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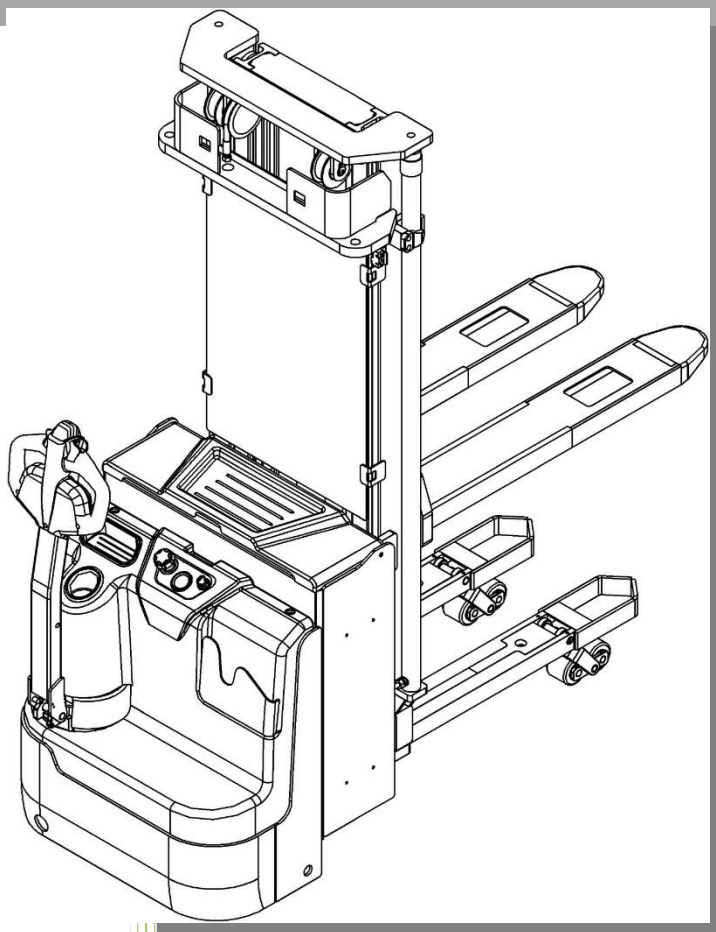
Service Manual

PSL Pallet Stacker

(PS 12DL,PS 16DL)



Warning

You must read and understand the operating instructions in this manual before using it.

- Caution:
- - Please check the last page of this document and the nameplate for all current product type designations.

Version 003/2023

PS 12/16DL-SM-003-EN

FOREWORD

Before operating the electric stacker, 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 stackers. When operating and servicing the truck, make sure, that it applies to your type.

Chapter 11 describes specialized stipulations and regulations for the American market. Follow these instructions and stipulations if you operate the truck within the American market!

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

This truck complies with the requirements according to EN ISO 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 1175-1 (Industrial truck safety – electrical 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.
The vibration is 0,85 m/s2 (if equipped with a platform) according to EN 13059.

ATTENTION:

- Environmentally hazardous waste, such as batteries, oil and electronics, will have a negative effect on the environment, or health, if Tiller d 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 stacker, 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.

1. CORRECT APPLICATION

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

The trucks described in this handbook are self propelled pedestrian controlled electric power stacker, with electrically powered low height lifting function. The trucks are designed for stacking operations in dedicated racking by lifting and lowering the palletized load up to the desired lifting height.

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 truck is used only by staff, which is trained and authorized to use this truck.

The 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 intensive operations 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 centre plane of the stacker.
Lifting or transporting people is forbidden. If travelling the load must be lowered to the lifting point.

It is not allowed to use this truck on tail lifts or loading ramps.

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

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

By not observing these instructions, the warranty becomes void.

2. DESCRIPTION OF THE STACKER

a. Overview of the main components

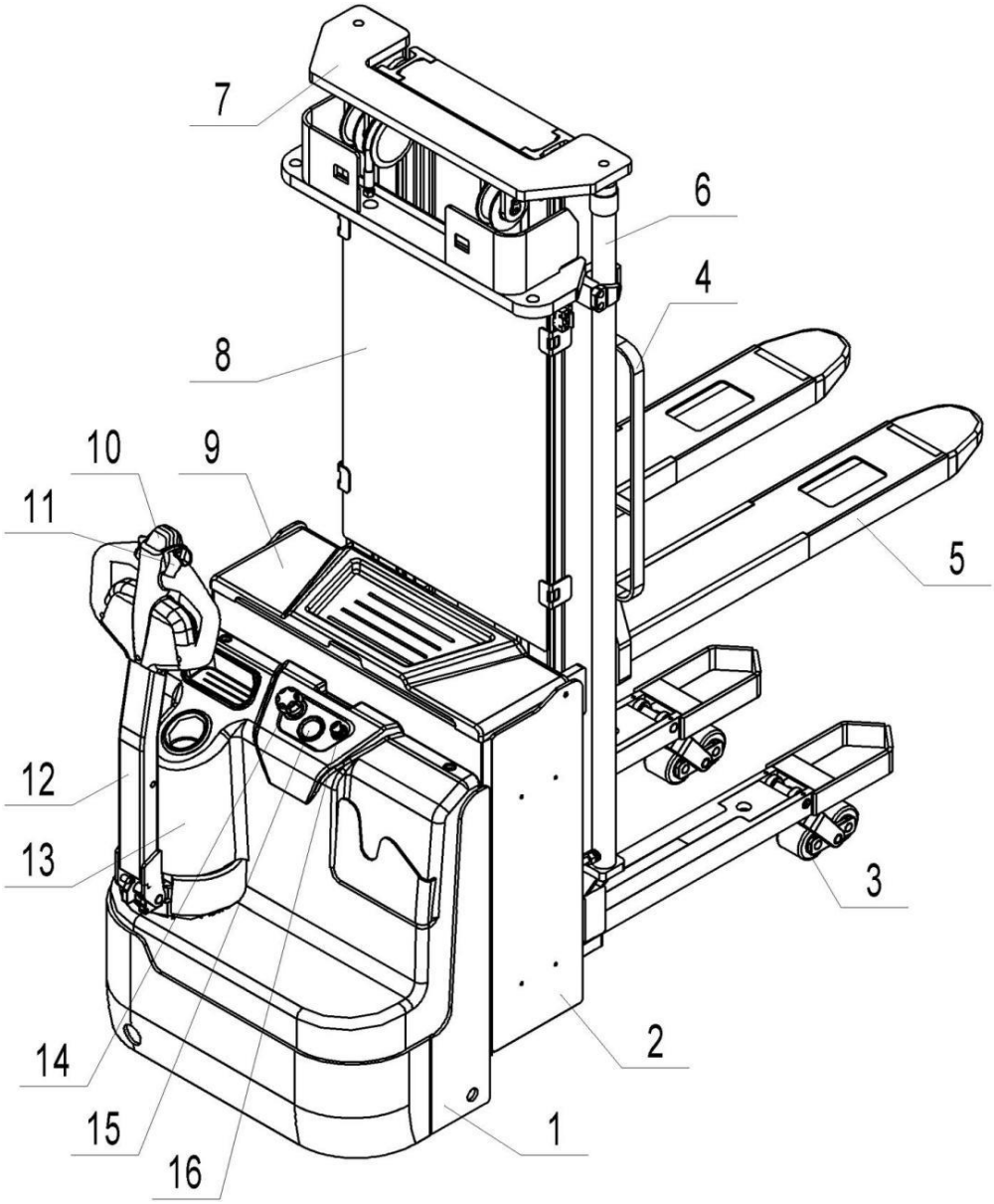


Fig. 1: Overview main components

1. Chassis
2. Battery compartment
3. Load roller assembly
4. Load backrest assembly
5. Fork carriage
6. Hydraulic system
7. Mast assembly
8. Protective board
9. Battery cover
10. Belly button
11. Accelerator
12. Tiller assembly
13. Main cover
14. Emergency button
15. Discharge indicator and charging indicating LED
16. Key switch

b.Main technical data

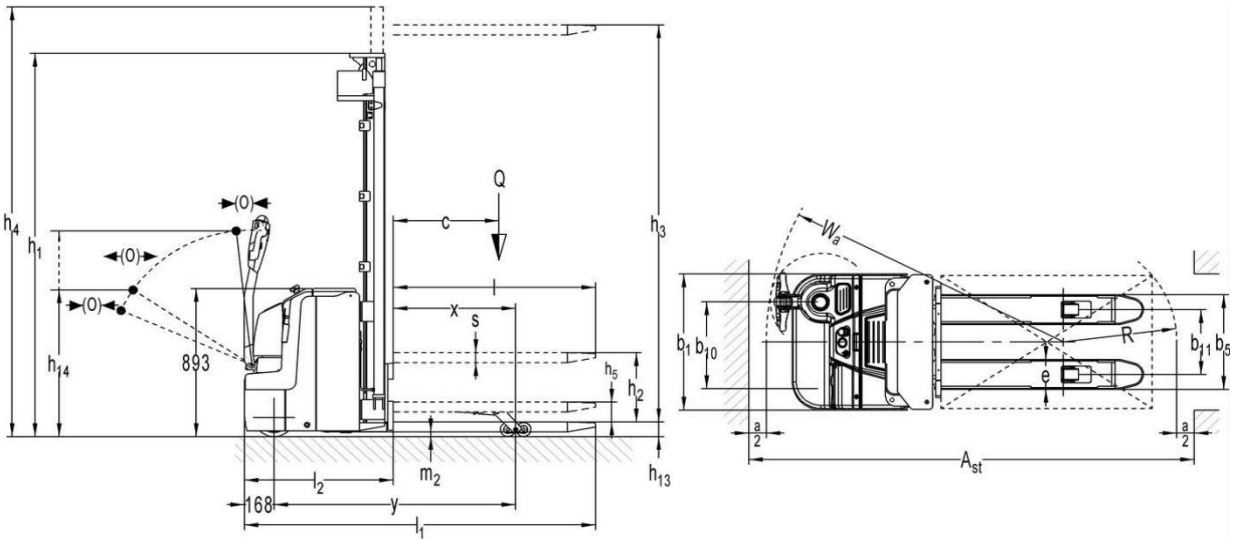


Fig. 2: Technical data

Table1: Main technical data for standard version

Type sheet for industrial truck acc. to VDI 2198					
Distinguishing mark	1.2	Manufacturer`s type designation		PS 12DL	PS 16DL
				3600	4600FFL
	1.3	Power (battery ,diesel, petrol, gas, manual)		Battery	
	1.4	Operator type		Pedestrian	
	1.5	Load Capacity / rated load	Q(t)	1.2	1.6
		Load Capacity / rated load (mast lift)		1.2	1.6
		Load Capacity / rated load (support arm lift)		2.0	2.0
	1.6	Load centre distance	C(mm)	600	
	1.8	Load distance ,centre of drive axle to fork	x(mm)	695[1)]	
	1.9	Wheelbase	y(mm)	1374[1)]	1417[1)]
Weight	2.1	Service weight	Kg	1070	1380
	2.2	Axle loading, laden front/rear	Kg	870/2200	1130/2250
	2.3	Axle loading, unladen front/rear	Kg	730/340	945/435
Tires, chassis	3.1	Tires		Polyurethane (PU)	
	3.2	Tire size, front	∅xW (mm)	Φ230×70	
	3.3	Tire size, rear	∅xW (mm)	Φ84×70	
	3.4	Additional wheels(dimensions)	∅xW (mm)	Φ150x54	
	3.5	Wheels, number front/rear(x=driven wheels)		1x+1/4	
	3.6	Tread, front	b_{10}(mm)	522	
	3.7	Tread, rear	b_{11}(mm)	390/505	
Dimensions	4.2	Lowered mast height	h1(mm)	2308	2108
	4.3	Free lift height	h2(mm)	-	1520
	4.4	Lift	h3(mm)	3530	4530
	4.5	Extended mast height	h4(mm)	4080	5080
	4.6	Height of tiller in drive position min./ max.	h5(mm)	120	
	4.9	Height, lowered	h14(mm)	850/1385	

	4.15	Lowered mast height	h13(mm)	90	
	4.19	Overall length	l1(mm)	1998	2042
	4.20	Length to face of forks	l2(mm)	848	892
	4.21	Overall width	b1(mm)	820	
	4.22	Fork dimensions	s/e/l(mm)	60/180/1150	
	4.25	Width across forks	b5(mm)	570/685	
	4.32	Ground clearance, centre of wheelbase	m2(mm)	28	
	4.33	Aisle width for pallets 1000X1200 lengthways	Ast(mm)	2540	2584
	4.34	Aisle width for pallets 800X1200 lengthways	Ast(mm)	2512	2555
	4.35	Turning radius	Wa(mm)	1667[1)]	1711[1)]
Performance	5.1	Travel speed, laden/unladen	km/h	5.5/6.0	
	5.2	Lift speed, laden/ unladen	m/s	0.09/0.14	0.13/0.20
	5.3	Lowering speed, laden/ unladen	m/s	0.25/0.20	0.28/0.23
	5.8	Max. gradeability performance, laden/ unladen	%	6/12	
	5.10	Driving brake		Electromagnetic	
Motor	6.1	Drive motor power S2 60	kw	1.7	
	6.2	Lift motor power S3 10%	kw	1.5	3.2
	6.3	Battery, DIN 43531/ 35/ 36 A, B, C		2VBS	3VBS
	6.4	Battery voltage, nominal capacity K5	V/Ah	24/180	24/270
	6.5	Battery weight	kg	175	230
	6.6	Energy consumption acc. to VDI cycle	kWh/h	1.00	0.96
Addi tio	8.1	Type of drive control		AC- speed control	
	8.4	Sound level at driver’s ear according to EN 12053	dB(A)	<70	

Table1: Main technical data for standard version

When double-deck operation: gantry lifting load is <= pallet lifting load.

1) load roller lowered: +72mm

Type	Lowered mast height h1(mm)	Free Lift height h2(mm)	Lift height h3(mm)	Extended mast height h4(mm)	Lift+fork height h3+h13(mm)
PS 12DL					
Two stage mast	1958	—	2830	3380	2920
	2108	—	3130	3680	3220
	2308	—	3530	4080	3620
Two stage mast FFL (Full-Free-Lift)	1958	1410	2830	3380	2920
	2108	1560	3130	3680	3220
	2308	1760	3530	4080	3620
PS 16DL					
Two stage mast	1958	—	2830	3380	2920
	2108	—	3130	3680	3220
	2308	—	3530	4080	3620
Two stage mast FFL (Full-Free-Lift)	1958	1410	2830	3380	2920
	2108	1560	3130	3680	3220
	2308	1760	3530	4080	3620
Three stage mast	1408	—	2430	2980	2520
	2008	—	4230	4780	4320
	2108	—	4530	5080	4620
Three stage mast FFL (Full-Free-Lift)	1708	1120	3330	3880	3420
	1908	1320	3930	4480	4020
	2008	1420	4230	4780	4320
	2108	1520	4530	5080	4620

c.Description of the safety devices and warning labels (Europe and other, excepting USA)

For the USA –market, the description of the safety and warning labels is mentioned in chapter 11.

A Crane hook label
B Warning decal: Do not step under or on the forks
C Residual lift capacity sticker
E Never reach through
F Identification plate (ID-plate)
G Sticker to read and follow these instructions
L Sign of filling point

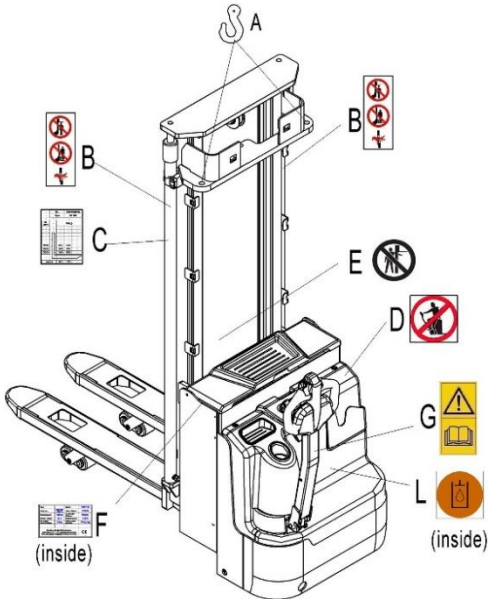


Fig.3: Safety and warning labels

The truck has an emergency button (14) which stops all lifting-, lowering-, driving- functions and engages the failsafe electromagnetic brake when it is pushed. By pulling this button, the truck can be operated after the controller checked the functions. Before operating, insert the key and turn the switch (16) clockwise. To prevent against unauthorized access, turn the key anti-clockwise and remove it, if you not operate this truck. The truck is equipped with a safety (belly) button (10) 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.VIN Location

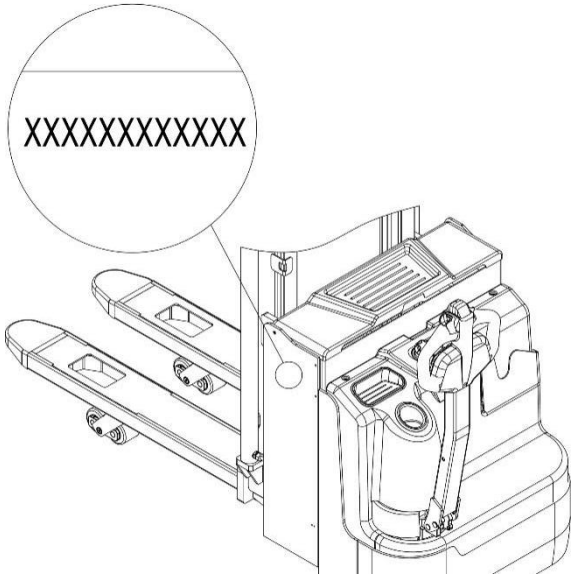


Figure 4: Vehicle identification code location

The vehicle identification number is located on the body of the vehicle.

e. Identification plate

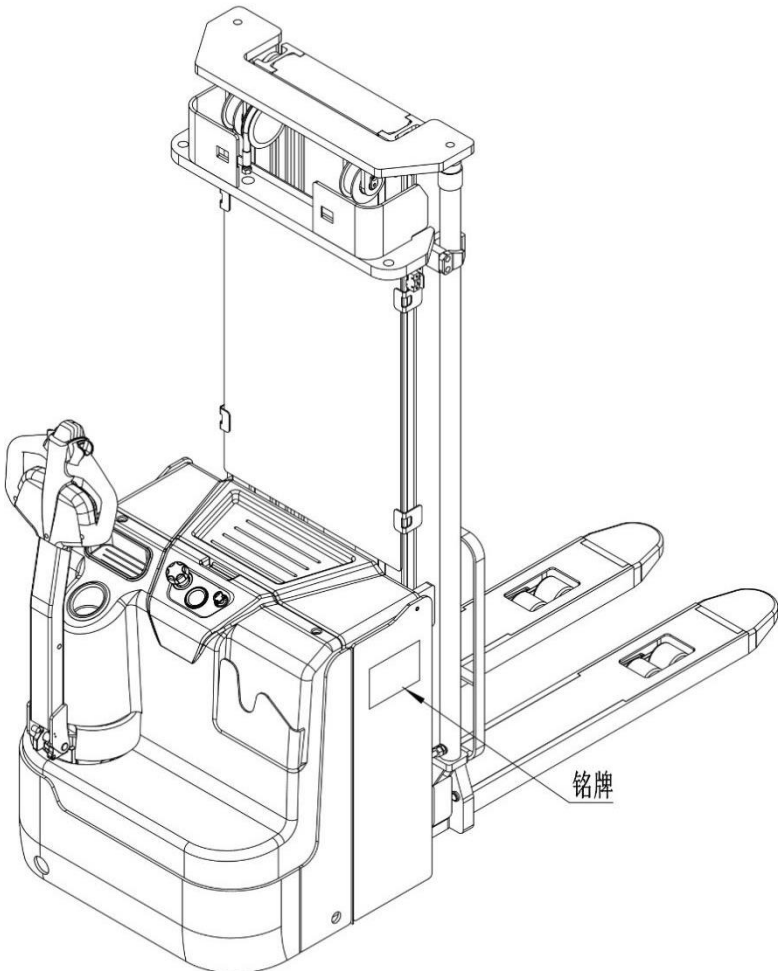


Fig. 5: Identification plate location

located on the body of the vehicle.

