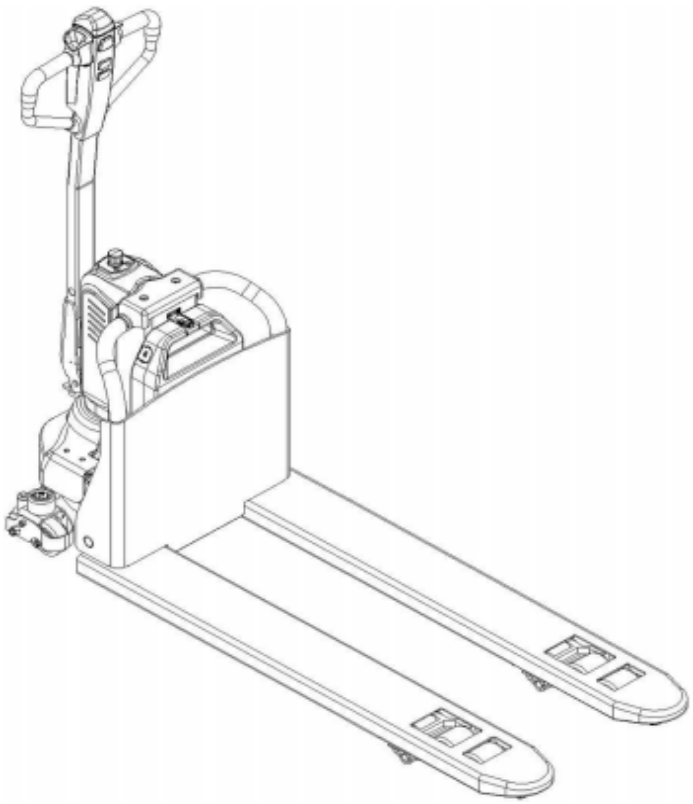
12EP-XB

Electric Pallet Truck

SERVICE MANUAL



WARNING

Do not use the pallet truck before reading and understanding these operating instructions.

NOTE:

- **Please check the designation of your present type at the last page of this document as well as on the ID-plate.**
- **Keep for future reference.**

FOREWORD

Before operating the truck, read this ORIGINAL INSTRUCTION HANDBOOK carefully and understand the usage of the truck completely. Improper operation could create danger.

This handbook describes the usage of different electric pallet trucks. When operating and servicing the truck, make sure, that it applies to your type.

Keep this handbook for future reference. If this or the warning/ caution labels are damaged or got lost, please contact your local dealer for replacement.

This truck complies with EN ISO 3691-1 (Industrial vehicles - Safety requirements and verification, Part 1), The standards of EN 12895 (Industrial vehicles - electromagnetic compatibility), EN 12053 (Safe industrial vehicles - test methods for the measurement of noise emissions),EN 1175-2020(Safety of industrial vehicles - electrical performance requirements) must ensure that the vehicle is used in accordance with the above purposes. According to EN 12053, the noise level in the driver's ear is 69 dB(A).

ATTENTION:

Environmentally hazardous waste, such as batteries, oil and electronics, will have a negative effect on the environment, or health, if handled incorrectly.

The waste packages should be sorted and put into solid dustbins according to the materials and be collected disposal by local special environment protection bureau. To avoid pollution, it’s forbidden to throw away the wastes randomly.

To avoid leaking during the use of the products, the user should prepare some absorbable materials (scraps of wooden or dry duster cloth) to absorb the leaking oil in time. To avoid second pollution to the environment, the used absorbable materials should be handed in to special departments in terms of local authorities.

Our products are subject to ongoing developments. Because this handbook is only for the purpose of operating /servicing the pallet truck, therefore please have understanding, that there is no guarantee out of particular features out of this handbook.

NOTE: On this manual, the left sign means warning and danger, which can lead to death or serious injury if not followed.

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1. CORRECT APPLICATION

It is only allowed to use this electric pallet truck according to this instruction handbook.

The trucks described in this handbook are self-propelled electric power pallet trucks. The trucks are designed to lift, lower and transport palletized loads.

A wrong usage can cause human injuries or can damage equipment.
The operator/ the operating company has to ensure the correct usage and has to ensure, that this pallet truck is used only by staff, which is trained and authorized to use this truck.

The pallet truck has to be used on substantially firm, smooth, prepared, level and adequate surfaces. The truck is intended to be used for indoor applications with ambient temperatures between +5°C and + 40°C and for various transportation applications without crossing permanent obstacles or potholes. The work on ramps is allowed if ramp is not exceeding the allowed angle. While operating, the load must be placed approximately on the longitudinal center plane of the truck.
Lifting or transporting people is forbidden.

If used on tail lifts or loading ramps, please ensure that these are used correctly according to the operating instructions.

The capacity is marked on capacity sticker as well on the Identification plate. The operator has to consider the warnings and safety instructions.
Operating lighting must be minimum 50 Lux.

Modification

No modifications or alterations to this pallet truck which may affect, for example, capacity, stability or safety requirements of the truck, shall be made without the prior written approval of the original truck manufacturer, its authorized representative, or a successor thereof. This includes changes affecting, for example braking, steering, visibility and the addition of removable attachments. When the manufacturer or its successor approve a modification or alteration, they shall also make and approve appropriate changes to capacity plate, decals, tags and operation and maintenance handbooks.

By not observing these instructions, the warranty becomes void.

2. DESCRIPTION OF THE PALLET TRUCK

a. Overview of the main components

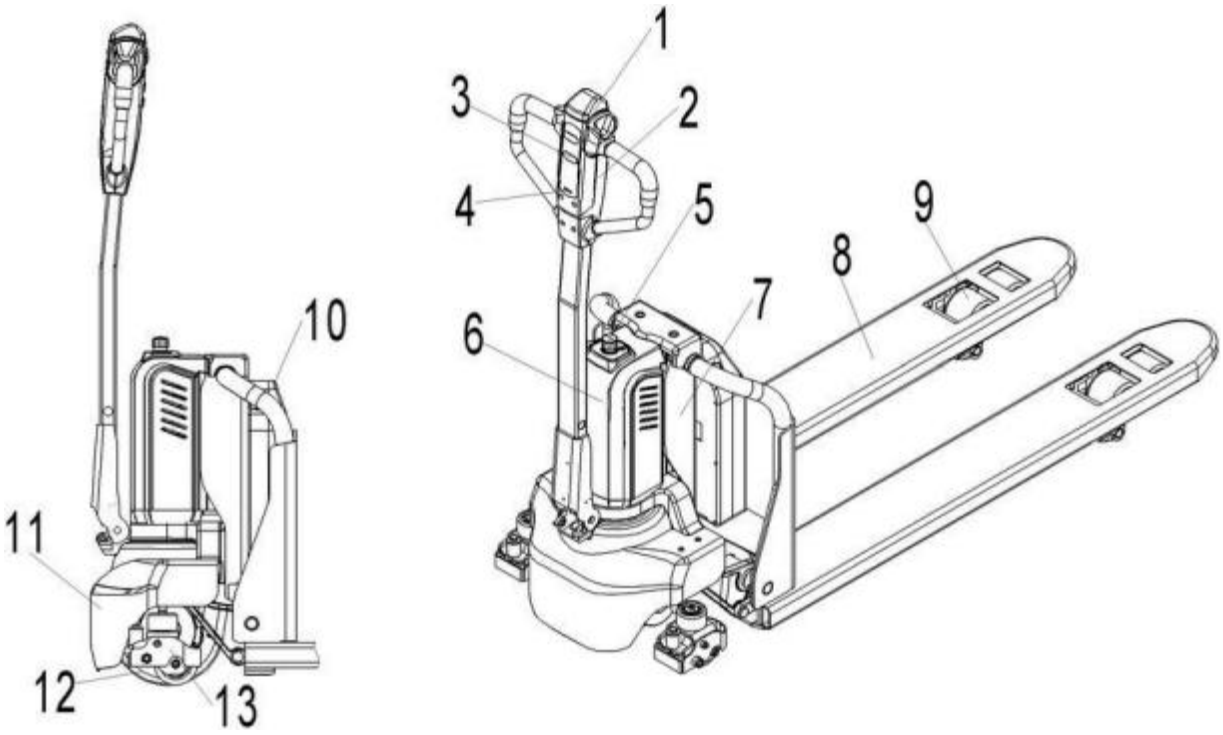


Fig. 1: Overview main components

1. Safety (belly) button
2. Tiller
3. Discharge indicator and charging indicating LED
4. Key switch
5. Emergency button
6. Hydraulic unit cover
7. Chassis
8. Fork
9. Load roller
10. Battery
11. Apron
12. Driving unit
13. Side roller (option)

b. Main technical data

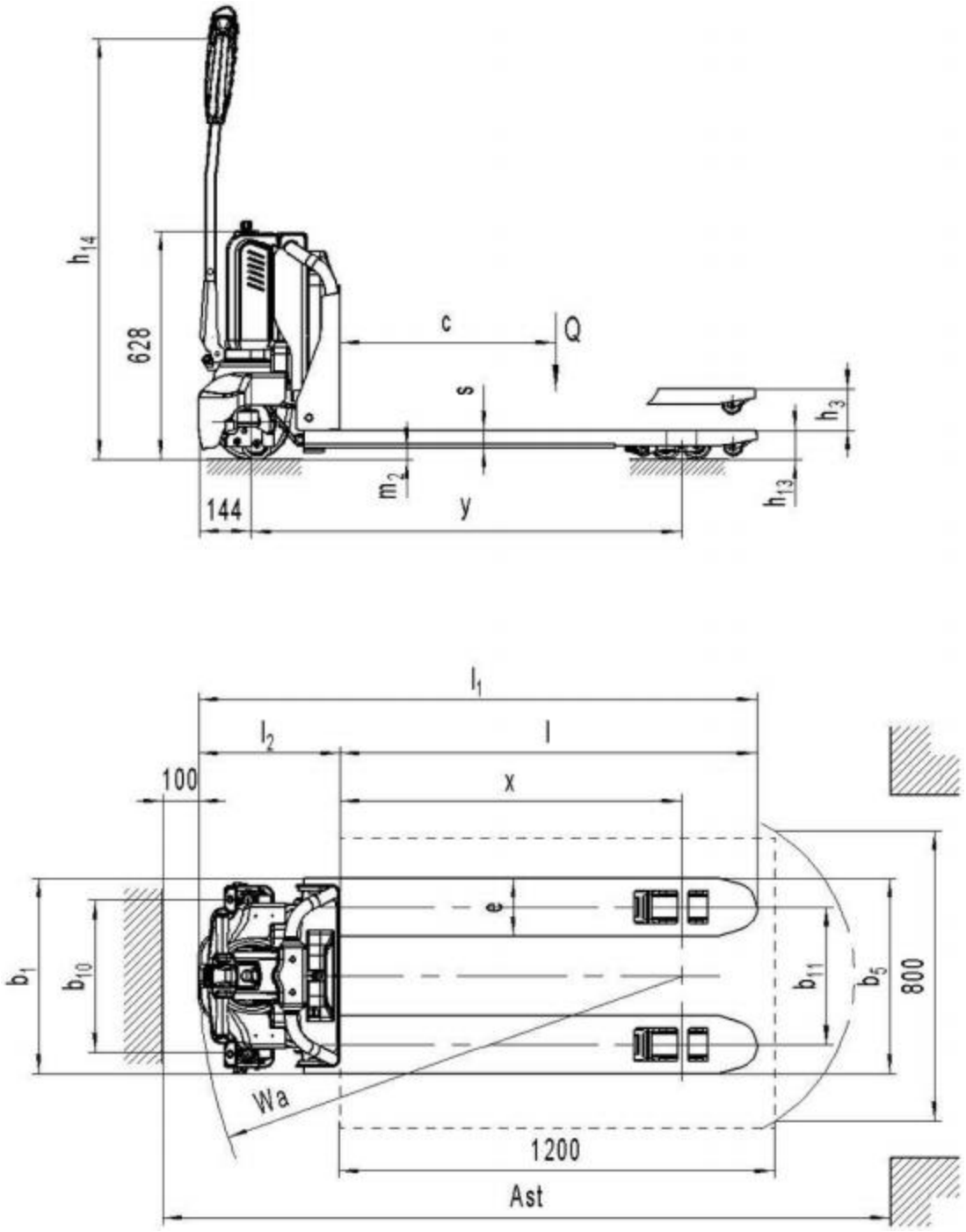


Fig. 2: Technical data

Table 1: Main technical data for standard version

		Type sheet for industrial truck（VDI 2198）			
Distinguishing mark	1.2	Manufacturer`s type designation		12EP-XB	
	1.3	Drive		Battery	
	1.4	Operator type		Pedestrian	
	1.5	Load Capacity / rated load	Q (t)	1.2	
	1.6	Load center distance	c (mm)	600	
	1.8	Load distance ,center of drive axle to fork	x (mm)	942	
	1.9	Wheelbase	y (mm)	1185	
Weight	2.1	Service weight	kg	124	129
	2.2	Axle loading, laden front/rear	kg	355 / 972	425 / 908
	2.3	Axle loading, unladen front/rear	kg	101 / 27	106 / 27
Tires, chassis	3.1	Tires		Polyurethane (PU)	
	3.2	Tire size,(front)	∅ x w (mm)	∅ 210×70	
	3.3	Tire size,(rear)	∅ x w (mm)	∅ 80×93(∅ 80×70)	
	3.4	Additional wheels(dimensions)	∅ x w (mm)	-/∅ 80×30	
	3.5	Wheels number front/rear (x=driven wheels)		1x/ 2(1x/ 4) or 1x +2/ 2(1x +2/ 4)	
	3.6	Tread, front	b_{10} (mm)	-/420	
	3.7	Tread, rear	b_{11} (mm)	380	525
Dimensions	4.4	Lift	h_3 (mm)	115	
	4.9	Height of tiller in drive position min./ max.	h_{14} (mm)	700 / 1160	
	4.15	Height, lowered	h_{13} (mm)	80	
	4.19	Overall length	l_1 (mm)	1537	
	4.20	Length to face of forks	l_2 (mm)	387	
	4.21	Overall width	b_1 (mm)	540	685
	4.22	Fork dimensions	s/e/l (mm)	48 / 160 / 1150	
	4.25	Width across forks	b_5 (mm)	540	685
	4.32	Ground clearance, center of wheelbase	m_2 (mm)	32	
	4.34	Aisle width for pallets800X1200 lengthways (200mm safe distance)	Ast (mm)	2007	
	4.35	Turning radius	Wa (mm)	1337	
Performance data	5.1	Travel speed, laden/ unladen	km/h	4.6 / 4.8	
	5.2	Lift speed, laden/ unladen	m/s	0.031 / 0.037	
	5.3	Lowering speed, laden/ unladen	m/s	0.069 / 0.051	
	5.8	Max. gradeability, laden/ unladen	%	4 / 16	
	5.10	Service brake		Electromagnetic	
Electric- engine	6.1	Drive motor rating S2 60min	kW	0.65	
	6.2	Lift motor rating at S3 10%	kW	0.50	
	6.3	Battery acc. to DIN 43531/ 35/ 36 A, B, C, no		No	
	6.4	Battery voltage, nominal capacity K5	V / Ah	24 /15	
	6.5	Battery weight	kg	4.4	

	6.6	Energy consumption acc. to VDI cycle	kWh/h	0.14
Additional data	8.1	Type of drive control		DC speed Control
	8.4	Sound level at driver`s ear acc. to EN 12053	dB(A)	<70

c. Description of the safety devices and warning labels

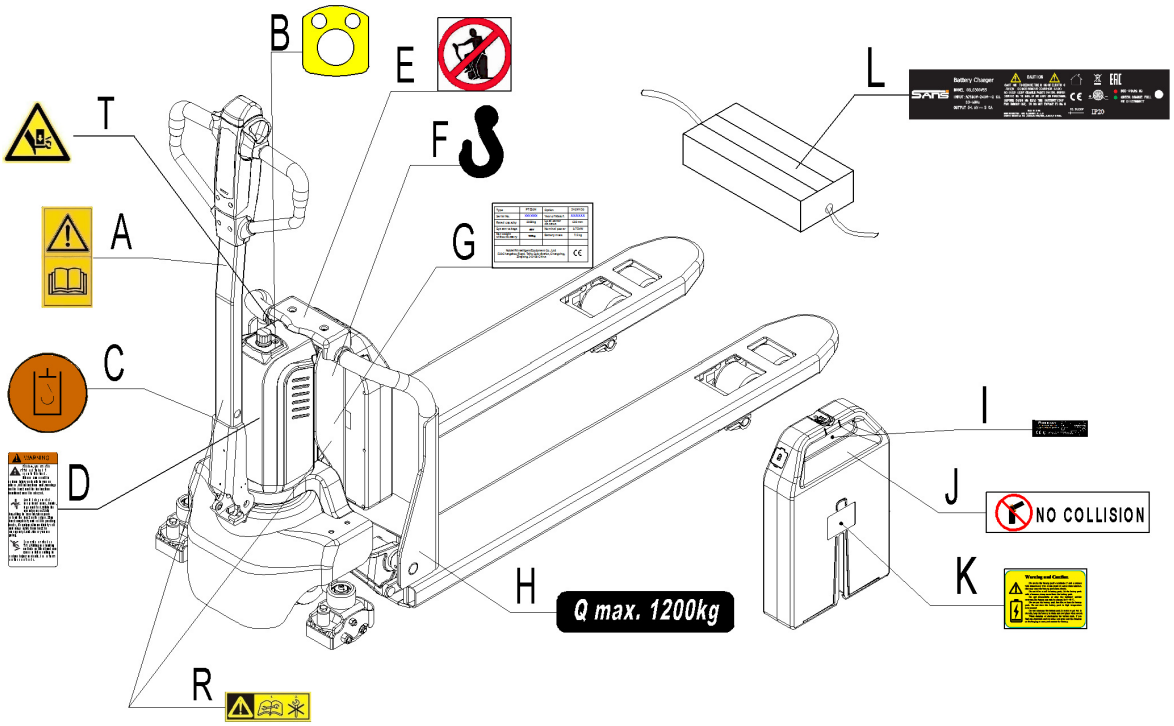


Fig. 3: Safety Label

A Sticker to read and follow this instruction
B Emergency button sticker
C Sign oil filling point
D Warning sticker
E “No passengers” decal
F Crane hook label
G Identification plate (ID-plate)
H Capacity sticker
I Battery ID plate
J No collision sticker
K Battery warning sticker
L Charger ID plate
R Sticker to read and follow service manual
T Warning sticker

The truck is equipped with an emergency switch (5) which stops all lifting-, lowering-, driving- functions and engages the failsafe electromagnetic brake when it is pressed. By turn this button clockwise, the truck can be operated after the controller checked the functions. Before operating, insert the key. To prevent against unauthorized access, press emergency switch (5) or remove key (4).

