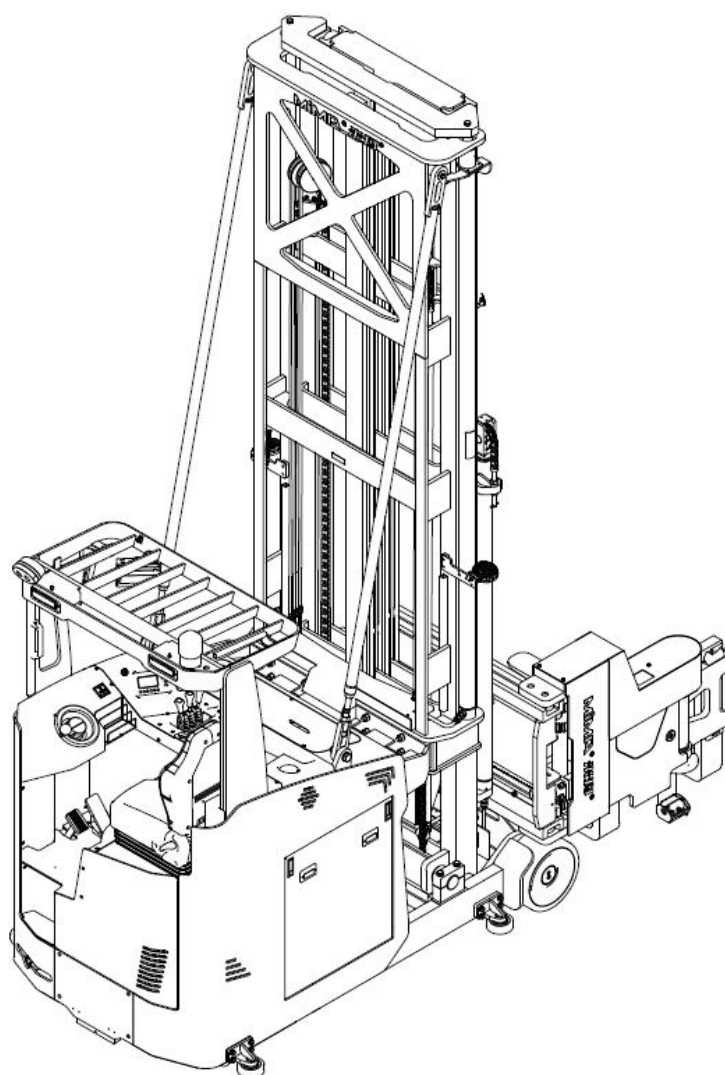




MATERIAL HANDLING EQUIPMENT DESIGNER & MANUFACTURER

Maintenance Instruction Manual

MCA Series 3-Way Pallet Stacker



BANYITONG SCIENCE & TECHNOLOGY DEVELOPING CO.,LTD.

www.mimaforklift.com

Preface

Referring to the advanced technology at home and abroad, MCA series 3-way pallet stacker is our new product to meet the market needs. Due to its small and beautiful appearance and flexible operation, it is especially suitable for loading and unloading, stacking, handling and other work in the high-racking warehouse, freight yard, supermarket and so on, with even ground and temperature from -10°C to 45°C .

Due to adopting the wide vision lifting system, EPS system, imported international famous brand speed-control system and the battery driving system, this forklift has the characteristics of excellent performance, simple and flexible operation, small noise, no pollution and so on.

This instruction clarifies the basic knowledge of the main components structure, working principles and maintenance of MCA series electric 3-way pallet stacker. It can help the operator to use the forklift reasonably and make the forklift perform its maximum efficiency. We sincerely hope that operator and equipment manager will read this instruction carefully before operating the machine.

Through reading carefully of the original maintenance instruction, users can master the technical knowledge necessary for forklift safe operation. The information in the instructions is concise and clear.

This maintenance instruction manual is written for different types of forklift. In the process of operation and maintenance, please pay attention to the specific provisions of each model.

Our company will continuously develop and optimize forklift equipments, so please understand that we have the right to amend the machine's appearance, equipment and technology. Out of this, the forklift users shall not derive any claims for any specific performance of our forklift from the instruction manual content.