Pallet stacker truck Special equipment manufacturing license no.			
Model	xxxx	Rated load weight	xxxx kg
Rated capacity	xx V	dead weight	xxxx kg
Maximum battery weight	xxx kg	Minimum battery weight	xxx kg
No load without battery weight	xxx kg	Maximum lifting height	xxxx mm
Product number	xxxxxxxxxx	Date of manufacture	xxxxxxxx
VIN	xxxxxxxxxx	Factory article number	xxxxxxxxxx
Equipment code			
Manufacturer's name XXXXXXXXXXXX manufacturer's address XXXXXXXXXXXX			

Figure 6: Nameplate (subject to specific posting)

3. WARNINGS, RESIDUAL RISK AND SAFETY INSTRUCTIONS

DO NOT

- Drive outside the stacking operation with a lifted load higher than the lifting point.
- 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.
- Use the truck without a removed protective screen.
- Side or end load. Load must be distributed evenly on the forks.
- Use the truck with unstable, unbalanced not stable load.
- Use truck without manufacturer's written consent.
- Lifted loads could become unstable at wind forces. In the case of wind forces do not lift the load if there is any influence to the stability

Watch difference in floor levels when driving. Load could fall down or the truck could get uncontrollable. Keep watching the condition of load. Stop operating the truck if load becomes unstable. Brake the truck and activate the emergency button (14) by pushing when sliding load on or off the truck. If the truck has any malfunctions, follow chapter 8.

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 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.
- To prevent unintended sudden movements when not operating the truck (i.e. from another person, etc.) switch off the truck and remove the key.

4. COMMISSIONING, TRANSPORTING, DECOMMISSIONING

a. Commissioning

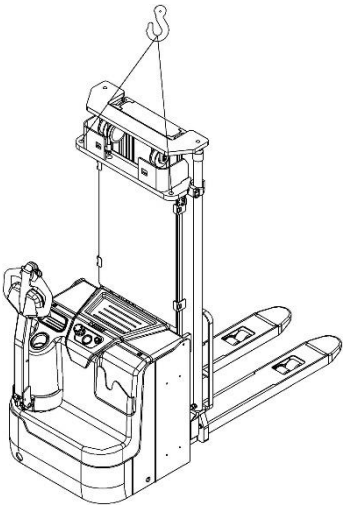
Table 2: Commissioning data

Type	PS 12DL / 3600	PS 16DL / 4600FFL
Commissioning weight [kg]	1100	1410
Version/ Lift [mm]	3600	4600

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

- Check if are all parts included and not damaged
- Eventually installation and charging the batteries (follow chapter 7)
- 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

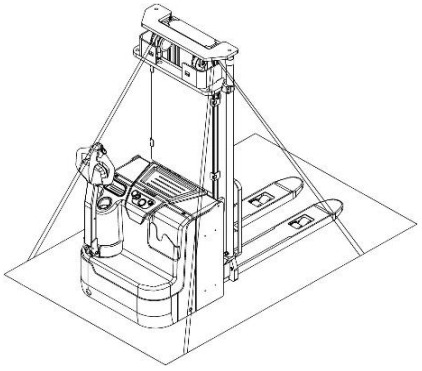
DO NOT STAND UNDER THE SWAYING LOAD

DO NOT WALK INTO THE HAZARDOUS AREA DURING LIFTING

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 truck's crane hook holes and fasten the other side at the transporting truck.

Transportation



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

Lower the forks and park the truck on the iron plate securely. Fixe the forks by the iron sheet with two screws. Fasten the truck by fixing dedicated lashing belts according to Fig. 6 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), eventual 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 vertical creep of the truck.
- Check the chain and rollers for damages or corrosion.
- Check the smooth movement of the wheels.
- Check the function of the emergency brake by activating the emergency button.
- Check, the tiller arm switch braking function
- Check the lifting and lowering functions by operating the buttons.
- Check if the protective screen has no damages and that is correctly assembled.
- Check the audio warning signal.
- Check if all bolts and nuts are tightened firmly.
- Check the function of the key switch.
- Check the speed limitation switch.
- Visual check if there are any broken hoses or 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).

BEFORE OPERATING THIS TRUCK, ENSURE THAT THE LOAD OR OTHER EQUIPMENT NOT CAUSES INSUFFICIENT VISIBILITY!

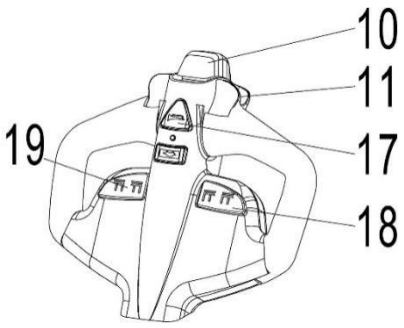


Fig.9: Tiller operating controls

Make sure, that the load is palletized and stable and that the daily inspection is carried out. For starting, insert the key and turn it clockwise to the “ON”- position. Eventually before inserting the key switch (16), the emergency button (14) must be pulled carefully.

Press the horn button (17) to activate the audible warning signal.

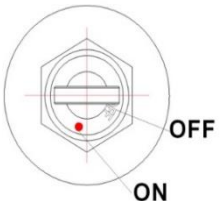


Fig.10: Key switch

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 and drive the truck to a safe area. Turn the key anti- clockwise to the “Off” – position and remove the key.

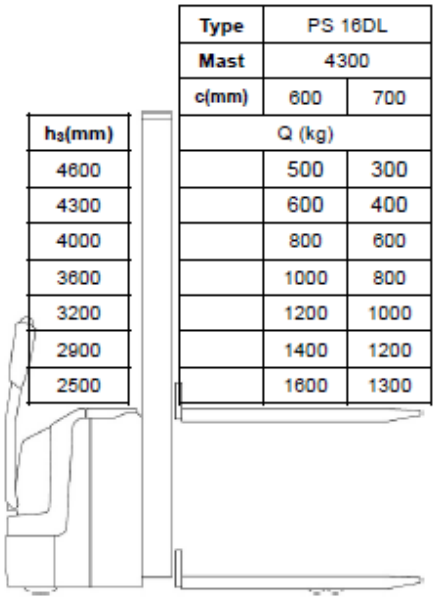
b. Residual lift diagram

The residual lift diagram indicates the maximum capacity Q [kg] for a given load centre c [mm] and the corresponding lift height H [mm] for the truck with horizontal load.

The white markings on the mast indicate if the specific lifting limits reached.

For instance with a load centre of gravity distance c of 600 mm and a maximum lift height H of 2500 mm, the max. capacity Q is 1600 kg.

Fig. 10 shows when the truck is used as pallet truck and stacker at the same time, the load capacity of fork and pallet is both 1000kg, so the total load capacity is 2000kg. When the fork lift height is within 120mm, the maximum stack height is 1600mm.



Type	PS 16DL	
Mast	4300	
c(mm)	600	700
h_3(mm)	Q (kg)	
4600	500	300
4300	600	400
4000	800	600
3600	1000	800
3200	1200	1000
2900	1400	1200
2500	1600	1300

Fig. 9: Residual lift diagram (stacking)

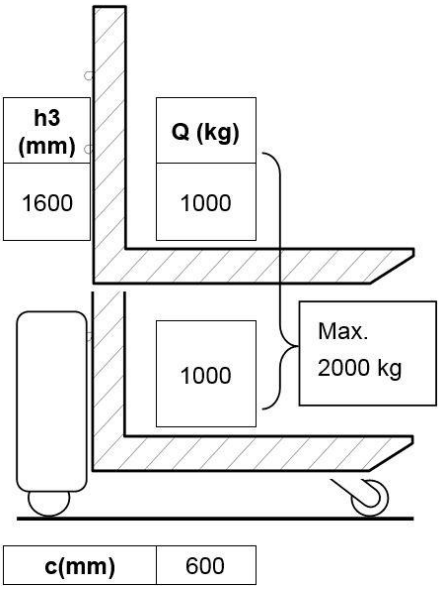


Fig. 10: Residual lift diagram (double lifting)

C. Lifting

DO NOT OVERLOAD THE TRUCK! THE MAXIMUM CAPACITY IS 2000kg WHEN THE LOAD CENTER IS 600MM. (ONLY USED AS PALLET TRUCK)

LIFT ONLY CAPACITIES ACCORDING TO THE RESIDUAL LIFT DIAGRAM.

Travel with the lowered forks fully underneath the pallet and press the lifting button (Fig. 7, 19) until you reached the desired lifting height.

This truck can be used as pallet truck and stacker.

When press the fork lift button (19), the fork and pallet lift together, the maximum lift height is 120 mm, maximum load is 2000 kg.

When the fork lifts to the height within 120 mm, press the pallet lift button (18), the pallet lifts for stacking, the maximum stack height is 1600 mm (the truck is used as pallet truck and stacker at the same time).

When stack height is more than 1600 mm, the fork can't lift (the truck is only used as stacker).

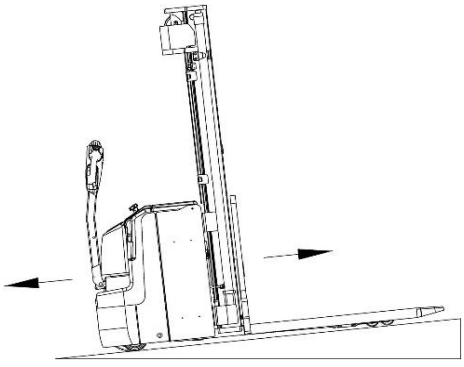


Fig.11: Load facing uphill

d. Lowering

If the forks are in the racking, firstly travel out of the racking carefully with or without the pallet. By travelling out of the racking, take care that the forks are not touching the racking.

Press the lowering button (Fig. 7, 18) carefully.

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

e. Travelling

TRAVEL ON INCLINES ONLY WITH THE LOAD FACING UPHILL(fig.11).
DO NOT TRAVEL ON INCLINES MORE THAN SPECIFIED WITH THE TECHNICAL DATA.
TRAVELLING IS ONLY ALLOWED IF THE FORKS ARE LOWERED DOWN TO THE LIFTING POINT (<300MM).

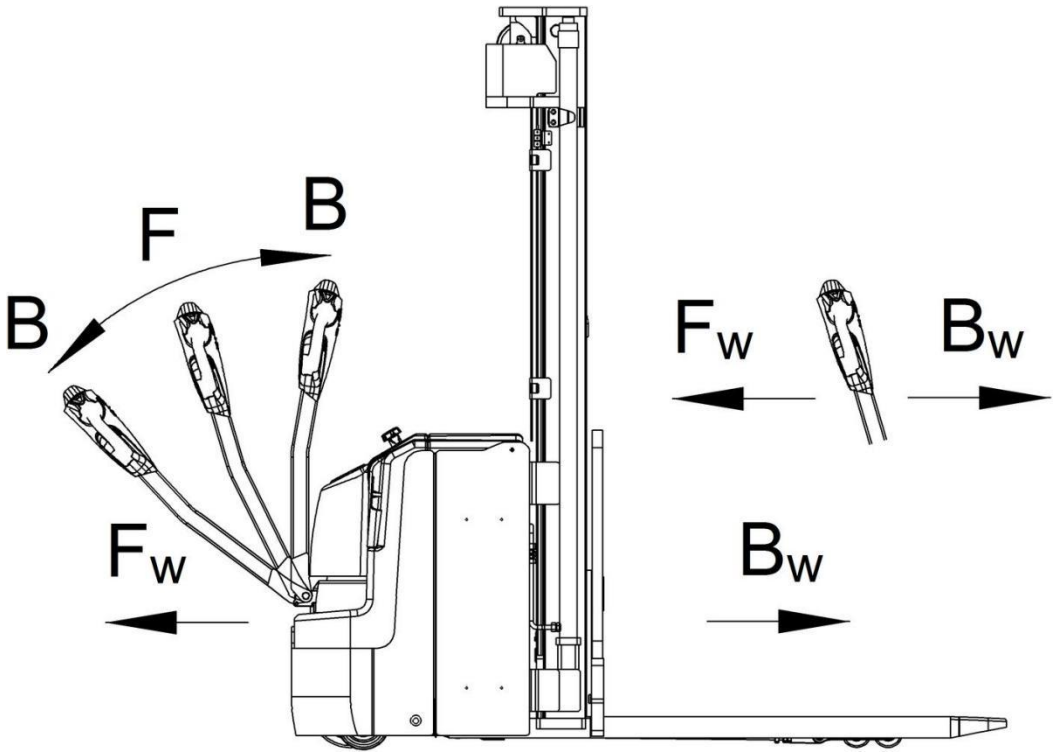


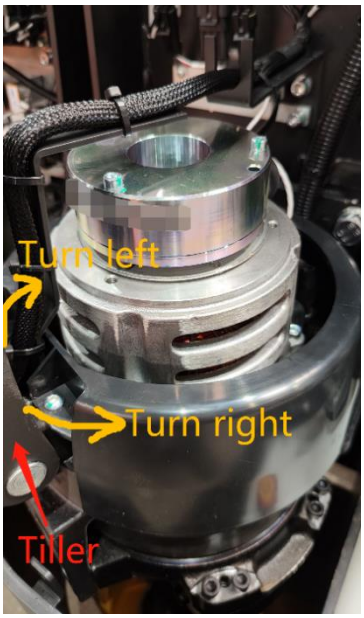
Fig.14: Operating direction

After starting the truck by turning the inserted key to the “ON”- position (Fig. 10), and eventually by pulling the emergency button carefully, move the tiller to the operating zone (‘F’, Fig.14).
Turn the accelerator button to the desired direction forward ‘Fw.’ Or backwards ‘Bw.’(Fig. 14).
Control the travelling speed by moving the accelerator button (Fig 9 , 11) 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.

f. Steering

You steer the truck by moving the tiller to the left or right side.

Appearance



Operate the vehicle by turning the Tiller to the left or right. When the vehicle is moving forward (opposite to the fork direction), turning the Tiller to the right will make the vehicle turn clockwise.

g. Braking

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 (11) 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 (11) from one driving direction directly to the opposite direction, the truck brakes regenerative until it starts travelling into the opposite direction.
- The truck brakes, if the tiller is moved up or down to the braking zones (‘B’). If the tiller is released, the tiller moves automatically up to the upper baking zone (‘B’).

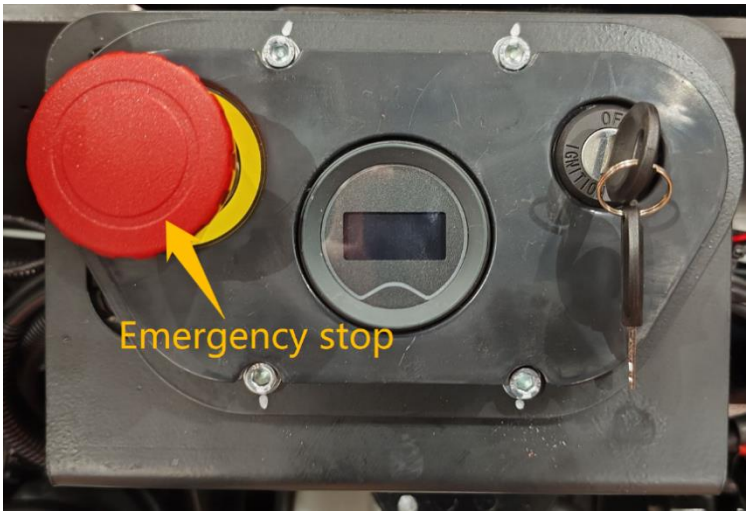
  The truck brakes until it stops.
- The safety (belly) button (10) prevents the operator from being crushed. If this button is activated, the truck decelerates and/ or starts travelling into the backwards direction (‘Bw.’) for a short distance and stops. Please consider, that this button also operates, if the truck is not travelling and the tiller is in the operating zone.

h. Malfunctions

If there are any malfunctions or the truck is inoperative, please stop using the truck and activate the emergency button (14) by pushing it. If possible, park the truck on a safe area, turn the key switch (18) anti- clockwise and remove the key. 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.

