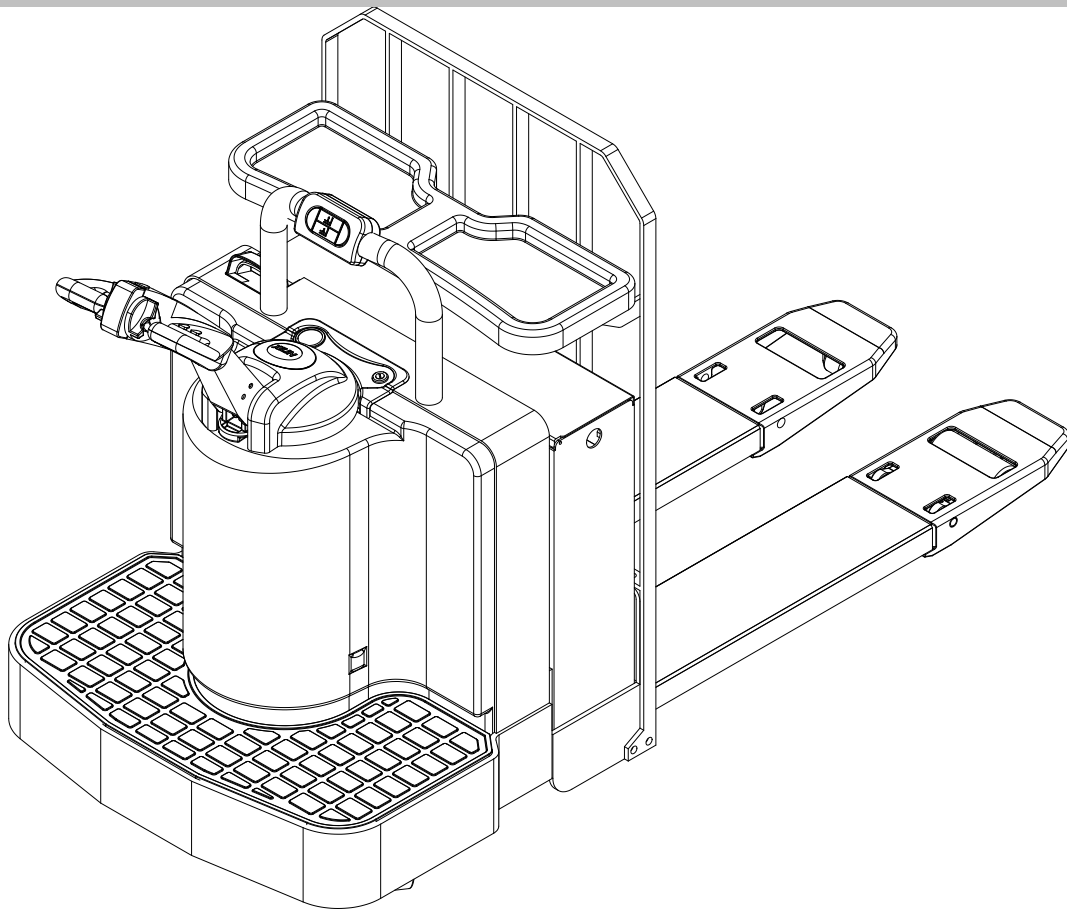


CBD25T/CBD30

Electric Pallet Truck

- Operation Manual
- Parts Catalogue



**Welcome to choose our 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 ISO3691“Safety Specifications of Motor Industrial Vehicles”. Untrained personnel are not allowed to operate the truck.

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Brief introduction :

CBD25T/CBD30 series electric pallet truck is powered by storage battery, and driven by motor. This kind of truck travels by means of gear drive. The fork is lifted by means of DC motor and hydraulic transmission, 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, such as labor-saving, high efficiency, stability in operation, simple and easy operation, safety and reliability, little noise, environmental friendly, etc. And the driving mode for this kind of truck is stand driving and steering operation of handle steering. 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

- a. Height above sea level shall not be over 1200m;
- b. Ambient temperature shall not be higher than +40°C and no lower than -25°C;
- c. When the ambient temperature reaches +40°C, the relative humidity should not exceed 50%; at a lower temperature, higher relative humidity is allowed;
- d. Hard and flat ground.
- e. 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.


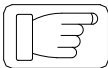
The instruction manual shall be carefully read before operation, for purpose of correct drive and suitable maintenance to ensure safe and effective material transportation.

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.

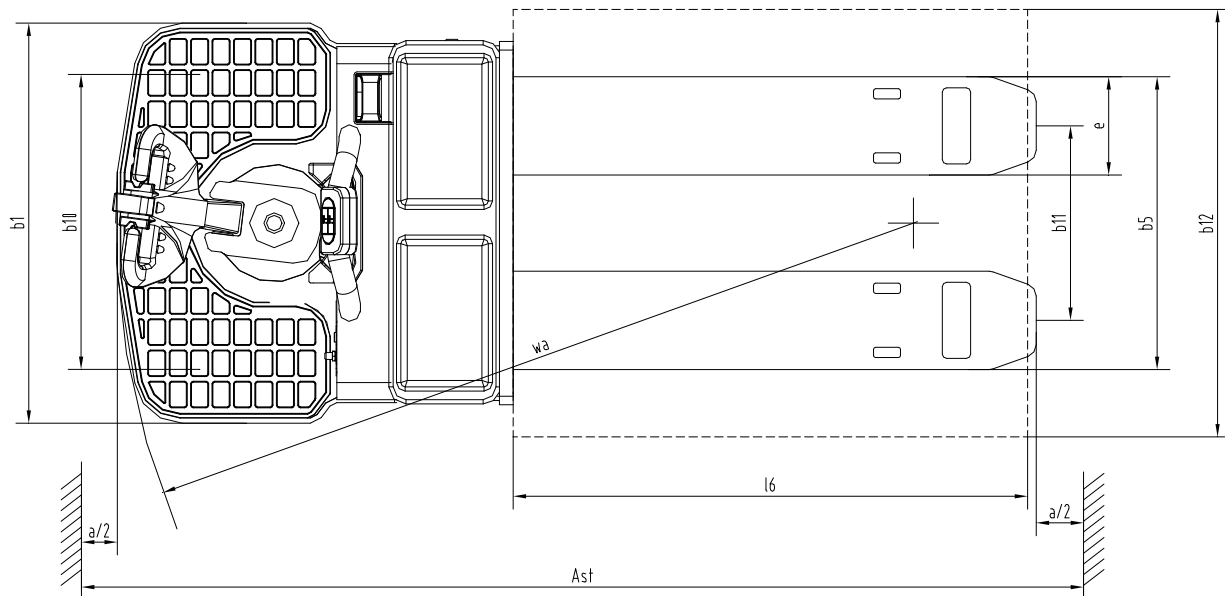
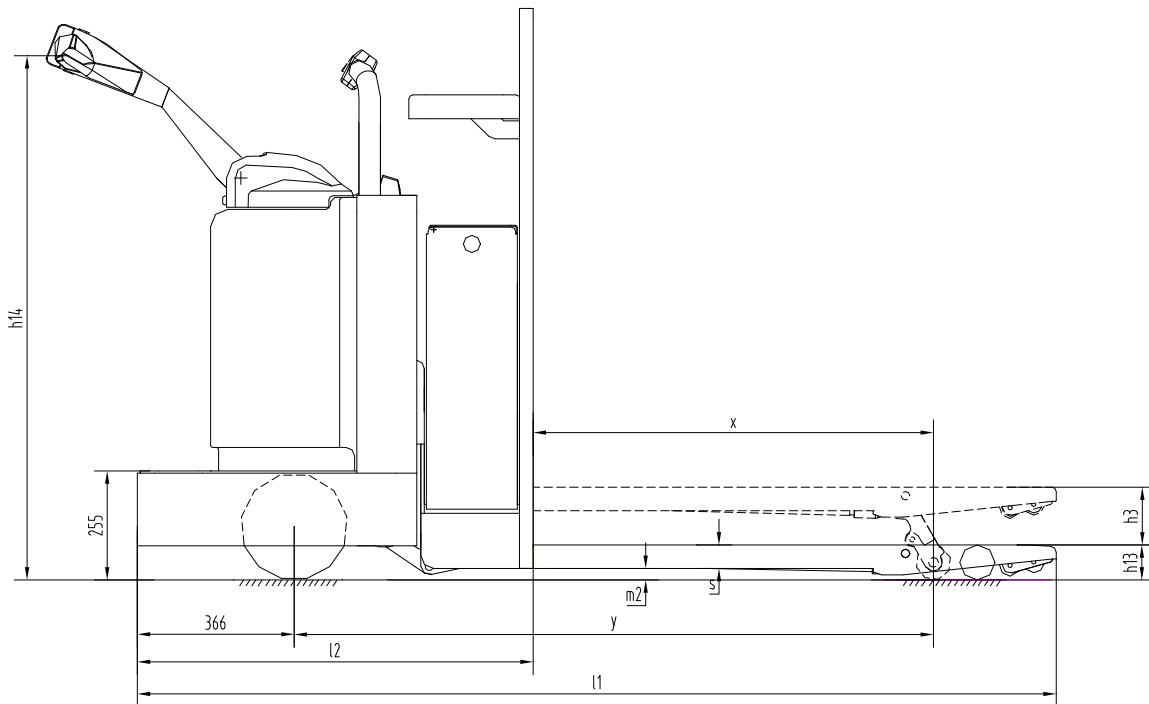
Please come into contact with our sales department in case of any problem.

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. CBD25T/CBD30 Outline drawing:

