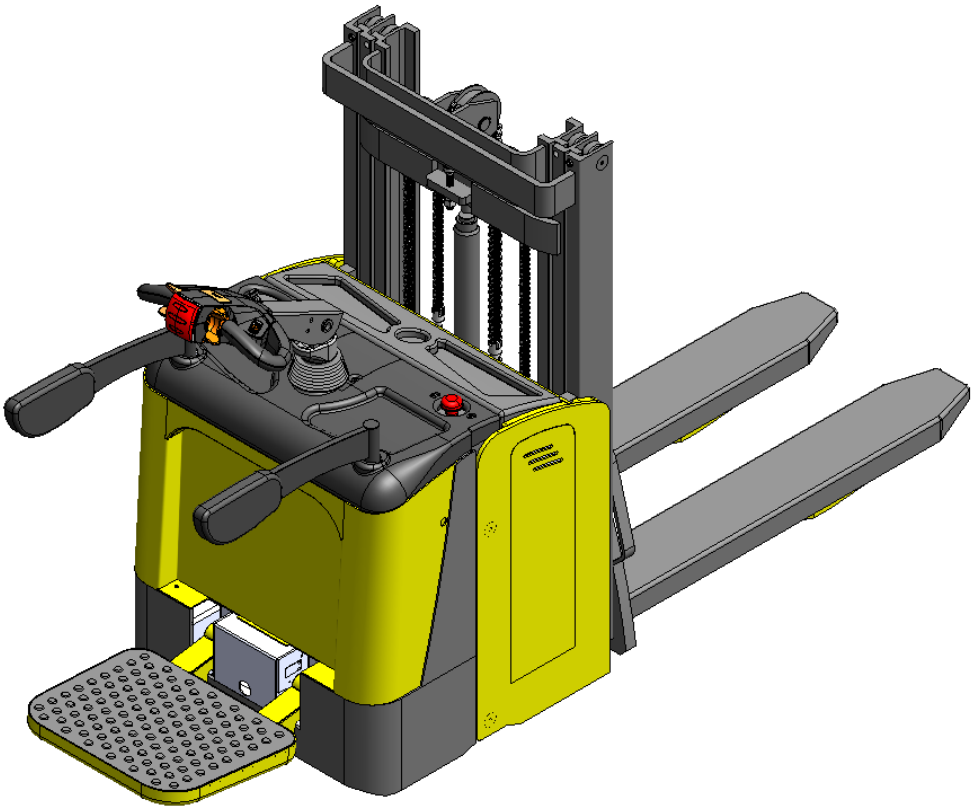
20EDPR

Electric Pallet Truck

- Operation Manual
- Parts Catalogue



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。
  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

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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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	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.

Content

Ⅰ. Specified use

the forklift truck is introduced for a ground conveying equipment, suitable for lifting and transporting goods.

Must be in strict accordance with the provisions of the operating instructions in use, operation and maintenance of forklift. It is used for any other purpose, which are not in conformity with the provisions operation behavior, can lead to injuries and fork lift truck or other property damage. The most important thing is to prevent the load is overweight or swaying caused by overload. Must abide by the the biggest load limit in equipment nameplate or Load graphic Drawing can't use the fork lift truck in a fire and explosion hazard area, cannot use in easy to cause corrosion rust and dust area.

Obligations and responsibilities of equipment user： "equipment user" Refers to natural person or legal person who is direct use or appointed entrust others use the forklift in this operation manual. In the rental, lease and other special circumstances, "equipment user" represent the contract terms between equipment ower and user. Equipment user must ensure that the forklift only is used to specified use, and promptly eliminate all may endanger the risk of life and health to user himself or a third party. In addition, the equipment use party must strictly abide by the accident prevention regulations, other safety technical regulations, and equipment operation, maintenance and maintenance philosophy. Equipment user must ensure that all operations staff carefully read and fully understand the content of the operating instructions.

 If you don't follow the operating instructions, the company's quality assurance to be automatic failure. If the customer and/or the third party to make the equipment non-standard without any allowable from out customer service department.， we will not undertake any any responsibility if there has any lost.

Installation accessories：If impact the function of the forklift truck or have added and need to install additional device，must obtain the written consent of the company. According to the actual situation, may also must obtain the consent of the competent department of local. Examine and verify results of department in charge do not represent the company opinion.

Ⅱ. Forklift introduction

1. Range of application

20EDPR series electric pallet truck is powered by storage battery, and driven by motor. This kind of truck travels by means of gear transmission. The fork is lifted by means of DC motor and hydraulic actuation, which motivate hydraulic cylinder up and down to lift fork and goods together.

Rated load datails on the forklift nameplate.

2. Service environment

a. Height above sea level shall not be over 1000m；

b. Ambient temperature shall not be higher than +40℃ and no lower than -25℃；

c. When the ambient temperature reaches +40℃, the relative humidity should not exceed 50%; at a lower temperature, higher relative humidity is allowed；

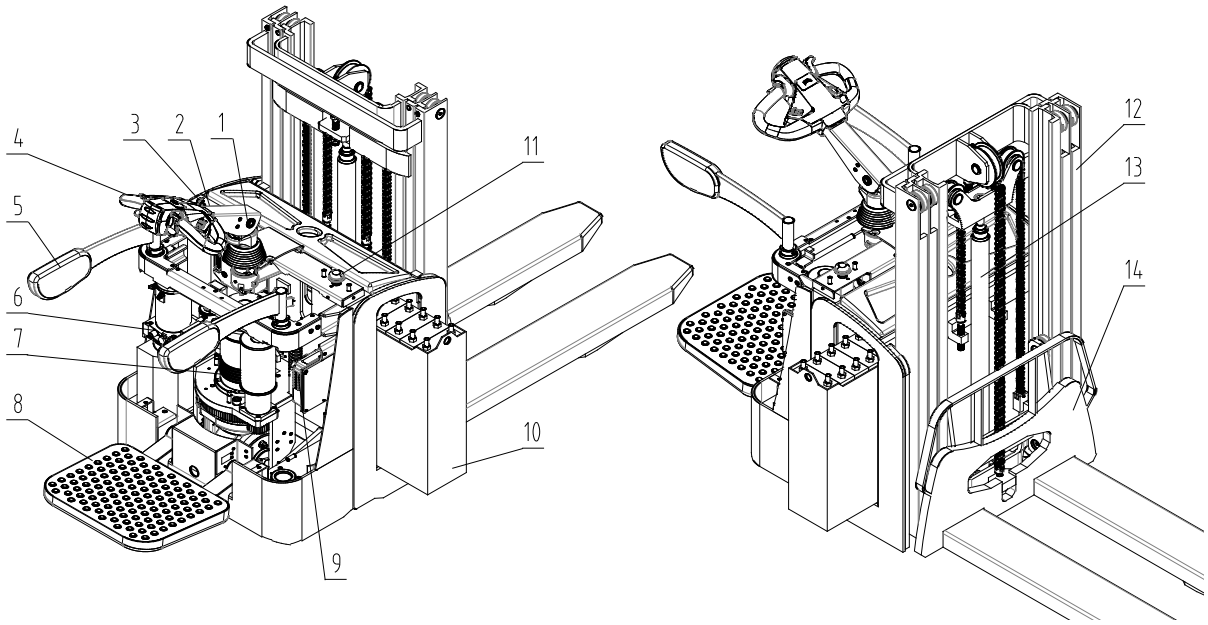
d. Hard and flat ground.

e. It is prohibited to use the truck in a flammable, explosive or corrosive environment with acid and alkali.

f. Because the vehicle itself without lighting equipment,so the truck should use in light brightly.

