transmission shaft. The gear pump absorbs the hydraulic oil from the fuel tank and passes the oil to the lifting cylinder through non-return valve. High pressure oil push the piston rod forward which give rise to the lifting of forks and the loading.

Release the lifting button and the oil pump motor stops. The gear pump stops absorbing the oil. And the non-return valve is closed which can keep the lifting cylinder and the loading in its original lifting position. When the lifting cylinder reaches the end or the truck is over loaded, the working pressure is exceeding the safety pressure defaulted in the system, the overflow valve will be open and the hydraulic oil returns back to the fuel tank.

Lowering the Loading

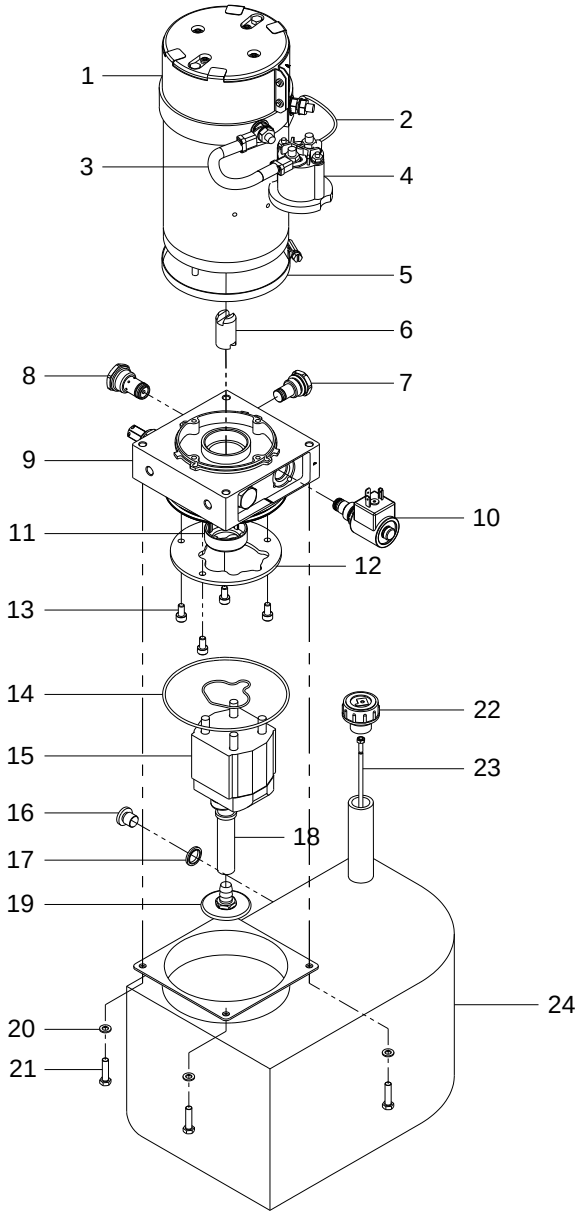
Press the lowering button of the control lever and the oil pump motor starts. When the closed electromagnetic valve is applied with electricity, the hydraulic oil in the lifting cylinder will flow back to the fuel tank due to gravity. Both the cylinder and the loading start to lower. Governor valve is used to prevent the trucks and loadings from being damaged due to the rapid lowering speed.



Hydraulic power unit

2.2 Hydraulic unit

The truck adopts combined hydraulic unit(see fig.2-6), which mainly consists of DC motor, coupling , flange, cartridge, pump, tank and other components.



1. Motor
2. Wire assy
3. Cable,Insulated
4. Starter
5. Clamp,Steel
6. Coupling
7. Plug
8. Flow control valve
9. Base assy
10. Valve
11. Bush
12. Filter,Screen ruturn
13. Screw
14. Seal kit
15. Pump
16. Plug
17. Seal,Washer
18. Tube,Plastic
19. Filter,Insert
20. Washer,Lock
21. Screw
22. Plug
23. Guage
24. Reservoir