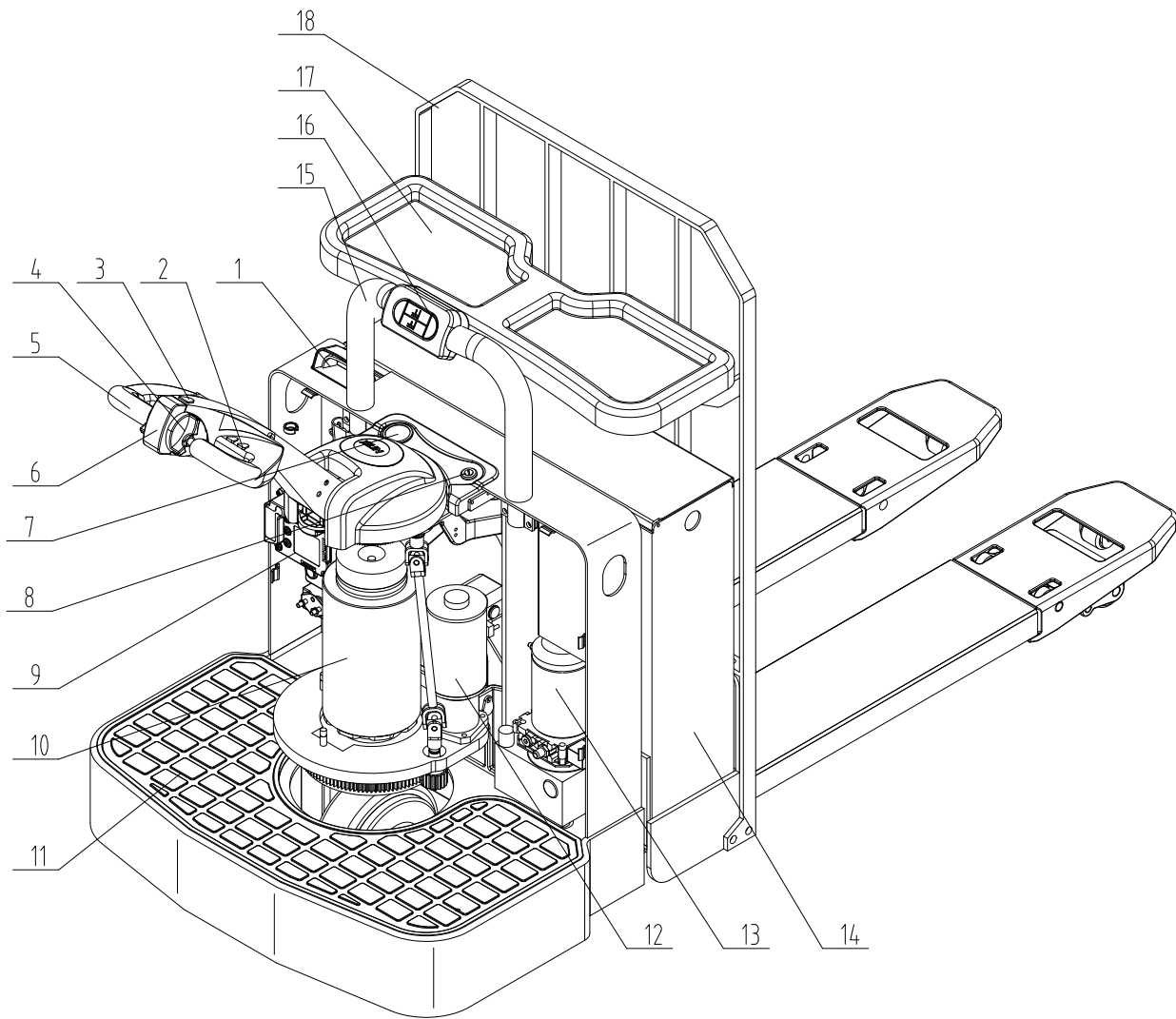


2、Main technical parameter

Characteristics	1.1	Manufacturer(abbreviated)			
	1.2	Model		CBD25T	CBD30
	1.3	Driving model : Electric(storage battery), diesel, gasoline, fuel gas		motor-driven	motor-driven
	1.4	Driving model (Manual, Walking, Stand driving, Seat driving ,Order picking)		Stand driving	Stand driving
	1.5	Rated load	Q(kg)	2500	3000
	1.6	Load center distance	c(mm)	600	600
	1.8	Front overhang	x(mm)	933	933
	1.9	Tread	Y(mm)	1613	1613
Weight	2.1	Service weight(with battery)	kg	860	860
	2.2	Axle load, front/rear, laden	kg	1240/2120	1360/2500
	2.3	Axle load, front/rear, unladen	kg	640/220	640/220
Wheel chassis	3.1	Wheels (rubber, high elasticity, pneumatic tyre, polyurethane wheel)		polyurethane wheel	polyurethane wheel
	3.2	Wheel dimension, front		φ250×80	φ250×80
	3.3	Wheel dimension, rear		φ82×173	φ82×173
	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_{10} (mm)	691	691
	3.7	Tread, rear	b_{11} (mm)	455	455
Dimension	4.4	Lift height	h_3 (mm)	135	135
	4.9	Min. /Max. height of operation handle, in driving position	h_{14} (mm)	1041/1374	1041/1374
	4.15	Height, lowered	h_{13} (mm)	82	82
	4.19	Overall length	l_1 (mm)	2265	2265
	4.20	Length to fork face	l_2 (mm)	1045	1045
	4.21	Overall width of truck body	b_1 (mm)	936	936
	4.22	Fork dimension	S/e/l(mm)	55x230x1220	55x230x1220
	4.25	Overall width of fork	b_5 (mm)	685	685
	4.32	Wheelbase ground distance	m_2 (mm)	27	27
	4.33	Aisle width, with pallet 1000x1200 crosswise	A_{st} (mm)	2465	2465
	4.34	Aisle width, with pallet 800x1200 lengthwise	A_{st} (mm)	2465	2465
4.35	Turning radius	W_a (mm)	1982	1982	
Performance Data	5.1	Traveling speed, laden/unladen	Km/h	7.5/8	6/6.5
	5.2	Lifting speed, laden/unladen	m/s	0.03/0.04	0.03/0.04
	5.3	Descending speed, laden/ unladen	m/s	0.05/0.045	0.05/0.045
	5.7	Gradeability, laden/unladen	%	6/8	6/8
	5.8	Max. gradeability, laden/unladen	%	8/20	8/20
	5.10	Traveling brake		regenerative brake	regenerative brake
Motor	6.1	Driving motor power	kW	1.5	2.2
	6.2	Lifting motor power	kW	1.5	1.5
	6.3	Battery voltage/rated capacity	V/Ah	24/300	24/300
	6.4	Battery weight	Kg	300	300
	6.5	Battery dimension (LXWXH)	mm	810×212×665	810×212×665
	8.4	Noise level at operator's ear, according to DIN12053	dB(A)	70	70

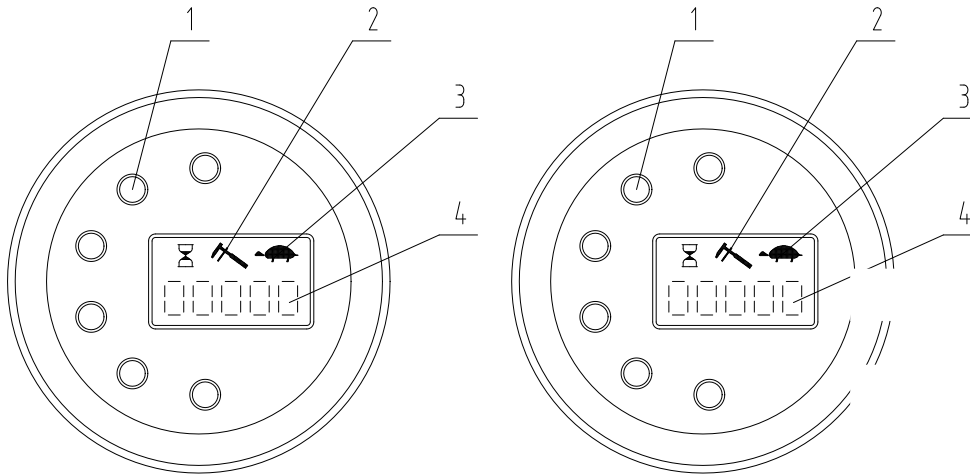
II .Structure description :

1. Structure of the entire truck:



- 1 power switch; 2 lifting button; 3 horn button; 4 accelerator knob; 5 operation handle;
 6 emergency reverse button;
 7 multi-functional instrument 8 electric lock; 9 electric control unit; 10 driving unit; 11 platform;
 12 steering power unit;
 13 hydraulic power unit; 14 storage battery; 15 handrail; 16 handrail control box; 17 tool pallet;
 18 backrest

2 Function introductions of instrument and operational control pieces:



(1)(1) instrument:

1. battery capacity indicator;
2. fault indicator;
3. low-speed indicator;

accumulative working time and fault code indicator

This instrument is a combination of battery capacity indicator, LCD hour meter, fault code and low-speed indicator, with the battery capacity indicator of five segments of colorful LED display.

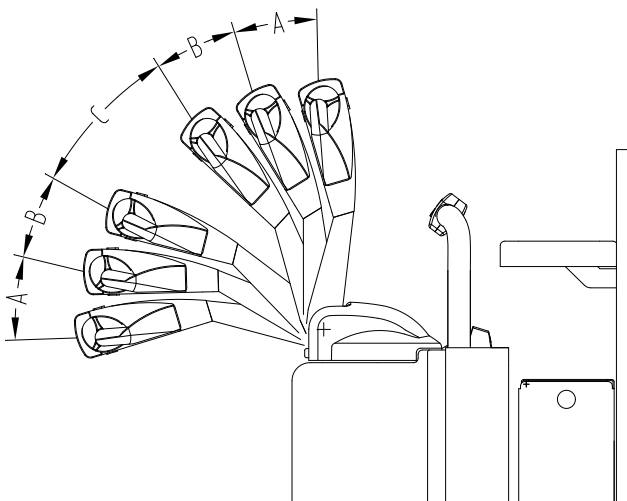
When the storage battery is fully charged, the five battery capacity indicators will be green. With battery capacity consuming up, the five indicators will go out one by one. When battery discharges by 70% capacity, the last indicator will flicker and shows "energy storage" alarm. When the battery discharges by 80%, the last indicator becomes red and shows "energy exhaust". After the external power supply is cut off, the internal battery can generally keep storage memory of 10 years. The life service time for monitoring of this 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, support bearings, potentiometer and steering power unit. The system is used to control travel direction of the truck.

(3)Braking:

the traveling brake of this truck is regenerative braking, with parking brake of electromagnetic brake. When the accelerator is released during the traveling of the truck, the controller will carry out regenerative braking at first. This kind of brake 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 type of regenerative brake with electromagnetic brake not only prolongs the service time of storage battery but also reduces the wearing of the brake plate, which extends the service time of brake



The position of operation handle is divided into 3 areas, i.e. area A , area B and area C which have different operational functions separately.

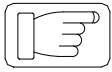
area A: When the operation handle is in area A, the truck will be in a state of braking. Then acceleration knob for traveling can not work but can only conduct lifting or lowering operation.

area B: When the operation handle is in area B, the truck will be in a state of traveling. When the accelerator knob is turned to one direction, the truck will travel in this direction. When the accelerator knob is turned in another direction, the truck will travel in another direction. When the accelerator knob is

released during

truck traveling, regenerative braking will take effect, making the truck slow down to stop.

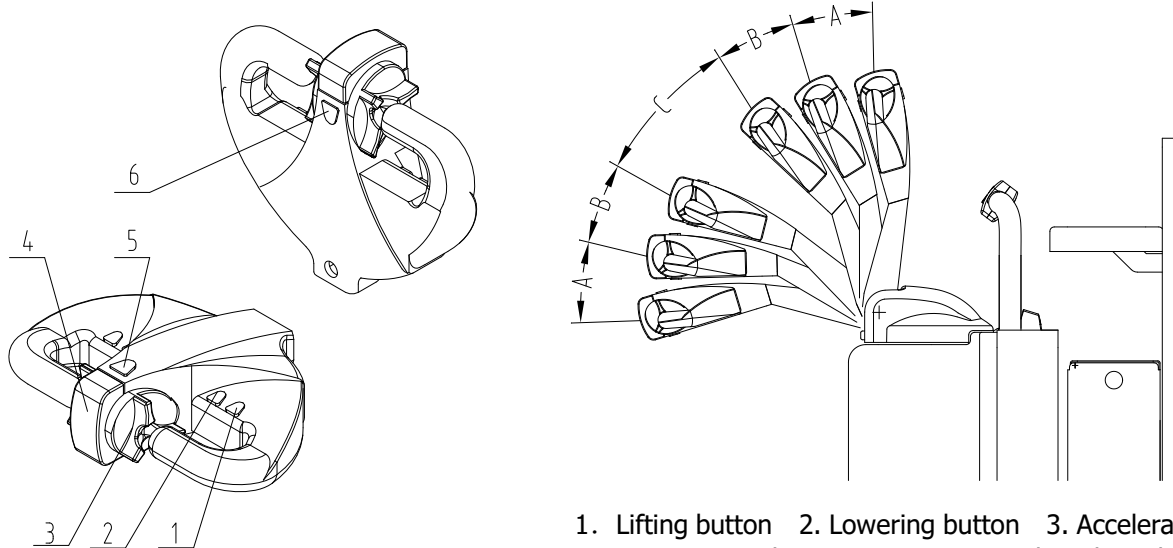
area C: When the operation handle is in area C, the truck will be in a state of traveling. When the accelerator knob is turned to one direction, the truck will travel in this direction. When the accelerator knob is turned in another direction, the truck will travel in another direction. When the accelerator knob is released during truck traveling, the truck will be in a state of free sliding.



When the operation handle is placed in area B or area C, the truck can conduct traveling operation as well as lifting operation. However, traveling and lifting operation can not realized at the same time, with the traveling operation as the preferential function.

(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.

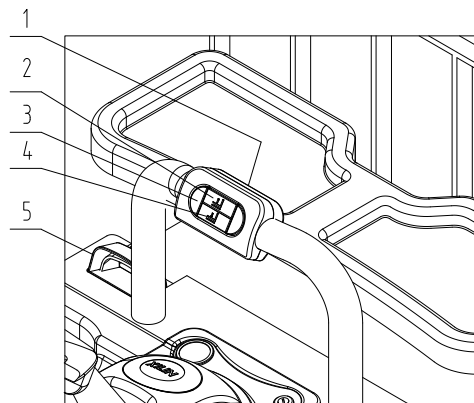


1. Lifting button 2. Lowering button 3. Accelerator knob
4. Emergency reverse button 5. Horn 6. Slow-down button

- 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 C shown as above. When the handle is placed in area A, the truck will be powered-off and braked. At this time, the truck can not drive. When the operation handle is placed in area C 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.