3. Technical parameters

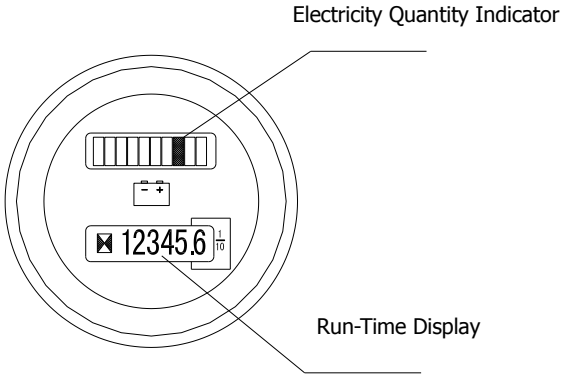
3.1 Structure



No.	20EDPR	Name
1	●	Steering mechanism
2	●	Instrument
3	●	Electric lock
4	●	Handle
5	●	Guardrail
6	●	Hydraulic power unit
7	●	Drive unit
8	●	Pedal
9	●	Electric control assembly
10	●	Battery
11	●	Emergency power disconnect
12	●	Mast assembly
13	●	Lift oil cylinder
14	●	Fork carriage assembly
	●	
●= standard assembly		○ =optional

（i）Instrument:

This instrument is a combination of battery capacity indicator and LCD hour meter, with the battery indicator of ten segments of colorful LED display (5 red segments, 3 yellow segments and 2 red LED).When battery discharges by 70% capacity, one red flicker lamp shows "energy storage" alarm. When the battery discharges by 80%, two red flicker lamps show "energy exhaust". After the external power supply is cut off, the internal battery can generally keep 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:

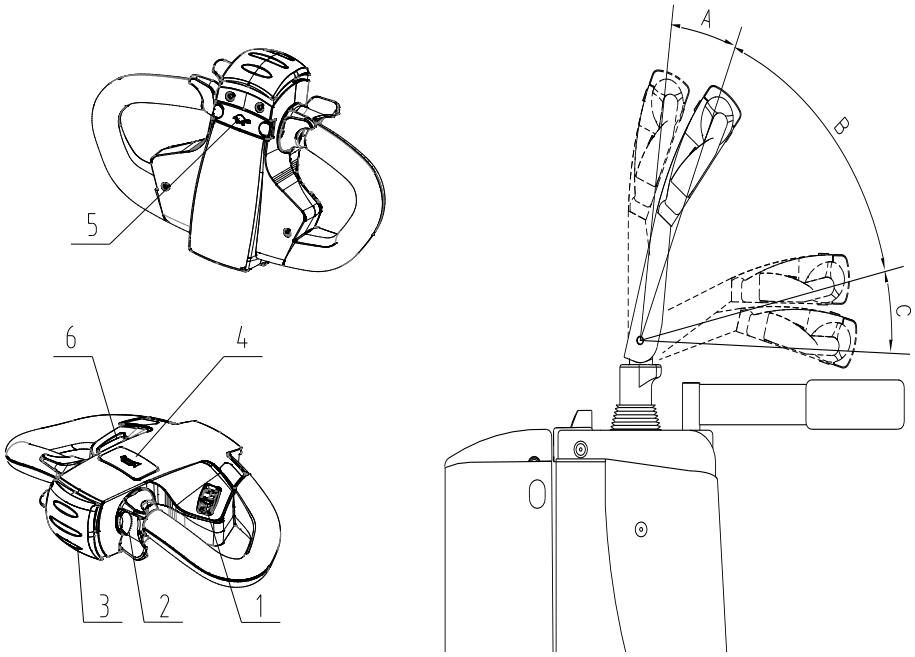
The steering system mainly composes of operation handle, steering device shaft, and floating

support bearings. The system is used to control travel direction of the truck.

（3）Braking:

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

（4）Operation control



1．Lift button of support leg 2.Accelerator knob 3.Emergency reverse button 4.Horn 5.Slow button 6.Lift button of fork

①Lifting and lowering operation: Press the lowering button of the forks, the forks will lower. While the lifting button is pressed, the fork will lift. Press the lowering button of the support leg, it lowers, Press the lifting button of the support leg, it lifts. Lift the forks when stacking and lift the support leg when carring.

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

③Horn button：Horn of the truck will be turned on if you press the button.

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.

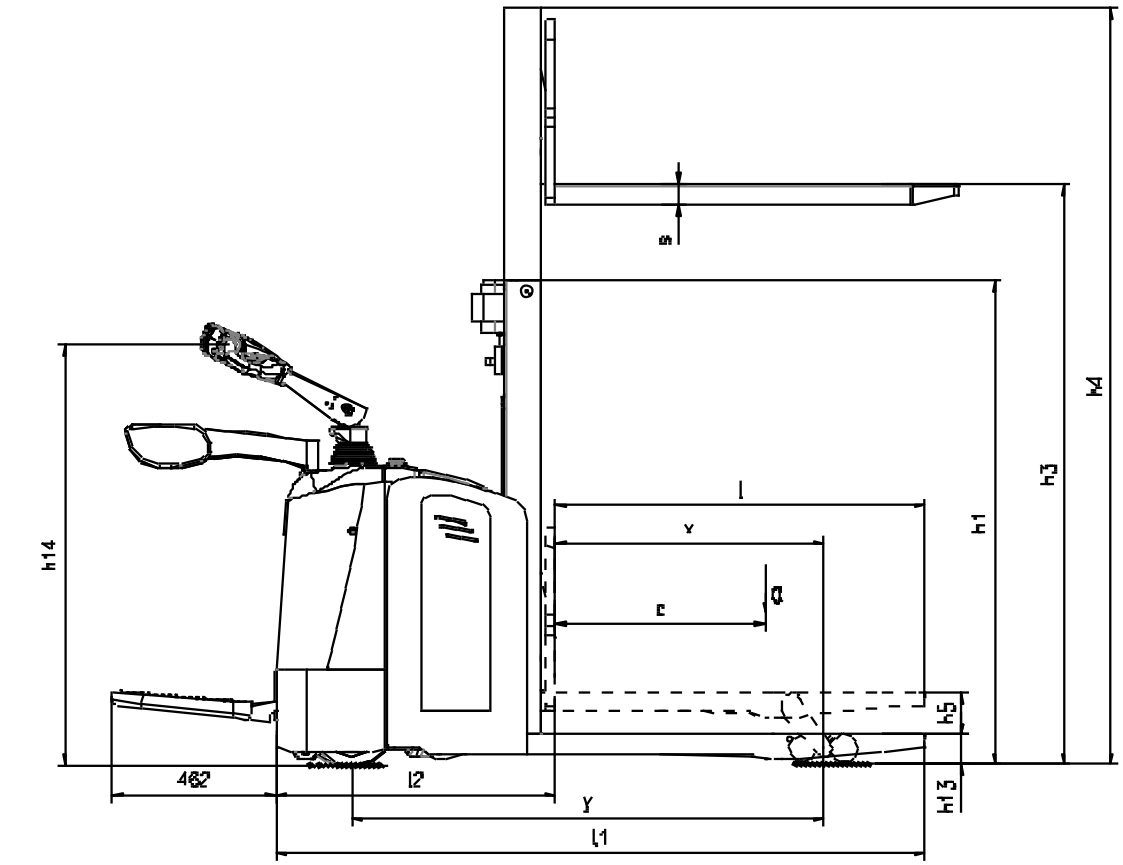
④Slow button: When this button is pressed, the truck will travel at an extremely slow speed. This button is applicable for operation on especially narrow field or on the condition that the truck needs to be accurately located.

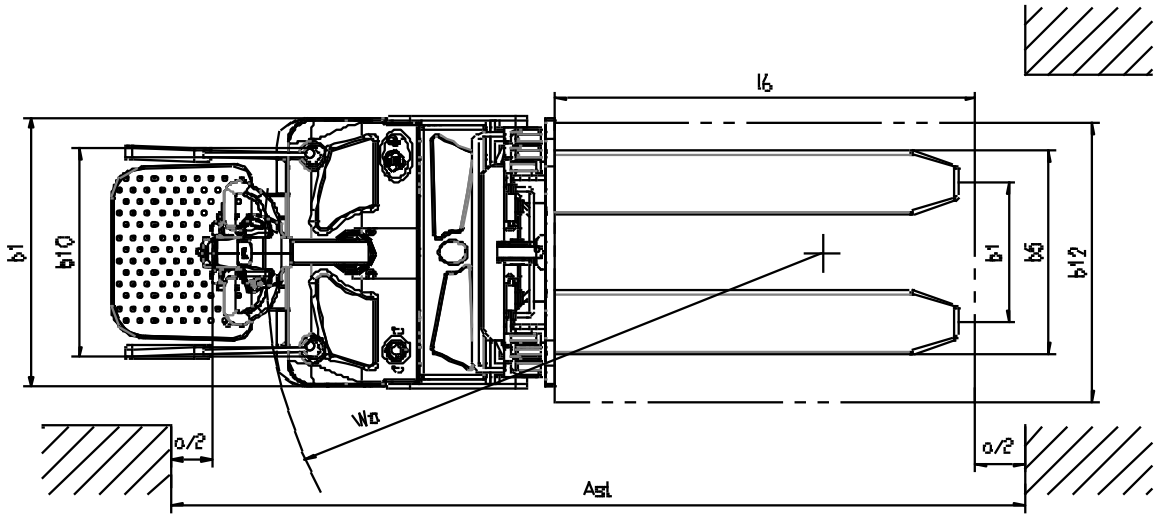
（5）Electric lock：It is used to control switching-on and switching-off of main power supply of the truck. Key of the electric lock shall be kept by the truck driver or personnel who have been specially assigned. Be sure to cut off the main power supply when you leave the truck, and take the key of electric lock, for fear occurrence of accident due to operation carried out by others.

