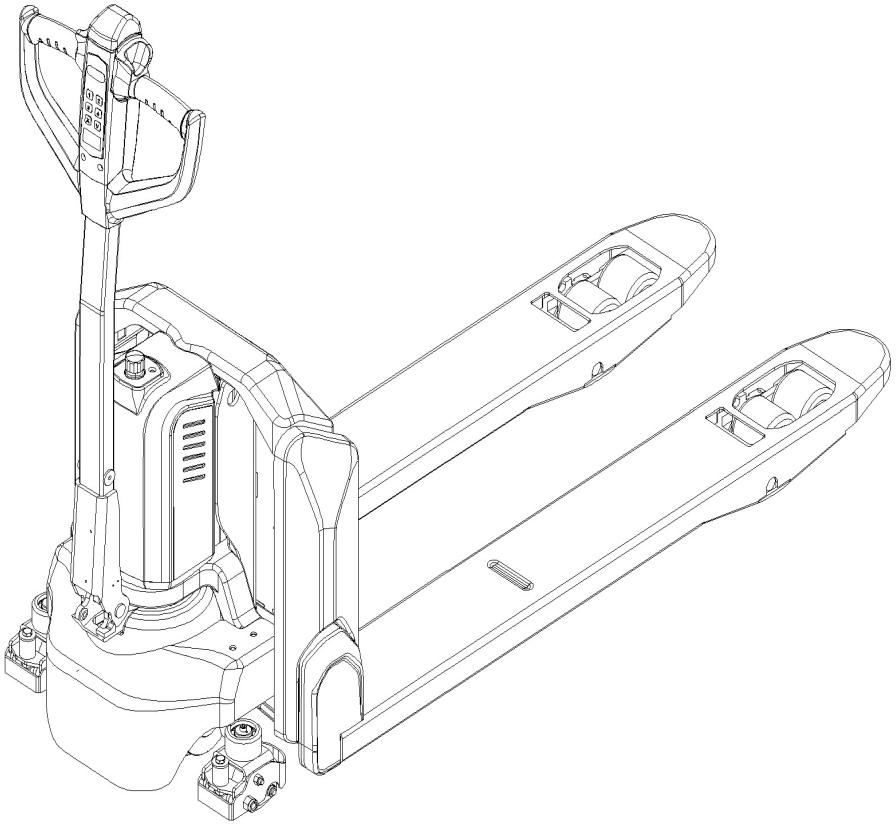
15/20 EP-XB

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 get lost, please contact your local dealer for replacement.
This truck complies with the requirements according to EN 3691-1 (Industrial trucks- safety requirements and verification, part 1), EN 12895 (Industrial trucks- electromagnetic compatibility), EN 12053 (Safety of industrial trucks- test methods for measuring noise emissions), EN 1175-2020 (Safety of industrial trucks - Electrical/electronic requirements), assumed the truck is used according to the described purpose.
The noise level for this machine is 69 dB(A) according to EN 12053.

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.

Copyright

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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.

Only in the event that the truck manufacturer is no longer in business and there is no successor in the interest to the business, may the user arrange for a modification or alteration to a powered industrial truck, provided, however, that the user:
a) arranges for the modification or alteration to be designed, tested and implemented by an engineer(s) expert in industrial trucks and their safety,
b) maintains a permanent record of the design, test(s) and implementation of the modification or alteration,
c) approves and makes appropriate changes to the capacity plate(s), decals, tags and instruction handbook, and
d) affixes a permanent and readily visible label to the truck stating the manner in which the truck has been modified or altered, together with the date of the modification or alteration and the name and address of the organization that accomplished those tasks.

By not observing these instructions, the warranty becomes void.

2. DESCRIPTION OF THE PALLET TRUCK

a. Overview of the main components

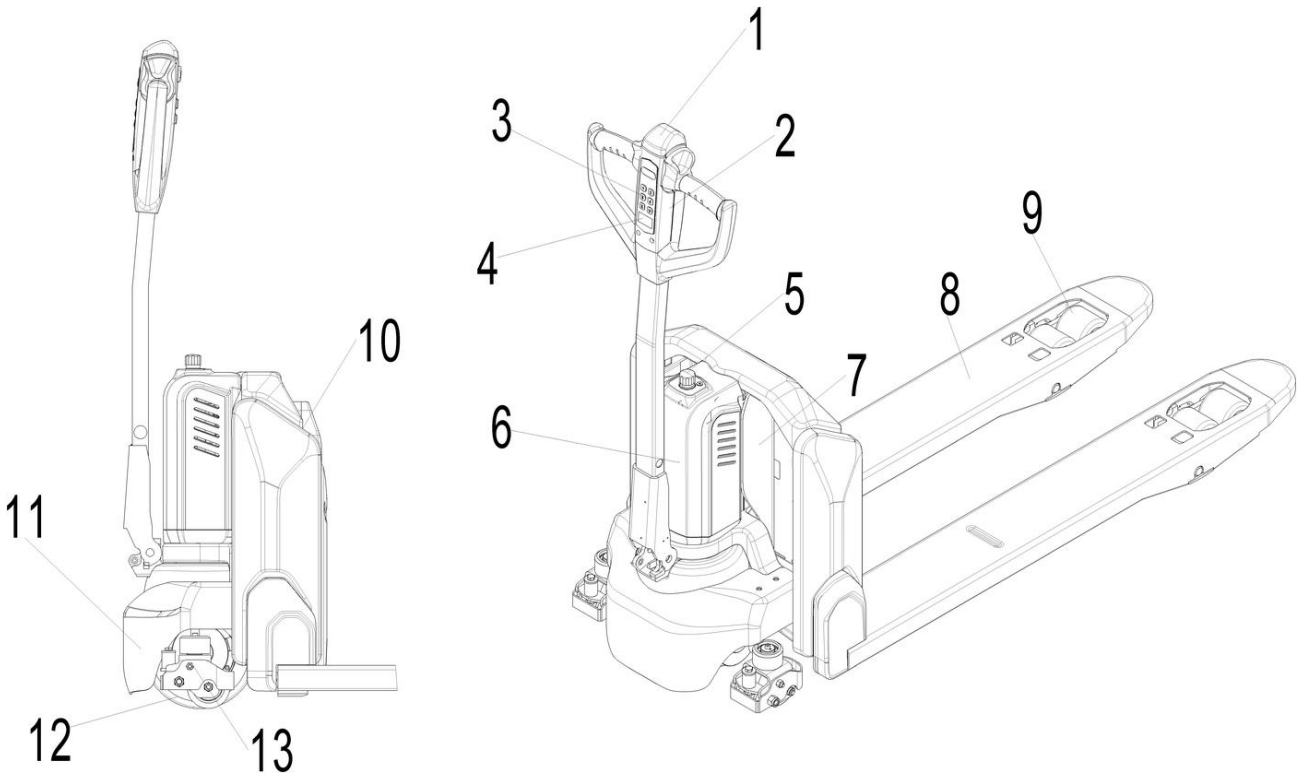


Fig. 1: Overview main components

1. Safety (belly) button
2. Tiller
3. Pin-code panel (20EP-X with card)
4. Discharge indicator and charging indicating LED
5. Emergency switch
6. Hydraulic unit cover
7. Chassis
8. Fork
9. Load roller
10. Battery
11. Apron
12. Driving unit
13. Side roller (option for 15EP-XB)

b.Main technical data

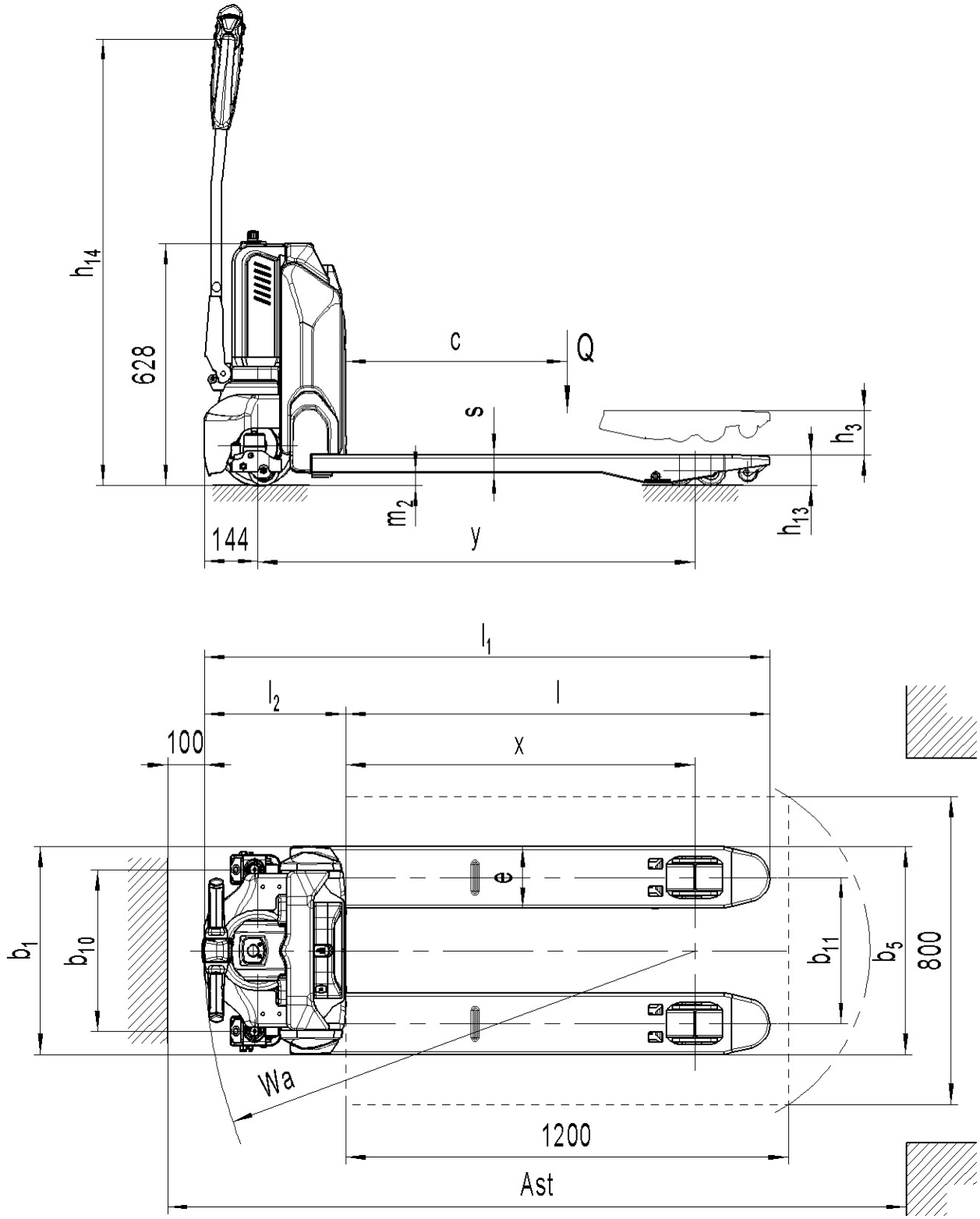


Fig. 2: Technical data

Table 1: Main technical data for standard version

Type sheet for Palletl truck acc. to （VDI2198）												
General data	1.2	Manufacturer`s type designation		15EP-XB				20EP-XB				
	1.3	Power(battery,diesel,petrolgas,manual)		Battery								
	1.4	Operator type		Pedestrian/Stand								
	1.5	Load Capacity / rated load	Q (t)	1.5				2.0				
	1.6	Load center distance	c (mm)	600								
	1.8	Load distance, center of drive axle to fork	x(mm)	947				951				
	1.9	Wheelbase	y (mm)	1185				1189				
Weight	2.1	Service weight	kg	123	136	126	139	149	143	153	146	
	2.2	Axle loading, laden front/rear	kg	623/1000	520/1116	626/1000	521/1118	621/1528	822/1321	625/1528	823/1323	
	2.3	Axle loading, unladen front/ rear	kg	96/27	105/31	99/27	107/32	115/34	109/34	119/34	111/35	
Tires, chassis	3.1	Tires		Polyurethane (PU)								
	3.2	Tire size, front	∅ x w (mm)	∅ 210×70/∅ 210×75								
	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		380		525		
Dimensions	4.4	Lift height	h_3 (mm)	115								
	4.9	Height of tiller in drive position min. / max.	h_{14} (mm)	700 / 1160(655 / 1160)								
	4.15	Height, lowered	h_{13} (mm)	80								
	4.19	Overall length	l_1 (mm)	1530				1536				
	4.20	Length to face of forks	l_2 (mm)	380/385				386/391				
	4.21	Overall width	b_1 (mm)	540		685		540		685		
	4.22	Fork dimensions	s/e/l (mm)	47 / 160 / 1150								
	4.25	Width across forks	b_5 (mm)	540		685		540		685		
	4.32	Ground clearance, center of wheelbase	m_2 (mm)	33								
	4.34	Aisle width for pallets 800X1200 lengthways	Ast(mm)	2000				2006				
	4.35	Turning radius	Wa (mm)	1330/1350				1336/1356				
P	5.1	Travel speed, laden/ unladen	km/h	4.6/4.8(4.2/ 4.4)				4.8/5.2(4.4/ 4.8)				

