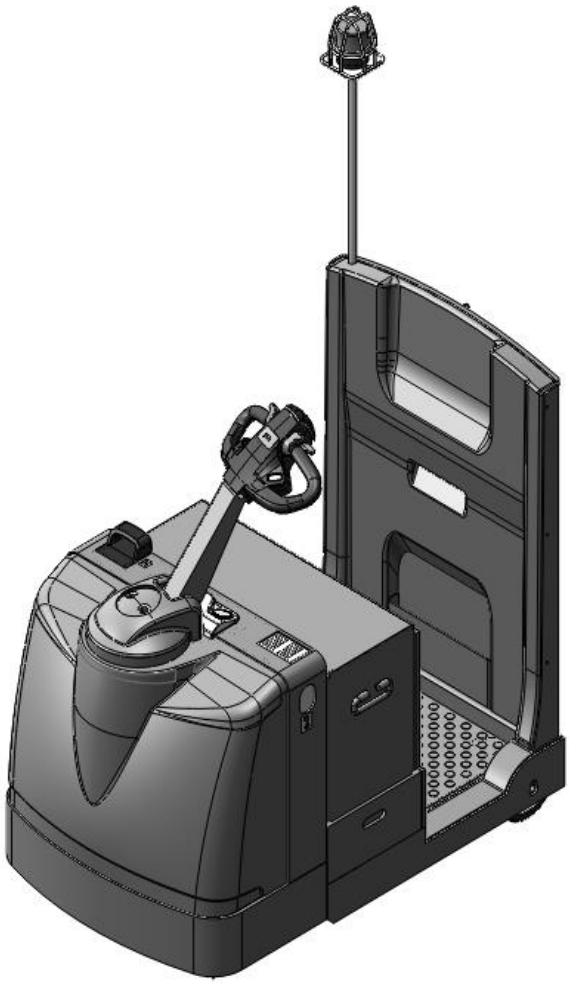
45ET

Electric Tow Tractor

- Operation Manual
- Service Manual



Welcome to choose HYUNDAI Electric pallet truck!

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

- Please read the manual carefully before operation.
- This manual is a common manual. We reserve the right to modify technology of the electric pallet truck. If there is anything in the manual that is not consistent with the actual truck, the actual truck should be considered correct and the manual is only for reference˚
- When the vehicle is rented out or transferred, please attach the manual.
  The instruction manual shall be accompanied with in case of truck leasing or transfer.
- Please come into contact with our dealer in case of any problem.

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

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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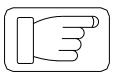
	Danger	Indicates an impending danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	Warning	Indicates a potential danger. Deaths or severe injuries would be resulted without any precaution or avoidance. You must observe those requirements.
	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 Tow Tractor is introduced for a ground conveying equipment, suitable for towing trailers. Must be in strict accordance with the provisions of the operating instructions in use, operation and maintenance of tow tractor. 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 biggest load limit in equipment nameplate or Load graphic drawing. Do not use the tow tractor in a fire and explosion hazard area can't 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 tow tractor in this operation manual. In the rental, lease and other special circumstances, "equipment user" represent the contract terms between equipment owner and user. Equipment user must ensure that the tow tractor 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 responsibility if there has any lost.

Installation accessories : If impact the function of the tow tractor 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. Electric Tow Tractor Introduction

1. Specified use

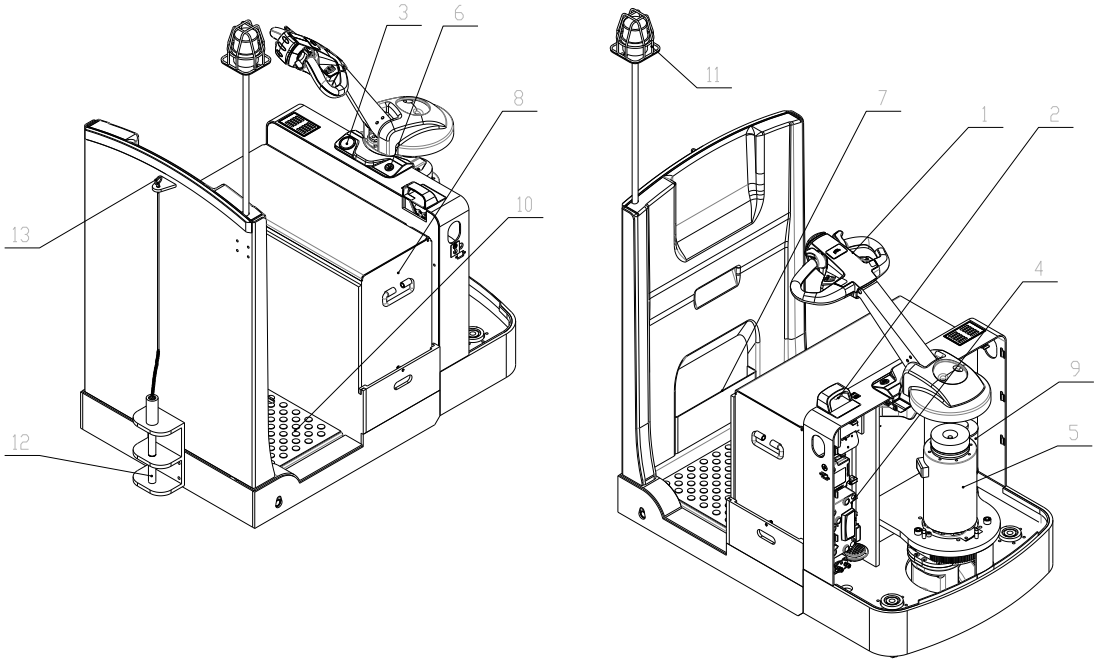
45ET series tow tractor is powered by storage battery, and driven by motor. This kind of truck travels by means of gear transmission and works through connecting coupler and trailer. The vehicle is electrically steered. Rated load details on the tow tractor nameplate.

2. Allowed environment for using

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.