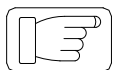


1. Horn button
2. Rise button
3. Tortoise climb button
4. Descend button
5. battery main switch

- 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. If your truck were out of control due to some reason, please immediately pull up the switch to cut off power supply for sake of any occurrence of accident.



As for the operation button on operation handle and handrail control case, the same buttons have the same control function, which is convenient for easy operation.

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 forbidden 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:



Warning

Don' t remake the truck

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 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:



Warning

Overloading operation of truck is forbidden. Overloading operation would cause damage to the truck or bring harm to operator

(9) Use suitable pallet:

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

(10) Electrical System Check:

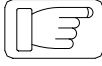


Notice

Before checking the electrical system, turn off the key switches and the emergency isolation switches.

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 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.

3 Operation norms:



Notice

The truck can only carry goods under rated capacity.

- 1) Forbid overloading operation.
- 2) Forbid defective 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.

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.

2. Driving:

(1) Start-up:




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

Turn the switch of electric lock to ON position. When the operation handle is turned to area B or area C 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. Then, the truck will be in a state of sliding. When the operation handle is turned to area B, regenerative braking take effect. And the truck will slow down until it stops.

(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 faces the forks. When the truck travels forward, if the operation handle is rotated counterclockwise, the truck will turn clockwise. If the operation handle is rotated clockwise, the truck will turn counterclockwise. When running backward, 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:

Turn the operation handle to area B and release the accelerator knob, then braking of the truck can be realized. While the operation handle is turned to area A, the truck will be in a state of braking, and traveling function will be cut of.

(5) Transportation operation:

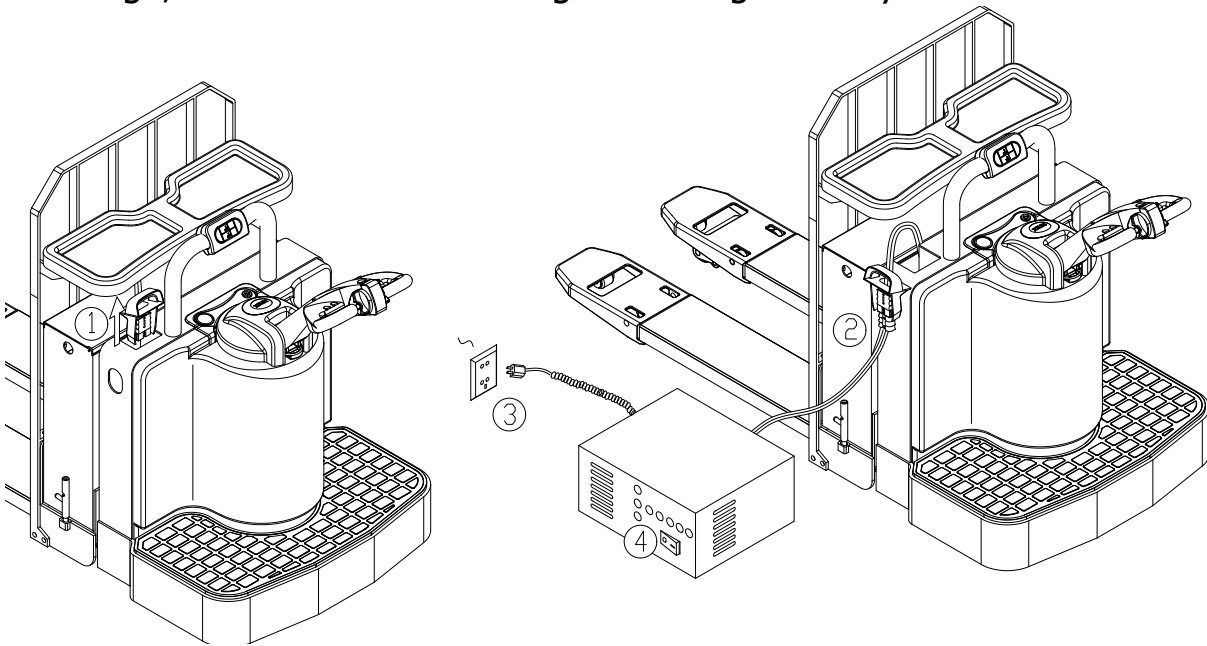


Notice
Before operating truck, do check the following items: Ensure no goods falling and damaged in the loading area.
Ensure no goods or objects impeditive for safety.

The following procedures 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 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 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;

V. Usage, maintenance and charge of storage battery



Schematic diagram of charging method

When it is necessary to conduct charging, please refer to the following operation methods,

1. Pull down the general power switch; 2. Connect the charging plug of storage battery to output connector of charger; 3. Then link the input connector of charger to AC power system; 4. Turn on the charger, and it starts to charge after several seconds.



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. 11 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 ± 0.005 (25°C) and a temperature of lower than 30°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:

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

D₂₅: the density of the electrolytic solution at 25°C

D_t: the 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. power source (charger) respectively and then turn on the power. Charge with the current of 40 A (the current of the first stage). After the charge voltage achieves 28.8V (12×2.4V=28.8V), switch to the 20A 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 40A and that of the second stage is 20A. 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 10 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 charging and 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 (12×2.6V=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 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 metho.

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 daily

(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.

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 week 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: 40A

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.
Lifting system	4	Oil pipe	Leakage or not.
	5	Hydraulic oil	Appropriate oil quantity.
	6	Lifting 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%.

Storage 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..

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.
Capacity of electrolyte	4	Inspect the liquid level of electrolyte, pure water can be used for supplement if the liquid level is too low.
Capability 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	Fuse	Whether it is perfect or not
	18	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.

Contacto	Burnish the coarse surface of contacto using sand paper
	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:

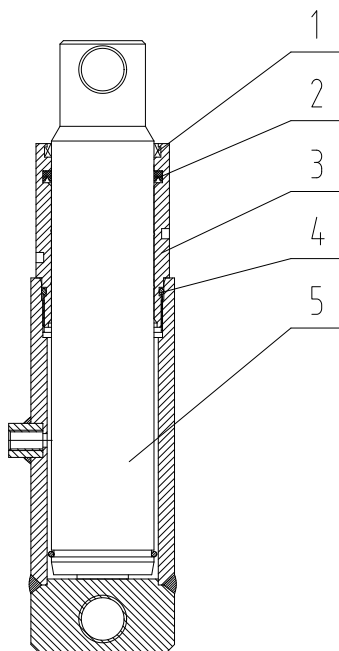
Hyperbola gear oil 85W-90(GL-5)

(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
Gearbox	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	
Oil pump motor	Check for carbon brushes and bearings	1000 hours	
Contactors	Burnish the coarse surface of contactor using sand paper.	1200 hours	Replace them if necessary

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 if it is normal or not.

Lower the forks to the lowest position.

Support the side near 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.

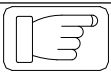
3 Loading and unloading of truck:

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

X. Replacement of storage battery

The weight of battery pack is about 290kg, and the replacement procedure of storage battery is as follows:

- 1.Pull down the socket connector of storage battery from the truck;
- 2.Turn on the safety pin of battery pack;
- 3.Pull out the storage battery from the side way and take the storage battery away with special car or using hoisting method;
- 4.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

XI. Common faults and trouble shooting: :

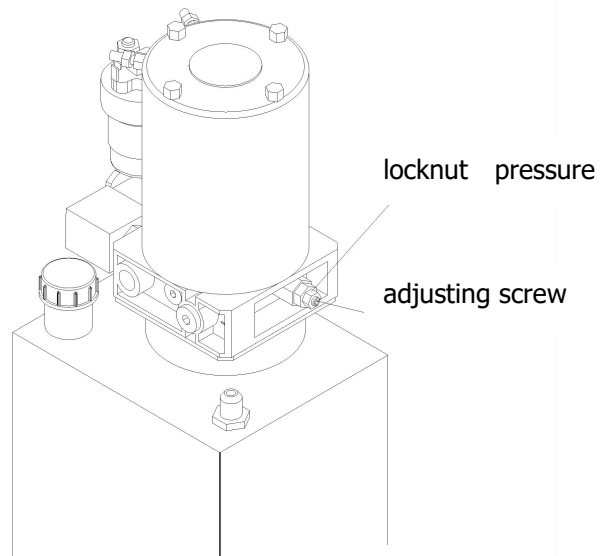
Faults	Possible cause	Trouble shooting
Abnormal noise during lifting	The oil-absorptive filter is blocked	Clean or replace the oil-absorptive filter
	The oil-absorptive tube leaks and the oil are foaming.	Fasten the tie-in, check the oil level, or add some oil.
	Hydraulic pump or motor is damaged.	Contact 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	Replace the oil or add some oil
	There is malfunction in valve pack.	Contact maintenance personnel of our company
	The pipeline is broken or leaking.	Contact maintenance personnel of our company
	The viscosity of oil is not suitable; the leakage loss is too great.	Replace the pipeline or screw down the tie-in.
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	The steering device is blocked by the abnormal matter.	Clean up the foreign matter.
	The steering potentiometer is loosened or invalid.	Replace the potentiometer or screw down the mounting screws.
	The steering power unit is faulty or wire terminal is loosened.	Tighten the screws or consult the maintenance personnel of our company.
	Malfunction of steering controller	Consult the maintenance personnel of our company.
Brake cannot work	The friction plates of the electromagnetic brake are damaged.	Replace
	Inching switch is damaged or ineffective connection.	Tighten it or replace it
	Steering potentiometer is damaged or loosened.	Tighten or replace it after adjustment
	Malfunction of controller	Consult the maintenance personnel of our company.
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

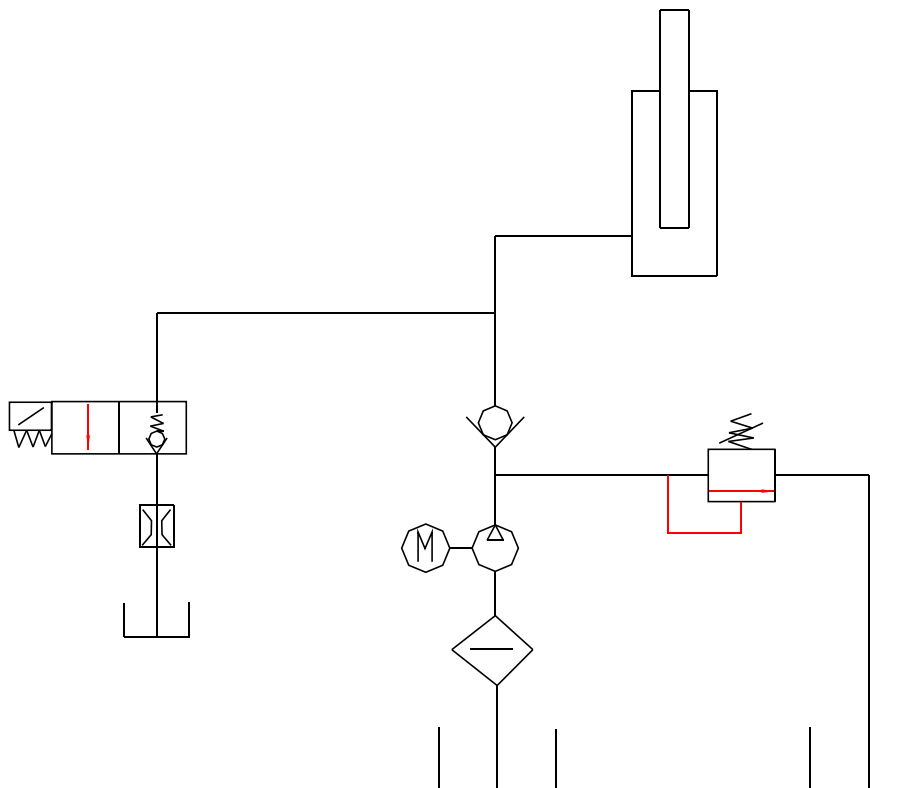
The pressure of safety valves has already been adjusted when the truck is ex-factory. Users shall not adjust the pressure at will. Otherwise it will bring danger to the truck's hydraulic system and safety. If the oil pressure is not in accordance with specified value, please ask the professional personnel 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 14Mpa 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.