	5.2	Lift speed, laden/ unladen	m/s	0.020/0.025(0.015/0.022)	0.017/0.022(0.012/0.019)
	5.3	Lowering speed, laden / unladen	m/s	0.05/0.04(0.05/0.026)	0.05/0.03(0.05/0.016)
	5.8	Gradeability, laden/ unladen	%	4/16(6/16)	7 / 16
	5.10	Service brake		Electromagnetic	
Electric	6.1	Drive motor rating S2 60min	kW	0.65	0.75
	6.2	Lift motor rating at S3 10%	kW	0.50	0.8
	6.3	Battery acc. to DIN 43531 /35 / 36 A, B, C, no		/ /	
	6.4	Battery voltage, nominal capacity K5	V/Ah	24 / 20(24 / 30；24 / 36)	48/ 20
	6.5	Battery weight (minimum)	kg	4.6	7.5
	6.6	Energy consumption acc. to EN16796-2	KWh/h	0.22	0.18
Other	8.1	Type of drive control		DC	
	8.4	Sound level at driver`s ear acc. to EN 12053	dB(A)	69	<70

c. Description of the safety devices and warning labels

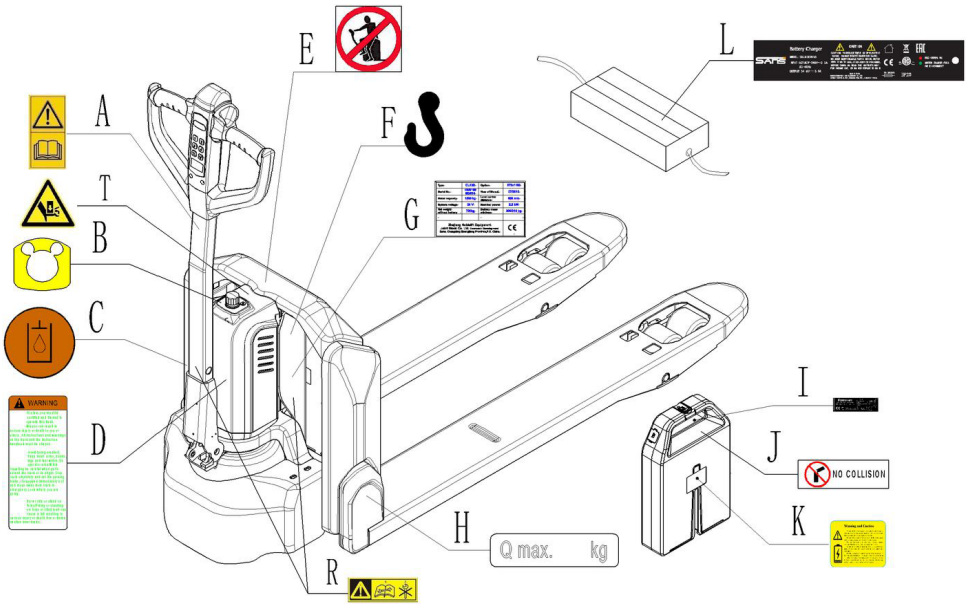


Fig. 3: Safety and warning labels

A Sticker to read and follow this instruction
B Emergency button sticker
C Sign oil filling point
D Warning sticker (on request/not mandatory)
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 turning this button clockwise, the truck can be operated after the controller checked the functions. Before operating, type the password on pin-code panel and press the √ button. For 20EP-X truck can also be activated with RFID access card. To prevent unauthorized access, press emergency switch (5) or press the X button of pin-code panel.
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

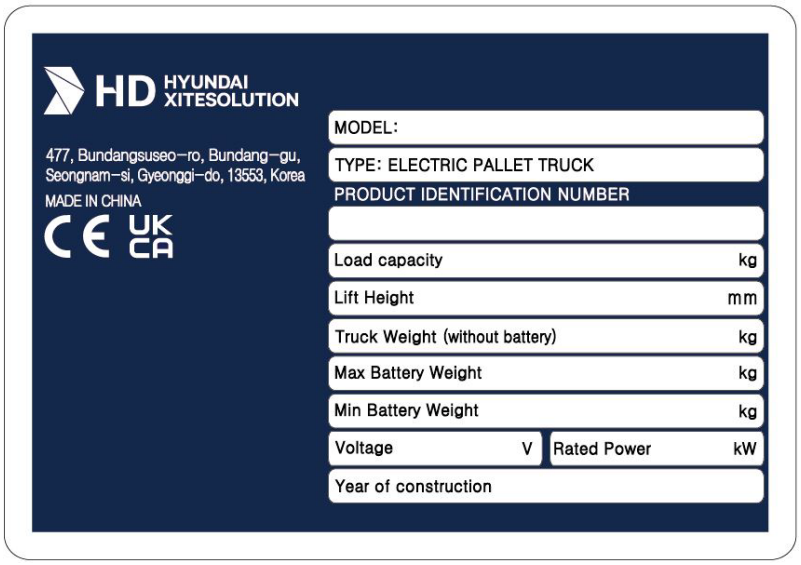


Fig. 4: Identification plate

Nameplate format content is subject to equipment posting

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
- Locate loads on sides or fork end. Load must be distributed evenly on the forks.
- Use the truck with unstable or unbalanced 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 switch (5) by pushing when sliding load on or off the truck. If the truck has any malfunctions, follow chapter 10.

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.
- No operation of this vehicle on a slope
- To prevent unintended sudden movements when not operating the truck (i.e. from another person, etc.), press emergency switch (5) or press the X button of pin-code panel.

4. COMMISSIONING, TRANSPORTING, DECOMMISSIONING

a. Commissioning

Table 2: Commissioning data

Type	15EP-XB (540X1150)	15EP-XB (685X1150)	20EP-XB (540X1150)	20EP-XB (685X1150)
Commissioning weight [kg]	123kg	126kg	149kg	153kg
Dimensions [mm]	1530x540x1250	1530x685x1250	1530x540x1250	1530x685x1250

Type	15EP-XB (540X1150)	15EP-XB (685X1150)	20EP-XB (540X1150)	20EP-XB (685X1150)
Commissioning weight [kg]	136kg	139kg	139kg	146kg
Dimensions [mm]	1530x540x1250	1530x685x1250	1530x540x1250	1530x685x1250

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

- Check if are all parts included and not damaged
- Make sure the tiller is assembled correctly (electrical socket is connected and fixed with two plastic clamps, circlip of the axle is installed)
- 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.

Park the truck securely and lash the truck according to the points identified in Fig. 5. Lift the truck to its destination and place the truck securely before removing the lifting gear. The lashing points are according to the Fig. 5.

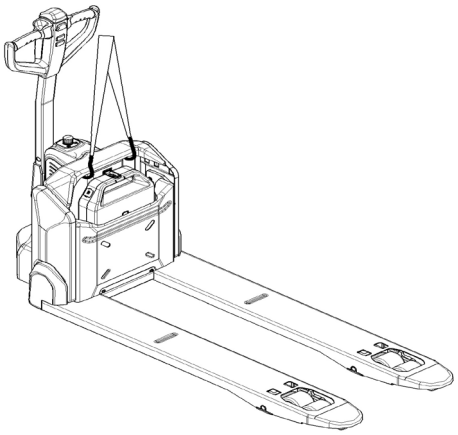


Fig. 5: Lifting with a crane

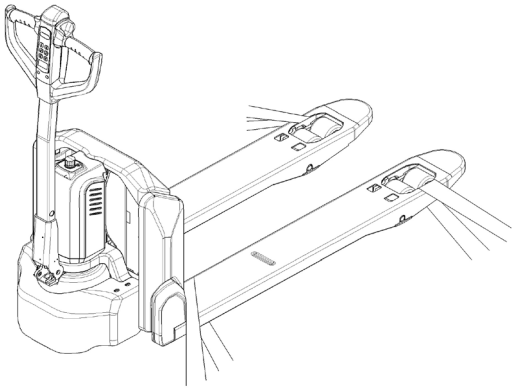


Fig. 6: fixing points

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, deformation or cracks.
- Check if there is any oil leakage from the cylinder.
- Check the smooth movement of the wheels.
- Check the function of key switch.
- Check the speed limit switch, etc.
- Check the function of driving in both directions (section 6d).
- Check the functions of braking by activation of tiller arm sensor, reversing of driving buttons, release of driving buttons and of the safety (belly) button (section 6f).
- Check the function of driving with tiller in its vertical position (section 6d).
- Check the function of the emergency brake by activating the emergency switch.
- Check the lifting and lowering functions by operating the buttons (section 6b and 6c).
- Check the function of steering by turning the tiller from one end position to the other one. The steering should be smooth, without jerks or abnormal sound.
- Check if all bolts and nuts are tightened firmly.
- Visual check if there are any broken electric wires.
- If supplied with a backrest extension, check it for damages and correct assembling.

6. OPERATING INSTRUCTIONS

BEFORE OPERATING THIS TRUCK, PLEASE FOLLOW THE WARNINGS AND SAFETY INSTRUCTIONS (CHAPTER 3).

Fig.8: Tiller operating controls

Make sure, that the load is palletized and stable and that the daily inspection is carried out.
Type the password on pin-code panel and press √ button to start the truck. For 20EP-XB, truck can also be activated with RFID access card.
Press the horn button (Fig.8,15) to activate the audible warning signal.

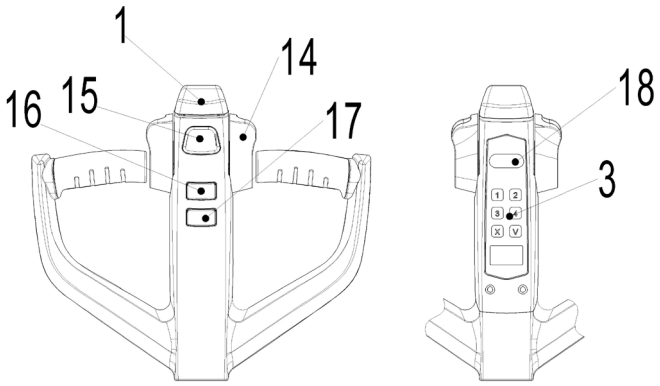


Fig.7: 20EP-XB control tiller

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!
THE MAXIMUM CAPACITY OF 15EP-XB IS 1500KGTHE MAXIMUM CAPACITY OF 20EP-XB IS 2000KG.

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

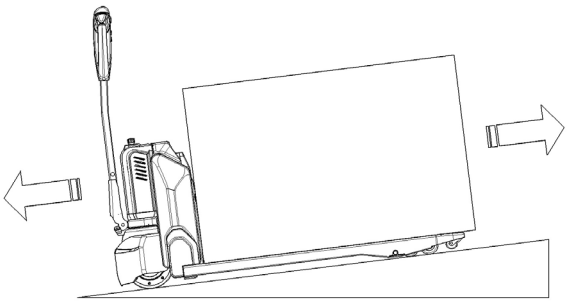
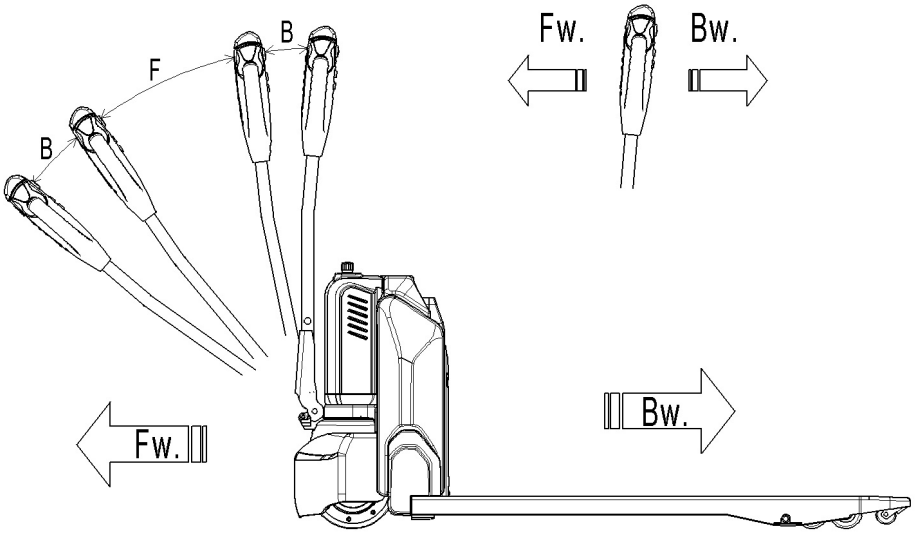


Fig. 8: Load facing uphill

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 activation from Pin-code panel, 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).



F. 10:Operating direction

Turn the acceleration button to the desired direction forward 'Fw.' or backward 'Bw.' (Figure 10).
Control the travelling speed by moving the accelerator button (Fig.8,13) 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 speed 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.

Steering

Steer the truck by moving the tiller to the left or right side. When the vehicle is moving forward (against the fork), turning the tiller to the right will turn the vehicle clockwise.

e. 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 braking 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.

f. Malfunctions

If there are any malfunctions or the truck is inoperative, please stop using the truck and activate the emergency switch (5) by pushing it. If possible, park the truck on a safe area and press the X button of pin-code 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.

g. Emergency

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

7. PIN-CODE PANEL

15EP-XB N is equipped with a pin-code panel (3).

20EP-XB Equipped with password ignition switch and ID card function.

a. Introduction

Password ignition switch (hereinafter referred to as "password lock") is an electronic system like an electronic anti-theft device. The machine will not be allowed to start until an authorized password is entered. The main function is to prevent unauthorized persons from operating the machine. In addition to the convenience of use, this product is also very helpful to the anti-theft and safety of the machine.

b. Main specification parameters

Operating voltage range: 12V-60V

Working environment: -40 C to + 90 C

Protection level: IP65

c. Main control codes and functions

The 15EP-XB is equipped with a password ignition switch, which supports 1 set of hand-entered password operation. The password consists of four digits, with a range of 0-9.

The 20EP-XB is equipped with a password ignition switch and ID card function. Supports up to 5 ID cards and 1 set of hand-entered passwords. The password consists of four digits in the range of 0-9.

ID card operation
Put the ID card near the password lock button panel, if the ID card is a valid ID card, the password lock will emit a short beeping sound, followed by a blue indicator light, indicating that the password lock is working normally, i.e. the electric lock switch signal is output normally. (The red indicator light will flash when the card is swiped incorrectly).

Password operation
The factory default password for the combination lock is "1234", the operator can directly use the password to start the vehicle

Refer to the following steps to reset the password:
- first enter "123", then press the "√" key and release
- then enter "123", then press the "√" key and release, the password is reset to "1234"

Refer to the following steps to add another operator's ID card.
- first enter "3434", then press the "√" key and release
- ID card refreshed within 5 seconds
- can add 5 ID cards to the machine

8. BATTERY SAFETY, CHARGING AND REPLACEMENT

- Only qualified personnel are allowed to service or charge the batteries. The instructions of this handbook must be observed.
- The batteries are lithium batteries.
- Recycling of batteries undergoes national regulations. Please follow these regulations.
- By handling batteries, open fire is prohibited!
- In the area of battery charging neither burning materials nor burning liquids are allowed. Smoking is prohibited and the area must be ventilated.
- Park the truck securely before starting charging or installing/changing the batteries
- Before finishing the maintenance work, make sure, that all cables are connected correctly and that they are no disturbing towards other components of the truck.

Table 3: Available batteries

Model	Battery options
15EP-XB	24V20Ah lithium battery
	24V30Ah lithium battery
	24V36Ah lithium battery
20EP-XB	48V20Ah lithium battery

Only lithium batteries are allowed.

Consider the operating temperature of the battery and the temperature at which it is allowed to charge

a. Replacement

Park the vehicle safely and press the emergency stop switch (5) to close the vehicle. Hold the battery box handle and lift the battery in a vertical direction.

Installation is the reverse of the removal.

Push the plastic part with your hand and gently pull it forward. Lift the battery up directly.