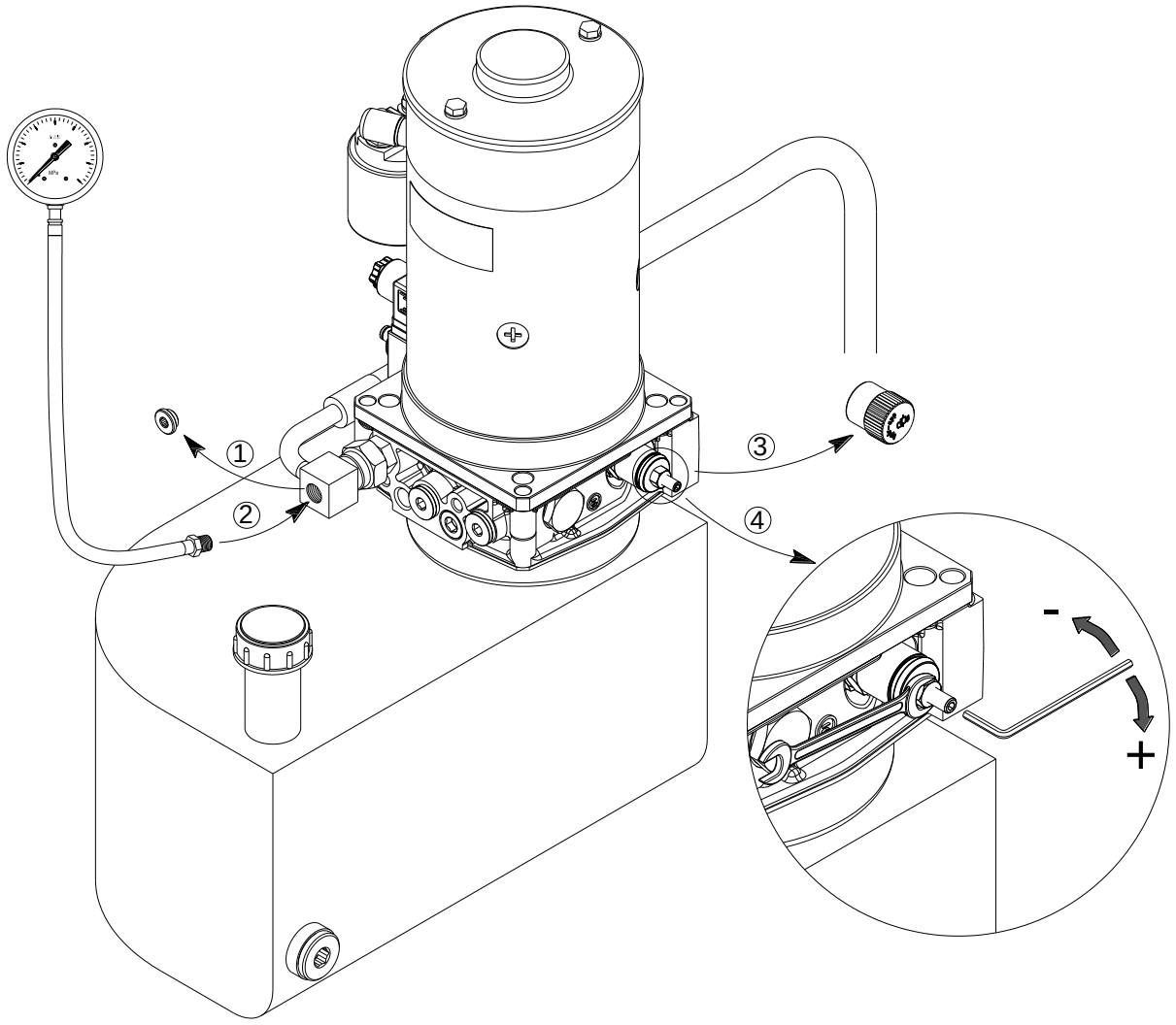
Fig.2-6 Hydraulic unit parts

Adjust Safety Pressure of Overflow Valve

Generally, users do not need to adjust the safety pressure of overflow valve because it is set already before delivery. Here below states the adjusting method of the safety pressure.

Procedure:

- Park the truck securely.
- Take down the hood.
- Remove the oil choking of the pressure hole ①.
- Connect the oil pressure gauge to the pressure hole ②.
- Take out the cap of the overflow valve ③.
- Loosen the nut of the main safety valve. Adjust the pressure and the bolts with a hexagon wrench. The pressure of main safety valve increases when adjusting the screws clockwise; and the pressure decreases when adjusting the screws counterclockwise ④.
- Adjust the pressure to the requested range.
- Once completed, apply back the fastened nut and the oil choking and clean it up.

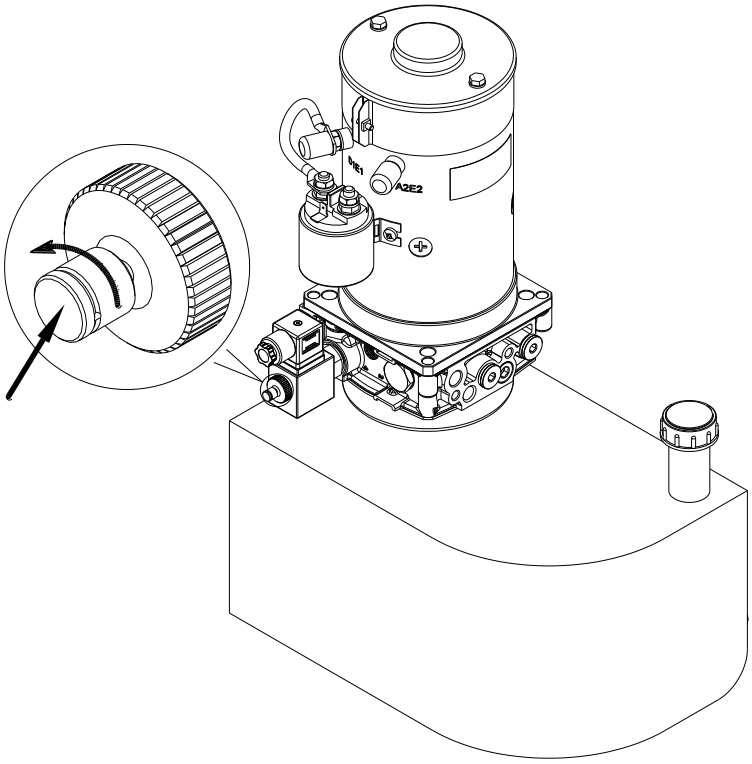


Manually Lowering the Unloading

When the battery runs out or the electromagnetic valve fails to work , and the loading can not be lowered mechanically, the emergency lowering device of the hydraulic unit can be applied manually to lower the loading.

Procedure:

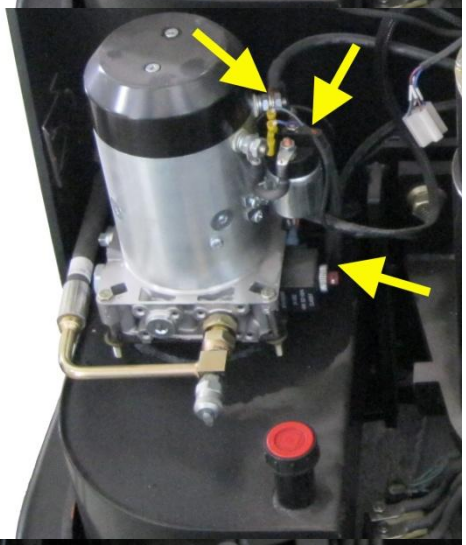
- Park the truck securely.
- Take down the hood.
- Screw out the bolts of the valve counterclockwise which can make the hydraulic oil flow back to the fuel tank.
- After emergency lowering of the forks, screw up the bolts of valve clockwise and assemble the engine hood back.



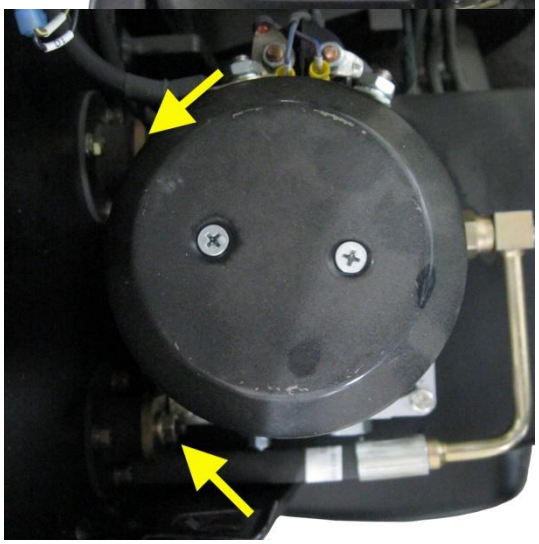
2.3 Hydraulic unit dismantle

- Dismantle the hood.
- Dismantle the connector of the hydraulic unit and the cylinder.

- Remove the wiring on the motor, contactor and control valve.



- Remove the tightening bolts that fix hydraulic unit.

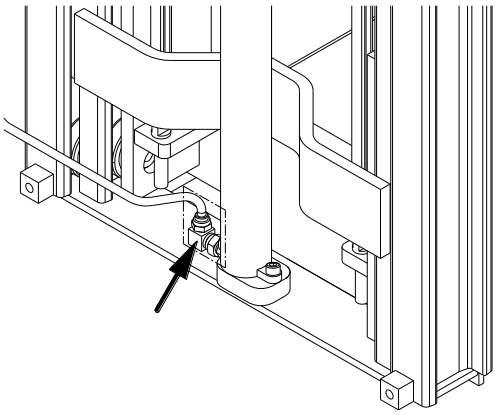


- Take down hydraulic unit.