The truck is equipped with a safety (belly) button (1) which switches the driving function away from the operator, if the truck travels towards the operator and the tiller is activated in the tillers operating zone. Follow also the instructions given on the decals. Replace the decals if they are damaged or missing.

d. Identification plate

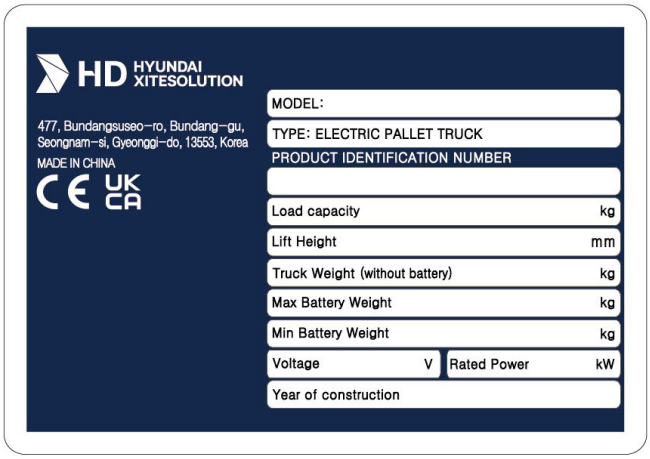


Fig. 4: Identification plate

3. WARNINGS, RESIDUAL RISK AND SAFETY INSTRUCTIONS

DO NOT

- Put foot or hand under or into the lifting mechanism.
- Allow other person than the operator to stand in front of or behind the truck when it is moving or lifting/lowering.
- Overload the truck.
- Put foot in front of the wheels, injury could result.
- Lift people. People could fall down and suffer severe injury.
- Push or pull loads
- Side or end load. Load must be distributed evenly on the forks.
- Use the truck with unstable, unbalanced not stable load.
- Use truck without manufacturer's written consent.
- Lifted loads could become unstable at wind forces. In the case of wind forces do not lift the load if there is any influence to the stability

Watch difference in floor levels when driving. Load could fall down or the truck could get uncontrollable.

Keep watching the condition of load. Stop operating the truck if load becomes unstable.

Brake the truck and activate the emergency button (5) by pushing when sliding load on or off the truck. If the truck has any malfunctions, follow chapter 9.

Practice maintenance work according to regular inspection. This truck is not designed to be water resistant. Use the truck under dry condition. Prolonged continuous operation might cause damage of the power pack. Stop operation if temperature of hydraulic oil is too high.

- When operating the electric pallet truck, the operator has to wear safety shoes.
- The truck is intended to be used for indoor applications with ambient temperatures between +5°C and + 40°C.
- The operating lighting must be minimum 50 Lux.
- Do not operate this vehicle on slopes
- To prevent unintended sudden movements when not operating the truck (i.e. from another person, etc.), press emergency switch (5) or remove the key (4).

4. COMMISSIONING, TRANSPORTING, DECOMMISSIONING

a. Commissioning

Table 2: Commissioning data

Type	12EP-XB (540X1150)	12EP-XB (685X1150)
Commissioning weight [kg]	124kg	129kg
Dimensions [mm]	1530x540x1250	1530x685x1250

After receiving our new pallet truck or for re-commissioning you have to do following before (firstly) operating the truck:

- Check if are all parts included and not damaged
- Make sure the tiller is assembled correctly
- Check that battery is charged (follow chapter 8)
- Do the work according to the daily inspections as well as functional checks.

b. Lifting/ transportation

For transporting, remove the load, lower the forks to the lowest position and fix the truck safe with dedicated lifting gear according to the following figures.

Lifting

USE DEDICATED CRANE AND LIFTING EQUIPMENT
DO NOT STAND UNDER THE SWAYING LOAD
DO NOT WALK INTO THE HAZARDOUS AREA DURING LIFTING

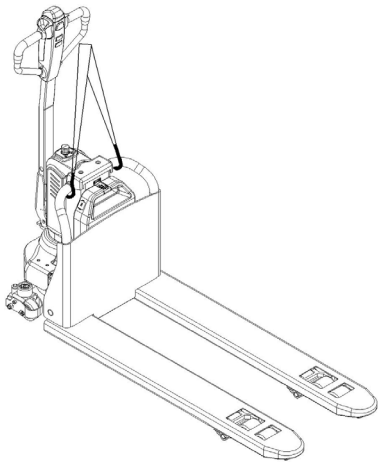


Fig. 5: Lifting with a crane

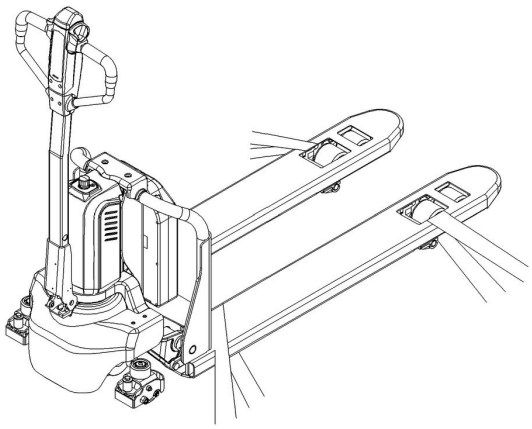


Fig. 6: fixing points

Transportation

DURING TRANSPORTATION ON A LORRY OR TRUCK ALWAYS FASTEN THE TRUCK SECURELY

Lower the forks and park the truck securely.
Fasten the truck according to Fig. 6 by fixing dedicated lashing belts to each side of the trucks crane hook holes and fasten the other side at the transporting truck.

c. Decommissioning

For storage, remove the load, lower the truck to the lowest position, grease all in this handbook mentioned greasing points (regular inspection), and eventually protect the truck against corrosion and dust. Remove the batteries and jack the truck safely, so that there will be no flattening after storage.
For final decommissioning hand the truck to a designated recycling company. Oil, batteries and electric components must be recycled due to legal regulations.

5. DAILY INSPECTION

This chapter describes pre-shift checks before putting the truck into operation.
Daily inspection is effective to find the malfunction or fault on this truck. Check the truck on the following points before operation.

Remove load from truck and lower the forks.
DO NOT USE THE TRUCK IF ANY MALFUNCTION IS FOUND.

- Check for scratches, deformations or cracks
- Check the cylinder for oil leaks
- Check that the wheels can turn flexibly
- Check the walking function when the handle is upright
- Activate the emergency button to check emergency braking function
- Check the handle proximity switch braking function
- Operate the buttons to check for lift and drop functions
- Check that all bolts and nuts are tightened
- Visually inspect for any damaged wires
- If the vehicle is equipped with a guard, check it for damage and for proper installation

6. OPERATING INSTRUCTIONS

BEFORE OPERATING THIS TRUCK, PLEASE FOLLOW THE WARNINGS AND SAFETY INSTRUCTIONS (CHAPTER 3). PLEASE ENSURE THAT THE GOODS ARE PLACED ON THE PALLET AND REMAIN STABLE, AND DAILY INSPECTION IS REQUIRED.

Make sure, that the load is palletized and stable and that the daily inspection is carried out.

Turn emergency button (Fig.1, 5) clockwise, and insert the key (Fig.1, 4).

Press the horn button (Fig.8, 15) to activate the audible warning signal.

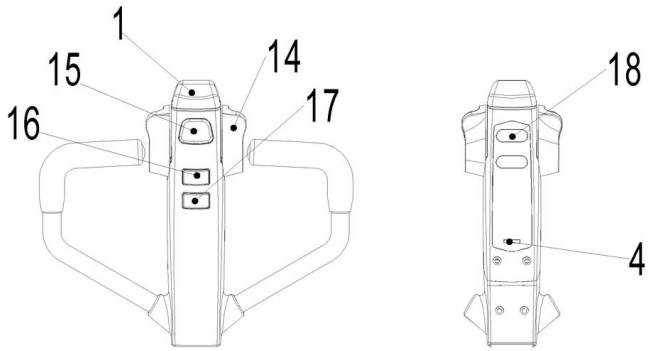


Fig.8: Tiller operating controls

Fig.7: 12EP-XB Tiller

a. Parking

DO NOT PARK THE TRUCK ON INCLINED SURFACES

The truck is equipped with an electromagnetic failsafe stopping and parking brake.
Always lower the forks fully. Press the emergency switch (5).

b. Lifting

DO NOT OVERLOAD THE TRUCK!
WHEN THE LOAD CENTER IS 600MM
THE MAXIMUM CAPACITY OF 12EP-XB IS 1200kg.

Travel with the lowered forks fully underneath the pallet and press the lifting button (Fig. 8, 16) until you reached the desired lifting height.

c. Lowering

Press the lowering button (Fig.8 ,17) carefully.
Lower the load until the forks are clear of the pallet, then drive the truck carefully out of the load unit.

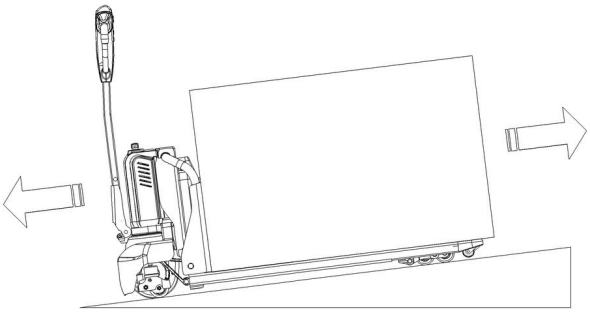


Fig. 9: Load facing uphill

d. Travelling

TRAVEL ON INCLINES ONLY WITH THE LOAD FACING UPHILL.
DO NOT TRAVEL ON INCLINES MORE THAN SPECIFIED WITH THE TECHNICAL DATA.

After starting the truck by inserting the key, move the tiller to the operating zone ('F', Fig.10).
Turn the accelerator button to the desired direction forward 'Fw.' or backwards Bw.'(Fig. 10).

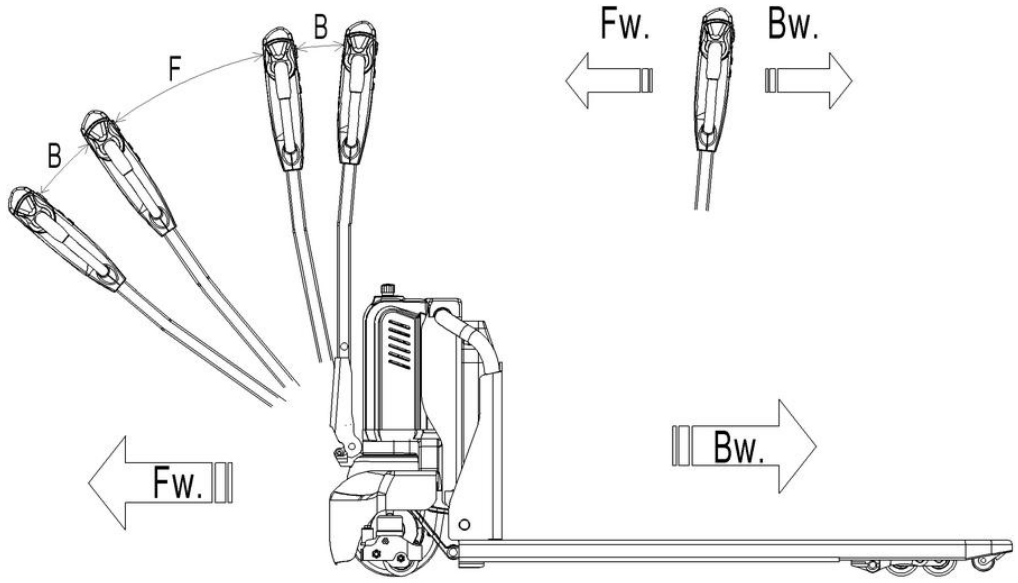


Fig. 10: Operating direction

Control the travelling speed by moving the accelerator button (Fig.8,14) carefully until you reached the desired speed. If you move the accelerator button back to the neutral position, the controller decelerates the truck until the truck stops. If the truck stopped, the parking brake will be engaged.
Drive carefully the truck to the destination. Watch the route conditions and adjust the travelling speed with the accelerator-button.
Press turtle button (Fig.8, 18) to enter into slow speed mode, travel slowly by moving the accelerator button (Fig.8,14), press turtle button again to return back to regular mode.
Press turtle button and hold for 2 seconds to activate driving function with tiller in its vertical position when operating in confined areas. The driving function is active only when turtle button is pressed (the speed is reduced); the release of turtle button will cause immediate stop. The activation of accelerator button in time gap shorter than two seconds after the turtle button is pressed will not activate the driving function, the activation cycle has to be repeated from the beginning. Accelerator button should remain in neutral position till two seconds passed.

e. Steering

Steer the vehicle by moving the handle to the left or right. When the vehicle is moving forward (in the opposite direction of the fork), turning the handle to the right will turn the vehicle clockwise.

f. Braking

PLEASE CHECK THE BRAKING DISTANCE WITH TRUCK BEFORE OPERATION
THE BRAKING PERFORMANCE DEPENDS ON THE TRACK CONDITIONS AND THE LOAD CONDITIONS OF THE TRUCK

The braking function can be activated on several ways:

- By moving the accelerator button (14) back to the initial ‘0’ position or by releasing the button, the regenerative braking is activated. The truck brakes until it stops.
- By moving the accelerator button (14) from one driving direction directly to the opposite direction, the truck brakes regenerative until it starts traveling into the opposite direction.
- The truck brakes, if the tiller is moved up or down to the braking zones (‘B’). If the tiller is released, the tiller moves automatically up to the upper baking zone (‘B’).The truck brakes until it stops.
- The safety (belly) button (1) prevents the operator from being crushed. If this button is activated, the truck decelerates and/ or starts traveling into the backwards direction (‘Bw.’) for a short distance and stops. Please consider, that this button also operates, if the truck is not traveling and the tiller is in the operating zone.

g. Malfunctions

If there are any malfunctions or the truck is inoperative, please stop using the truck and activate the emergency button (5) by pushing it. If possible, park the truck on a safe area and press the "X" button on the combination lock panel. Inform immediately the manager and, or call your service. If necessary, tow the truck out of the operating area by using dedicated towing/ lifting equipment.

h. Emergency

In emergencies or in the event of tip over (or off dock), keep safe distance immediately. If possible push the emergency button (5). All electrical functions will be stopped.

7. BATTERY SAFETY, CHARGING AND REPLACEMENT

a. Description of the lithium-ion battery

- Lithium battery is a battery with a rechargeable high-performance energy cell.
- The battery is designed for industrial vehicles and can withstand severe shocks and knocks.
- Batteries have special interfaces for charging and discharging, do not use incorrect batteries and chargers.
- The battery has intelligent battery management system, including voltage, temperature, current detection, under voltage, over voltage, low temperature, over temperature, over current, short circuit, communication and other protection safety functions.
- The internal resistance of the battery is very low, which minimizes heat generation and maximizes the available power of the car.
- Battery operating temperature range
- The battery operates at +5℃ to +40℃ to achieve the best battery life.
- Low temperature will reduce the available capacity of the battery, and high temperature will reduce the service life of the battery.
- The temperature difference between the two ends of the battery shall not exceed 5℃.

Only approved battery chargers can be used to charge the lithium battery.