（6）Battery main switch ：to control the emergency power off,put down the mushroom head is power dump.,pull out the mushroom head is power-on，when your truck is out of control, please press the mushroom head to cut off power to avoid the accident.

（7）Pedal and guardrail: The operation mode of this truck is stand driving. Under normal conditions, the standing pedal and guardrail should be open before driving the truck. During operation of the truck, the driver should stand on the pedal. When the working area is relatively narrow, the standing pedal and guardrail can be put away. Then, the maximum traveling speed should not be over 4km/h.

3.2 Main technical parameters (20EDPR Electric pallet truck)

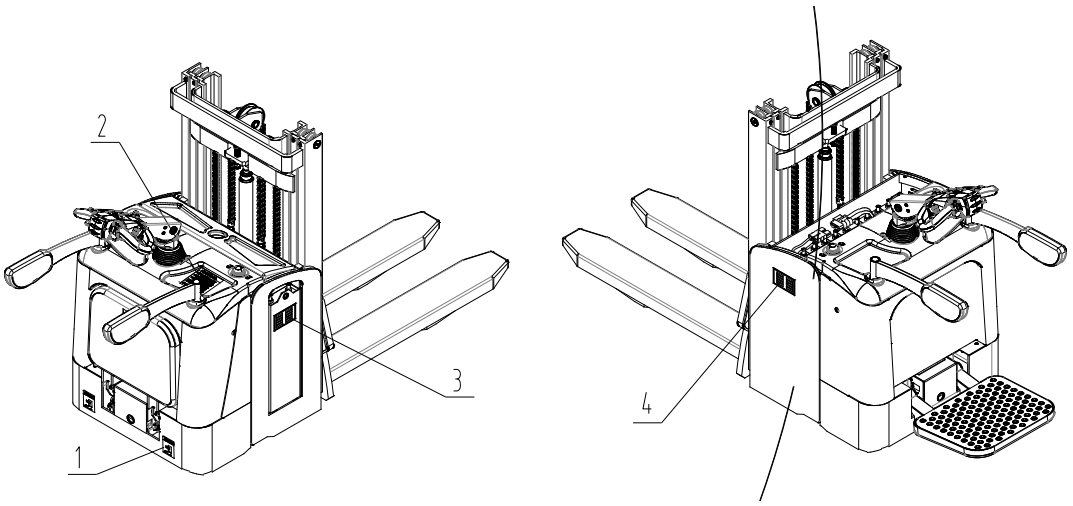




Characteristics	1.1	Manufacturer(abbreviated)		HHI
	1.2	Model		20EDPR
	1.3	Driving type：Electric(Storage battery), diesel, gasoline, fuel gas		Electric
	1.4	Operation type（Manual, Walking, Stand driving, Seat driving ,Order picking）		Standing
	1.5	Rated load	Q(kg)	2000
		Rated load of the mast	Q(kg)	1000
		Rated load of the rocker arm	Q(kg)	2000
	1.6	Load center distance	c(mm)	600
	1.8	Front overhang	x(mm)	767
	1.9	Tread	y(mm)	1348
Weight	2.1	Service weight(with battery)	kg	1130
	2.2	Axle load, front/rear, laden	kg	1090/2040
	2.3	Axle load, front/rear, unladen	kg	840/290
Wheel chassis	3.1	Wheels (rubber, high elasticity, pneumatic tyre, polyurethane wheel)		PU wheel
	3.2	Wheel dimension, front		Φ250×70
	3.3	Wheel dimension, rear		Φ80×70
	3.4	Additional wheel(dimension)		Φ127×57
	3.5	Wheel number, front/rear （x = drive wheel）		1X+2/4
	3.6	Tread, front	b_{10}(mm)	490
	3.7	Tread, rear	b_{11}(mm)	400/470
Dimension	4.4	Lift height	h_3(mm)	1600/2000/2500
	4.6	Lift height of the support leg	h_5(mm)	120
	4.9	Min. /Max. height of operation handle, in driving position	h_{14}(mm)	1150/1430
	4.15	Fork height, lowered	h_{13}(mm)	90
	4.19	Overall length	l_1(mm)	1898/1948
	4.20	Length to face of fork	l_2(mm)	798
	4.21	Overall width	b_1(mm)	775
	4.22	Fork dimension	S/e/l(mm)	54×180×1100(1150)
	4.25	Width overall fork	b_5(mm)	570/650
	4.32	Wheelbase ground distance	m_2(mm)	28
	4.33	Aisle width for pallet 1000x1200 crossways	A_{st}(mm)	2098/2148
	4.34	Aisle width for pallet 800x1200 lengthways	A_{st}(mm)	2198
	4.35	Turning radius	W_a(mm)	1600
Performance Data	5.1	Travel speed, laden/unladen	Km/h	9/9.1
	5.2	Lift speed, laden/unladen	m/s	0.07/0.08
	5.3	Lower speed, laden/ unladen	m/s	0.08/0.07
	5.7	Gradeability, laden/unladen	%	8/20
	5.8	Max. gradeability, laden/unladen	%	10/20
	5.10	Traveling brake		Electromagnetic brake
t	6.1	Drive motor power	kW	1.5

	6.2	Lift motor power	kW	2.2
	6.4	Battery voltage/rated capacity	V/Ah	24/240
	6.5	Battery weight	Kg	200
		Battery dimension（LXWXH）	mm	750×170×570
	8.4	Noise level at operator's ear, according to DIN12053	dB(A)	70

3.3 Installation position of warning label and nameplate



No.	Name	Remarks
1	Foot warning label	
2	Operating warning label	
3	Instruction lable of maintenance of the battery	
4	Nameplate	

III.Operation instruction

Warning 1. Safety Norms:

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 stacker; check the truck whether it is in its normal condition before each operation. It is forbidden to use faulty stacker; repair by untrained persons is forbidden as well.

4) Overloading operation is forbidden.
5) As for goods carrying and operation, center of gravity of the goods must be within range of the two forks. It is forbidden to transport loose goods
6) The truck shall travels slowly when forks pass in or out of pallet.
7) It is strictly forbidden to press the lifting or lowering button during the traveling of the truck. Meanwhile, don't switch lifting and lowering buttons rapidly or frequently, because rapid and frequent lifting or lowering will cause damage to the truck and goods.
8) Don't load heavy goods on the forks rapidly.
9) Don't lay the goods on the truck for a long time!
10) It is strictly forbidden to make sharp turn on narrow aisle. When it is turning, slow down the truck so as to ensure the safety of personnel and goods.
11) Descend the forks to the lowest position when the truck is not used.
12) It is strictly forbidden to put any part of the body under heavy goods and forks.
13) This truck is suitable to be used on flat ground or flat platform. Don't put the truck on the slope for a long time.
14) Overloading operation is forbidden. Otherwise the wheel will skid, resulting in the damage of wheel and motor as well as danger of the human body and goods.
15) It is strictly to use the truck under stipulated voltage of 20.4V.
16) It is strictly forbidden to conduct charge by connecting the plug to AC power directly.

1.1 Safety operation norms:

 （1）Training of driver:

Even though each electric pallet stacker 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：

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：

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

 （4）Safety of working place：

This kind of electric stacker 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

Do not make modifications on the truck.

A Please observe safety rules and regulations of your working place during operation, inspection, and maintenance of the truck.

B Unauthorized truck modification is not permitted.

No modifications or alterations to a powered industrial truck, which may affect, for example, capacity, stability or safety requirements of the truck,

（6）Prepare safety operation procedure:

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

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

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

（8）Overloading operation of truck is forbidden:

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:

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

1.2 Safety Operation Specification

（1）Check the safety condition around the truck

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

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

C Ensure no people around the truck when driving backwards.

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

E At crossroad or other places impeditive for view, the driver shall not drive until there is no

person at both sides.

F 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

A Never start up, brake or turn abruptly。（Abrupt start-up or braking may cause the falling of goods.Abrupt turning during traveling may cause the tilting of truck and result in serious accident.

Do decelerate and take care to turn.

B 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.

C Ensure to provide certain clearance between truck and entrance.

(3) Never drive too close to roadside

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.**

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

Warning

（4）Forbid overloading operation.

（5）Passengers on truck must be forbidden.

（6）Never push or pull the handle abruptly.