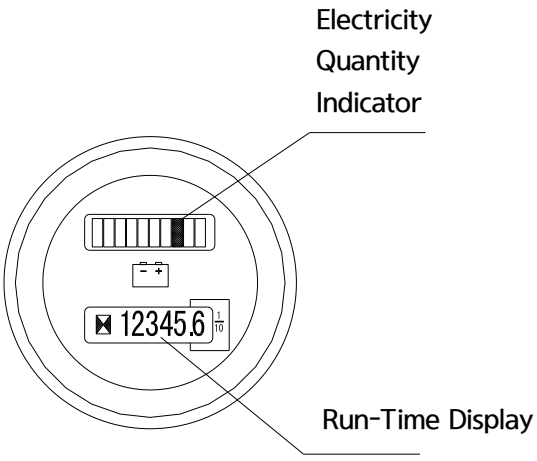
3. Technical parameters

3.1 Structure description



1. Operation handle
2. Emergency power off
3. Instrument
4. Electric control assy.
5. Drive element
6. Electric lock
7. Storage box
8. Battery
9. Power steering unit
10. Stand pedal
11. Charger Indicator Light(opt)
12. Coupler
13. Coupler pull tab

（1）Instrument：



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

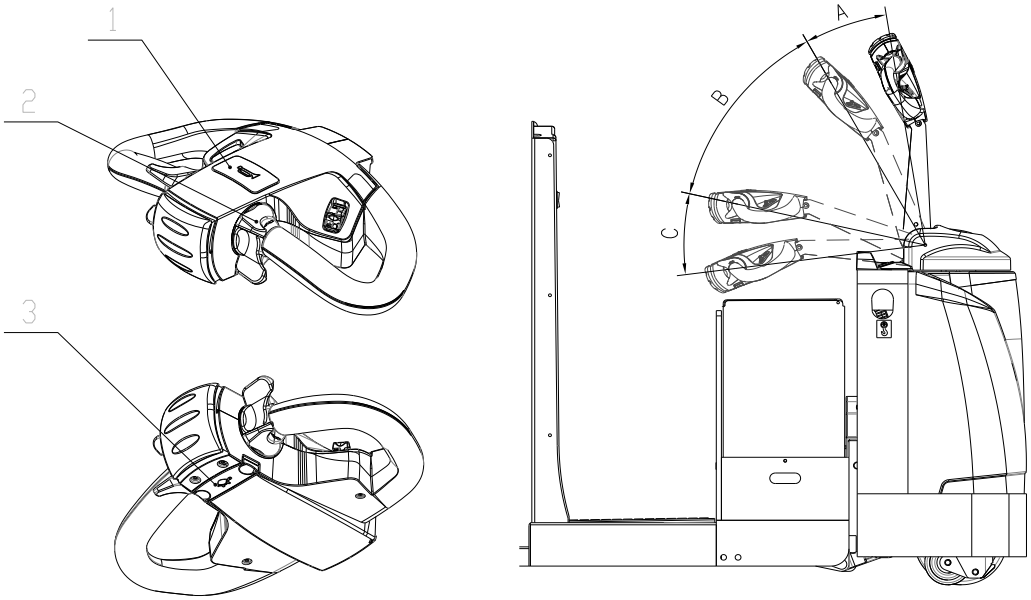
（2）Steering system:

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. Horn 2. Accelerator knob 3. Slow-down button

① Accelerator knob: It is used to control the travel direction and speed of the electric truck. Before operation of the truck, firstly turn the operation handle to area B shown as above. When the handle is placed in area A or C, the truck will be powered-off and braked. At this time, the truck can not drive. When the operation handle is placed in area B and the acceleration knob is turned in one direction, the truck will travel in that direction. Meanwhile the truck will be accelerated with the increasing of rotation amplitude of the knob. When the accelerator knob is turned in another direction, the truck will travel in another direction. Likewise, the truck will speed up with the increasing of rotation amplitude of the knob.

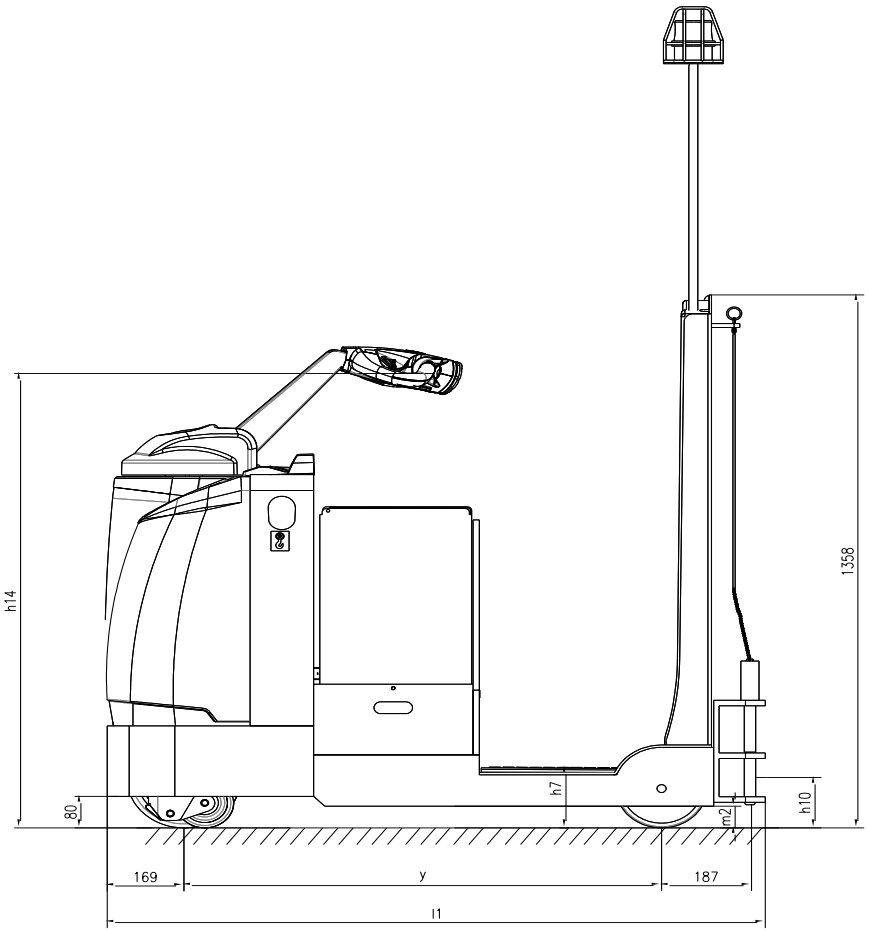
② Horn button： Horn of the truck will be turned on if you press the button.