Hydraulic principle diagram



Hydraulic principle diagram

XII.Common faults and trouble shooting

—. failure and failure elimination of swing controller:

1) MICRO SLAVE KO

CAN Bus code = 246

- Reason: Use in stepping moter.When the stepping moter direction which is tested by the Lord microprocessor doesn't match with the direction which is tested by microprocessor , **fault alarm.**

Turning error of the Lord microprocessor doesn't match with the direction which is tested by microprocessor.

besides, inspection transfer of the Lord microprocessor without limitation and the microprocessor has.

- Handle: Should change the controller.

2) MICRO SLAVE #4

CAN Bus code = 221

- Reason: One of the meet the following conditions occurred fault:

(Should be limited to open cycle system) Direction of turning of stator voltage which is tested by microprocessor is contrary to the speed signal of stepping motor , **fault alarm.**

(Should be limited to closed-loop system) Direction of turning of stator voltage which is tested by microprocessor is contrary to the setting direction, **fault alarm.**

- Handle: Should change the controller.

3) MICRO SLAVE

CAN Bus code = 250

- Reason: when the message bus between microprocessor and the Lord microprocessor is locked to numerical value 0xFF, (microprocessor can't be upgraded to the state of trunk configuration), failure warning will be happen.

- Handle: Should change the controller.

4) MICRO SLAVE #8

CAN Bus code = 212

- Cause: The Lord microprocessor which is calculated by encoder does not match with microprocessor, **fault alarm.**

- Handle: Should change the controller.

5) INPUT ERROR #1

CAN Bus code = 99

- Cause: Before the security contacts closing, voltage of CNA#4 is higher than 12V .(NK1: low potential of safety junction (see 7.6), **fault alarm.**

- Handle: When security contact disconnect, CNA#4 voltage approaches 0V, This quantity of battery positive terminal or negative terminal is independent(see 7.6)。

The fact is (Security contact is connected with battery positive terminal), When security contact disconnect, CNA#4 through load to connect with battery negative terminal. Only NK1 connection with the device errors occur, voltage will be higher than 12 V.

6) SERIAL ERR #1

CAN Bus code = 6

- Cause: Communication between microprocessor and the Lord microprocessor through local serial interface。

When the Lord microprocessor can't through the serial interface to send information from microprocessor, **fault alarm.**

- Handle: Should change the controller.

7) SLAVE COM. ERROR

CAN Bus code = 227

- Cause: Communication between microprocessor and the Lord microprocessor through local serial interface.

When the Lord microprocessor can't through the serial interface to send information from microprocessor, **fault alarm.**

- Handle: Should change the controller

8) NO SYNC

CAN Bus code = 227

- Cause: Every 16 milliseconds, code to internal circulation 1 time. The Lord microprocessor signal up and then down, and then will signal transmission give from microprocessors (SYNC). When microprocessors in greater than 100 milliseconds time not to the edge of the signal detection, can appear fault alarm, this is the function of watchdog.

- Handle: Should replace the controller.

9) KM CLOSED

CAN Bus code = 253

- Cause: Close the electric lock. In the main microprocessor before setting, testing safety from microprocessor contact is closed, fault alarm.
- Handle: If the connection CNA# 5 (K1) is in 12 V voltage range, when close the electric lock. fault alarm. In fact, When security contact disconnect, K1 should be attached to a positive terminal battery voltage is end (not 12 V). Check the hardware or replace the controller.

10) KM OPEN

CAN Bus code = 251

Cause: When the Lord microprocessor testing safety contact is in closed state, but in broken state from a microprocessor detection, fault alarm.

- Handle: Should replace the controller.

11) KS CLOSED

CAN Bus code = 254

- Cause: safety contact is closed before microprocessor set. fault alarm.
- Handle: If the connection CNA# 5 (K1) is in 12 V voltage range, when close the electric lock. fault alarm. In fact, When security contact disconnect, K1 should be attached to a negative terminal battery voltage is end (not 12 V). Check the hardware or replace the controller.

12) KS OPEN

CAN Bus code = 252

- Cause: When the Lord microprocessor testing safety contact is in closed state, but in broken state from a microprocessor detection, fault alarm.
- Handle: Should replace the controller.

13) CLOCK PAL NOT OK

CAN Bus code = 218

- Cause: The main uC sends an analog signal towards the slave uC to reset the slave uC on demand. When the slave uC detects this analog signal external to a window from 2.2 to 2.8 and not in the range to generate the reset on demand, the slave uC raises this alarm.
- Handle: Should replace the controller.

14.1.2 Trouble light fliters 2 times.

1) HIGH CURRENT

CAN Bus code = 70

- Cause: Closing the electric lock or repeat the electric lock, motor running, motor current of controller detection reaches limit value.
- Handle: Check the eps-ac0 motor matched with controller (cannot too big), or need to replace controller.

2) POWER FAILURE #1

CAN Bus code = 73

- Cause: Motor start to operation, but motor W phase current is 0, then fault alarm.
- Handle: Check the power insurance is normal or not. Check the battery and the wiring of positive controller. Check the wiring of motor W phase. Otherwise need to replace controller

3) POWER FAILURE #2

CAN Bus code = 72

- Cause: *Motor start to operation, but motor U phase current is 0, then fault alarm.*
- Handle: Check the power insurance is normal or not. Check the battery and the wiring of positive controller. Check the wiring of motor U phase. Otherwise need to replace controller.

4) POWER FAILURE #3

CAN Bus code = 71

- Cause: *Motor start to operation, but motor V phase current is 0, then fault alarm.*
- Handle: Check the power insurance is normal or not. Check the battery and the wiring of positive controller. Check the wiring of motor V phase. Otherwise need to replace controller.

5) LOGIC FAILURE #1

CAN Bus code = 19

- Cause: When practical voltage of the interphase motor of between W and U are different with expected value, fault alarm.
- Handle: Should replace the controller.

6) LOGIC FAILURE #2

CAN Bus code = 18

- Cause: When practical voltage of the interphase motor of between W and U are different with expected value, fault alarm.
- Handle: Should replace the controller.

7) MAIN CONT. OPEN

CAN Bus code = 48

- Cause: when CAN BUS is set by PRESENT causes fault.
Contactor close is controlled by traction controller, eps-ac0 outstanding message through CAN. If this information lacks more than about 1.5 secs, this alarm occurs. If there is no information transmission more than 1.5 seconds, may cause fault.
- Handle: The cause of the problem is the traction control of the main contactor in the open

8) CAN BUS KO

CAN Bus code = 247

- Cause: when CAN BUS is set by PRESENT causes fault.
Eps-ac0 Must receive all information of traction controller. If there is no information transmission more than 1.5 seconds, may cause fault.
- Handle: Check the CAN Bus communication system, analysis structure of traction controller turn to steering.

9) MOTOR LOCKED

CAN Bus code = 220

- Cause: Motor current keep close to maximum current time more than 1 second, there will be an fault alarm.
- Handle: Check if motor has mechanical lock or not, Simple method is to DEBUG OUTPUT Settings for 11 (see 12.4.6.4).

14.1.3 Trouble light flickers 3 times.

1) D LINE SENSOR KO

CAN Bus code = 243

- Cause: When the average voltage of step motor (join CNA#9) is not zero causes fault: Stepping motor voltage is a sine wave of total null voltage.
- Handle: Check the step motor connection, especially resistance measurement between CNA# 9 and

battery anode (stepping motor dormant) is very low (close to 30ohms).

2) Q LINE SENSOR KO

CAN Bus code = 242

- Cause: When the average voltage of step motor(join CNA#8) is not zero cause sfault: Stepping motor voltage is a sine wave of total null voltage.
- Handle: Check the step motor connection,especially resistance measurement between CNA# 9 and battery anode (stepping motor dormant) is very low (close to 30ohms).

3) S.P OUT OF RANGE

CAN Bus code =248

- Cause: Adjust wrong potentiometer occurs fault. (CPOC1 on CNA#9, CPOC2 on CNA#8). When choosing single unit output potentiometer, if the output signal goes beyond between 0.8 V and 4.2 V will be a fault. When choosing double potentiometer, two ways of output voltage beyond the scope of the 4.5 V to 5.5 V will be a fault.
- Handle: Check the wiring of potentiometer, when the connection point potentiometer damaged can be caust fault alarm.

4) F.B OUT OF RANGE

CAN Bus code =249

- Cause: Potentiometer feedback (CPOTon CNB#6) signal is wrong If CPOT out of the range between 0.3Vand 4.7V,alarming.
- Handle: Check the wiring of feedback potentiometer. Feedback potentiometer wiring damage will alarm.

5) POSITION ERROR

CAN Bus code =228

- Cause: the fault occurred when tests potentiometer feedback.
 - 1) When the feedback potentiometer is used together with the feedback encoder, When feedback potentiometer and feedback encoder used together, and controls steering Angle of steering wheel . The same setting in the test menu of FEEDBACK ENC and FEEDBACK POT When both numerical different, more than 20 degrees will be alarm.

(SET MAX FB POT–SET MIN FB POT amount to 180 degree).
 - 2) When encoder feedback and trigger switches used together, if the area (trigger switch to install and configure area) is not match with encoder calculation will be alarm.

This area is read through the test menu of FEEDBACK SECTOR: Encoder calculated value is read through WHEEL ANGLE of testing menu. Special note: the actual application is two trigger switch.

Guide wheel deflection Angle [degree]	Confirm area	Affirmative feedback area
-22 to +22	1 st or 4 th	3.13 V or 1.88 V
+23 to +67	1 ^s	3.13 V
+68 to +112	1 st or 2 nd	3.13 V or 4.39 V
+113 to +157	2 nd	4.39 V
+158 to -158	2 nd or 3 rd	4.39 V or 0.62 V
-157 to -113	3 rd	0.62 V
-112 to -68	3 rd or 4 th	0.62 V or 1.88 V
-67 to -23	4 th	1.88 V

- Treatment: check the potentiometer connection is correct or not . the trigger switch connection between the CNA# 2 and CNA# 3,check if the inspection wiring is correct or not , and will AUX FUNCTION 11 is set

correctly, set correctly with AUX FUNCTION 11 (see 12.4.1.9), And check motor bearing sensor (encoder) whether slip (bearing sensor has two loop connection: one connects rotor shaft; another connects electric cabinet) or not, no slip, check if the two road rate differential wiring structure reliable connect or not.

6) STEER SENSOR KO

CAN Bus code = 84

- Cause: If the jitter range of instructions (CPOC1 on CNA#9 or CPOC2 on CNA#8) to potentiometer is more than MAX SP SLOPE (see 12.4.6.3) will cause fault.
The fault is often due to potentiometer provides discontinuous voltage signal.
- Handle: Replace two-way potentiometer

7) JERKING FB POT

CAN Bus code = 223

- Cause: numerical changes of feedback potentiometer in 16 milliseconds jitters greater than 0.3 V will failure. Failure is often due to a discrete output voltage signal of feedback potentiometer.
 - o Handle: Change the feedback potentiometer.

8) FB POT LOCKED or FB SENS LOCKED CAN

Bus code = 222

- Cause: The application of a feedback potentiometer, adjust potentiometer numerical but feedback potentiometer (CPOT on CNB# 6) also don't change (or opposite direction change), at this time will failure.
In the application of trigger switch, set ENCODER CONTROL to off, it controls the change of potentiometer but feedback ENCODER potentiometer is not calculated value change, at this time will failure.
- Treatment: In the application of trigger switch, check if the encoder is mechanical loose or not and steering wheel has choking phenomenon or not.
Make sure that the wiper is not beyond the maximum machinery limitation of steering wheel.
In addition, fault may occur in the installation, when the motor rotation direction is not the same with the expected direction.
 - o In the application of trigger switch, check if the encoder is mechanical loose or not and steering wheel has choking phenomenon or not.
It is easy to solve the problem, set DEBUG OUTPUT to 11 (see 12.4.6.4).