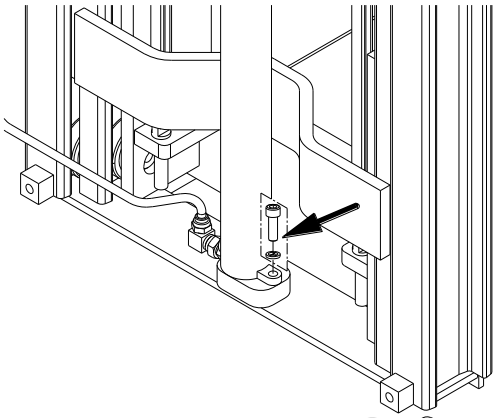
Assembling order is opposite to the disassembling order.

2.4 Dismantle the lifting cylinder from the truck or replace

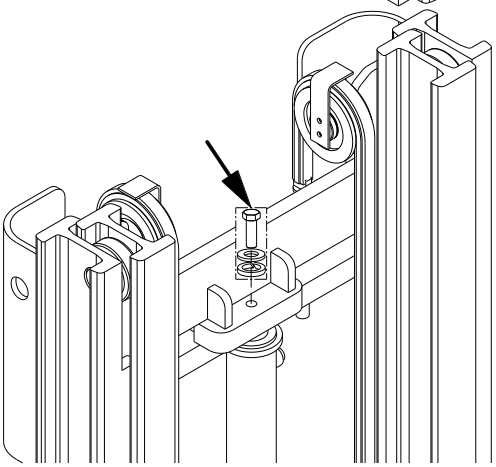
- Park the truck.
- Dismantle piping joint, exhaust the bottom oil in the cylinder and pipe.



- Dismantle the fixed bolt and washer in bottom of the cylinder.

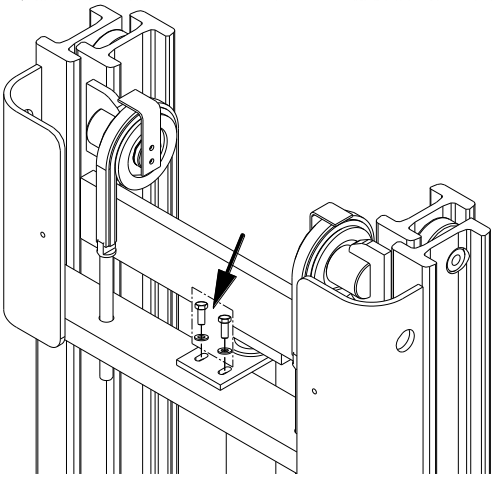


- Dismantle the fixed bolt and washer in bottom of the cylinder.



- Dismantle two sets of bolts and gasket from cylinder fixed plate, take out the cylinder from the truck.

Assembling order is opposite to the disassembling order.