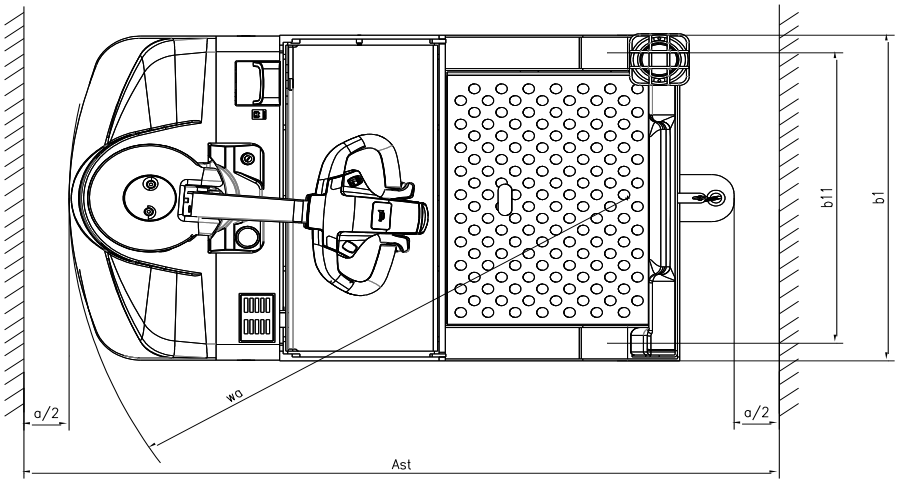
③ Slow-down button: When this button is pressed, the truck will travel at an extremely slow speed. This button is applicable for operation on especially narrow field or on the condition that the truck needs to be accurately located.

④ 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.

⑤ Battery main switch: to control the emergency power off, pulling out is power dump, pulling down is power-on, when your truck is out of control, please pull out it to cut off power.

3.2 Main technical parameters (45ET Electric Tow Tractor)





Charact-eristics	1.1	Manufacturer(abbreviated)		HYUNDAI
	1.2	Model		45ET
	1.3	Driving model		motor-driven
	1.4	Driving model （Manual, Walking, Stand driving, Seat driving ,Order picking）		Stand driving
	1.5	Load capacity	Q(kg)	4500
	1.6	Rated drawbar pull(60min)	(kg)	110
	1.7	Draw chassis height	H_{10} (MM)	128
	1.8	Maximal drawbar pull(5min)	(kg)	300
	1.9	Tread	Y(mm)	1054
Weight	2.1	Service weight(with battery)	kg	
	2.2	Axle load, front/rear, laden	kg	
	2.3	Axle load, front/rear, unladen	kg	
Wheel chassis	3.1	Wheels (rubber, high elasticity, pneumatic tire, polyurethane wheel)		Front(polyamine),rear(rubber)
	3.2	Wheel dimension, front		Φ250×80
	3.3	Wheel dimension, rear		Φ200×50
	3.4	Additional wheel(dimension)		Φ127×57
	3.5	Wheel number, front/rear （x = driving wheel）		1X+2/2
	3.7	Tread, rear	b_{11}(mm)	740
Dimens-ion				
	4.9	Min. /Max. Height of operation handle, in driving position.	h_{14}(mm)	1070/1370
	4.19	Overall length	l_1(mm)	1450
	4.21	Overall width of truck body	b_1(mm)	830
	4.32	Wheelbase ground distance	m_2(mm)	55
	4.33	Aisle width, with pallet 1000x1200 crosswise	A_{st}(mm)	1670
	4.35	Turning radius	W_a(mm)	1235
Perform-ance Data	5.1	Traveling speed, laden/unladen	Km/h	9/14
	5.8	Max. gradeability, laden/unladen	%	4/20
	5.10	Traveling brake		Electromagnetic brake
Motor	6.1	Driving motor power	kW	4
	6.4	Battery voltage/rated capacity	V/Ah	24/560
	6.5	Battery weight	Kg	559
		Battery dimension（LXWXH）	mm	780×335×625
	8.4	Noise level at operator's ear, according to DIN12053	dB(A)	70

III. Operation

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 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. It is strictly forbidden to make sharp turn on narrow aisle. When it is turning, slow down the tow tractor and pay attention to the persons passing by, the barriers and the hollows.
6. It is strictly forbidden to put the hands, feet or other parts of body out of the tow tractor and the vehicle is not manned.
7. This tow tractor is suitable to be used on flat ground or flat platform. Don't put the truck on the slope for a long time.
8. 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.
9. It is strictly to use the truck under stipulated voltage of 20.4V.
10. It is strictly forbidden to conduct charge by connecting the plug to AC power directly.

1.1 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 tire 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 No modification or addition shall be made to the truck without written permission by our company. A modification of the truck may have a negative effect on its safe operation.

（6）Prepare safety operation procedure:

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

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

A Operation under unsafe condition is forbidden, such as under conditions with uneven floor, or impeded road. Goods lifting on slope is strictly forbidden.

B Faulty truck is forbidden to use.

C Make sure a daily inspection of the truck would be taken. Please immediately repair or replace in case of any abnormal conditions.

（8）Overloading operation of truck is forbidden

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 drivers should pay more attention for carrying extra-wide cargo. Pay attention to the safety of all around meanwhile

（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 Ensure no people around the truck when driving backwards.

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

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

E Keep concentration when operating truck.

（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 on slope; otherwise the truck can go tilting.

Warning

1) Once the truck is overturning, the driver should stay far away from the truck rapidly°

1) Forbid overloading operation.
2) Forbid deflective transportation.
3) Passengers on truck must be forbidden.
4) Never push or pull the handle abruptly.