9) STEPPER MOTOR MISM

CAN Bus code = 219

- Cause: when the attachment frequency of stepping motor is not match with differential pressure will be fault.
 - o (such as: There is high differential pressure but low frequency of connection between D and Q of stepping motor). when the step motor difference increases in normal conditions, the stepping motor frequency also will be increase subsequently.
- Treatment: Need to change the controller.

10) ENCODER ERROR

CAN Bus code = 241

- Cause: When ENCODER CONTROL sets up to ON. The actual frequency can't reach a set frequency will be alarm.
- Treatment: Since the two conditions of individual exists: encoder resolution is not match with the actual encoder, or there is wrong connection of two encoder galleries. the new way is connecting two encoder galleries.

11) BAD ENCODER SIGN

CAN Bus code =83

- Cause: When the signal of the frequency and the electrical machine is opposite, use trigger switch will be fault.
- Treatment: Interchange the two holding wire of encoder (CNB#7 with CNB#8).

14.1.4 Trouble light flickers 4 times

1) EEPROM KO

CAN Bus code = 13

- Cause: There is wrong read in EEPROM position when testing, the soft will be take it to a ready-made data. Also happens in three pieces of redundancy area provides different hour count; Or happened in data busy block, EEPROM cannot finish read in 12 microseconds - Treatment: Need to change the controller.

2) GAIN EEPROM KO

CAN Bus code = 244

- Cause: gain compensation of current amplifier parameters (ADJUSTMENT #03 and ADJUSTMENT #04) adjustment is the redundancy treatment of erasable storage unit. Actually each adjustment is fixed position for 3 erasable storage unit. If the value number of position 3 is different will be cause fault alarm.
- Treatment: Must be sent to the controller ZAPI, a maximum current adjustment. .

3) CURRENT GAIN

CAN Bus code = 225

- Cause: Fault occurs in the default setting of gain compensation parameters (ADJUSTMENT #03 and ADJUSTMENT #04) of current amplifier (For example: not to adjust the biggest current value)
- Treatment: Need to adjust the maximum current value of Zapi controller.

14.1.5 Trouble light flickers 5 times

1) HIGH TEMPERATURE

CAN Bus code = 61

- Cause: Fault occurred in electronic control base temperature higher than 75 ° .
- Treatment: Improve the refrigeration condition of controller and need to change the controller if not.

2) MOTOR TEMPERAT.

CAN Bus Code = 65

- Cause: Fault occurs in DIAG MOTOR TEMP is set to "on", temperature measured by temperature probe of motor inside is higher than 150 ° .when motor internal temperature higher than 150 ° will be fault. (DIAG MOTOR TEMP is ON).
- Treatment: Check the temperature probe and improve the refrigeration environment of motor if normal.

14.1.6 Trouble light flickers 6 times

1) STBY I HIGH

CAN Bus code = 53

- Cause: There are two cases:
 - 1) I close the electric lock, in the initial idle state, Current amplifier output signal is out of 1.2-1.8 V range. .
 - 2). primary diagnosis After failure, current output voltage of amplifier is greater than the + /-0.15 V. .
- Treatment: Need to change the controller.

2) VMN NOT OK

CAN Bus code = 32

- Cause: Fault occurs in the initial idle state after electric lock closed, amplifier output

- of motor voltage is not in 2.2-2.8 V range
- Treatment: Need to change the controller.

3) LOGIC FAILURE #3

CAN Bus code = 17

- Cause: Fault occurs in idle state.voltage amplifier drift of interphase voltage between Vu and Vw is more than $\pm 0.25V$.
- $\pm 0.25 V$.
- Treatment: Need to change the controller.

4) LOGIC FAILURE #4

CAN Bus code = 16

- Cause: Fault occurs in idle state, voltage drift of voltage amplifier output between Vw and Vv is 0.25V.
- greater than $\pm 0.25V$.
- Treatment: Need to change the controller.

14.1.7 Trouble light flickers 32 times

1) DATA ACQUISITION

MDI-PRC Code = 245

Cause: Fault occurs in setting motor resistance or current amplifier compensation parameters adjustment (after adjustment is the largest current value.

- Treatment: Switch the electric (switch) lock again.

14.1.8 Trouble light don't flicker (Warning)

The warning will not cut off the forklift truck operation, they will only make speed slowing down. So they just remind the operator attention of a particular state of truck.

1) STEER HAZARD

CAN Bus code = 85

- Cause: This is only a notice warned, turning controller to limit the turn direction angle and will not slow down in traction.

2) WAITING DATA

CAN Bus code = 237

- Cause: The warning occurs in setting CAN BUS to PRESENT, close the electric lock eps-ac0 through CAN Bus to receive parameter inventory from traction controller. Request cannot receive the right parameter occurs alarm. a fault in, steering motor was not drove when fault, safety relays keep disconnect state.

3) WAITING FOR TRAC

CAN Bus code = 239

- Cause: Close the electric lock, eps-ac0 need to agree a signal to joint the safety closing which is from traction controller and to change the mode of operation.If don't agree ,will be fault. When the warning is exists, operation is not activated, safety relays keep off

4) EPS NOT ALIGNED

CAN Bus code = 238

- Cause: The fault disconnect traction controller connection. This problem happened in the initial set, Have not set straight forward in 6s will be failure. 6 S activated failure, safety relays will disconnect, simultaneously traction controller stopped working.

14.2 CAN BUS error listing

AC0 (Device code06) See following fault codes:

6:	SERIAL ERR #1
13:	EEPROM KO
16:	LOGIC FAILURE #4
17:	LOGIC FAILURE #3
18:	LOGIC FAILURE #2
19:	LOGIC FAILURE #1
32:	VMN NOT OK
48:	MAIN CONT. OPEN
53:	STBY I HIGH
61:	HIGH TEMPERATURE
65:	MOTOR TEMPERAT.
70:	HIGH CURRENT
71:	POWER FAILURE #3
72:	POWER FAILURE #2
73:	POWER FAILURE #1
83:	BAD ENCODER SIGN
84:	STEER SENSOR KO
85:	STEER HAZARD
99:	INPUT ERROR #1
212:	MICRO SLAVE #8
218:	CLOCK PAL NOT OK
219:	STEPPER MOTOR MISM
220:	MOTOR LOCKED
221:	MICRO SLAVE #4
222:	FB POT LOCKED
223:	JERKING FB POT
225:	CURRENT GAIN
226:	NO SYNC
227:	SLAVE COM. ERROR
228:	POSITION ERROR
237:	WAITING DATA
238:	EPS NOT ALIGNED
239:	WAITING FOR TRAC
241:	ENCODER ERROR
242:	Q LINE SENSOR KO
243:	D LINE SENSOR KO
244:	GAIN EEPROM KO
245:	DATA ACQUISITION
246:	MICRO SLAVE KO
247:	CAN BUS KO
248:	S.P OUT OF RANGE
249:	F.B OUT OF RANGE
250:	MICRO SLAVE
251:	KM OPEN

- 252: KS OPEN
- 253: KM CLOSED
- 254: KS CLOSED

2. Fault and elimination methods of walk controller

The main menu alarm log records of controller fault alarm, controller has FIFO characteristics.

, that means when the database has full or new alarm occurs, then the first alarm fault record will be lost. **ALARMIM** Alarm log consists of five information as follow. To distinguish these five types of alarm.:

- 1) Alarm code
- 2) the duration of the alarming time
- 3) hour meter of the latest alarm event count.
- 4) the inverter temperature of the latest alarm event count.

When the alarm was revised recently, the function can be further fault diagnosis.

Note: if the same fault continuously happen, the alarm log will not store that fault again, but will update the number count of the storage unit. hourmeter can show first time occurs alarm, so compared with controller hourmeter can sure:

- First time of alarm occurred
- Hours from the first time alarm occurs up to now
- Several times alarm from the first time to this day.

14.1 Fault diagnosis system

COMBIAC1 Controller fault diagnosis system can be divided into two groups

ALARMS: The fault is will shut off the power unit, and is shut off the power bridge, main contactor disconnect, activate electric braking. .

Cause for fault:

- Motor or controller fault, the power unit can't drive the vehicle.
- Security reasons

WARNING : The fault is can't stop the truck or stopped by regenerative braking. In other words, the controller works well, but detect some unfavorable factors will reduce vehicle performance or the truck will stop under the circumstance of open the power unit. .

Cause for fault:

- Wrong operation order
- Impact performance factors (such as high temperature)

14.2 Main microcontroller alarm lists

Error code of main controller	Error code	Fault state	Fault influence	State of truck when testing	Restart procedure
CAPACITOR CHARGE AL60	Await for traction	Power capacitor voltage doesn't increase	Valve, pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start	Request of valve, lift or traction

VMN LOW AL30	Await for traction	Motor output voltage is lower than ideal value	Valve、pump motor, Traction electric machine is stopped , Master contactor is disconnection,_ electromagnetic braking	start	Request of valve、lift or traction.
VMN HIGH AL31	Await for traction	Motor output voltage is higher than ideal value	Valve、pump motor, Traction electric machine is stopped , Master contactor is disconnection,_ electromagnetic braking	start	Request ofvalve、lift or traction
POWER MOS SHORTED AL7*	Await for traction	Power MOS shorted	Valve、pump motor, Traction electric machine is stopped , Master contactor is disconnection,_ electromagnetic braking	start	Request ofvalve、lift or traction
COIL SHORT HW KO Hardware failureAL7 5	Await for traction	Hardware circuit fault with short-circuit protection of main contactor and EMBR coil	Valve、pump motor, Traction electric machine is stopped , Master contactor is disconnection,_ electromagnetic braking	start	Request ofvalve、lift or traction
COIL SHORTED AL76	Await for traction	Main contactor or braking coil shorted	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection,_ electromagnetic braking	Static state、 traction	Request ofvalve、lift or traction
DRIVER SHORTED AL74	Await for traction	Main contactor coil driving shorted,shouldn't turn-off the main contactor.	Valve、pump motor, Traction electric machine stopped , Master contactor is disconnection,_ electromagnetic braking	Start、 Static state、 traction	Request ofvalve、lift or traction
CONTACT OR DRIVER AL75	Await for traction	Main contactor coil driving damaged (main contactor cannot close)	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection,_ electromagnetic braking	Static state、 traction	Request ofvalve、lift or traction

CONTACTOR OPEN AL38	Await for traction	Main contactor coil has drove ,but the switch can' t close.	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start	Request ofvalve、lift or traction
CONTACTOR CLOSED AL37	Await for traction	Main contactor fault	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start	Request ofvalve、lift or traction
AUX DRIVER SHRT Auxiliary coil driving shorted	Await for traction	Electric braking MOS shorted.	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start , Static state	Request ofvalve、lift or traction
AUX DRIVER OPEN Auxiliary coil driving shorted	Await for traction	Braking coil driving damaged(cannot close)	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Static state , traction	Request ofvalve、lift or traction
POS AUX SHORT Auxiliary coil positive pole shorted.	Await for traction	When the handlebreak up, Smart Instrument drivingoutputs high level to EMBR coil.	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start	Request of valve 、 lift or traction
LOGIC FAILURE #1 #1AL19	Await for traction	overvoltage/low tension	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start , Static state, traction	Request ofvalve、lift or traction
LOGIC FAILURE #2 AL18	Await for traction	Voltage feedback circuit damaged	Valve、 pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Static state after main contactor closed and traction immediately	Request of valve 、 lift or traction

