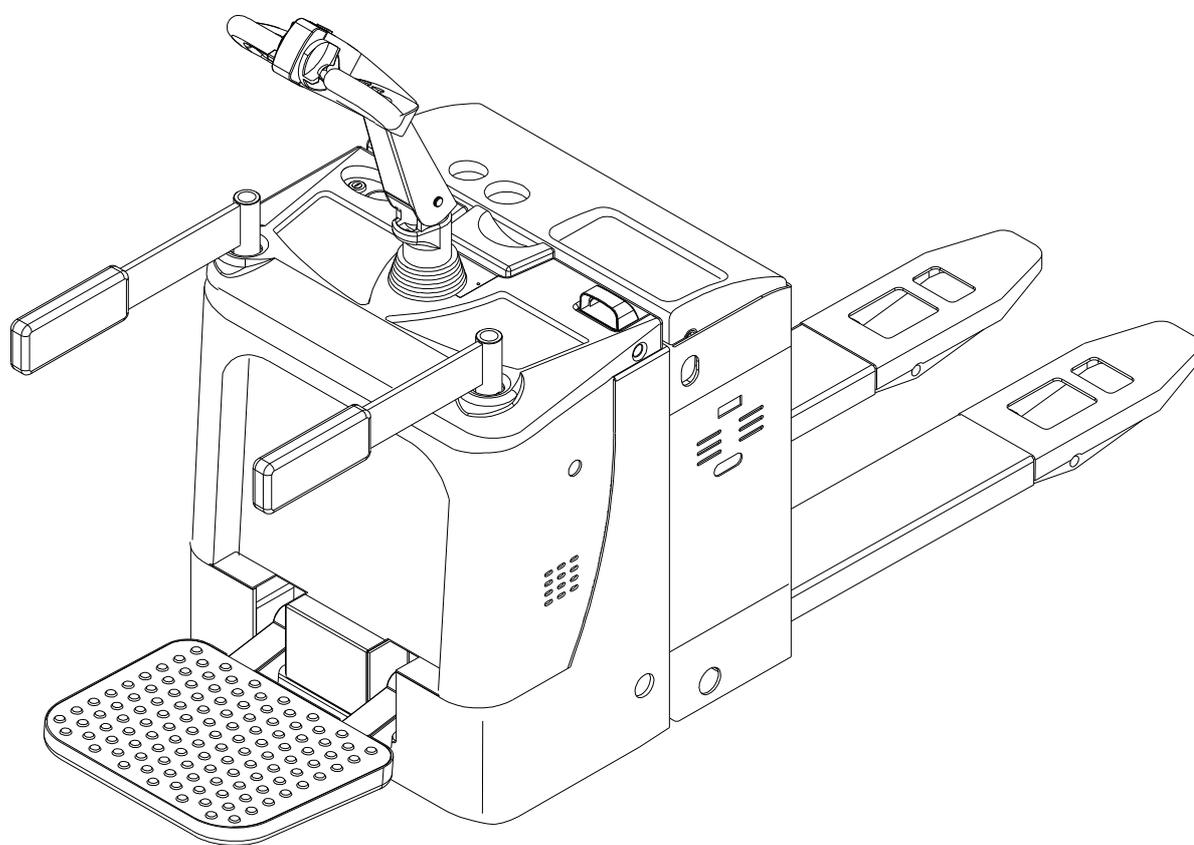


- Operation Manual
- Service Manual



**Welcome to choose "HYUNDAI" electric pallet truck!**

**We hope our electric trucks will bring great convenience to your work!**

- **Please read the manual carefully before operation.**
- **This manual is a common manual. We reserve the right to modify technology of the electric pallet truck. If there is anything in the manual that is not consistent with the actual truck, the actual truck should be considered correct and the manual is only for reference.**

\*\*\*\*\*

## Warning

- Operators must strictly conform to ISO/DIS 3691-1.3:2008 "Safety Specifications of Motor Industrial Vehicles". Untrained personnel are not allowed to operate the truck.

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- Unauthorized truck modification is not permitted.
- No modifications or alterations to a powered industrial truck, which may affect, for example, capacity, stability or safety requirements of the truck, shall be made without the prior written approval of the original truck manufacturer, its authorized representative, or a successor thereof. This includes changes affecting, for example braking, steering, visibility and the addition of removable attachments. When the manufacturer or its successor approve a modification or alteration, they shall also make and approve appropriate changes to capacity plate, decals, tags and operation and maintenance handbooks.
- Only in the event that the truck manufacturer is no longer in business and there is no successor in the interest to the business, the user may arrange for a modification or alteration to a powered industrial truck, provided, however, that the user shall:
  - a) Arrange for the modification or alteration to be designed, tested and implemented by an engineer(s) expert in industrial trucks and their safety;
  - b) Maintain a permanent record of the design, test(s) and implementation of the modification or alteration;
  - c) Approve and make appropriate changes to the capacity plate(s), decals, tags and instruction handbook;
  - d) Affix a permanent and readily visible label to the truck stating the manner in which the truck has been modified or altered together with the date of the modification or alteration, and the name and address of the organization that accomplished the tasks.

## Brief introduction :

20EPR/25EPR series electric pallet truck is powered by storage battery, and driven by motor. This kind of truck travels by means of gear transmission. The fork is lifted by means of DC motor and hydraulic actuation, which motivate hydraulic cylinder up and down to lift fork and goods together. As this truck is electrically driven for traveling and lifting, it possesses many characteristics as labor-saving, high efficiency, stability in operation, simple and easy operation, safety and reliability, little noise and environmental friendly, etc. This truck adopts 24V large capacity battery cell, which greatly extends service time within one charge.

The kind of truck is applicable for goods transportation on hard and flat ground.

Allowed environment for using : Height above sea level shall not be over 1000m;

- a. Ambient temperature shall not be higher than +40°C and no lower than -25°C;
- b. When the ambient temperature reaches +40°C, the relative humidity should not exceed 50%; at a lower temperature, higher relative humidity is allowed.
- c. Hard and flat ground
- d. It is prohibited to use the truck in a flammable, explosive or corrosive environment with acid and alkali.

## Description:

The instruction manual shall be kept by the operator, and shall be read by the operator until he gets a full understanding.

The instruction manual is composed of correct operation, convenient and simple maintenance, and routine inspection.

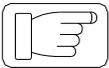
The instruction manual shall be carefully read before operation, for purpose of correct drive and suitable maintenance to ensure safe and effective material transportation.

The instruction may be in disagreement with practical product due to product innovation.

The instruction manual shall be accompanied with in case of truck leasing or transfer.

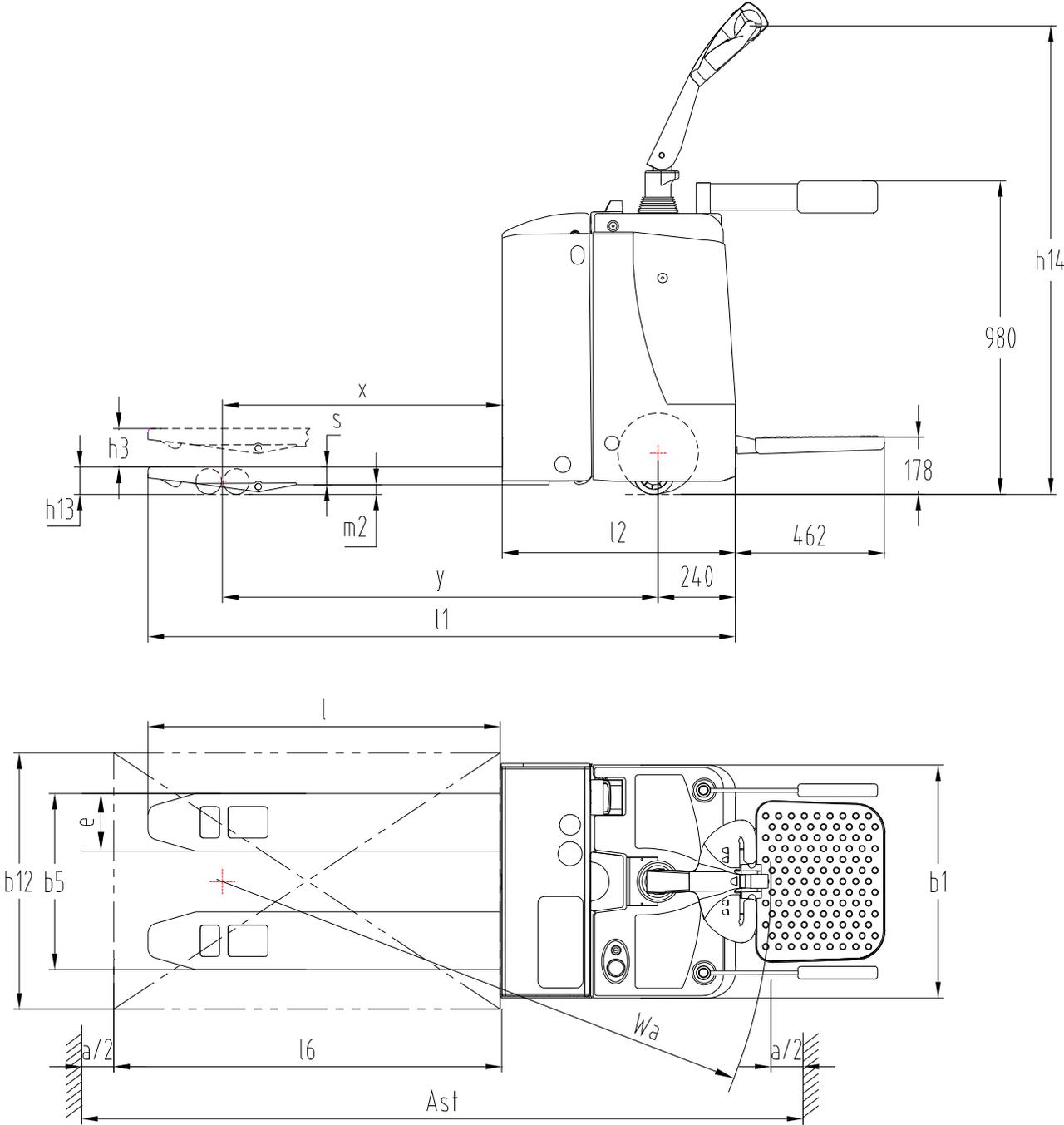
Please come into contact with our sales department in case of any problem.

Description of symbol: Regulations of the following symbols are of great importance to your safety and others as well.

	Danger	Indicates an impending danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Warning	Indicates a potential danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Caution	Indicates a potential danger. Moderate injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Notice	You shall pay attention to statements that are in direct or indirect relation with personal security and truck maintenance.