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.
Wheels	4	Pins, screws and all the fasteners	Check all the fasteners of the truck's wheels, i.e. pins or screws, loose or not.
	5	Wearing status	Compare the parameter list, replace the wheel when its diameter reduces by 5%.
Battery	6	Charge	Confirm the display state of the battery capacity.
	7	Electrolyte	The solution level and density of electrolyte.
	8	Connecting line	The connecting line and socket shall be firm.
Horn	9	Horn	Press down the horn button to check whether the horn sounds.
Instrument	10	Function	Turn on the switch of electric lock to check whether the instrument displays normally.
Others	9	Truck frame, etc	Damaged or not. If there is any crack.

	10	Function	Check that whether lifting, lowering, forward & backward movement and emergency reverse of the truck is normal, and if there is any abnormal noise.
Braking system	11	Check point	Check content
	12	Operation handle	When the operation handle is turned, with the handle switching between area A and B, there is a noise from the brake.
Driving	13	Accelerator button	This is to check whether it is normal about forward and backward.

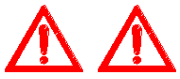
Warning

Never use the faulty truck

2.2 Driving：

(1) Start-up

Stand on the 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) 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.

(3) Turning

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

(4) Braking：

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

(5) Transportation operation

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 coupler, placing it right to the drawing head.
4) Pull the draw pin and drive the vehicle slowly. Insert the drawing head into the drawing hole. Then put down the couple and let the drawing pin connected together with the couple.

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.

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.

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) Turn the steering wheel to the middle position.

b) 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

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.

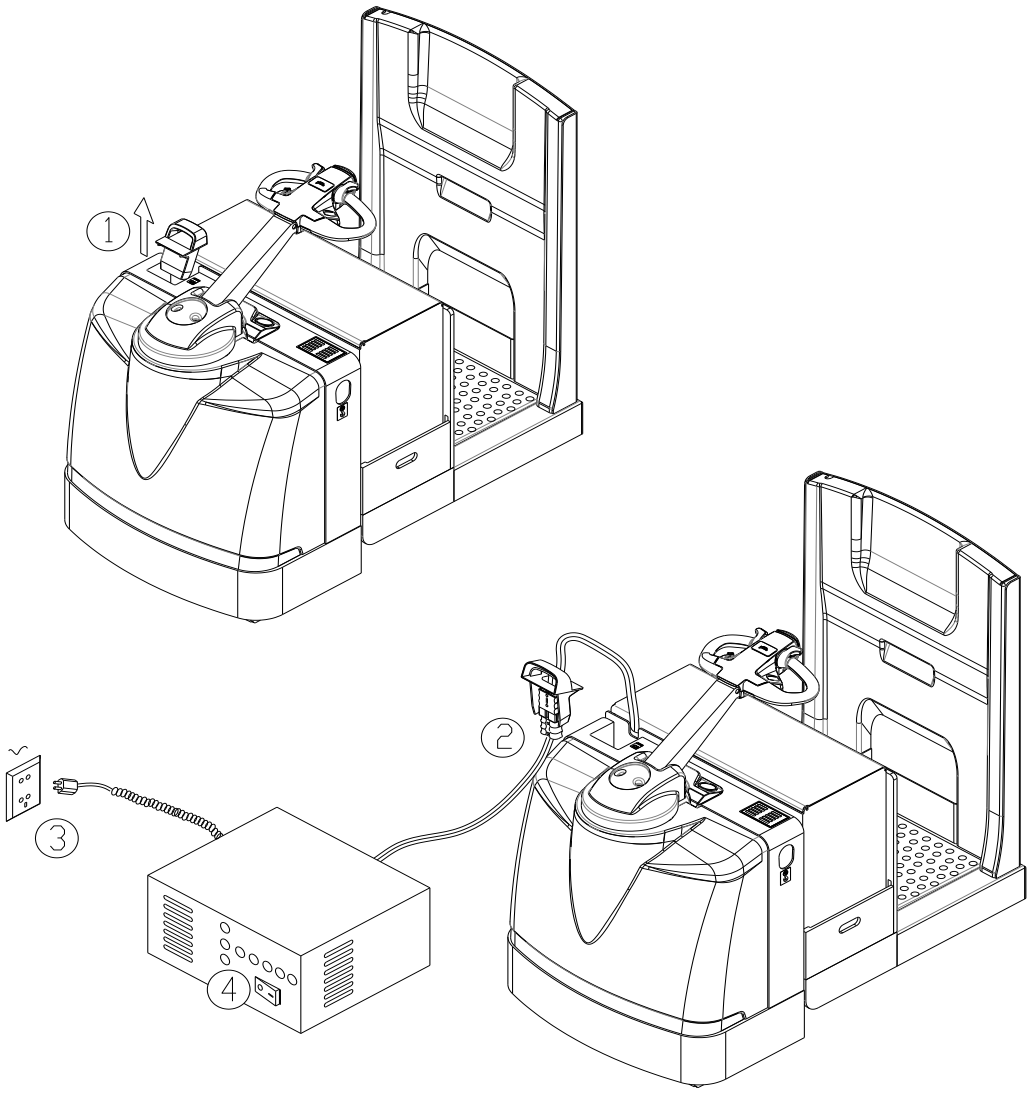
c. Add lubricating oil and grease if necessary.

d. Replace faulty components.

Ⅳ. Usage, maintenance and charge of storage battery

Standard configuration is external charger and the optional is built in charger.

Charging operation method as follow: :