Only lithium batteries are allowed.
Consider the operating temperature of the battery and the temperature at which the battery is allowed to be charged.

b. Battery Decals

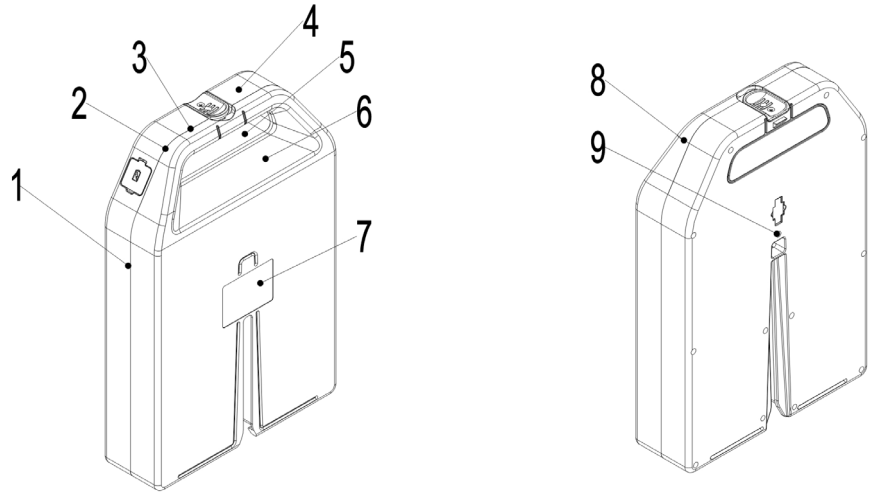


Fig. 11: Battery Decals

Table 3: Battery Decals

Item	Description	Item	Description
1	Disposal mark	6	Warning notice: "Avoid collision"
2	Charging indication	7	Safety information
3	Serial number	8	No random disposal
4	Fuse location	9	Fuse label
5	Identification plate		

Battery identification plate

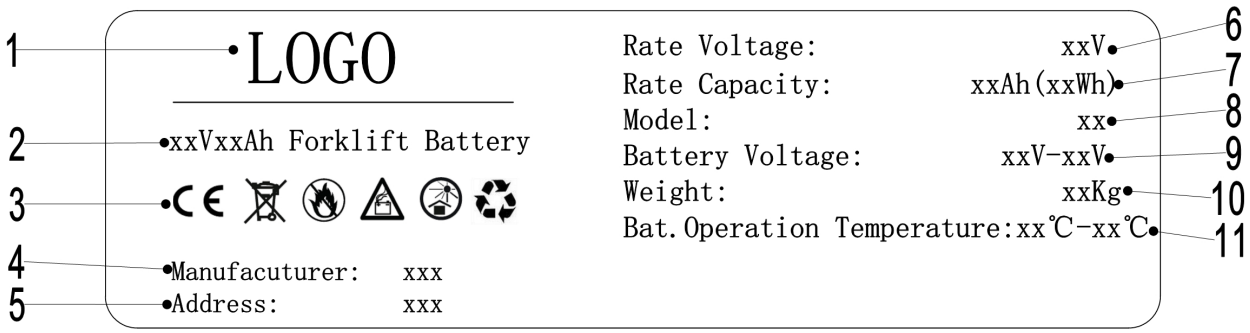


Fig. 12: Battery identification plate

Table 4: Battery data plate

Item	Description	Item	Description
1	Manufacturer trademark	7	Battery capacity
2	Battery information	8	Model designation
3	CE mark and other safety labels	9	Voltage range
4	Battery manufacturer	10	Battery weight
5	Manufacturer address	11	Operating temperature range
6	Rated voltage		

Service mass is indicated on the battery data plate, the center of gravity is located approximately at middle of the battery case

c. Safety Instructions, Warning Indications and other Notes

Safety regulations for handling lithium-ion batteries

Do not try to make any repairs or servicing of lithium batteries. Replacement of parts is not assumed.

Risk of electric shock and burning

The battery's charging and discharging connectors have open terminals, avoid any body contacts, contamination or direct contacts with objects which can cause short circuit connection of terminals. Use necessary pre-cautions and protective caps to secure the open terminals. The connectors should be maintained in clean and dry conditions.

Use only batteries designed and approved by the manufacturer for the truck.
Do not try to modify or alter the battery.

Any damage or defects to the charger can result in accidents. Use only charger approved by the manufacturer of the truck, which is suitable for used battery.

In case charger has any damages or defects, exclude the charger from operation and contact your service provider. Do not modify or try to repair the charger.

Improper use of charger or use of wrong charger can cause damages to a battery or charger. Follow the required charger specifications; If the operation voltage of the charger is out of the applicable voltage range, the charger or battery may be damaged causing serious safety risks. The charger in use must be approved by the battery (truck) manufacturer.

Reversed connection of charging plug is prohibited. Follow the instruction for correct connection. For disconnection of charging plug use dedicated grip and never pull out the plug by means of cable.

Stop charging immediately if any abnormalities are detected, e.g. severe temperature increase, deformation of battery case, smoke, noise etc.

Intermediate charging

Lithium batteries support so called opportunity charging. The lithium battery, which is not fully discharged can be charged in any time. However, frequent opportunity charging not to the full charging state and stop of charging process before the appearance of corresponding indication of charger may result in dis-balance voltage of cells which increases the battery BMS calculation error. In order to effectively deal with this phenomenon, charge the battery in full allowing the automotive balancing process to be completed at least once a week.

Do not charge a fully charged battery

Note that in order to prevent the battery from continuing restart of charging under fully charged condition causing reduction of battery lifetime, the BMS has a protection function that prohibits recharging of fully charged battery. The charger will not work while battery is fully charged.

Potential hazards

If equipment is used according to its design purpose, following the correct operations procedures, there are no hazards anticipated.

The following hazards can arise in the event of improper use:

- Physical damage to the battery in case a battery falls or is deformed through impacts. Mechanical damages can cause leakages of harmful materials, fire or battery explosion.
- Short circuits may be caused by short connection of battery terminals, for instance, by water or other intentional/unintentional short connections.
- Temperature damages caused by placing of batteries in overheated environment conditions or being exposed to impact of fire, open sunlight etc. can cause leakages of harmful materials, fire or battery explosion.

In order to avoid fire, explosion and/or leakage of harmful materials, a safe place for storing non-functional or damaged batteries until the service arrives on site must satisfy the following criteria:

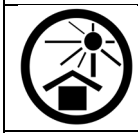
- Do not store in places where personnel is located.
- Do not store in places with valuable objects and close to valuable objects.
- A Class D fire extinguisher must be available on demand.
- There should not be any fire or smoke detectors in the storage area in order to ensure that an automatic fire detection system is only activated in the event of actual danger (e.g. flames).
- No ventilation intake pipes should be in the facility to exclude spreading of discharged content within a building.

Examples of where to store a non-functional battery:

- Roofed outdoor position.
- Ventilated container.
- Covered fire resistant box with pressure and smoke discharge option.

Symbols - Safety and Warnings

Table 5: Symbols - Safety and Warnings

	Used lithium-ion batteries must be treated as hazardous waste. Lithium-ion batteries marked with the recycling symbol and the sign showing a crossed-out waste bin must not be disposed of with ordinary household waste.
	Avoid fire and short circuits causing overheating. Do not ignite or locate batteries close to open flame, heat sources or sparks. Keep lithium-ion batteries away from heat sources.
	Caution! Battery short-circuit is prohibited.
	Protect the lithium-ion battery from solar radiation or other forms of heat radiation. Do not expose the lithium-ion battery to heat sources.
	The battery can be recharged cyclically

Explosion and fire hazard

Physical damage, thermal impacts or incorrect storage in the event of a defect can result in explosions or fire. The battery materials can be flammable.

Particular hazard from combustion products

The lithium batteries may be damaged by a fire. When extinguishing a lithium battery fire, the following information must be taken into consideration.

Contact with combustion products can be hazardous

Fire produces combustion products, which can occur in the form of smoke, through leaking fluids, escaping gases, debris as well decomposition products of certain chemicals. These combustion products are substances that enter the body through the respiratory tract and/or the skin, can produce and adverse effects such as choking.

Avoid contact with combustion products.
Use protective equipment.

Special firefighting protective equipment

Use self-contained breathing apparatus.
Wear protective equipment.

Additional firefighting instructions

To prevent secondary fires, the lithium-ion battery must be cooled from the outside.

Suitable extinguishing agents

- Carbon dioxide extinguisher (CO2)
- Water (not on mechanically opened or damaged batteries)

Unsuitable extinguishing agents

- Foam
- Grease fire extinguishing agents
- Powder extinguishers
- Metal fire extinguishers (PM 12i extinguishers)
- Metal fire powder PL-9/78 (DIN EN 3SP-44/95)
- Dry sand

Instructions for cooling an overheated, non-physically damaged battery

This type of damage may be caused by a short circuit inside the battery, which may result in leakage of harmful materials, fire or battery explosion.

Material discharge

Battery electrolyte fluid can be hazardous

Electrolyte fluid can be discharged if the battery is physically damaged. Avoid its contact with skin or eyes. If the contact happened:

- Rinse the affected parts with big amount of water and request for medical assistance immediately.
- In case of skin irritation or if any substances are breathed in request the medical assistance immediately.

Precautionary measures for personnel

- Keep personnel away, avoid any contact with smoke or discharged materials.
- Block off the affected area and ensure its reasonable ventilation.
- Wear personal protective equipment. If vapors, dust or aerosols are presented use self-contained breathing apparatus.

Precautionary measures for the environment

Do not allow spilled fluids to enter the water system, drainage system or the underground water.

Cleaning measures

The leaked fluid must be removed professionally following the related protocols.

Battery lifetime, maintenance and storage

The lithium-ion batteries are maintenance-free.

Deep discharge can damage the battery

Self-discharge without periodical recharge can lead the battery to fully discharged state. Full discharge shortens the service life of the battery and can cause deep discharge and activation of related safety protocols when battery will not be able to be charged anymore.

Before a long period of inactivity, the battery must be charged to 40%~60%.
Control the level of battery charge at least every 12 weeks and re-charge if necessary.
The temperature range for storing of the battery should be within the range of 0°C to 30°C.

If the battery is deeply discharged or if the battery temperature is below the permissible level, the battery cannot be charged. Deeply discharged batteries can never be charged. Due to the risk of condensate formation, batteries that have been stored at 0°C or below must only be charged after natural warming up to at least +5°C, forced heating is forbidden.

Instructions for safe handling of batteries

- Do not modify the battery.
- Do not open, damage, drop, penetrate or deform the battery.
- Do not throw the battery into a fire.
- Protect the battery from overheating.
- Protect the battery from direct sun light.
- Follow storage and charging procedures
- Protect the battery from water damages and other impacts

Failure to comply with these safety instructions can result in fire and explosion or the leakage of harmful materials.

Pre-shift checks before the system is put into operation

Check that the battery is in its normal condition, has no evidence of damages, leakages, abnormal findings, e.g. high temperature, smell, smoke etc. The surface of the battery should be clean and dry, without evidence of water damages, marks of rust on terminals and housing (if applicable). Connecting cables and plugs are in good condition.

Faults

If any damage is found to the battery or battery charger contact the service provider immediately.
Do not open the battery or attempt to repair it.

Disposal and transport of a lithium-ion battery

Instructions for disposal

Lithium-ion batteries must be disposed in accordance with the relevant national environmental protection regulations. Batteries must be treated as hazardous waste. Batteries must not be disposed with ordinary waste.

Shipping information

The lithium-ion battery is a hazardous material. The applicable regulations must be fulfilled during transportation.

Shipping functional batteries

Functioning batteries can be shipped in accordance with the related regulations

Shipping faulty batteries

To transport faulty lithium-ion batteries, contact the service provider. Faulty lithium batteries require following of special transporting procedures.

d. Charging the battery

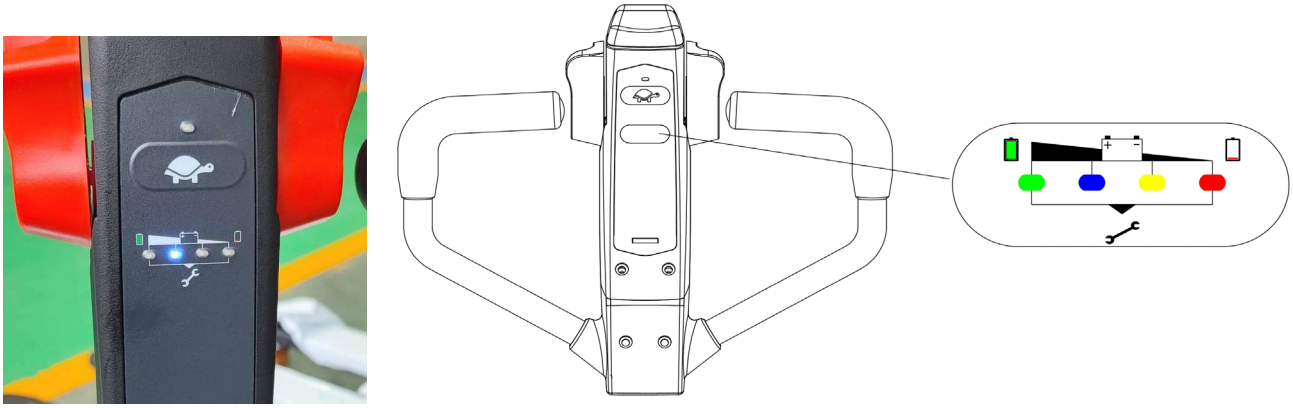


Fig.13: Charge Status Indicator

The charge status indicator of the battery is integrated in the control handle.

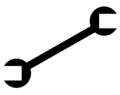
The 1st green LED from left is on, indicating 75% -100% of battery power.
The 2nd blue LED from left is on, indicating 50% -75% of battery power.
The 3rd yellow LED from left is on, indicating 25% -50% of battery power.
The 4th LED from left is on, indicating 0% -25% of battery power.

If there is fault code, four LEDs will flash for 1s, then the 1st green LED from left will flash and count, after that the 4th LED from left will flash and count. The amount that green LED flashes times ten, then plus the amount that led LED flashes means the fault code.

Table 6: Error codes

Code	The error code appears if ...	Effect
0	Low battery power.	Lift function is deactivated and travel speed is reduced.
91	Battery over discharged.	Lift function is deactivated and travel speed is reduced.

Table 7: Main symbol specification

	**Turtle Symbol:** It is normally off, when the turtle speed button is activated, the green light above the button indicates that the truck is in speed reduction mode.
	**Monkey Wrench Symbol:** It is normally off, when it appears (fixed) it shows the request of programmed maintenance or the alarm state. In this case the relative code will be displayed.

Charging the Battery with External Charger

Maintenance personnel

Batteries may only be charged, serviced or replaced by trained personnel. These operating instructions and the battery manufacturer's instructions must be observed when performing these operations.
Park the truck securely before carrying out any work on the batteries.

General information

- The charge status of the battery is indicated by LEDs on the battery charger.
- The charging time depends on the battery charge status. The time it takes to charge an almost fully depleted battery depends both on the battery capacity and the charge current. The approximate duration can be calculated as follows:
  Charging time = capacity of battery / charge current of battery charger.
- The lithium-ion battery can also be used when not fully charged. In this case, the remaining operating time is reduced.
- Charging continues automatically after a mains failure is restored.

The battery temperature rises by approx. 13°C during charging. Battery charging should only start when the battery temperature is below 40°C. The battery temperature before charging should be at least 5°C.

Status of the LEDs on the battery charger

When the battery charger is connected to the battery and to the power supply, the LEDs on the charger indicate the following:

Table 8: LEDs

LED lit	Status
Green	The battery is fully charged
Red	Battery is charging

If the green LED does not light up or if the red LED lights up permanently or not at all, this indicates a fault.

The truck is equipped with the following batteries:

Table 9: Available batteries

Model	Battery options	Weight
12EP-XB	24V20Ah lithium battery	5.8 kg
	24V30Ah lithium battery	7.5 kg
	24V36Ah lithium battery	7.7 kg

Charging the battery

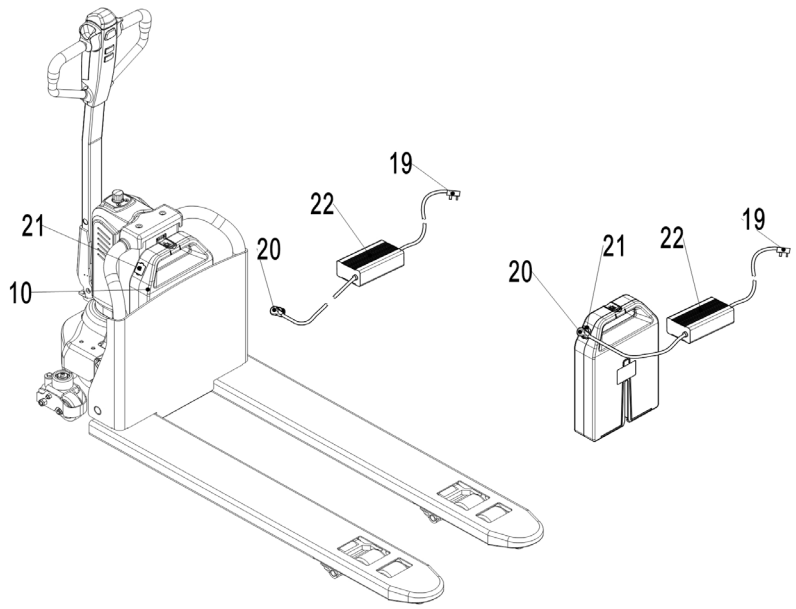


Fig.14: Charging the battery

Requirements

- The truck is parked securely.
- The battery charger is approved for the battery type in use.

Tools and Material Required

- Battery charger

Procedure

- Open the charging socket (21) of the battery and connect the charge connector (22) of the battery charger (20).
- Then connect the mains plug (22) of the battery charger (19) to the power supply.
- The status of charging process is indicated by the illumination of the red LED.
- Check the charging status; also refer to the instructions of the battery charger (22).
- The charging process is completed when the green LED lights up.
- Once the battery (10) is charged, disconnect the battery charger (22) from the power supply before unplugging it from the battery.
- Close the charging socket (21) with the cap.