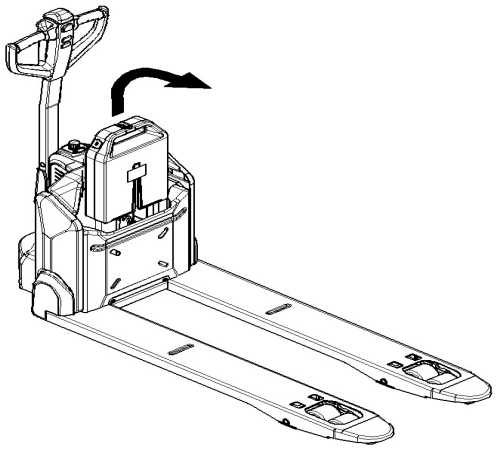
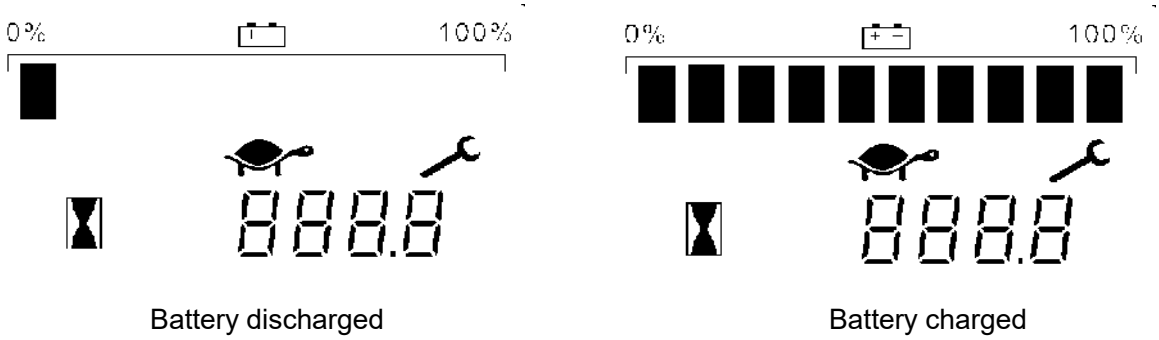


Fig.11: Replacing the battery

The difference between15EP-XB and 20EP-XB battery packs

Difference	15EP-XB	20EP-XB
EDGE15's battery appearance is not clearly marked, EDGE20's battery has a 48V mark at the top of the puller		
There is a battery model sticker in the recess of the puller, EDGE15 is labeled 24V, EDGE20 is labeled 48V		
Two models of battery dock connector jack is exactly opposite, a positive triangle and an inverted triangle, and in the color identification also has a color difference, EDGE15 is dark gray, EDGE20 is light gray		
Battery voltage is different, you can measure the voltage to distinguish	**24V**	**48V**

Battery Level Indicator



Battery discharged

Battery charged

Fig. 12: Battery discharge indicator

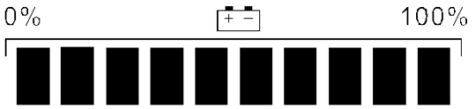
Display

An alpha-numeric liquid crystal display is fitted in the center of the unit that shows the hours worked. The display is backlight (the backlight is normally lighted).

Alarms

The same display can also indicate the alarm state, showing a code corresponding to the type of alarm.

Battery State of charge



The battery's state of charge indication is integrated in the LCD display; it is shown by ten notches. Each notch represent the 10% of the battery charge. As the battery becomes discharged, the notches turn off progressively, one after the other, in proportion to the value of the residual battery charge. This value, sent to the display by the controller via CAN-BUS.

15EP-XB: When there is fault code 0 on the display, means BATTERY LOW POWER. The lifting function will be cut off. Fault code 91 will appear if truck is further used without charging, driving speed will be slower.

20EP-XB : When there is fault code 12 on the display, means BATTERY LOW POWER. The lifting function will be cut off. Fault code 91 will appear if truck is further used without charging, driving speed will be slower.

Turtle Symbol: 

It is normally off, when it appears (fixed) it shows activation of the “soft” mode of the truck, in which maximum speed and acceleration are reduced.

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. The information supplied by the MDI-CAN can be extremely useful. Failures can be quickly identified by the operator or service technician thereby finding the fastest solution to the problem.

Hourglass Symbol:  It blinks when the hour meter is working.

b. **Charging**

- Before charging ensure that you are using an appropriate charger for charging the installed battery and that all safety measures are taken into consideration
- Before using the charger, please fully understand the instructions of the charger instructions.
- Always follow these instructions
- The room, where you are charging must be ventilated.
- The exactly charge status can be only checked from the discharge indicator. To control the status, the charging must be interrupted and the truck must be started.
- Do not make attempts to charge the battery if it is impacted and the battery case is damaged

Park the truck at a dedicated secured area with a dedicated power supply.
Lower the forks and remove the load;
Switch the truck off and connect the charger plug (20) to the charging port (21) on the battery. The charger starts charging the battery if the charger plug is connected to the main power supply.
Disconnect the charger plug from the battery and close the cap after the charger finished charging.
When charging is finished, disconnect the plug from the socket and place it in the designated pocket.
It's also allowed to remove the battery out and charge in dedicated area.
If a second battery is selected, the vehicle can be replaced with batteries to continue working, and the batteries that need to be recharged will be charged separately.

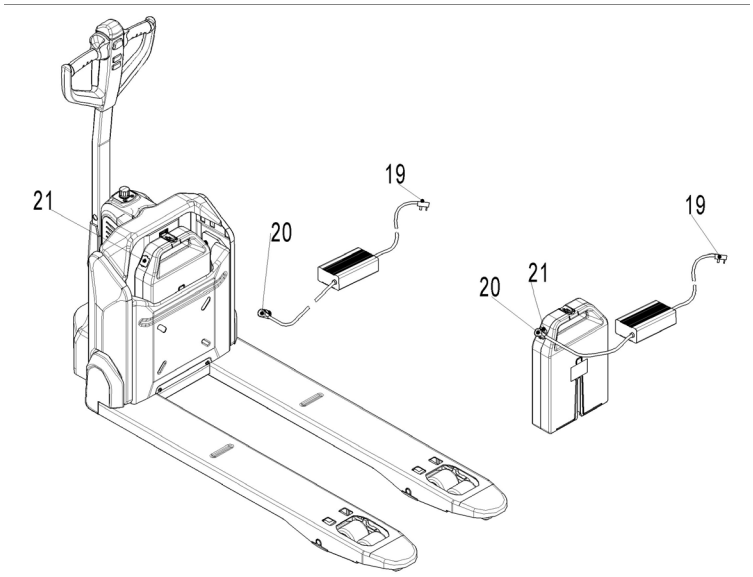


Fig.13: Battery charging

Table 4: LED-Status

LED- signal	Function
Red	Charging
Green	Fully charged

Table 5 : 15EP-XB charger Specifications

Model	Specification	Input	Output
DZL2420SS02	24V5A	100Vac -240Vac～2.0A MAX	29.4V 5.0A
DZL300SS02	24V8A	180Vac -240Vac～3.0A MAX	29.4V 8.0A
SSLC300V29	24V8A（EU）	180Vac -240Vac～3.0A MAX	29.4V 8.0A
SSLC300V29	24V8A（US）	108Vac -132Vac～5.0A MAX	29.4V 8.0A
QQE288-10CH109	24V12A	100Vac -240Vac～6.0A MAX	29.4V 12.0A

Table 6: 20EP-XB Charger Specifications

Model	Specification	Input	Output
DZL500SS02	48V9A	180Vac -240Vac ～2.0A MAX	54.6V 9.0A
SSLC500V48	48V9A（EU）	100Vac -132Vac ～5.0A MAX	54.6V 9.0A
SSLC500V48	48V9A（US）	180Vac -240Vac ～2.0A MAX	54.6V 9.0A

9. REGULAR MAINTENANCE

- Only qualified and trained personnel are allowed to do maintenance on this truck.
- Before maintaining, remove the load from the forks and lower the forks to the lowest position.
- If you need to lift the truck, follow chapter 4b by using designated lashing or jacking equipment. Before working, put safety devices (for instance designated lift jacks, wedges or wooden blocks) under the truck to protect against accidental lowering, movement or slipping.
- Please pay attention by maintain the tiller arm. The gas pressure spring is pre-loaded by compression, carelessness can cause injury.
- Use approved and from your dealer released original spare parts.
- Please consider that oil leakage of hydraulic fluid can cause failures and accidents.
- It is allowed to adjust the pressure valve only from trained service technicians.
- Long-term storage of vehicle batteries (more than 3 months) must be placed in a dry, cool place. Charge and discharge the battery once every 3 months with a storage voltage of about 25 to 26V.

If you need to replace the wheels, please follow the instructions above. The casters must be round and free of abnormal wear.
Check the items emphasized in maintenance checklist.

a. Maintenance checklist

Table 7: Maintenance checklist		Interval(Month)			
		1	3	6	12
Hydraulic					
1	Check the hydraulic cylinder for damage noise and leakage		•		
2	Check the hydraulic joints for damage and leakage		•		
3	Inspect the hydraulic oil level, refill if necessary		•		
4	Replace the hydraulic oil (12 month or 1500 working hours)				•
5	Check and adjust the pressure valve (1500kg(PTE15N)+0/+10% or 2000kg(PTE20N)+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 the steering bearing				•
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		•		
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		•		
Battery					
27	Check the battery voltage		•		
28	Clean the terminals for corrosion and damages		•		
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 tiller proximity switch function	•			
General					
40	Check if all decals are legible and complete	•			
41	Inspect the castors, adjust the height or replace 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.

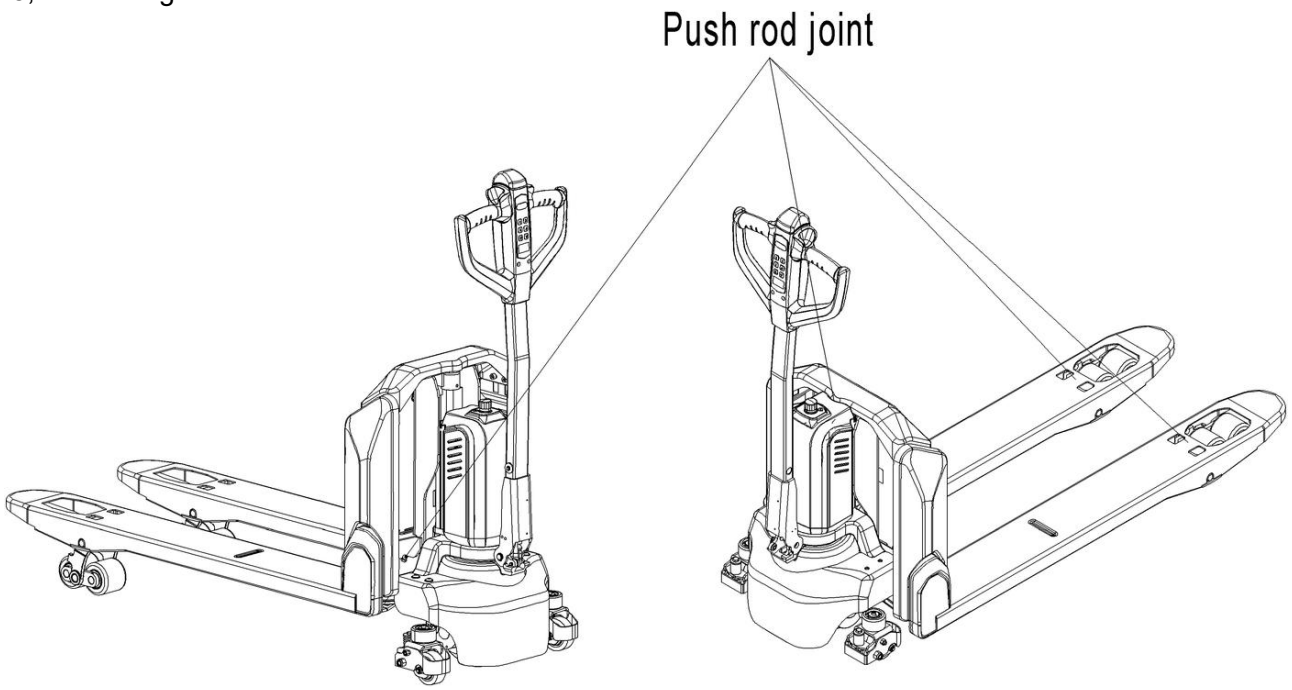


Fig. 14: Lubricating points

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 properly 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

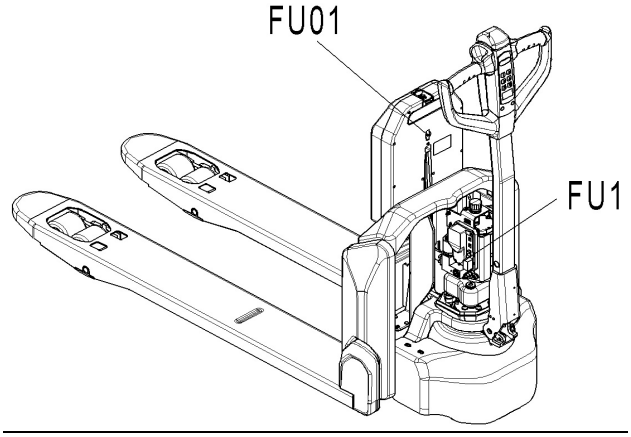


Fig. 15 Location of fuses for 15EP-XB

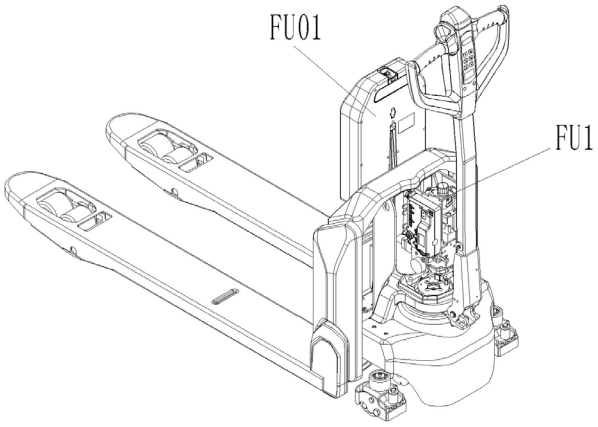


Fig. 16: Location of fuses for 20EP-XB

Table 8: Rate of the fuses

	Specification
fuse 01	70A
fuse 1	10A

10. TROUBLE SHOOTING

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

Table 9: Trouble shooting

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 from 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 switch clockwise
	Tiller in the operating	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.

Meter fault code display

Some faults will be displayed in the meter，The icon lights up and a fault code is displayed in the time display.