External charger

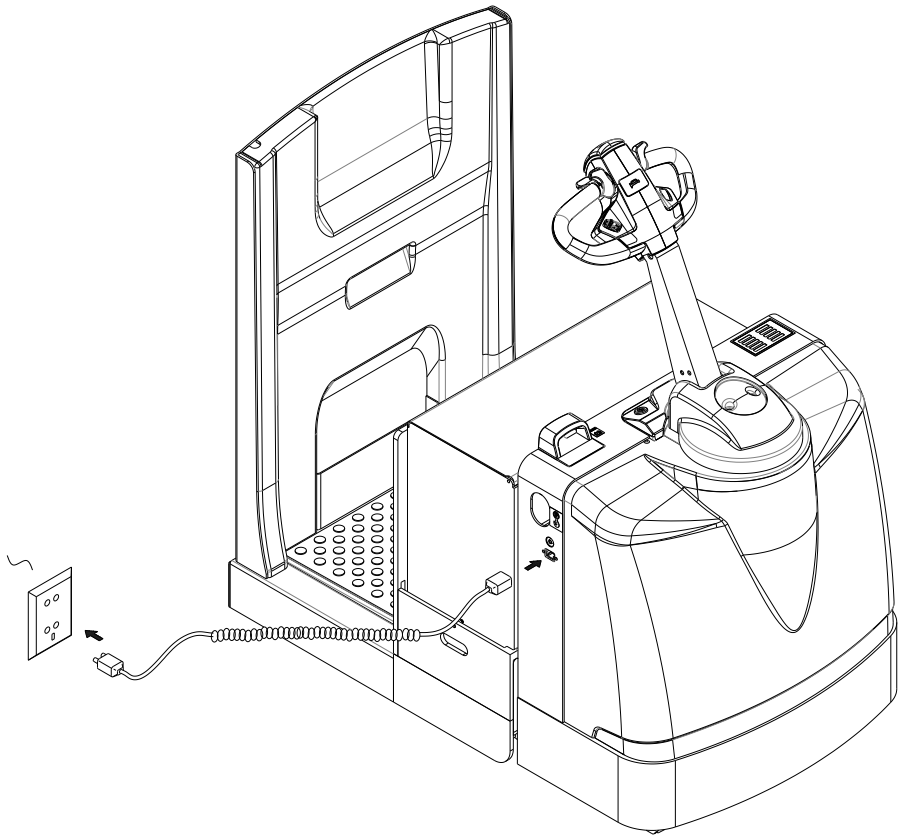
Charging ways for external charger:

Open the cover, the first step, pull out the charging socket from main circuit.

Step two, connect with charging plug of battery and charger.

Step three, put the battery socket into two-phase AC power supply.

Step four, open the power switch.



Direct charger

Charging ways for built-in charger：open the cell box cover if the truck has car charger and then put one head of charger lead into charging socket hole. Put the other head into two-phase AC power supply.

Warning

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

1 Initial charge

1. 1 Initial charge shall be made for new battery, i.e. the first time charge. Clean up the surface of the battery before the initial charge, and then check for damage to ensure reliable connection.

1. 2 Open gas cap.

1. 3 When the charging equipment is able to operate normally, pour the sulfuric acid electrolyte with a density of 1.260±0.005 (25℃) and a temperature of lower than 30℃ 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℃. (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℃) 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 t ℃.

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

1. 5 Dry up the electrolyte spilled on the surface of battery. Connect the positive and negative poles of batteries with those of D.C. source (charger) respectively and then turn on the power. Charge with the current of 60A (the current of the first stage). After the charge voltage achieves 28.8V (12×2.4V=28.8V), switch to the 30A current of the second stage for continuative charge. When charging, the temperature of electrolyte shall never exceed 45℃. When the temperature raising up nearly to 45℃, reduce the current by half or stop charging temporarily. After the electrolyte temperature reduce below 35℃, 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℃), 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. 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.

1. 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

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 60A and that of the second stage is 30A. The charging method is the same as that of initial charge. The charged volume is 130-140 % of the discharged volume and the charging time is about 12 hours.

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

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

2. 4 Equalizing charge：

a. Charge with 8A 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% (4A) and continue to charge.

c. When the batteries are fully charged, stop charging for 0.5 hour and charge again with a 2A current for one more hour.

d. Stop charging for another 0.5 hour and charge with a 2A 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℃. The valid storage period is 2 years. Safekeeping shall be made within storage period according to the following requirements:

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

4 Operation of electrolyte

(1)Density check

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

(2) Operation besides check

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

(3) Electrolyte leakage

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

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

(1) Operation of storage batteries during the final stage of their lifetime
When the lifetime of storage battery is about to terminate, the electrolyte in single battery reduces very fast. For this reason, distilled water shall be complemented everyday.
(2) Treatment of waste battery
As for the waste battery, draw out the electrolyte and decompose the battery. It can be discussed that whether the waste battery shall be recycled by the battery manufacturer. The waste electrolyte can be disposed according to relevant local rules and regulations.

6 Emergency treatment

(1) The electrolyte spills on skin: wash with large amount of water

(2) The electrolyte spills into eyes: wash with large amount of water, and then seek help from specialized doctor.
(3) The electrolyte spills on clothes: take off clothes right away, wash with water, and then flush with 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: 60-70A
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