（7）Never use the truck as towing vehicle.

2. Drive and operation

2.1 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.

	No.	Check point	Check content
Braking system	1	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
	2	Brake clearance	The clearance between brakes should be kept between 0.2mm and 0.8mm.
Steering system	3	Operation handle	Degree of tightness and rotary flexibility.
	4	Oil pipe	Leakage or not.
	5	Hydraulic oil	Appropriate oil quantity.
	6	Lifting oil cylinder	Whether there is any oil leakage.
Wheels	7	Pins, screws and all the fasteners	Check all the fasteners of the truck's wheels, i.e. pins or screws, loose or not.
	8	Wearing status	Compare the parameter list, replace the wheel when its diameter reduces by 5%.
Battery	9	Charge	Confirm the display state of the battery capacity.
	10	Electrolyte	The solution level and density of electrolyte.
	11	Connecting line	The connecting line and socket shall be firm.
Horn	12	Horn	Press down the horn button to check whether the horn sounds.
Instrument	13	Function	Turn on the switch of electric lock to check whether the instrument displays normally.
Others	14	Truck frame, etc	Damaged or not. If there is any crack.
	15	Function	Check that whether lifting, lowering, forward & backward movement and emergency reverse of the truck is normal, and if there is any abnormal noise.
handle	16	Emergency reversing device	Put the handle to B section, press the emergency reversing device, see if the truck can move forward
	17	Lifting, move button	Check if the lifting, movement of truck is normal.

 Warning **Never use the faulty truck**

2.2 Driving：

⑴ Start-up

Get off the standing pedal and open the guardrail to turn the switch of electric lock to ON

position. When the operation handle is turned to area B and accelerator knob is rotated slowly, the truck will start gradually. The greater the accelerator knob is turned, the faster the truck travels.

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

（2）Deceleration

The drive motor is AC motor, the RPM of the motor is always controlled by the speed controller, so when releasing the acceleration knob slowly, the truck also slows dowm slowly to decelerate.

When the working area is relatively narrow during operation, the standing pedal and guardrail can be put away. Then, the maximum traveling speed should not exceed **4Km/h.**

（3）Turning

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

Warning 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.

（4）Braking： Release the accelerator knob, then braking of the truck can be realized。

（5）Transportation operation

The following procedure shall be observed for goods transportation：

1) Decelerate when approaching the goods area;
2) Inspect safety condition around the stacking area;
3) Adjust position of the forklift, placing it in front of place where goods locate;
4) Slowly start the forklift, and insert fork arms to the bottom of goods as deeply as possible.
5) Press the lifting button, raising forks to a position with a distance of over 40mm between bottom of the pallet and ground;
6) Start the truck stably, carry the goods to the destination, then adjust the position, driving the truck to stop the arrival of shelf space and slow prong at a distance of 300mm shelf unit, then operate the handle lifting fork up to proper height of the shelf (bottom of the pallet is over the shelf 100mm or so), slowly move the goods to the exact position of shelf. At last, operating the handle lowering fork, carefully placing goods on the shelves, and made the forks leaving the cargo, slowly drive the truck, so that make the fork out of the shelf (the fork head is in 300mm distance from the shelf), lower the fork down to about 300mm from the ground, the truck leave the shelves . It should be noted the obstacles around in the process of moving, slow down when turning.

（6） The operation of taking down the goods from the shelf

- drive the truck near the goods shelf (the fork head is in 300mm distance from the good shelf), press the lift button, adjust the fork height into place, insert the fork slowly as deep as possible into the goods pallets, press the lift button, operate the handle lifting the goods to the height that the bottom of the pallet is 100mm over the shelf, slowly drive the truck, so that make the goods out of the shelf (the fork head is in 300mm distance from the shelf), press the lower button, lower the fork down to about 200-300mm off the ground, the truck leave the shelves.Then park the truck after travel to the needed position, at last, lower the fork and the goods, make the fork leave the goods completely, shift the fork out of the pallet slowly.

 If the goods is very heavy and it need to carry a long distance, advice lowering the fork to the lowest position to make the fork contact the support leg, lift the support leg to make the goods leaving the ground to carry.

 Before operating truck, do check the following items:

1. Ensure no goods falling and damaged in the loading area.
2. Ensure no goods or objects impeditive for safety.

2.3 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) 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

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

(3) Charge：

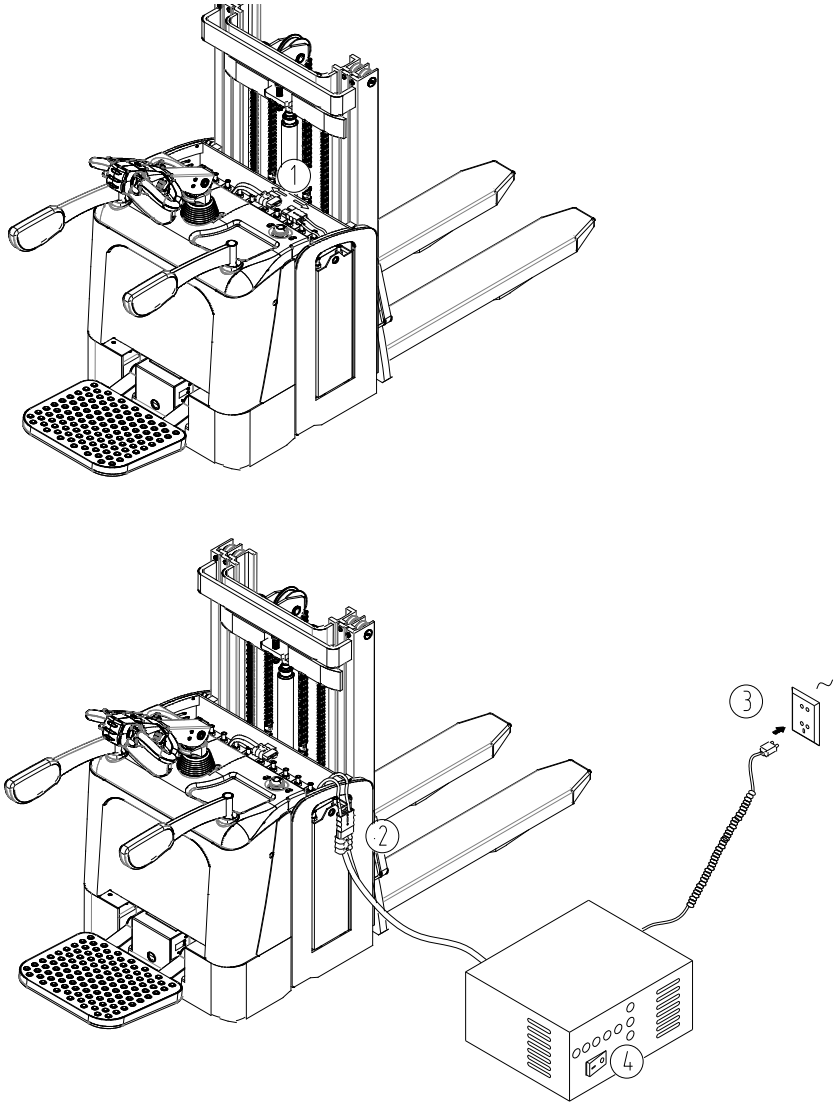
 Warning Open flame is forbidden to appear at the charge places, otherwise, explosion or fire disaster can be caused.

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

a. 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.
b. The situation about deformation, distortion, damage or breakage.
c. Add lubricating oil and grease if necessary.
d. Replace faulty components.

Ⅳ. Maintenance, charge and replacement of battery

Standard configuration is external charger and the optional is built in charger. Charging operation method as follow：



Outer charger

Charging ways for outer charger：

Open the cover,1, pull out the charging socket from main circuit；2，connect with charging plug of battery and charger ；3，put the battery socket into two-phase AC power supply；4,open the power switch;charge after a few 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）Initial charge should be conducted for batteries that have never been used. Before the initial charge, the surface of the batteries should be cleaned and the batteries should be examined for damage. The bolts should be tightened to ensure reliable connection.

（2）Pull out the sealing cover and replace it with the open cover type liquid hole plug and open the cover.

（3）When the charging equipment is able to operate normally, pour the sulfuric acid electrolytic solution with a density of 1.260±0.05 (25℃) and a temperature of lower than 30℃ into the batteries. The liquid surface should be 15-25mm higher than the protective board. In order to reduce the temperature rise caused by chemical reaction of the electrolytic solution and let the electrolytic solution fully penetrate into the pores of the polar plates and the baffles, the batteries should be placed still for 3-4 hours but not exceeding 8 hours. The initial charging can only be conducted when the temperature of the solution reduces to below 35℃. (When necessary, the batteries can be put into cold water for temperature reduction). After the still placement, if the surface of the solution reduces, electrolytic solution should be added.