11. WIRING/ CIRCUIT DIAGRAM

a. Electrical circuit diagram

PTE15N without speed reduction on curves

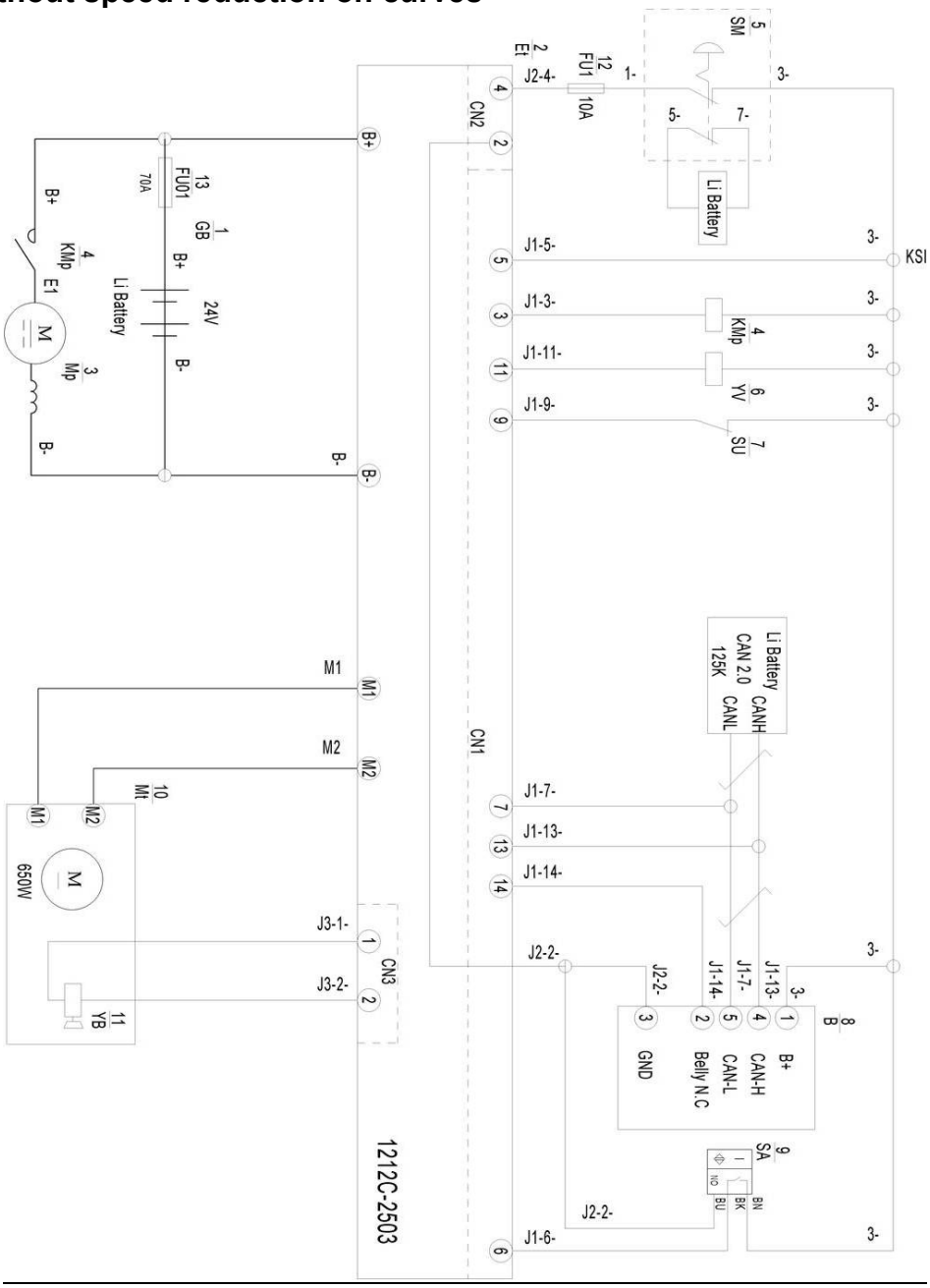
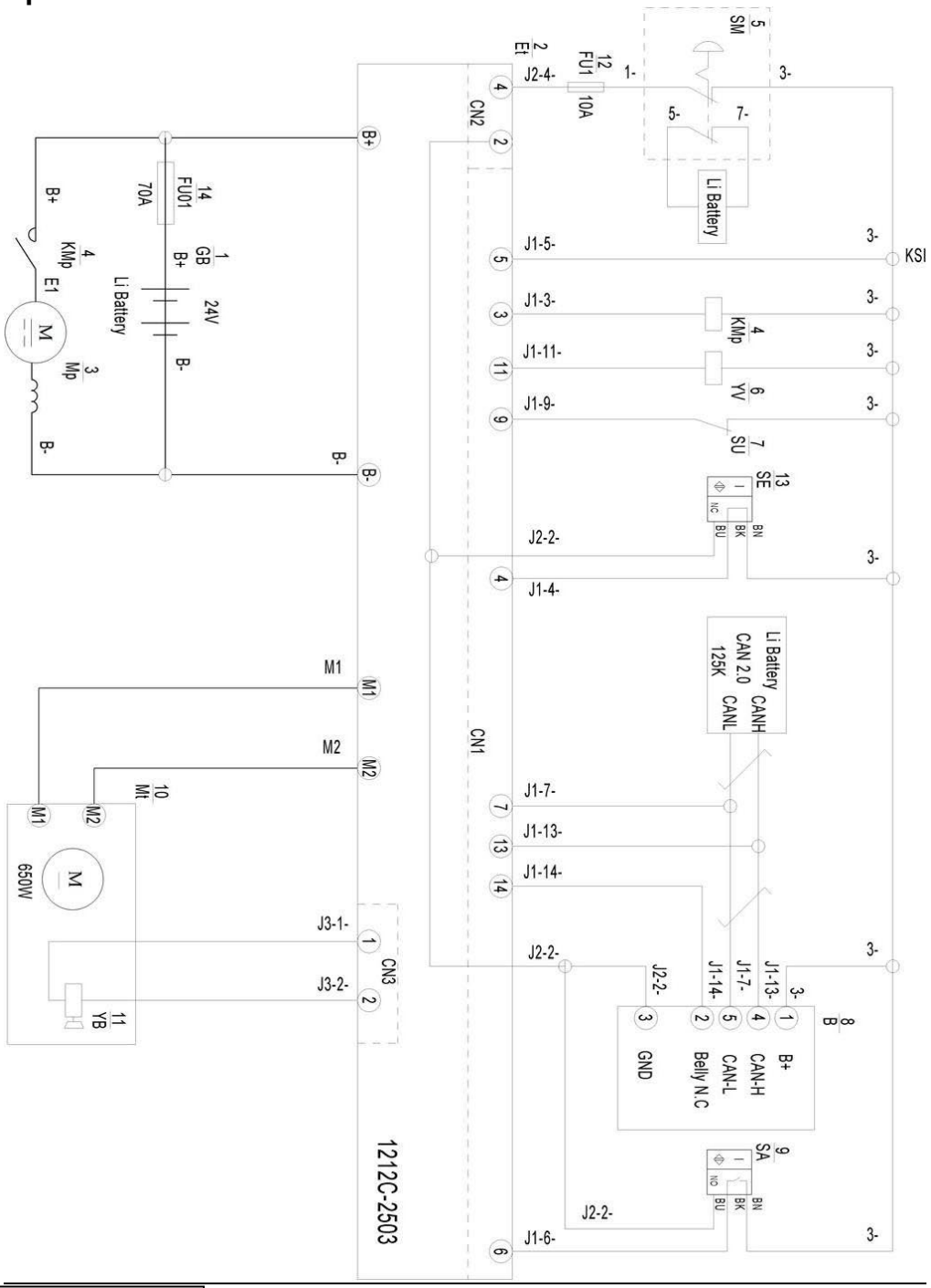


Fig.17: Circuit diagram

Table 10: 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 switch	FU1	10A fuse
YV	Electromagnetic valve	FU01	70A fuse
SU	Micro switch		

15EP-XB speed reduction



fuse 1 : 10A fuse 01 : 70A

Fig 18: Circuit diagram

Table 11: 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 switch	FU1	10A fuse
YV	Electromagnetic valve	SE	Proximity switch
SU	Micro switch	FU01	70A fuse

15EP-XB without speed reduction on curves (20CE/EN1175)

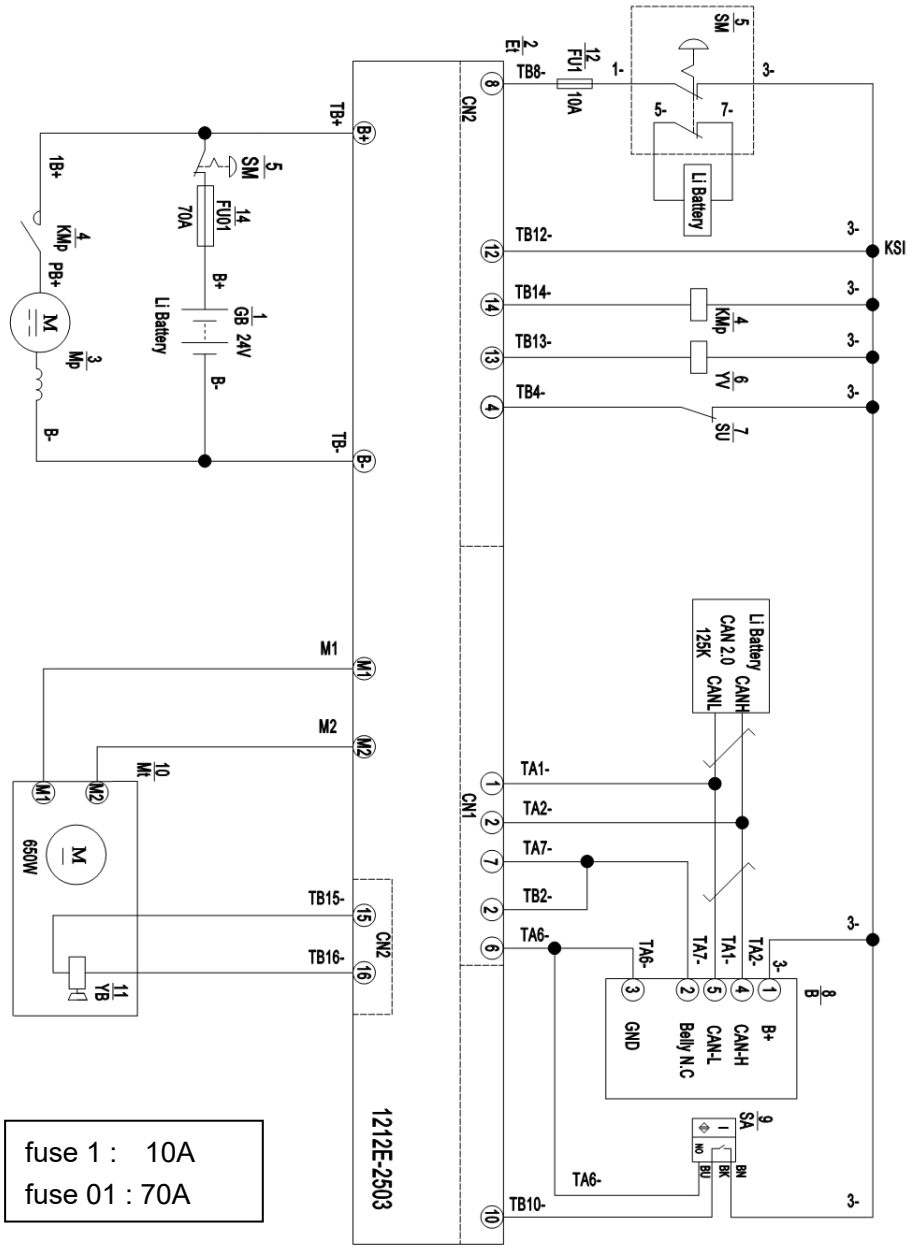


Fig 19: Circuit diagram

table 12: 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 switch	FU1	10A fuse
YV	Electromagnetic valve	FU01	70A fuse
SU	Micro switch		

15EP-XB speed reduction (20 CE/EN1175)