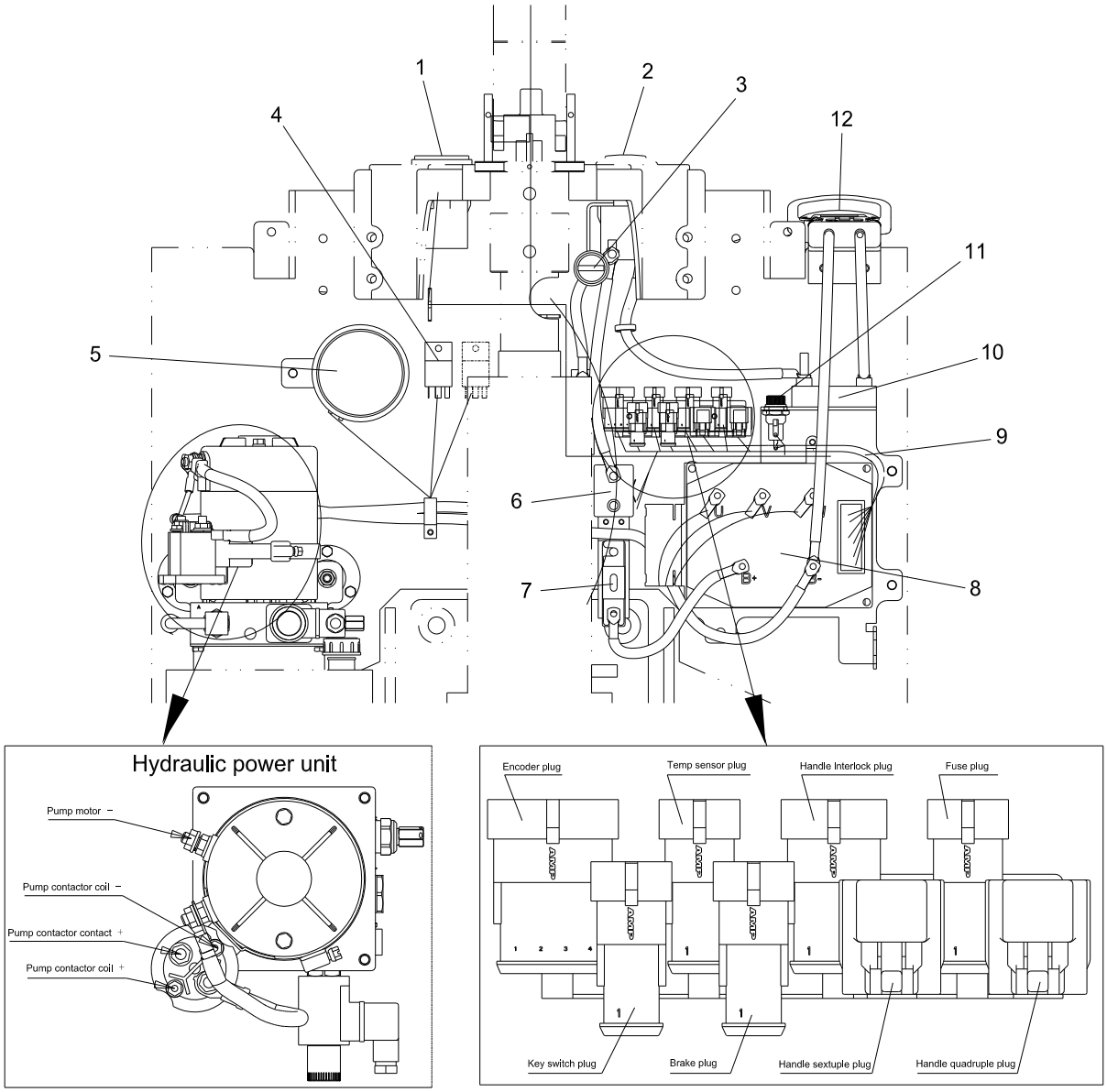


2.5 Hydraulic system fault diagnosis and correction

Fault		Probable cause	Corrective action
No oil pumps from the pump		Low oil level	Fill to the specified oil level
		Blocking of strainer	Clean oil pipe and oil tank. If hydraulic oil is dirty, please change it.
Low oil pressure of oil pump output		Bearing worn; retainer, O-ring damage	Change the bad spare parts
		Adjustment failure of safety valve	Rise pressure with pressure gage
		Air in the oil pump	Fill hydraulic oil to the oil tank, use the pump after bubble vanishing
Noise of oil pump		Cavitation arising from the strainer blocking	Adjust or replace soft tube and clean the strainer
		Cavity caused by the high viscosity of hydraulic oil	Replace new hydraulic oil, whose viscosity suits pump running speed Work only when the oil temperature is normal
		Bubble in the hydraulic oil	Check the reason for the bubble and then take measures
Forks can't lift	Gear pump works	Oil way block or damage	Repair or replace
	Gear pump no work	Lifting inching switch loosen or damage	Re-fix or replace
		Motor or circuit fault	Repair
Forks do not drop down		Solenoid valve block or damage	Repair or replace
Pressure of safety valve is unstable or can't be adjusted		Pressure adjusting screw loosen	Re-adjust and lock.
		Pressure adjusting spring deformation or damage.	Replace
		Safety valve spool wear or sticking	Replace or clean to reassemble.
		Pump failure	Repair pump

3 Electric system

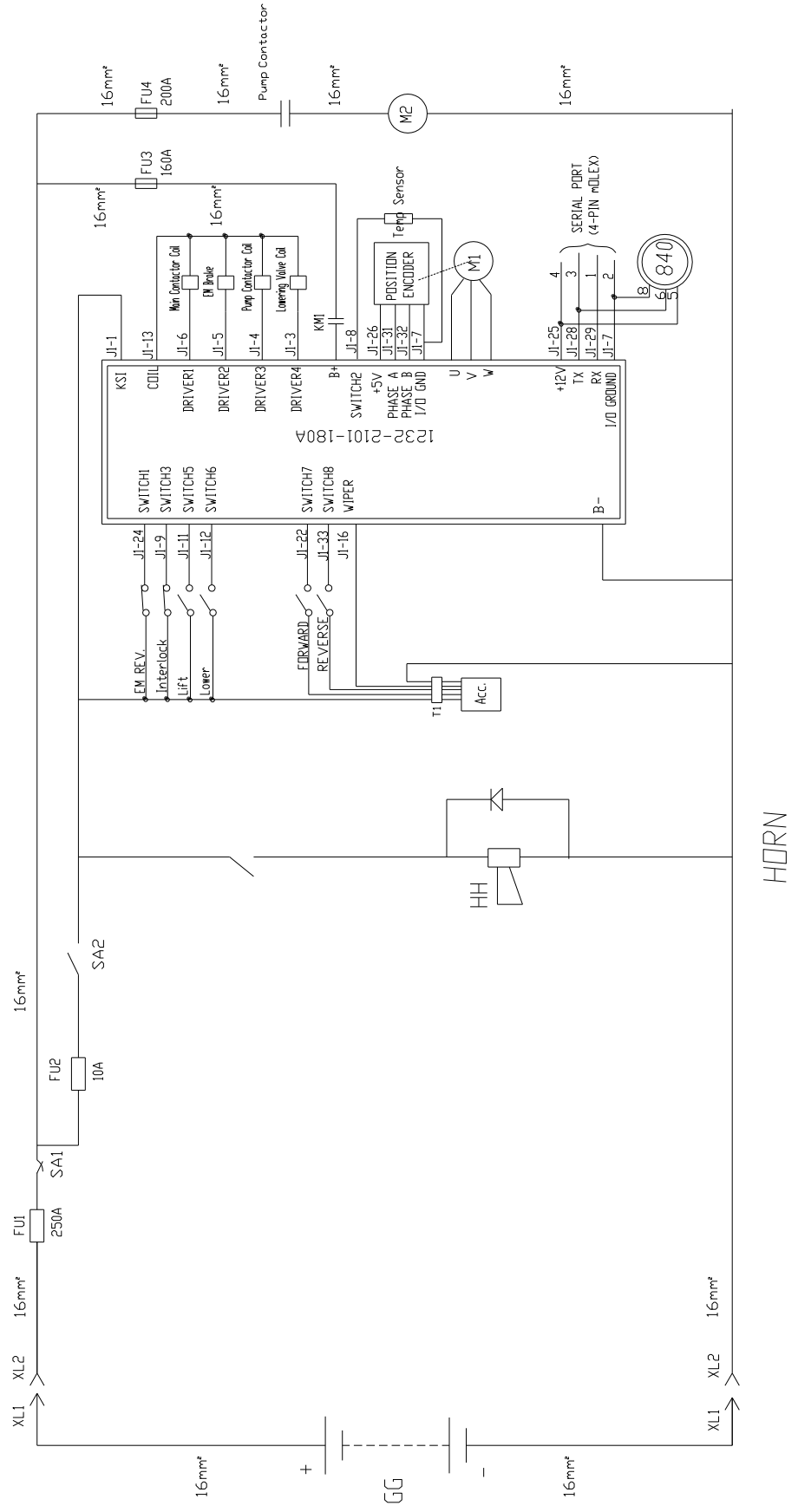
Electric system of this truck is double wire system, all circuits do not ground. Working voltage is DC24V.



1. Instrument
2. Emergency stop switch
3. Key switch
4. Relay
5. Electric horn
6. Contactor
7. Fuse protector
8. AC motor controller
9. Main wiring harness
10. Fuse protector
11. Fuse
12. Truck power cable assy

Fig. 2-7 Electric system

3.1 Electrical schematic diagram



Electrical schematic diagram of code corresponding to the electrical components:

Code	Name	Specification	Q'ty
GG	Battery	2V 210A.h	12
	Battery	2V 240A.h	12
HH	Horn	24V	1
FU1	Fuse	250A	1
FU2	Fuse	10A	1
FU3	Fuse	160A	1
FU4	Fuse	200A	1
SA1	Tight stop button	125A	1
SA2	Key switch	10A	1
M1	Traction motor	1.1kW	1
M2	Pump motor	2.2kW/3.0kW	1
KM1	Connectors	2V	1

3.2 AC motor controller

3.2.1 Maintenance

AC motor controller, fuse protector and fuse are installed on the electronic control mounting bracket, when mounting the controller, apply heat conduction silicon grease to its bottom.

Maintenance

Controller has no user repair parts. Do not try to open, repair or alter the controller. Otherwise it may damage the controller and also invalid the guarantee.

It's suggested to keep the controller clean and dry, periodically check and get rid of diagnose historical files.

Cleaning

Periodically clean the outside controller is good for preventing corrosion or other controller fault from dirty, dust and chemical, which is part of the environment and always exist in battery power supply system.

Be careful when operating the truck power supplied by battery. Including but not limit to the following: correct training, wear goggles, do not wear loose clothing and jewelry.

Carry out maintenance according to the following cleaning procedure. Never clean the controller with high pressure washer.