（4）The sulfuric acid electrolytic solution 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 and density of the electrolytic solution can be converted as follows:

$$D25 = Dt + 0.0007 (t-25)$$

Where: D25: the density of the electrolytic solution at 25℃

Dt: the actual density of the electrolytic solution at a temperature of t ℃.

t: temperature of the electrolytic solution when testing the density.

（5）Sweep the electrolytic solution on the surface of the batteries and connect the positive and the negative poles of the battery pack respectively with the positive and the negative ends of the DC power supply (charger). Turn on the power supply. First charge with 18A (the first stage current,); when the voltage reaches 28.8V (12 ×2.4V = 28.8V), change to the second stage current 9A and continue to charge. The temperature of electrolytic solution during the process of charging must not exceed 45℃ and when it is close to 45℃, the charging current should be reduced by 50% or the charging should stop temporarily. Wait till the temperature drops to 35℃ to continue the charging. The charging time, however, should be properly prolonged.

（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℃), no obvious variation 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.

（7）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 inconsistence, 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.

（8）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

（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）Common charge: The first stage current of common charge is 26A and that of the second stage is 13A. 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 15 hours.

（3）The batteries in normal use should avoid over-charge, but over-charge must be properly conducted for the batteries in the following situation, i.e. equalizing 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 equalizing 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. Equalizing charge should be conducted for the batteries in normal use every 2-3 months.

（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 electrolytic solution, the current should be reduced by 50% (2A) and continue to charge.

c. When the batteries are fully charged, stop charging for 0.5 hour and charge again with a 1A current for one more hour.

d. Stop charging for another 0.5 hour and charge with a 1A current for another one hour.

e. Repeat according to item d till air bubbles occur violently in the batteries once the charger is switched on.

3 Storage

Batteries should be stored in a clean, dry and well ventilated warehouse with a temperature of 5-40℃. The valid shelf life is 2 years. The batteries should be kept according to the following requirements during storage:

a. No direct sunlight on the batteries and at least 2m away from heat source.

b. Avoid contacting with any harmful substances. No metallic matters are allowed to drop into the batteries.

c. The batteries should not be placed upside down and should not be hit mechanically or heavily

pressed.

d. The batteries must not be stored with electrolytic solution. When it is required in special situation that the batteries must be stored with electrolytic solution, the batteries should be fully charged and the density and the liquid surface of the batteries should be adjusted to the stipulated values. When the storage period comes to one month, the batteries should be complementarily charged with the common charge method.

4 Operation of electrolyte

⑴Density check

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

⑵Operation besides check

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

⑶Electrolyte 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、storage battery operation of end service life

⑴Operation of storage batteries during the final stage of their lifetime

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

⑵ Treatment of waste battery

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

6、Emergency treatment

⑴The electrolyte spills on skin: wash with large amount of water

⑵The electrolyte spills into eyes: wash with large amount of water, and then seek help from specialized doctor.

⑶ The electrolyte spills on clothes: take off clothes right away, wash with water, and then flush with week basic soap solution.

⑷ The electrolyte leakage: in case of electrolyte leakage outside, neutralize it with lime, strong carbonic acid soda or carbonic acid soda, and then flush with large amount of water。

7、Charger

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

a. The output voltage of charger: 24V

b. The output current of charger: 30A

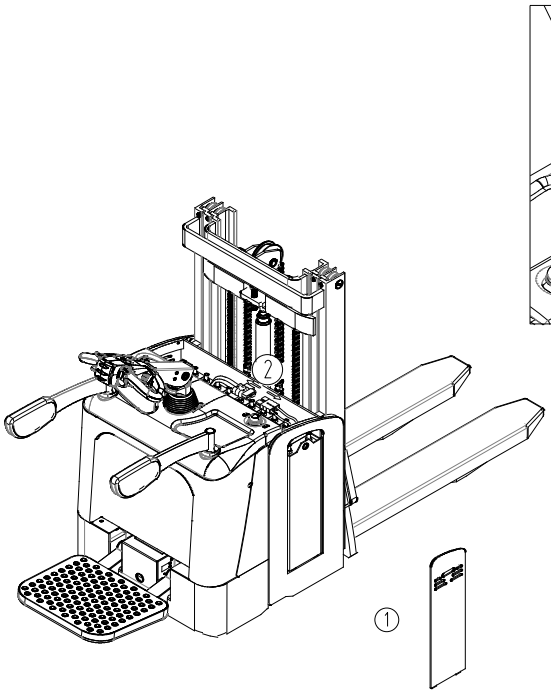
If the charger you use is semi-automatic or manually adjustable, please charge the battery pack according to the requirements of use and maintenance mentioned in the second tip.

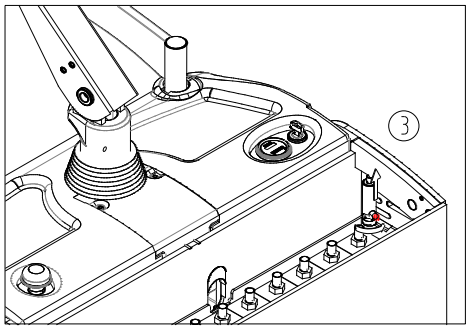
8. Replacement of the battery

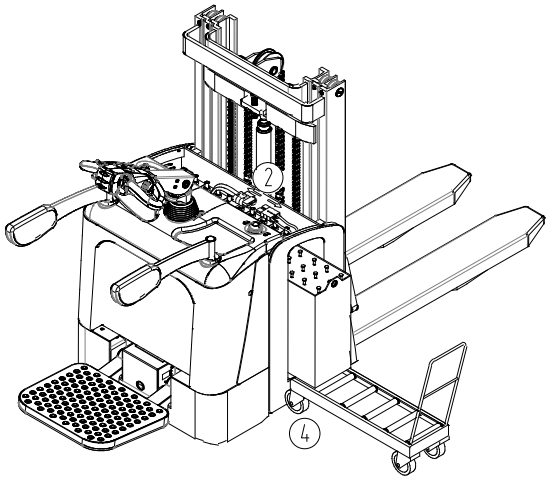
The weight of battery pack is about 240kg, and the replacement procedure of storage battery is as follows:

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

Caution 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







Ⅴ. Maintenance and repair

1. Maintenance

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

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.

1.1 Precautions during maintenance：

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.。

Places for maintenance：

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

（1） Precautions before repair and maintenance：

No smoking.

Arrange the self-protection work.

Wipe out the effusive oil in time.

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

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

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

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

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

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

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

1.2 Check and maintenance before use

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 4.1.

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.

1.4 Inspection as needed

Clean the truck
Inspect and screw down each fastener
Inspect the damage state of wheels

1.5 The inspection and maintenance after 50 hours （Weekly）

Braking system	1	When the operation handle is turned, with the steering handle switching between area A and B, there is a noise from the brake.
	2	The oil dirt and dust on the turning gearwheel should be cleaned.
	3	The clearance between brakes should be kept between 0.2mm and 0.8mm
Capability of electrolyte	4	Inspect the liquid level of electrolyte, pure water can be used for supplement if the liquid level is too low.
density of electrolyte	5	The specific gravity should be1.28g/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.

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	Contactor	Contact performance and function
	15	Inching switch	Function
	16	Controller	Function
	17	Driving motor	Wearing status of carbon brush and selenium rectifier.
	18	Lifting motor	Wearing status of carbon brush and selenium rectifier.
	19	Steering motor	Wearing status of carbon brush and selenium rectifier.
	20	Fuse	Whether it is perfect or not
	21	Wiring harness and connection terminals	Whether flexible and whether damaged or not.

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

1.6 Recommended working medium:

⑴ 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 viscidity 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.