# I. Technical parameters:

## 1. 20EPR/25EPR Outline drawing:

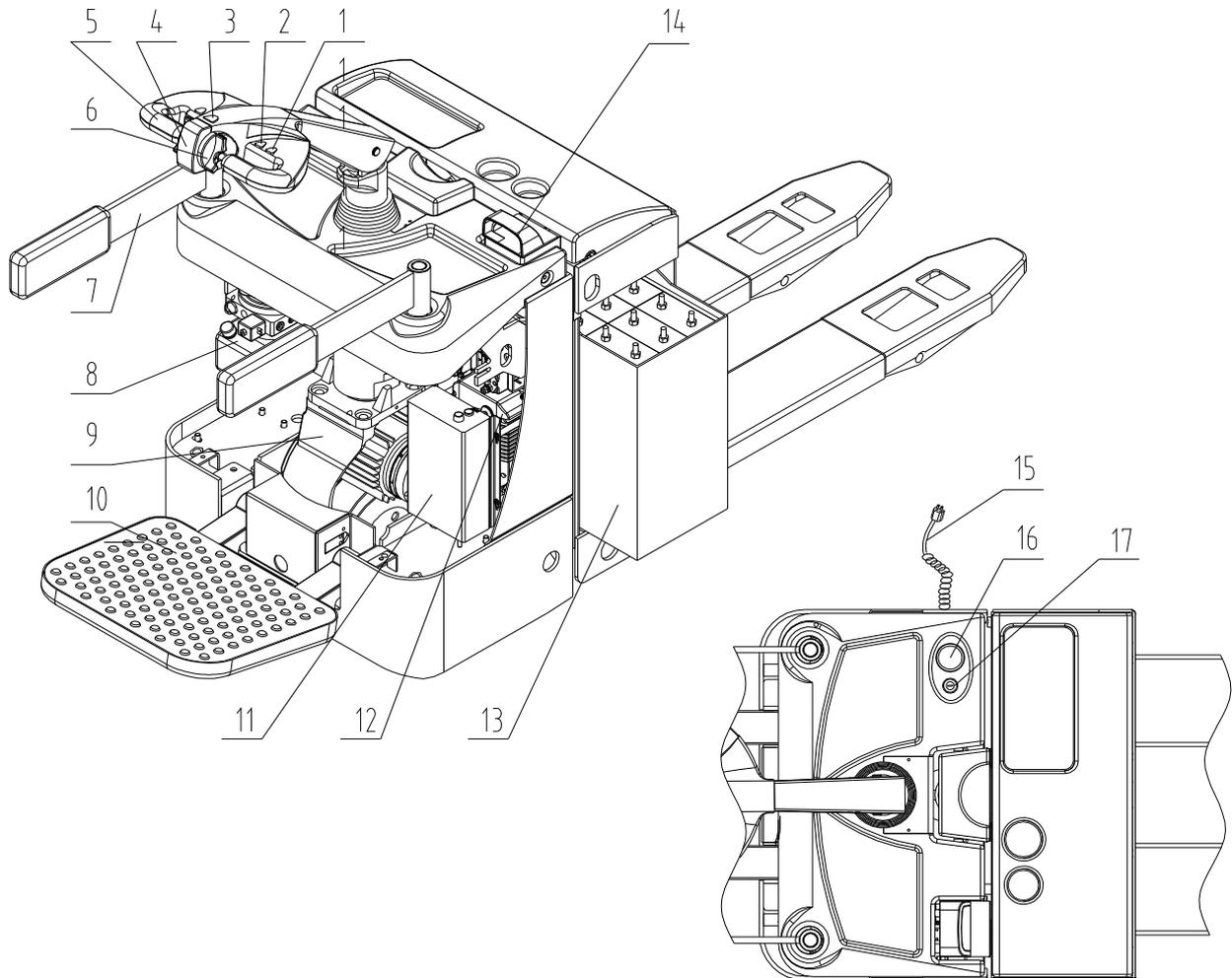


## 2、 Main technical parameter

Characteristics	1.2	Model		20EPR	25EPR
	1.3	Driving model : Electric(storage battery), diesel, gasoline, fuel gas		Electric	Electric
	1.4	Driving model ( Manual, Walking, Stand driving, Seat driving ,Order picking)		Stand driving	Stand driving
	1.5	Rated load	Q(kg)	2000	2500
	1.6	Load center distance	c(mm)	600	600
	1.8	Front overhang	x(mm)	818/868/938	818/868/938
	1.9	Tread	Y(mm)	1302/1352/1422	1302/1352/1422
Weight	2.1	Service weight(with battery)	kg	720	720
	2.2	Axle load, front/rear, laden	kg	1640/1030	2040/1180
	2.3	Axle load, front/rear, unladen	kg	160/560	160/560
Wheel chassis	3.1	Wheels (rubber, high elasticity, pneumatic tyre, polyurethane wheel)		polyurethane	polyurethane
	3.2	Wheel dimension, front		Φ250×70	Φ250×70
	3.3	Wheel dimension, rear		Φ80×70	Φ74×70
	3.4	Additional wheel(dimension)		Φ127×57	Φ127×57
	3.5	Wheel number, front/rear ( x = driving wheel)		1X+2/4	1X+2/4
	3.6	Tread, front	b <sub>10</sub> (mm)	491	491
	3.7	Tread, rear	b <sub>11</sub> (mm)	340/370/470/505	340/370/470/505
Dimension	4.4	Lift height	h <sub>3</sub> (mm)	120	120
	4.9	Min. /Max. height of operation handle, in driving position	h <sub>14</sub> (mm)	1150/1450	1150/1450
	4.15	Height, lowered	h <sub>13</sub> (mm)	75/85	75/85
	4.19	Overall length	l <sub>1</sub> (mm)	1823/1873/1943	1823/1873/1943
	4.20	Length to fork face	l <sub>2</sub> (mm)	723	723
	4.21	Overall width of truck body	b <sub>1</sub> (mm)	733	733
	4.22	Fork dimension	S/e/l(mm)	53×180×1100(1150/1220)	53×180×1100(1150/1220)
	4.25	Overall width of fork	b <sub>5</sub> (mm)	520/550/650/685	520/550/650/685
	4.32	Wheelbase ground distance	m <sub>2</sub> (mm)	30	30
	4.33	Aisle width, with pallet 1000x1200 crosswise	A <sub>s1</sub> (mm)	2135/2185/2255	2135/2185/2255
	4.34	Aisle width, with pallet 800x1200 lengthwise	A <sub>s2</sub> (mm)	2235/2235/2255	2235/2235/2255
	4.35	Turning radius	W <sub>6</sub> (mm)	1700/1750/1820	1700/1750/1820
Performance Data	5.1	Traveling speed, laden/unladen	Km/h	7.9/8	6.7/6.8
	5.2	Lifting speed, laden/unladen	m/s	0.03/0.032	0.03/0.032
	5.3	Descending speed, laden/ unladen	m/s	0.032/0.03	0.032/0.03
	5.7	Gradeability, laden/unladen	%	4/8	3/8
	5.8	Max. gradeability, laden/unladen	%	8/20	6/20
	5.10	Traveling brake		regenerative brake +electromagnetic brake	regenerative brake +electromagnetic brake
Motor	6.1	Driving motor power	kW	1.5	1.5
	6.2	Lifting motor power	kW	1.5	1.5
	6.3	Battery voltage/rated capacity	V/Ah	24/240	24/240
	6.4	Battery weight	Kg	240	240
	6.5	Battery dimension (LXWXH)	mm	650×250×505	650×250×505
	7.1	Noise level at operator's position	dB(A)	73	73
	7.2	Measurement uncertainty	dB(A)	1.5	1.5
	8.1	Vibration on till	m/s <sup>2</sup>	0.13	0.13
	8.2	Measurement uncertainty	m/s <sup>2</sup>	0.05	0.05

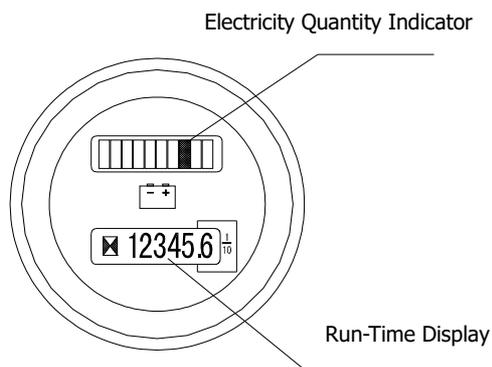
## II . Structure description :

### 1. Structure of the entire truck :



- |                    |                              |                        |                            |                   |
|--------------------|------------------------------|------------------------|----------------------------|-------------------|
| 1 Lifting button   | 2 Lowering button            | 3 Horn button          | 4 Emergency reverse button | 5 Steering handle |
| 6 Accelerator knob | 7 Guardrail                  | 8 Hydraulic power unit | 9 Drive unit               | 10 Standing pedal |
| 11 Charger;        | 12 Electric control assembly | 13 Storage battery     | 14 Power switch            | 15 Electric lock  |
| 16 Instrument      | 17 Charging plug             |                        |                            |                   |

### 2 Function introductions of instrument and operational control pieces :



#### (1) instrument:

This instrument is a combination of battery capacity indicator and LCD hour meter, with the battery indicator of ten segments of colorful LED display (5 red segments, 3 yellow segments and 2 red LED). When battery discharges by 70% capacity, one red flicker lamp shows "energy storage" alarm. When the battery discharges by 80%, two red flicker lamps show "energy exhaust". After the external power supply is cut off, the internal battery can generally keep a memory of 10 years. The life service time for monitoring of instrument is 99999.9 hours recorded on LCD displays. Hour

meter resets automatically and continue to time and display. Only if it is connected to battery, LCD hour meter will start working. This instrument possesses high reliability under extremely bad environment.

(2)Steering system:

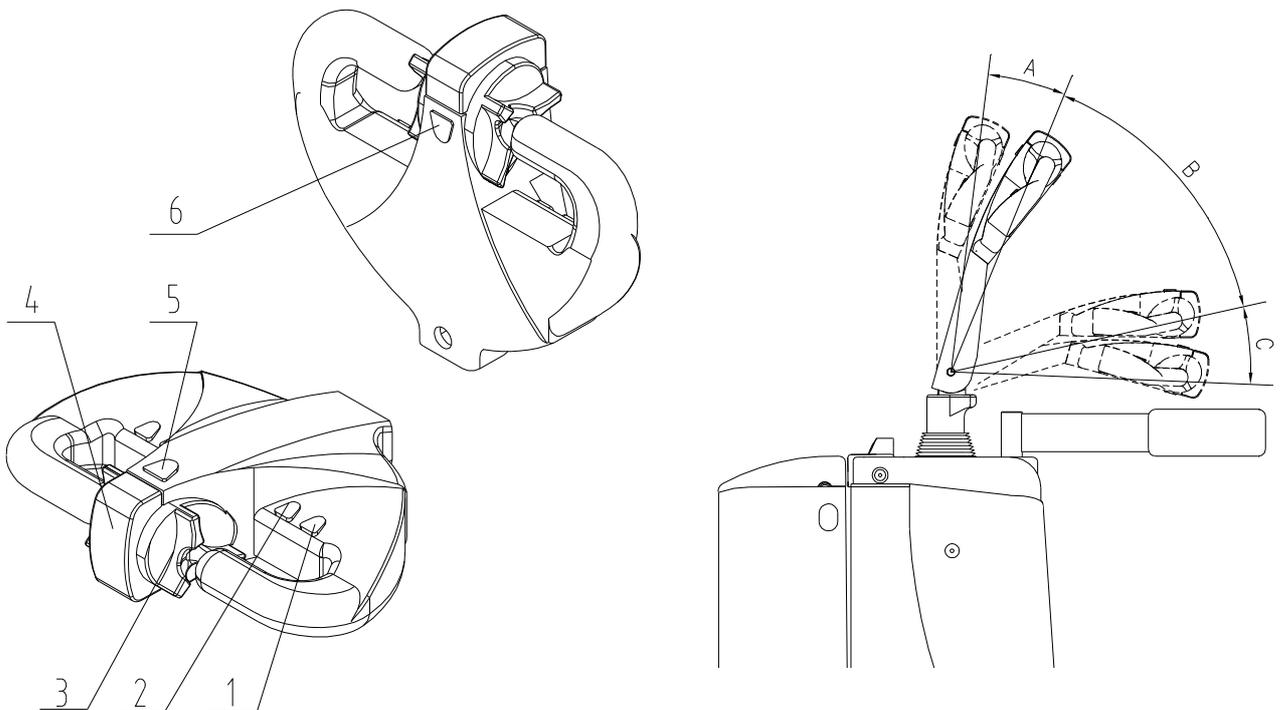
The steering system mainly composes of operation handle, steering device shaft, and floating support bearings. The system is used to control travel direction of the truck.

(3) Braking:

The brake of this truck is electromagnetic. When the accelerator pedal is released, the electromagnetic arrester will be out of power and braked. When the accelerator is released during the traveling of the truck, the controller will carry out electric brake at first. This kind of brake is regenerative braking and can turn the dynamic energy to electric energy which can be recharged to battery. When the truck is stopped, the electromagnetic arrester will be out of power and braked again. This electromagnetic brake type not only prolongs the service time of storage battery and arrester but also reduces the wearing of the brake plate.

(4) Operation control:

- 1) Lifting and lowering operation: Press the lowering button of the forks, the forks will descend. While the lifting button is pressed, the fork will rise.



1. Lifting button 2.Lowering button 3.Accelerator knob 4. Emergency reverse button 5. Horn  
6.Slow-down button

- 2) Accelerator knob: It is used to control the travel direction and speed of the electric truck. Before operation of the truck, firstly turn the operation handle to area B shown as above. When the handle is placed in area A or C, the truck will be powered-off and braked. At this time, the truck can not drive. When the operation handle is placed in area B and the acceleration knob is turned in one direction, the truck will travel in that direction. Meanwhile the truck will be accelerated with the increasing of rotation amplitude of the knob. When the accelerator knob is turned in another direction, the truck will travel in another direction. Likewise,

the truck will speed up with the increasing of rotation amplitude of the knob.