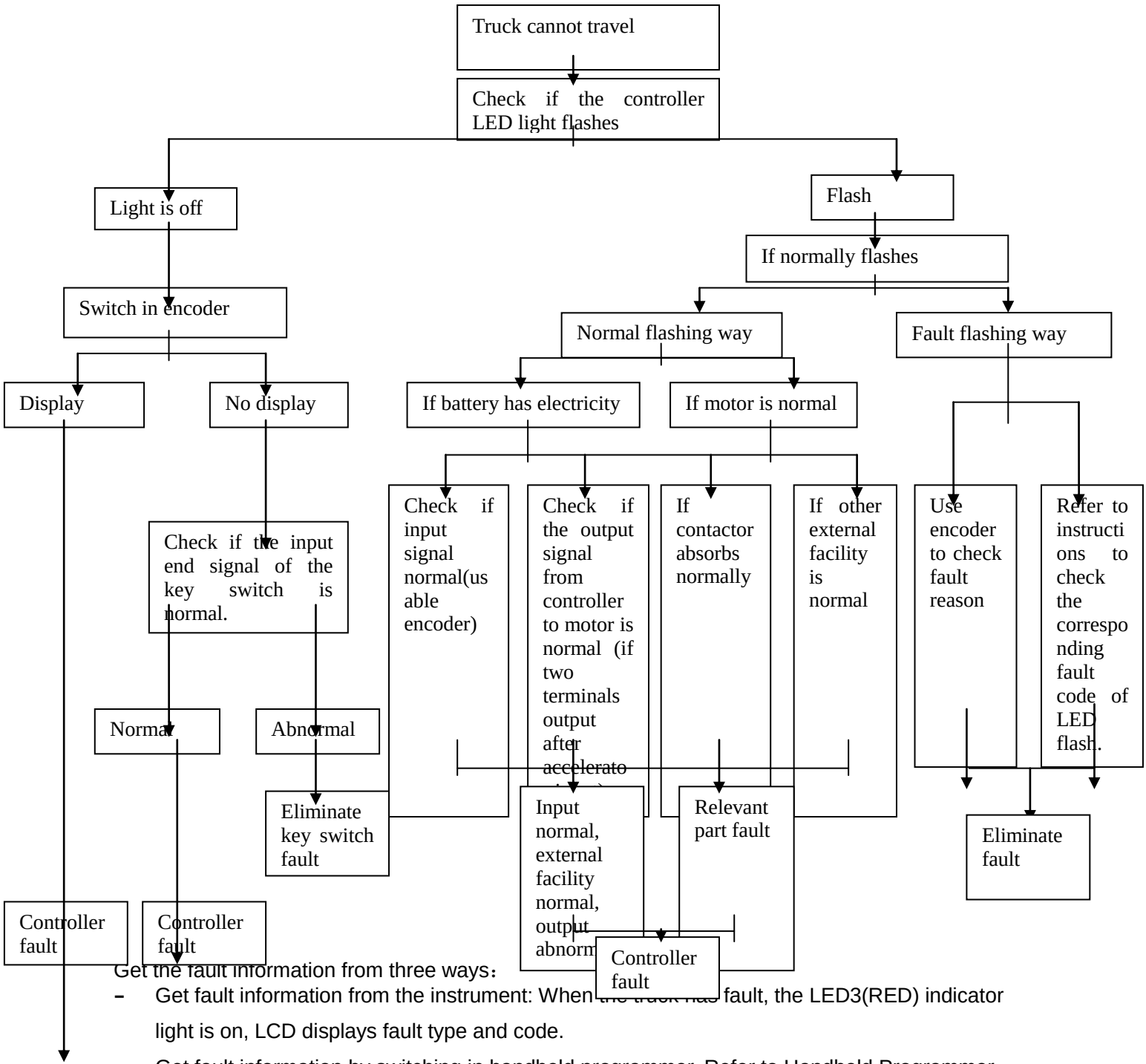
- Remove battery to disconnect power.
- Connect load(like contactor coil or horn) between controller B+ and B- to discharge controller capacity.
- Clean dirt or corrosive on the power and signal binding post. Wipe the controller with wet cloth, dry the controller before connecting the battery. Controller can't suffer the water impact with pressure.
- Make sure the wiring is correct and fastened.

WARNING

- **Strictly prohibit water in the product. Strictly prohibit operating with electricity. Strictly prohibit reverse polarity. Strictly prohibit motor short circuit.**

3.2.2 Diagnosis and troubleshooting

Diagnosis procedure



Get the fault information from three ways：

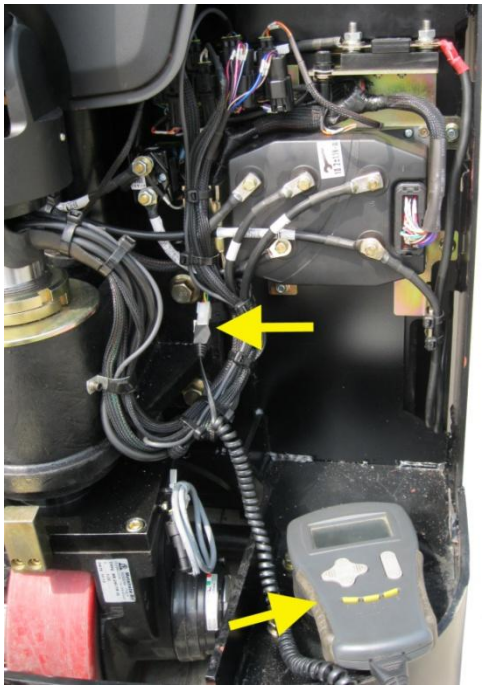
- Get fault information from the instrument: When the truck has fault, the LED3(RED) indicator light is on, LCD displays fault type and code.
- Get fault information by switching in handheld programmer. Refer to Handheld Programmer.
- Get fault information by observe controller built-in LED indicator lights. Refer to LED Status Indicator.

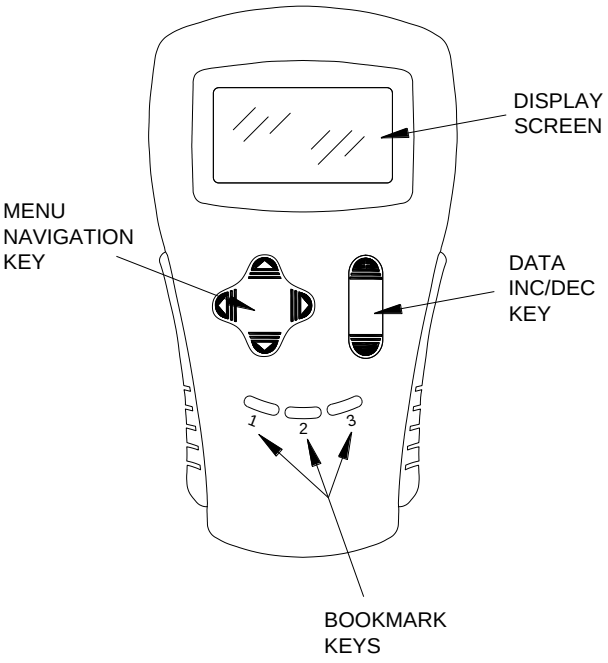
1311 Handheld Programmer

1311Handheld Programmer is a handheld tool that allows user programming, testing and diagnosing the traction motor controller, refer to the following picture. Program setting handheld terminal owns one menu navigation key, one data Inc/Dec key and three bookmark keys to control all programmable functions.