⑵ Gear oil：

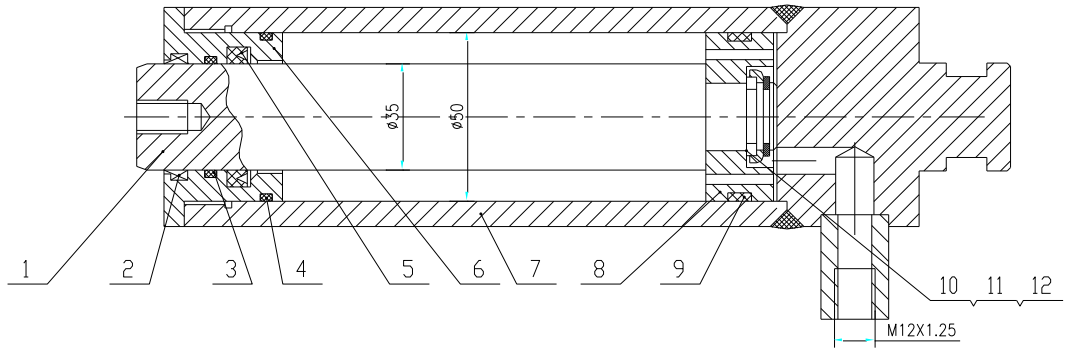
Hyperbola gear oil 85W-90(GL-5)

⑶ Lubricating grease:

Lithium grease of type 3

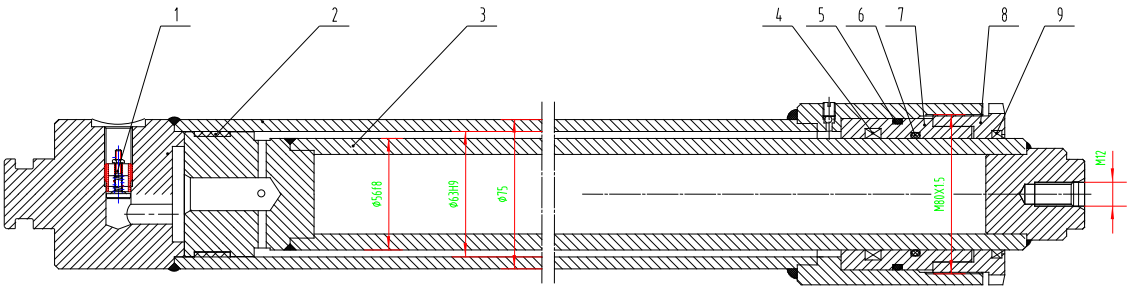
☞ All kinds of depleted hydraulic oil, gear oil and grease will pollute the environment. For this reason, recycle the replaced working medium or treat according to local pertinent regulations.

1.7 Structure of lift oil cylinder and wearing parts(support leg)：



1. plunger 2. dust ringDH35 3. O-rings 35.5X2.65 4. O-rings 42X2.65 5. seal ring UHS35 6. guide sleeve 7. Oil cylinder 8. piston 9. guide ring 10. semi-ring 11.bowl washer 12. circlip for shaft 20

1.8 Structure of lift oil cylinder and wearing parts(forks)：



1.Explosion proof valve, 2. Support ring, 3.Plunger，4.Seal ring UHS56, 5.O-ring 70X3.55，6.O-ring 56X3.55， 7.Guide sleeve， 8.Hood 9.Dust ring DH56

1.9 Maintenance period of consumables and partial parts:

Items	Maintenance content	Maintenance period	Remarks
Bearings of fork wheel	Replacement	1200h	
Fork wheel	Replacement	1200h	
Seals	Replacement	1200h	Replace when finding out damage
Gear box	Replacing lubricant grease	1000h	
Hydraulic oil	Replacement	1000h	
High pressure oil pipe	Replacement	2000h	Replace when finding out damage

Strainer of hydraulic reservoir	Cleaning	1000h	
Driving motor	Check for carbon brushes and bearings	1000h	
Steering motor	Check for carbon brushes and bearings	1000h	
Oil pump motor	Check for carbon brushes and bearings	1000h	

2. Common faults and trouble shooting:

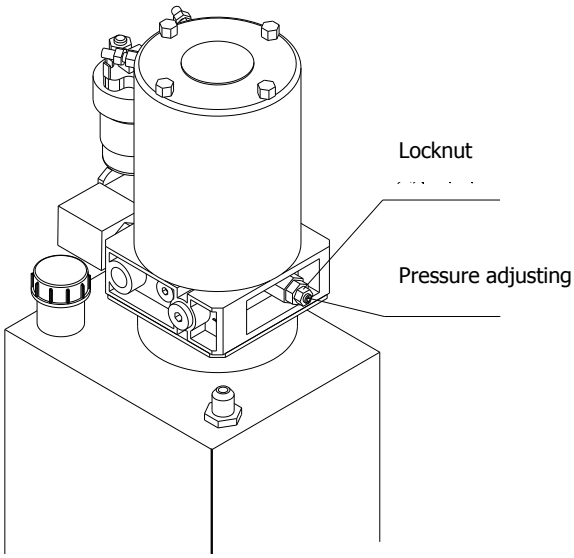
1. Mechanical faults

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 viscidity of oil is not correct, oil level is too low.	Replace the oil or add some oil
Hydraulic system has no pressure or the pressure is too low	Malfunction in pump oil-absorptive, and noise exists.	Replace the oil or add some oil
	Oil pump is damaged	Contact maintenance personnel of our company
	There is malfunction in valve block.	Contact maintenance personnel of our company
	The pipeline is broken or leaking.	Replace the pipeline or screw down the tie-in.
	The viscidity of oil is not suitable; the leakage loss is too great.	Change the oil.
The oil pressure is not stable	The cause is the same as that of abnormal noise.	Refer to the treatment methods for abnormal noise.
	The lifting cylinder or seal ring is worn.	Replace the cylinder sleeve or seal ring
	The quantity of oil is not enough	Add oil
The truck cannot start.	Storage battery is used up.	Inspect, charge, or replace the storage battery
	The wire terminal is loosened.	Screw down the terminal screw
	he fuse is burn out.	Replace the fuse
	The accelerator is damaged.	Replace accelerator
The direction is ineffective and heavy.	The steering device is blocked by the abnormal matter.	Clean up the foreign matter.
	The bearings of steering device are worn.	Replace the bearings
Brake cannot work	The friction plates of the electromagnetic brake are damaged	Replace

Not release after braked	The electromagnetic brake is out of electricity.	Check the circuit.
	The clearance of the electromagnetic brake is too large.	Adjust the brake clearance to 0.2mm.

（1）Adjustment methods of safety valve pressure

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



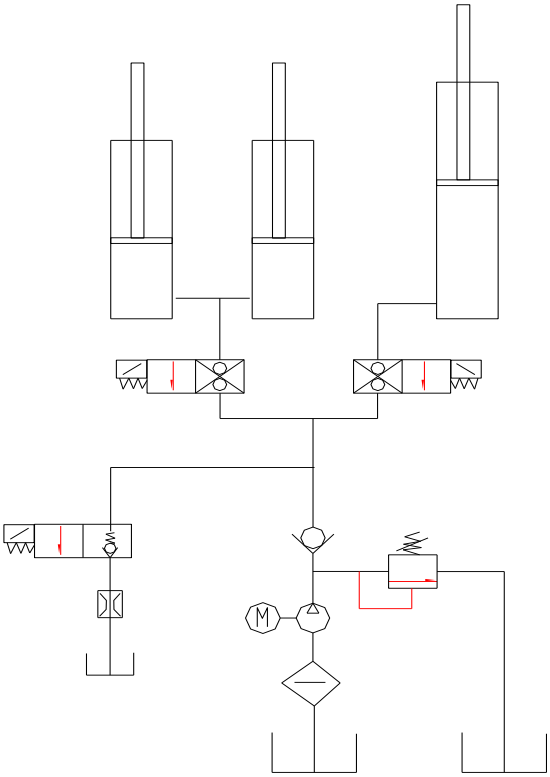
1 Screw out high pressure oil tube and install pressure meter with capacity over 20Mpa at the high pressure oil outlet.

2 Press lifting operation button to measure the system pressure. The stipulated system pressure is 11.5Mpa for truck with rated load of 2000KG and 14.5 Mpa for truck with rated load of 2500KG.