LOGIC FAULT# 3 AL17	Await for traction	Hardware protectionfault of high current	Valve、pump motor, Traction electric machine stopped , Master contactor is disconnection, electromagnetic braking	Start 、 Static state	Request ofvalve 、 lift or traction
STBY I HIGH High quiescent current AL53	Await for traction	(motor not have current) current feedback withion allowed band in static state	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start 、 Static state	Request ofvalve 、 lift or traction
WRONG SET BATTERY	Await for traction	Lower electric quantity ((0.8V or) 1.2V)	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start、static state (Main contactor closed and traction immediatel y)	Request ofvalve 、 lift or traction
ANALOG INPUT	Await for traction	Fault digital to analogconverter of main microcontroller	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start、static state 、traction	Request ofvalve 、 lift or traction
ENCODER ERROR AL58	Await for traction	Encoder error	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start、static state 、traction	Request ofvalve 、 lift or traction
TILLER ERROR AL97	Await for traction	Imput signal of soft/hard switchand handle switch don' t match .	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start、static state 、traction	Request of valve、 lift or traction
WATCHDO G AL08	Await for traction	Main microcontroller can't through the CANBUS to receive the signal from the micro controller.	Valve、pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start、static state 、traction	Restart the switch lock

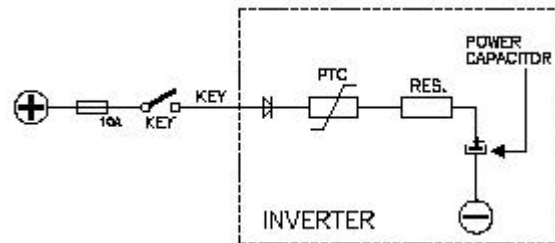
HW FAULT AL7*	Await for traction	Main microcontroller detected from micro controller can't shut off the traction allow end or main contactor and electric braking allows end	Valve, pump motor, Traction electric machine stopped , Master contactor is disconnection, electromagnetic braking	Start, static state (Main contactor closed and traction immediatel y)	Restart the switch lock
NO CAN MSG N5 Information transfer fault	Await for traction	Unable to receive signals from the micro controller	Valve, pump motor, Traction electric machine stopped, Master contactor is disconnection, electromagnetic braking	Start, static state , traction	Restart the switch lock
WRONG SETPOINT	Await for traction	micro controller control hydraulic function set is wrong which is detected from mian mircocontroller.	Valve, pump motor, Traction electric machine is stopped , Master contactor is disconnection, electromagnetic braking	continuatio n	Restart the switch lock
SAFTY FEEDBACK	Await for traction	Electromagnetic valve drive feedback fault which is detected by main mircocontroller.	Valve, pump motor, Traction electric machine is stopped , Master contactor is disconnection, electromagnetic braking	continuatio n	Restart the switch lock

14.3 Main microcontroller alarm analysis and solution

Home page for the handheld unit, press ENTER button to enter into the main menu

1) "CAPACITOR CHARGE" Power capacitor power

Below is the power of capacitance charging system



When closed electricity lock switch, inverter through power resistance to charge with power capacitor, testing the capacitor is charging in preinstall time, if not, there will be a fault display, main contactor disconnect.

Solution:

A) shunt load of power capacitor external ends, power capacitor will generate reverse current when in charge, which hinders the capacity charge. With a light bulb or a DC/DC converter or an auxiliary load instead of power capacitor used to detect faults.

B) Charging resistance disconnect, Insert power resistance to the main contactor power; If a fault disappeared, that means the controller charging resistance damage.

C) Controller internal charging circuit fault

D) Power unit of controller fault.

1 "VMN LOW" Low voltage of motor

Cause 1: Detection when start

before closed main contactor switch, with the software testing power bridge: alternate closed above power MOS tube, hope to increase phase voltage to power capacitor voltage value, if phase voltage not increase, will fault alarm

Cause 2:

Motor running test, when the motor is running, the power bridge in closed state, testing the motor voltage feedback; If lower than the set value that failure. Solution:

A) If the problem occurred in start-up (main contactor not closed), detection:

- Motor internal connection
- The motor power cable connection
- Electric leakage to frame
- That is the fault of the controller if motor connection correct,

B) If the fault occurred in the motor running, detection:

- Motor connection
whether Motor coil/ cable leakage to frame or not
- Good contacts of the main contactor power.
- That is the fault of the controller if motor connection correct

2 "VMN HIGH" Motor voltage is too high

Cause 1:

before closed main contactor switch , with the software testing power bridge: alternate closed above power MOS tube, hope to increase phase voltage to power capacitor voltage value, if phase voltage not increase, will fault alarm

Cause 2:

The fault diagnosis program is skipped will happen fault alarm when starts, therefore closed main contactor. In this condition, we hope to get the phase voltage less than half of the battery voltage. If this value is higher than that failure

Solution:

A) If the problem occurred in start-up (main contactor not closed), detection:

- Motor internal connection
- The motor power cable connection
- If motor connected correctly, it may be that the fault of the controller

B) after close the main contactor switch, fault detection.:

- Motor connection
- whether is Motor coil/ cable leakage to frame or not
- Controller fault if the motor is normal

4) "POWER MOS SHORTED"

Cause: before close the main contactor, detected the power bridge use soft: close the top and bottom MOS tube alternately , in the hope of reducing phase voltage to battery negative extreme value (increase phase voltage reaches to battery positive value). If phase voltage is not in conformity with the requirements, will failure.

Solution ways:

The fault type has no relationship with external constitute, change the controller

5) "COIL SHORTED HW KO" coil shorted hardware damaged

Cause : hardware circuit of main contactor and electromagnetic brake coil, which used in short-circuit protection is fault.

Solution:

This fault type has no relationship with external constitute, replace the controller.

6) "COIL SHORTED"

Cause: one of COMBIAC1 outputting winding shorted (main contactor or electromagnetic brake coil shorted) will be alarm.

Operation request activated alarm disappear automatically without overloaded condition.

Solution ways:

A) The typical cause of coil shorted is loading coils or output the first step will be detect the controller output and laden connection.

B) The fault will not happen in external connection, the controller has the problem , need to replace the controller.

7) "DRIVER SHORTED"

Cause: Main contactor coil driver shorted

Solution ways :

A) Check the cathode of main contactor coil (AMP saab type, on CNA#17end, AMP seal type, on CNA#12 end) whether shorted with the battery cathode or not.or if connected with a lower resistance value or not.

o

B) Drive circuit of controller damaged,need to change.

8) "CONTACTOR DRIVER" Contactor driver is damaged.

Cause: Main contactor coil of driving circuit can't drive loads. May be contact device itself or its driving circuit is damaged.

This fault type has no relationship with external constitute,replace the controller.

9) "CONTACTOR OPEN " Contactor disconnection.

Cause: Controller drive main contactor coil, but contactor switch has no closing.

Solution: Maybe the main contactor point of contact fault,which causes contact device does not work, replace main contactor

10) "CONTACTOR CLOSED"

Cause:before drive main contactor coil, check if controller contactor detection is normal or not. Then controller will drive power bridge 10 subtles in order to discharging the electric quantity of power. If no discharge shows failure.

Solution: Check the connection between the mian contactor and power unit.replace the main contactor .

11) "AUX DRIVER SHORTED"

Cause: Drive circuit of electric braking coil shorted.

Solution:

A) Detection of negative electromagnetic brake coil (AMP saab type , on the end of CNA#31, AMP seal type,on the end of CNA#4) ,check if it has shorted with battery cathode or not.

B) Controller driving circuit is damaged, replace controller

12) "AUX DRIVER OPEN" open circuit of auxiliary coil drive

Cause: Electromagnetic brake coil driver can't drive loads

Solution: replace the controller

13) "POS AUX SHORT " positive electrode of auxiliary coil shorted.

When the bat-handles switch and soft/hard has broken , SMART instrument output high level to positive electromagnetic brake coil.

Solution:

A) Check the output first, the purpose is to check if solenoid valve anode has matched with the SMART instrument output. (AMP saab type, on the end of CNA#30, AMP seal type,on the end of CNA#2)

B) If smart instrument don't connect with adapting piece. but output is always high level, that is means controller and smart instrument may shorted

14) "LOGIC FAILURE#1" logic card fault#1

When the controller detected overvoltage or undervoltage will be display fault.limitation of overvoltage

is 45V, limitation voltage is 9V in 24 controller undervoltage .

Static or start-up failure solutions; Static or starting may arise when voltage fault, need to check

A) The lock of the pulse signal input voltage drop (below the voltage limited voltage), the reason is external load, like start DC/DC converter, relays and contactor switch, incentive/disconnect solenoid.

B) If detected no voltage signal of input end, once closed electricity lock switch will be alarm, May be controller hardware failure. That need to change the controller.

Solution ways of motor operation fault: arise undervoltage or overvoltage fault when motor running.

A) If alarming in traction speed up or drive hydraulic function, probably owes pressure fault, check the battery power, power cable connection.

B) If alarming in releasing the brake period is likely to be pressure fault, check the connection and main contactor power cable of connection.

14) "LOGIC FAILURE#2" Logic card fault #2

Reason: Logic card used in voltage feedback ,its hardware parts will have fault.

Solution ways: It doesn't matter with the external constitute.so need to change the logic card when has fault.

15) "LOGIC FAILURE#3" Logic card fault #3

Reason: circuital current of logic card is overtop(overload) resulted in hardware failure.

Solution ways:

It doesn't matter with the external constitute.so need to change the logic card when has fault.

16) "STBY I HIGH" quiescent current is overtop.

Cause: The controller current sensor or current feedback circuit damaged.

Solution:

It doesn't matter with the external constitute.so need to change the logic card when has fault.

18"WRONG SET BATTERY"

Cause:

controller will test battery voltage and displays in the window to calibration of voltage value is in nominal level when start.

Solution:

A) "SET BATTERY" Check the controller parameter value if matchs with battery voltage of nominal value or not.

B) Check if the TEST MENU / BATTERY VOLTAGE indications of the parameters equal with voltage value measured by voltmeter or not. if not equal, "ADJUST BATTERY" to adjust the voltage.

C) Change the battery.

19) "ANALOG INPUT"

Cause:

When the analog input is frozen, all the signals are converted over for freezing time more than 400 milliseconds, then the fault alarm.

The purpose is to test the diagnosis of digital-to-analog converters fault or code flow fault, Code flow may omit the process to update analog signals.

Solution:

If a fault persists, need to replace controller.

20) "ENCODER ERROR"

Cause: In the following conditions caused a fault signal: Motor input frequency higher than 40 HZ, encoder signal feedback is higher than 40 HZ in 10 milliseconds. The fault directs at the multi-function encoder.

Solution:

A) Check the electric and mechanical encoder functional, wire was huddled up

B) Check the encoder machinery installation, the internal encoder slide will cause fault alarm.

C) Bearing the electromagnetic noise encoder can also cause alarm, this kind of situation will need to replace encoder.

D) If still have fault after change the encoder may be the problem of controller.

21) "TILLER ERROR" Handle switch fault

Cause: soft /hard switch input and handle switch input signal don't match.

Solution: Check the connection of AMP saab type of CNA#7end and input voltage of CNA#6 end (AMP seal type connection, check CNA#29 end and CNA#1 end). If the input of the state is correct, that may be the internal controller fault, need to replace the controller.

22) "WATCHDOG" watchdog fault

Cause: This is a safety detection, implement the diagnosis between internal main microcontroller in logic card and microcontroller.

Solution:

Alarm maybe caused by CANBUS fault, it hinders the communication between main microcontroller and microcontroller, if not, need to replace.

23) "HARDWARE FAULT" Hardware fault

Cause :

micro controller can't shut off the of permission end traction function or the permission end of main contactor end and electric braking .

Solution:

The logic of the card controller fault, replace the controller.

24) "NO CAN MESSAGE N5"

Cause: Not receive from the information from micro controller

Solution: This alarm may be due to CANBUS fault, it hinders communication between the main microcontroller and the microcontroller. If not, may be controller internal fault, need to change.

25) "WRONG SETPOINT"

Reason:

Security detection, setting wrong hydraulic function tested by main microcontroller.

Solution ways:

Internal fault of controller,should replace the controller.

26) "SAFETY FEEDBACK "feedback of safety signal

Cause:

Security detection,fault feedback of Solenoid Valve Driving tested by main microcontroller.