Table 10：12EP-XB Charger specification

Specification	Input	Output
24V5A (Chinese sticker）	180Vac -240Vac～2.0A MAX	29.4V 5.0A
24V5A (English sticker）	180Vac -240Vac～2.0A MAX	29.4V 5.0A
24V5A (US）	100Vac -240Vac～3.5A MAX	29.4V 5.0A
24V5A (EU）	180Vac -240Vac～3.0A MAX	29.4V 5.0A

e. Battery removal and installation

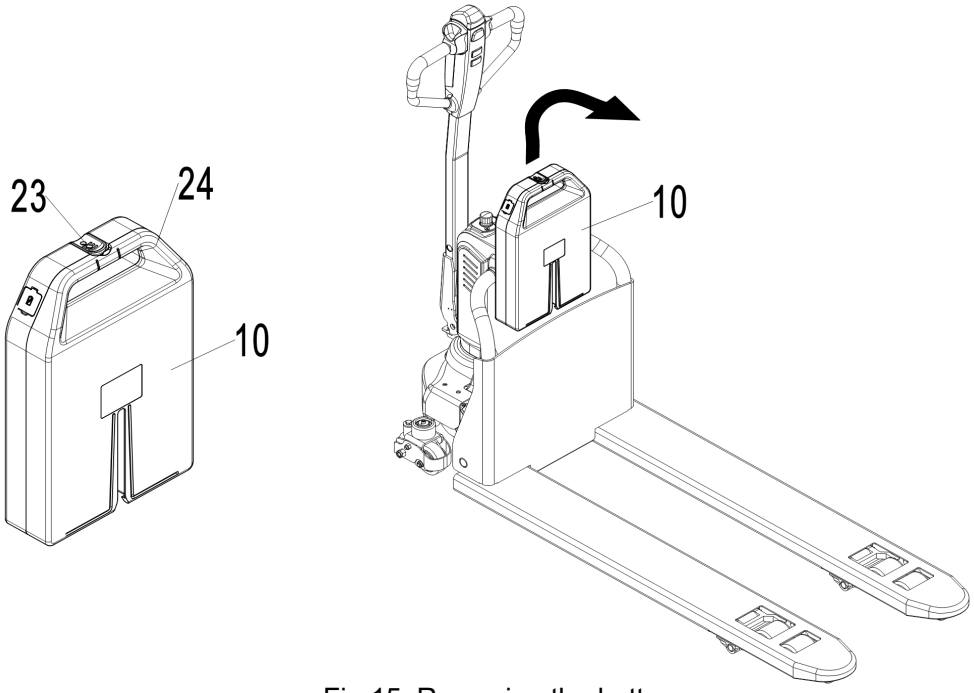


Fig.15: Removing the battery

Removing the battery

Requirements

- The truck is parked securely.
- The emergency disconnect switch is actuated.

Procedure

- Unlock the battery latch (23).
- Lift the battery (24) up by the battery handle (10).

The battery has been removed.

Battery installation

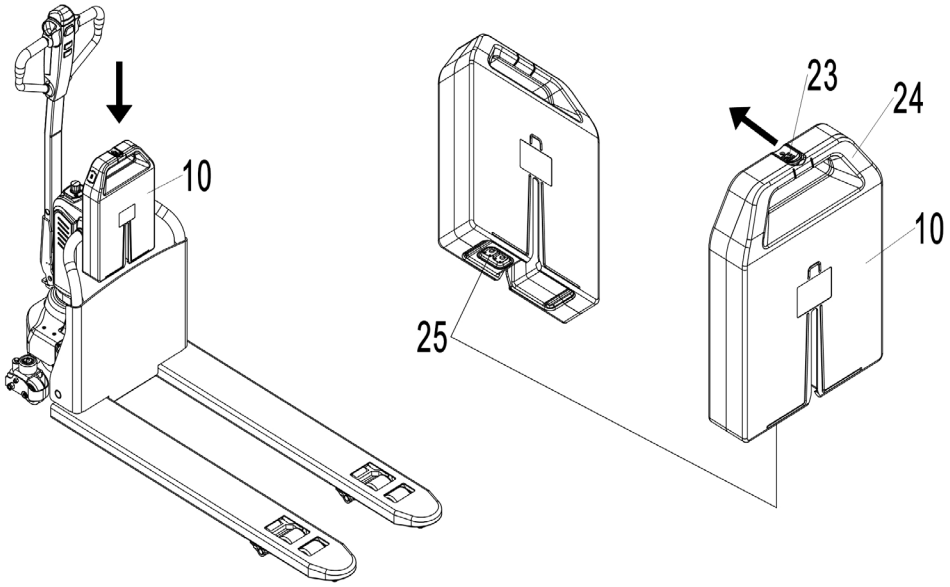


Fig.15: Battery installation

Installing the battery

Requirements

- The truck is parked securely.

Procedure

- Insert the battery (10) into the battery compartment.
- The plug connection (25) between the battery and truck must be fully connected.
- Lock the battery latch (23).
- Release the emergency disconnect switch.

The battery is now installed.

8. REGULAR MAINTENANCE

- Only qualified and trained personnel are allowed to carry out maintenance work on the vehicle
- Before maintenance, remove the goods from the fork and lower the fork to the lowest position
- To lift the vehicle, use the specified lashing equipment or lifting equipment in accordance with Chapter 4. Before operation, place safety devices (such as designated lifting jacks, wedges or blocks) under the vehicle to prevent it from accidentally falling, moving or sliding
- Please maintain the handle lever. By compression, the gas pressure spring has been pre-installed. Carelessness is apt to cause injury
- Please use approved and distributor issued original spare parts
- Please consider the leakage of hydraulic oil that may lead to machine failures and accidents
- Only trained service technicians are allowed to adjust the pressure valve
- Long-term storage of vehicle batteries (more than 3 months) should be kept in a dry, cool place. Charge and discharge the battery every 3 months, and the storage voltage is about 25 to 26V.

Check the items emphasized in maintenance checklist.

a. Maintenance checklist

Table 11: Maintenance checklist		Interval(Month)			
		1	3	6	12
Hydraulic					
1	Check the hydraulic cylinder(s), piston for damage noise and leakage		●		
2	Check the hydraulic joints for damage and leakage		●		
3	Inspect the hydraulic oil level, refill if necessary		●		
4	Refill the hydraulic oil (12 month or 1500 working hours)				●
5	Check and adjust function of the pressure valve (1200kg (12EP-XB)+0/+10%)				●
Mechanical system					
6	Inspect the forks for deformation and cracks		●		
7	Check the chassis for deformation and cracks		●		
8	Check if all screws are fixed		●		
9	Check the push rods for deformation and damages		●		
10	Check the gearbox for abnormal sound and noise		●		
11	Inspect the wheels for deformation and damages		●		
12	Inspect and lubricate the steering bearing if necessary				●
13	Inspect and lubricate the pivot points if necessary		●		
14	Lubricate the grease nipples	●			
Electrical system					
15	Inspect the electric wiring for damage		●		
16	Check the electric connections and terminals		●		
17	Test the Emergency switch function		●		

18	Check the electric drive motor for noise and damages		●		
19	Test the display		●		
20	Check, if correct fuses are used		●		
21	Test the warning signal		●		
22	Check the contactor(s)		●		
23	Check the frame leakage (insulation test)		●		
24	Check function and mechanical wear of the accelerator		●		
25	Check the electrical system of the drive motor		●		
Braking system					
26	Check brake performance, if necessary replace the brake disc or adjust the air gap		●		
Battery					
27	Check the battery voltage		●		
28	Clean and grease the terminals and check for corrosion and damage		●		
29	Check the battery housing for damages		●		
Charger					
30	Check the main power cable for damages			●	
31	Check the start-up protection during charging			●	
Function					
32	Check the horn function	●			
33	Check the air gap of the electromagnetic brake	●			
34	Test the emergency braking	●			
35	Test the reverse and regenerative braking	●			
36	Test the safety (belly) button function	●			
37	Check the steering function	●			
38	Check the lifting and lowering function	●			
39	Check the tiller arm switch function	●			
General					
40	Check if all decals are legible and complete	●			
41	Inspect the castors, adjust the height or replace these if worn out.		●		
42	Carry out a test run	●			

b. Lubricating points

Lubricate the marked points according to the maintenance checklist. The required grease specification is: DIN 51825, standard grease.

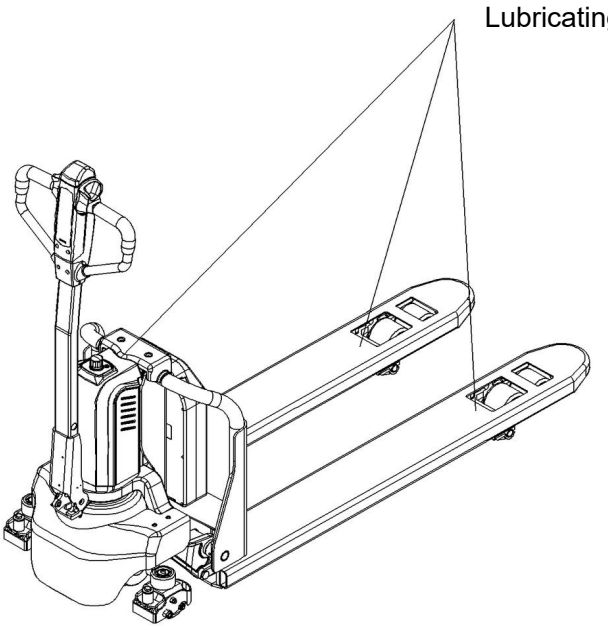


Fig.16: Lubricating points

c. Check and refill hydraulic oil

It is recommended to use hydraulic oil in connection with average temperature:

Environment temperature	–5℃~25℃	>25℃
Type	HVLP 32， DIN 51524	HLP 46， DIN 51524
Viscosity	28.8-35.2	41.4 - 47
Amount	0.4L	

Waste material like oil, used batteries or other must be probably disposed and recycled according to the national regulations and if necessary brought to a recycling company.

The oil level in the oil tank should be between min and max marks with fully lowered forks.

If necessary add oil at the filling point.

d. Checking electrical fuses

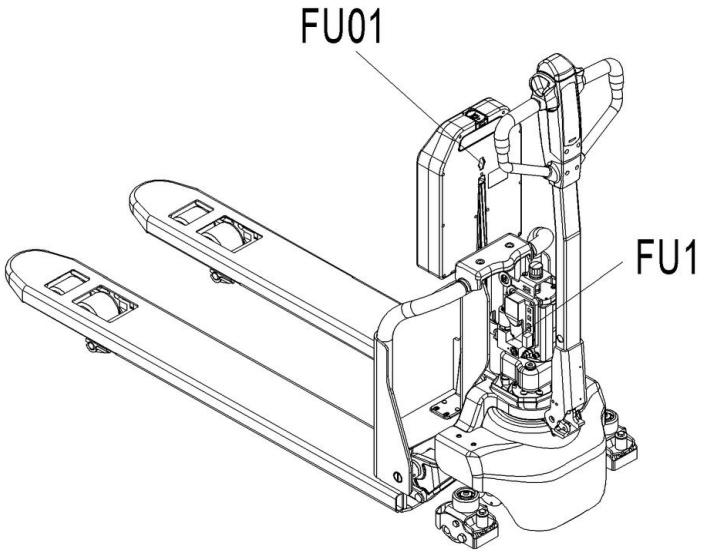


Fig.17: Location of fuses for 12EP-XB

Table 12: Size of the fuses

	Rate
FU 1	10A
FU 01	70A

9. TROUBLESHOOTING

If the truck has malfunctions follow the instructions, mentioned in chapter 6.

Table 13: Troubleshooting

TROUBLE	CAUSE	REPAIR
Load can't be lifted	Load weight too high	Lift only the max. capacity, mentioned on the ID-plate
	Battery low power	Charge the battery
	Lifting contactor failure	Check and contact with service support for replacement if necessary
	Hydraulic oil level too low	Check and eventually refill hydraulic oil
	Oil leakage	Repair the sealing of the cylinder
Oil leakage from air breathing	Excessive quantity of oil.	Reduce oil quantity.
Truck not starts operating	Battery is charging	Charge the battery completely and then remove the main power plug form the electrical socket.
	Battery not connected	Connect the battery correctly
	Fuse faulty	Check and eventually replace fuses
	Low battery	Charge the battery
	Emergency switch is activated	Turn the emergency clockwise
	Tiller in the operating zone	Move the tiller firstly to the braking zone.

If the truck has malfunctions and can't be operated out of the working zone, jack the truck up and go with a load handler under the truck and safe the truck securely. Then move truck out of the aisle.

The handle fault code is displayed

Part of the fault will be displayed on the meter, the icon will light up, and the fault code will be displayed at the time.

10. WIRING CIRCUIT DIAGRAM

Electrical circuit diagram

12EP-XB without speed reduction on curves

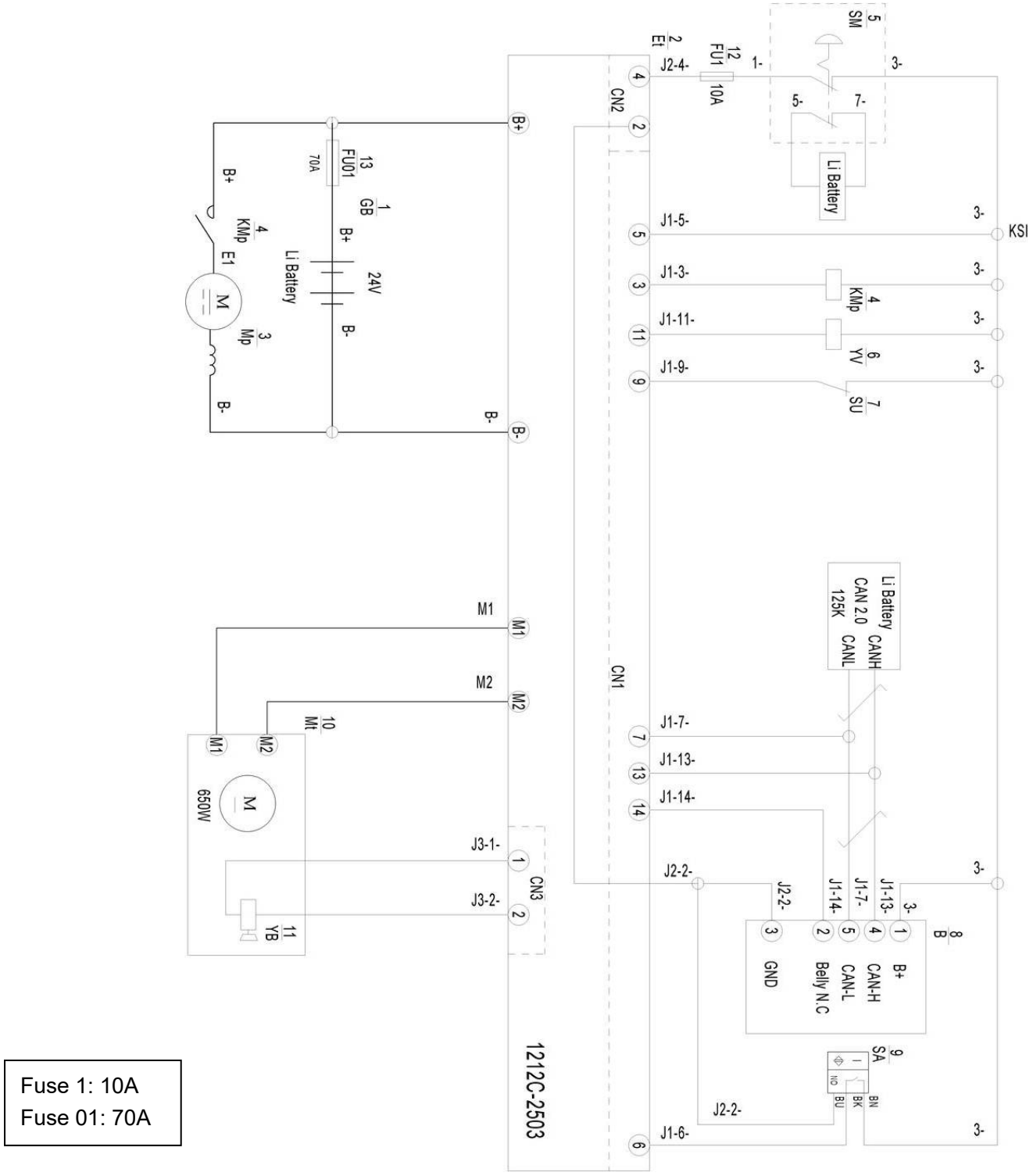


Figure 18: 12EP-XB without turning deceleration circuit diagram

Table 14: Description of electrical diagram

Code	Item	Code	Item
GB	Battery	B	CAN tiller
Et	Controller	SA	Proximity switch
Mp	Pump motor	Mt	Traction motor
KMp	Pump contactor	YB	Electromagnetic brake
SM	Emergency button	FU1	10A fuse
YV	Electromagnetic valve	FU01	70A fuse
SU	Micro switch		