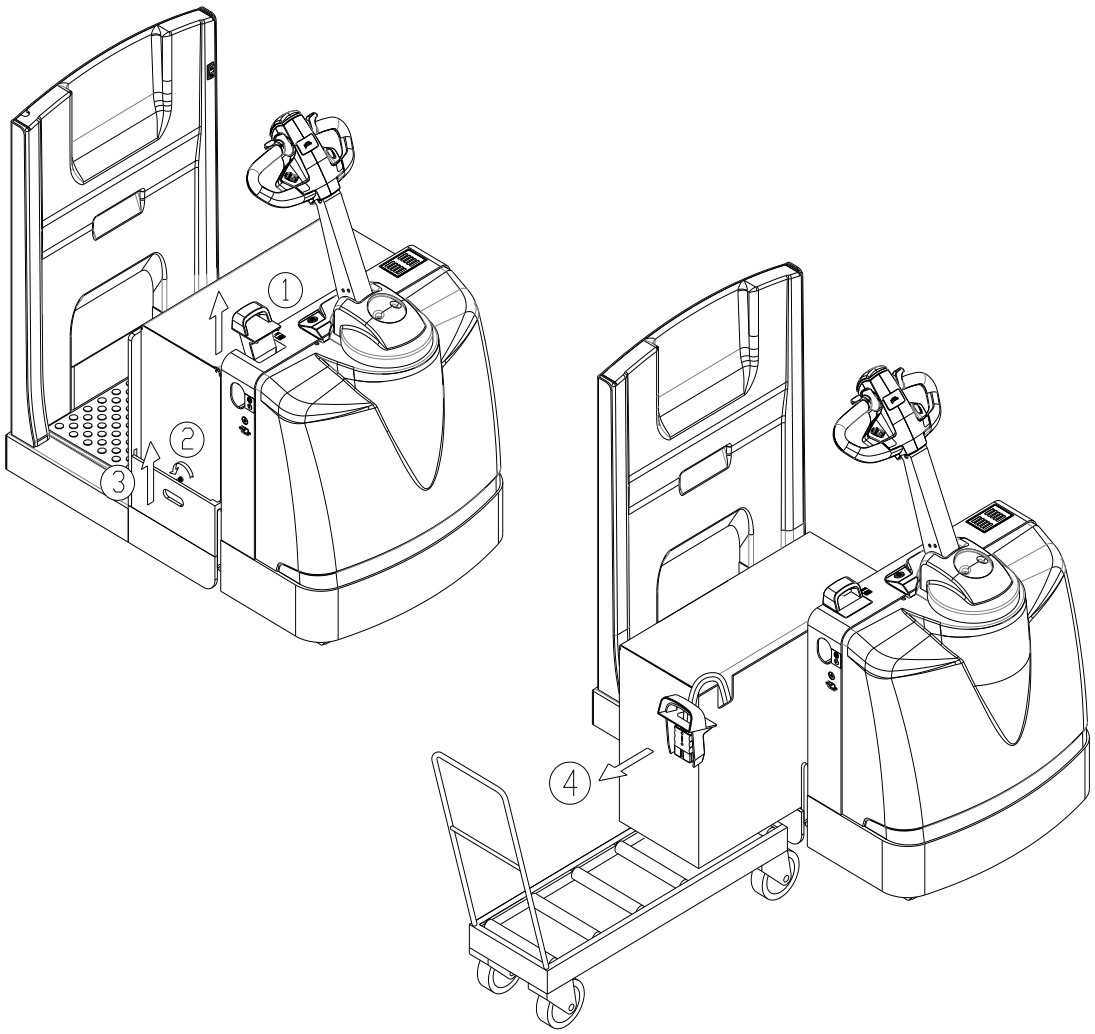
8 Replacement of storage battery

The weight of battery pack is about 560kg, and the replacement procedure of storage battery is as follows:

1. Take the connector of the battery down form the vehicle.
2. Loosen the positioning screw.
3. Open the side way door and take it down.
4. Pull out the storage battery from the side way and take the storage battery away with special car or using hoisting method.
5. The mounting method of putting the storage battery back into the battery pack is opposite to the above procedures.

Note

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



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.

 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.

1.1 Precautions during maintenance：

 Notice

The components for replacement shall be produced completely by our company. When replacing components of the truck, the components with the same safety requirement with the original design shall be used. The lubricating oil and hydraulic oil in use shall be recommended by our company.

(1) Places for maintenance：

 Notice

The places for maintenance shall be appointed and can provide other services such as hoisting and safety protection facility etc. The places shall have level ground and good ventilation.
The places shall be equipped with fire-extinguishing devices.

(2) Precautions before repair and maintenance：

 Notice

No smoking.
Arrange the self-protection work.
Wipeout the effusive oil in time.
Before adding lubricating oil, clean up the dirty oil or dust on the joint with brush or cloth.
Except certain situation, turn off the key switch and pull off the power socket.
Lower down the fork arms to the lowest point when carrying out maintenance.
Ensure no goods on the truck when demounting the high pressure oil pipe. Besides, the fork arms shall be descended to the lowest position, by this way, the pressure of hydraulic system can be released. For the reason that there are capacitors storing a little amount of electric energy in circuit, so before contacting the binding post of the main circuit, discharge at first.
Clean the electric section with compressed air, never flush with water. When the truck requires high-position maintenance, the altitude safety protection must be carried out for the repairing and maintenance personnel.

1.2 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 4.1.

1.3 Daily inspection

Check the capacity of storage battery. Refer to the use and maintenance of storage battery.

1.4 The inspection according to the need

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.
Storage battery, charger and electric system	8	Electrolyte	Liquid level, specific gravity and cleanness
	9	Plug	Function, whether it is damaged or not
	10	Key switch	Function
	11	Contactor	Contact performance and function
	12	Inching switch	Function
	13	Controller	Function
	14	Driving motor	Wearing status of carbon brush and selenium rectifier.
	15	Steering motor	Wearing status of carbon brush and selenium rectifier.
	16	Fuse	Whether it is perfect or not
	17	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.
Wheel and bearings	Check the wearing condition, and replace them if necessary

1.6 Recommended working medium:

(1) Gear oil：Hyperbola gear oil 85W-90(GL-5)