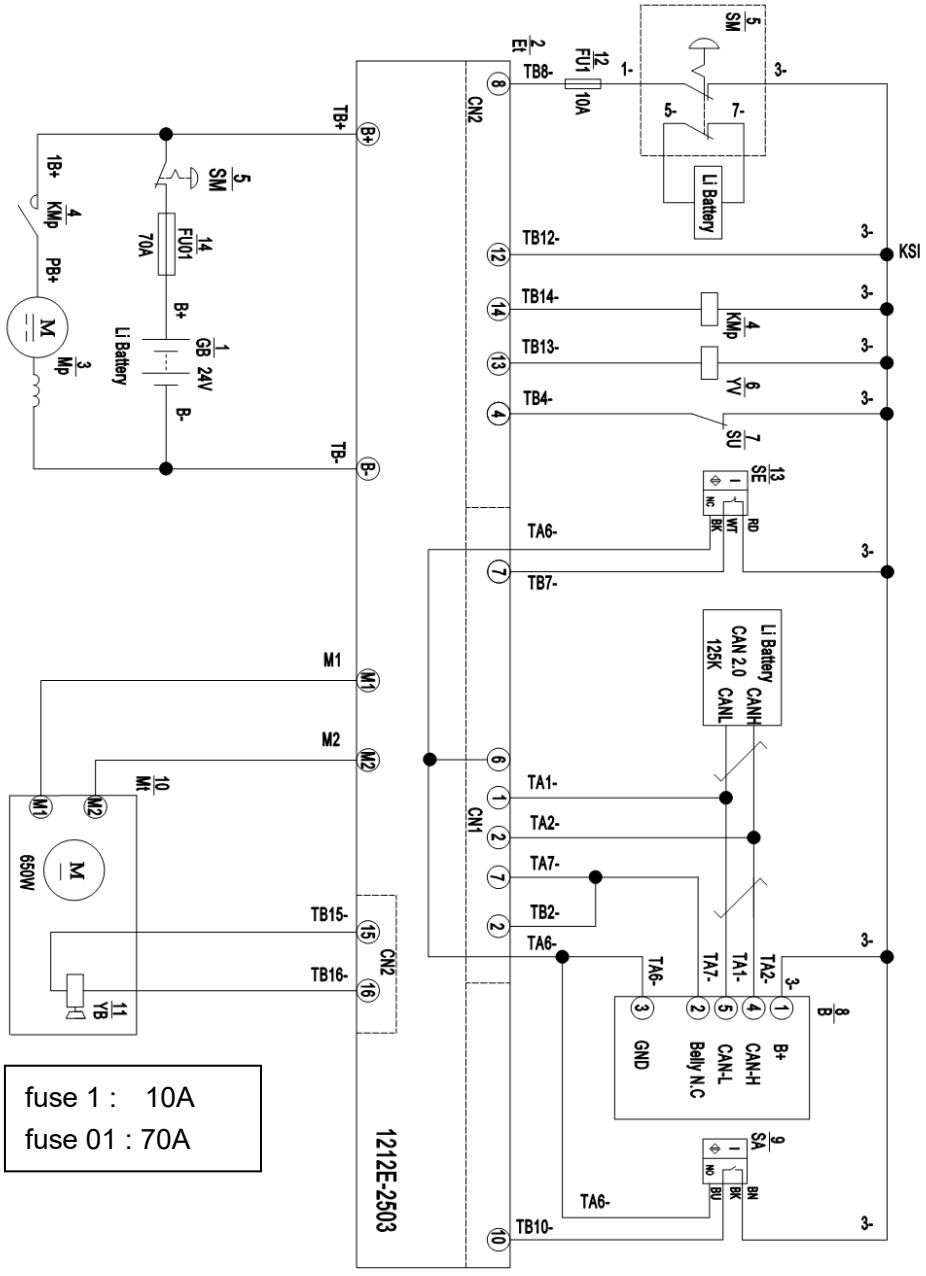
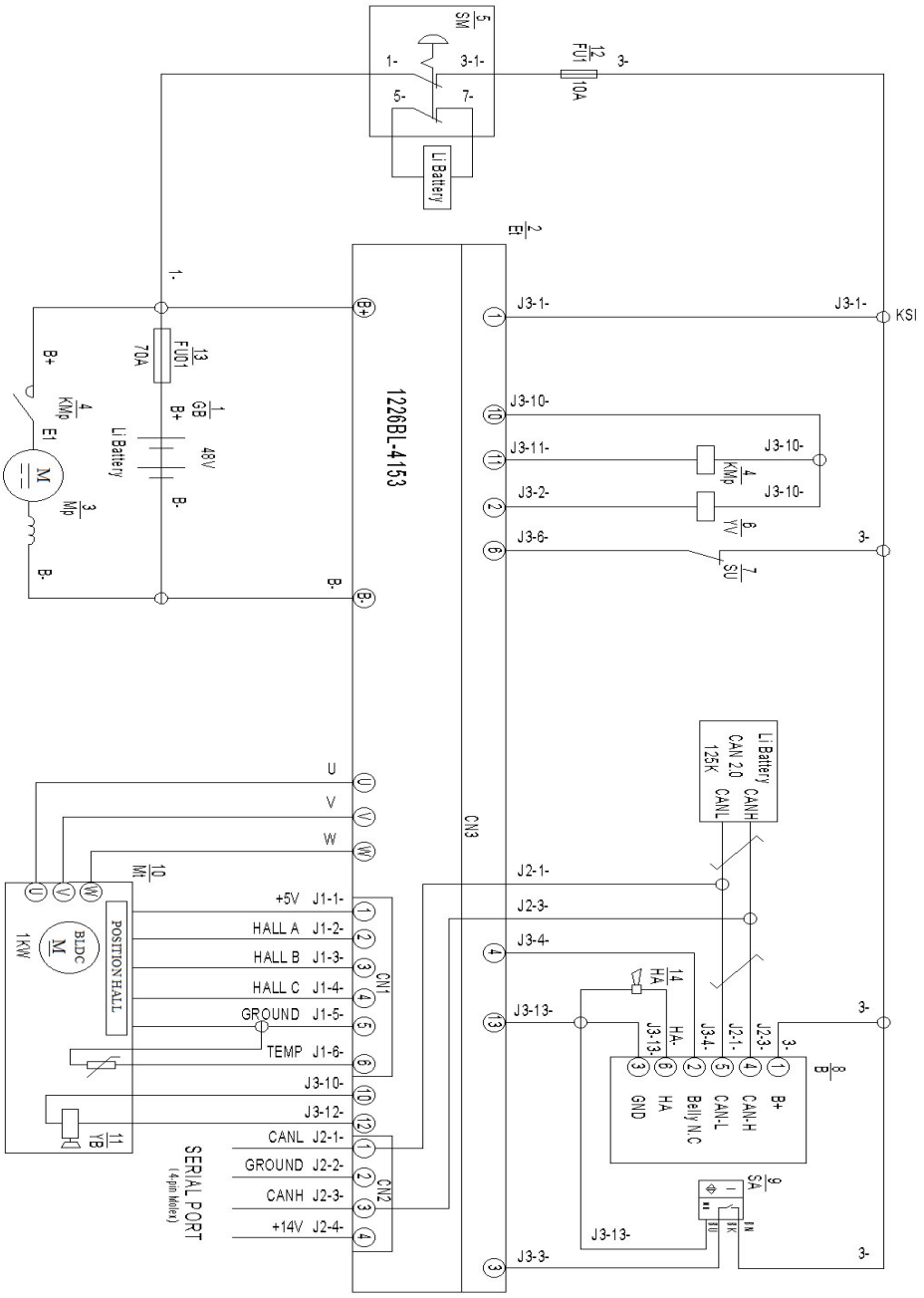


Fig 20: Circuit diagram

Table 13: 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 switch	SE	Proximity switch
YV	Electromagnetic valve	FU1	10A fuse
SU	Micro switch	FU01	70A fuse

20EP-XB without speed reduction on curves



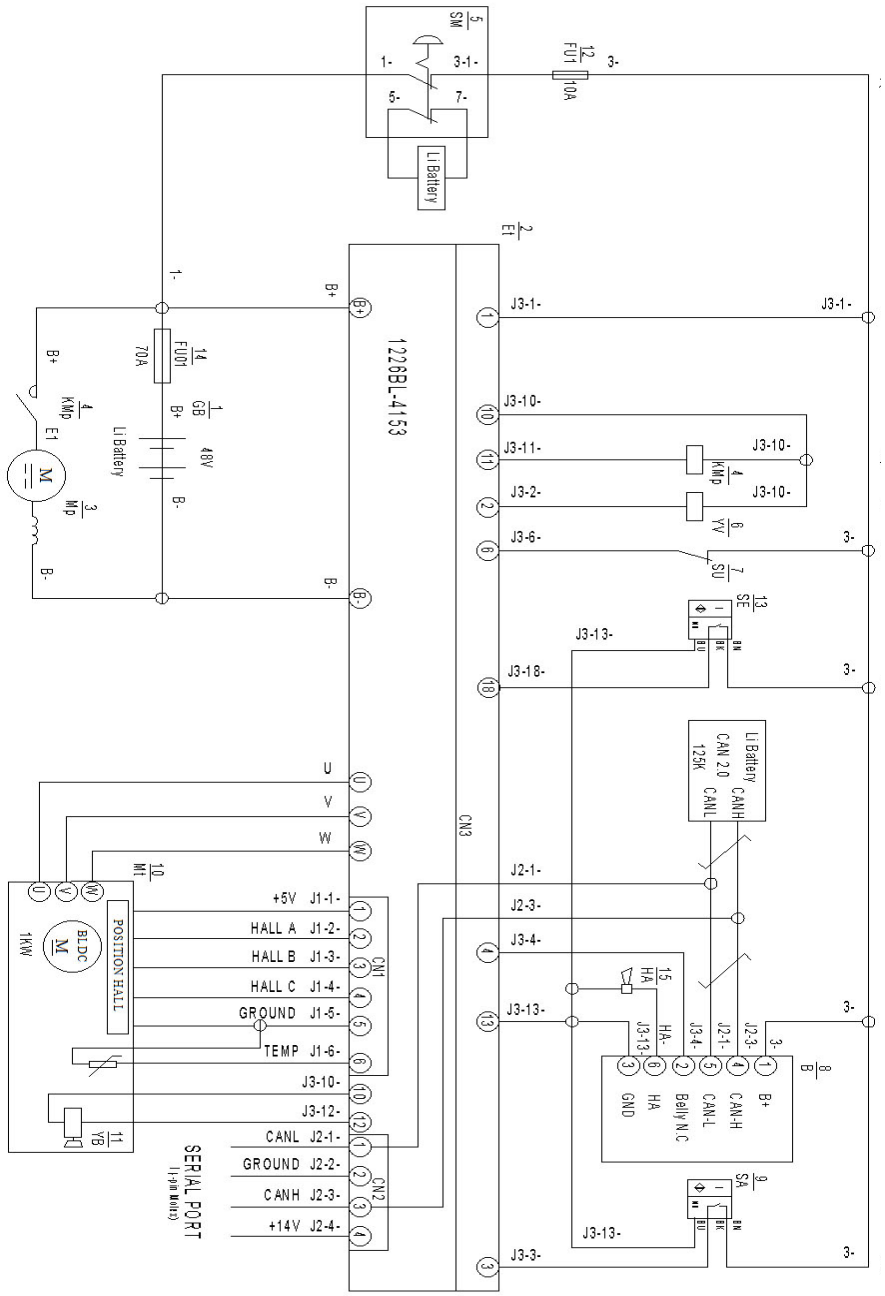
fuse 1 : 10A
fuse 01 : 70A

Fig.21: 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	HA	Buzzer

20EP-XB speed reduction



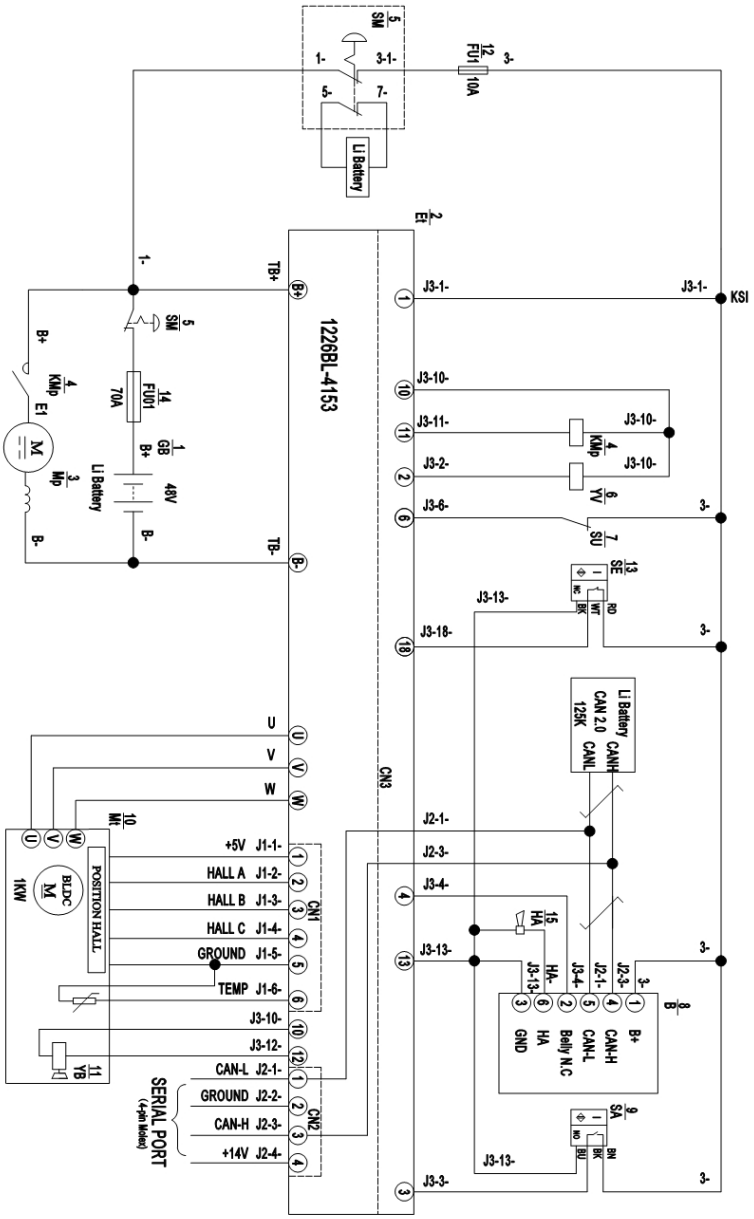
fuse 1 : 10A
fuse 01 : 70A

Fig 22: Electrical 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	FU01	70A fuse
SU	Micro switch	HA	Buzzer
SE	Proximity switch		

20EP-XB speed reduction (20 CE/EN1175)



fuse 1 : 10A
fuse 01 : 70A

Fig 23: Circuit Diagram

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	FU01	10A fuse
YV	Electromagnetic valve	FU1	70A fuse
SU	Micro switch	HA	Buzzer
SE	Proximity switch		

b. Hydraulic circuit

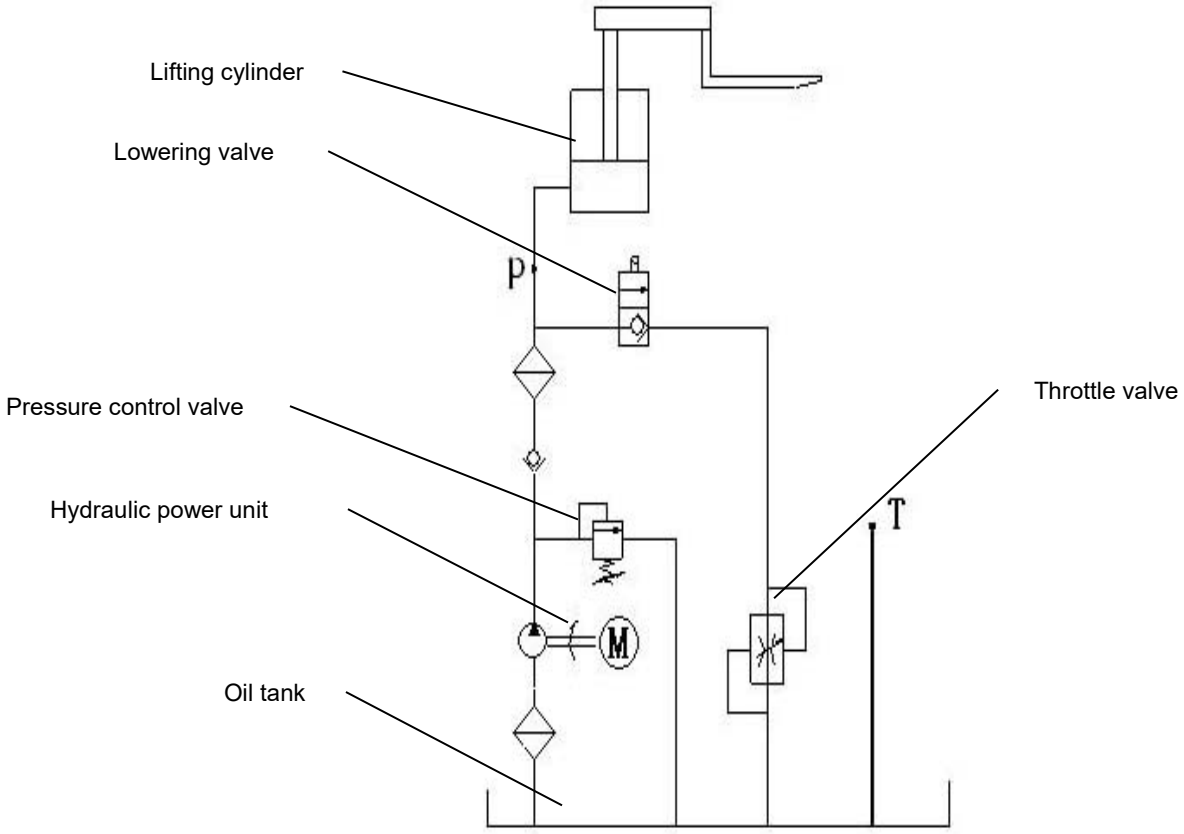


Fig.24: Hydraulic circuit

Hydraulic oil inspection

Appearance	Scent	Situation	Results
Clear without discoloration	Good	Good	Can be used
Transparent color	Good	Mixing with other oils	Check viscosity, if it passes, it can continue to be used
Color changes like milk	Good	Mixing with air and water	Separate the water or replace the hydraulic oil
Color changes to dark brown	Not good	Oxidation	Replace the hydraulic fluid
Color is clear but with small black spots	Good	Mixing with other particles	Filter and use

12. Electronic Systems

a-1 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.