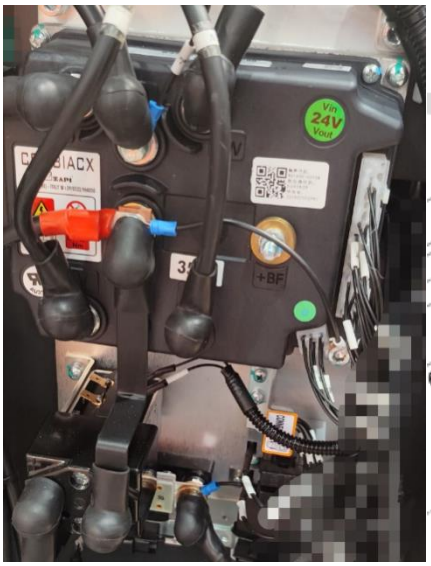
i. Emergency

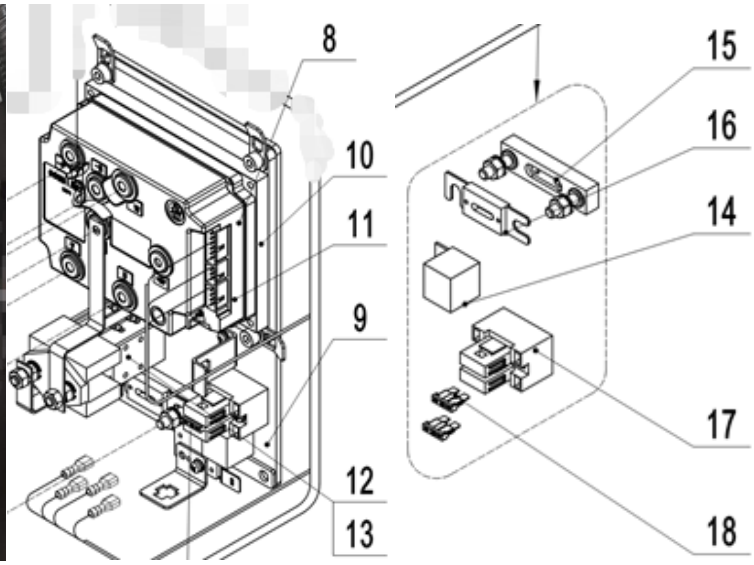
In emergencies or in the event of tip over (or off dock), keep safe distance immediately. If possible, push the emergency button (14). All electrical functions will be stopped.



7. BATTERY CHARGING AND REPLACEMENT

Controller appearance

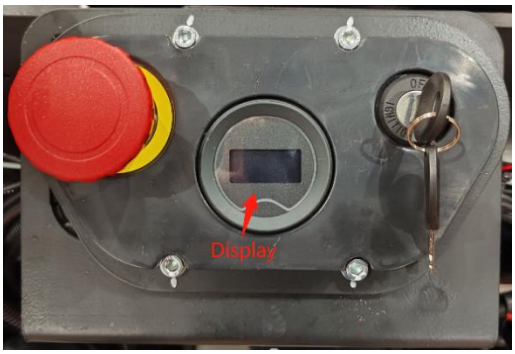




SN	Item Name	Quantity
8	Electronic control assembly	1
9	Mounting plate	1
10	Mounting plate	1
11	Controller	1
12	Controller	1
13	Mount	1
14	Relay	1
15	Fuse holder	1
16	Fuse 350A	1
17	Fuse holder	1

Testing and troubleshooting

The current fault code can be viewed on the instrument panel and hand-held programmer.



Test

a. Controller

Measure the diode voltage of the AC MOSFET circuit inside the controller and check whether it is burnt or damaged.

The test shall be carried out according to the following table. Each test item must be tested repeatedly for more than 3 times.

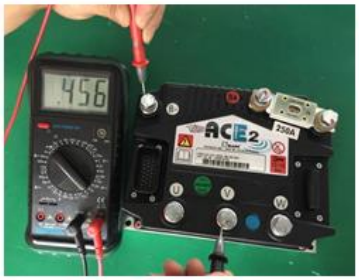
item	Multimeter terminals		Normal value range	
	Red pen	Black pen	Determination of polarity value	Resistance measurement
1	B+	U/V/W/B-		Above 1M Ω
2	B-	U/V/W		Above 1M Ω
3	U/V/W	B+	0.3-0.6V	
4	B-	U/V/W	0.3-0.6V	

Pull the multimeter to the Ω position (resistance value measurement) and pull the multimeter to the diode position (polarity value measurement)

1) Remove the cable and harness connected to the controller and completely release the power of the internal capacitor (discharge the B+and B - terminals with a resistance of 30 Ω/5W).

2) Use a multimeter to measure the voltage of the diode (0.3-0.6 V) and check whether it is normal.

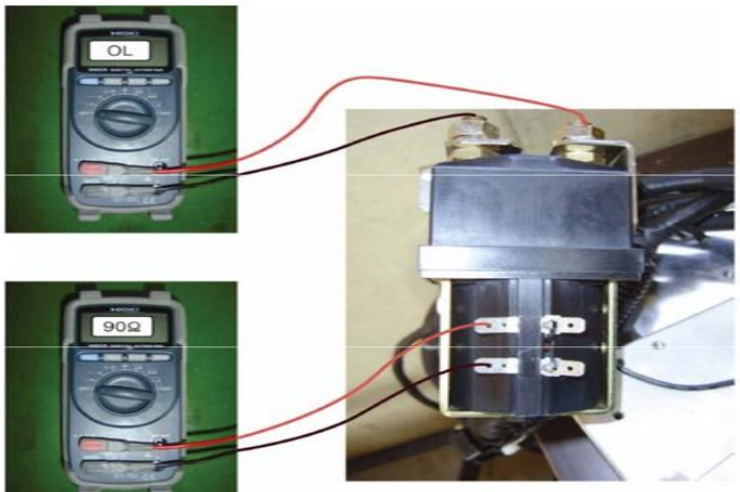
Test 1: Measure the diode voltage. The red wire is B - and the black wire is U, V and W


Test 2: Use the red lead to measure the diode voltage to U, V and W, and the black lead to B+

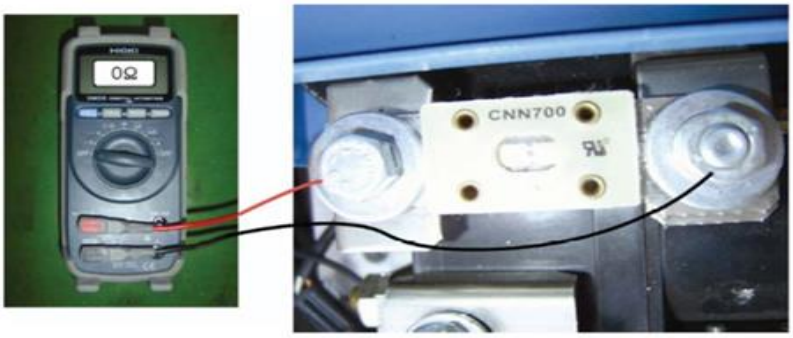
Note: The pointer of the multimeter cannot be connected reversely

b. Line contactor and fuse



线路 接触器

图 2-22

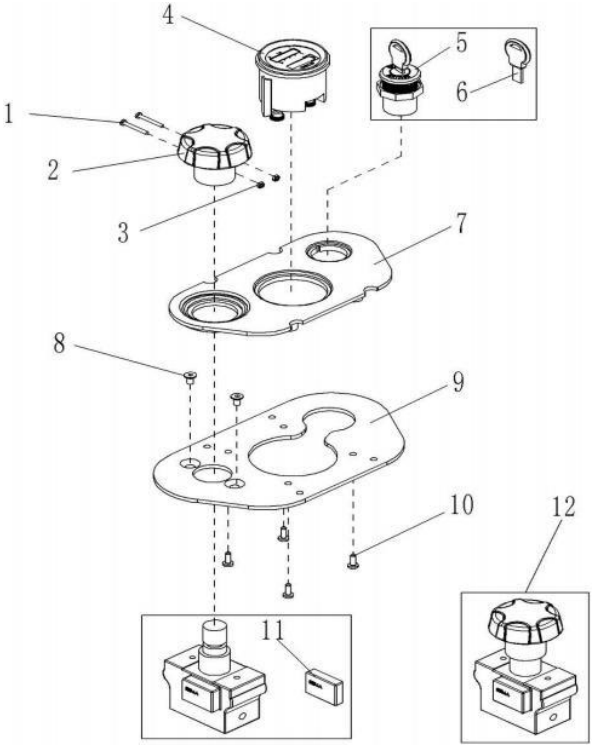


线路 保险丝

图 2-23

For line contactor and line fuse, connect an ohmmeter at the point shown in the figure and check whether it measures the specified value.

c. Instrument assembly

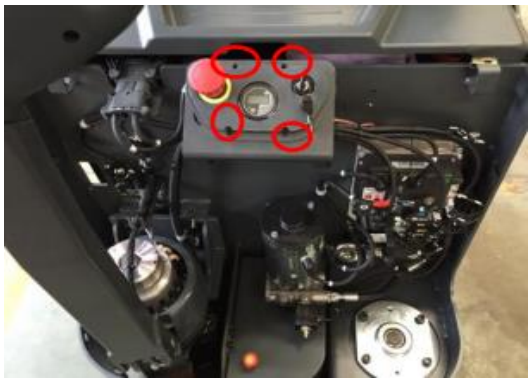


Number	Item	Quantity	Note
4	Electricity meter	1	
5	Universal key switch	1	LKS-101A
11	DC power switch	1	ZDK32-350

d.Replace electrical parts

Disconnect the power supply before replacing electrical parts

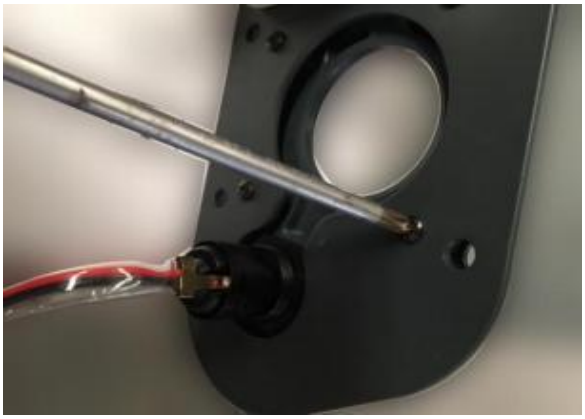
Note: Before maintenance, lower the fork to the bottom, then turn off the key switch and disconnect the power supply.

	
1. Remove the bolts in the figure below with an internal 6mm hexagonal wrench.	2. Disconnect the vehicle power, that is, unplug the battery connection port in the figure below
	
3. Use a 6mm Allen wrench to unscrew four screws and cut the binding band around the wire harness	4. Unplug the three plugs
	
5. Loosen the wiring nuts on both sides of the emergency stop switch box with a 14mm wrench, and then remove the wiring	6. Remove the instrument

Emergency stop switch replacement

1. Use a Phillips screwdriver to unscrew the two screws of the emergency stop switch

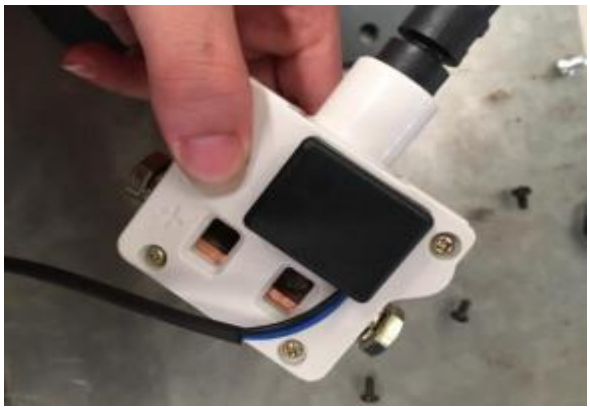
2. After removing the screws, you can remove the mushroom head



3. Use a Phillips screwdriver to unscrew the screws

4. Separate the integrated leaf-type panel from the instrument fixing plate

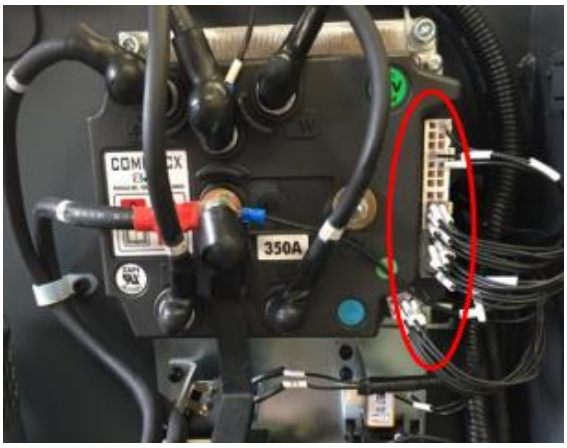
5. Use a Phillips screwdriver to unscrew the two set screws



6. Remove the DC power switch

	
7. Press the micro switch on both sides of the snap by hand, you can pull off the micro switch	The installation process is the reverse of the above process.

Controller replacement



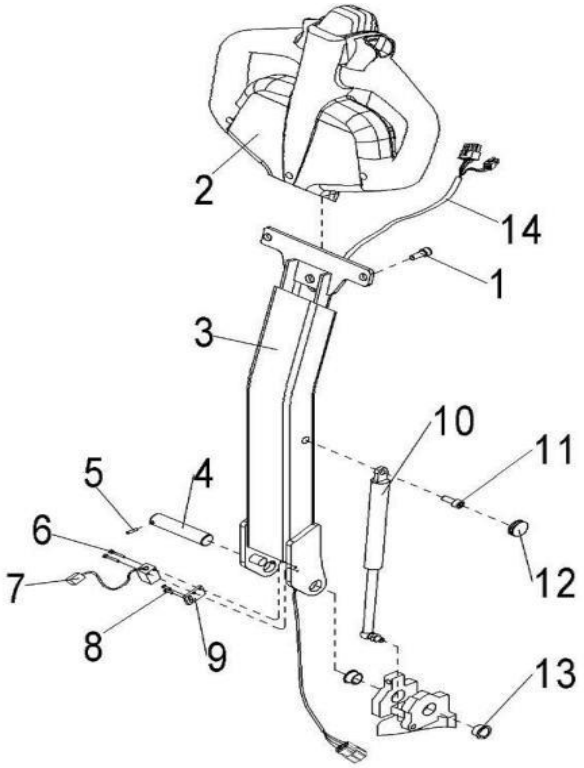
1. Take off the wiring on the electric control in turn, pull out the connector, and write down the different ports corresponding to different wiring

2. Unscrew V, U, W, -P, -B five screws with a 10mm open-end wrench, and remove the wiring in turn

3. Use a Phillips screwdriver to unscrew the four controller fixing screws, you can take off the controller installation process that is the reverse process of disassembly

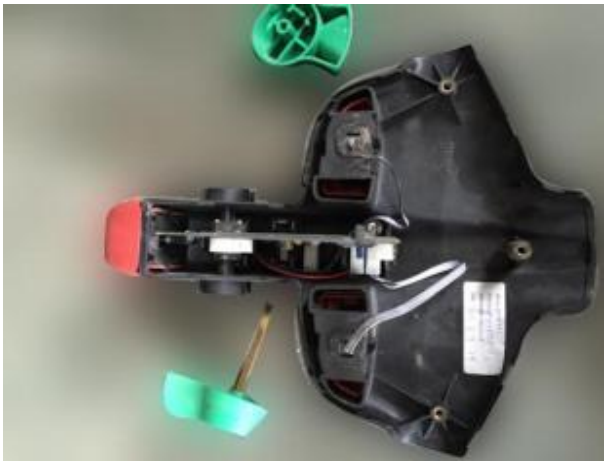
e.Tiller

Tiller assembly



PCB motherboard replacement

	
1. Use 6mm hexagonal wrench to unscrew the outer cover screws	2. After unscrewing the screws carefully open the Tiller housing, and unplug the connection plug

	
3. Use a 2mm hexagonal wrench to unscrew the screw securing the drive switch	4. Carefully remove the drive switch
	
5. Use a Phillips screwdriver to remove the set screws PCB motherboard replacement	6. Remove the old PCB board, and unplug the plug wires in turn, the installation process and the reverse process of the above process

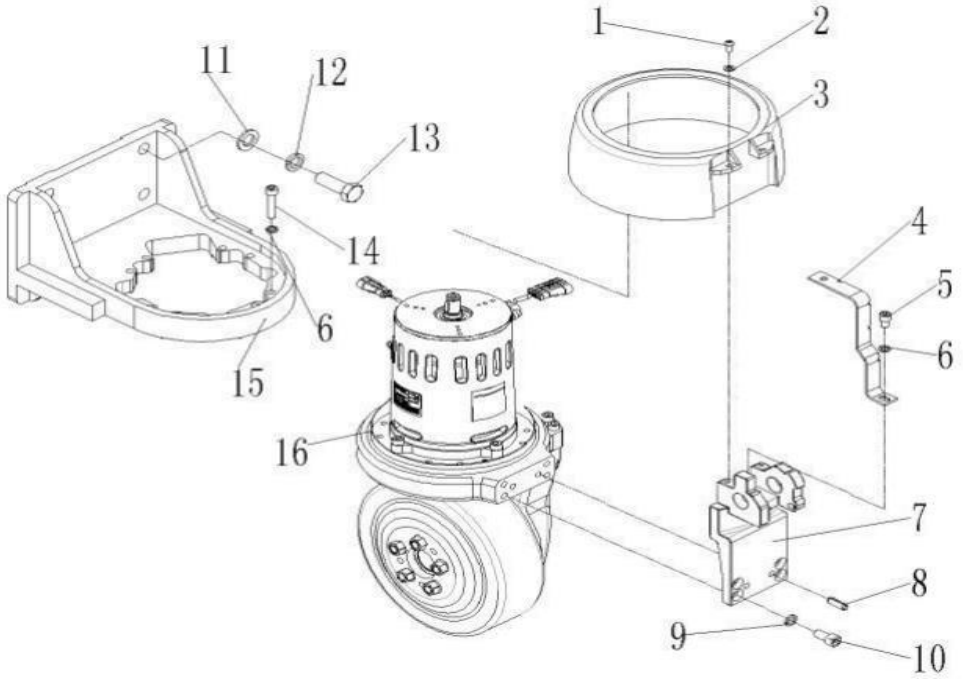
Replace the gas spring (you can refer to the Tiller assembly diagram)