12EP-XB with speed reduction on curves

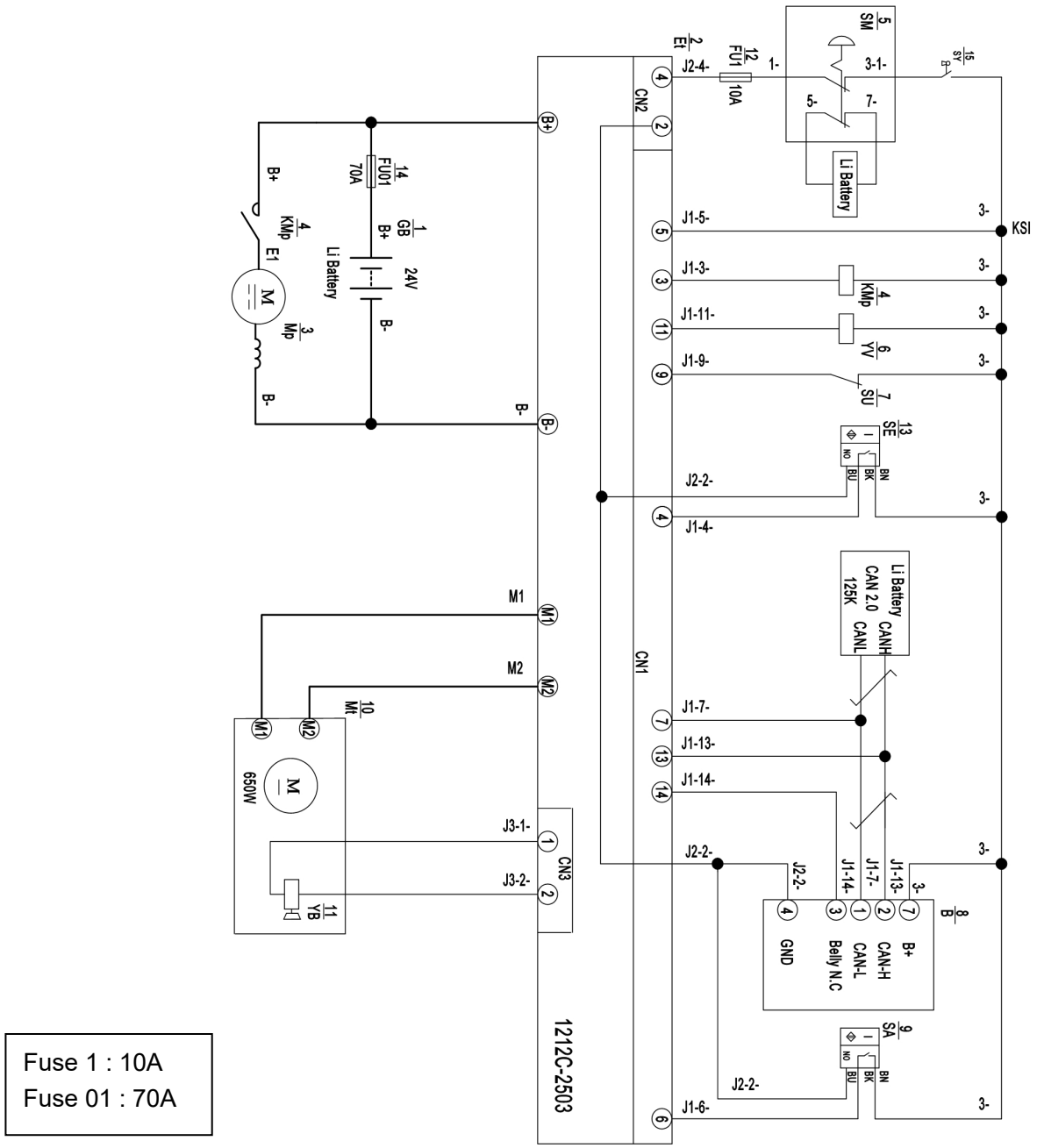


Figure 19: 12EP-XB with turn deceleration circuit diagram

Table 15: Description of electrical diagram

Code	Item	Code	Item
GB	Battery	B	CAN tiller
Et	Controller	SA	Proximity switch
Mp	Pump motor	Mt	Traction motor
KMp	Pump contactor	YB	Electromagnetic brake
SM	Emergency button	FU1	10A fuse
YV	Electromagnetic valve	SE	Proximity switch
SU	Micro switch	FU01	70A fuse

12EP-XB without speed reduction on curves (20CE/EN1175)

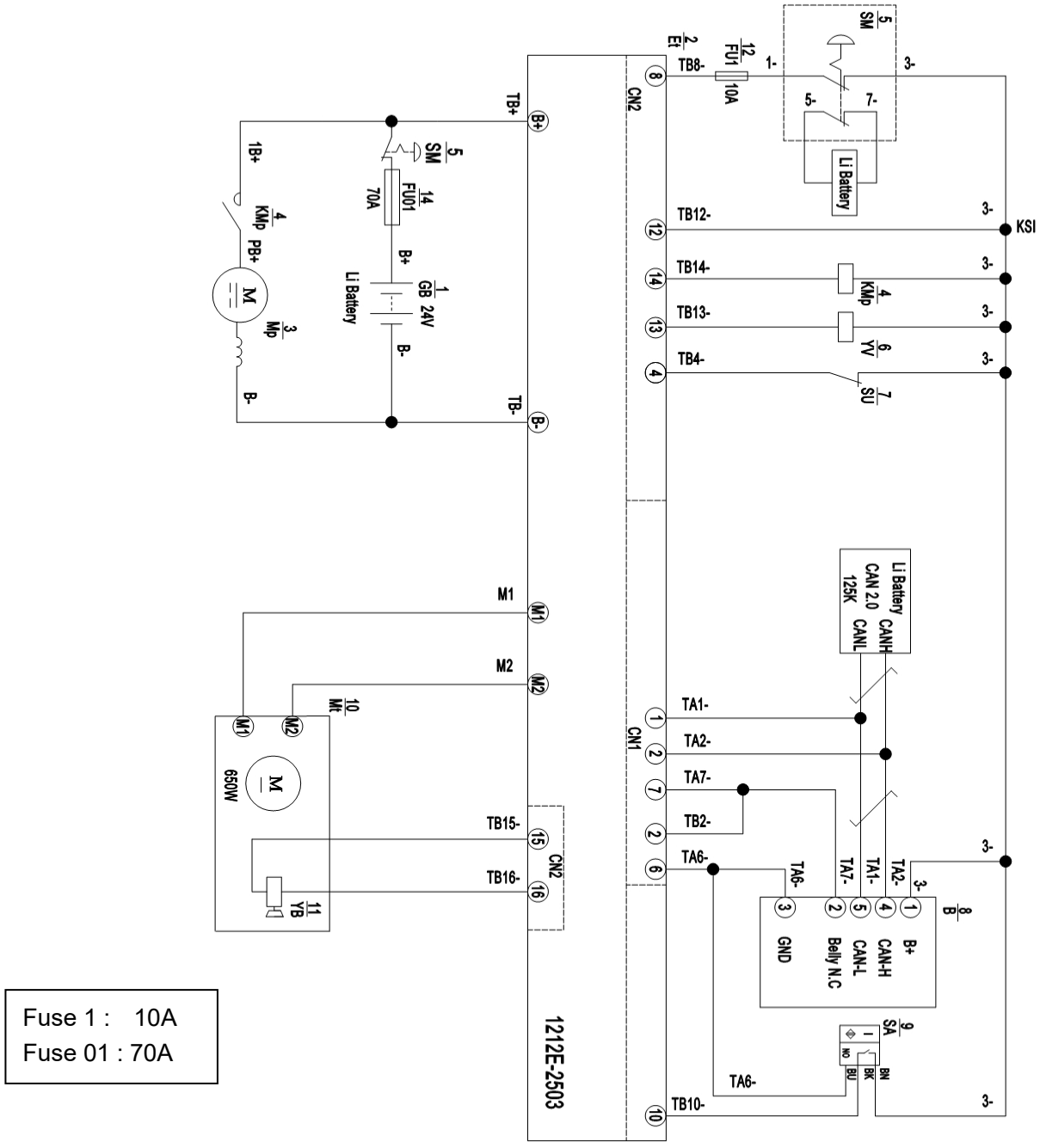


Fig.20: 12EP-XB without speed reduction on curves (20CE)

Table 16: Description of electrical diagram

Code	Item	Code	Item
GB	Battery	B	CAN tiller
Et	Controller	SA	Proximity switch
Mp	Pump motor	Mt	Traction motor
KMp	Pump contactor	YB	Electromagnetic brake
SM	Emergency button	FU1	10A fuse
YV	Electromagnetic valve	FU01	70A fuse
SU	Micro switch		

12EP-XB with speed reduction on curves (20CE/EN1175)

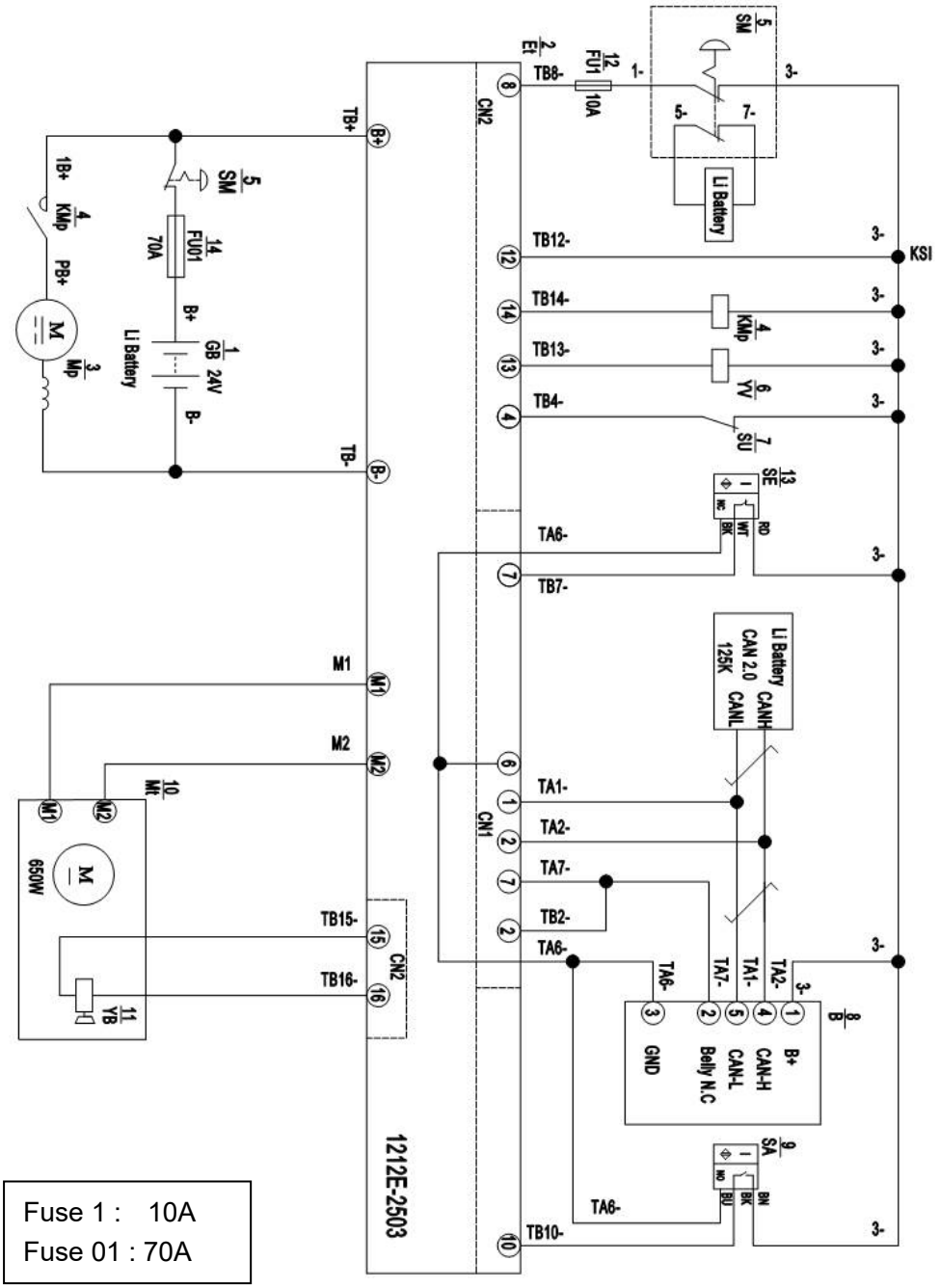


Fig. 21: 12EP-XB with speed reduction on curves (20CE)

Table 17: Description of electrical diagram

Code	Item	Code	Item
GB	Battery	B	CAN tiller
Et	Controller	SA	Proximity switch
Mp	Pump motor	Mt	Traction motor
KMp	Pump contactor	YB	Electromagnetic brake
SM	Emergency button	FU1	10A fuse
YV	Electromagnetic valve	SE	Proximity switch
SU	Micro switch	FU01	70A fuse

b. Hydraulic circuit

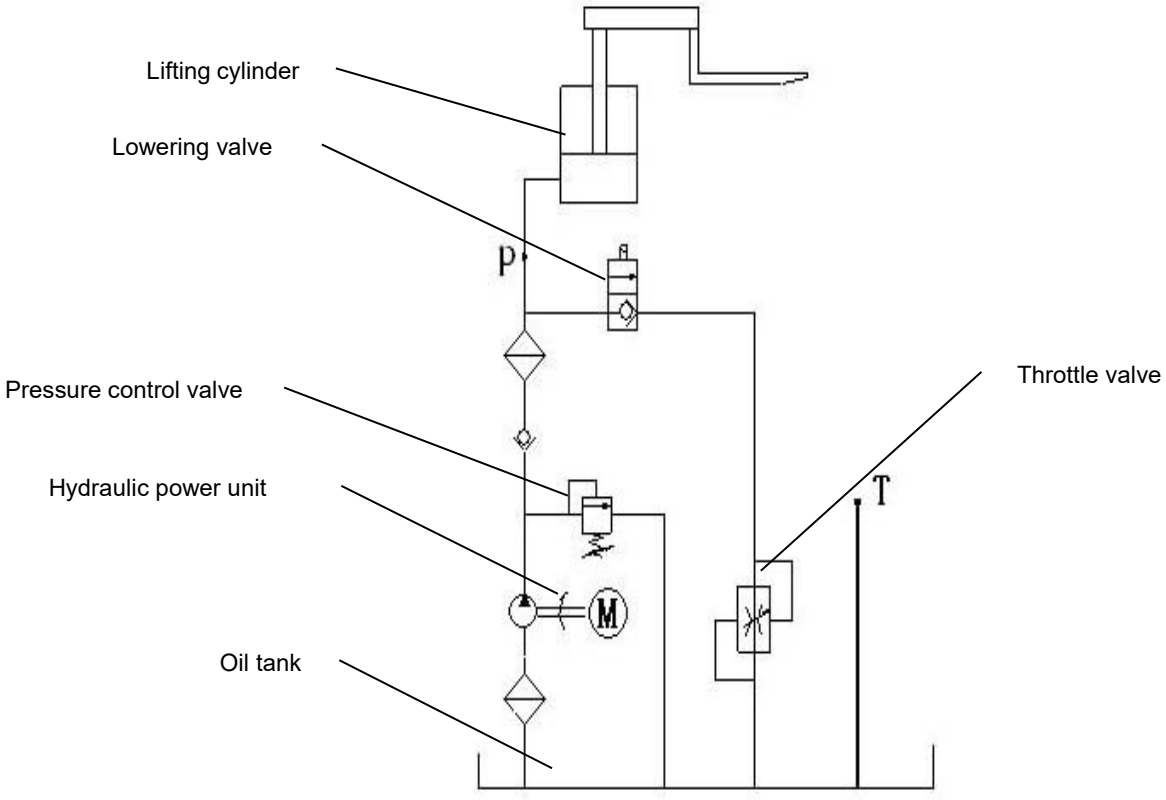


Fig.22: Hydraulic circuit

Hydraulic oil inspection

Appearance	Smell	Condition	Result
Clear and non-discoloration	good	good	Can use
Transparent color	good	Mix with other oils	Check viscosity, if qualified can continue to use
Color changes like milk	good	Mixed with air and water	Separate water or replace hydraulic oil
The color turns dark brown	No good	oxidation	Change hydraulic oil
The color is clear but with small black spots	good	Mix with other particles	Use after filtration

11. Electronic Systems

a. Overview

The model is equipped with an electrical system consisting of the following components:

1 Batteries power the electrical system.
2 The power switch can be pressed in case of emergency to turn off all DC and AC circuits.
3 The motors, controllers and related equipment provide the necessary drive and pump power for the vehicle based on their interaction with sensors, switches, relays and actuators, as well as many parameter settings.
4 When the load is supplied with current higher than the limit, the fuse protects all DC loads from overcurrent by cutting off the power supply to the load.
5 Other DC loads activated by the operator's direct demand work independently of the controller. First, they are not controlled by the controller and are not the purpose for which they signal. However, they may interact with them in some configurations. These loads include light groups and speakers.
6 tiller displays gauges to monitor vehicles to inform users of their condition

b. Emergency switch

b-1 Appearance and specifications

b-2 Function

The emergency stop switch is used to cut off the current in the electrical system in case of emergency, thus stopping the operation of the vehicle. When pressed, all DC and AC circuits are open.

DC Circuit Open Circuit

Once the emergency stop switch is turned on, the battery is disconnected, so all DC loads are cut off.

Disassembly and installation

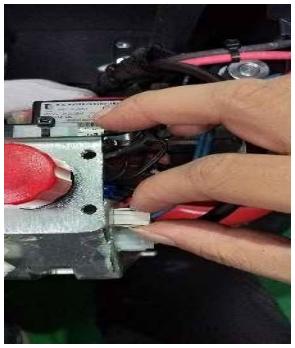
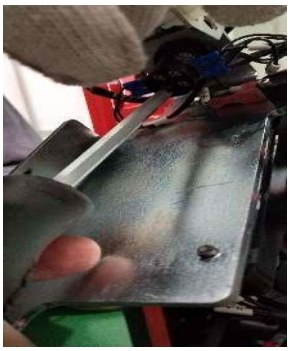
Preliminary Steps

1 Park the vehicle safely and remove the housing.

2 Cut off the power supply.

3 Disconnect the battery connector.

Emergency Stop switch disassembly and installation

12EP-XB			
			
Remove the line card with a Phillips screwdriver	Remove the two bolts on the right side of the bracket with a 5mm hexagon socket	Remove the bolt on the left side of the bracket with a 5mm hexagon socket	Removal of two inserts in the bracket
			
Pinch both sides of the connector to disengage the bracket to avoid line pulling when the bracket is removed	Use a Phillips screwdriver to remove the line under the emergency stop switch	Loosen the emergency stop switch fastening nut to remove the emergency stop switch	

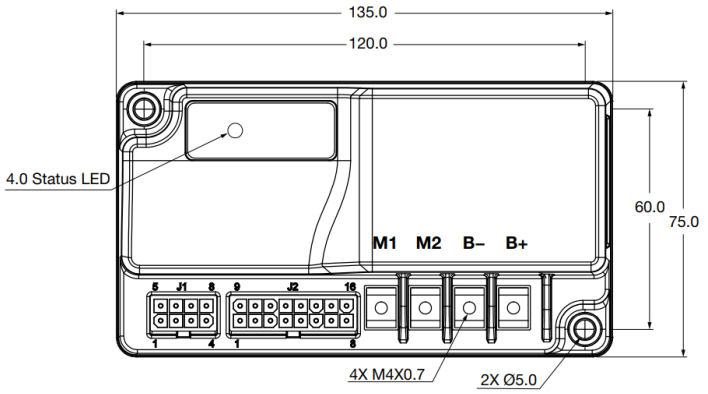
Conversely, installing an emergency stop switch is the reverse process of the above steps.

c. controller and related devices

c-1 Appearance

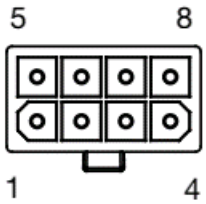
1). Controller Curtis 1212C(12EP-XB)
Logic section insert: 14 pole Molex Mini-Fit Jr., P/N 39-01-2140
Electromagnetic brake plug-in: 2 pole Molex Mini-Fit Jr;
Handheld programming port plug-in: 4-pole Molex Mini-Fit Jr;
Power section plug-in: AMP plug-in, P/N 12076SL02

2).controller Curtis 1212e(20 CE/EN1175)(12EP-XB)



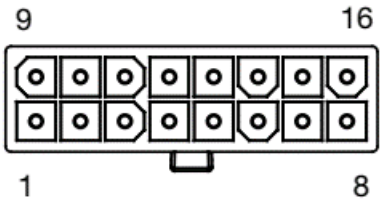
Docking connector : 8 core Molex Mini-Fit Jr.
16core Molex Mini-Fit Jr.