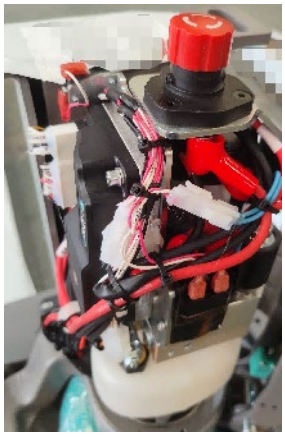
4 When the load is supplied with current higher than the limit, the fuse protects all DC loads from overcurrent by cutting off the power supply to the load.

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-1Appearance 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

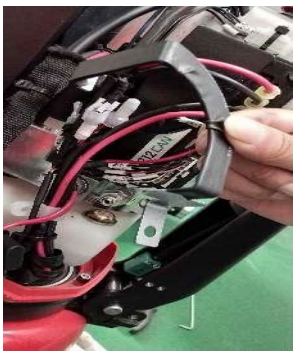
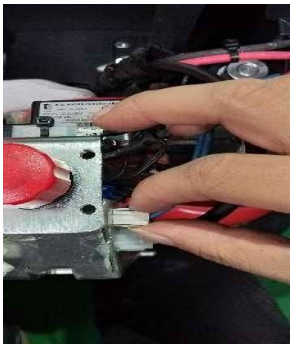
Preliminary Steps

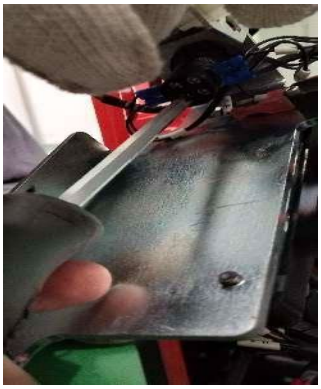
1 Park the vehicle safely and remove the housing.

2 Cut off the power supply.

3 Disconnect the battery connector.

Emergency Stop switch disassembly and installation

15EP-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	The pressure plate will be removed, the installation of the upper end of the hook must be hooked on the bracket plate, not hooked on the controller
			
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

20EP-XB			
			
Remove the 3 fixing bolts of the bracket with a 5mm hexagon socket		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.

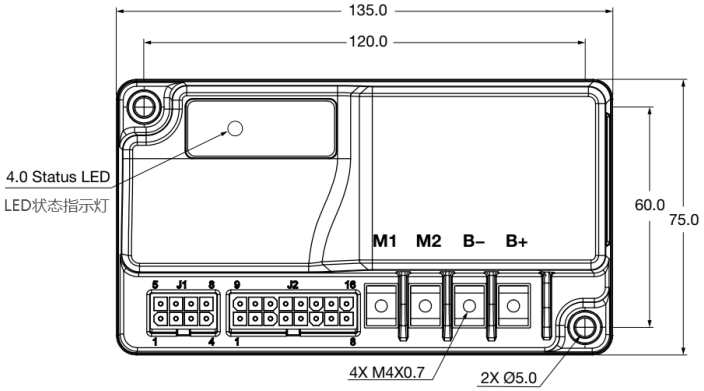
c.Controller and related devices

c-1 Appearance

1)Controller Curtis 1212C(15EP-XB)

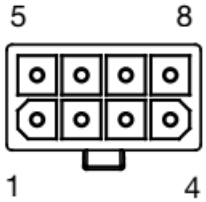
Logic section insert: 14 pole Molex Mini-Fit Jr., P/N 39-01-2140
Electromagnetic brake plug-in: 2 pole Molex Mini-Fit Jr;
Handheld programming port plug-in: 4-pole Molex Mini-Fit Jr;
Power section plug-in: AMP plug-in, P/N 12076SL02

2)Controller Curtis 1212e(20 CE/EN1175)(15EP-XB)



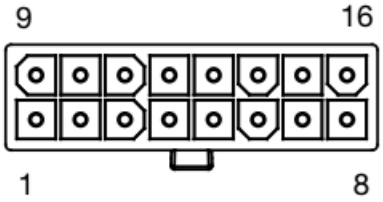
Docking connector： 8core Molex Mini-Fit Jr.
16core Molex Mini-Fit Jr.

CONNECTOR PINOUT CHARTS



J1

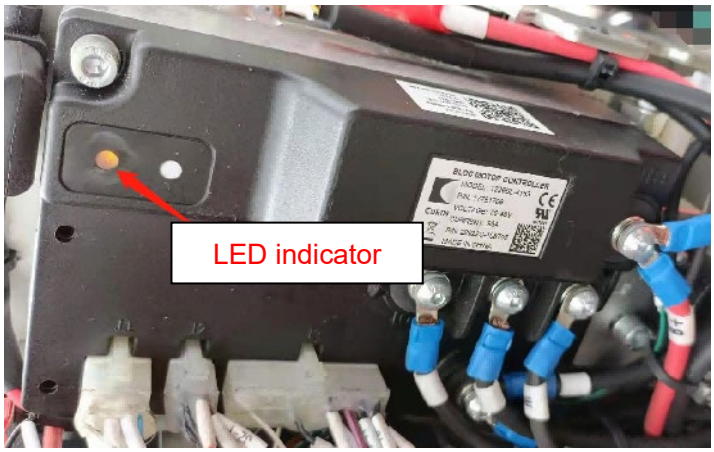
Pin	Description
1	CAN L
2	CAN H
3	Switch 1
4	Charger Inhibit
5	Switch 5
6	I/O Ground
7	Switch 2
8	Horn Driver



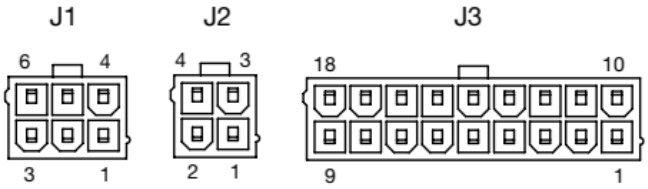
J2

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+

3).controller Curtis 1226BL　EN1175:2020 (20EP-XB)



CONNECTOR PINOUT CHARTS



J1

PIN	DESCRIPTION
1	EXT +5V
2	Speed Sensor Input/ Switch6/Analog6
3	Generic Driver 1
4	Brake +
5	I/O Ground
6	Motor Temp Sensor Input/Switch5/Analog5

J2

PIN	DESCRIPTION
1	Serial Rx/CAN L
2	I/O Ground
3	Serial Tx/CAN H
4	EXT +14V

J3

PIN	DESCRIPTION	PIN	DESCRIPTION
1	KSI	10	Coil Return
2	Horn Driver	11	Generic Driver 3
3	Interlock Input/Switch 7	12	Generic Driver 2
4	EMR NC Input/ LED3 Driver/Switch 3/Analog3	13	I/O Ground
5	BDI Output	14	EMR NO Input/Switch 10
6	Speed Limit Pot Input/ Switch 2/Analog 2	15	Charge Inhibit/Switch 11
7	Pot Wiper/ Switch1/Analog1	16	Pot High/Switch 4/Analog 4
8	Reverse Input/LED2 Driver/Switch 8	17	Forward Input/Switch 12
9	Push Input/Switch 9	18	Mode Input/LED1 Driver/Switch 13

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.

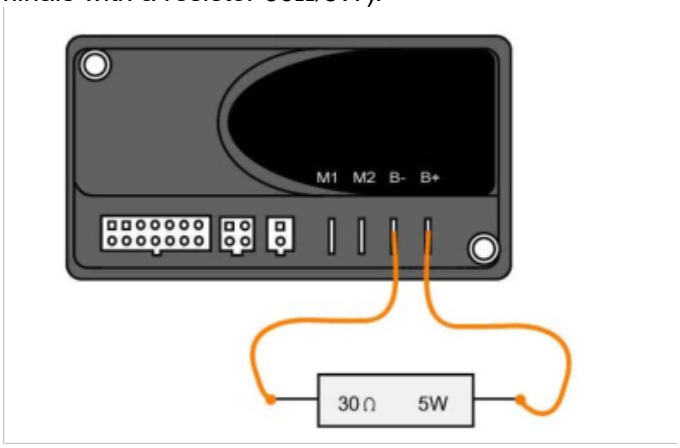
5. The motor controller has self-diagnostic function. In the process of working, once the controller fails, the fault code will be displayed on the tiller display instrument, and the controller will automatically stop working to ensure the security of the operating system.

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

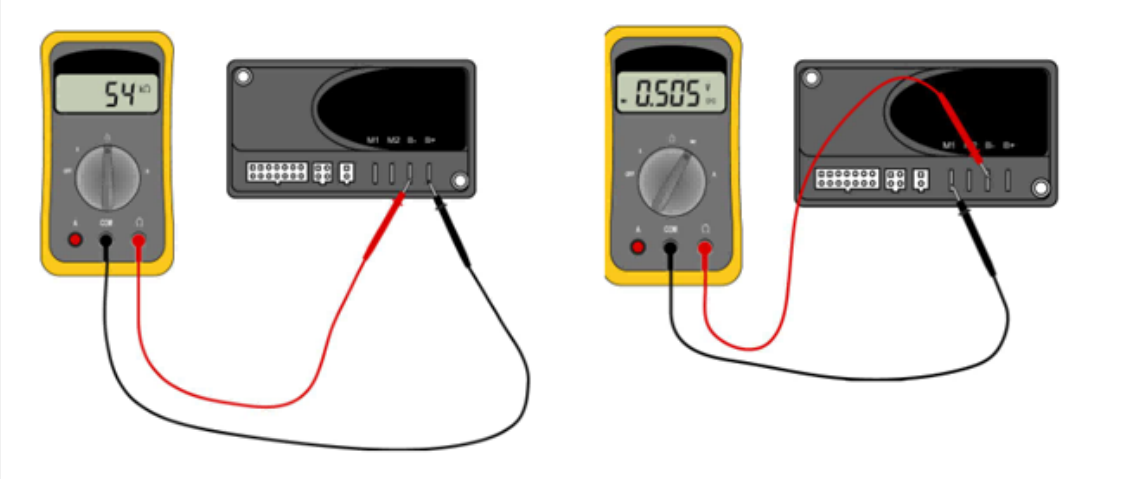
c-3 Test (Example: Curtis 1212C)

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



Item	Multimeter 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	

Multimeter pull to Ω file (resistance value determination) Multimeter 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

15EP-XB Controller Disassembly			**20EP-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**	**Remove the harness plug-in, remove the cable fixing bolt and controller fixing bolt with hexagonal angle within 5mm, remember the cable number and installation location, one to one**

Installing the controller is the reverse of the above steps.

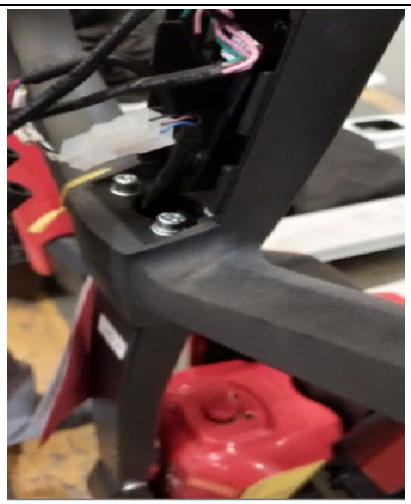
d. Tiller head

d-1 Function

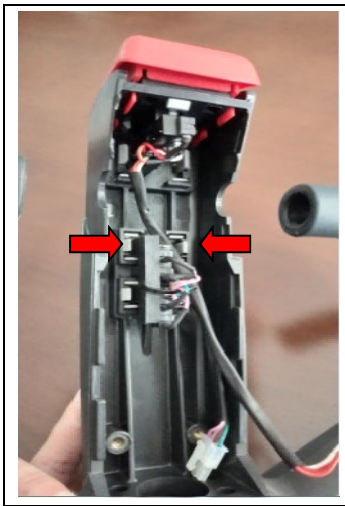
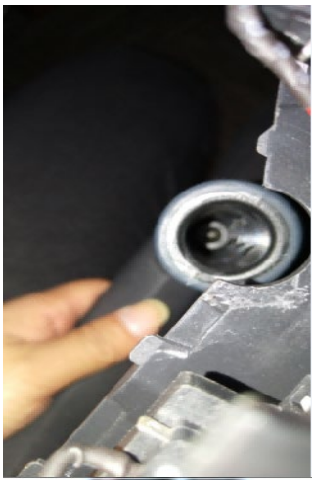
The tiller head controls some of the vehicle's movements through up and down buttons, belly switches, turtle buttons, throttle and combination locks and controller interplay.
A combination lock
B lift and lower
C belly switch
D throttle
E turtle switch
F horn switch

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.

3. Difference between the tiller of 15EP-XB and 20EP-XB

Differentiation points	15EP-XB	20EP-XB
EDGE15 tiller is a pure combination lock with only four numeric keys, EDGE20 tiller is based on this increase in the function of card unlocking		

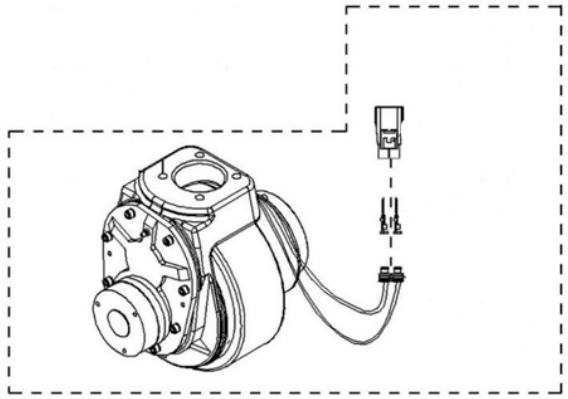
13.Drive/Brake System

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.
4. 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

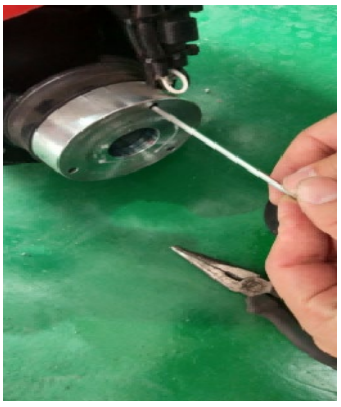
		
1. Remove with 5mm hexagon	**2. Use 6mm hexagon to remove 4 bolts on the bearing cover, here the bolts need to be installed with 1243 strength thread adhesive**	**3. The drive assembly is dropped so that the drive part is separated from the car body**
		
4. Use iron or other hard objects to pad the middle 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

Brake Disassembly

15EP-XB Brake Disassembly		20EP-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.**	**Remove the brake by removing the three brake retaining bolts with a 4mm hexagon socket.**

c. Trouble shooting

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

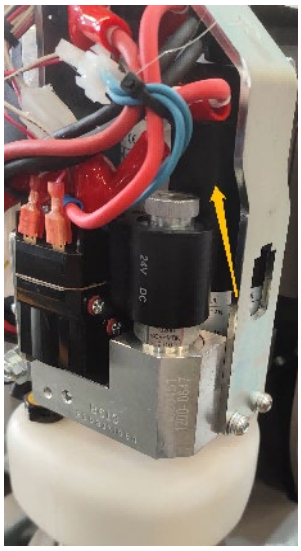
c-2 Dirver box

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 retorque 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 retorque to the specified torque.