Display window includes a seven-line 128 × 64 pixel LCD screen, this screen can show the test and pictures at the same time, visible in the lightest condition, and adjust program to set menu.

Program is driven by the menu, and enters the next menu by pressing menu navigation button. When the program is connected to motor controller, all motor controller information uploads to the handheld programmer.





Display screen： It can show seven-line test and pictures at the same time.

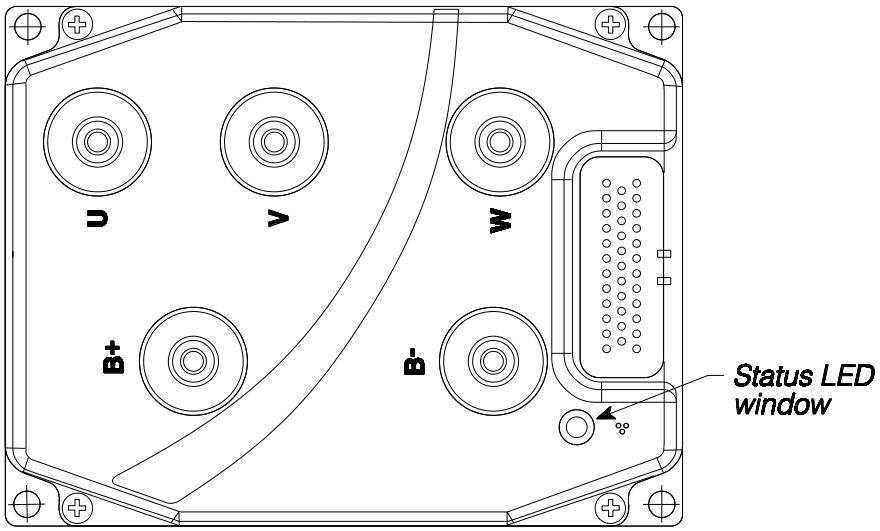
Menu navigation key： Move the cursor on the screen up or down to pass the menu list(up or down arrow),open or close submenu(right or left arrow)

Data Inc/Sec key： Alter data values by display cursor.

Bookmark key： Three bookmark keys allow you to return fast or reach your favor or often use menu interface without through the menu navigation. Press on the relevant bookmark button for 4 seconds, it can store relevant menu interface to this button. Press the relevant bookmark key, it can skip to the corresponding menu interface of your chosen bookmark. After close the programmer, the bookmark button will not be kept.

3.2.3 LED Status Indicator

Controller built in one LED status indicator light(display red or yellow)



Display	Information
LED light is off	Controller power is not on; or vehicle has dead battery; or other severe damage.
LED light flashes yellow	Controller is in normal working status.
LED light is often red	Controller failed to supervise or did not load software. Restart KSI cycle, load software if necessary.
LED flashes yellow or red alternately	Controller has detected a fault.

Red and yellow lights flash alternately in a repeated interval. Each code consists of two digits. Numbers of yellow lights flash means the figure of the fault code relevant position. Red flashes once or twice stands for the following yellow flashes stands for the first or second of the fault code; the yellow LED then flashes the appropriate number of times for the first digit. The red LED flashes twice to indicate that the second digit of the code will follow; the yellow LED flashes the appropriate number of times for the second digit.

For example, fault code “23” LED status indicator light shows as follows:

Red	Yellow	Red	Yellow
✱	✲✲	✱✱	✲✲✲
（the first digit）（2）		（the second	digit）（3）

3.2.4 Fault code table

This fault codes provide the following information:

- Fault code
- Display fault name on the Curtis programmer
- Display caused by the fault
- Probable fault reason
- Fault deep reason
- Troubleshooting

When there is fault, if it's affirmed not the wiring error or truck malfunction, you can try to restart through key switch. If fault still exists, please turn down key switch, check if the connector of pin 35 connects right or gets dirt, after repair and clean , reconnect, and then start again.

Fault code table

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
12	**Controller Overcurrent** Motor stops working Main connector disconnects EM brake shutdown Throttle invalid Brake Pump stops working	1. External short of phase U,V,W motor connections 2. Motor parameters do not match.。 3. Controller malfunction	Reason：Phase current exceeds limited current Troubleshooting：restart the key switch
13	**Current Sensor Fault** Motor stops working Main connector disconnects Electromagnetic brake disconnects Throttle invalid Brake, Pump stops working	1. Leakage to vehicle frame from phase U,V, or W 2. Controller malfunction	Reason：Deviation reads out to controller current sensor. Troubleshooting：restart the key switch
14	**Precharge Failed** Motor stops working Main connector disconnects Electromagnetic brake disconnects Throttle invalid Brake Pump stops working	1. External load on positive terminal of the capacitor that prevents the capacitor from charging.	Reason：Key switch input voltage failed to charge the capacitor. Troubleshooting： Reset or re-input interlock switch through VCL function precharge().
15	**Controller Severe Undertemp** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle failure Brake Pump stops working	1. Severe controller working environment.	Reason：Radiator temperature is lower than -40℃. Troubleshooting：Raise the temp above -40℃, restart the key switch or interlock switch.
16	**Controller Severe Overtemp** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle failure Brake, pump stops working	1. Severe controller working environment. 2. Truck overloads. 3. Incorrect controller mounting	Reason：Radiator temperature is higher than 95℃. Troubleshooting：Drop the temp below 95℃. Restart the key switch or interlock switch.
17	**Severe Undervoltage** **Too low voltage** Driving torque reduce	1. Setup error of battery parameter. 2. Power consumption of non controller system. 3. Too large battery impedance. 4. Battery disconnects. 5. Fuse protector disconnect, or the main contactor disconnect.	Reason： When MOSFEET axle working, capacitor voltage is lower than the minimum voltage limit. Troubleshooting： Raise the capacitor voltage.
18	**Severe Overvoltage** **Overhigh voltage** Motor stops working Main contactor disconnects Electromagnetic brake disconnects	1. Setup error of battery parameter. 2. High battery impedance. 3. Battery disconnects when regenerative breaking.	Reason：When MOSFEET axle working, capacitor voltage exceeds the minimum voltage limit. Troubleshooting： Reduce the