- 3) Horn button: Horn of the truck will be turned on if you press the button.
- 4) Emergency reverse button: when the operation handle is placed in area B and the emergency reverse button is pressed, the truck will travel in an opposite direction away from the operator immediately. This is a safety switch which can avoid the operator from being squeezed under unexpected condition.
- 5) Slow-down button: When this button is pressed, the truck will travel at an extremely slow speed. This button is applicable for operation on especially narrow field or on the condition that the truck needs to be accurately located.
- 6) Electric lock: It is used to control switching-on and switching-off of main power supply of the truck. Key of the electric lock shall be kept by the truck driver or personnel who have been specially assigned. Be sure to cut off the main power supply when you leave the truck, and take the key of electric lock, for fear occurrence of accident due to operation carried out by others.
- 7) Power switch: It is used to control emergency power-off of the truck. Pulling up the switch, then main power supply will be cut off, and inserting down represents switching-on. Please immediately pull up the switch to cut off power supply for sake of any occurrence of accident, if your truck were out of control due to some reason.
- 8) Charging plug: This plug is placed in the side hole of the truck. And this plug is connected to the charger with a spring cable. When the battery needs to be charged, take down the plug and insert it into the socket which is connected to network. Then the battery can start to charge. (Battery charger and its accessories are optional parts of the truck, please consult with the authorized representative to buy authentic parts. This part shall fulfill the related safety requirements)
- 9) Pedal and guardrail: The operation mode of this truck is stand driving. Under normal conditions, the standing pedal and guardrail should be open before driving the truck. During operation of the truck, the driver should stand on the pedal. When the working area is relatively narrow, the standing pedal and guardrail can be put away. Then, the maximum traveling speed should not be over 6km/h.

### III. Safety Norms:



#### Warning

Please pay attention to the following items first before operation of the truck:

- 1) This electric truck is only limited to utilization indoor with a hard flat floor. Operation in inflammable, explosive environment or corrosive environment such as acid or alkaline condition shall be strictly forbidden.
- 2) Only drivers who have received formal training or are authorized can be allowed to drive the truck.
- 3) Read this instruction carefully before operation so as to master the performance of the truck; check the truck whether it is in its normal condition before each operation. It is forbidden to use faulty truck; repair by untrained persons is forbidden as well.
- 4) Overloading operation is forbidden.
- 5) As for goods carrying and operation, center of gravity of the goods must be within range of the two forks. It is forbidden to transport loose goods
- 6) The truck shall travels slowly when forks pass in or out of pallet.
- 7) It is strictly forbidden to press the lifting or lowering button during the traveling of the truck. Meanwhile, don't switch lifting and lowering buttons rapidly or frequently, because rapid and frequent lifting or lowering will cause damage to the truck and goods.
- 8) Don't load heavy goods on the forks rapidly.

- 9) Don't lay the goods on the truck for a long time!
- 10) It is strictly forbidden to make sharp turn on narrow aisle. When it is turning, slow down the truck so as to ensure the safety of personnel and goods.
- 11) Descend the forks to the lowest position when the truck is not used.
- 12) It is strictly forbidden to put any part of the body under heavy goods and forks.
- 13) This truck is suitable to be used on flat ground or flat platform. Don't put the truck on the slope for a long time.
- 14) Overloading operation is forbidden. Otherwise the wheel will skid, resulting in the damage of wheel and motor as well as danger of the human body and goods.
- 15) It is strictly to use the truck under stipulated voltage of 20.4V.
- 16) It is strictly forbidden to conduct charge by connecting the plug to AC power directly.

## 1. Safety operation norms :

### (1) Training of driver:



#### Notice

Even though each electric pallet truck may have the same technical parameters, there may be differences on features of braking and acceleration as well. Never drive the truck until you get familiar with all those operations.

### (2) Wear of the driver during truck driving:



#### Notice

Please put on safety shoes and protective clothes. Do not wear clothes that are too loose for sake of being caught, which would result in danger.

### (3) Rules that must be observed:



#### Notice

Never drive the truck when you are tired or un-concentrated, with an injection of drug, or after a liquor drinking.

- Safety rules and regulations shall be observed during operation or maintenance of the truck.

### (4) Safety of working place:



#### Notice

This kind of electric truck is only limited to utilization indoor with a hard flat floor. Operation in inflammable, explosive environment or corrosive environment such as acid or alkaline condition shall be strictly forbidden.

- A Good roadway condition shall be kept and the traffic should be smooth.
- B Sufficient light ray shall be ensured on working place.
- C Fire extinguishing appliances shall be equipped in the places where truck and charging is operated. The extinguishing appliances shall comply with the requirements of extinguishing fire of solid combustible matter and electric apparatus.

D The value of truck noise mentioned in instruction is measured under the condition of new truck running on flat, smooth and hard ground. If the traffic surface is bad or the tyre of truck is damaged, the noise may be amplified.

(5) Integrity of the truck shall be realized:



- A Please observe safety rules and regulations of your working place during operation, inspection, and Maintenance of the truck.
- B No modification or addition shall be made to the truck without written permission by our company. A modification of the truck may have a negative effect on its safe operation.

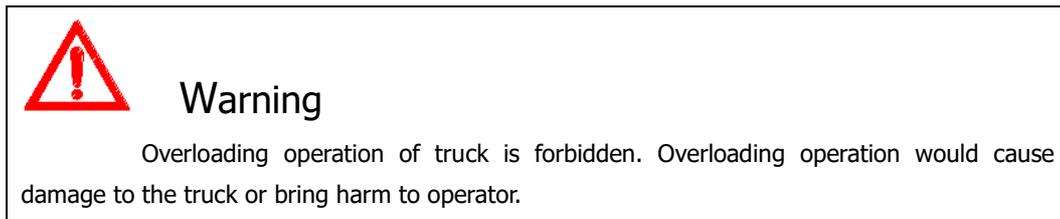
(6) Prepare safety operation procedure:

Safety operation procedure shall be formulated with consideration of practical situations before operation of the truck. Safety shall be taken into full consideration in preparation of the safety operation procedure.

(7) Operation of truck under unsafe condition is strictly forbidden:

- A Operation under unsafe condition is forbidden, such as under conditions with uneven floor, or impeded road. Goods lifting on slope is strictly forbidden.
- B Faulty truck is forbidden to use.
- C Make sure a daily inspection of the truck would be taken. Please immediately repair or replace in case of any abnormal conditions.

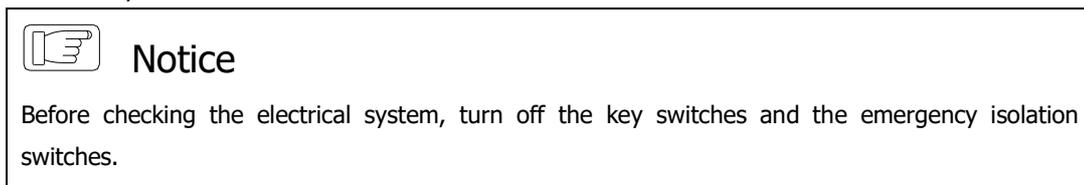
(8) Overloading operation of truck is forbidden:



(9) Use suitable pallet:

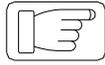
The pallet shall be of suitable dimensions, neither too wide nor too large.

(10) Electrical System Check:



## 2 Safety Operation Specification :

(1) Check the safety condition around the truck:



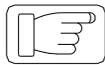
### Notice

Before starting up the truck, please ensure that there is no person around it.



### Notice

If the driver's view is shielded by the bulky goods carried, please drive backwards or drive under the guidance of other working personnel.



### Notice

Ensure no people around the truck when driving backwards.



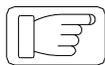
### Notice

Driving through the narrow access shall be guided by working personnel.



### Notice

At crossroad or other places impeditive for view, the driver shall not drive until there is no person at both sides.



### Notice

Keep concentration when operating truck.



### Caution

The driving mechanism of truck is installed on the backside. Due to this difference from common vehicles, the backside of truck swings comparatively fast when turning around. For this reason, to prevent collision with other objects nearby the backside of truck, do drive or turn slowly.

(2) Strictly forbid harsh driving:



### Notice

Never start up, brake or turn abruptly.

Abrupt start-up or braking may cause the falling of goods.  
Abrupt turning during traveling may cause the tilting of truck and result in serious accident.  
Do decelerate and take care to turn.



### Notice

Observe all items of safety rules on working place. Decelerate and sound horn when travel by other truck or vehicles. Avoid driving in places with bad view.



### Notice

Ensure to provide certain clearance between truck and entrance.

(3) Never drive too close to roadside :



### Notice

Ensure to provide enough distance between the truck and roadside or platform edge.

When running on narrow road or platform, keep a certain safety distance with the edge against falling of the truck.



### Warning

Avoid turning or loading and unloading operation on slope; otherwise the truck can go tilting.



### Notice

Once the truck is overturning, the driver should stay far away from the truck rapidly.

### 3 Operation norms :



### Notice

The truck can only carry goods under rated capacity.

1) Forbid overloading operation.

- 2) Forbid deflective transportation.
- 3) Passengers on truck must be forbidden.
- 4) Never push or pull the handle abruptly
- 5) Never use the truck as towing vehicle.
- 6) When transporting over-wide goods, the driver shall be extremely careful to turn slowly to keep balance of the goods. Decelerate when ascent and descent, meanwhile, watch around for sake of safety.
- 7) The faulty truck for future repair must not be parked at places impeditive for traffic. Lower down the fork arms to the lowest position and put on the warning board. Pull off the key.

#### 4 Important notice after operation :

- 1) Parking: Park the truck at appointed place. Never park the truck on slope.  
Ensure the following points to be achieved before leaving away the truck:

- a) Lay down the fork to the lowest position naturally.
- b) Turn the steering wheel to the middle position.
- c) Turn off the key switch.

- 2) Clean up the truck:



**Notice**

When cleaning up the electrical system, use compressed air but not water.

- 3) Charge:



**Warning**

Open flame is forbidden to appear at the charge places, otherwise, explosion or fire disaster can be caused.

- Make a record of charge. As for the charge method, refer to the part about storage battery operation.

## IV. Drive and operation:

### 1. Prepare before operation :



**Warning**

Never use the faulty truck.

a) Before operation, check the truck to make sure: whether oil leakage of hydraulic pipe exists, whether all the supporting wheels work well, whether blocking phenomenon appears. Never use the faulty truck.

b) Check the charge quantity of storage battery. Never use the truck with empty batteries. Otherwise, the lifetime of storage battery can be reduced greatly. More seriously, the storage batteries can be damaged.

c) Check the braking of truck and the ascent, descent, running forward and backward.

d) Turn the operation handle to the position of B area and press the emergency reverse button on top of the operation handle to check that whether the truck can move forward or not.

## 2. Driving :

(1) Start-up:

**Warning**  
When forking goods or moving goods, never rotate the accelerator knob rapidly to speed up the truck abruptly.

Get off the standing pedal and open the guardrail to turn the switch of electric lock to ON position. When the operation handle is turned to area B and accelerator knob is rotated slowly, the truck will start gradually. The greater the accelerator knob is turned, the faster the truck travels.

(2) Decelerate:

The driving motor of the truck is AC motor. The running speed of motor is controlled by speed regulation actuator all the time. So, if the accelerator knob is released slowly, the truck will slow down so as to decelerate.

**Notice**  
When the working area is relatively narrow during operation, the standing pedal and guardrail can be put away. Then, the maximum traveling speed should not exceed **6Km/h**.

(3) Turning:

**Caution**  
The driving mechanism of truck is installed on the backside. Due to this difference from common vehicles, the backside of truck swings comparatively fast when turning around. For this reason, to prevent collision with other objects nearby the backside of forklift, do drive or turn slowly.

The driver stands on the truck pedal in the right gesture and backs to the forks. When the truck travels forward, if the operation handle is rotated clockwise, the truck will turn clockwise. If the operation handle is rotated counterclockwise, the truck will turn counterclockwise.

(4) Braking:

Release the accelerator knob, then braking of the truck can be realized.