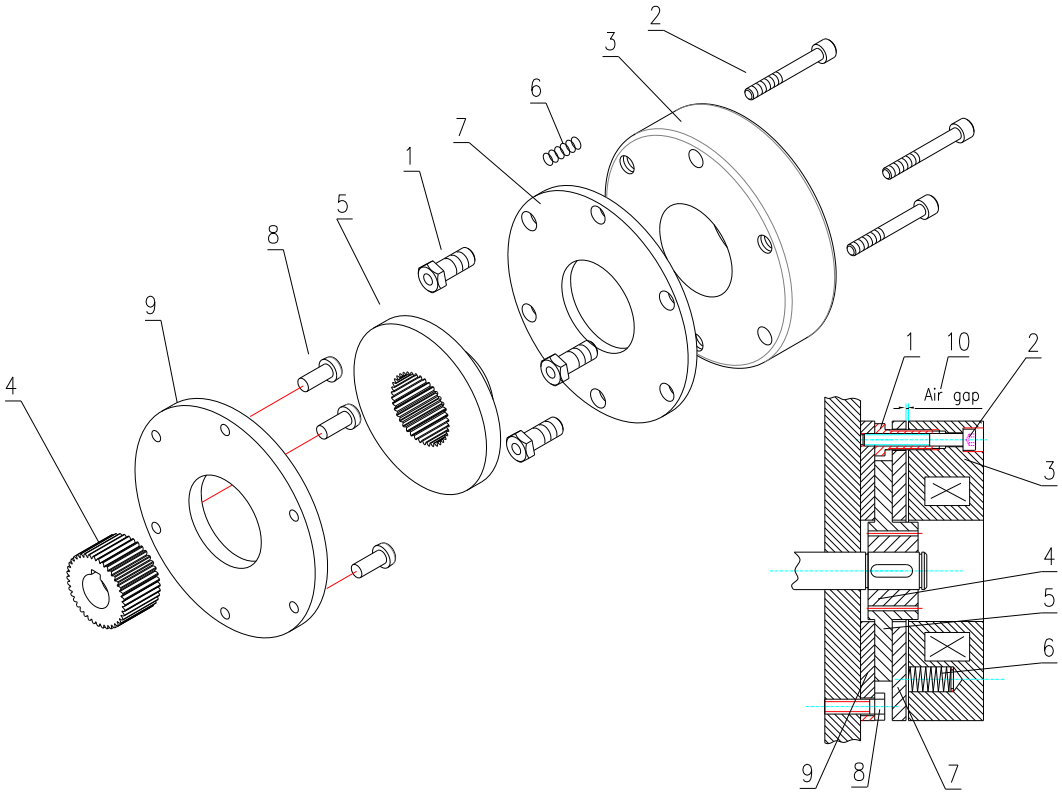
3 If oil pressure is not in accordance with the specified value, please loosen locknuts of the overflow valves. Turn pressure screw left and right until the pressure reaches the s turned clockwise, the system pressure increases. While the screw is turned counter-clockwise, the system pressure decreases.

4 After the adjustment, please screw down the locknuts.

Hydraulic principle schematic

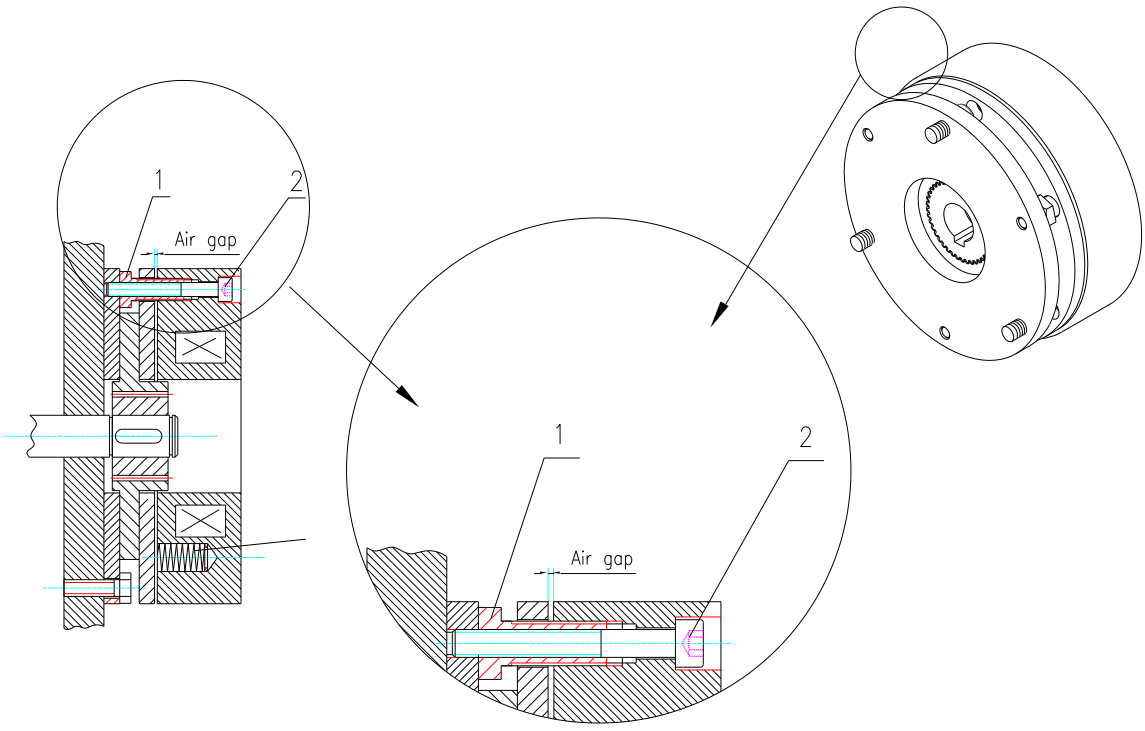


（2）Adjustment of the brake clearance

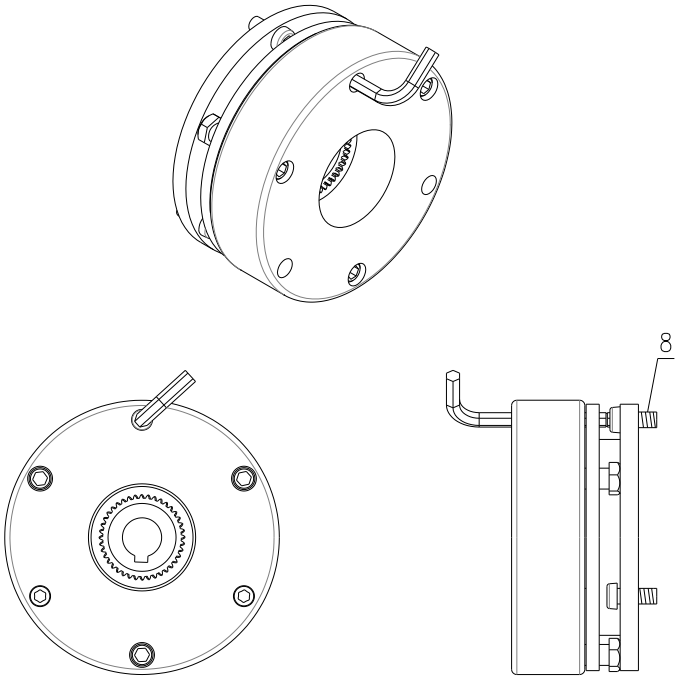


①Hollow screw ②Fitting screw ③Coil ④spline sleeve
⑤Friction plate ⑥Spring ⑦Iron ⑧Mounting screw
⑨Mounting cover plate ⑩Clearance