Solution ways:

Controller fault,should replace the controller .

14.4 Give an alarm of main controller

Error code of main controller	Error code	Fault state	Fault influence	State of truck when testing	Restart procedure
PUMP WARNING		Alarm from controller			
SLIP PROFILE		Wrong settings of outline of sliding-vane parameters	Traction stopped	Start, await orders, traction	Tracriion request
FORWARD + BACKWARD AL80		Activate of forward and backward request	Traction stopped	Start, await orders, traction	Tracriion request
INCORRECT START AL79		Startup sequence is wrong	Traction stopped	Start, await orders, traction	Tracriion request
VACC NOT OK Accelerator fault AL78		he accelerator values is higher than the set, direction and permission switch disconnect.	Traction stopped	Start, await orders, traction	Tracriion request
HIGH TEMPERATURE AL62		controller temperature reaches to cut 85 °C temperature	Traction controller linear reduces current value from the maximum to 0 A, temperature rises from 85 °C to 105 °C..	continuation	
BATTERY LOW AL66		When BATTERY CHECK settings is over 0, Battery electric value is less than or equal to 10%	Maximum current reduced by half, speed cuts (If CHECK OPTION=1)	continuation	
EEPROM LOW EEPROM		EEPROM hardware or EEPROM software fault	controller works according to the default parameters	continuation	

damaged					
MOTOR TEMPERATURE AL65		The motor temperature sensor disconnect (if that is digital), or (if it is simulated) more than limit voltage 150. °C	Maximum current reduced by half, speed cuts	continuation	
THERMIC SENS KO temperature probe fault		Controller of the temperature sensor output beyond the range	Maximum current reduced by half, speed cuts	continuation	
CHECK UP NEEDED Service warning		Warning users machine maintenance time has passed, the machine need to maintain.			
DATA ACQUISITION		the maximum current adjustment (note: only ZAPI with the test unit to perform the procedure)	Stop pulling	Await orders	Request of traction
PEDAL WIRE KO Footstep connection is wrong AL86		The accelerator potentiometer negative (NPOT) voltage range beyond (less than 0.3 V, or greater than 2 V)	Stop pulling	Start , Await orders , traction	Request of traction
TILLER OPEN AL97		The handle switch broke and the truck in static, maintenance time is more than 30 S	Main contactor switch disconnection	Await orders	Request of valve, lift or traction
CURRENT GAIN		Maximum current parameter value @ behind for default, this means that still doesn't perform maximum current adjust program.	Controller worked as lower than the maximum value	Start , Await orders	
WAITING FOR NODE		micro controller in fault state, main microcontroller waiting for the troubleshooting.		continuation	

14.5 Main controller alarm analyze and solution

1) "PUMP WARNING" lift request .

Cause: Fault from controller.

Solution: handheld unit and controller connection ,inspection alarm.

2) "SLIP PROFILE"

Reason: Choice wrong preferences of slip profile.

Solution: Check the parameter values of hardware setting。

3) FORW+BACK

When activate back and forward request meanwhile will be happen alarm.

Solution: Check back and forward input connection request (Use TESTER functions to solve) Check whether the micro switch fault or not 。 Also may be logical card fault, so when has the request switch to ensure operation proofreading good work, its correctness, need to replace controller.

4) "INCORRECT START" Abnormal start

Cause: improper start-up alarming

Solution: The possible causes of the alarm (using TESTER functions to solve):

A) activate operation request of electricity lock switch.

B) The operator of the existing electric lock switch signals effectively.

Check the wiring, check the micro switch, may be the the order of operation is wrong , also may be the logical card fault. So when examined above may reasons, then if any mistake, replace the controller。

5) "VACC NOT OK" Accelerator fault

Cause: Test after the request of electric lock closed or broke 20S,When release the accelerator,

If accelerator value read from the TESTER menu higher than that read from the minimum voltage accelerator set 1 V, fault alarm。

6) "HIGH TEMPERATURE"

Reason : When the underpan temperature of controller is over than 85℃ ,alarming will be happen.TheMaximum current with the temperature from 85 ℃ to 105 ℃ rise, reduced in proportion。 Current is 0 ampere when in 105℃.

Solution ways: improve the cooling device of controller. When the controller cooling,if has occurs alarm , may be due to temperature sensor fault or logic card fault。 In this case,need to replace the controller。

7) "BATTERY LOW"

Reason : When battery electric energy less than 10% of all over voltage, cause faults."BATTERY CHECK" , parameter values of battery electric quantity is not zero 。 (reference menu SET OPTION)

Solution ways:

Battery charging , If the battery doesn't work, use voltmeter to measure thr battery voltage value , compared with BATTERY VOLTAGE values.if the two vaues can' t equal, "ADJUST BATTERY" parameter。

8) "EEPROM KO"EEPROM damaged

Reason: Built-in Storage controller parameters "eeprom" damaged or hardware or software fault. This alarm will not banned the operation of trucks and works according to default.

Solution ways:

Try to perform "CLEAR EEPROM" clear memory command (portable unit). Disconnect the electric lock switch then closed, and check the result. If the alarm persists, need to replace controller. If the alarm disappear, previously stored parameter values are replaced by default values.

9) "MOTOR TEMPERATURE"

Reason: The temperature probe has broken down (numeric type)or more than 150°C (analogue type)
Check the temperature of the motor (Read "MOTOR TEMPERATURE" motor temperature value through TESTER menu); Check the sensor resistance and sensor wiring. If the sensor no problem, improve the air cooling device, if still happen alarm, may be motor internal malfunction.

10) "THERMIC SENSOR KO" temperature probe fault

Cause: Controller of the temperature sensor output beyond the range.

Solution:

This type of fault form has no relationship with external constitute,change the controller.。

11) "CHECK UP NEED"Sevice warming

Reason: It is time to examine and repair.

12) "DATA ACQUISITION"

Reason: Current gain

Solution ways: Obtained

13) "PEDAL WIRE KO"

REASON: The connection of two input terminals of continuation detection potentiometer. two input terminals connection of software which is testing accelerator potentiometer continuation. Testing including induction diode on both ends of the voltage drop,the two s is NPOT(AMP SAAB ADAPTING PIECE CNA#23 end) and GND, Cascaded with potentiometer: If potentiometer is not connected to the pspot end or npot end, no current through inductive diode, so to the voltage of npot connection slumped.

When the voltage of the npot is below 0.3 v, or higher than dc2v, alarm happen.。(Also can test the damage of the diode's damaged condition)

Solution ways: Inspect for the connection between valtage NPOT and potentiometer.

14) "TILLER OPEN"

Reason:

Alarm: After 30s ,main contactor disconnection when release the bat-handle switch.

Solution ways : when active the next operation request,alarm disappear.

15) "CURRENT GAIN"

Reason: obtained parameter values of maximum current is default, This suggests that haven't execute

the maximum current to adjust program.

Solution ways: get help from ZAPI, adjust of access to current procedure of parameters correctly.

Obtained

16) "WAITING FOR NODE"

Reason: controller can test another wrong controller through CANBUS, so the controller of traction can't enter into running status and await for controller get right.

14.6 Alarming from controller

Fault code from controller	Fault code of master control	Fault state	Fault influence	State of truck when testing	Restart procedure
EVP DRIVER SHORTED	Awaiting for node	Electromagnetic valve driver shorted (Always in "ON" state)	Valve、 pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetic braking	Start、 static state	Request of valve、 lift or traction
PUMP VMN LOW AL30	Awaiting for node	Low valtage of pump motor input.should controlled by PWM.	Valve、 pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetic braking	Start、 static state	Request of valve、 lift or traction
PUMP VMN HIGH AL31	Awaiting for node	Output voltage is on the high side of pump motor,controllef by PWM	Valve、 pump motor, Traction electric machine stopped , Master contactor is disconnection, electromagnetic braking	Lifting status	Request of valve、 lift or traction
ANALOG INPUT	Awaiting for node	Converter fault of microcontroller A/D	Valve、 pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetic braking	continuation	Request of valve、 lift or traction
LOGIC FAILURE#1 1	Awaiting for node	Overvoltage/Undertension	Valve、 pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetic braking	continuation	Request of valve、 lift or traction
WRONG ZERO	Awaiting for node	Output of amplifier(usefor current and voltage measurement)should inspect near zero. current sign is greater than 2.85V or lass	Valve、 pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetic braking	Initial state (iv, iw, huw, hvw) rpm) 20HZ (lv, lu)	Request of valve、 lift or traction

		then 2.15V.Failure warning will be happen when the voltage sign is greater than 3V or less than 2V.			
SAFETY FEED (TG)	Awaiting for node	Fault of drive feedback of maincontactor which is tested by microcontroller	Valve、 pump motor, Tractionelectricmachine stopped Master contactor disconnection, electromagnetic braking	continuation	Restart electricity lock
SAFETY FEED (Eb)	Awaiting for node	Fault of EMBR feedback of maincontactor which is tested by microcontroller	Valve、 pump motor, Tractionelectricmachine stopped ,Master contactor disconnection, electromagnetic braking	continuation	Restart electricity lock
WRONG SETPOINT	Awaiting for node	Hydraulic function setting point from microcontroller test to the main microcontroller	Valve、 pump motor, Tractionelectricmachine stopped, Master contactor disconnection,electromagnetism brake.	continuation	Restart the switch lock
INPUT MISMATCH	Awaiting for node	Input tested from microcontroller (figure、 imitate and encoder) doesnt match with input that corresponding with Main microcontroller	Valve、 pump motor, Tractionelectricmachine stopped, Master contactor disconnection,electromagnetism brake.	continuation	Restart the switch lock
OUTPUT MISMATCH	Awaiting for node	Main microcontroller tested from microcontroller drives traction electric machine with a wrong way.(regardless of the status of the operator command)	Valve、 pump motor, Tractionelectricmachine stopped, Master contactor disconnection,electromagnetism brake.	continuation	Restart the switch lock
WATCHDOG AL08	Awaiting for node		Valve、 pump motor, Tractionelectricmachine stopped, Master contactor disconnection,electromagnetism brake.	continuation	Restart the switch lock

NO CAN MSG #2	Awaiting for node	Information dropout from main microcontroller	Valve, pump motor, Traction electric machine stopped , Master contactor disconnection, electromagnetism brake.	continuation	Restart the switch lock
HW FAULT	Awaiting for node	main microcontroller Tested from microcontroller can't stop the hydraulic functions.	Valve, pump motor, Traction electric machine stopped, Master contactor disconnection, electromagnetism brake.	Start (test involved in solenoid valve) static state (test involved in hoist controller)	Restart the switch lock

*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, except for the following conditions:
The truck mounted working platform (except for the high-lift order picker):
- A) The platform should be fixed on fork rack/ fork firmly.
 - B) If there is no ascent control device, when there is person on the platform, the driver should leave the driving position.
 - C) When there is person standing on the platform with ascent control device, only this ascent control device on the platform can be used.
 - D) The overall weight of the platform, the load and the people should not over the half of the weight marked on the vehicle nameplate.
 - E) The platform on the truck should not be used to transport people. But if for the hand work, the truck can be adjusted for operation in a small range.
- 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 stated in the section 6, 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 the color differing from the surrounding circumstance.

The driving type high-lift truck should be mounted with protection cabane, except for the condition where the load could not drop onto the driver.

When conveying the load maybe fall to the driver using high-lift truck, should adopt shielding shelf with enough height, weight and the opening size is small enough to prevent the entire load or part of them from falling onto the driver.

When it is necessary to denote the working condition, the truck should add caution device, such as light or flash lamp.

In the permit of the factory, it is allowed to install turning hand hold on the steering wheel formerly without it.

14.1.4.4 The transportation and storage of the fuel

The truck should refuel in the stated place. The fuel station should be ventilative, in order to reduce the accumulation of the fuel gas to the least. In opening pit, subway entrance, and lift well or other similar conditions nearby should not fill in the liquefied petroleum gas and replace other dismountable liquefied petroleum gas container.

It is forbidden to smoke in the place of refuel, and should alarm using placard.

If the liquid fuel is not transport using pipeline, it should be transported using airtight container.