(5) Transportation operation:



### Notice

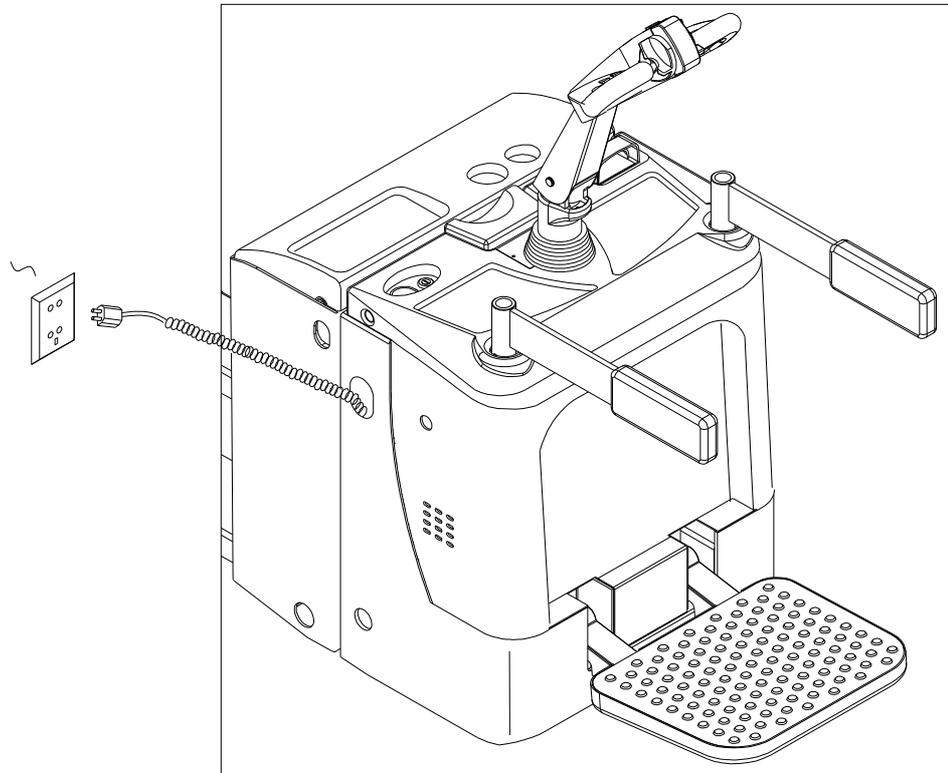
Before operating truck, do check the following items: Ensure no goods falling and damaged in the loading area.

Ensure no goods or objects impeditive for safety.

The following procedure shall be observed for goods transportation:

- 1) Decelerate when approaching the goods area;
- 2) Inspect safety condition around the stacking area;
- 3) Adjust position of the forklift, placing it in front of place where goods locate;
- 4) Slowly start the forklift, and insert fork arms to the bottom of goods as deeply as possible.
- 5) Press the lifting button, raising forks to a position with a distance of over 40mm between bottom of the pallet and ground;
- 6) Start the truck and carry the goods to destination. Press lowering button and put the goods on the ground, making the forks totally out of the bottom of the pallet. Then backward the truck slowly.
  - ① Decelerate when approaching the goods area.
  - ② Inspect safety condition around the stacking area.
  - ③ Adjust position of the truck, placing it in front of place where goods locate.
  - ④ Slowly start the truck, and insert fork arms to the bottom of goods as deeply as possible.
  - ⑤ Press the lifting button, raising forks to a position with a distance of over 40mm between bottom of the pallet and ground.
  - ⑥ Start the truck steadily and carry the goods to destination. Press lowering button and put the goods on the ground, making the forks totally out of the bottom of the pallet. Then drive back the truck slowly.

## V . Usage, maintenance and charge of storage battery



### Schematic diagram of charging method

Charging operation method: The truck is equipped with a charger. When the truck needs to be charged, first open the cover of battery box to take out the charging plug from the side hole of the truck, then insert the charging plug into the two –phase AC power. Finally, the charger starts charging after several seconds. (Battery charger and its accessories are optional parts of the truck, please consult with the authorized representative to buy authentic parts. This part shall fulfill the related safety requirements)



### Warning

Hydrogen is aggregated in the battery box when charging. For this reason, the charging condition shall be good ventilated. In avoidance of explosion and fire disaster, open flame is forbidden.

#### 1 Initial charge

1. 1 Initial charge shall be made for new battery, i.e. The first time charge. Clean up the surface of the battery before the initial charge, and then check for damage to ensure reliable connection.
1. 2 Open gas cap.
1. 3 When the charging equipment is able to operate normally, pour the sulfuric acid electrolyte with a density of  $1.260 \pm 0.005$  ( $25^{\circ}\text{C}$ ) and a temperature of lower than  $30^{\circ}\text{C}$  into the batteries. The electrolyte level should be 15-25mm higher than the protective board. In order to reduce the

temperature rise caused by chemical reaction of the electrolyte and let the electrolyte fully penetrates into the pores of the polar plates and the baffles, the batteries should be placed still for 3-4 hours, not exceeding 8 hours. The initial charging can only be conducted when the electrolyte temperature reduces to below 35°C. (When necessary, the batteries can be put into cold water for temperature reduction). After the still placement, if the electrolyte level reduces, electrolyte should be added.

1. 4 The sulfuric acid electrolyte is prepared with battery sulfuric acid complying with the state standard GB4554-84 and distilled water. Never use industrial sulfuric acid and running water. The standard temperature (25°C) and density of the electrolytic solution can be converted as follows:

$$D_{25} = D_t + 0.0007(t - 25)$$

Where: D<sub>25</sub>: the density of the electrolytic solution at 25°C  
D<sub>t</sub>: the actual density of the electrolytic solution at t °C.  
t: temperature of the electrolytic solution when testing the density.

1. 5 Dry up the electrolyte spilled on the surface of battery. Connect the positive and negative poles of batteries with those of D.C. source (charger) respectively and then turn on the power. Charge with the current of 30A (the current of the first stage). After the charge voltage achieves 28.8V (12×2.4V=28.8V), switch to the 15A current of the second stage for continuative charge. When charging, the temperature of electrolyte shall never exceed 45°C. When the temperature raising up nearly to 45°C, reduce the current by half or stop charging temporarily. After the electrolyte temperature reduce below 35°C, continue charging. However the charge time need to be extended appropriately.
1. 6 Fully charged basis: When the voltage during the second stage charging reaches 31.2V (12 ×2.6V = 31.2V), the variation of the voltage is no greater than 0.005 (V). The density of the electrolytic solution reaches 1.280 ±0.005 (25°C), no apparent changes in 2 hours and there are fine air bubbles appear violently, it can be deemed that the batteries are fully charged. The charged power capacity is 4-5 times of the rated capacity and the charging time is about 70 hours.
1. 8 In order to accurately control the sulfuric acid content of the electrolytic solution, the electrolytic solution density of the batteries should be examined during the last period of charging. If there is inconsistency, adjust with distilled water or sulfuric acid with a density of 1.40. The electrolytic solution density and the liquid surface should be adjusted to the stipulated value within two hours in the charging state.
1. 9 After the initial charging is completed, the surface of the batteries should be cleaned. Close the cover of the open cover type liquid hole plug and then the batteries can be used.

## 2 Use and maintenance

2. 1 In order to guarantee the service life of the batteries, the batteries in use should be fully charged. Insufficiently charged batteries must not be used. During the process of use, close attention should be paid to the discharge extent. Over discharge is prohibited---the voltage reduces to 1.7V per battery. (when the total voltage reduces to 1.7V×12 = 20.4V) When the density of the electrolytic solution reduces to 1.17, discharging should be stopped and charging should be conducted at once. The batteries should not be placed idle for a long period of time. The supplementary charging frequently

conducted during the process of use is called common charge.

2. 2 Common charge: The first stage current of common charge is 30A and that of the second stage is 15A. The charging method is the same as that of initial charge. The charged volume is 130-140 % of the discharged volume and the charging time is about 12 hours.

2. 3 The batteries in normal use should avoid over-charge, but over-charge must be properly conducted for the batteries in following situation, i.e. balance charge.

- a. The "lag-behind" batteries--- batteries with a voltage lower than that of the other batteries in the discharging process and the batteries having been repaired for failure. (When balance charge is conducted, the positive and negative poles of the "lag-behind" battery should be respectively connected with the positive and negative ends of the charger, the DC power supply, and the charge should be conducted independently.)
- b. Balance charge should be conducted for the batteries in normal use every 2-3 months.
- c. Balance charge should be conducted for the batteries that have not been used for a long period of time before use.

2. 4 Equalizing charge:

- a. Charge with a 4A current
- b. When the charge voltage reaches 31.2V ( $12 \times 2.6V = 31.2V$ ) and air bubbles occur in the electrolyte, the current should be reduced by 50% (2A) and continue to charge.
- c. When the batteries are fully charged, stop charging for 0.5 hour and charge again with a 1A current for one more hour.
- d. Stop charging for another 0.5 hour and charge with a 1A current for another one hour.
- e. Repeat according to item d till air bubbles occur violently in the batteries once the charger is switched on.

### 3 Keep and storage

The storage battery shall be kept in clean, dry and ventilated warehouse within the temperature range of 5 to 40°C. The valid storage period is 2 years. Safekeeping shall be made within storage period according to the following requirements:

- a. Avoid direct sunlight. The distance from heat source shall not less than 2m.
- b. Avoid contact with any harmful substance. No metal impurity shall fall inside the battery.
- c. No inversion, no mechanical collision or heavy weight is permitted.
- d. Storage with electrolyte is forbidden. Under special cases that the storage with electrolyte is necessary, the density and solution level of electrolyte shall be adjusted to the specified value. Whenever one month of storage period expires, a complementary charge shall be made with the common charge method.

### 4 Operation of electrolyte

(1) Density check

The suction type densimeter shall be used to check density. During operation, avoid spilling out the electrolyte, and do wear protection appliance.

(2) Operation besides check

Consult professional personnel, especially when complementing electrolyte (dilute sulfuric acid).

(3) Electrolyte leakage

As for the electrolyte leakage resulting from storage battery tilting and damage, emergency treatment shall be made at once (See emergency treatment item).

## 5 Operation of storage batteries during the final stage of their lifetime

- (1) Operation of storage batteries during the final stage of their lifetime

When the lifetime of storage battery is about to terminate, the electrolyte in single battery reduces very fast. For this reason, distilled water shall be complemented everyday.

- (2) Treatment of waste battery

As for the waste battery, draw out the electrolyte and decompose the battery. It can be discussed that whether the waste battery shall be recycled by the battery manufacturer. The waste electrolyte can be disposed according to relevant local rules and regulations.

## 6 Emergency treatment

- (1) The electrolyte spills on skin: wash with large amount of water
- (2) The electrolyte spills into eyes: wash with large amount of water, and then seek help from specialized doctor.
- (3) The electrolyte spills on clothes: take off clothes right away, wash with water, and then flush with weak basic soap solution.
- (4) The electrolyte leakage: in case of electrolyte leakage outside, neutralize it with lime, strong carbonic acid soda or carbonic acid soda, and then flush with large amount of water.

## 7 Charger

If the charger you use is full automatic type. It must meet with the following 2 requirements:

- a. The output voltage of charger: 24V
- b. The output current of charger: 30A

If the charger you use is semi-automatic or manually adjustable, please charge the battery pack according to the requirements of use and maintenance mentioned in the second tip.

## VI. Inspection before operation:

For the sake of safety operation and good situation of the electric truck, it is compulsory to check the truck completely before operation. Contact the sales department of our company when founding problems.

### 1 Check point and check content:

	No.	Check point	Check content
Braking system	1	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
	2	Brake clearance	The clearance between brakes should be kept between 0.2mm and 0.8mm.
Steering system	3	Operation handle	Degree of tightness and rotary flexibility.
	4	Oil pipe	Leakage or not.
	5	Hydraulic oil	Appropriate oil quantity.
	6	Lifting oil cylinder	Whether there is any oil leakage.
Wheels	7	Pins, screws and all the fasteners	Check all the fasteners of the truck's wheels, i.e. pins or screws, loose or not.
	8	Wearing status	Compare the parameter list, replace the wheel when its diameter reduces by 5%.
Battery	9	Charge	Confirm the display state of the battery capacity.
	10	Electrolyte	The solution level and density of electrolyte.
	11	Connecting line	The connecting line and socket shall be firm.
Horn	12	Horn	Press down the horn button to check whether the horn sounds.
Instrument	13	Function	Turn on the switch of electric lock to check whether the instrument displays normally.
Others	14	Truck frame, etc	Damaged or not. If there is any crack.
	15	Function	Check that whether lifting, lowering, forward & backward movement and emergency reverse of the truck is normal, and if there is any abnormal noise.

## VII. Inspection after operation:

After operation, the smudge on truck shall be wiped out. Besides, the following check shall be carried out:

Keep visibility of all graphics context marks such as warning signs, nameplate and notice board. These marks are able to instruct, caution and warn the operator to some degree.

The situation about deformation, distortion, damage or breakage

Add lubricating oil and grease if necessary.

Replace faulty components.

## VIII. Periodic maintenance and repair:

Comprehensive check for truck can avoid malfunction and ensure the service life. The hours listed in maintenance procedures is based on the cases that the truck works for 8 hours per day and 200 hours per month. For the sake of safety, maintenance shall be carried out according to maintenance procedure.



### Notice

All the repair work shall be carried out by professional personnel.

Please contact the sales department of our company if you need to adjust or replace the components.