CONNECTOR PINOUT CHARTS



J1

Pin	Description
1	CAN L
2	CAN H
3	Switch 1
4	Charger Inhibit
5	Switch 5
6	I/O Ground
7	Switch 2
8	Horn Driver



J2

Pin	Description	Pin	Description
1	EMR NO	9	Reverse
2	Switch 3	10	Interlock
3	Pot-High / Inhibit	11	Forward
4	Lift Inhibit	12	KSI (keyswitch)
5	Mode Input	13	Lower Driver
6	Pot Wiper	14	Lift Driver
7	Switch 4	15	EM Brake–
8	B+	16	EM Brake+

c-2 Functions

The controller is connected via the following sensors, switches, relays and actuators.

Emergency stop switch

accelerator

Tiller proximity switch

Emergency reverse switch

Hydraulic control switch

These devices provide DC power and interact with the controller, which activates or receives data from them to control the machine based on a number of parameter settings.

By correctly setting the motor technical parameters and control technical parameters and function values of the controller, the safe and efficient operation performance and complete operation functions of the electric vehicle can be achieved.

1. The crawling speed of the electric vehicle can be adjusted. The crawling speed setting function of the controller enables the electric vehicle to run at low speed for a long time.

2. Acceleration rate can be set. Acceleration rate is the "soft and hard" feeling of throttle pedal when operating an electric vehicle. By setting the acceleration rate, the vehicle can meet the requirements of acceleration operation under different working conditions.

3. Maximum speed can be adjusted. Reasonable setting of maximum speed of electric vehicle can prevent traction motor from overloading due to excessive speed.

4. Safety protection function. If the power element of the controller is damaged during vehicle operation, the controller will disconnect the main contactor in the shortest time. When the controller temperature rises too high, the controller automatically limits the armature current of the motor. When the battery voltage is too low, the controller stops working for safety.

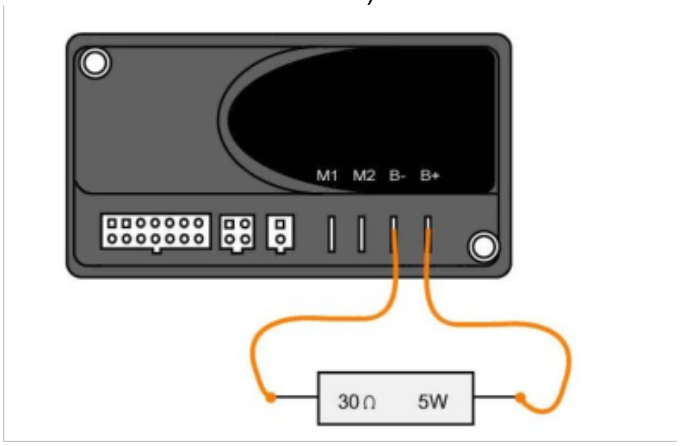
5. The motor controller has self-diagnostic function. In the process of working, once the controller fails, the fault code will be displayed on the tiller display instrument, and the controller will automatically stop working to ensure the security of the operating system.

6. The tiller display will show the battery power and the accumulated working hours.

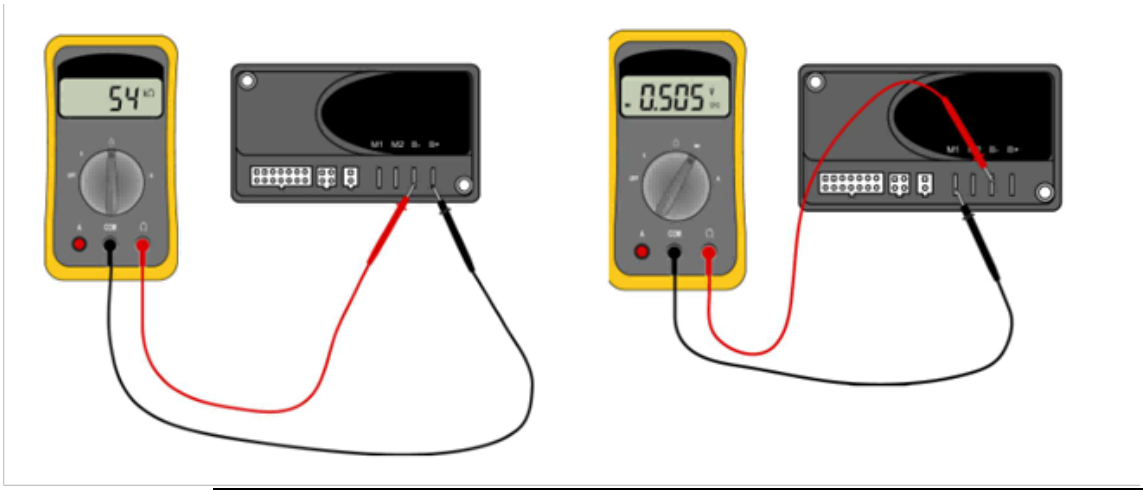
c-3 Test (Example: Curtis 1212C)

controller

Measure the diode voltage of the AC MOSFET circuit inside the controller to check whether it is burned or damaged. Remove the cables and harnesses connected to the controller and completely discharge the internal capacitor (discharge the B+ and B- terminals with a resistor 30Ω/5W).



Use a multi meter to measure according to the table below and check whether it is normal. Each test item must be tested more than 3 times.



Item	Multi meter terminals		Normal value range	
	Red test lead	Black test lead	Measurement of polarity value	Measurement of resistance value
1	B+	B-		40KΩ+
2	B+	M2		80KΩ+
3	B+	M1		80KΩ+
4	M1	M2		60KΩ+
5	B-	M2	0.3-0.6V	
6	B-	M1	0.3-0.6V	

Multi meter pull to Ω file (resistance value determination) Multi meter pull to diode file (polarity value determination)

c-4 Disassembly and installation

1.Remove the housing to access the drive motor controller.

2.Turn off the emergency stop switch.

3.Disconnect the battery.

4.Keep the emergency stop switch on so that the power module can discharge. Twice for 30 seconds.

5. Turn off the emergency stop switch.

Note: Please remember that the controller contains ESD (Electrostatic Discharge) sensitive components. Proper precautions should be taken when connecting, disconnecting and handling.

Controller disassembly and installation

12EP-XB Controller Disassembly		
		
Before removing the controller, remember the wiring order, the cable from top to bottom is power positive, power negative, motor negative, motor positive	**Unplug the wire**	**Remove the controller by removing two controllers anchor bolts with 5 mm inner hexagonal**

Installing the controller is the reverse of the above steps.

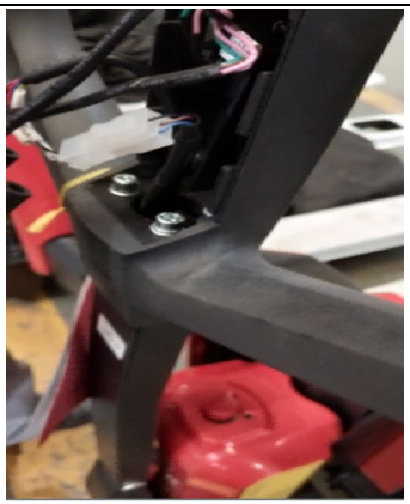
d. Tiller head

d-1 Function

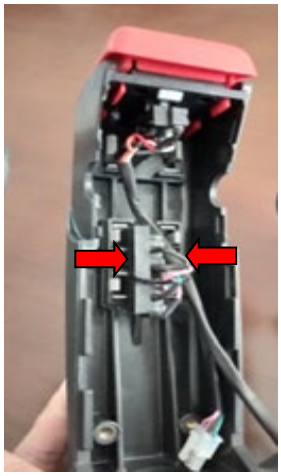
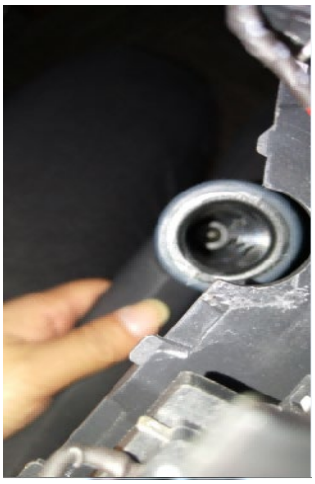
The tiller head controls some of the vehicle's movements through up and down buttons, belly switches, turtle buttons, throttle and combination locks and controller interplay.

A lift and lower
B belly switch
C throttle
D turtle switch
E horn switch

d-2 Tiller Head disassembly and Installation
1.Disassembly of tiller

		
Tiller rear cover fixing bolt removed with 5mm hexagon socket	**Remove the tiller back cover by unplugging the connector**	**Tiller front cover 4 fixed bolts can be removed with a 5mm hexagonal socket, you can remove the tiller**

2.tiller sub-part disassembly

			
Pinch both sides of the switch button snap, you can remove the switch button	**After the removal of the two switch buttons, the original switch button position below the implementation of a Phillips screwdriver to unscrew the micro switch set can be removed**	**Remove the bolt here with a 3mm hexagon socket to remove the gas pedal handle**	**Remove the bolt inside the handle tube with a 4mm hexagonal socket to remove the handle glove**

Installing the tiller and subassemblies is the reverse process of the above steps.

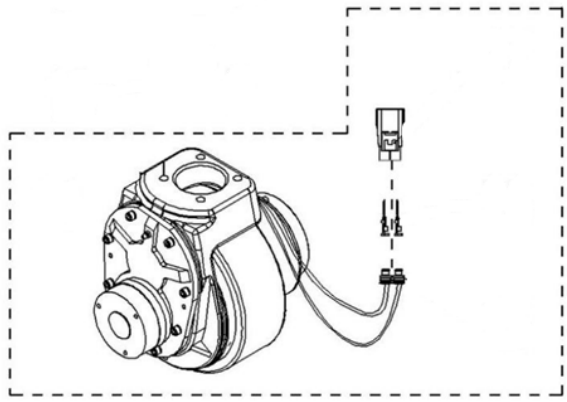
12. Drive/Brake System

a. Overview

The drive/brake system includes the following:
1) The drive motor controlled by the controller transmits the rotational force to the drive shaft (electric power mechanical power).
2) The drive shaft converts the rotational force transmitted from the drive motor into torque and speed suitable for driving through its gear set and sends them to the corresponding wheels (mechanical power). They also contain service brakes, which are electromagnetic brakes controlled by a controller to generate braking power (friction).
3) The accelerator sends the CAN number to the drive motor controller to accelerate the motor (CAN signal)

a-1 Driver Assembly

Appearance



Operation

On the electric side, the drive motors turn their drive wheels so that the vehicle can move forward/backward

controlled by controller
Each drive motor is connected to the controller via M1 and M2 wires. The controller operates the drive motor based on inputs from a number of switches and sensors, as well as internal parameter settings.
The drive motor operates when the following conditions are met:
1. Battery connection, emergency switch on to supply power to the controller,
2. Move the tiller to the operating area.
3. Determine the driving direction.
Twist the accelerator on the tiller

Drive Assembly disassembly and Installation
Preliminary steps
1. Park the vehicle safely and remove the drive wheel cover
2. Turn off the emergency stop switch.
3. Disconnect the battery connector

Procedure

		
1. Remove with 5mm hexagon	2. Use 6mm hexagon to remove 4 bolts on the bearing cover, here the bolts need to be installed with 1243 strength thread adhesive	3. The drive assembly is dropped so that the drive part is separated from the car body
		
4. Use iron or other hard objects to pad the middle hole and use a puller to disassemble the bearing	5. After the removal of the tapered bearing, the four bolts below the bearing can be removed with a 6mm hexagon to remove the connection flange, where the bolts need to be installed with 1243 strength thread adhesive	6. Round cover fixing bolts in the connection flange below, you need to turn over the connection flange, with 5mm hexagonal removal

Installing the drive assembly is the reverse of the above steps.

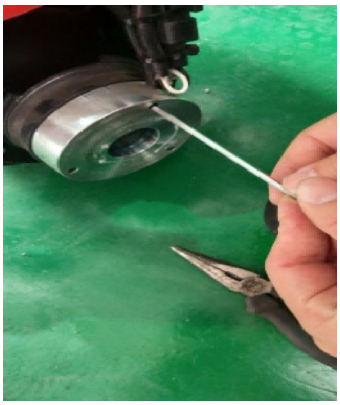
Note: Bearing GB276-6013-2RS (Step 3)

Tapered roller bearing type GB297-32913 on the connecting flange (Step 5)

b. Brake

Appearance

Brake Disassembly

12EP-XB Brake Disassembly	
	
When replacing the brake, you need to remove the plastic cover from the top of the brake, which is fixed with glue.	Remove the brake by removing the three brake fixing bolts with a 4mm hexagon socket.

c. Troubleshooting

c-1 Drive motor

Problem	Possible Cause
Drive motor does not work	Switches not closing (battery connector, tiller proximity switch, accelerator): Turn off the switch. If it still doesn't work, use a voltmeter to test the power to the control panel and the current to each switch.
	Poor signal. Fuse blown: Check battery connection. Check the battery connector connection. Check fuses, drivers and logic. Replace fuse if blown. Check the drive motor and control panel for possible blown fuses. Some reasons are: Operating under excessive load, current limit is too high
	Low battery voltage: Check battery terminal voltage. If it's too low, recharge the battery.
Drive motor does not work	Excessive carbon brush wear（Spring pressure piece to the lowest position of the carbon brush groove）
Traction does not work during normal work, but hydraulic operation is normal	The brakes were defective, causing excessive drag. Heat builds up, causing the motor to stall. Check brake adjustment.
	Heavy traction loads: Reduce duty cycle loads.
Neither traction nor hydraulics will last the entire normal operating period	The vehicle has a battery that is too small:
	The battery is not fully charged during battery charging: Check if the battery is charged Check if the battery charger is faulty.
	The battery replacement interval is too long or the cooling time of the replacement battery is too short.
	The battery has one or more defective cells causing the battery's rated capacity and capabilities to be below normal:
	The drive system is consuming too much battery power due to a

	drive system failure. Check brake adjustment. Check wheel bearings, axles and other mechanical components so that corrections can be made to eliminate the fault. Change to tires with less friction
	Excessive battery drain from the hydraulic system due to lift failure, or incorrect hydraulic conditions for the duty cycle Check the mast for restrictions during operation.
	After a work shift, the vehicle works beyond its designed capacity without available power:
The positive (+) or negative (-) pole of the battery is in direct contact with the vehicle frame (body) or drive motor	Battery or control panel wire connections that make contact with the vehicle frame: Do a continuity test and move the wire contact. Remove wires sequentially until fault clears. The fault will break at the end of the wire
	Dirty Motor：Please clean up the toner in time
	Wet Motor：The motor is damp
The vehicle is not reaching its top speed	The battery is not fully charged or has a bad battery: Charge the battery.
	Faults in the drive motor, control panel, or drive train: Check vehicle speed in both directions and turn to speed limit proximity switch. If control panel adjustments are required, follow the appropriate section of Section 2 Electrical Systems. If the drive motor fails, test the motor assembly

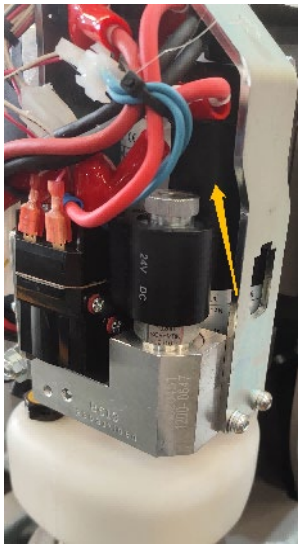
c-2 Driver box

Problem	Possible Cause
Noise or vibration in the gearbox	Out of lube: Meet the correct amount of lubricant
	Using non-standard oils: Replace oil with standard oil.
	Gears are damaged or dented: Change the gear.
	Bearing damage: Replace bearings.
	Loose mounting bolts: Apply thread compound to the threads of the bolt and re-torque to the specified torque.
Noise or vibration in the brake disc pack	Using non-standard friction material: Replace friction material with standard material.
	Friction lining wear: Replace the friction lining.
Installation part leaks	Loose mounting bolts: Apply thread compound to the threads of the bolt and re-torque to the specified torque.

13. Hydraulic System

a. Overview

The hydraulic system is composed of working oil pump, lifting cylinder and piping and other components. The hydraulic oil is supplied by the oil pump directly connected to the motor. The oil pump pumps the hydraulic oil to the cylinder.