14.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.

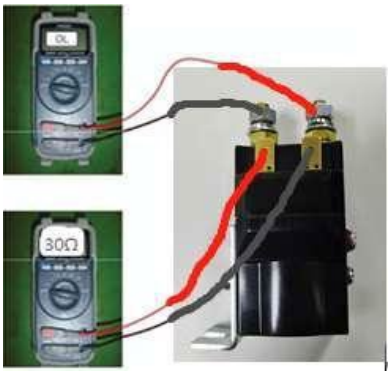
The pump motor is connected to the controller via a motor contactor. The controller operates the pump motor contactor based on inputs from multiple switches and sensors and internal parameter settings.

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

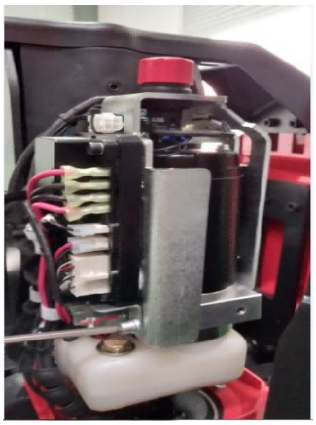
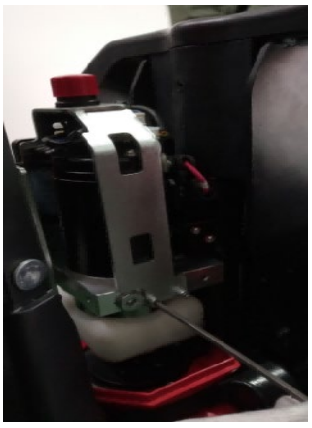
Pump motor contactor Inspection:

For the pump motor contactor, as shown in Fig.

and check that it measures the specified value.



b-2 pump station disassembly (pump body and cylinder connection part of 20EP-XB reference cylinder 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.**	**O-ring specification is 13.5*1.8**

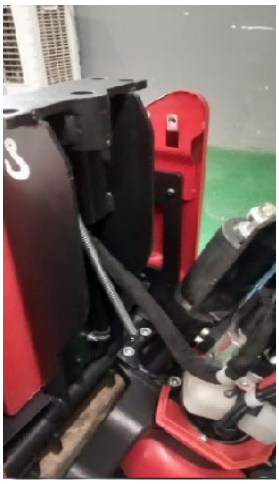
			
Use a screwdriver to loosen the clamp	**The tank and the pump station can be pulled apart. When installing the pump station, pay attention to whether the O-ring is installed in place and cannot be stuck by the tank opening and exposed outside and not in the groove.**	**Note: Pump station pressure adjustment First use a 10mm wrench to loosen the nut counterclockwise**	**Note: Pump station pressure adjustment Then use the 3mm hexagonal pressure adjustment, tighten is pressurized spin loose is to release pressure**

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

c.Lifting cylinder

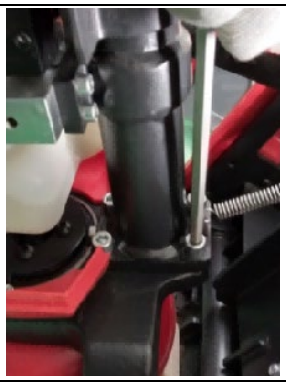
The cylinder is powered by a pump station.

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**
		**The separation of the cylinder from the pump station and the disassembly of the cylinder, see next page, there are slight differences in the structure of PTE15N and PTE20N**	
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.

			
15EP-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		20EP-XB cylinder and pump station connection structure and 15EP-XB slightly different, where the two O-ring specifications are 12.7 * 9.8 * 1.25, 9.5 * 1.8, in addition to the pump body O-ring specifications with 15EP-XB 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-XB'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.

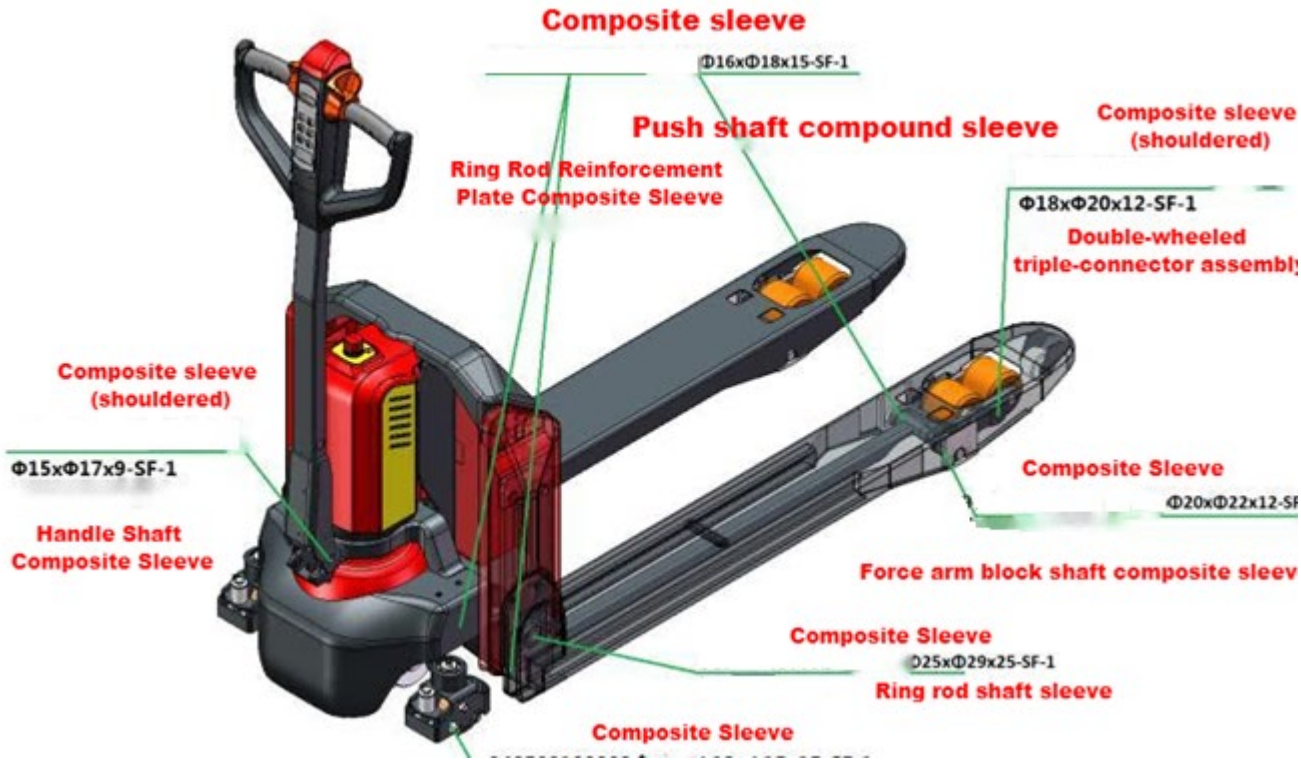
d.Troubleshooting

Pump motor

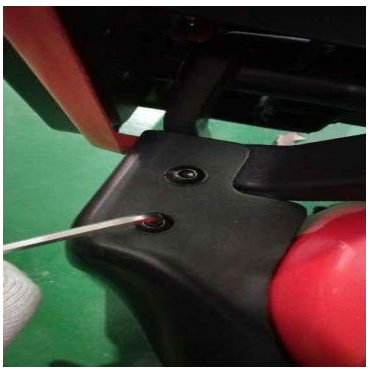
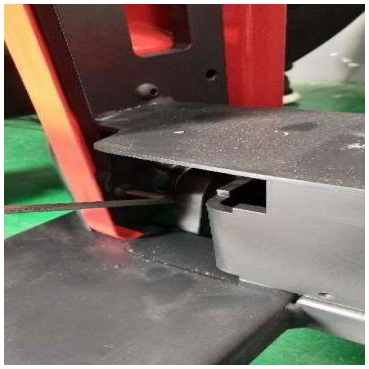
Problem Display	Possible Cause
Hydraulic pump motor does not work.	Poor connection or blown fuse. Check battery connection. Check key fuse. Check the hydraulic pump motor for possible blown fuses.
	power switch, upper limit switch, line contactor not closed. Turn off the power switch. Use a multimeter 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)

15.Main components, disassembly and installation and description requirements

a.The whole truck composite sleeve specifications diagram



b.Disassembly of coverings

		
Remove the two bolts on the top of the motor cover using a 4mm hex socket to pull them out upwards	**Remove two bolts on the left and right sides of the drive cover using a 6mm hexagonal socket**	**Remove the two bolts on the inside of both sides of the top cover with 6mm inner hexagonal**
		
The front cover is fixed with one bolt on the left and right sides, and can be removed with a 6mm inner hexagon	**Two bolts in front and bottom of the front cover. Remove the front cover with 6mm inner hexagonal**	**Three bolts in triangular area below the inside of both sides secured the side cover and can be removed with 6 mm inner hexagonal**

c.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**

d.Drive Wheel Ring Replacement

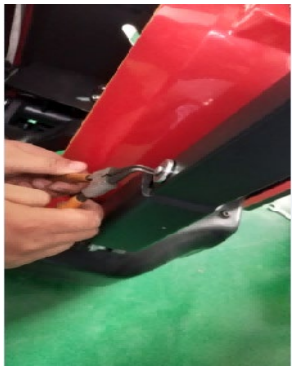
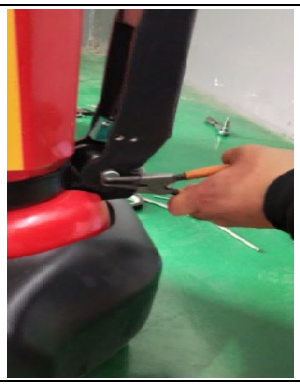
15EP-XB Drive Wheel		20EP-XB Drive Wheel
		
When replacing the drive wheel, cut off the tie and unplug the motor cable connector	**Remove 10 retaining bolts of driving wheel ring with 5 mm inner hexagonal angle, then remove the wheel ring, pay attention to the location of positioning holes and pins during 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).**	**PTE20N drive wheel is AC motor, blue connector is U, V, W three-phase motor, two black ones are encoder, one is temperature sensor, after unplugging the encoder plug-in is four cores, the temperature sensor is two cores, can not be inserted incorrectly. Operation of disassembling driving wheel ring with 15EP-XB after unplugging plug-in**

e.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.**

f.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**

Installation

			
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.**

g.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.

h. 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**

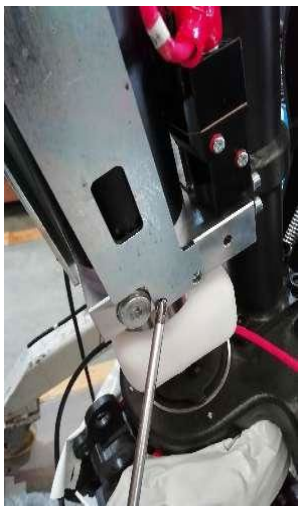
Installing the contactor is the reverse process of the above steps.

i.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**

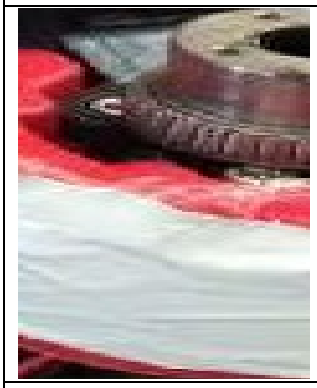
Installing the motor is the reverse process of the above steps.

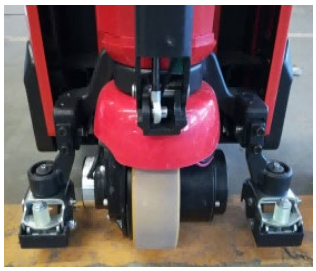
j.Limit micro switch disassembly and installation

15EP-XB			**20EP-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**	**20EP-XBN Limit micro motion in this position, disassembly similar to 15EP-XB**

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

k.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；**

16.CURTIS Handheld 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

Note: The electronic control of 20EP-XB can not connect to the handheld unit before mid-2018. The connection wires are different from 15EP-XB and the software on PC side is different.

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

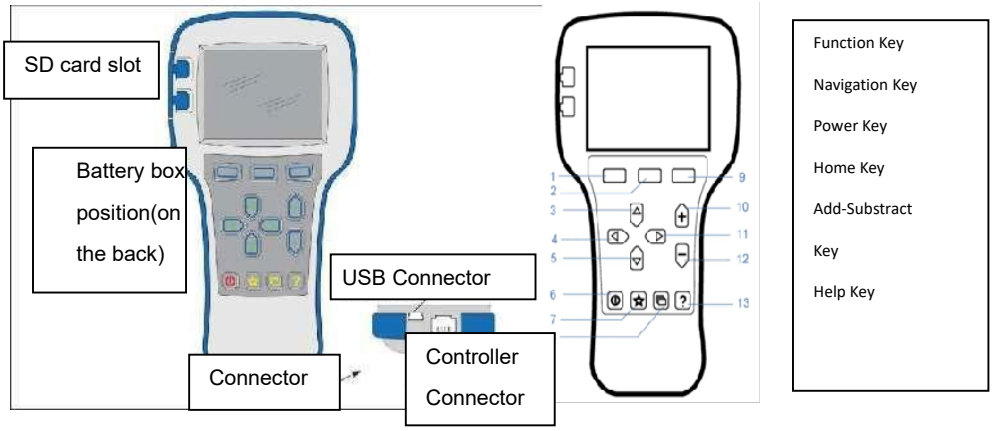
Please open the corresponding Inspection menu sub item according to the need, run the vehicle, and observe the change of handheld value.