### 1 Precautions during maintenance:

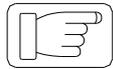


### Notice

The components for replacement shall be produced completely by our company. When replacing components of the truck, the components with the same safety requirement with the original design shall be used.

The lubricating oil and hydraulic oil in use shall be recommended by our company.

#### (1) Places for maintenance:



### Notice

The places for maintenance shall be appointed and can provide other services such as hoisting and safety protection facility etc.

The places shall have level ground and good ventilation.

The places shall be equipped with fire-extinguishing devices.

#### (2) Precautions before repair and maintenance:



### Notice

No smoking.

Arrange the self-protection work.

Wipeout the effusive oil in time.

Before adding lubricating oil, clean up the dirty oil or dust on the joint with brush or cloth.

Except certain situation, turn off the key switch and pull off the power socket.

Lower down the fork arms to the lowest point when carrying out maintenance.

Ensure no goods on the truck when demounting the high pressure oil pipe. Besides, the fork arms shall be descended to the lowest position, by this way, the pressure of hydraulic system can be released.

For the reason that there are capacitors storing a little amount of electric energy in circuit, so before contacting the binding post of the main circuit, discharge at first.

Clean the electric section with compressed air, never flush with water.

When the truck requires high-position maintenance, the altitude safety protection must be carried out for the repairing and maintenance personnel.

## 2 Inspection and maintenance before the new truck put into operation

In order to follow the industry related regulations and ensure the absolute security to the truck in the transportation, for new ex-factory truck, it is possible that there is no electrolyte inside storage battery before the first use (except the inland sale).

The electrolyte of storage battery is prepared well before the truck leave the factory, and it is filled into the storage battery by the professional personnel before the first use. First, place the truck to the site with good ventilation, open the lid of storage battery box, and open all the top plastic lids of storage battery. The plastic pot with storage battery electrolyte inside is raised using plastic funnel, and the electrolyte is poured into the storage battery in a slow way until the liquid level can be seen. After all the storage battery is filled, conduct initial charge to the storage battery timely according to the operation requirements of initial charge 5.1

## 3 Daily inspection

Inspection of hydraulic oil level: lower the fork to the lowest position, look over the oil level from the oil window. The distance between oil level and the bottom of oil tank is about 70mm, and oil charge is 1.5L. Recommendatory trademark for the hydraulic oil should be chosen.

Check the capacity of storage battery: refer to the use and maintenance of storage battery.

## 4 The inspection according to the need

Clean the truck

Inspect and screw down each fastener

Inspect the damage state of wheels

## 5 The inspection and maintenance after 50 hours (Weekly)

Braking system	1	When the operation handle is turned, with the steering handle switching between area A and B, there is a noise from the brake.
	2	The oil dirt and dust on the turning gearwheel should be cleaned.
	3	The clearance between brakes should be kept between 0.2mm and 0.8mm
Capability of electrolyte	4	Inspect the liquid level of electrolyte, pure water can be used for supplement if the liquid level is too low.
density of electrolyte	5	The specific gravity should be 1.28g/ml after charged.
Clean the storage battery	6	Cover the lid, and flush with tap water.
Inspect the contactor	7	Burnish the coarse surface of contacts using sand paper.

## 6 The inspection and maintenance after 200 hours (Monthly)

Besides the weekly maintenance, the following maintenance should be carried out, and when the parts must be adjusted and replaced, please contact with maintenance personnel of our company. (keep monthly maintenance record)

	No.	Check point	Check content
Whole truck	1	Whole status	Abnormal or not.
	2	Horn	Sound
Steering system, braking system, hydraulic system and lifting system	3	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
	4	Brake clearance	The clearance between brakes should be kept between 0.2mm and 0.8mm.
	5	Operation handle	Degree of tightness and rotary flexibility.
	6	Truck frame and fastener	Function, and check cracks, lubrication and tightness of fasteners.
	7	Connecting rod and wheel carrier	Function and check the cracks, bending, deformation and lubrication condition.
	8	Oil pipe	Whether oil pipes leak or not.
	9	Hydraulic oil	Proper quantity of oil.
	10	Lifting oil cylinder	Whether there is any oil leakage or not.
Storage battery, charger and electric system	11	Electrolyte	Liquid level, specific gravity and cleanness
	12	Plug	Function, whether it is damaged or not
	13	Key switch	Function
	14	Contacto	Contact performance and function
	15	Inching switch	Function
	16	Controller	Function
	17	Driving motor	Wearing status of carbon brush and selenium rectifier.
	18	Lifting motor	Wearing status of carbon brush and selenium rectifier.
	19	Steering motor	Wearing status of carbon brush and selenium rectifier.
	20	Fuse	Whether it is perfect or not
	21	Wiring harness and connection terminals	Whether flexible and whether damaged or not.

## 7 Maintenance for 600 hours (every three months)

During the maintenance every three months, the monthly maintenance process shall be repeated. When the parts must be adjusted and replaced, please contact with maintenance personnel of our company.

Contactor	
	Replace according to the status when the function is not well.
Motor	Wearing status of carbon brush and selenium rectifier.
Brake	Clean the dirt and dust on friction plates of the brake, meanwhile check the wearing status of the friction plates.

## 8 Maintenance for 1200 hours (every six months)

During the maintenance for a half year, the maintenance process for three months shall be repeated. When the parts must be adjusted and replaced, please contact with maintenance personnel of our company.

Contactor	Burnish the coarse surface of contacts using sand paper.
	Replace according to the status when the function is not well.
Motor	Wearing status of carbon brush and selenium rectifier.
Decelerate box	Replace the gear oil
Oil filter	clean
Brake	Clean the dirt and dust on friction plates of the brake, meanwhile check the wearing status of the friction plates.
Hydraulic system	Replace hydraulic oil. Check that whether there is any leakage in the lifting cylinder or not and replace the seals when necessary.
Fork wheel and bearings	Check the wearing condition, and replace them if necessary

## 9 Recommended working medium:

### (1) Hydraulic oil:

#### A. When it is normally loaded, we advise:

Hydraulic oil: LHPISOVG46, in accordance with standard DIN51524T.2, the average sustained temperature should between 40 degrees to 60 degrees.

#### B. When it is over loaded, we advise:

Hydraulic oil: LHPISOVG68, in accordance with standard DIN51524T.2, the average sustained temperature is above 60 degrees.

#### C. When it is lightly loaded with low temperature, we advise:

Hydraulic oil: HLPISOVG32, in accordance with standard DIN51524T.2, the average sustained temperature is below 60 degrees.

#### D. At the occasion with variable loading, we advise:

All the working conditions mentioned above can use the hydraulic oil LHPISOVG46 in accordance with standard DIN51524T.2 for replacement. The viscosity of this lubricant is very high (mostly used hydraulic oil).

If it is difficult to buy hydraulic oil, SAE20W/20 engine oil can be used to substitute HLP68 hydraulic oil.

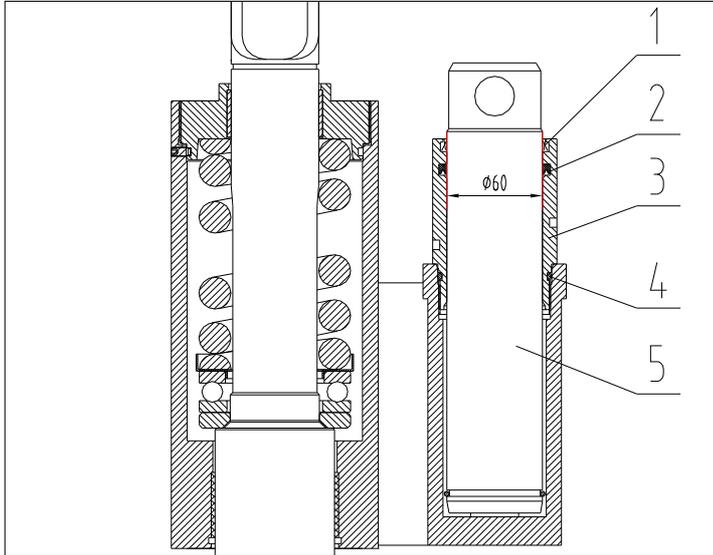
### (2) Gear oil:

Hyperbola gear oil 85W-90(GL-5)

- (3) Lubricating grease:  
Lithium grease of type 3

All kinds of depleted hydraulic oil, gear oil and grease will pollute the environment. For this reason, recycle the replaced working medium or treat according to local pertinent regulations

### 10 Structure of lifting cylinder and wearing parts:



1. Dustproof ring DH60;
2. Seal ring UHS60X70X6;
3. Oil cylinder;
4. O-type seal ring 65X3.55;
5. Plunger

### 11 Maintenance period of consumables and partial parts:

Items	Maintenance content	Maintenance period	Remarks
Bearings of fork wheel	Replacement	1200 hours	
Fork wheel	Replacement	1200 hours	
Seals	Replacement	1200 hours	Replace when finding out damage
Gear box	Replacing lubricant grease	1000 hours	
Hydraulic oil	Replacement	1000 hours	
High pressure oil pipe	Replacement	2000 hours	Replace when finding out damage
Strainer of hydraulic reservoir	Cleaning	1000 hours	
Driving motor	Check for carbon brushes and bearings	1000 hours	
Steering motor	Check for carbon brushes and bearings	1000 hours	
Oil pump motor	Check for carbon brushes and bearings	1000 hours	

## IX. The store, transportation and loading of truck:

### 1 The store of truck:

If the electric pallet truck is not used for over two months, it should be placed in the room which is in good ventilation, no frost, clean and dry; also the following measures should be taken:

Clean the truck thoroughly.

Lift the forks completely for several times, check it is normal or not.

Lower the forks to the lowest position.

Support the side near to driver of truck with square timber to lift the driving wheels of truck from the ground.

Apply a layer of flimsy oil or grease on all the bared surface of mechanical parts.

Lubricate the truck.

Check the status of storage battery and electrolyte, and imbrue the non-acid lubricating grease to the binding post of storage battery.

All the electrical contacts should be sprayed using appropriate contacts spray.

### 2 Transportation of truck:

If the truck needs to be transported for a long distance, support the side near to driver of truck with square timber to lift the driving wheels of truck from the ground. The two front wheels of truck shall be fixed stably by sphenoid wood block. Fasten the truck to transport vehicle with ropes.

### 3 Loading and unloading of truck:

Before loading the truck, check out the nameplate for the total weight of truck to choose appropriate hoisting handling equipment. The hoisting of truck shall be kept level, and landing shall be kept slow and stable. The personnel around shall watch for safety. One of the personnel is responsible for conducting. If the other truck is used for loading and unloading, please watch the bottom situation of the truck. Take care to insert the fork

arms to the bottom, in avoidance of damaging the driving wheel, balance wheel and forward wheel.

#### 4 Movement of the damaged truck

Towing of the truck is not allowed. As for the movement of damaged trucks, please refer to the operation methods of loading & unloading and transportation mentioned above.

## X. Replacement of storage battery

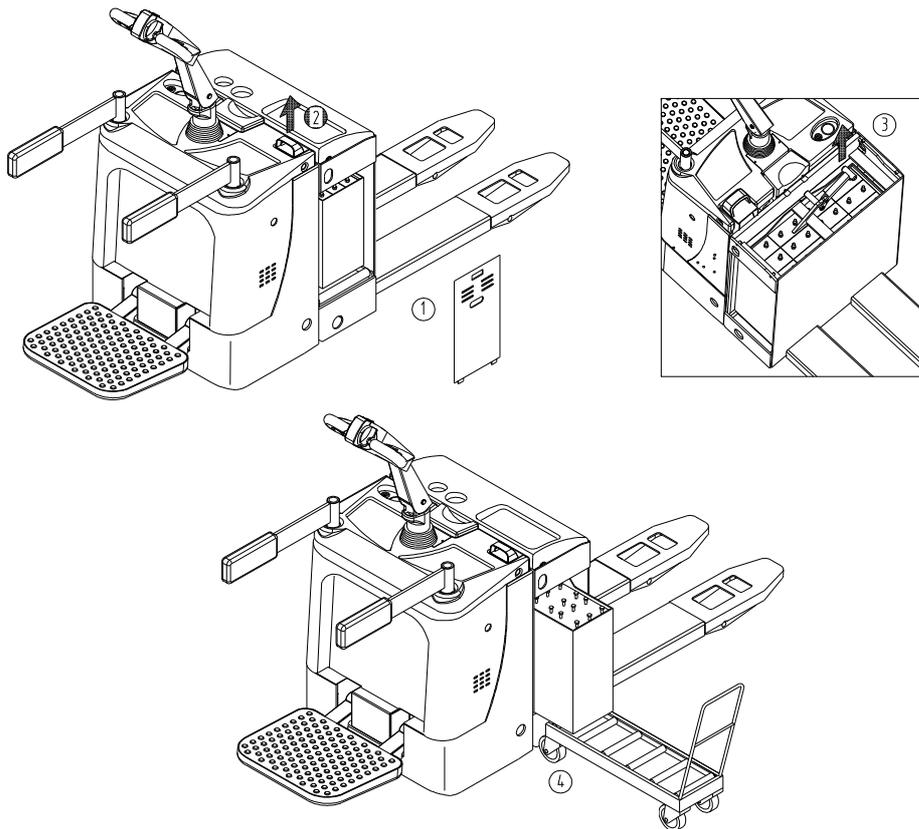
The weight of battery pack is about 240kg, and the replacement procedure of storage battery is as follows:

1. Open the side door of storage battery and take it down.
2. Pull down the socket connector of storage battery from the truck.
3. Turn up the handle of battery locking mechanism to loosen the battery.
4. Pull out the storage battery from the side way and take the storage battery away with special car or using hoisting method.
5. The mounting method of putting the storage battery back into the battery pack is opposite to the above procedures.