Only the personnel trained and appointed can fill or change the liquefied petroleum gas container.

When store and transport the liquefied petroleum gas container, should fasten up the filling valve, and the safety valve should be connected to the vaporization room directly. When storing the container, should screw the protective cap on the connection mouth.

Before filling and/or reusing, should inspect the container to ensure that it is vapor proof. Especially pay attention to the valve and the connective part is vapor proof. The damaged container should not be used. Only the permitted corporation could repair the liquefied petroleum gas container.

14.1.4.5 The charging and changing of the battery

The battery charging station should be 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.

14.1.4.6 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.

14.1.4.7 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 equipped 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.

14.1.5.6 Elevator (lifter)

The elevator (lifter) for transporting the industrial truck can bear the overall weight of truck, load and the drivers. This kind of elevator (lifter) must be appointed, and the drivers should use the appointed elevator (lifter).

14.1.5.7 Operating on the road vehicle (trailer) and rail vehicle

Before the motor industrial vehicle drive to the road, the road vehicle should apply the brake and wedging to prevent moving.

Exception: the road vehicle equipped with automatic snap lock type parking brake can not use the wedge.

The industrial motor truck passing in and out without connect to the tractor, to prevent the semi-trailer hold up can use support.

It is necessary to build up the operating communication and operating order, to prevent the rail vehicle move accidentally when downloading.

The road vehicle (trailer) and rail vehicle should endure the overall weight of vehicle, load and the drivers. It is necessary to inspect if the pavement is crushing, having holes or other damage.

When the industrial truck is operating at high place or platform, should not use the industrial truck to move other vehicles. Never open the door of the rail truck using industrial truck; expect for equipped with special device and the driver has passed the train to use the device.

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 (lifting and stacking) 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. When operating high stacking job, convey high and multi-piece piled goods using driving type high-lift truck, it is necessary to use the truck with blind goods shelf and canopy guard shelf.

Exception: if there is no danger of the load fall down on the driver, the truck without blind goods shelf can be used.

When operating high stacking job, convey high and multi-piece piled goods using walking type truck, the blind goods shelf is necessary.

14.2.2 Load carriage (lifting and stacking) rule

14.2.2.1 Load

The industrial truck or the combination of the industrial truck and attachment only can convey the load not over its rated load weight. The capacity of the industrial truck with attachment may be less than the one marked on the nameplate.

Any measure of enhancing the capacity of the truck is forbidden, for example the adding people or balance weight.

In any conditions, especially when using the attachment, it is necessary to pay attention to the operation, location, fixation and transportation of the load. The truck with attachment when unloaded should be treated as with some capacity.

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.

- C) When conveying high and multi-piece piled goods, it is necessary to tilt the mast backward a little (if can tilt back) to stabilize the load, and should be careful specially.
When unloading the goods, it is necessary to descend carefully. If possible, tilt the mast forward a little (or limited) in order to put ready the load and draw out the fork.

14.2.2.3 Stacking

When stacking, the mast should tilt backward to ensure the stability of the load, approach the goods pile slowly.

When the truck approach and face to the goods pile, it is necessary to adjust the mast to the vertical location, and lift the load a little higher than the height of the pile. Then running backward the truck or if using reach truck, extends the fork and descend it to unload the goods.

After lifting, start the vehicle, no matter with or without load, it is necessary to operate the brake carefully and placidly.

It is necessary to ensure that the stacking is firm.

After stacking, draw off the fork, and lower the fork to the operating height. After confirm there is no block on the road, drive away the truck.

As for truck can tilt backward, it is necessary to use this function to stabilize the load.

14.2.2.4 Unpiling

The truck approaches the pile slowly, and stopped when the fork tip is 0.3 m far away from the pile.

The space of the fork should adjusted to the width of the conveying load, and should check the weight of the load, to make sure the load is in the lifting weight range of the truck.

It is necessary to lift the fork vertically and insert it to the bottom of the goods.

After lifting, start the truck, no matter the truck with or without load, it is necessary to operate the brake carefully and placidly.

The fork should insert into the bottom of the load as possible. But pay attention to not make the fork tip touch the substance except the load. Then lift the fork to the enough height to move the goods.

Further lift the fork, make the goods away from the pile exactly. If the mast can tilt backward, the fork should tilt back properly to stabilize the load. If it is reach truck, it is necessary to draw back the fork.

After make sure the road is smooth, descend the load from the pile.

The fork should be descended to the operation height and the mast tilt backward mostly. After make sure the road is smooth, drive the truck away placidly.

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.

The load or the device that bears load must be kept at the operating height when the truck is moving. If possible, the load shall be tilted backward when the vehicle is running. Except for stacking operation, it is not permitted to lift the load. This regulation does not apply to truck specially designed that can move with lifting load.

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.

Exception: Under some condition (such as stacking and climbing), the load should be located in the front of the truck's moving direction when the truck is moving. At this moment, the driver should drive the truck very carefully. If operating conditions requires, some subsidiary (attached help) facilities or the other person's lead can be adopted.

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.

When the truck is operating with load, the driver must control turning equipment and brake system slowly and stably.

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.

It is forbidden that to put the arms, legs or the head in the columns of mast or between the trucks's other moving components.

When the vehicle is running, the driver must not let his body outside the contour line of the truck.

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, if possible, when the lifted load truck and flat stacking truck (except the side bearing load fork-lift truck, cross-country fork-lift truck, stride- truck and platform carrying vehicle) moves, the load surface must be in a upgrade direction.
- F) When the truck works on various slopes, the load and the load bearing device must tilt backward (if possible), and the driver can only elevate the load's height that is enough for running through the road surface and local barrier.

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.

14.2.3.5 Working in road truck and railroad vehicle

Before a motor-driven industry truck runs on (or run down) the road vehicle or railroad vehicle, some necessary measures must be taken to prevent road truck and railroad vehicle from moving.

Before a semi- trailer that is not linked with a tractor runs on the road truck or railroad truck, it must be ensured that the supporting part of the stilt of the semi- trailer is located at the supporting position.

Before a motor-driven industry truck runs on the road vehicle or railroad vehicle, it must be ensured that the floor board can endure all the weight of the industry vehicle, load and the driver. Besides, it is required to check the plank to see if there are crashes, holes or other damages.

When the industry truck works on high place or platform, it is forbidden to move other truck by industry truck. It is also prohibited to close railroad truck's door by industry truck except for one case that the industry truck is equipped with a special device and the driver has also been trained how to use this device.

- If possible, the truck should cross over the railway virgule.
- 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), it is necessary to put the control device in the central position. Switch off the power, and tighten the brake.
- 14.2.3.8 Parking
 After the driver leaving, the carrying device must lower to the lowest position, put the control device to the central position, switch off the power, and tighten the brake, 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: fuel oil system, alarm system, power system, brake, steering equipment, lighting, wheel and air tire pressure (namely gas filled type) and lifting system (including lifting chain, wire rope, limit switch and hydraulic cylinder).
 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.
 The truck which fuel oil system is leaking could not be uses without repair.
- 14.2.4.2 Refuel
 Before refuel, it is necessary to close the engine, brake the truck and the driver should leave the truck.
 The open flame and smoking is forbidden during refueling.
- 14.2.4.2.1 Liquid fuel (for example gasoline and diesel fuel)
 The truck using liquid fuel should add fuel in the appointed places.
 Before take away the refueling equipment, cover the filler cap and clear up the excessive fuel, the engine could not start up.
- 14.2.4.2.2 Liquefied petroleum gas fuel (liquefied petroleum gas)
 Only the personnel trained and appointed can refuel or change the liquefied petroleum gas container.
 The person charging for refuel liquefied petroleum gas should wear protective suit (that is to say long sleeve unit and glove).
 The pouring of the fixed type liquefied petroleum gas container and the pouring and change of the liquefied petroleum gas container should be carried on the appointed place.
 When transporting or conveying the liquefied petroleum gas container, it is necessary to be careful, the container should not fall down, nor be thrown, rolling or draw. If it is necessary to transport several containers one time, a proper transporting device should be adopted.
 The liquefied petroleum gas container should not be filled in excessive.
 Before filling the fuel, power off the engine, brake the truck, and the driver leave away the truck.

It is necessary to using soap liquid to check the leak dictation.

The truck driven by liquefied petroleum gas could not park near the heat source, open flame or the similar ignition, and not near to the open air pit, the entrance of the under crossing, the elevator well or other similar place, and could not change the removable container in the upper place.

Before fill fuel into all liquefied petroleum gas container and before the reuse of the removable liquefied petroleum gas container, it is necessary to inspect if there is defect or damage as follows:

- A) the dent, scoring and groove of the pressure container;
- B) the damage of any kinds of valve and fluid level gage;
- C) the scraping in the safety valve;
- D) the damage or the lose of the safety bonnet;
- E) the leak in the connection of valve or screw-threaded joint;
- F) The deterioration, damage or lose of the flexibility seal in the connection of prime or

air feed.

If finding the above defect and/or damage, the container should not be used until repaired.

The truck which is driven by liquefied petroleum gas is over night or stay indoor for a long time and the liquefied petroleum gas container stayed on the truck, it is necessary to close all of the feed valves on the container.

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 following items shall be carried on for all motor industrial vehicles shall be in accordance with schedule, especially with maintenance instructions supplied by the manufacture.

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

15.2.1 Brake set, steering mechanism, control mechanism, alarming device, lighting, adjustor, and overload protection device for lifting shall be kept within safe operation condition.

15.2.2 Regular inspection shall be taken for components and members of lifting and inclination systems, which shall be kept within safe operation condition.

15.2.3 Regular inspection shall be taken for safety protection shelf and safety devices, which shall be kept within safe operation condition.

15.2.4 Regular inspection and maintenance shall be taken for all the hydraulic systems.

Inspection must be taken for oil cylinder, valve, and other similar components to ensure that internal leakage or external leakage would not develop into a dangerous condition.

- 15.2.5 Inspection and maintenance shall be taken for storage battery, driving motor, contactor and controller, limit switch, protection device, lead wire and connecting assembly, which shall be kept within safe operation condition. Special attention shall be paid to electrical insulation state.
- 15.2.6 Inspection for damage and leakage must be taken for exhaust gas system of internal combustion truck, adjustor of carburetor, evaporator, and fuel injection pump.
- Notice: hazardous substances may be produced by the internal combustion engine in case of operation under close place. Sufficient ventilation is recommended in that condition.**
- 15.2.7 Check damaged condition of wheel tread, side face and wheel rim of the air-filled type pneumatic tire. Pressure of the tire that is specified by the manufacture must be kept. Gas in the tire shall be firstly be released before dismantling the air-filled type pneumatic tire from separable rim.
- 15.2.8 Check the bonded condition between solid tire and metal wheel band or wheel rim. Foreign matters on wheel tread of the tire shall be cleared if necessary.
- 15.2.9 Make sure that all the nameplates, indicator boards and labels (pattern) are clear and legible.
- 15.2.10 Inspection shall be taken for fuel oil system and auxiliary fittings to see if there is any leakage. Soap bath shall be used for leakage inspection of liquefied petroleum gas system. Truck must leave the working site in case of any leakage in fuel oil system. And the truck cannot be put into operation until all the leakages have been repaired.
- Inspection must be taken before reuse of all the dismountable liquefied petroleum gas containers or filling fuel into all the liquefied petroleum gas containers, to see whether there is the following defective or damage:
- A) Dent, scuffing, flute;
 - B) Damage of various valves or lever meters;
 - C) Scraps in emergency valve;
 - D) Damage or loss of emergency valve bonnet;
 - E) Leakage at connection of valve and thread;
 - F) Deterioration, damage, or loss of flexible seal at connections of gas filling or gas supply.
- In case of occurrence of any defective or damage as above mentioned, no container would be allowed to be used before 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.
- 15.2.12 Special purpose truck or equipment that is designed for dangerous condition, or is permitted to be used under dangerous condition, shall be paid special attention to, thus ensure the original safe operation performance of the truck.
- 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 for the truck. Data that are in demand of record shall be carefully kept.