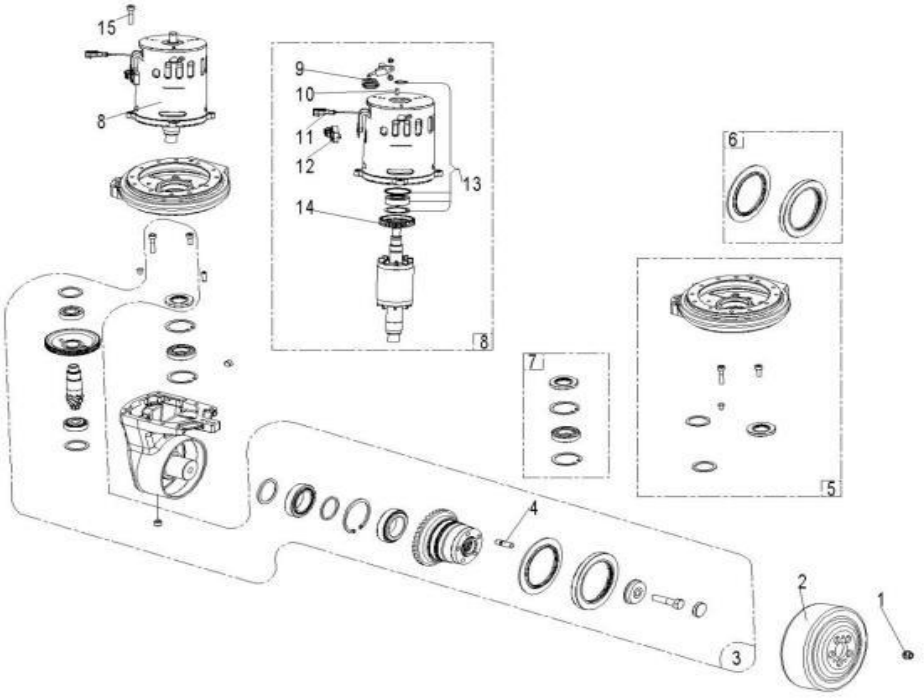
<table>
<tr><td colspan="2">1. Pull out the rubber plug.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>2. Unscrew the bolt with a 6mm hexagonal wrench.</td><td>3. Use a 13mm open-end wrench to unscrew the screws at the lower end of the fixed gas spring.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>4. Remove the gas spring</td><td>Installation of gas springs is the reverse process of disassembly</td></tr>
</table>

f.Steering

Drive system components

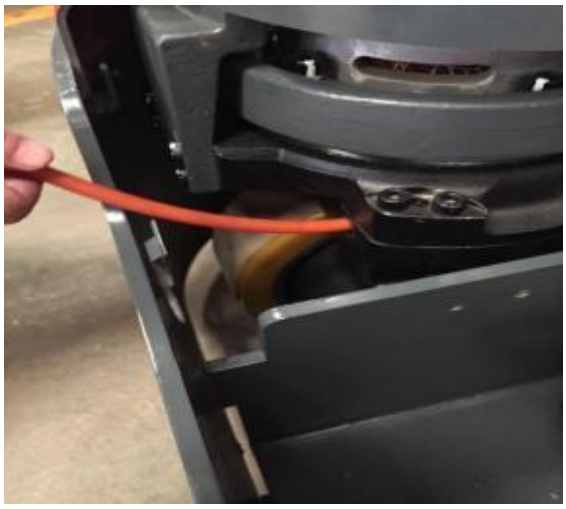


1.3kw drive wheel

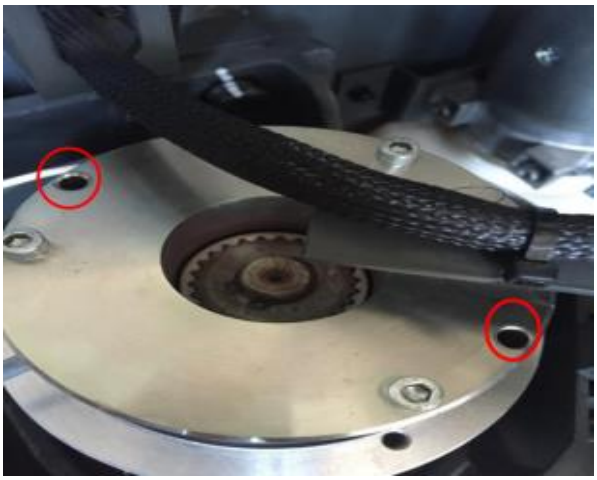


Drive wheel gearbox lubricant oil change

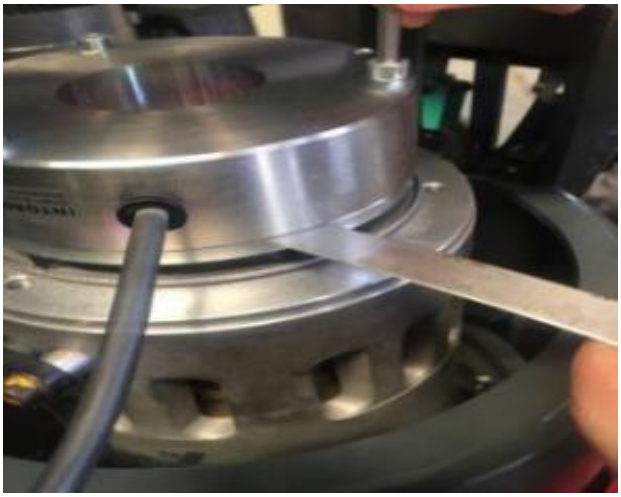
	
1. There is an oil filling hole in the front of the drive wheel	2. There is an oil drain hole at the bottom of the drive wheel
	
3. Use a jack to lift the body to a certain height	4. Use 7mm hexagonal wrench to unscrew the bolt of the oil release hole at the bottom, and quickly place the waste oil collection container at the bottom to collect the waste oil so that the waste oil will not flow out and pollute the environment. After the waste oil flows out, screw the bolt.

	
5. Use 7mm hexagonal wrench to unscrew the oil filling hole bolt	6. Fill the lubricant through the oil pipe. The lubricant used is 85W/90 GL-5 heavy-duty vehicle gear oil

Brake disc replacement

	
1. Screw the two bolts into the bolt holes of the brake with a 4mm hexagonal wrench, the bolt size is M6×40	

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>2. Use a 4mm hexagonal wrench to attach the brake to the</td><td>3 bolts unscrewed</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">4. Unplug and cut the cable ties</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">5. You can remove the brake, the installation process is the reverse process of disassembly.</td></tr>
</table>

<table>
<tr>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td colspan="2">Brake clearance adjustment: use a 4mm hexagonal wrench to unscrew the three screws and use a stopper to measure the brake clearance to control at 0.3mm. You need to use the stopper to measure the three bolts one by one to ensure that the clearance is 0.3mm.</td>
</tr>
</table>

8. BATTERY CHARGING AND REPLACEMENT

- Only qualified personnel are allowed to service or charge the batteries. The instructions of this handbook and from the battery- manufacturer must be observed.
- The batteries are liquid acid traction batteries. Optional maintenance free batteries are available; for these batteries re- filling is prohibited.
- Recycling of batteries undergoes national regulations. Please follow these regulations.
- By handling batteries, open fire is prohibited, gases could cause explosion!
- 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 there are no disturbing towards other components of the truck.

Depending on the version, the truck is equipped with following liquid acid traction battery- type:

PS 12DL 1 PCS 2PzB 24V/ 180 Ah (C5) [660 x 146 x 657 (LxWxH)]

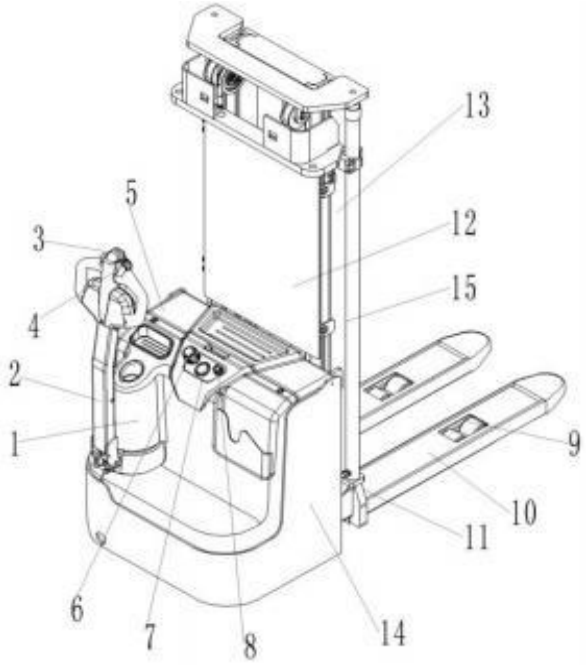
PS 16DL 1 PCS 3VBS 24V/ 270 Ah (C5) [752 x 172 x 657 (LxWxH)]

IT IS ONLY ALLOWED TO USE LIQUID ACID TRACTION BATTERIES.
THE WEIGHT OF THE BATTERIES HAS AN INFLUENCE TO THE TRUCKS OPERATING BEHAVIOR.
PLEASE CONSIDER THE MAXIMUM OPERATING TEMPERATURE OF THE BATTERIES.

a. Replacement

Park the truck securely and switch off the stacker with the key (16) and activate the emergency button (14). Open the battery cover and pull out the hinge. Then remove the battery cover, pull out the battery plug (Fig.13), and take the batteries out with a crane.

The installation is in the reverse order of the removal. Please connect the positive terminals firstly. Otherwise the tuck could be damaged.



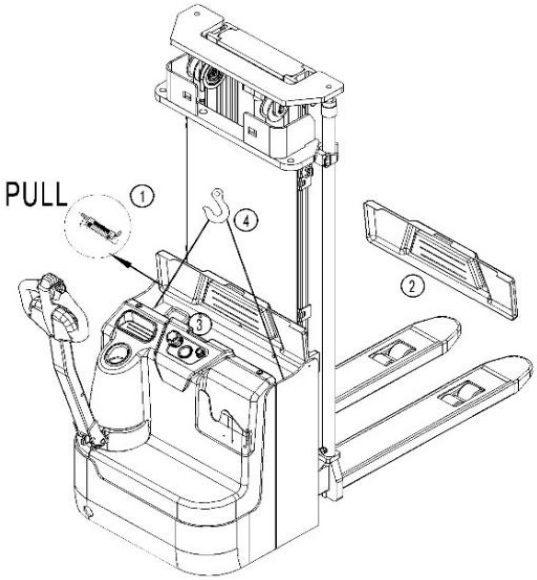


Fig. 13: battery replacement

Lifting type

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">1. Pull out the hinges and remove the battery box cover.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>2. Remove the battery power plug</td><td>3. Connect here with tools, such as hooks, and then remove the battery</td></tr>
</table>

Side pull type

1. Open the battery box cover

2. Unplug the power supply

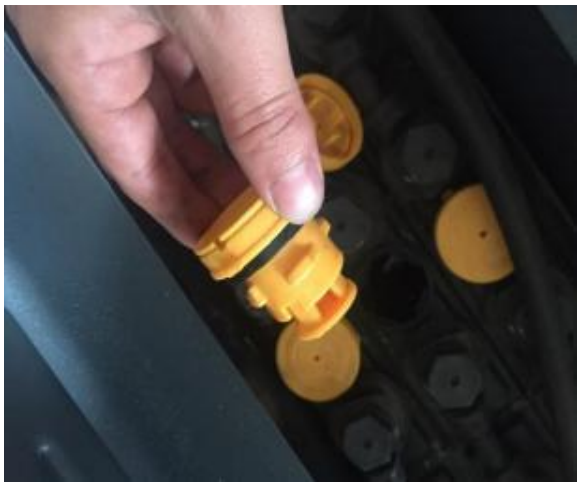
3. Unscrew the bolt with a 5mm hexagonal wrench

. Unplug the pins

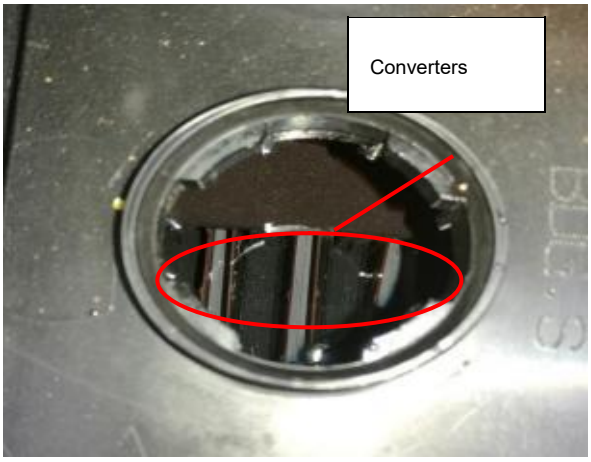
Take out the battery in the direction indicated by the arrow. The installation process is the reverse of the disassembly process

b.Battery maintenance

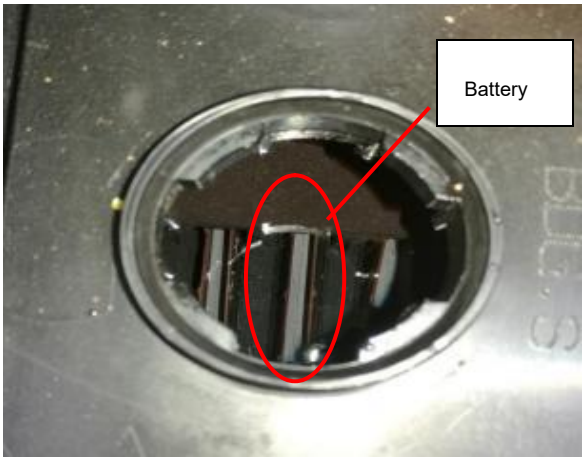
1. Unplug the power switch



2. Unscrew the battery water cap

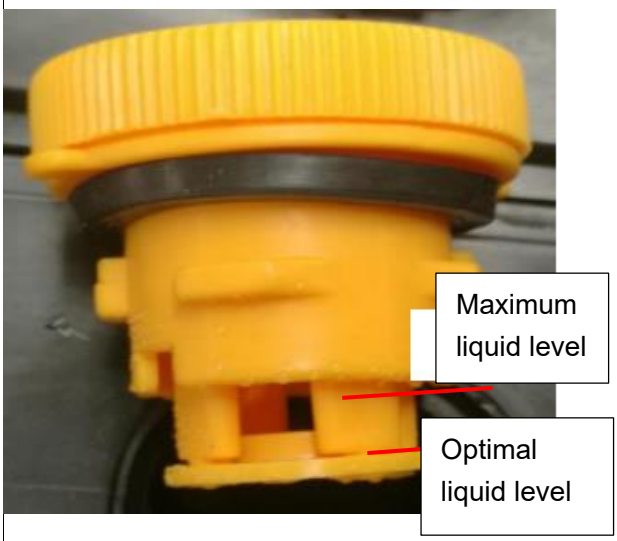


3. When the battery liquid level is lower than the sink, make up water



4. Some models of battery filling holes can not see the sink, the liquid level drops to 10mm from the battery partition, to make up water

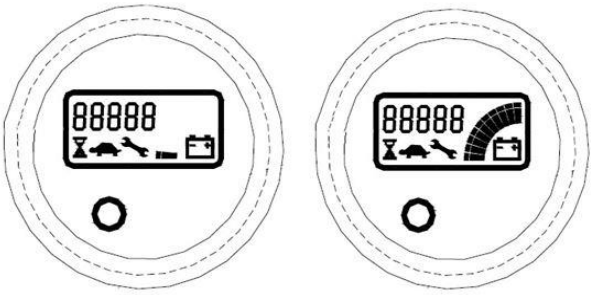
5. Use a plastic funnel to add water



6. Battery hydration height

c.Power indicator

The discharge situation is indicated by 10 red LED display segments.



Battery discharge Battery full

Figure 16: Battery discharge

The rightmost LED lights up only when the battery is properly charged. As the battery charge condition decreases, the LEDs light up sequentially, but only one at a time.

- The second LED from the left flashes, indicating "energy reserve" (70% of discharge depth).
- The leftmost 2 LEDs flash alternately, indicating "empty" (80% of discharge depth).

d.Charging

- Charge only with the included charger
- Before using the charger, please fully understand the contents of the charger instruction manual
- Please observe these rules
- The charging room must be well ventilated
- The full charge situation can only be viewed from the discharge display. To control this situation, interrupt the charging process and start the vehicle

Park the vehicle in a special secure area with dedicated power supply.
Lower the forks and remove the load.
Open the battery cover and keep it upright.
Turn off the vehicle power and connect the connector and charger.
The charger starts charging.
When charging is complete, remove the connector from the charger.
Connect the connector to the vehicle
Cover the battery cover.