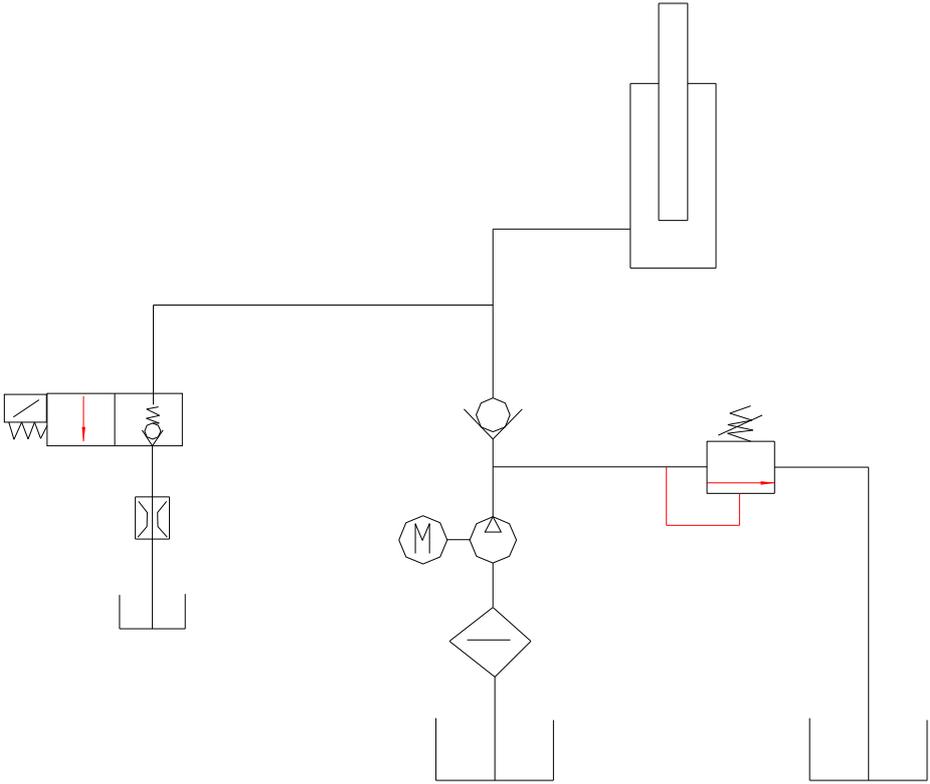


### Note

Handle the storage battery gently during hoisting and transportation of the battery. Otherwise it will cause damage to the battery or bring danger to human body.

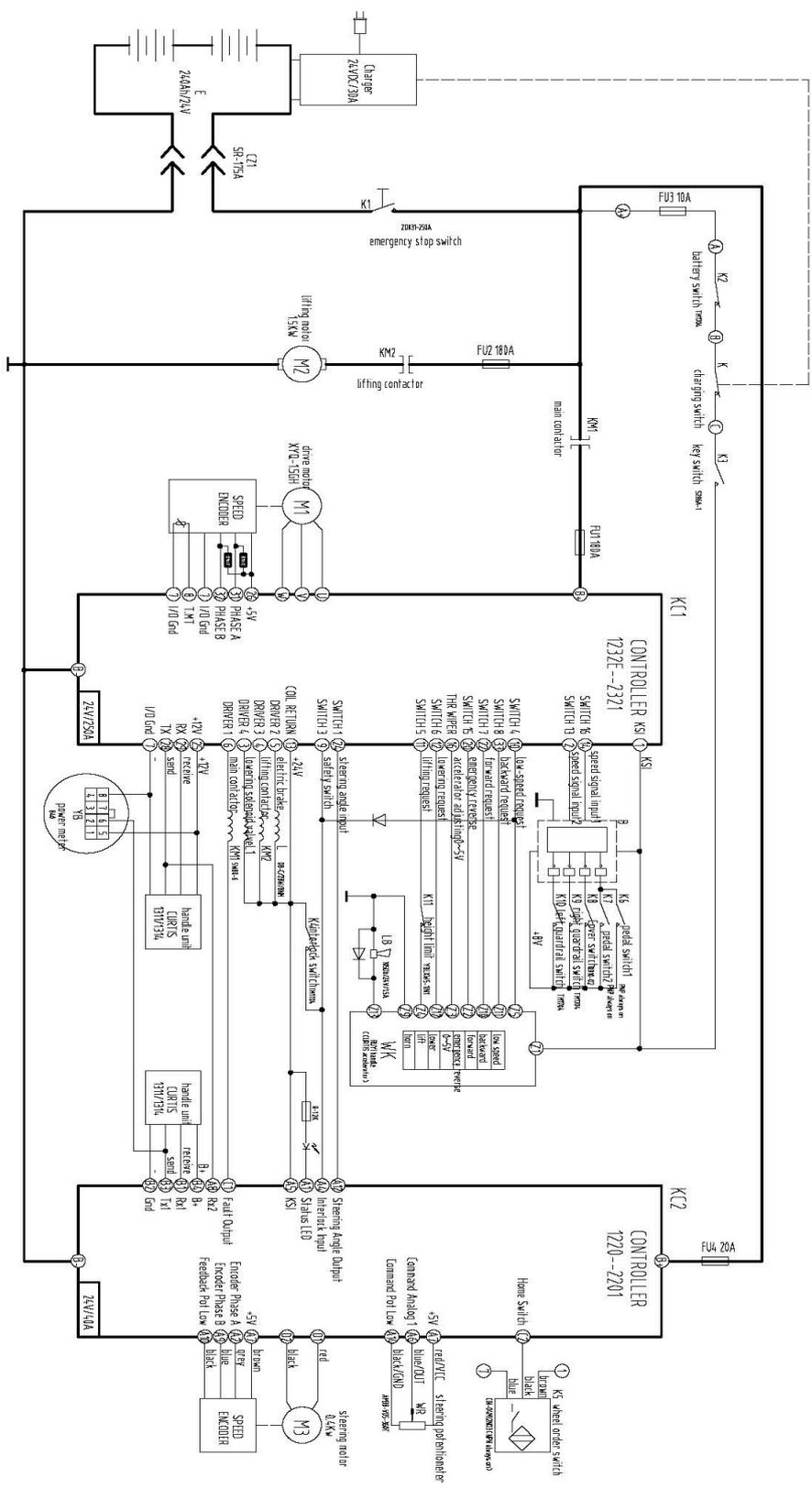


**Hydraulic principle diagram**



Hydraulic principle diagram

# Electric principle diagram



## XI. Common faults and trouble shooting

### 1234 programmer fault menu and LED status display format

There are two LED lights (Red and Yellow) on the case of controller. The two LEDs have four different display modes, indicating the type of information they are providing.

DISPLAY	STATUS
Neither LED illuminated	Controller is not powered on, has a dead battery, or is severely damaged.
Yellow LED flashing	Controller is operating normally.
Yellow and red LEDs both on solid.	Controller is in Flash program mode.
Yellow and red LEDs flashing alternatively.	Controller has detected a fault.

Code	Fault Display	Possible cause
1, 2	Controller Overcurrent (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake.)	<ol style="list-style-type: none"> <li>1. External short of phase U,V, or W motor connections.</li> <li>2. Motor parameters are mis-tuned.</li> <li>3. Controller defective.</li> </ol>
1, 3	Current Sensor Fault (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake.)	<ol style="list-style-type: none"> <li>1. Leakage to vehicle frame from phase U, V, or W (short in motor stator).</li> <li>2. Controller defective.</li> </ol>
1, 4	Precharge Failed (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake. )	<ol style="list-style-type: none"> <li>1. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging.</li> <li>2. See 1311 menu Monitor. Battery: Capacitor Voltage.</li> </ol>
1, 5	Controller Severe Undertemp (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; Full brake)	<ol style="list-style-type: none"> <li>1. Controller is operating in an extreme environment (below -40°C.)</li> <li>2. See 1311 menu Monitor. Controller Temperature.</li> </ol>
1, 6	Controller Severe Overtemp (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; FullBrake.)	<ol style="list-style-type: none"> <li>1. Controller is operating in an extreme environment.(over 95°C)</li> <li>2. Excessive load on vehicle.</li> <li>3. Improper mounting of controller.</li> <li>4. See 1311 menu Monitor. Controller: Temperature.</li> </ol>
1, 7	Severe Undervoltage (Reduced drive torque.)	<ol style="list-style-type: none"> <li>1. Battery Menu parameters are misadjusted.</li> <li>2. Non-controller system drain on battery.</li> <li>3. Battery resistance too high.</li> <li>4. Battery disconnected while driving.</li> </ol>

		<p>5. See 1311 menu Monitor. Battery: Capacitor Voltage.</p> <p>6. Blown B+ fuse or main contactor did not close.</p>
1, 8	<p>Severe Overvoltage (Shutdown Main Contactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; FullBrake.)</p>	<p>1. Battery Menu parameters are misadjusted.</p> <p>2. Battery resistance too high for given regenerative current.</p> <p>3. Battery disconnected while regenerative braking.</p> <p>4. See 1311 menu Monitor. Battery: Capacitor Voltage.</p>
2, 1	<p>Controller Under temp Cutback (Reduced drive and brake torque.)None, unless a fault action is programmed in VCL.</p>	<p>1. Controller is performance-limited at this temperature.</p> <p>2. Controller is operating in an extreme environment.</p> <p>3. See 1311 menu Monitor. Controller: Temperature.</p>
2, 2	<p>Controller Over temp Cutback Reduced drive and brake torque.</p>	<p>1. Controller is performance-limited at this temperature.</p> <p>2. Controller is operating in an extreme environment.</p> <p>3. Excessive load on vehicle.</p> <p>4. Improper mounting of controller.</p> <p>5. See 1311 menu Monitor. Controller: Temperature.</p>
2, 3	<p>Under voltage Cutback (Reduced drive torque.)</p>	<p>1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage.</p> <p>2. Battery parameters are misadjusted.</p> <p>3. Non-controller system drain on battery.</p> <p>4. Battery resistance too high.</p> <p>5. Battery disconnected while driving.</p> <p>6. See 1311 menu Monitor. Battery: Capacitor Voltage.</p> <p>7. Blown B+ fuse or main contactor did not close.</p>
2, 4	<p>Overvoltage Cutback (Reduced drive torque.)</p>	<p>1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage.</p> <p>2. Battery parameters are misadjusted.</p> <p>3. Battery resistance too high for given regen current.</p> <p>4. Battery disconnected while regen braking.</p> <p>5. See 1311 menu Monitor. Battery: Capacitor Voltage.</p>
2, 5	<p>+5V Supply Failure (None, unless a fault action is programmed in VCL.)</p>	<p>1. External load impedance on the Set: +5V supply (pin 26) is too low.</p> <p>2. See 1311 menu Monitor outputs: 5 Volts and Ext Supply Current.</p>
2, 6	<p>Digital Out 6 Overcurrent (Digital Output 6 driver will not turn on.)</p>	<p>1. External load impedance on Digital Output 6 driver (pin 19) is too low.</p>
2, 7	<p>Digital Out 7 Overcurrent (Digital Output 7 driver will not turn on. )</p>	<p>1. External load impedance on Digital Output 7 driver (pin 20) is too low.</p>
2, 8	<p>Motor Temp Hot Cutback (Reduced drive torque.)</p>	<p>1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back.</p>