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
	Throttle invalid Brake Pump stops working		voltage and then restart the key switch.
21	**Controller Undertemp Cutback** No fault(unless VCL set the incurred fault)	1. Controller works in limited condition. 2. Severe controller working environment.	Reason：Radiator temperature is lower than-25℃. Troubleshooting：Make the radiator temperature higher than -25℃.
22	**Controller Overtemp Cutback** Drive or regenerative braking torque reduces.	1. Severe controller working environment. 2. Truck overloads. 3. Incorrect controller mounting	Reason：Radiator temperature exceeds 85℃. Troubleshooting：Reduce the temperature.
23	**Undervoltage Cutback** Driving torque reduces	1. Insufficient battery power. 2. Setup error of battery parameter. 3. Power consumption of non controller system. 4. Too large battery impedance. 5. Battery disconnects. 6. Fuse protector disconnects or main contactor disconnects.	Reason：Too low capacitor voltage. Troubleshooting：Raise capacitor voltage.
24	**Overvoltage Cutback** Regenerative braking torque reduces.	1. During regenerative braking, regenerative braking current cause the raising of battery voltage. 2. Setup error of battery parameter. 3. Too large battery impedance. 4. When regenerating braking, battery disconnects.	Reason：When MOSFEET axle working, capacitor voltage exceeds the maximum voltage limit. Troubleshooting：Reduce capacitor voltage.
25	**+5V Supply Failure** No fault(unless VCL set the incurred fault)	1. External load impedance is too low.	Reason：5V supply outside the 5V±10% range Troubleshooting：Bring voltage within range.
26	**Digital Out 6 Failure** **Digital Out 6 driver is not active.**	1. External load impedance is too low.	Reason：Digital Output 6 current exceeds15mA. Troubleshooting：Adjust load, set “set_digout()” by VCL, and restart.
27	**Digital Out 7 Overcurrent** **The Digital Out 7 driver is not active**	1. External load impedance is too low.	Reason：Digital Output 7 current exceeds15mA. Troubleshooting：Adjust load, set “set_digout()” by VCL, and restart.
28	**Motor Temp Hot Cutback** Driving torque reduced.	1. Motor temperature reaches or exceeds parameter limit, thus cause current output reduce. 2. Motor temperature parameters incorrect. 3. If motor does not apply temperature sensor, programming parameter “Temp compensation” and “Temp cutback” must set “OFF”.	Reason：Input voltage value of motor temperature sensor is 0 or larger than 10V. Troubleshooting：Return the motor temperature to be within the permitted limits.
29	**Motor Temp Sensor Fault** Max. speed drops to LOS status and motor temperature cutback invalid.	1. Motor temperature sensor is connected wrongly. 2. If motor does not apply temperature sensor, programming parameter “Temp compensation” and “Temp cutback” must set “OFF”.	Reason：Input voltage value of motor temperature sensor is 0 or larger than 10V. Troubleshooting: Adjust input voltage value of motor temperature sensor to the normal scope.
31	**Coil 1 Driver Open/Short** Driver 1 output shut	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason：Driver 1 (pin 6) is either open or shorted. This fault can be set only when “Main Enable” set to “OFF”. Troubleshooting：Correct open or

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
			short circuit, restart output.
31	**Main Contactor Coil Open/Short** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle invalid Brake Pump stops working	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason： Main contactor driver (pin 6) is either open or shorted. This fault can be set only when “Main Enable” set to “ON”. Troubleshooting：Correct open circuit/short circuit, restart output.
32	**Coil2 Driver Open/Short** Driver 2 output shut	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason： Driver 2 output(pin 5) is either open or shorted. This fault can be set only when “EM brake Type” set to 0. Troubleshooting：Correct open or short circuit, restart output.
32	**EM Brake Open/Short** Electromagnetic brake disconnects Throttle invalid Brake	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason： EM Brake output(pin 5) is either open or shorted. This fault only occurs when “EM brake Type” set to 0. Troubleshooting：Correct open or short circuit, restart output.
33	**Coil3 Driver Open/Short** Driver 3 output shut	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason：Driver 3 output (pin 4) is either open or shorted Troubleshooting：Correct open or short circuit, restart output.
34	**Coil4 Driver Open/Short** Driver 4 output shut	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason：Driver 3 output (pin 3) is either open or shorted Troubleshooting：Correct open or short circuit, restart output.
35	**PD Open/Short** PD shut	1. Connected load open or short. 2. Connecting pin stained. 3. Wrong wiring.	Reason：PD(pin 2) is either open or shorted Troubleshooting：Correct open or short circuit, restart output.
36	**Encoder Fault** Electromagnetic brake disconnects	1. Motor encoder error. 2. Wrong wiring.	Reason：Encoder fault Troubleshooting：Restart key switch.
37	**Motor Open** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle invalid Brake Pump stops working	1. Motor phase is open. 2. Wrong wiring.	Reason：Motor phase, U,V,W detected open Troubleshooting：Check phase and restart the key switch.
38	**Main Contactor Welded** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle invalid Brake Pump stops working	1. Main contactor tips are welded. 2. Motor phases U and V is disconnected or open. 3. An alternate voltage path is providing a current to capacitor(B+ connection terminal)	Reason：Main contactor keep too much connecting, capacitor voltage can’t discharge. Troubleshooting：Restart the key switch
39	**Main Contactor Did Not Close** Motor stops working Main contactor disconnects Electromagnetic brake disconnects Throttle invalid Brake Pump stops working	1. Main contactor does not close 2. Contactor contacts have oxidized, melted, or connection status is unstable. 3. External load on the capacitor. 4. Fuse protector disconnects.	Reason：When the main contactor is closed, capacitor voltage does not charge B+ voltage. Troubleshooting：Check the contactor, restart the key switch.
41	**Throttle Wiper High** Throttle invalid	1. Throttle pot wiper voltage too high	Reason： Throttle pot wiper(pin 16) voltage is higher than the high fault threshold(can be changed with the VCL function