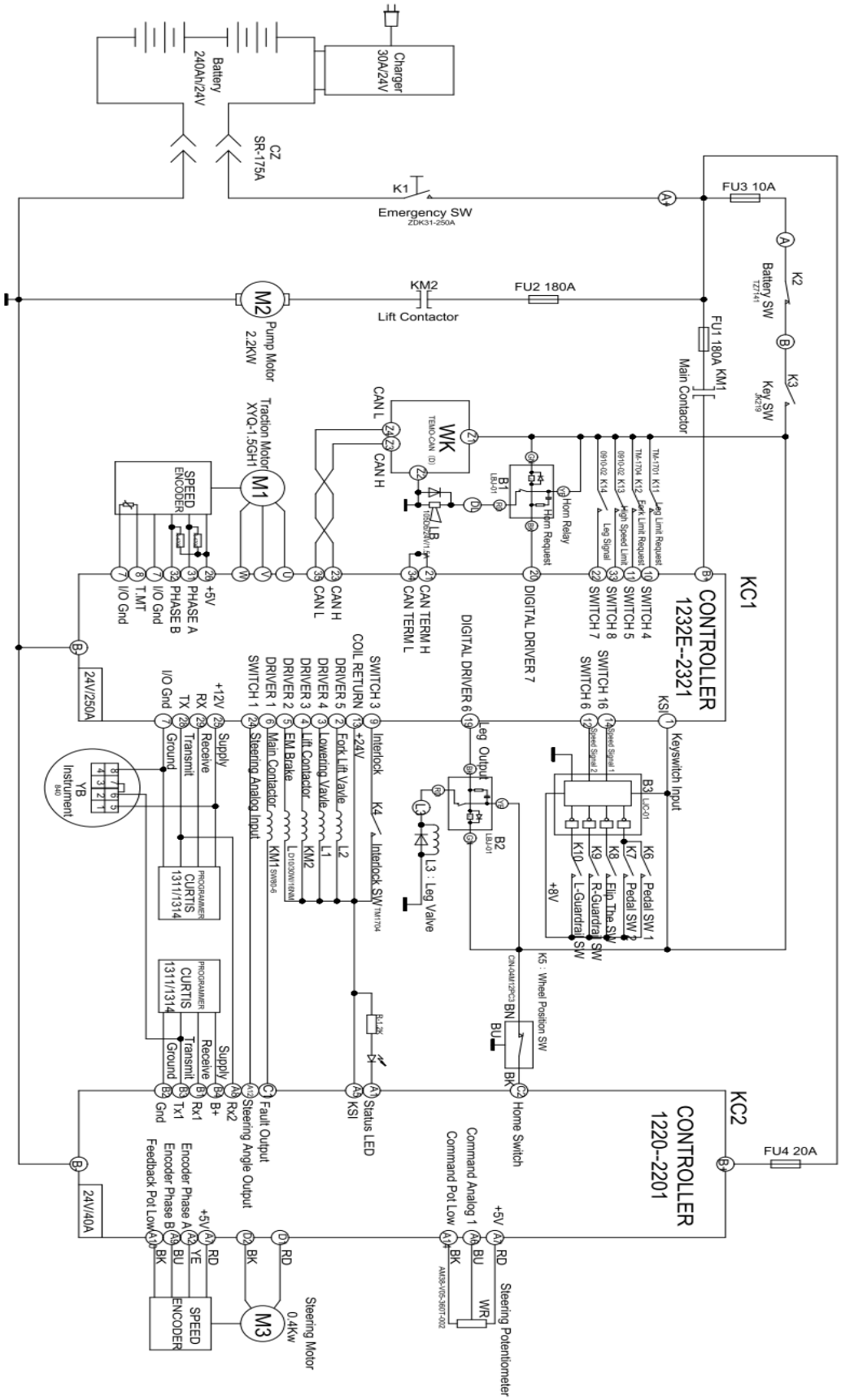
The brake structure is indicated as the Fig on the right. After being used for a while, the performance of the brake may decline with the wearing of the brake block or the brake plate can't be released. At this time, it is necessary to adjust brake clearance. As indicated in the figure on the right, in braking status, use a feeler to check the gap between the brake block and electromagnet, if the gap is more than 0.5mm, then it needs adjustment. Before adjustment, clean the dirt and dust on the friction plate. When adjusting, loosen the fixed screw 2, adjust the length of set screw 1, then fasten the retention screws, after adjustment, the clearance between the brake block and electromagnet should be fixed from 0.2~0.25mm. It has to be noted that even adjustment for three retention screws can make even clearance gap between the brake block and electromagnet after adjustment. After the adjustment, turn on the brake with 24v DC power. Then the brake will make clear sound



The disassembly of the brake is shown as the following picture, use tools to loose screw 8.



2. Electrical faults



LED CODE	1311 DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,2	motor speed encoder	The speed sensor signal can't be detected.	1 Incorrect or ineffective speed sensor wiring.
			2 Controller defective.
	Motor Failsafe	The motor speed is not in the normal scope.	1 Speed sensor malfunction.
			2 The electromagnetic brake of motor is not loosened completely.
			3 Insufficient braking torque.
			4 P,I setting improper
			5 Failsafe delay too short
1,3	Motor Overcurrent	Motor overcurrent	1 Incorrect motor wiring
			2 Controller defective.
	Motor Output Fault	Controller output abnormal	1 Incorrect motor wiring
			2 Controller defective.
1，4	Static Return To Off	SRO sequencing error	1 Improper sequence of KSI,INTERLOCK,F/R
			2 Wrong SRO type selected.
			3 Direction switch malfunction.
			4 Sequencing delay too short.
2，1	Throttle Wiper High	Accelerator voltage is too high.	1 Accelerator is damaged.
			2 Wrong accelerator type selected.
2，2	EMR Wiring Open	EMR wiring fault	1 EMR wire or check wire broken.
2，3	High Pedal Disable	HPD	1 Incorrect sequence of accelerator and KSI, INTER LOCK.
			2 Wrong HPD type selected.
			3 Accelerator malfunction
			4 Key switch and INTERLOCK power-off.
			5 Sequencing delay too short.
			6 Wrong accelerator type selected.
2，4	Throttle Wiper Low	Accelerator voltage is too low.	1 Accelerator is damaged.
			2 Wrong accelerator type selected.
3，1	Multiplexer Fault	Multiplexer malfunction	Multiplexer malfunction
3，2	Main Contactor	Misssing or welded main contactor.	1 Main contactor coil open.
			2 Main contactor stuck closed
			3 Welded main contactor
			4 Main contactor driver shorted.
	Precharge	Precharge fault	1 Controller defective.
			2 Low battery voltage.

3，3	Brake Fault	Electromagnetic brake fault.	1 Brake coil shorted or open.
			2 Brake driver fault.
4，1	Service Total Disable	Total driving timer has expired.	Total driving timer has expired.
	Service Driver Disable	Setted (KSI) service timer has expired.	Setted (KSI) service timer has expired.
	Service Total Expired	Setted (driver) service timer has expired.	Setted (driver) service timer has expired.
	Service Driver Expired	Battery voltage is too high.	Battery voltage is too high.
4，2	Battery Over voltage	Battery voltage is too low.	1 Battery voltage is too low.
	Battery Under voltage	Controller heatsink is too hot or too cold.	2 Corroded battery terminal.
			3 Storage battery is damaged.
			1 The power of controller is small.
4，3	Temperature Cutback	Mode switch is closed at startup.	2 Excessive load on vehicle fo a long time.
			3 Abstraction of heat is bad.
			1 Mode switch is adhesive.
4，4	Anti Tiedown	Hardware failure	2 Switch is in M2 position.
			Controller defective.
5，1	Hardware Failure	Software failure	Controller defective.
5，2	Software Failure	Parameters corrupt.	Controller defective.
5，3	Parameters Corrupt	Total driving timer has expired.	Total driving timer has expired.

LED display code examples，（2,4 ）：☼☼ ☼☼☼☼ LED flashes 2 times continuously and flashes 4times again after several seconds

- 1230 controller equipped with motor encoder
- .specific steps of inspection :

Do system measurement and troubleshooting with encoder ligature and voltage.Voltage between positive pole and negative pole is 12 v in normal circumstances.

- relative negative pole of voltage A(J2-2) is 0V or 10V,
- relative negative pole of voltage B(J2-4)

■alternating transformation are 0V and 10V of rotary motor encoder A、B and negative pole (J2-5). Speed cases will keep 5 v unchanged under the condition of fast speed

VI. The store, transportation and loading of truck

1. 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.

2. Transportation:

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.

Movement of the damaged truck

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

3. Storage:

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

Clean the truck thoroughly.

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

Lower the forks to the lowest position.

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

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

Lubricate the truck.

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

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

Appendix I

Packing list of 20EDPR Electric Pallet Truck

Consignee： manufacturing number：

contract number： date of production：:

Serial number	Cargo name	Number of units	Net (kg)	contour dimension （Long×wide×height）	Remark
1	20EDPR Electric Pallet Truck	1			Complete machine
2	Accessory bag	1			Technical documents, accessories and spare parts

Note：1. The following documents are in the file bag

① 20EDPR Electric Pallet Truck operating instruction 1 volume

② Packing list 1 copy

③ certificate of quality 1 copy

Accessory and spare parts

No.	Name	Use part	Specification	Q'ty	Remarks
1	Electriclock key	Open electric lock		1	
2	Charging plug、socket	Matched with		1	
3	Fuse	Electrical	20A	2	
4	Fuse	Electrical	180A	1	
5	Seal ring	Oil cylinder	UHS35	1	Side oil cylinder
6	O-seal ring	Oil cylinder	35.5×2.65	1	
7	O-seal ring	Oil cylinder	45×2.65	1	
8	Dust ring	Oil cylinder	DH35	1	
9	Seal ring UHS56	Oil cylinder	56×66×6	1	Middle oil cylinder
10	O-seal ring	Oil cylinder	56×3.55	1	
11	Dust ring DH56	Oil cylinder	DH56	1	
12	O-seal ring	Oil cylinder	70×3.55	1	

Appendix II

Maintenance and repairing recording card:

Items	Maintenance time	Maintenance part	Material used	Maintenance personnel	Remarks

Appendix I

Customer advisement feedback

Items	Time occurred	Trouble location	Fault cause	Trouble-shooting	Remarks