(2) 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

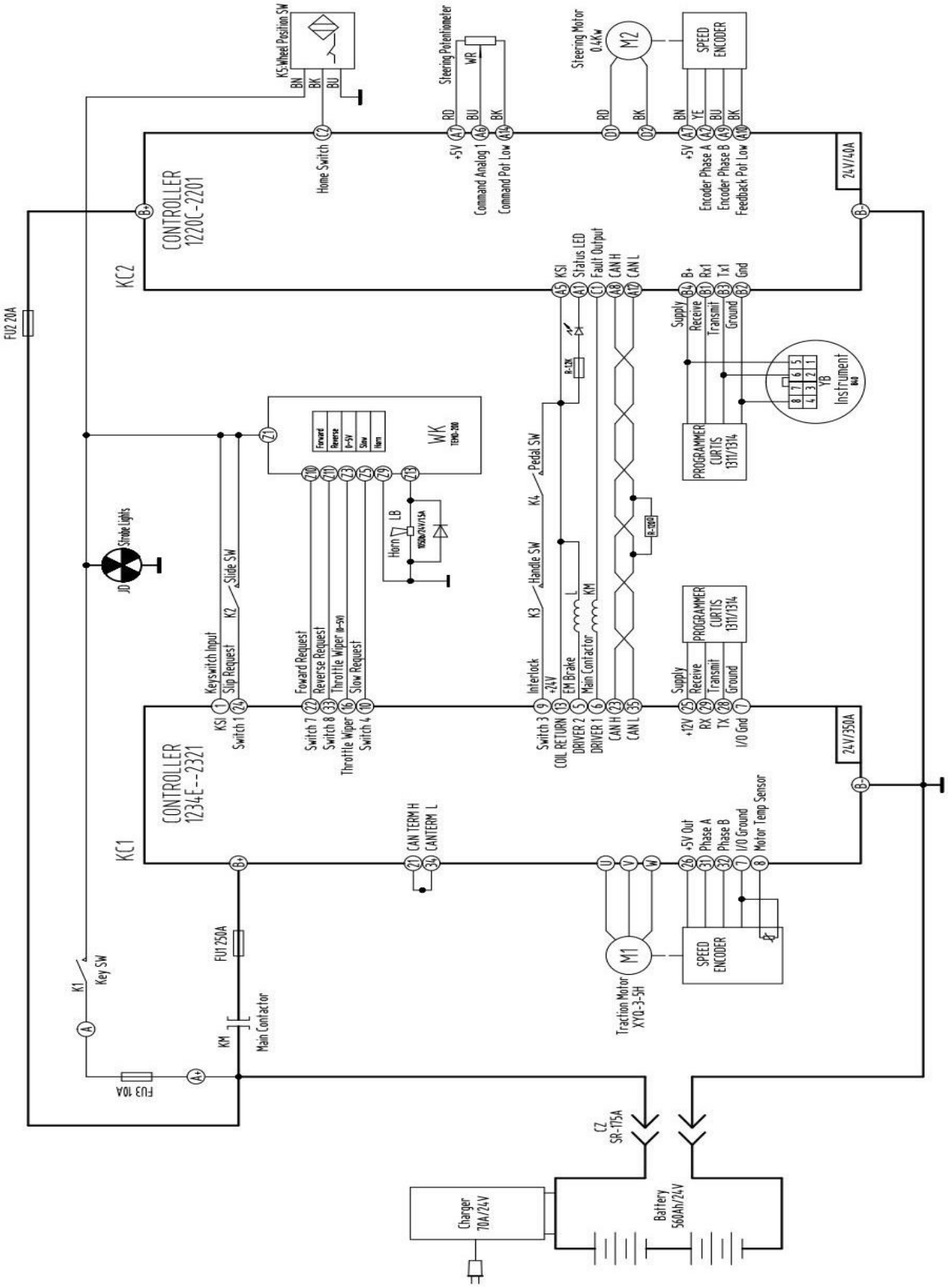
1.7 Maintenance period of consumables and partial parts :

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

2. Common faults and Troubleshooting :

Faults	Possible cause	Trouble shooting
The truck cannot start	Storage battery is used up.	Inspect, charge, or replace the storage battery
	The wire terminal is loosened.	Screw down the terminal screw
	The fuse is burn out.	Replace the fuse
	The accelerator is damaged.	Replace accelerator
The direction is ineffective and heavy.	The steering device is blocked by the abnormal matter.	Clean up the foreign matter.
	The bearings of steering device are worn.	Replace the bearings
Brake cannot work	The friction plates of the electromagnetic brake are damaged	Replace
Not release after braked	The electromagnetic brake is out of electricity.	Check the circuit.
	The clearance of the electromagnetic brake is too large.	Adjust the brake clearance to 0.2mm.

Electric principle diagram



2. Electrical equipment faulty

There are two LED on the controller cover and different colors represent different faults as the following shows :

Status	Meaning
Neither of them are lighted	Free of power, maybe the battery without electricity or the circuit with some problems
The yellow one is lighted	The controller is normal.
Both of them are lighted	The controller is upgrading the software.
Both of them are flickering	The controller has some problems.

1234 programming fault code and LED diagnosis list

LED CODE	DISPLAY	POSSIBLE CAUSE
1, 2	Controller Over current	1. U, V or W are short circuit. 2. Motor parameter setting has some problem. 3. The controller has some problem.
1, 3	Current Sensor Fault	1. U, V, W are short circuit. 2. The controller has some problems.
1, 4	Pre charge Failed	1. Outer loading connected with capacitor bank prevents powering on. 2. check the temperature of the controller under the supervisory controlling menu.
1, 5	Controller Severe Under temp	1. the controller is working under the limiting condition.（less than-40℃） 2. check the temperature of the controller under the supervisory controlling menu.
1, 6	Controller Severe Over temp	1. the controller is working under the limiting condition. (more than 95℃) 2. the vehicle is overloaded. 3. the installing of the controller is wrong. 4. check the temperature of the controller under the supervisory controlling menu.
1, 7	Severe Under voltage	1. Voltage parameter setting has some problem. 2. The battery is powering off. 3. The resistance is too high. 4. When driven, the battery is not connected. 5. Check the voltage under the supervisory controlling menu. 6. B+ fuse and is fused or the main connector is not closed.
1, 8	Severe Overvoltage	1. Voltage parameter setting has some problem 2. The resistance is to high when regenerative current is produced. 3. The battery is not connected when regenerative current is produced.

		4. Check the voltage under the supervisory controlling menu.
2, 1	Controller Under temp Cutback	1. The controller under temperature function is working. 2. The controller is working under the limiting condition. 3. Check the temperature of the controller under the supervisory controlling menu.
2, 2	Controller Over temp Cutback	1. The controller over temperature function is working. 2. The controller is working under the limiting condition. 3. The vehicle is overloaded. 4. The controller is wrongly installed. 5. Check the temperature of the controller under the supervisory controlling menu.
2, 3	Under voltage Cutback	1. When it works normally, the battery needs powering on, the controller under voltage function is working. 2. Voltage parameter setting has some problem. 3. The battery is powered off. 4. The resistance is to high 5. When driven, the battery is not connected. 6. Check the voltage under the supervisory controlling menu. 7. B+ fuse and is fused or the main connector is not closed.
2, 4	Overvoltage Cutback	1. When it works normally, the battery needs powering on, the controller over voltage function is working. 2. Voltage parameter setting has some problem. 3. The resistance is too high when regenerative current is produced. 4. The battery is not connected when regenerative current is produced. 5. Check the voltage under the supervisory controlling menu.
2, 5	+5V Supply Failure	1. Outer loading resistance connected with+5V supply side is too low. 2. Check the 5V voltage and Ext supply current under the supervisory controlling menu.
2, 6	Digital Out 6 Overcurrent	1. Outer loading resistance connected with data output 6 Pin19 is too low.
2, 7	Digital Out 7 Overcurrent	1. Outer loading resistance connected with data output 7. Pin20 is too low.
2, 8	Motor Temp Hot Cutback	1. The motor temperature is over the parameter settings, so the current required is cut off. 2. The motor temperature controlling parameter has not been adjusted correctly. 3. Check the temperature of the controller and the input of Analog2 under the supervisory controlling menu. 4. If you don't use the temperature adjustment, the temperature compensation and the temperature cut off must be set as OFF.
2, 9	Motor Temp Sensor Fault	1. The motor temperature sensor is not connected well. 2. If you don't use the temperature adjustment, the temperature