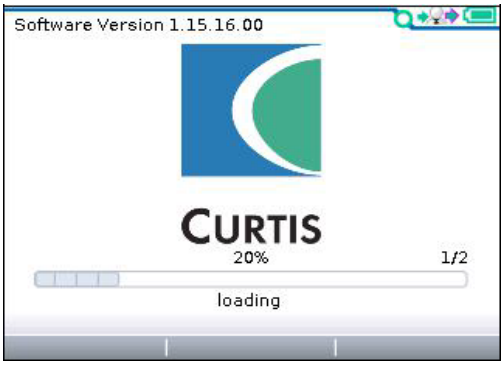
Contents of CURTIS Handheld Menu

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.





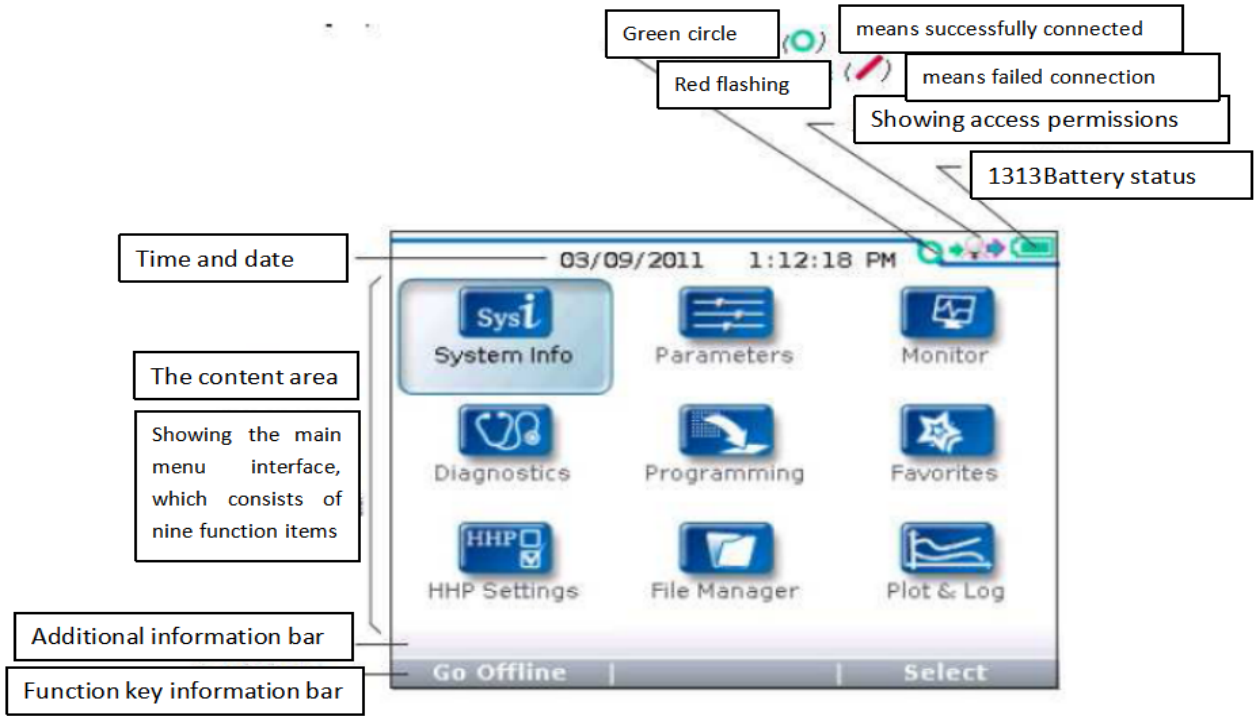
Once the 1313 HHP has uploaded the information from the controller, it displays the Main Screen

Programmer power on

The difference between the connection cables of handheld programmers

	
Connection cable for 15EP-XB	Connection cable for 15EP-XB

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

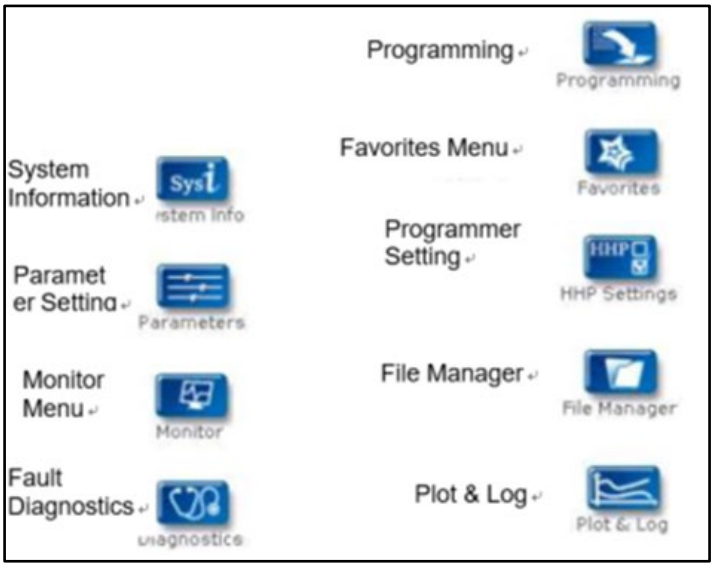
Menu structure

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.

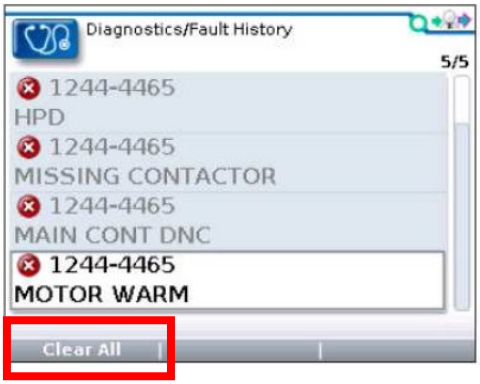
Nine main menus



。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"

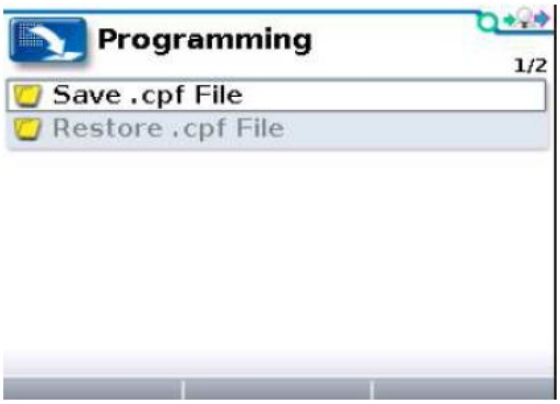
Note: the fault caused by a temporary event captured in the circuit is not a real system fault in some cases. and you can determine if the fault really exists by restarting the system and observing the automatic fault indication. In the history failure folder, the failures listed are all failures encountered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

17.Troubleshooting for Each Fault Code

a.15EP-XB Countermeasures of fault codes(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 overtemp. 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

15EP-XB Countermeasures of fault codes Curtis 1212e(20CE/EN1175:2020)

No	Code	Fault name	Possible cause	Source
1	11-1	Severe Undervoltage	Controller defective Battery defective	1212E Controller
2	12-1	Undervoltage 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 Undertemp	Temperature sensor defective Low ambient temperature	1212E Controller
7	16-1	Controller Overtemp Cutback	Temperature sensor defective High current for a long time	1212E Controller
8	17-1	Controller Severe Overtemp	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	Precharge Failed	Precharge PTC defective	1212E Controller
20	26-2			
21	31-1	Stall Detected	Precharge 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, the use of equipment	Lithium Battery

			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

b.20EP-XB Fault Code List (Curtis 1226BL)

N200(26C-1) & N200(26C-1)Tiller Fault Code Lookup Table					
No.	Code	Display	Description	Source	Electric control fault LED
1	0	Mode fault	Tiller tortoise speed button fault. The tortoise speed button is detected closed before starting.	Tiller	
2	1	Lift fault	Lifting button fault. The lifting button is detected closed before it is switched on.	Tiller	
3	2	Lower fault	Lowering button fault. The lowering button is detected closed before it is switched on.	Tiller	
4	3	BMS Communication Outage	Lithium battery communication timed out, 1. Lithium battery BMS damaged. 2. The communication line from the lithium battery to the tiller damaged. 2. The tiller communication module damaged.	Tiller	
5	4	Throttle_FAULT	The Accelerator is not in the middle before entering the password. A reset of the Accelerator is required to remove the fault. Improper sequence of throttle input.	Tiller	
6	12	SEVERE UNDERVOLTAGE	Capacitor bank voltage dropped below the Severe Undervoltage limit	1226BL-4153 controller	1,2
7	12	UNDERVOLTAGE CUTBACK	Capacitor bank voltage dropped below the Undervoltage limit with the FET bridge enabled	1226BL-4153 controller	1,2
8	13	SEVERE OVERVOLTAGE	Capacitor bank voltage exceeded the Severe Overvoltage limit	1226BL-4153 controller	1,3
9	13	OVERVOLTAGE CUTBACK	Capacitor bank voltage exceeded the Overvoltage limit with the FET bridge enabled.	1226BL-4153 controller	1,3
10	14	CONTROLLER OVERTEMP CUTBACK	Heatsink temperature over +75C	1226BL-4153 controller	1,4

11	14	CONTROLLER SEVERE UNDERTEMP	Heatsink temperature below -40C	1226BL-4153 controller	1,4
12	14	CONTROLLER SEVERE OVERTEMP	Heatsink temperature over +85C	1226BL-4153 controller	1,4
13	15	MOTOR TEMP SENSOR	Motor thermistor input is at the voltage rail(0 or 10V)	1226BL-4153 controller	1,5
14	15	MOTOR TEMP HOT CUTBACK	Motor temperature is at or above the Temperature Hot parameter setting	1226BL-4153 controller	1,5
15	21	THROTTLE	Throttle input is out of range	1226BL-4153 controller	2,1
16	21	HPD SEQUENCING	HPD(High Pedal Disable) or sequencing fault caused by incorrect sequence of KSI, interlock, direction and throttle inputs	1226BL-4153 controller	2,1
17	22	MAIN CONTACTOR WELDED	Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge	1226BL-4153 controller	2,2
18	22	MAIN CONTACTOR DID NOT CLOSE	With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+	1226BL-4153 controller	2,2
19	22	MAIN DRIVER FAULT	Main Contactor driver is either open or shorted	1226BL-4153 controller	2,2
20	22	PRECHARGE FAILED	Controller failed to precharge	1226BL-4153 controller	2,2

21	23	ENCODER	Motor encoder phase failure detected	1226BL-4153 controller	2,3
22	23	STALL DETECTED	No motor encoder movement detected	1226BL-4153 controller	2,3
23	24	MOTOR OPEN	Motor phase U,V or W detected open	1226BL-4153 controller	2,4
24	25	EMBRAKE DRIVER FAULT	Electromagnetic brake driver is either open or shorted.	1226BL-4153 controller	2,5
25	31	EM BRAKE FAILED TO SET	After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed.	1226BL-4153 controller	3,1
26	31	EMER REV TIMEOUT	Emergency Reverse was activated and ran until the EMR Timeout timer expired.	1226BL-4153 controller	3,1
27	32	EMER REV HPD	At the conclusion of emergency Reverse, the fault was set because various inputs were not returned to nutral.	1226BL-4153 controller	3,2
28	32	EMR SRO	The EMR switches are turned on before KSI	1226BL-4153 controller	3,2
29	33	PUMP DRIVER FAULT	Pump driver is either open or shorted	1226BL-4153 controller	3,3
30	34	PUMP SRO	The lift switch is turned on before KSI	1226BL-4153 controller	3,4
31	35	VALVE DRIVER FAULT	Valve driver is either open or shorted	1226BL-4153 controller	3,5
32	36	VALVE SRO	The lower valve input switches are turned on before KSI	1226BL-4153 controller	3,6

33	41	FIVE V SUPPLY FAILURE	The voltage of internal +5V supply is upper or lower than the threshold voltage The Torrance is -/+10%	1226BL-4153 controller	4,1
34	41	FIFTEEN V SUPPLY FAILURE	The voltage of internal +15V supply is upper or lower than the threshold voltage The Torrance is -/+10%	1226BL-4153 controller	4,1
35	41	EXTERNAL SUPPLY OUT OF RANGE	The voltage of external +5V or +14V is either greater than the upper voltage threshold or lower than the lower voltage threshold. The Torrance is -/+10%	1226BL-4153 controller	4,1
36	42	CAN BUS LOADING	CAN overload	1226BL-4153 controller	4,2
37	42	PDO TIMEOUT	CAN communication timeout	1226BL-4153 controller	4,2
38	42	PDO MAPPING ERROR	PDO Mapping Error	1226BL-4153 controller	4,2
39	43	HW FAILSAVE	The hardware is defeated	1226BL-4153 controller	4,3
40	44	SW FAULT	The CRC code of the application is not right	1226BL-4153 controller	4,4
	47	LOW_BDI	Low battery	1226BL-4153 controller	4,7
	49	STEERING_SENSOR	Turn Sensor Fault	1226BL-4153 controller	4.9
41	81	PARAMETER MISMATCH	When the EMR Input Type is set to type 2, the switch 2 input should be set as disable. Otherwise, the Parameter Mismatch fault is reported	1226BL-4153 controller	8,1
42	81	PARAMETER CHANGE	Adjustment of a parameter that requires cycling of KSI	1226BL-4153 controller	8,1

43	83	NV FAILURE	Controller operating system tried to write to EEPROM memory and 1226BL Basic Information Rev 1.0 19 failed.	1226BL-4153 controller	8,3
44	84	SUPERVISION	Mismatched redundant readings; damaged Supervisor	1226BL-4153 controller	8,4
45	90	Over Voltage	The battery voltage is too high. 1. The charger may be overcharged. 2. Battery BMS has problems. 3. Feedback current charging caused by long downhill descent.	Lithium battery	
46	91	Over Discharge	Battery overdischarge. 1. Lithium batteries are not used for a long time, resulting in low battery power. 2. Overuse.	Lithium battery	
47	92	Communication Outage	Battery communication timed out, controller communication timed out	Lithium battery	
48	93	Under Voltage	Battery under voltage , 1. Long-term storage, not timely charging. 2. The internal battery core is damaged, causing the battery to be unable to charge.	Lithium battery	
49	94	Over Current	Battery overcurrent, 1. The device is not running according to the program originally set by the controller. 2. Parameters do not match after controller replacement. 3. Lithium batteries have problems in current detection.	Lithium battery	
50	95	Over Temperature Protect	Battery servere overtemp , use or transportation environment, resulting in serious high temperature inside the battery.	Lithium battery	
51	96	Temperature Protect	Battery overtemp , use or transportation environment, resulting in serious high temperature inside the battery.	Lithium battery	