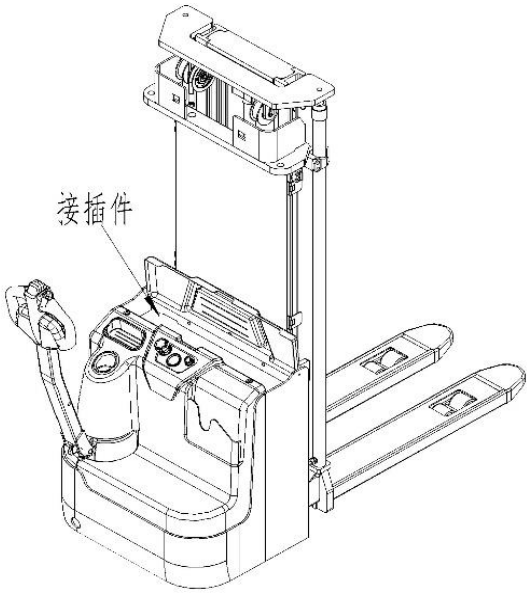


Figure.17:Battery charging

9. Supply power (lithium battery)

Brief introduction

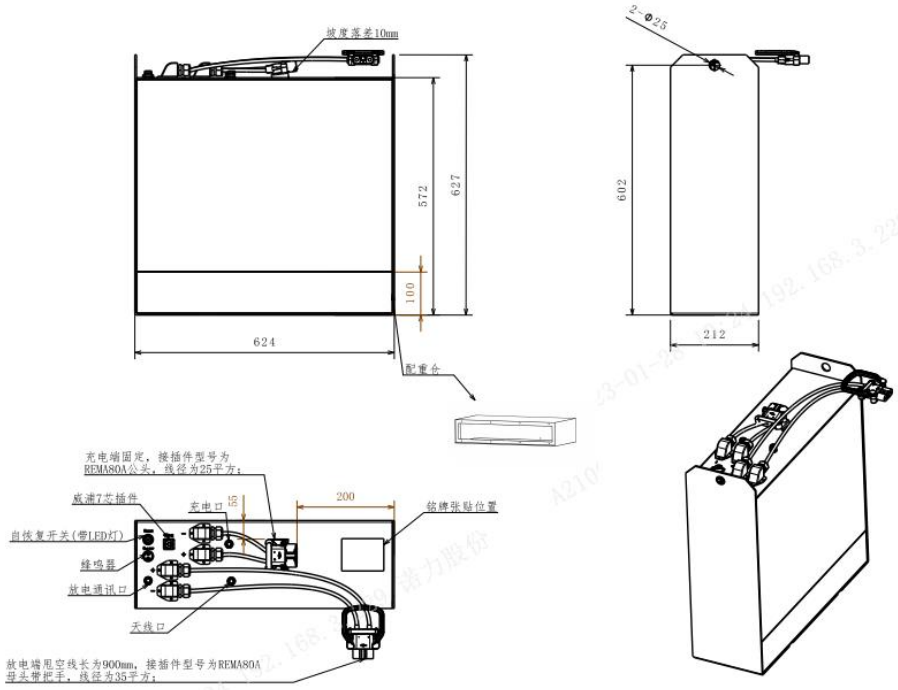
a.Product features

(1) The product is specially designed for pure electric forklifts and pure electric trucks to strengthen the structure and be able to withstand strong vibration and environmental impact.

2) The battery pack is equipped with intelligent battery management system, which has the functions of voltage and temperature collection, under voltage, over voltage, over temperature, over current, short circuit protection, etc.

3) The product is a custom battery pack made by Noritake, which ensures the applicability of the product from the design source.

4) The battery has low internal resistance, which can minimize heat generation and provide more sufficient power.



Outline diagram (24V 150Ah)

b.Technical parameters

Item		Parameter	Note
Specification		Standard 24V 150Ah	Optional 24V 200Ah
Nominal voltage		24V	
Rated capacity		150Ah	0.5C discharge
Reference weight		72kg	
Discharge	Maximum continuous discharge current	80A	
	Maximum pulse discharge current	180A	30seconds
	Discharge cut-off voltage	≥20V	
Charging	Standard charging current	60A	
	Maximum charging current	75A	
	Charging voltage	29.2V	
Internal resistance		Less than 25mΩ	Between positive and negative poles
Charging temperature		0～55℃	
Discharge temperature		-20～60℃	
Storage temperature range		-20～35℃	

Safety Precautions

Please read carefully and strictly observe the following safety precautions before installation and use, otherwise it may cause damage to your life and property.

● Preventing fire

●Prevent from catching fire

-Forbid to expose it to more than 60℃ environment

-Do not place it next to heat sources, such as fireplaces, fireplaces, etc.

-Avoid direct sunlight

-Prohibit placing the product near flammable and explosive materials.

●Prevent leakage of electricity

-Do not disassemble

-Do not touch with wet hands

-Do not expose it to moisture or liquids

-Do not place in a location that is easily accessible to children or animals

●Prevent damage to the battery system

-Do not expose it to liquids or corrosive chemicals

-Prohibit high temperature and pressure

-Do not step on, disassemble, or drop the battery.

-No charging from the discharge port and no discharging from the charging port

●Prevent explosion

-Prohibit strong impact

-No puncturing
-Do not throw it into fire or water

C. Installation and use

1). Installation environment

Recommended installation environment: temperature 0~35℃, humidity 5%~95%.

Avoid excessive temperature difference (more than 5℃) on both sides of the battery.

2). Installation method

Install vertically downward, avoid violent bump, impact and drop during installation, and the charging port should be facing the opposite direction to the discharge port of the whole vehicle for charging.

3). Use requirements

Use according to the following table, avoid exceeding the specified use requirements, otherwise it may cause damage to the product.

Discharge	Maximum continuous discharge current	80A	
	Maximum pulse discharge current	180A	can not exceed 30 seconds
	Discharge cut-off voltage	≥20V	
Charging	Standard charging current	60A	
	Maximum charging current	75A	
	Charging voltage	29.2V	

d.Emergency Handling

In case of the following emergencies during the storage, installation and use of the product, please follow the methods provided in this section.

1). Product on fire

If the product is smoking and on fire, stop working on the product. Under the premise of ensuring the safety of personnel, you can use a Class D fire extinguisher or sand to extinguish the fire. It is forbidden to dismantle the machine for private maintenance.

2). Product immersed in water

If the product is immersed in water, please stop working on the product. Please contact our company or authorized dealer for technical support as soon as possible.

3). Product odor

If the battery has a distinct odor (similar to the smell of white wine), remove the battery pack immediately. Avoid contact with leaking liquid and gas. Once contacted, please clean it promptly.

4). Necessary safety equipment

Self-contained breathing apparatus and personal protective equipment

Class D fire extinguisher

Other unknown cases can contact our company or authorized distributors for technical support.

e. Notes

1). Charging requirements

The battery has a built-in protection system, when the system is over-discharged, the internal relay will cut off the output and exhibit a high resistance state (OD). The maximum charging voltage of the charger is limited to 29.2V, and the voltage and current output is controlled by the battery BMS.

2). Caution

Battery is prohibited to be charged below 0℃, otherwise it will seriously cause battery performance degradation and even safety events.

The battery is not allowed to be charged at low temperature, and it should not be used at low temperature (cold storage or outdoor in winter), especially in places where the ambient temperature changes drastically, condensation water droplets will be generated inside the battery, and the water droplets will break the internal electronic devices of the battery and produce unpredictable hidden danger. After taking out from the cold environment, the battery should be placed at room temperature for at least 4 hours before use.

The protection level of the battery is IP54. The battery cannot be rinsed directly with water, but can be wiped with a cloth dipped in water, but not the charge/discharge port.

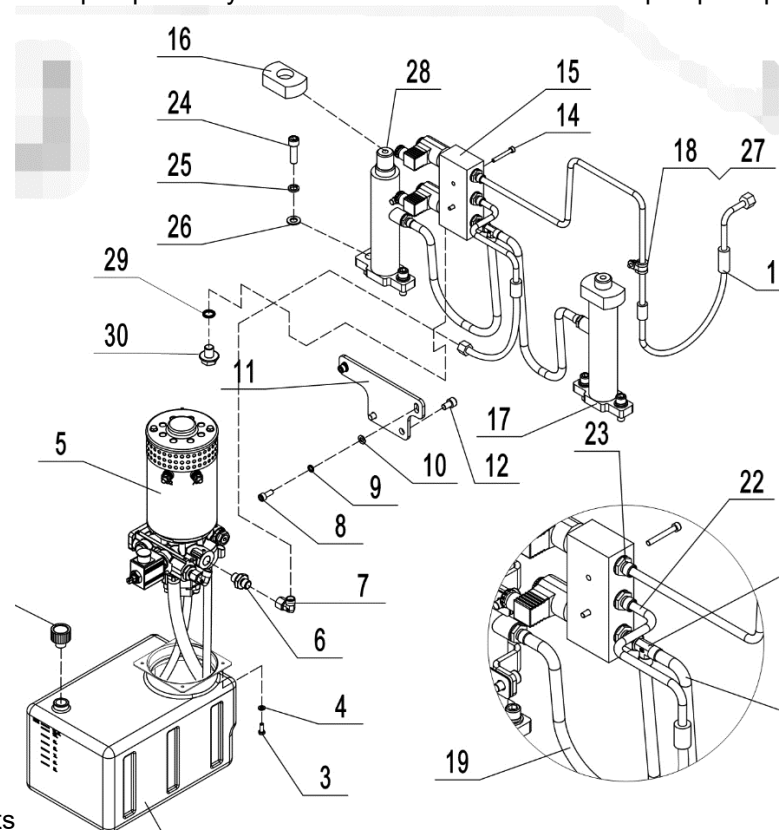
The battery should not be used in marine salt spray environment, nor in wet environment for a long time (aquatic market, cold storage, ice factory, bathroom, acid factory and other environments).

When the lithium battery pack is not used for a long time, please do not store it in a fully charged state, try to store it in a semi-charged state (the battery voltage is around 26.4V), and store it in a cool place.

10.Hydraulic system

a. Overview

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



1) Components

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

1 A pump motor controlled by a controller drives the main hydraulic pump.

2The 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 drawn in by the main hydraulic pump for reuse.

Hydraulic oil circulation

The hydraulic oil tank stores the hydraulic oil which is supplied to the main hydraulic pump through the filter. The main hydraulic pump pressurizes the supplied oil and sends it to the lifting cylinders. On receipt of the hydraulic oil, these systems perform their functions and then discharge the waste oil to the tank through the return filter.

2) Detection

The pump motor transmits power electrically to the main hydraulic pump in order 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 key emergency stop switch is closed.
The limit switch and rise button are closed.
Pump motor contactor is engaged
Pump motor contactor detects.
For the pump motor contactor, follow the diagram shown in
and check that it measures the specified value.

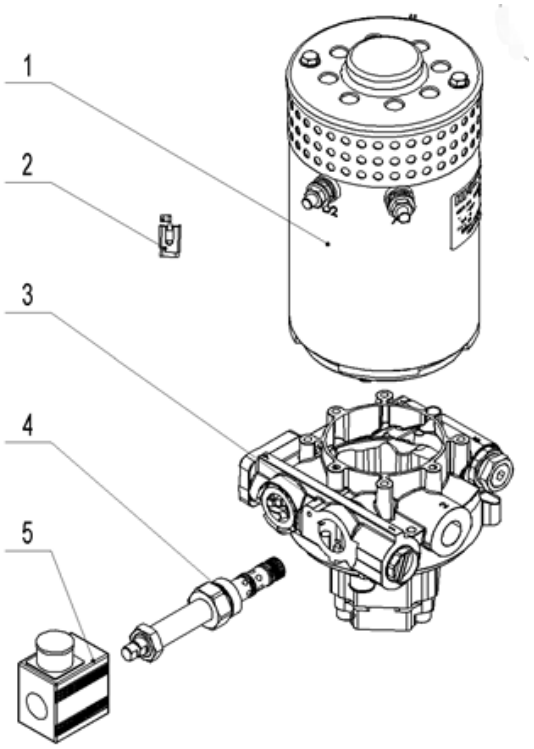
DANGER-

Pressurized hydraulic fluid can cause severe burns and may even lead to amputation infection."

Make sure you have relieved pressure from the system before performing the following steps.

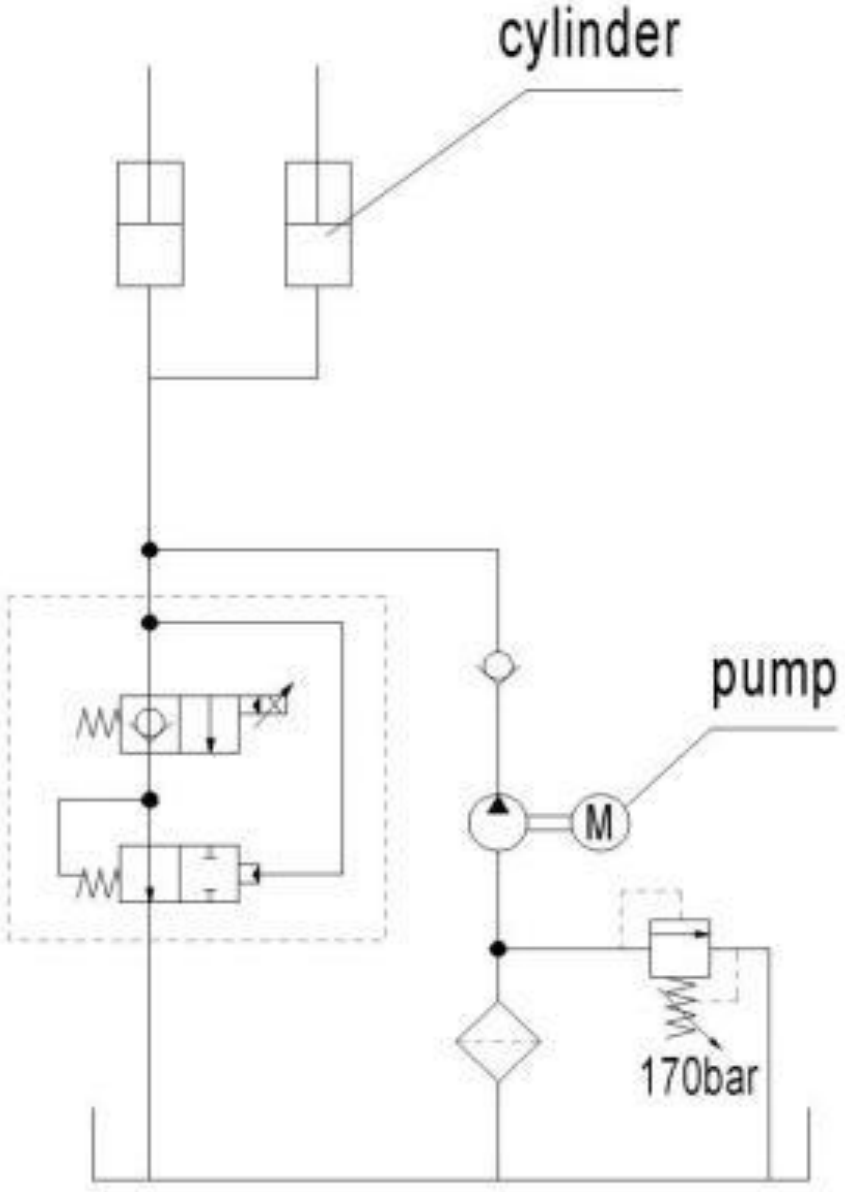
Safety valve pressure has been adjusted before the factory, do not allow users to adjust and disassemble at will

b.Pump station



No	Material Code	ITEM	Quantity	NOTE
/	950900100015	Pump station	1	
1	534798510006	Motor	1	
2	534798520026	Carbon Brush	1	
3	534798510007	Valve block	1	
4	534798520024	Solenoid Valve Spool	1	Provided together with the coil
5	534798520025	Coils	1	**Provided together with the coil**

c. Hydraulic schematic



d. Troubleshooting

Pump motors

Failure	Possible cause
The hydraulic pump motor does not work.	Poor connection or blown fuse. Check battery connection. Check key fuse. Check hydraulic pump motor for possible blown fuse.
	Key switch, upper limit switch, line contactor not closed. Turn off the key switch. Use a multimeter to check power flow through key switch, line contactor coil and line contactor. Key switch must be turned o
	Insufficient voltage. Charge the battery or replace it. Check that the cable terminals fit snugly into the battery terminals and control panel connectors. Check for broken wires inside the cable.
	Incorrect operation of the lift and drive system.
	The battery is not fully charged during battery charging operation.
	The hydraulic system consumes too much battery power due to lifting or hydraulic control for incorrect work cycles.
	The hydraulic pump motor overheats. If the motor temperature reaches 155°C (311°F)
The battery can not last the full normal working time.	The battery is not fully charged during the battery charging operation. Check whether the battery is charged evenly(Charging makes all batteries equal specific gravity). Check the battery charger for defects.
	The battery charging interval is too long or the charging battery cooling time is too short. Reduce battery working duration.
	(Lead-acid battery)Battery attenuation，This maybe cause it under the rated capacity and battery capacity. Test and find the defective cell. Replace defective batteries. Battery units are connected in series, and a bad cell unit results in high resistance in series with other batteries. As the resistance of the battery increases, this reduces the speed of the motor. This can happen when other batteries are almost fully charged.
	The hydraulic pump motor overheats.

Hydraulic Pumps

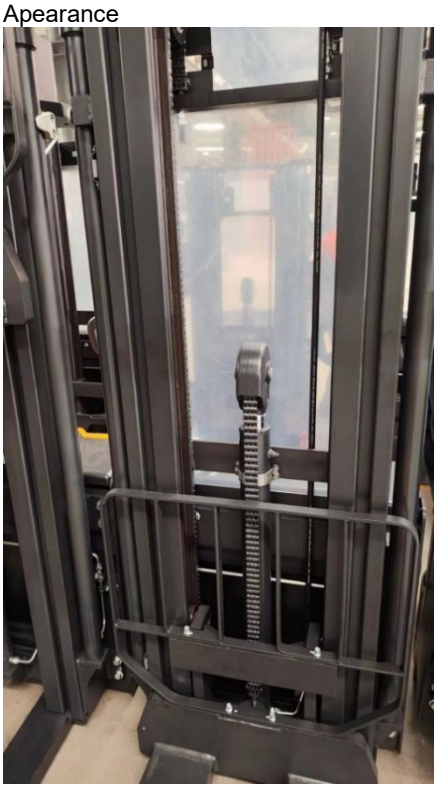
Failure	Possible cause
Noise in the pump.	Low oil level.
	Oil is very thick (viscosity is too high)
	Pump inlet piping has restrictions.
	Wear parts in the pump.
	The oil is dirty.
	Air leaks into the inlet line.
The oil temperature is too high.	Low oil level.
	Restricted oil channels
	The oil is too thin.
	Leakage at pump shaft seal.
	The pump is too worn.
	Shaft seal is worn.
Leakage at pump shaft seal.	The pump body is worn internally.
	Operation with a low oil level in the tank can cause suction on the seal.
	Seal is cut in the shoulder of the pump or keyway during installation.
	Seal lips are dry anSystem is operating at too high a pressure.d hardened by heat.
	Low oil content in the tank.
The pump cannot deliver the fluid.	Pump inlet line has restrictions.
	Air leak in pump inlet line. Loose bolts.
	Defects in the suction line of the bay.
	Oil viscosity is wrong.
	The pump is too worn.
	Pump shaft failure
	Pump bolts are not properly torqued.