		<p>2. Motor Temperature Control Menu parameters are mis-tuned.</p> <p>3. See 1311 menus Monitor. Motor: Temperature and Monitor. Inputs: Analog2.</p> <p>4. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.</p>
2, 9	<p>Motor Temp Sensor Fault MaxSpeed reduced (LOS, Limited Operating Strategy) and motor temperature cutback is disabled.</p>	<p>1. Motor thermistor is not connected properly.</p> <p>2. If the application doesn't use a motor thermistor, Temp Compensation voltage within range and Temp Cutback should be programmed Off.</p> <p>3. See 1311 menus Monitor. Motor: Temperature and Monitor. Inputs: Analog2.</p>
3, 1	<p>Coil1 Driver Open/Short (Shutdown Driver1.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
	<p>Main Contactor Coil Open/Short (Shutdown Driver1; Shutdown Motor; Shutdown EMBrake.)</p>	<p>1. Open or short on main contactor coil.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
3, 2	<p>Coil2 Driver Open/Short (Shutdown Driver2.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
	<p>EM Brake Open/Short (Shutdown Driver2; Shutdown Throttle; FullBrake.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
3, 3	<p>Coil 3 Driver Open/Short (Shutdown Driver3.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
3, 4	<p>Coil 4 Driver Open/Short (ShutdownDriver4.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad harness or faulty wiring.</p>
3, 5	<p>PD Open/Short (Shutdown PD.)</p>	<p>1. Open or short on driver load.</p> <p>2. Dirty connector pins.</p> <p>3. Bad crimps or faulty wiring.</p>
3, 6	<p>Encoder Fault Control Mode changed to LOS (Limited Operating Strategy).</p>	<p>1. Motor encoder failure.</p> <p>2. Bad crimps or faulty wiring.</p> <p>3. See 1311 menu Monitor. Motor: Motor RPM.</p>
3.7	<p>Motor Open Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake.</p>	<p>1. Motor phase U、 V and W is open.</p> <p>2. Bad cable wire or faulty wiring.</p>
3, 8	<p>Main Contactor Welded (Shutdown MainContactor;</p>	<p>1. Main contactor tips are welded closed.</p> <p>2. Motor phase U is disconnected or open.</p>

	Shutdown Motor; Shutdown EMBrake.)	3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal).
3, 9	Main Contactor Did Not Close (Shutdown Main Contactor; Shutdown Motor; Shutdown EMBrake.)	1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse.
4, 1	Throttle Wiper High (Shutdown Throttle.)	1. Throttle pot wiper voltage too high. 2. See 1311 menu Monitor. Inputs: Throttle Pot.
4, 2	Throttle Wiper Low (Shutdown Throttle.)	1. Throttle pot wiper voltage too low. 2. See 1311 menu Monitor. Inputs: Throttle Pot.
4, 3	Brake Wiper High (FullBrake.)	1. Brake pot wiper voltage too high. 2. See 1311 menu Monitor. Inputs: Brake Pot.
4, 4	Brake Wiper Low (FullBrake.)	1. Brake pot wiper voltage too low. 2. See 1311 menu Monitor. Inputs: Brake Pot.
4, 5	Pot Low Overcurrent (Shutdown Throttle; FullBrake.)	1. Combined pot resistance connected to pot low is too low. 2. See 1311 menu Monitor. Outputs: Pot Low.
4, 6	EEPROM Failure (Shutdown Main Contactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; Shutdown Interlock; Shutdown Driver1; Shutdown Driver2; Shutdown Driver3; Shutdown Driver4; Shutdown PD; Fullbrake.)	1. Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the 1311, or by loading new software into the controller.
4, 7	HPD/Sequencing Fault (Shutdown Throttle)	1. KSI, interlock, direction, and throttle inputs applied in incorrect sequence. 2. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. Clear: Reapply inputs in correct sequence. 3. See 1311 menu Monitor. Inputs.
	Emer Rev HPD Shutdown Throttle Shutdown EMBrake	1. Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.

4, 9	Parameter Change Fault (Shutdown MainContactor Shutdown Motor Shutdown EMBrake)	1. This is a safety fault caused by a change in certain 1311 parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.
5, 1- 6, 7	OEM Faults	1. These faults can be defined by the OEM and are implemented in the application-specific VCL code. See OEM documentation.
6, 8	VCL Runtime Error (Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; Shutdown Interlock; Shutdown Driver1; Shutdown Driver2; Shutdown Driver3; Shutdown Driver4; Shutdown PD; Fullbrake)	1. VCL code encountered a runtime VCL error. 2. See 1311 menu Monitor. Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file.
6, 9	External Supply Out of Range	1. External load on the 5V and 12V supplies draws either too much or too little current. 2. Fault Checking Menu parameters Ext Supply Max and Ext Supply Min are mis-tuned. 3. See 1311 menu Monitor. Outputs: Ext Supply Current.
7, 1	OS General Shutdown MainContactor; Shutdown Motor; Shutdown EMBrake; Shutdown Throttle; Shutdown Interlock; Shutdown Driver1; Shutdown Driver2; Shutdown Driver3; Shutdown Driver4; Shutdown PD; FullBrake.	1. Internal controller fault.
7, 2	PDO Timeout	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.
7, 3	Stall Detect Control Mode changed to LOS(Limited Operating Strategy)	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See 1311 menu Monitor. Motor: Motor RPM.
8, 7	Motor Characterization Fault (Shutdown MainContactor;	1. Motor characterization failed because of an Overvoltage or Undervoltage fault, Motor Temperature Sensor fault, or

	Shutdown Throttle; Shutdown EMBrake; Shutdown Motor.)	Motor_Temperature > 150°C during the characterization process.
8, 8	Encoder Characterization Fault Shutdown MainContactor; Shutdown Throttle Shutdown EMBrake; Shutdown Motor	1. Encoder characterization failed during the motor characterization process. 2. Motor encoder pulse rate is not a standard value (32, 48, 64, 80 ppr).
8, 9	Motor Type Fault (Shutdown MainContactor; Shutdown Throttle Shutdown EMBrake; Shutdown Motor)	1. The Motor_Type parameter value is out of range.
9, 2	EM Brake Failed to Set Enter Position Hold	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.
9, 3	Limited Operating Strategy (LOS) (Enter LOS control mode)	1. Limited Operating Strategy (LOS) control mode has been activated, as a result of either an Encoder Fault (Code 36) or a Stall Detect Fault (Code 73). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle is stalled.
9, 4	Emer Rev Timeout Shutdown Throttle Shutdown EMBrake	1. Emergency Reverse was activated and concluded because the EMR Timeout timer expired. 2. The emergency reverse input is stuck On.

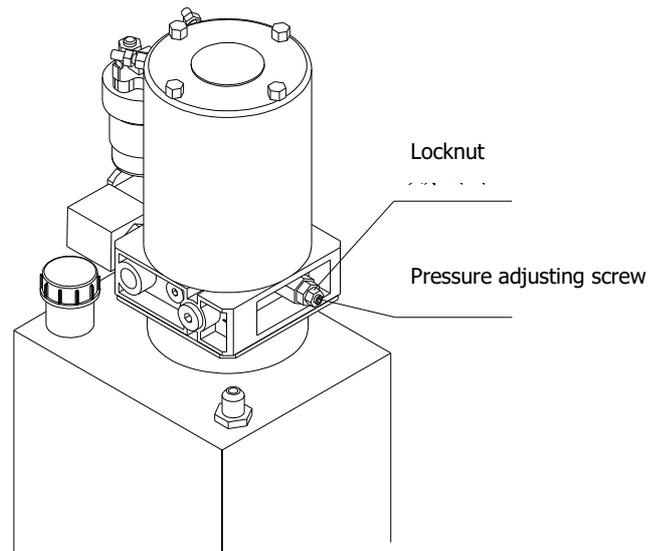
Faults	Possible cause	Trouble shooting
Abnormal noise during lifting	The oil-absorptive filter is blocked	Clean or replace the oil-absorptive filter
	The oil-absorptive tube leaks and the oil are foaming.	Fasten the tie-in, check the oil level, or add some oil.
	Hydraulic pump or motor is damaged.	Contact maintenance personnel of our company
	Seal malfunction, and make the air enter oil pump.	Contact maintenance personnel of our company
	The viscosity of oil is not correct, oil level is too low.	Replace the oil or add some oil
Hydraulic system has no pressure or the pressure is too low	Malfunction in pump oil-absorptive, and noise exists.	Replace the oil or add some oil
	Oil pump is damaged	Contact maintenance personnel of our company
	There is malfunction in valve block.	Contact maintenance personnel of our company

	The pipeline is broken or leaking.	Replace the pipeline or screw down the tie-in.
	The viscosity of oil is not suitable; the leakage loss is too great.	Change the oil.
The oil pressure is not stable	The cause is the same as that of abnormal noise.	Refer to the treatment methods for abnormal noise.
	The lifting cylinder or seal ring is worn.	Replace the cylinder sleeve or seal ring
	The quantity of oil is not enough	Add oil
The truck cannot start	Storage battery is used up.	Inspect, charge, or replace the storage battery
	The wire terminal is loosened.	Screw down the terminal screw
	The fuse is burn out.	Replace the fuse
	The accelerator is damaged.	Replace accelerator
The direction is ineffective and heavy.	The steering device is blocked by the abnormal matter.	Clean up the foreign matter.
	The bearings of steering device are worn.	Replace the bearings
Brake cannot work	The friction plates of the electromagnetic brake are damaged	Replace
Not release after braked	The electromagnetic brake is out of electricity.	Check the circuit.
	The clearance of the electromagnetic brake is too large.	Adjust the brake clearance to 0.2mm.

### Adjustment methods of safety valve pressure

The pressure of safety valves has already been adjusted when the truck is ex-factory. Users shall not adjust the pressure at will. Otherwise it will bring danger to the truck's hydraulic system and safety. If the oil pressure is not in accordance with specified value, please ask the professional personnel to adjust according to the test methods stipulated in the JB/T3300 standards as well as the following methods:

- 1 Screw out high pressure oil tube and install pressure meter with capacity over 20Mpa at the high pressure oil outlet.
- 2 Press lifting operation button to measure the system pressure. The stipulated system pressure is 11.5Mpa for truck with rated load of 2000KG and 13.5Mpa for truck with rated load of 2500KG.
- 3 If oil pressure is not in accordance with the specified value, please loosen locknuts of the



overflow valves. Turn pressure screw left and right until the pressure reaches the specified value. When the screw is turned clockwise, the system pressure increases. While the screw is turned counter-clockwise, the system pressure decreases.

4 After the adjustment, please screw down the locknuts.

## *Motor industrial vehicle—Safety Norms*

### **The Second Part Safety Norms of motor industrial vehicles in service, operation and maintenance**

- 14 Safety rules for the user and driver  
In order to use the motor industrial vehicle well, this part set up some rules. The 14.1 is applied to the user, the 14.2 is for the driver.
- 14.1 Applied to the user  
The users are the owner or the leaser individual or corporation of the truck.
- 14.1.1 The qualification of the driver  
The driver of the motor industrial vehicle should be trained, pass examination and get the operation qualification.
- 14.1.2 The truck working in flammable and explosive circumstance  
Only the industrial motor truck getting the qualification of the national authoritative department and getting the license of working in the flammable and explosive circumstance, should work in the circumstance.  
This kind of truck should be marked with proper stamp sign, and the relevant building or the plant should be marked too.  
The classification of the building or the field condition should agreed on by the user and the national relevant authoritative department.
- 14.1.3 Passenger  
Except for special seats, the vehicle can not carry passengers. The passengers are forbidden to step on the ascent machine or the attachment.
- 14.1.4 The use of the forklift
- 14.1.4.1 The change of the capacity and nameplate of the truck  
The truck in use shall not exceed the rated capacity stipulated by the factory.  
Without the permit of the factory, any amendment of the design is forbidden, and should not add any attachment on the truck, in order to prevent the influence of the capacity and operation safety of the truck.  
Any changing because of adding attachment should not reduce the security and accord to the requirement of this rule. After adopting the attachment, the capacity of the truck, the operation and the repair direction board, label or pattern should be altered correspondently.  
The user should ensure all the nameplate and label in proper position, and maintain handwriting clear.
- 14.1.4.2 Stability  
The user should pay attention to section 6 of the code, which is about the stability of the truck in the working conditions.  
When operating correctly, the high lift truck accord with the section 6 is steady, but the incorrect operating or the wrong maintenance could let the truck working unsteadily.  
The factors that may influence the stability are: the condition of the ground and the floor, grade ability, speed, load, the weight of the storage battery, the dynamic force and the static force as well as the judgment train conditions of the drivers.  
When the truck is working in the condition differ to the regular working condition should reduce the load.  
When the truck mounted attachment working without load, it should be viewed as partial load.
- 14.1.4.3 The protection requirement and protection equipment  
The truck should be painted with the color differing from the surrounding circumstance.  
When it is necessary to denote the working condition, the truck should add caution device, such as light or flash lamp.
- 14.1.4.4 The charging and changing of the battery  
The battery charging station should set in the appointed area. The charging station should prepare the equipment using for flushing and neutralizing the overflow electrolyte, the fire control device, the measure avoiding the truck damage the charging device and the adequacy ventilation facility blow away the fume off from the battery.  
In the area of charging, it is forbidden to smoke and alarm with placard.  
Only the personnel trained and permitted can change or charge the battery. The battery repairing people should wear protective clothes.