		compensation and the temperature cut off must be set as OFF. 3. The motor temperature is over the maximal data.
3, 1	Coil1 Driver Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
	Main Open/Short	1. The main connector is broken or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
3, 2	Coil2 Driver Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
	EM Brake Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
3, 3	Coil 3 Driver Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong
3, 4	Coil 4 Driver Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
3, 5	PD Open/Short	1. The connected load is cut off or circuit. 2. The connector is polluted. 3. The wicking is broken or the connecting line is wrong.
3, 6	Encoder Fault	1. The motor code has something wrong. 2. The wicking is broken or the connecting line is wrong. 3. The motor supervision menu : motor RPM.
3.7	Motor Open	1. U′ V′ W are cut off. 2. The wicking is broken or the connecting line is wrong.
3, 8	Main Contactor Welded	1. The main connector is jointed together. 2. U line is bad connected or cut off. 3. An alternant voltage provides current for (B+).
3, 9	Main Contactor Did Not Close	1. The main connector is jointed together. 2. The main connector is jointed together or burnt. 3. B+ outer loading prevents the capacitor bank powering on. 4. B+ is fused.
4, 1	Throttle Wiper High	1. The voltage of the sliding side of the accelerator is too low. 2. Check the potentiometer input under the supervisory controlling menu.
4, 2	Throttle Wiper Low	1. The voltage of the sliding side of the accelerator is too low. 2. Check the potentiometer input under the supervisory controlling menu.
4, 3	Brake Wiper High	1. The voltage of the sliding side of the accelerator is too high. 2. Check the potentiometer input under the supervisory controlling

		menu.
4，4	Brake Wiper Low	1. The voltage of the sliding side of the accelerator is too low. 2. check the potentiometer input under the supervisory controlling menu°
4，5	Pot Low Overcurrent	1. The prevention from potentiometer unit to the lower end is too low. 2. Check the potentiometer input under the supervisory controlling menu.
4，6	EEPROM Failure	1. EEPROM failure. EEPROM memory storage is written through VCL, CAN bus, adjusting 1311 parameter or upgrading the connector software.
4，7	HPD/Sequencing Fault	1. The input order of the key switch, interlocking, direction and the accelerator is wrong. 2. The connecting of the key switch, interlocking, direction and the accelerator is not well or the switch is broken. 3. Check the input under the supervisory controlling menu.
	Emer Rev HPD	1. The operator of the emergency doesn't work, but the accelerator, Forward or backward input, interlocking switch don't return to neutral gear.
4，9	Parameter Change Fault	1. This is caused by 1311 parameter and can be solved through opening the electric door. For example, if the customer changes the accelerator type, only reopening the switch of the electric door can operate the vehicle again.
5, 1-67	OEM Faults	These faults are OEM level and you can solve the problems once you have higher level.
6，8	VCL Runtime Error	1. VCL runtime error. 2. See to 1311 controller supervisory menu：VCL error mode 和 VCL error. This kind of error can be regarded as error code of runtime VCL and OS system.
6，9	External Supply Out of Range	1. Input current produced by any outer 5v or 12v load is too high or too low. 2. The outer maximal and minimal input adjustment of the fault parameter is not correct. 3. See to 1311 input supervisory menu: outer input current.
7，1	OS General	Inside controller is broken.
7，2	PDO Timeout	1. CAN PDO receiving time is more than the PDO overtime period.
7，3	Stall Detect	1. The motor is broken. 2. The code of the motor is broken. 3. The wiring is broken or the connection is error. 4. The code provide. 5. See to 1311 input supervisory menu：motor RPM.
8，7	Motor Characterization Fault	1. Motor characteristic described by the motor describing step has something wrong.

8，8	Encoder Characterization Fault	1. Code characteristic described by the code step has something wrong. 2. The motor code pulse frequency is not a standard one（32，48，64，80ppr）
8，9	Motor Type Fault	1. The motor parameter data is out of the range.
9，2	EM Brake Failed to Set	1. After the brake signal, the vehicle is still driving. 2. The magnetic brake can't hold the rotating motor tightly.
9，3	Limited Operating Strategy （LOS）	1. Whether it is the problem of the code or detect, both of them can make the limited control mode active. 2. The motor code has some problem. 3. Wicking is broken or connection is cut off. 4. The vehicle is out of speed.
9，4	Emer Rev Timeout	1. Emergency reverse direction is at active state but it doesn't work because of the overtime. 2. Emergency reverse direction signal is adhered.

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.

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

45ET Electric Tow Tractor packing list

Consignee：　　manufacturing number：

contract number：　　date of production：

Serial number	Cargo name	Number of units	Net (kg)	contour dimension (L ×W×H)	Remark
1	45ET Electric Tow Tractor	1			Complete machine
2	Accessory bag	1			Technical documents, accessories and spare parts

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

45ET Electric Tow Tractor operating instruction　　1 volume

Packing list　　1 copy

Certificate of quality　　1 copy

Accessory and spare parts

Designation	Use part	Specification	Quantity	Remark	Designation
1	Electric lock key	Open electric lock		2	
2	Fuse	Electrical equipment	10A	2	
3	Fuse	Electrical equipment	30A	1	
4	Fuse	Electrical equipment	180A	1	
5	Charging cable	Charger		1	For direct charger

Appendix II

Maintenance and repairing recording card:

Items	Maintenance time	Maintenance part	Material used	Maintenance personnel	Remarks

Appendix III

Customer advisement feedback:

Items	Time occurred	Trouble location	Fault cause	Trouble-shooting	Remarks