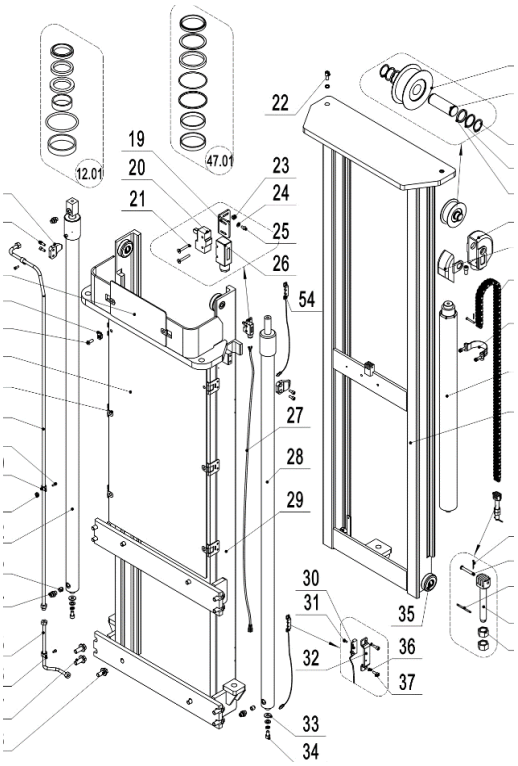
11.mast system
a.Overview
Lifting system is powered by the main hydraulic pump.

Forks: two fork-shaped objects to support the load
Chain: the part that lifts the pallet and the mast

Lifting cylinder: single acting cylinder pulling back the chain of the pallet

mast: the vertical structure at the front of the forklift that extends and retracts to lift and lower the load
b.Mast
Apearance





mast Lifting

The mast assembly uses two masts and a single acting cylinder to lift the load. Rollers mounted on the inside and outside of the forks and mast respectively facilitate these up/down movements.

Cylinders

After receiving hydraulic oil from the pumping station, the rod of the cylinder extends and pushes the inner mast upward, and at the same time, the fork is pulled by the lifting chain, which is connected to the outer mast and lifted together with the chain.

Lowering

If the operator presses and holds the lowering button, the oil output from the cylinder will begin to flow by

gravity to the tank.

As the oil is discharged, the cylinder rod and the attached internal mast will retract. When the internal mast is lowered, the tension on the lift chain will be slackened and the forks will be lowered as well.

Fork

1) Fork inspection

Forks should be inspected at least once every 12 months. If the vehicle is used in multiple shifts or heavy duty operations, it should be inspected every six months.

a. Check the forks carefully for cracks. Special attention should be paid to the heel section, all welded areas and mounting brackets. Forks with cracks should be replaced

b. Check the angle between the upper surface of the fork blade and the front surface of the fork Tiller .

If the angle exceeds 93 degrees or deviates from the original angle beyond 90 degrees by more than 3 degrees, the fork should be removed from service.

2) Fork disassembly/installation

a.Fill 10cm thick sleeper under the fork and lower the fork completely.

b.Disconnect the chain and fork.

c.Slowly raise the mast to make the fork frame free from the mast and take out the fork.

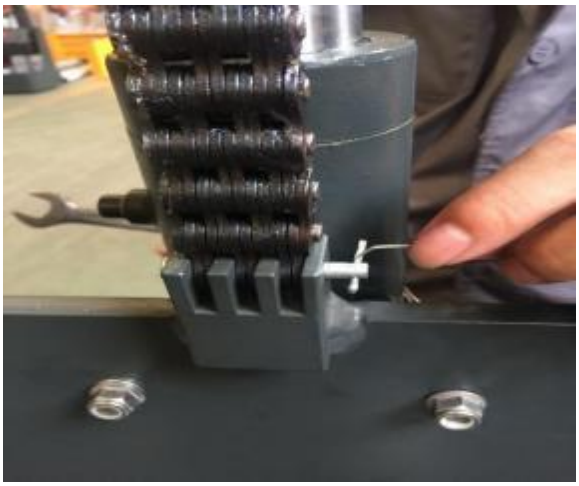
d. Perform the above steps in reverse order to install the forks.

Note: During disassembly, inspect the forks and fork carriers and replace any parts that may be damaged, broken or excessively rusted.

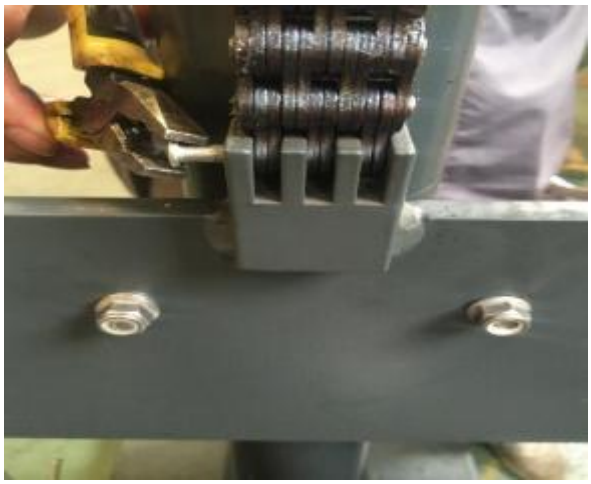
Chain

Chain replacement

1. Lift the pallet rack, pad the wood, so that the chain does not stress the state



2. Remove the cotter pin at the top end of the chain



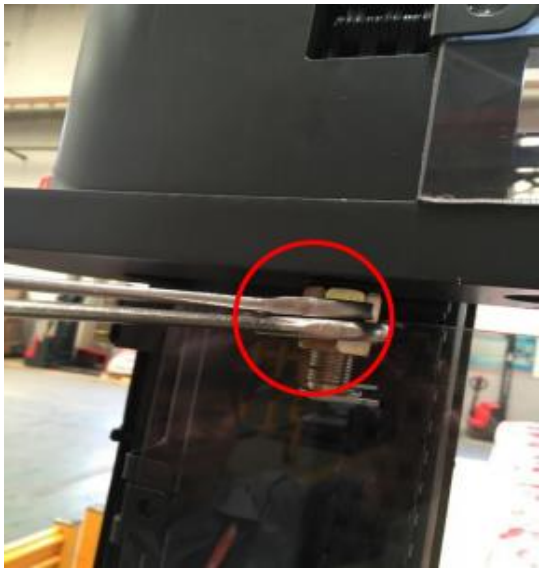
3. Remove the pin

4. Remove the cotter pin at the lower end of the chain

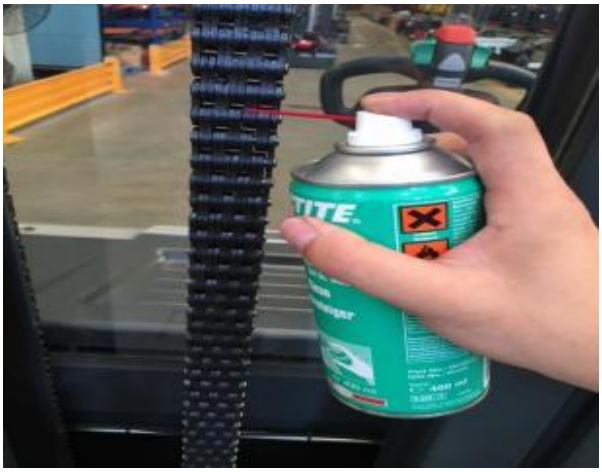
5 Remove the pin

5. You can remove the chain and replace it, the installation process is the reverse process of disassembly

Maintenance Chain



We need to use two 24mm open-end wrenches to tighten the chain bolts so that the chain is still under force when the pallet is in the lowest position. Then use your fingers to press each chain until you feel the same rebound force.



2. In the process of long-term use of the product, there will be a lot of dirty things on the chain, so we need to clean the chain and use a grease-soluble cleaning agent.

3. In the process of using the product for a long time, the chain will be rusted, in order to avoid this phenomenon, we need to lubricate the chain. The required grease specification is: DIN 51825 standard grease.

Lifting cylinder

Replace outer cylinder

External cylinder right

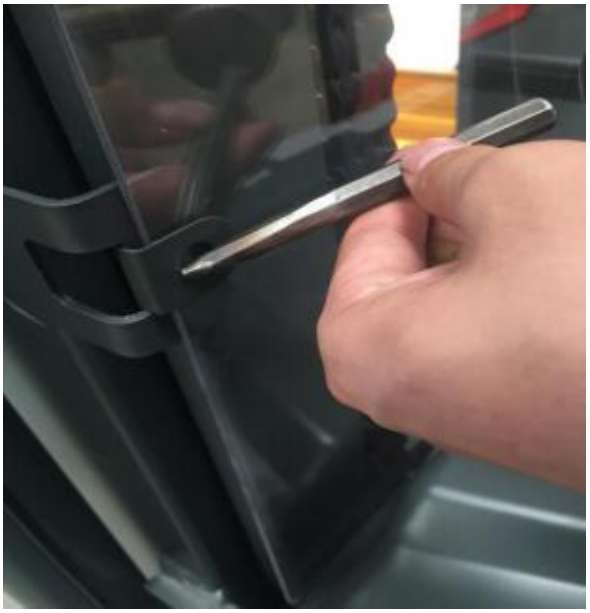
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">1. Use the 19mm open-end wrench to remove the oil pipe at both sides of the lifting cylinder, note: hydraulic oil will seep out when dismantling the oil pipe, it is recommended to put back the yarn or rag when dismantling.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>2. Use a 12mm wrench to remove the oil return pipe on both sides</td><td>3. Remove the top bolt of the cylinder with a 12mm hexagon socket..</td></tr>
</table>

	
4. Unscrew the cylinder lever fixing bolt with a 6mm hexagon socket	5. Use 12mm hexagonal wrench to take off the cylinder base fixing bolt,
	
6. Remove the cylinder, the installation process and the reverse of the above process	

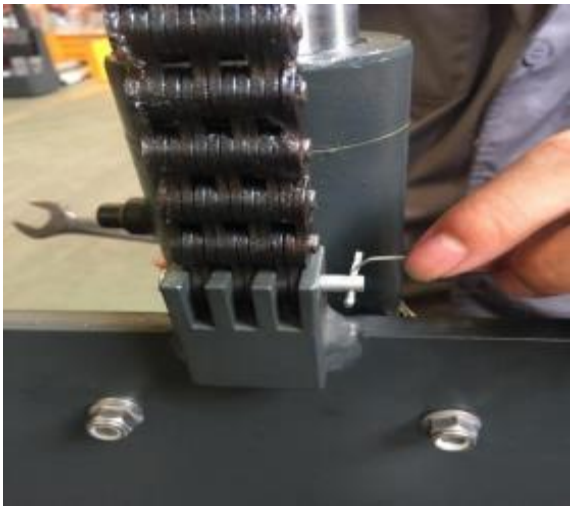
External cylinder left

	
1. Use 22mm open-end wrench to remove the oil pipe at the bottom of the cylinder	2. Use 22mm open-end wrench to remove the top oil pipe of the cylinder
	
3. Use a 12mm hexagon socket to remove the two bolts holding the top of the left and right cylinders to the mast.	4. Remove the four bolts on the left and right cylinder pressure plate with a 6mm hexagon socket.
	
5. Use 12mm hexagonal wrench to remove the cylinder base fixing bolt	6. Remove the entire cylinder

Replacement of medium oil cylinder

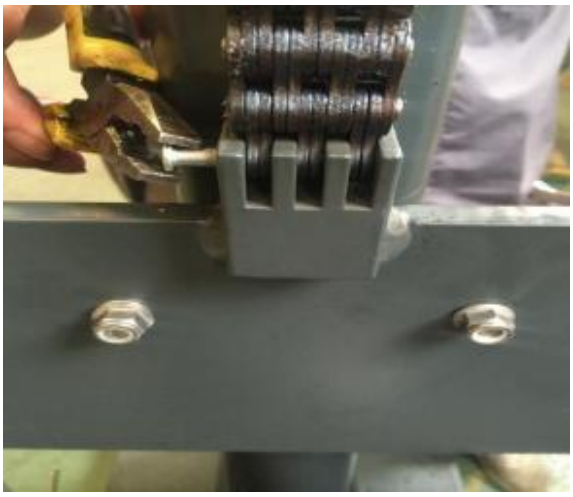


1. Use a punch to knock down the spring clamp and remove the protection plate



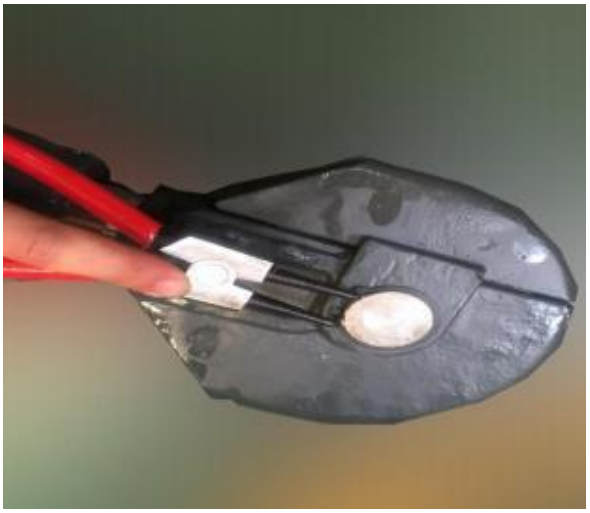
2. Use 22mm open-end wrench to unscrew the oil pipe at the bottom of the middle cylinder.

3. Remove the cotter pin



4. Take out the pin, you can take off the chain

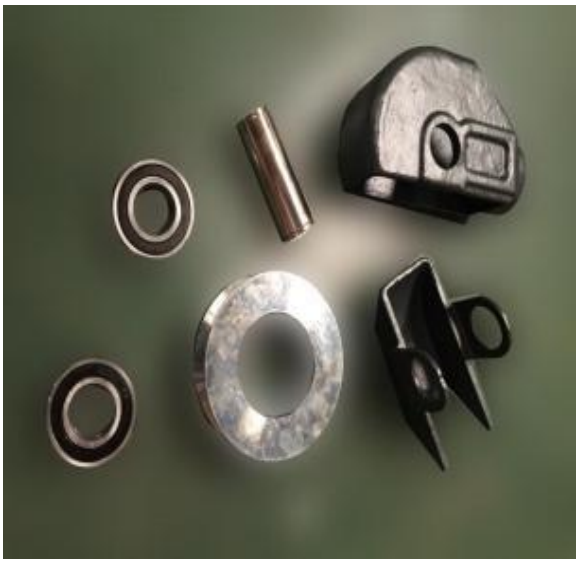
5. Use 13mm open-end wrench to unscrew the hoop bolt and take off the hoop



7. Remove the middle oil cylinder

8. Remove the spring with a spring clamp

9. Remove the sprocket shaft

	
10. Remove the side cover with a 12mm hexagonal wrench to remove all parts for replacement and repair. The installation process is the reverse process of disassembly.	

12.REGULAR MAINTENANCE

-  Only qualified and trained personnel are allowed to do maintenance on this truck.
- Before maintaining, remove the load and lower the forks to the lowest position.
- If you need to lift the truck, follow chapter 4 b 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.
- If you need to change the wheels, please follow the instructions above. The castors must be round and they should have no abnormal abrasion.

  Check the items emphasized maintenance checklist.

a.Maintenance checklist

Table 3: Maintenance checklist		Interval (Month)			
		1	3	6	12
	Hydraulic				
1	Check the hydraulic cylinder, piston for damage noise and leakage		□		
2	Check the hydraulic joints and hose for damage and leakage		□		
3	Inspect the hydraulic oil level, refill if necessary		□		
4	Refill the hydraulic oil (12 month or 1500 working hours)				□
5	Check and adjust the function of the pressure valve (1200/1600 kg +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 mast and chain for corrosion, deformation or damages, replace if necessary	□			
10	Check the gearbox for noise and leakage		□		
11	Check the wheels for deformation and damages, replace if necessary		□		
12	Lubricate the steering bearing				□
13	Inspect and lubricate the pivot points		□		
14	Lubricate the grease nipples	□			
15	Replace the guarding and/or protective screen if it is damaged	□			
	Electric system				
16	Inspect the electric wiring for damage		□		
17	Check the electric connections and terminals		□		
18	Test the Emergency switch function		□		
19	Check the electric drive motor for noise and damages		□		
20	Test the display		□		
21	Check if correct fuses are used, if necessary replace.		□		
22	Test the audio warning signal		□		
23	Check the contactors		□		
24	Check the frame leakage (insulation test)		□		
25	Check function and wear of the accelerator		□		
26	Check the electrical system of the drive motor		□		
	Braking system				
27	Check brake performance, if necessary replace the brake disc or adjust the air gap		□		
	Battery				
28	Check the battery voltage		□		
29	Clean and grease the terminals and check for corrosion and damage		□		
30	Check the battery housing for damages		□		
	Charger				
31	Check the main power cable for damages			□	
32	Check the start-up protection during charging			□	
	Function				
33	Test the audio warning signal	□			
34	Check the air gap of the electromagnetic brake	□			

35	Test the emergency braking	□			
36	Test the reverse and regenerative braking	□			
37	Test the safety (belly) button function	□			
38	Check the steering function	□			
39	Check the lifting and lowering function	□			
40	Check the tiller arm switch function	□			
41	Test the key switch of damages and function	□			
42	Test the speed limitation switch (lifting height >~300mm)	□			
	General				
43	Check if all decals are legible and complete	□			
44	Check if the protective screen and or guarding is not damaged	□			
45	Inspect the castor, adjust the height or replace it, if worn out		□		
46	Carry out a test run	□			

b.Lubrication points

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

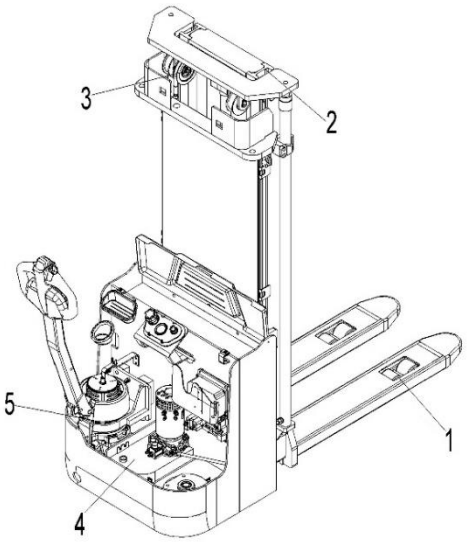


Fig. 18: Lubrication point

1 Load wheel bearing

2 mast

3 Chain

4 Hydraulic system

5 Steering bearing

c. Check and refill the hydraulic oil

The required hydraulic oil type is:

Ambient temperature	–5℃~25℃	>25℃
Type	HVLP 32, DIN 51524	HLP 46, DIN 51524
Viscosity	28.8-35.2	41.4 - 47
Refueling volume	9.3L to 9.5L	

Waste materials such as used oil, used batteries or other materials must be disposed of and recycled according to national regulations, and if necessary handed over to a recycling company for recycling.