The hydraulic system operates the lifting cylinders by means of pressurized hydraulic oil from the main hydraulic pump and pumps out the oil discharged from these cylinders.

1) The main hydraulic pump is driven by the pump motor controlled by the controller.

2) The main hydraulic pump pressurizes the oil in the hydraulic tank using the rotational force output from the motor and delivers the oil to the lifting cylinders.

3) The hydraulic oil tank stores the hydraulic oil returned from the lifting cylinder. The stored oil is sucked by the main hydraulic pump for reuse.

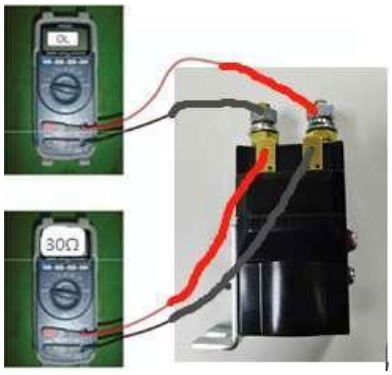
b. Pump assembly

b-1 Pump motor

The pump motor electrically transmits power to the main hydraulic pump to pump hydraulic fluid to operate the hydraulic system.

The pump motor is connected to the controller via a motor contactor. The controller operates the pump motor contactor based on inputs from multiple switches and sensors and internal parameter settings.

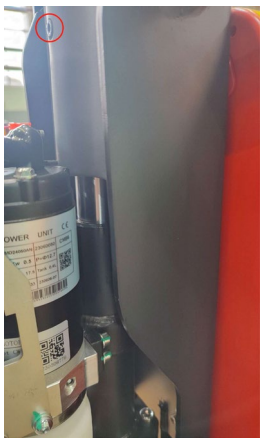
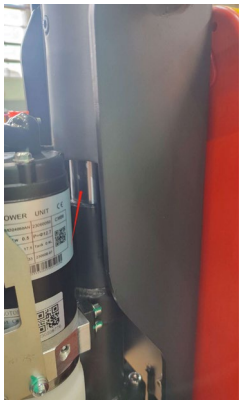
The pump motor operates when the following conditions are met:
The emergency stop switch is open.
Limit switch and rise button are closed.
Pump motor contactor is engaged



Pump motor contactor Inspection:

For the pump motor contactor, as shown in Fig.
and check that it measures the specified value.

b-2 pump station disassembly installation

			
Remove the left fixing bolt of the bracket with a 5mm hexagon socket	Remove the right fixing bolt of the bracket with a 5mm hexagon socket	Remove the cylinder head locating bolt with a 5mm hexagon socket	Use wooden blocks to pad the front half of the vehicle
			
The vehicle is energized, press and hold the down button, and give the upper end of the cylinder a slight downward pressure to make the piston rod retract	When the piston rod leaves the upper seat, place the rear half backward	Remove the connection bolt between the cylinder and the pump station with a 5mm hexagon socket; use 1243 strength thread adhesive to tighten the bolt here.	When the cylinder is separated from the pump station, note that there should be a sealed O-ring here, do not lose. O-ring specification is 13.5*1.8
			
Use a screwdriver to loosen the clamp	The tank and the pump station can be pulled apart. When installing the pump station, pay attention to whether the	Note: Pump station pressure adjustment First use a 10mm wrench to loosen the nut counterclockwise	Note: Pump station pressure adjustment Then use the 3mm hexagonal pressure adjustment, tighten is

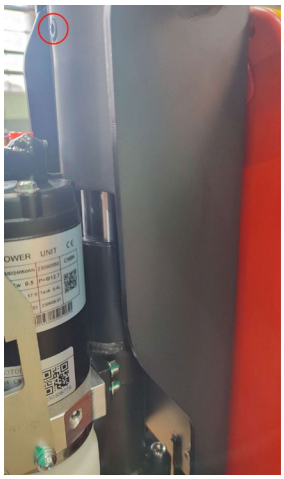
	O-ring is installed in place and cannot be stuck by the tank opening and exposed outside and not in the groove.		pressurized spin loose is to release pressure

Installing a pump station is the reverse of the above steps.

c. Lifting cylinder

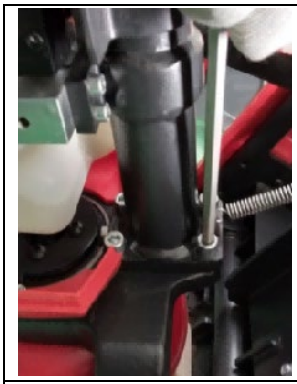
The cylinder is powered by a pump station.

Cylinder disassembly and installation

			
Remove the cylinder head locating bolt with a 5mm hexagon socket	Use wooden blocks to pad the front half of the vehicle	The vehicle is energized, press and hold the down button, and give the upper end of the cylinder a slight downward pressure to make the piston rod retract	When the piston rod leaves the upper seat, place the rear half backward
			
Remove the mounting sleeve from the top of the cylinder	Remove the connection bolt between the cylinder and the pump station with a 5mm hexagon socket; use 1243 strength thread adhesive to tighten the bolt here.		

Mounting the cylinder is the reverse process of the above steps.

	
12EP-XB cylinder and the pump station separation note that there should be a seal O-ring, do not lose. o-ring specifications for 13.5 * 1.8	

		
Remove the cylinder base bolt with a 6mm hexagon; use 1222 strength thread adhesive when installing the bolt here.	15EP-XB can be directly removed from the cylinder, 20EP-X's cylinder has a nut here, after disassembly, the cylinder can be removed	The spring here is used to hang the front and rear drive part of the frame after the cylinder is disassembled to prevent it from falling apart. The size of the spring is Φ10.4*Φ1.6*160, and the two ends are hooked on the car body separately.

d. Troubleshooting

Pump motor

Problem Display	Possible Cause
Hydraulic pump motor does not work.	Poor connection or blown fuse. Check battery connection. Check key fuse. Check the hydraulic pump motor for possible blown fuses.
	power switch, upper limit switch, line contactor not closed. Turn off the power switch. Use a multi meter to check power flow through the power switch, line contactor coil, and line contactor. The power switch must be turned off.
	The voltage is not enough. Charge the battery or replace the battery. Check that the cable terminals are a tight fit with the battery terminals and control panel connectors. Check for broken wires inside the cable.
	Improper operation of lift and drive systems
	During battery charging operation, the battery is not fully charged.
	The hydraulic system is consuming too much battery power due to lift or hydraulic control not being correct for the duty cycle.
	The hydraulic pump motor is overheating. If the motor temperature reaches 155°C (311°F)

14. Main components, disassembly and installation and description requirements

a. Chassis disassembly

		
The ring bar and the front Chassis pin shafts can be pulled out by simply tapping one of the elastic pins out with a punch. Here the elastic pin specification is 6*40	The pin at the connection between the ring bar and the rear Chassis needs to be removed from the reed and then pulled out of the pin	Replacing the bearing wheel first knocks out the four elastic pins at the finger with a punch, where the specifications of the elastic pins are 5*30
		
The bearing wheel can be replaced by knocking out the bearing pin shaft	Replacing the arm block first requires that the elastic pin at the finger be knocked out with a punch to separate the arm block from chassis, where the elastic pin specification is 5*30	Then use the punch to knock out the elastic pin here, i.e. The pusher can be separated from the arm block, where the elastic pin size is 5*28

b. Drive Wheel Ring Replacement

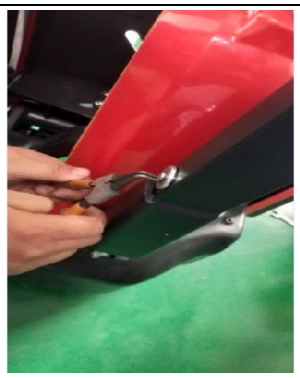
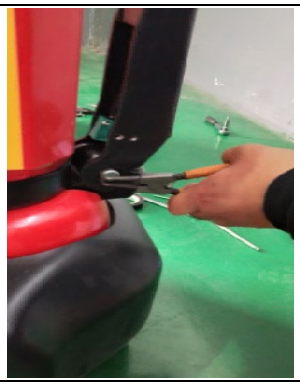
12EP-XB drive wheel	
	
When replacing the drive wheel, cut off the tie and unplug the motor cable connector	Remove 10 retaining bolts of driving wheel ring with 5 mm inner hexagonal angle, then remove the wheel ring, pay attention to the location of positioning holes and pins during installation Note: When the thickness of the PU ring is less than 1/3 of the thickness of the new ring, the new ring thickness is (13mm).

c. Disassembly and adjustment of auxiliary wheels

	
Two 17mm wrenches remove one end nut and pull out the screw to remove the wheel ring	The pressure adjustment of the auxiliary wheel frame only needs a 13mm wrench, and the screw rotates clockwise, counterclockwise or decompressed as shown in the figure.

d. Tiller Gas Spring disassembly and Installation

Disassembly

			
Remove the lower bolt of gas spring with 5mm hexagon socket	The upper pin of the gas spring is removed with a spring clamp	The upper pin can be removed after the spring is disassembled	Remove the pin after removing the lower pin spring from the tiller rod

Assembly

			
Gas spring inserted into the tiller rod	Insert the top pin	Insert the hexagon socket through the lower bearing hole into the screw hole and lift it upward to make the two holes parallel.	Insert the bottom end of the gas spring into the flat iron, cock it to fix the position of the hole at the bottom end of the gas spring and then put the screw on.

e. Tiller Proximity Switch Disassembly and Installation

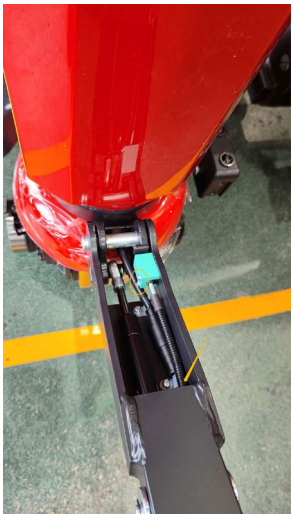
Preliminary steps

First park the vehicle safely, turn off the emergency stop switch and disconnect the power.

1). Press down on the tiller and disconnect the proximity switch harness.

2). Remove the proximity switch set screw and remove the proximity switch.

To install the tiller proximity switch, follow the above steps in reverse order.



f. Pump station contactor disassembly and installation

	
Use a 10mm open-end wrench to remove the contactor pile head cable, use a Phillips screwdriver to remove the contactor bracket fixing bolt, remove the contactor together with the bracket and then split	Remove the line at the contactor insert

Installing the contactor is the reverse process of the above steps.

g. Pump station motor disassembly and installation

	
First, use a 10mm open-end wrench to remove the cable on the motor, then use a 10mm wrench to loosen the two bolts on top of the motor and pull them out to remove the pump station motor	The motor top cover will be pulled off, visible 4 carbon brushes, each two welded to the motor positive and negative pile head

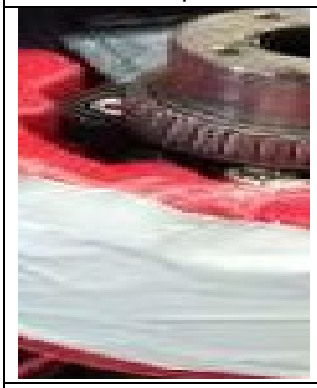
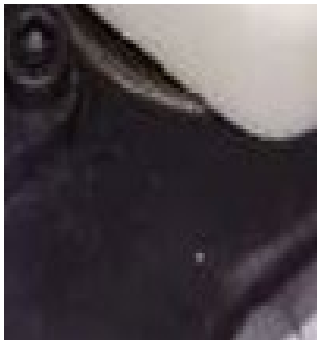
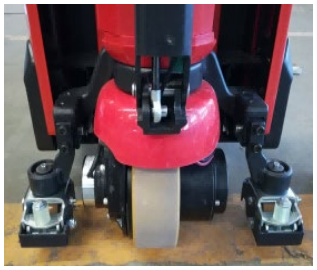
Installing the motor is the reverse process of the above steps.

h. Limit micro switch disassembly and installation

12EP-XB		
		
Remove a total of three bracket fixing screws as shown in the figure	Lift fixing bracket	Remove the limit micro motion switch by removing the fixing screw with a hexagon in 3mm

Installing the limit micro switch is the reverse process of the above steps.

i. Torque requirement for main fixing screw

Picture example	position	Fastener Name	Tightening requirements
	Connection flange and drive wheel connection screw	Screw GB70.1-M10x25-8.8	Torque 50N.m Diagonal Tightening
	Bearing cap screw with connection flange	screw GB70.2-M8x16-10.9	Torque 30N.m Diagonal Tightening
	Lift cylinder and drive wheelset connect screw	screw GB70.1-M10x30-8.8	Torque 50N.m diagonal tightening;
	Pumping station valve block and lifting cylinder connection screw	screw GB70.1-M6x16-8.8 flat washer GB97.1-6-200HV	Torque 8 N.m Diagonal Tightening in Stages
	Universal Wheel Component Connects with Drive Wheel Seat	screw GB70.1-M10x25-8.8 flat washer GB97.1-10-200HV	Torque 50N.m；

15. CURTIS Hand-held programmer

Operating Precautions:
The handheld unit note function is to facilitate vehicle inspection and maintenance. Adjustment of controller parameters is not allowed without the approval of the vehicle manufacturer to avoid vehicle and personal safety accidents.
After the handheld unit modifies the parameters, it will be saved automatically and only needs to be turned off the power switch and restarted.
The CURTIS handheld unit can be connected with the controller powered or unpowered

Process of Vehicle Fault Reading

Please turn on the power switch after connecting the handheld unit to the controller Check for the faults based on the CURTIS handheld unit menu list

When running the vehicle, the flashing line of the handheld cursor will prompt English fault content, which can be interpreted by referring to the fault code list

Vehicle Signal Inspection

Please turn on the power switch after connecting the handheld programmer to the controller

Check for the Monitor based on the CURTIS handheld menu list

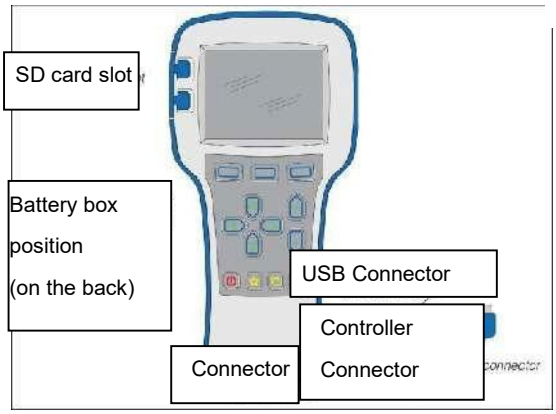
Please open the corresponding Inspection menu sub item according to the need, run the vehicle, and observe the change of handheld value.

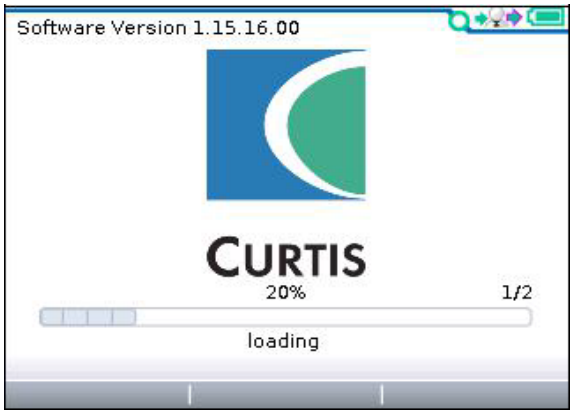
Contents of CURTIS Handheld Menu

The Curtis 1313 handheld programmer is used to configure the Curtis electronic control system. The set parameters, real-time monitoring controller data and fault diagnosis may be adjusted and saved through this programmer.

Warning： The control system will affect the performance of vehicle's acceleration, deceleration, hydraulic system and brakes. Hazardous conditions may occur if the vehicle control system is incorrectly programmed or beyond safety limit. Only the vehicle manufacturer or authorized service agent may program the control

The programmer has two interfaces with a battery box and a memory card slot, of which one is used to communicate with electric control, and the other is used to communicate with PC.