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
			setup_pot_faults()） Troubleshooting： Reduce the throttle pot wiper voltage
42	**Throttle Wiper Low** Throttle invalid	1. Throttle pot wiper voltage too low	Reason： Throttle pot wiper(pin 16) voltage is lower than the low fault threshold(can be changed with the VCL function setup_pot_faults()） Troubleshooting： Raise the throttle pot wiper voltage
43	**Pot 2 Wiper High** Full brake	1. Pot 2 wiper voltage too high	Reason：Pot 2 wiper(pin 17) voltage is higher than the high fault threshold(can be changed with the VCL function setup_pot_faults()） Troubleshooting：Reduce the pot wiper voltage
44	**Pot2 Wiper Low** Full brake	1. Pot 2 wiper voltage too low.	Reason： Pot 2 wiper(pin 17) voltage is lower than the low fault threshold(can be changed with the VCL function setup_pot_faults()） Troubleshooting：Increase the pot wiper voltage
45	**Pot Low Overcurrent** Throttle invalid Full brake	1. Potentiometer impedance is too low.	Reason： Pot low end (pin 18) exceeds 10mA. Troubleshooting: Reduce low end current, restart the key switch
46	**EEPROM Failure** Motor stops Main contractor stops. EM brake stops Throttle stops Interlock stops Driver1-4 stop PD stops Brake Pump stops	1. Error writing to the EEPROM. It may be caused by VCL writing to EEPROM, or CANBUS, or incorrect parameter editing.	Reason：Controller system tries to write into EEPROM but failed. Troubleshooting：Download correct software(OS), set correct parameter, and then restart the key switch.
47	**HPD/Sequencing Fault** Throttle invalid	1. Wrong sequence setting of key start, interlock, direction and throttle input sequence setting. 2. Wiring, switch key, interlock, direction or throttle input fault.	Reason：The wrong input of key start, interlock, direction and throttle cause HPD and sequencing fault. Troubleshooting ： Re-input according to correct sequence.
47	**Emer Rev HPD** Throttle invalid	1. Emer Rev already finished, but the throttle, forward or reverse input and interlock do not return to neutral.	Reason：After Emer Rev finishes, each input does not return to neutral, that cause the fault. Troubleshooting ： Re-input according to correct sequence.
49	**Parameter Change Fault** Motor stops working Main contractor stops working EM brake stops working Throttle invalid Brake Pump stops working	1. In order to protect truck safety, change of certain special parameter is only valid after restart the key switch.	Reason：Parameter change needs restart of the key switch. Troubleshooting：Restart the key switch
51-67	**OEM Faults**	1. Users can define fault by themselves, show the fault through VCL code.	Define according to users themselves.
68	**VCL RunTime Error** Motor stops	1. VCL runtime.	Reason：VCL runtime error.

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
	Main contactor stops EM brake stops Accelerator stops Interlock stops Driver 1-4 stop PD stops Brake Pump stops		Troubleshooting：Edit VCL software and correct, check new software to make correct parameter matching; restart the key switch.
69	**External Supply Out of Range**	1. External load on 5V and 12V supplies too high or too low. 2. Parameter error in the Checking Menu, like “ExtSupply Max”，,“Ext Supply Min”	Reason：Upper limit of external power supply(total current: 5V(pin 26) and 12V(pin 25) is defined by External Supply Max and lower limit is defined by External Supply Min Troubleshooting：Adjust external current.
71	**OS General** Motor stops Main contactor stops EM brake stops Accelerator stops Interlock stops Driver 1-4 stop PD stops Brake Pump stops	1. Inner controller invalid.	Reason：Inner controller invalid. Troubleshooting：Restart the key switch.
72	**PDO Timeout** Interlock stops CAN NMT State set to Preoperational	1. Time between CAN PDO messages received exceeds PDO Timeout Period	Reason：Time between CAN PDO messages received exceeds PDO Timeout Period Troubleshooting：Restart the key switch, or accept CAN NMT message
73	**Stall Detected** EM brake stops Switch the control mode to LOS(Limited operation status)	1. Motor is stalled. 2. Motor encoder fault. 3. Wiring damaged. 4. Problem with power supply for motor encoder.	Reason：No motor encoder is detected. Troubleshooting：Throttle Command=0,Motor RPM=0 Restart the key switch, or detect the effective signal of motor encoder in LOS mode, and set the parameter to Throttle Command=0,Motor RPM=0.
87	**Motor Characterization Fault** Motor stops Main contactor stops EM brake stops Accelerator stops Brake Pump stops	1. Refer to the following code during motor matching： 0=Normal 1= Controller receives encoder signal, but pulse value not defined. Set pulse value manually 2= Motor temperature sensor failure 3= Motor high temperature cutback failure 4= Motor overtemp cutback failure 5= Motor low temperature cutback failure 6= Low voltage cutback failure 7= High pressure cutback f failure 8= Controller can’t detect encoder signal and passage signal disappears. 9= Motor parameter setting exceeds the scope.	Reason： Motor matching process failure. Troubleshooting：Correct the fault and restart the key switch.
89	**Motor Type Fault**	1. Motor type parameter values	Reason：Motor Type parameter

Code	Programmer display Fault display	Probable fault reason	Deep fault reason/troubleshooting
		exceed the range	setting value is an illegal value. Troubleshooting：Reset and restart the key switch.
91	**VCl/OS Mismatch** Motor stops Main contactor stops EM brake stops Accelerator stops Interlock stops 1-4 output stops PD stops Brake Pump stops	1. The controller VCL does not match OS.	Reason：The controller VCL does not match OS. Troubleshooting：Update new VCL and OS.
92	**EM Brake Failed to Set** EM Brake failure Throttle invalid	1. Truck continues to move after the EM brake has been commanded to set 2. Small EM braking force.	Reason：After EM brake locks, the truck still moves. Troubleshooting：Check if the throttle works normal.
93	**Encoder LOS (Limited Operating Strategy)**	1. LOS activated due to motor installing or encoder fault. 2. Wrong wiring. 3. Truck is stalled	Reason：LOS activated due to motor installing or encoder fault. Troubleshooting：Restart the key switch，if it is caused by motor installing, make sure encoder work under normal condition, Throttle Command=0,Motor RPM=0.
94	**Emer Rev Timeout** EM Brake failure Throttle invalid	1. Emer Rev timeout activated due to EMR Timer overdue 2. Emer Rev switch is always at ON position.	Reason：Emer Rev function activated to operate until Emer Rev timing end. Troubleshooting：Check Emer Rev switch.
98	**Illegal Model Number** Motor stops Main contactor stops EM brake stops Throttle stops Brake Pump stops	1. Controller model can’t be identified. 2. Software and hardware do not match. 3. Controller damage.	Reason：Controller model can’t be identified Troubleshooting：Choose correct controller, and download correct controller software.
99	**Dualmotor Parameter Mismatch** Close main contactor Close EM brake Close accelerator Brake and close the pump	Enable parameter of dualmotor is set as ON, and control mode selecting parameter not set as 0（Speed Mode Express) or 1（Speed Mode）	Reason：When the dual drive software enabled, control mode should set as 0（Speed Mode Express) or 1（Speed Mode）, otherwise there will be fault. Troubleshooting：Adjust to proper value and switch KSI.

Attachment：Table for bolt's tightening torque

Unit：N·m

Bolt's diameter	Grade			
	4.6	**5.6**	**6.6**	**8.8**
6	4～5	5～7	6～8	9～12
8	10～12	12～15	14～18	22～29
10	20～25	25～31	29～39	44～58
12	35～44	44～54	49～64	76～107
14	54～69	69～88	83～98	121～162
16	88～108	108～137	127～157	189～252
18	118～147	147～186	176～216	260～347
20	167～206	206～265	245～314	369～492
22	225～284	284～343	343～431	502～669
24	294～370	370～441	441～539	638～850
27	441～519	539～686	637～784	933～1244

Note： ·Use entirely 8.8 grade bolt in the important joint position.
·Bolt's grade can be found in the head of the bolt, if it can't be found, the grade is 8.8.

Maintenance Record

Date	Repair, maintenance content	Serviceman

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