All the work of changing the battery should be carried out according to the description of user's manual from the factory. When reinstall the battery, should adopt measures to make the battery connecting, orientation and fixation correctly. Do not put tools and other metal substance on the lidless battery.

Without the special approval (for example the truck factory), the electrical motor truck should not change the battery with different voltage, weight or size.

It is obliged to use the battery stated by the factory. It is obliged to prepare the facility for changing battery safely. When hanging up the battery using hoisting equipment, it is necessary to use insulated steeve.

If adopting chain hoist, it is necessary to equip chain box. If adopting chain block, the lidless battery should be covered by a piece of rubber blanket or other insulated materials, to prevent the short circuit of chain and the connecting wire or connecting terminal between the battery lattices.

#### 14.1.4.5 The invalid or damaged truck

If finding the motor industrial vehicle existing insecurity factors, it should stop using and give away on the spot. After repairing and recovery to the safety conditions, it can be reused.

#### 14.1.4.6 Accident

Once the accident happens, for example the staff injures, the truck damages the building or the equipment, firstly should organize salvage, do best to protect the accident field and report to the governor.

#### 14.1.5 Operating conditions

##### 14.1.5.1 Channel and stacking field

The ground of the operating field should have enough carrying capacity, and it is necessary to maintain it well not to influence the truck operating safely.

The transporting channel of the truck should have well visual field, and it is easy to turn, and no grade, steep slope, narrows channel and low roof board. The outline or the borderline must be clear.

In the road where it is easy to meet the stepping truck, the width of the channel should be adjusted.

Advising the grade of the channel should not over 10%, the top and the bottom of the slope should transit smoothly, to prevent the load vibration or the bottom of the truck colliding the ground.

When the grade is over 10%, installing a sign is advised.

If the truck is in operation (transport) and the load block off the sight, when the vehicle is operating, the load should located on the backward of the truck operation direction.

For example: in some conditions (for example stacking and climbing), when the vehicle is operating, the load is required on the forward of the vehicle operation direction. Then, the driver should drive the vehicle carefully. It is necessary to attend: if the operation condition require, should equip accessory (assistant) equipment or assistant.

The passage, road, runway, floor or slope should maintain good operating conditions, to prevent the truck or the load from being damaged, and to prevent reducing the stability of the vehicle.

In dangerous state, including the barrier danger on the top should mark on the clear location. The fire fighting passage, the upstairs passage and the fire fighting equipment should maintain expedite.

##### 14.1.5.2 Gangplank or transition board

All the gangplank or transition board should has enough safety coefficients to bear the truck with load. On the gangplank or transition board should marked the max passing load perpetually.

The gangplank or transition board should fix firmly, to prevent the accidental move, vibration or slide.

On the gangplank or transition board should equipped handing or other available equipment to the effect of safety transport. On the conditions of possible, should set the fork hole or suspending ear for moving goods.

The gangplank or transition board should have non-slip finishing.

On the both sides of the gangplank or transition board, should mount the facility to prevent the truck from going over its edge.

When the gangplank or transition board is fixed its location, should adopt measures to prevent

the reverse joint truck from moving suddenly.

#### 14.1.5.3 Lighting

When the photometric brightness on the operating field is less than 32LX, the vehicle should be equipped with auxiliary light.

#### 14.1.5.4 The suspending of the truck

The sling should be tied to the lifting spot which the factory appointed.

#### 14.1.5.5 The synchronizing operation of the truck

Conveying bulky or heavy load using two trucks simultaneously is a dangerous operating which requires special care. And this kind of conditions should be taken as special conditions and carried out under the supervision of the operator responsible for operation.

### 14.2 Applied to the driver

The safety operating of the industrial truck lies on the control manner of the driver to a considerable degree. The safety rules applied to the driver are as follows:

- A) general rule;
  - B) transporting rule;
  - C) operating (driving) rule;
  - D) the rule for the driver maintaining the truck.
- Without regard to the rules may be conducted:
- A) the serious danger of damaging the driver or other personnel;
  - B) Damage the materials.

#### 14.2.1 General rule

Only the personnel who have been trained and get the qualification of operation are permitted to drive the industrial truck.

The motor industrial vehicle could not carry passengers, except for equipped with the facility for the passengers sitting.

The driver should pay special attention to the operating circumstance, including the person nearby other staves and fixed or moving substances, and it is necessary to watch out for the passerby at any moment.

No matter whether there is load on the lifting part of the truck, it is forbidden anyone passing or standing under the lifting part of the truck.

If the people, building, organization or equipment accident happens, it is necessary to report to the relevant officer at once.

The driver should not change, add or demolish the truck components without the permission to influence the performance of the truck. It is not allowed to install accessory frame or handle on the steering wheel, except the factory has installed it.

The driver should use the truck in the using range.

#### 14.2.2 Load carriage (lifting and stacking) rule

##### 14.2.2.1 Load

The truck can only convey the load not over its rated load weight.

Any measure of enhancing the capacity of the truck is forbidden.

Only the rank stabilized or safety load can be conveyed, especially when convey the super long or high load, should pay special care.

When convey the load which center of gravity is uncertain, operating the vehicle should special carefully.

##### 14.2.2.2 The loading and unloading of goods.

When loading the goods with forks:

- A) The space between the forks should fit the width of the conveying load.
- B) The fork should insert into the inner of the load as deep as possible. But pay attention to not make the fork tip touch the substance except the load. Then the fork should lift to the enough height to move the goods.

#### 14.2.3 Running (driving) rule

##### 14.2.3.1 General rule

The driver should drive the truck along the right side of the road, and the driver should see the road clearly and attend other truck, passengers and safety space.

The drivers should abide by all the traffic rules, including the speed limit specified in the factory.

It is necessary to hold a certain space with the front operating truck.

The driver should drive the truck with earnest and responsible attitude at any time. The

sudden starting, stopping and turn over at high speed are forbidden. Except for the requirement of the operation conditions, advising the steering wheel should not put on the limiting position when the vehicle is starting. If starting on the limiting position, it is necessary to operate carefully.

In operation (or called transport) state, if the load obstruct the driver's sight, then when the truck running, the load should be located in the back of the truck's moving direction.

In crossroads and the occasion that would obstruct the driver's sight, the driver must reduce the speed of the truck, and issue sound signal.

In crossroads and the occasion that would obstruct the driver's sight or some dangerous occasion, the truck must not exceed other truck moving at the same direction.

The driver must avoid the truck rolling over some fluffy object in order to avoid article damages or personnel hurts.

When turning, if there are some other trucks or pedestrians, the driver must issue warning signal.

The driver must comply with all labels about ground load carrying capacity and requirements of other instructive labels.

The driver must pay special attention to the load carrying capability of slopes and channels leading to electric elevator.

#### 14.2.3.2 Vehicle speed

The truck speed should coordinate with the status of person's activity, visibility, road or the ground conditions and load conditions of the running area. When the vehicle is moving on wet and smooth road surface the driver must be very carefully.

Under any situation, the vehicle speed must be controlled within the range that the truck can be stopped safely.

#### 14.2.3.3 Running on the slope

When operating on the slope, the following regulations must be obeyed:

- A) Moving up and down a slope slowly.
- B) Except for the side loading and no lifted load truck, it may as well make the bearing load device's surface towards the downgrade direction.
- C) Turning on the slope and bestride the slope are all forbidden.
- D) When the vehicle is near the slope, high platform or platform edge, the driver must drive carefully. The distance between the vehicle and the platform or platform edge must keep at least a truck tyre width.
- E) When the gradient is more than 10% during the truck's running up and down the slope, the load surface must be in a downgrade direction.

#### 14.2.3.4 Get across a gap

It must be ensured that under hanging devices (such as: lamps, pipeline and fire extinguishing system) there is an enough clearance height.

Before getting across the passage and door, it must be ensured that there is an enough gap among the vehicle, the driver and the load.

#### 14.2.3.6 The truck operating on the gangplank or transition board

Before the motor industrial vehicle pass the gangplank or transition board, it is necessary to make sure the firm of the board.

The overall weight of the truck should not excess the rated capacity of the gangplank or the transition board.

When passing the gangplank or the transition board, the driver should drive the truck carefully and slowly.

#### 14.2.3.7 The use of the truck in elevator (lifter)

Before the motor industrial vehicle driving into the elevator (lifter), it is necessary to make sure the elevator (lifter) can endure the over all weight of the truck, load and drivers.

Before allow the truck driving in or out of the elevator (lifter), all other personnel should leave away from the elevator (lifter).

After the bridge box floor of the elevator (lifter) is even to the ground, the truck should slowly drive in as the positive direction.

It should be the load go into the elevator (lifter) first not the driver, this is specially adapted to the walking type truck.

After the truck driving into the elevator (lifter), switch off the power.

#### 14.2.3.8 Parking

After the driver leaving, the carrying device must lower to the lowest position, switch off the power, stay steady the vehicle to prevent accidental move or make bold by others without approval.

When parking the truck, the fire fighting passage, access stairs and fire fighting passages should keep fluently.

The parking location of the truck should keep a safety distance to the railway.

#### 14.2.4 The vehicle maintaining rule for the drivers

##### 14.2.4.1 General rule

Before starting the truck, it is necessary to inspect the technical condition of the truck. According to the different type of the truck, should pay more attention to some special location: [for example: alarm system, power system, brake, steering equipment, wheel and lifting system.

If the truck is found to be repaired, or during the operation the defect develops, it is necessary to report it to the superior in concern. It is forbidden to repair or adjust the truck by the truck by the driver without permission.

##### 14.2.4.3 The charging and changing of the battery

The charging and changing of all the battery should be carried out by the personnel who has been trained and appointed staves and proceed as the description of the user's manual of the battery or truck factory. As usual the driver can be appointed.

Before charging or changing battery, the truck should be located correctly and brake.

When charging, the exhaust cap should be in the correct position to prevent the electrolyte spilling out, and make sure that the wind hole is in effect. Open the cover of the battery (or separate room) to exhaust the gas and thermal.

In the battery charging area, should adopt measures to prevent open flame, spark or electric arc. Smoking is forbidden.

The tools and other metal substance should put far away from the top of the battery without cover.

The top of the battery should keep dry; the connection terminal should keep clean, wipe a little Vaseline and screw down correctly.

Without approval, the battery of different voltage, weight or size could not replace the former one in the vehicle.

When reinstalling the battery, the battery should be put on the correct place.

Inspecting the liquid surface in the battery using open fire is forbidden.

When getting the solvent in the acid carboy, the acid carboy tilting device or siphon pipe could be used. When diluting oil of vitriol confect the electrolyte, only adding the oil of vitriol into water is permitted, not add water into oil of vitriol.

## 15 Maintenance

### 15.1 General description

Good performance of the motor industrial vehicle depends upon maintenance. Truck may damage personal health and properties in case of maintenance neglect.

### 15.2 Maintenance items

The items of check, lubrication, maintenance shall be carried out according to maintenance instructions supplied by the manufacture.

Only professional and qualified maintenance personnel are allowed to go along with the inspection, maintenance, modification and repair.

#### 15.2.11 Neither modification in design nor addition to the truck shall be taken without permission of the manufacture for sake of weakening performance or operation security of the truck. Nameplate and instruction manual shall be revised accordingly in that condition.

#### 15.2.13 All the components that are used for replacement must be of the same model, or at least of the same quality with the original part.

#### 15.2.14 Industrial truck must be kept clean for sake of fire. Find loose or defective part in time. Keep clean for lifting device, carrying device, wheel tread, foot pedal, and floor of the truck. No grease, oil stain, or other dirty substances shall be kept.

### 15.3 Inspection

#### 15.3.1 If any potential defective, abrasion, or damage is found in the vehicle after inspection, which would threaten safe performance, effective measure shall be taken. Truck cannot be put into operation before repair.

#### 15.3.2 Protective maintenance, lubrication and inspection shall be taken in accordance with schedule