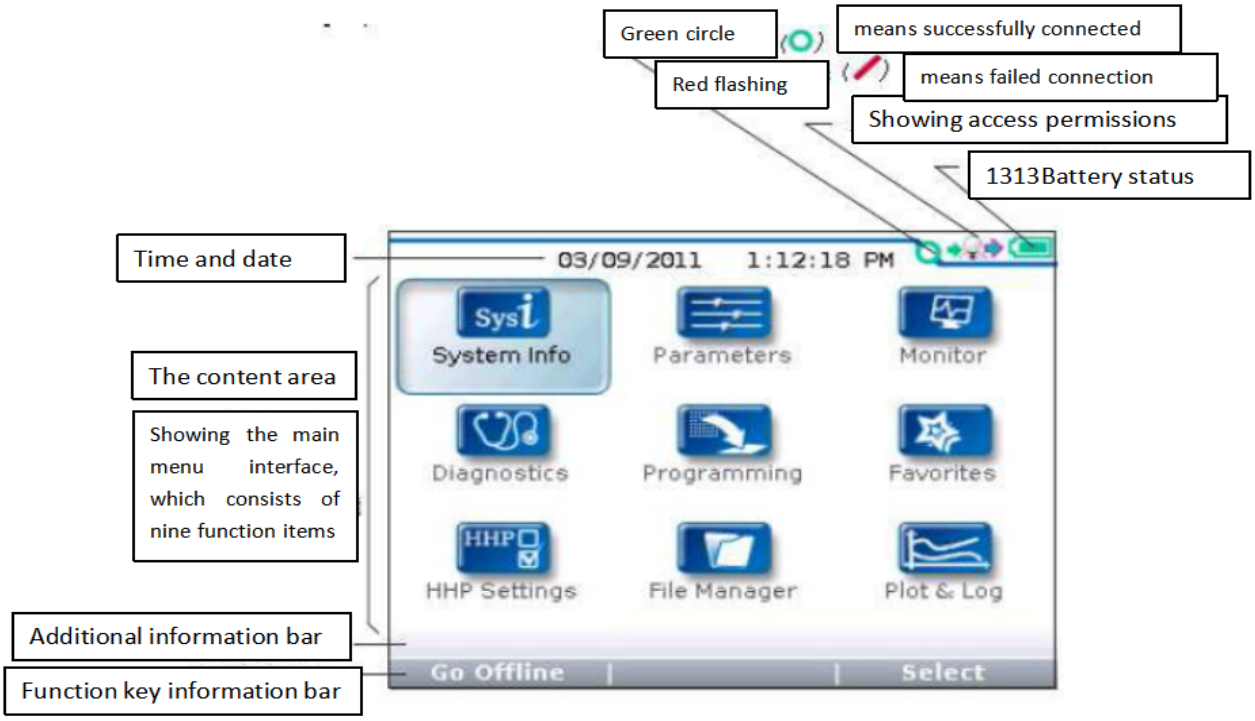
Once the 1313 HHP has uploaded the information from the controller, it displays the Main Screen

Programmer power on

The difference between the connection cables of handheld programmers

	
Connection cable for 12EP-XB	Connection cable for 12EP-XB(20CE)

The handheld programmer is connected to the controller by plugging the cable of the handheld programmer into the programming port of the controller. After connecting to the controller, the handheld programmer will automatically power up and display the control information on the programmer.


Green circle
means successfully connected
Red flashing
means failed connection
Showing access permissions
1313Battery status
Time and date
03/09/2011 1:12:18 PM
The content area
Showing the main menu interface, which consists of nine function items
System Info
Parameters
Monitor
Diagnostics
Programming
Favorites
HHP Settings
File Manager
Plot & Log
Additional information bar
Function key information bar
Go Offline
Select

Function keys

The three keys will be blank because the function of the three keys is based on the specified content. At any given time, the functions of the buttons are displayed on the LCD screen above. Directional arrow key

The information displayed can be selected by pressing up, down, or left or right through 4 directional keys.

+ / - Button

The parameters can be added or subtracted by the two keys. Meanwhile, "+" refers to "Yes" in the operation system, and "-" refers to "No", which may be used as a scrolling options in some cases

Power switch

When the programmer inserts an already powered controller, it is not necessary for the programmer to be initiated by pressing the power switches, and the programmer will start up automatically. When it is held down for a few seconds, the programmer will prompt turn off confirmation, which shall be answered by selecting "Yes" or "No" of the function keys. When the programmer is turned off, a few seconds of pressing will trigger the restarting of the programmer.

Key of favorite

There are 2 ways to enter the menu of "Favorites" 1. You can enter through the main menu "Favorites"; 2. You can also press this key to enter

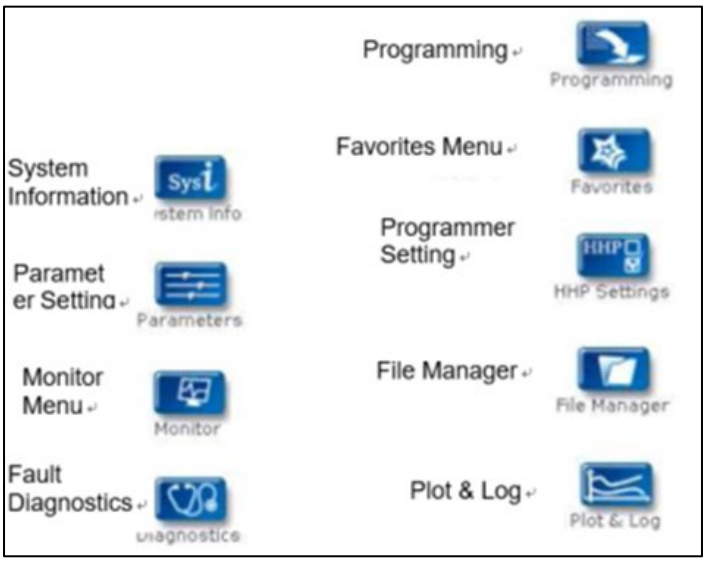
Menu structure

The main menu consists of nine submenus, each of which is displayed with a specific icon, and each item of the submenu is arranged in a hierarchy.

Some menus contain one item only, but most menus contain more than one item, and you can access the next level of submenus through each folder. It is possible for you to expand the table through grid options, enter a set of execution commands through dialog options, and return to the next level of menu whichever interface you are in.

All nine submenu names are shown in bold on the main menu and below the icons. When you enter the stepped menu, the name of the submenu or the path you are in are displayed at the top of the screen.

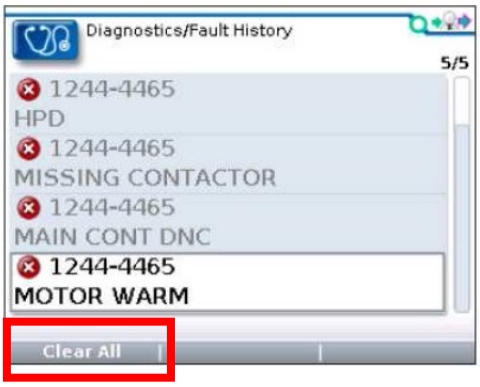
Nine main menus



。Fault diagnosis menu

In the main menu, Select the "Diagnostics" Fault diagnosis icon and press the corresponding function key to enter the Fault diagnosis menu, which includes two folders: "Present Errors" and "Fault History"

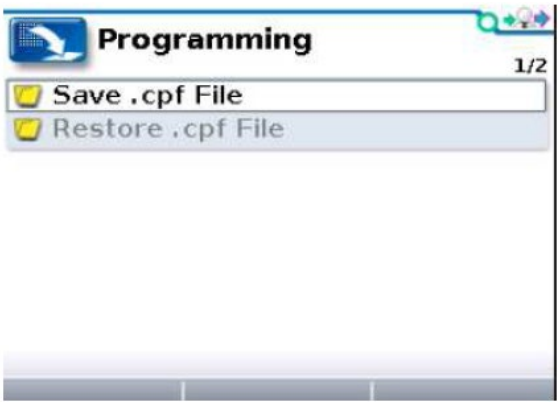
Note: the fault caused by a temporary event captured in the circuit is not a real system fault in some cases. and you can determine if the fault really exists by restarting the system and observing the automatic fault indication. In the history failure folder, the failures listed are all failures encountered after the last history failure was cleared, which can be restarted by clearing the fault content in the entire folder.



"Clear All" is used to Clear the history failure folders. A function key will be highlighted separately if there is a history failure in the history failure folder, and will be grayed out if there is no history failure.

Programming edit menu

In the main menu, Select the "Programming" programming icon and press the corresponding function key of "Select" to enter the menu. You can store and restore parameter setting files (.cpf files) through the programming menu.



Save.cpf File

Use the save. cpf file function in the programming menu to back up the currently set parameters. You can save as many. cpf files as you need, and you need to name each. cpf file with a different name.Restore.cpf File

Restore.cpf File

You can select the. cpf file saved earlier to replace the. cpf file of the current controller. When the whole data recovery process is completed, a dialog box will pop up on the screen asking for the system to be restarted.

16. Troubleshooting for Each Fault Code

a. 12EP-XB fault codes table(Curtis 1212C)

NL-200tiller error check list			
Code	Error description	Error reason	Source
0	LOW_BDI	Low power	1212C-2503 controller
1	PUMP_SRO_FAULT	Lift / lower action key start switch	1212C-2503 controller
2	SRO_FAULT	operating sequence is not correct including moving、lock，start switch	1212C-2503 controller
3	HPD_FAULT	operating sequence is not correct including lock，accelerator or accelerator not go to neutral position if suddenly changing the moving direction	1212C-2503 controller
4	WIRING_FAULT	Accelerator problem	1212C-2503 controller
5	THROTTLE_FAULT	Accelerator wiring problem	1212C-2503 controller
6	PRECHARGE_FAULT	Controller problem	1212C-2503 controller
7	MAIN_DRIVER_FAULT	Contactor fault	1212C-2503 controller
8	MAIN_RELAY_WELDED	Contactor adhere	1212C-2503 controller
9	MAIN_RELAY_DNC	Contactor not-close	1212C-2503 controller
10	BRAKE_OFF_FAULT	Electromagnetic brake open circuit / coil short-circuit	1212C-2503 controller
11	MOTOR_OVER_TEMPERATURE	Motor overheat	1212C-2503 controller
12	BATTERY_DISCONNECT_FAULT	Battery wiring connection problem	1212C-2503 controller
13	BRAKE_ON_FAULT	Electromagnetic brake open circuit / coil short-circuit	1212C-2503 controller
14	CURRENT_SENSE_FAULT	Controller problem	1212C-2503 controller
15	HARDWARE_FAULT	Controller problem or incorrect motor action	1212C-2503 controller
16	SOFTWARE_FAULT	Controller problem	1212C-2503 controller
17	PARAMETER_CHANGE_FAULT	Data changing fault	1212C-2503 controller
18	MOTOR_SHORT	Motor short circuit	1212C-2503 controller
19	MOTOR_OPEN	Motor open circuit	1212C-2503 controller
20	CONTROLLER_OVERCU	Controller overcurrent	1212C-2503

	RRENT		controller
21	MOTOR_TEMP_HOT_CUTBACK	Motor hot cutback	1212C-2503 controller
22	CONTROLLER_OVERTEMP_CUTBACK	Controller over temp. Cutback	1212C-2503 controller
23	CONTROLLER_UNDERTEMP	Controller low temp.	1212C-2503 controller
24	CONTROLLER_SEVERE_OVERTEMP	Controller severe high temp.	1212C-2503 controller
25	OVERVOLTAGE_CUTBACK	Over-voltage cut off	1212C-2503 controller
26	SEVERE_OVERVOLTAGE	Over voltage	1212C-2503 controller
27	UNDERVOLTAGE_CUTBACK	Low-voltage cut off	1212C-2503 controller
28	SEVERE_UNDERVOLTAGE	Low voltage	1212C-2503 controller
29	PARAMETER_FAULT	Controller fault or incorrect parameter setting	1212C-2503 controller
30	GAGE_PDO_TIMEOUT	Display communication over time	1212C-2503 controller
32	PDO_TIMEOUT	Tiller communication overtime	1212C-2503 controller
33	LIFT_DRIVER_FAULT	Drive 1（J1-3) fault	1212C-2503 controller
34	LOWER_DRIVER_FAULT	Drive 2（J1-11) fault	1212C-2503 controller
36	BMS_PDO_TIMEOUT	BMS communication overtime	1212C-2503 controller
37	EMR_SEQUENCING_FAULT	operate before changing moving direction	1212C-2503 controller
38	TILLER_HANDSHAKE_FAILED	No communication between knob and controller	1212C-2503 controller
39	COAST_SRO_FAULT	1.The action of an upright walking switch ahead of a key switch 2.interlock from on to off when the upright walk switch is closed	1212C-2503 controller
40	PUSH_SRO_FAULT	Action before starting	1212C-2503 controller
80	Mode fault	Turtle speed button fault	Tiller
81	Lift fault	Lifting button fault	Tiller
82	Lower fault	Lowering button fault	Tiller
83	BMS Communication Outage	BMS Communication overtime	Tiller
90	Over Voltage	Battery high voltage	Li-battery
91	Over Discharge	Battery over discharging	Li-battery
92	Communication Outage	Battery Communication overtime	Li-battery
93	Under Voltage	Battery low voltage	Li-battery
94	Over Current	Battery over current	Li-battery
95	Over Temperature Protect	Battery extra high temperature	Li-battery
96	Temperature Protect	Battery high temperature	Li-battery

b. 12EP-XB fault codes table Curtis 1212e(20CE/EN1175:2020)

No	Code	Fault name	Possible cause	Source
1	11-1	Severe Under voltage	Controller defective Battery defective	1212E Controller
2	12-1	Under voltage Cutback	Incorrect battery voltage Main relay defective Controller AD defective	1212E Controller
3	13-1	Severe Overvoltage	Incorrect battery voltage Main relay defective Controller AD defective	1212E Controller
4	13-2			
5	14-1	Overvoltage Cutback	Incorrect battery voltage Main relay defective Controller AD defective	1212E Controller
6	15-1	Controller Severe Under temp	Temperature sensor defective Low ambient temperature	1212E Controller
7	16-1	Controller Over temp Cutback	Temperature sensor defective High current for a long time	1212E Controller
8	17-1	Controller Severe Over temp	Temperature sensor defective	1212E Controller
9	21-1	Throttle Fault	Throttle wiring fault Incorrect throttle type setting Incorrect throttle operation Steering Angle Pot wiring fault	1212E Controller
10	21-2			
11	21-3			
12	21-4			
13	22-1	HPD Sequencing	Incorrect throttle operation Throttle defective	1212E Controller
14	23-1	Main Relay Welded	Main relay defective	1212E Controller
15	24-1	Main Relay Did Not Close	Main relay defective Incorrect relay pull in voltage setting	1212E Controller
16	24-2			

17	25-1	Main Driver Fault	Main driver defective	1212E Controller
18	25-2			
19	26-1	Pre charge Failed	Pre charge PTC defective	1212E Controller
20	26-2			
21	31-1	Stall Detected	Pre charge PTC defective	1212E Controller
22	32-1	Motor Short	Motor Short	1212E Controller
23	32-2			
24	33-1	Motor Open	Motor Open	1212E Controller
25	33-2			
26	34-1	EM brake failed To Set	EM brake defective	1212E Controller
27	41-1	Push SRO	Incorrect operation sequence Controller defective	1212E Controller
28	42-1	Interlock SRO Fault	Incorrect operation sequence Controller defective	1212E Controller
29	43-1	Low BDI	Battery over discharged	1212E Controller
30	44-1	Speed Supervision	Speed is out of allowed range	1212E Controller
31	44-2			
32	44-3			
33	44-4			
34	44-5			
35	51-1	Over Current Fault	Controller defective Current sensor defective	1212E Controller
36	52-1	Current Sense Fault	Current sampling circuit defective	1212E Controller
37	52-2			
38	53-1	Driver Fault	Driver open or short Incorrect parameter settings	1212E Controller
39	53-2			
40	53-3			
41	53-4			
42	54-1	PUMP SRO Fault	Incorrect operation sequence Switch defective Incorrect parameter settings	1212E Controller
43	54-2			
44	54-3			
45	54-4			
46	54-5			
47	55-1	EMR SRO Fault	EMR switch defective EMR Incorrect operation sequence Incorrect parameter settings	1212E Controller
48	55-2			
49	55-3			
50	56-1	Creep SRO Fault	Incorrect operation	1212E

51	56-2		sequence Cost	Controller
52	56-3			
53	56-4			
54	61-1	PDO Timeout PDO	CAN bus too heavy Incorrect parameter setting	1212E Controller
55	61-2			
56	61-5			
57	62-SDO Abort ID	PDO Mapping Error	Incorrect variable data length Incorrect access mode Incorrect CAN index	1212E Controller
58	71-1	Hardware Fault	MOSFET defective Micro defective	1212E Controller
59	71-2			
60	71-3			
61	71-4			
62	71-5			
63	81-Parameter index	Parameter Out Of Range	Incorrect variable data	1212E Controller
64	82-1	Parameter Fault	Incorrect parameter settings FRAM defective	1212E Controller
65	82-2			
66	82-3			
67	82-4			
68	82-6			
69	83-Block num	NV Failure	FRAM operation failed	1212E Controller
70	83-2			
71	83-3			
72	83-4			
73	83-5			
74	84-code	Supervision	Cross check failed	1212E Controller
75	80	Mode fault	Tiller Turtle speed button failure, Turtle speed button detected closed before power on.	Tiller
76	81	Lift fault	Rise button failure, the rise button is detected as being pressed before the power is turned on.	Tiller
77	82	Lower fault	Faulty drop button, the drop button is detected as being pressed before the power is turned on.	Tiller

78	83	BMS Communication Outage	Lithium battery communication timeout, 1. Lithium battery BMS damaged. 2. Lithium battery to Tiller communication line broken. 2. Tiller communication module damaged.	Tiller
79	84	Throttle FAULT	The gas pedal is not in the neutral position before the code is entered, and the gas pedal needs to be reset to clear the fault.	Tiller
80	85	Controller Communication Outage	Controller communication lost	Tiller
82	86	Lift system failure	Pump station output continuous operation, lifting system failure, possibly rising micro switch failure	Tiller
83	90	Over Voltage	Battery voltage is too high. 1, may be the charger overcharge. 2, battery BMS problems. 3, the vehicle for a long time downhill, caused by the feedback current charging.	Lithium Battery
84	91	Over Discharge	Battery over-discharge. 1, lithium batteries are not used for a long time, resulting in low battery power. 2, overuse.	Lithium Battery
85	92	Communication Outage	Battery communication timeout, communication timeout with controller	Lithium Battery
86	93	Under Voltage	Battery voltage is too low, 1, long-term storage, not in time to charge. 2, the battery internal cell damage, resulting in the inability to charge into the power.	Lithium Battery
87	94	Over Current	Battery overcurrent, 1,	Lithium Battery

			the use of equipment is not in accordance with the original program set by the controller to run. 2, after the replacement of the controller, the parameters do not match. 3, the lithium battery current Inspection problems.	
88	95	Over Temperature Protect	Severely high battery temperature, use or transport environment, causing severe internal high temperature of the battery.	Lithium Battery
89	96	Temperature Protect	High battery temperature, use or transport environment, causing high temperature inside the battery.	Lithium Battery