The oil level should not be lower than the minimum amount of oil required to lift the cargo. If necessary, the oil should be added to the refueling point..

d. Check the electrical fuse

Remove the main cover, the fuse is located in the position shown in Figure 19. Fuse specifications are shown in

Table 4: Fuse Specifications

	Specification
Fuse 1	10A
Fuse 2	10A
Fuse 01	350A

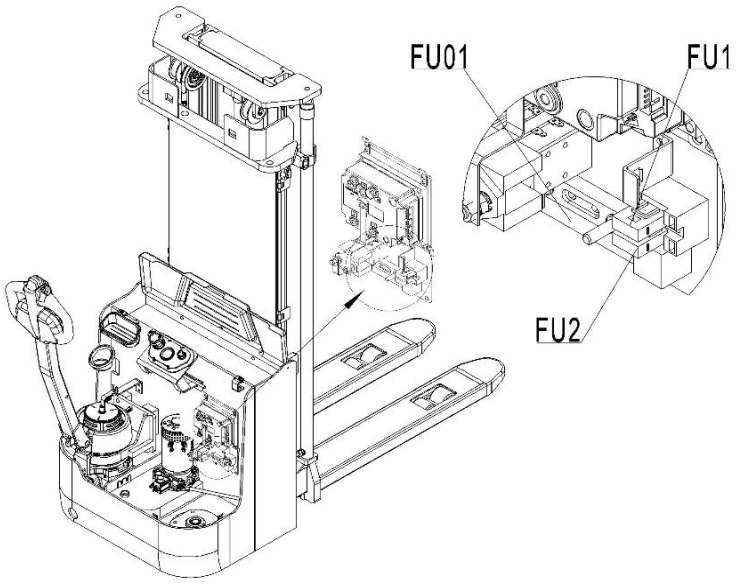


Figure . 19: Fuse position

e. Remove and reinstall the guard

Do not use this vehicle if the guard is damaged or not properly installed.

If the guard needs to be removed, unscrew the screws holding it in place and carefully remove the guard with the screws still on it. When reinstalling, place the guard in the correct position and secure each screw correctly. If you need replacement parts, please contact your nearest service partner.

Remove the clips protecting the shield and remove the shield. Reverse the installation procedure. Make sure that the shield is properly fixed and not damaged.

13 TROUBLE SHOOTING

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

Table 5: Trouble shooting

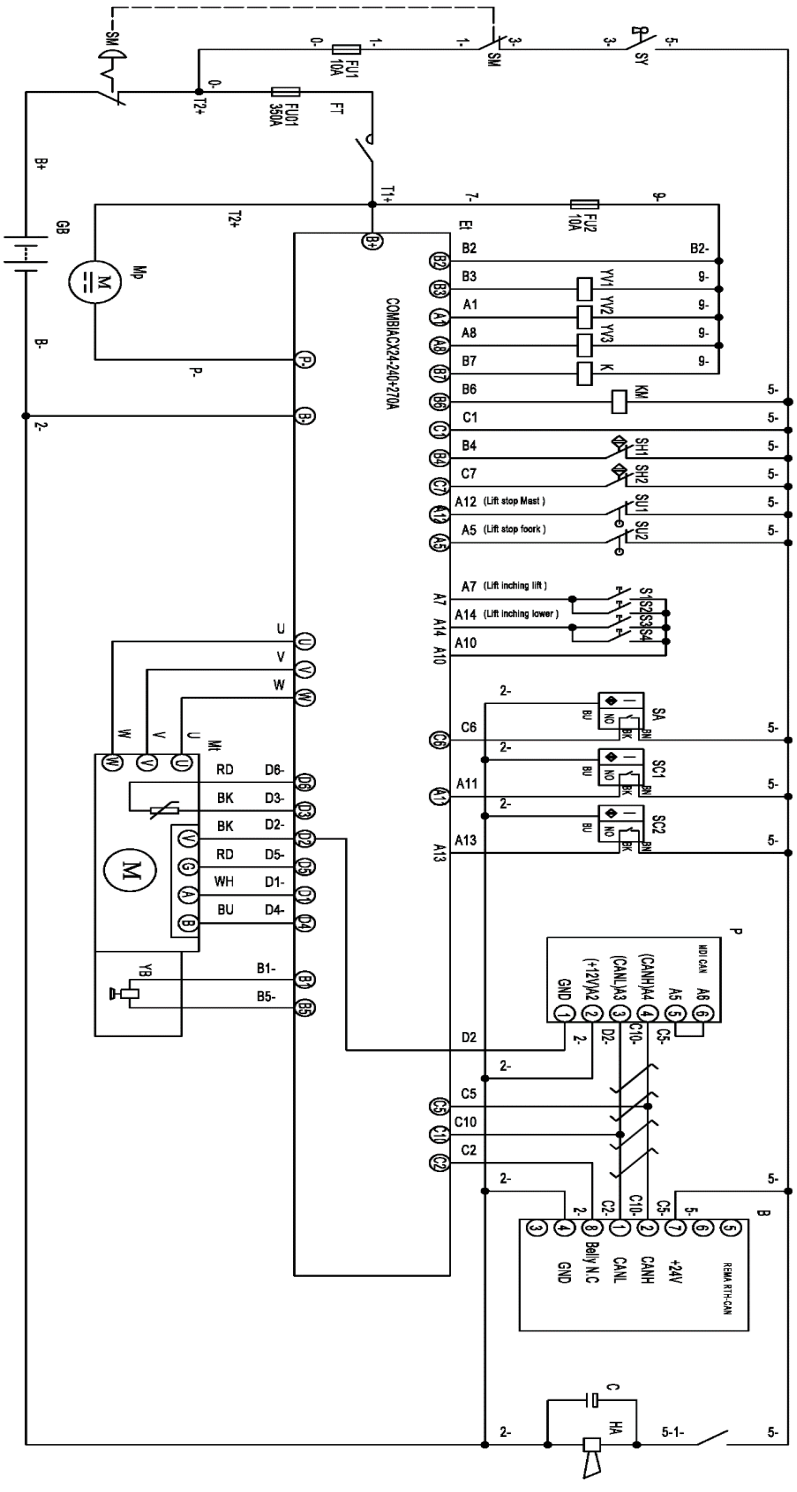
TROUBLE	CAUSE	REPAIR
Load can't be lifted	Load weight too high	Lift only the max. capacity, mentioned on the ID-plate
	Battery discharged	Charge the battery
	Lifting fuse faulty	Check and eventually replace the lifting fuse
	Hydraulic oil level too low	Check and eventually refill hydraulic oil
	Oil leakage	Repair the hoses and/or the sealing of the cylinder
	Lifting stops at ~1800mm	Move the protective arms into the downside position
	Lifting stops at ~1800mm	Check the sensor for the protective arm
	Height sensor for 1800mm height defect	Check the height sensor on the mast
Oil leakage from air breathing	Excessive quantity of oil.	Reduce oil quantity.
Stacker not starts operating	Battery is charging	Charge the battery completely and then remove the main power plug form the electrical socket.
	Battery not connected	Connect the battery correctly
	The fuse is faulty	Check and eventually replace fuses
	Battery discharged	Charge the battery
	Combined emergency switch is activated	De-activate the combined emergency switch by insert and pull the knob.
	Tiller in the operating zone	Move the tiller firstly to the braking zone.
	Protective arms in the upright position, platform folded upright	Move the protective arms into the downside position
	Foldable platform or protective arms in one of the allowed positions	Check the proximate sensors for the arms and platform
	Foldable platform or protective arms not in one of the allowed positions	Check the correct function of the arms and/or platform
Only travelling in one direction	The accelerator and the connections are damaged.	Check the accelerator and the connections.
The stacker only travels very slowly	The battery is discharged.	Check the battery status at the discharge indicator
	The electromagnetic brake is engaged.	Check the electromagnetic brake
	The relating tiller cables are disconnected or damaged	Check the tiller cables and connections.
	Defective height sensor for reduced speed at ~300mm height	Check the sensor
	Electric system overheated	Stop using and cool down the truck
	Defective heat sensor	Check and if necessary replace the

		heat sensor
The stacker starts up suddenly	The controller is damaged.	Replace the controller.
	The accelerator not moves back to its neutral position.	Repair or replace the accelerator.

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 the truck out of the aisle.

14.WIRING/ CIRCUIT DIAGRAM

a. Electrical circuit diagram



Fuse 1 : 10 A Fuse 2 :10 A Fuse 01 : 350 A			
	ITEM	CODE	ITEM

B	Tiller	P	Indicator
C	Capacitor	S1,S2,S3,S4	Inching switch
Et	Controller	SA	Inter-lock switch
FU01,FU1,FU2	Fuse	SH1,SH2	Magnetic switch
GB	Battery	SM	DC power switch
HA	Horn	SU1,SU2	Micro switch
K	Relay	SY	Key switch
KM	Main contactor	YB	Electromagnetic brake
Mp	Pump motor	YV1	Proportional valve
Mt	Traction motor	YV2,YV3	Electromagnetic valve

Fig.20: Electrical diagram (EPS)

Table 6: Description of electrical diagram

b. Hydraulic circuit

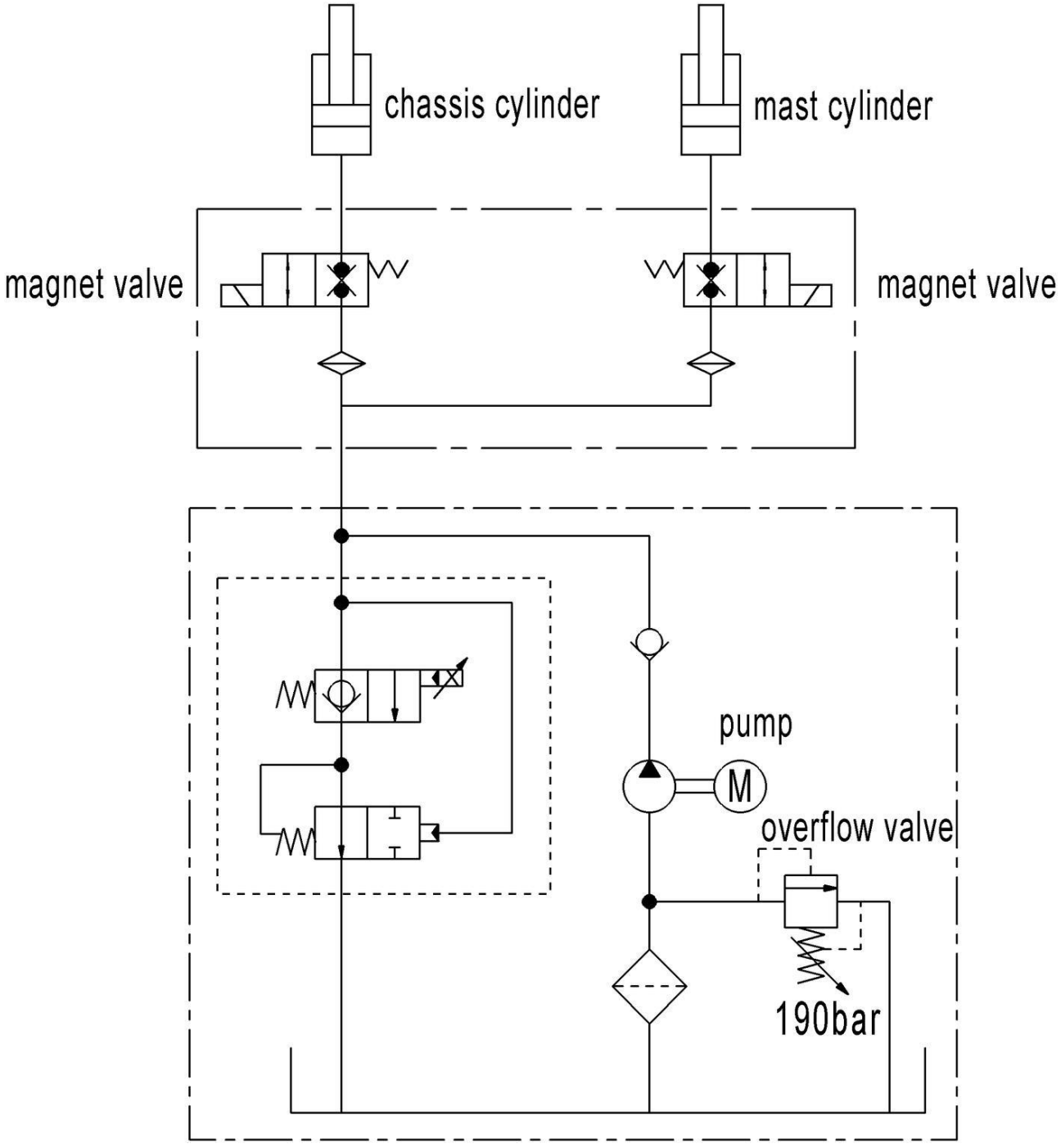


Fig.21 Hydraulic circuit

c.Brake system schematic

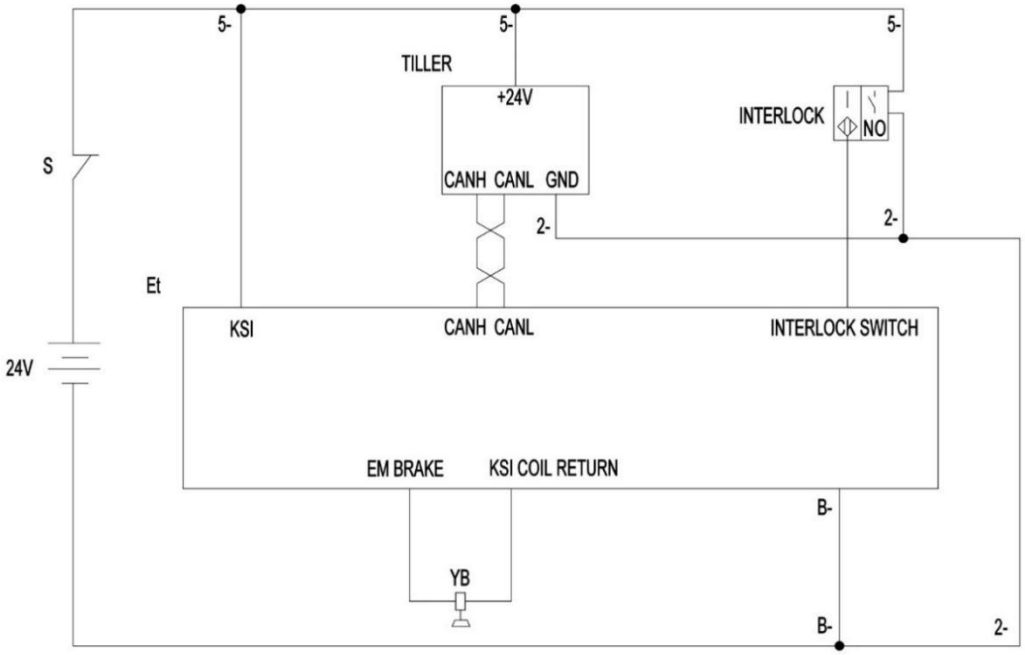


Figure.22 Braking schematic

15 The use of ZAPI handheld programmers

The power supply

In the battery car, the traction battery can be used as the power supply voltage for the handheld programmer. For lead-acid batteries, the nominal battery voltage is 12V-80V.

> ***For batteries with a nominal voltage greater than 80V, the intelligent controller can be powered by internal batteries. Do not connect the source voltage beyond the maximum rating or the controller will be damaged!***

Handheld programmer turns on

1)Connect the wire harness to the ZAPI handheld programmer CNX connector. Figure 1 shows the wire harness customized for Nori.

2)Emergency side screw to avoid accidental disconnection

3)CONNECT the ZAPI manual programmer wire harness TO the vehicle CAN line (CONNECT TO):You CAN insert the connector before opening the vehicle or when the vehicle is already running.

4) Cable red crocodile clipping vehicle power positive pole, black crocodile clipping vehicle power negative pole.

5)Once the CNX8 voltage is available, the ZAPI manual programmer opens and the home screen appears. The handheld programmer CAN connect to the Zapi controller inside the CAN line.

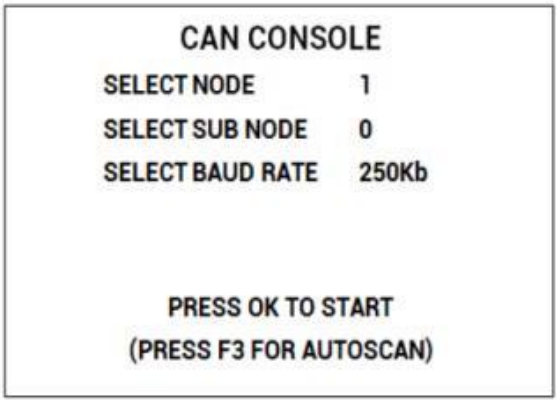
The main screen

When the Zapi logo appears, the home screen is rendered

In addition, the green LED must be turned on and kept bright.

Connection methods：CAN CONSOLE

Select CAN CONSOLE and press OK: a new menu will appear.



New menu requests CAN node and child node connections: the current value appears on the right. The third line

requests the connection speed.

Use the up/down keys to move between rows and the left/right keys to change the value of each item.

Once the correct value is set, press OK to try to communicate with the node/child node.

SELECT NODE 2 Is the connection point of the walking controller,

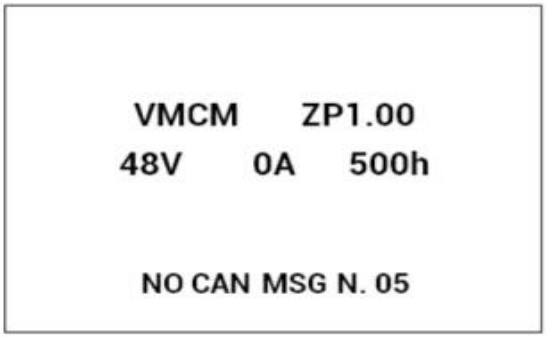
SELECT NODE 3 Is the connection point of the pump station controller

Press ESC to abort connection attempts at any time.

If the connection fails, a"no communication" warning will appear: press the ESC key to find the reason for blocking the connection

The connected

If the connection is successful, the monitor will display an image similar to the following.



This menu presents basic information about the controller in a manner similar to that of a super controller.

- The first line describes the controller firmware
- The second line presents the controller voltage, current, and hour meter
- The last line shows the current alarm code,(if any)

Press OK to enter the main menu

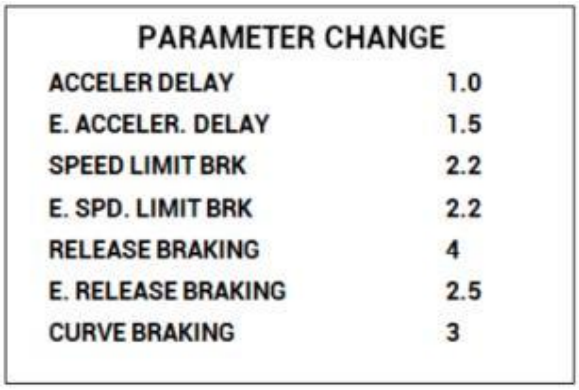
The main menu includes a complete list of menus available to the controller. In contrast to the super controller, only the

controller has no "hide" menu, which requires pressing multiple buttons immediately to reach: all menus are now visible.

Use the up and down keys to browse the list: Press OK when you find the menu you want.

Change the parameters

Go to the parameter change menu from the main menu.

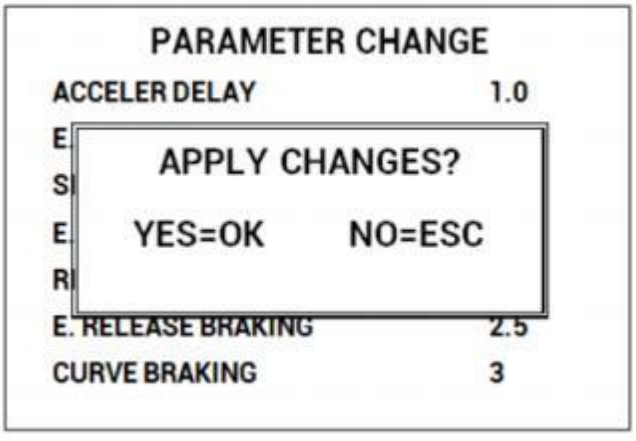


Use up and down keys to scroll through the list: Once the parameter you want to change is selected, use left or right to reduce or increase the value of the parameter.

Press left/right to change the value repeatedly.

Automatic repetition: This feature will speed up the program if many parameter values have to be changed.

You can press ESC to exit the menu at any time. If some parameters have been changed, the controller prompts the request to confirm/remove the changes.

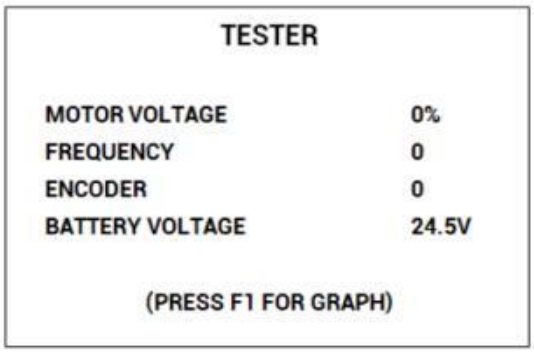


The above descriptions are valid for every menu that contains parameters and options such as setup options,

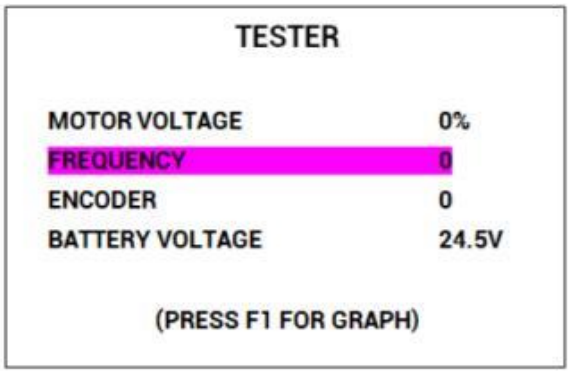
adjustments, hardware settings, etc.

Monitoring menu

The monitoring menu has changed significantly compared to the standard handheld. Immediately display four variables: scroll the menu as usual using the up/down key.

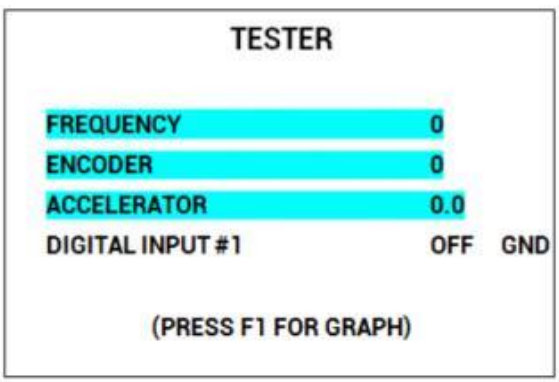


A variable may be "stuck" and it will keep scrolling. Once the desired variable is selected, right-click: it will be selected in a different color.



Once Start scrolling up or down again, and the "stuck" variable will appear on the top first line: From now on, it will no longer move, but will update the current value as usual. "Stuck: variables will be highlighted in light blue.

The block program can be repeated up to three times, so that three variables are fixed on the screen as the fourth variable scrolls. See the following example



In this way, it is possible to record four variables that are far apart from each other in the full list in a single view.

Press the left button to "unlock" the last locked variable. Pressing the left button up to three times will unlock all variables.

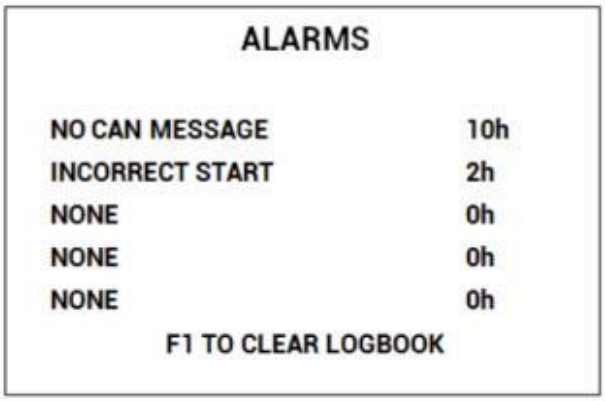
Press ESC to return to the main menu.

Note that pressing the F1 key activates the time- exceeded graphical representation of the selected variable.

The graphics tester is not fully functional: it will be activated in future firmware.

Alarm

The alarm menu is different from the older handheld programmers. The display immediately renders all alarms of the controller.



The maximum number of alarm codes stored in the controller is 5.

Use different colors to distinguish between recurrent alarm codes and rare events. In order of alarm names according to the increased frequency:

• White: up to 5 events

• Yellow: up to 20,

• Orange: Up to 40,

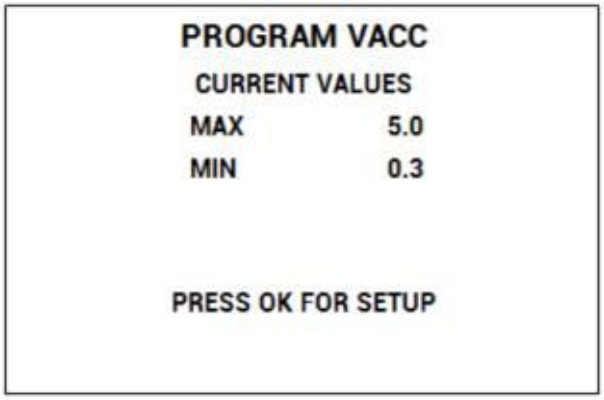
• Red: greater than 40.

Use the up/down key to select an alarm in the list: If you press OK, other information about the alarm will be displayed.

Press F1 to delete the controller alarm log: When the key is pressed, the controller will request confirmation.

Program VACC

The program VACC menu has changed slightly compared to the old controller. Upon entering this menu, the controller renders the current set value.



When you press OK, the VACC program will start: The controller will invite you to:

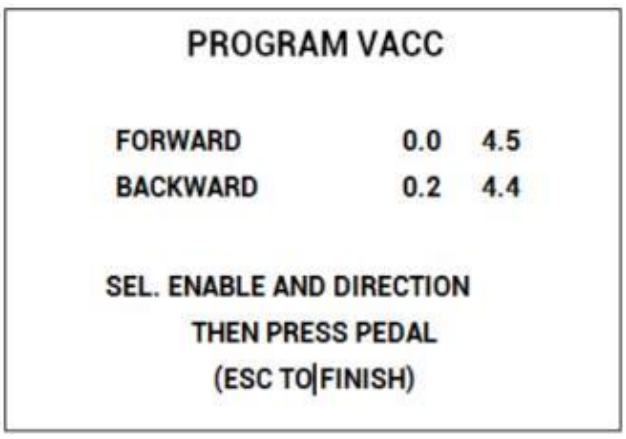
•Select the start switch, if any

•Select direction switch (forward or backward)

•Press and hold the pedal until it reaches its maximum range.

The display value changes with the input of the operator.

The above sequence can be changed slightly depending on the controller firmware. However, the logic remains consistent: before setting the minimum/maximum, perform any necessary start sequence, and then press the pedal/push lever.



When ESC is pressed, the controller asks to store or delete the set value.

End connections

Return to the home screen to end the connection: at this point, the cable may be removed from the target controller.

If the cable is removed from another menu, the controller will return to a no communication alarm state.

Controller shutdown

Once the cable is removed, the controller will automatically shut down.

16.ZAPI Fault Code List

MDI CODE	CAN CODE	ALARM	Fault name	Solution
79	79	INCORRECT START	Start sequence failure	Start sequence is not correct, possible causes. 1. The direction switch has been closed before the machine is turned on. 2. Wrong operation sequence. 3. The wire connection is not correct. 4. If you can not eliminate the fault, you need to replace the controller.
0	66	BATTERY LOW	Low battery power	If the battery detection function "BATTERY CHECK" parameter is not set to 0, when the battery power is lower than 15%, there is no grid above the meter, the fault alarm, lifting function is locked. At this time, the battery should be charged in time. If you find that the battery still has power, then check whether the value of the parameter "ADJUST BATTERY" of the controller is consistent with the battery voltage.
0	252	WAITING FOR NODE	Waiting for node signal	In the CAN communication network, a controller receives a signal that another controller cannot communicate properly, and the controller is always in a waiting state until the CAN communication network is all normal. Check why the wiring of the modules that cannot communicate is not normal, and check whether the software version or parameters are set correctly.
1	240	WRONG CONFIG	Configuration error	Check the internal parameters of the controller and whether the software is compatible with the model.
8	8	WATCH DOG	Watchdog fault	At startup, the watchdog circuit is activated before the software starts. The watchdog signal is invalid in the standby or running state (alarm state). Failure analysis: The watchdog hardware circuit or the output part of the microcontroller is damaged. Both cases are not related to external components, replace the controller
13	13	EEPROM KO	Memory damage	The vehicle does not run, there is a problem with the storage area of the parameters, the fault stops the vehicle. If the fault persists after repeated closing of the electric lock, replace the logic card. If the fault disappears, the original stored parameters are replaced by the wrong ones and need to be reset.
17	17	LOGIC FAILURE#3"	Logic card failure 3	c card current protection function failure. The controller should be replaced

18	18	LOGIC FAILURE#2	Logic Card Failure 2	Logic card on the phase voltage feedback hardware circuit part failure, replace the controller
19	19	LOGIC FAILURE#1	Logic card failure 1	The fault occurs when the low voltage or overvoltage protection function occurs. In a 24V system, the controller detects a voltage of more than 45V or less than 9V; in a 48V system, the controller detects a voltage of more than 65V or less than 11V. Possible causes: 1. 1. Whether there is a short circuit in the circuit system, such as DC-DC, brake coil, etc., or whether the controller input power contact is good. 2. Whether the battery voltage is too low or too high. 3. Test B +, B, the main contactor and other terminals above the power cable is tight. 4. Whether the controller voltage calibration parameters and the actual voltage is consistent. 5. Logic card on the overvoltage protection hardware circuit failure, replace the controller.
30	30	VMN LOW	VMN 低	Cause: The voltage at the high end of the MOS tube is less than 66% of the capacitor voltage when the motor is turned on, or this voltage is less than the required value during the motor operation. Possible causes. 1. motor wiring is not correct, or motor circuit problems; check whether the three-phase connection of the motor is correct; motor to ground whether there is leakage, whether There is a motor coil break. 2. The main contactor suction is solid. Contact has no wear. 3. Replace the controller
31	31	VMN HIGH	VMN HIGH	Cause: When the power is on, the voltage at the low end of the MOS tube is higher than 10% of the normal battery voltage, or the phase voltage is higher than 1/2 the battery voltage. Possible causes. 1, the motor wiring is not correct, or motor circuit problems; check whether the three-phase motor

				connection is correct; motor to ground whether there is leakage, whether there is a motor coil break. 2, replace the controller
37	37	CONTACTOR CLOSED	Contactor sticking	When closing the main contact coil, the controller should first detect whether the main contactor contacts are sticking or not. Try to discharge the capacitor, if the capacitor voltage is reduced by 20% of the battery voltage, the fault may arise. 1, it is recommended to check whether the contactor contacts are sticking, or replace the contactor.
38	38	CONTACTOR OPEN	Contactor does not close	Logic card has driven the main contactor coil, but the contactor is not closed, the possible causes: 1. 1. Contactor mechanical failure, jammed, etc. 2. contactor contact poor contact 3. If the contactor works properly, then replace the controller.
53	53	STBY I HIGH	High standby current	The current sensor output signal detected by the micro control system is outside the allowed range of unoperated current. This fault does not involve peripheral components and requires replacement of the controller.
60	60	CAPACITOR CHARGE	Capacitor charging error	When the electric lock is on, the controller will charge the capacitor through the power resistor and detect whether the capacitor is fully charged within the specified time, if it is not fully charged, the capacitor voltage is still less than 20% of the battery voltage, the controller will alarm, and the main contactor will not close. Possible causes. 1, peripheral devices, such as DC-DC, motor or other equipment interfere with the charging process of the controller, need to exclude the interference generated by these devices.

				2, charging resistor disconnection, charging circuit failure, power supply module problems, need to replace the controller
61	61	HIGH TEMPERATURE	Controller over-temperature protection	So that the controller's own temperature down to 85 ° below, if this fault still exists, it is possible that the temperature sensor failure or the controller's own logic board failure, at this time, you need to replace the controller.
65	65	MOTOR TEMPERAT.	High motor temperature	1、If the motor temperature digital switch is open, or the analog signal exceeds the cut-off value, this fault is generated. 2、When the motor temperature reaches 120℃, the controller alarm, at this time, the vehicle can still run, but the maximum current is cut, the vehicle performance is reduced. When the motor temperature reaches 125 ℃, the motor stops working. At this time should try to cool down the motor. 3, when the motor cooling fault still exists, check the wiring. If all is good, replace the controller.
68	235	CAN BUS KO EPS	No CAN signal from EPS	CAN communication failure between steering and traction. Detection of CAN wiring and software settings and version information.
70	253	ENCODER ERROR	Encoder failure	The controller detects a large difference between two consecutive speed readings from the encoders: Since it is impossible to change the speed of the encoders within the system by a large amount in a short period of time, it is possible that the encoders are faulty (one or both encoder wires are worn or broken), check the mechanical and electrical function of the encoders; it is

				possible that the alarm is caused by electromagnetic interference on the sensor bearings. If none of the above, replace the controller. Please note that human intervention may also cause the controller to display this fault, in which case it is necessary to power down and restart the vehicle. For example, the following cases. 1, the vehicle suddenly hit an obstacle, resulting in the vehicle can not walk. 2, when the vehicle is running at high speed, suddenly apply the brakes sharply.
71	251	HANDBRAKE	Handbrake closed	The handbrake switch is always closed
73	250	THERMIC SENSKO	Temperature sensor malfunction	The output signal of the controller temperature sensor is out of range. The fault is not related to external components, replace the controller.
75	75	CONTACTOR DRIVER	Drive short circuit	When the electric lock is closed, the controller will detect whether the main contactor driver is short-circuited, if short-circuited will alarm; detect the main contactor coil positive pole to A16 or power negative is short, if the periphery of all normal, then replace the controller.
78	78	VACC NOT OK	Accelerator fault	Detection time: Standby state This alarm indicates that the gas pedal voltage is more than 1V greater than the minimum value set in the gas pedal signal range (PROGRAM VACC). Possible causes. 1. The upper and lower voltage limits of the accelerator are not collected, enter the PROGRAM VACC menu and collect them again. 2. Accelerator error, maybe the accelerator pedal is not back, or the gas pedal internal error. 3. Controller failure.

80	80	FORW+ BACK	Forward and reverse signals are present at the same time (direction switch sticking)	The controller will always detect, when there are two directions at the same time to request the operation of the signal will be alarmed. Possible causes. 1. Broken wire 2. Directional switch failure 3. Improper operation 4. If the fault can not be eliminated, you need to replace the controller
86	86	PEDAL WIRE KO	Faulty positive and negative accelerator connections	Checking that the positive and negative gas pedal terminals are connected to the controller.
89	247	PEV NOT OK	PEV failure	Check whether CNB#2 is connected to the contactor behind the B+ above;
92	228	TILLER ERROR	Interlock and H&S input mismatch	Replacement of the controller.
97	99	CHECK UP NEEDED	Maintenance time	Maintenance time is up and maintenance is needed Forward and reverse signals are present at the same time (direction switch sticking)
99	249	CHECK UP KO	Maintenance completed	After the maintenance is finished, this fault is reported and disappears after reboot.