Version Number: 202006

Contents

| | |
|---|----|
| Chapter 1 Introduction of MCA series 3-way pallet stacker..... | 1 |
| 1.1 MC series models sheet..... | 1 |
| 1.2 Definition of driving direction..... | 1 |
| 1.3 Main components of MCA series forklifts..... | 2 |
| 1.3.1 Main components of MCA series forklifts..... | 2 |
| ① Overhead guard..... | 3 |
| ② Seat mounting kit (rear cover)..... | 4 |
| ③ Protective parts..... | 5 |
| ④ Tank..... | 5 |
| Chapter 2 Switches, display and operation mode of MCA series forklift..... | 7 |
| 2.1 Diagram and components of multi-way valve operation panel of standard vehicle..... | 7 |
| 2.2 Diagram and components of proportional valve operation panel of optional vehicle..... | 7 |
| 2.3 Instrument (display panel)..... | 8 |
| 2.4 Steering wheel..... | 10 |
| 2.5 Pedal..... | 12 |
| 2.6 Switches and operation lever..... | 13 |
| 2.7 Connector..... | 15 |
| Chapter 3 Safety marks and nameplates of MCA series forklift..... | 17 |
| Chapter 4 Main parameters of MCA series forklifts..... | 20 |
| Chapter 5 Safety operation and regulations of MCA series forklift..... | 22 |
| 5.1 Transportation..... | 22 |
| 5.2 Hoisting..... | 23 |
| 5.3 Parking..... | 23 |
| 5.4 Preparation before use..... | 25 |
| 5.5 Check before use..... | 25 |
| ◆ Inspection items and contents..... | 25 |
| ◆ Inspection of instruments..... | 26 |
| ◆ Inspection of light and horn..... | 26 |
| ◆ Inspection of steering system..... | 27 |
| ◆ Inspection of braking system..... | 27 |
| ◆ Inspection of wheel..... | 28 |
| ◆ Inspection of hydraulic system and mast..... | 28 |
| ◆ Inspection of battery..... | 29 |
| 5.6 Precautions for forklift operation..... | 30 |
| Chapter 6 Driving and Operation..... | 31 |
| 6.1 Start preparation..... | 31 |
| 6.2 Driving..... | 31 |
| ◆ Start..... | 31 |
| ◆ Steer..... | 31 |
| ◆ Brake and parking..... | 32 |
| ◆ Parking..... | 32 |
| 6.3 Stacking operation..... | 32 |

| | |
|---|----|
| Chapter 7 The Maintenance of battery..... | 36 |
| 7.1 Safe operation for battery..... | 36 |
| 7.2 Battery charging..... | 37 |
| Chapter 8 General fault diagnosis..... | 38 |
| 8.1 Lifting system fault diagnosis and treatment..... | 38 |
| 8.2 Hydraulic system..... | 39 |
| 8.2.1 Hydraulic schematic diagram..... | 39 |
| 8.2.2 Models and specifications of main hydraulic components..... | 42 |
| 8.2.3 Hydraulic system fault diagnosis and treatment..... | 42 |
| 8.3 Drive system..... | 45 |
| 8.3.1 Drive system structure..... | 46 |
| 8.3.2 Drive system adjustment essentials..... | 46 |
| 8.4 Steering system..... | 48 |
| 8.4.1 Steering system structure..... | 48 |
| 8.4.2 EPS system principles..... | 48 |
| 8.4.3 Advantages of EPS system..... | 48 |
| 8.4.4 Precautions..... | 49 |
| 8.4.5 LED indicators of electric steering controller..... | 49 |
| 8.4.6 Common fault codes..... | 51 |
| 8.5 Braking system..... | 52 |
| 8.5.1 Driving brake structure..... | 52 |
| 8.5.2 Parking brake structure..... | 54 |
| 8.6 Electric system..... | 57 |
| 8.6.1 Electrical schematic diagram..... | 57 |
| 8.6.2 AC motor failure analysis..... | 58 |
| 8.6.3 Battery fault analysis..... | 59 |
| 8.6.4 Common controller fault code analysis..... | 61 |
| Chapter 9 Maintenance..... | 71 |
| 9.1 Driving permit..... | 71 |
| 9.2 Driver's rights, obligations and code of conduct..... | 71 |
| 9.3 Non staff are not allowed to use the forklift..... | 71 |
| 9.4 Forklift damage and defects..... | 71 |
| 9.5 Forklift maintenance..... | 71 |
| 9.6 Dagerous area..... | 71 |
| 9.7 Safety devices and warning signs..... | 71 |
| 9.8 Safety rules for maintenance..... | 71 |
| 9.9 Forklift cleaning..... | 72 |
| 9.10 Battery maintenance..... | 72 |
| 9.11 Motor maintenance..... | 73 |
| 9.12 Electromagnetic brake maintenance..... | 73 |
| 9.13 Maintenance work..... | 73 |
| 9.14 Lubrication part table..... | 76 |

Chapter 1 Introduction of MCA series 3-way pallet stacker

The MCA series forklift contains stand-on type 3-way pallet stackers, it can stack goods from both sides and front direction. and is suitable for narrow aisle stacking in warehouses. Due to the working aisle has been greatly reduced, increasing storage capacity has been realized, and the utilization ratio of the warehouse can be improved to the greatest extent.

1.1 MCA series models sheet

MCA series model as below:

| Model | Rated Capacity (Kg) | Load Center (mm) | Lift Height (mm) | Mast Type | Valve Type |
|---------|---------------------|------------------|------------------|------------------------|---|
| MCA15SQ | 1500 | 600 | 4500-10000 | triplex full free mast | Multi-way valve (standard) Proportional valve (optional) |

1.2 Definition of driving direction

Definition of driving direction as below

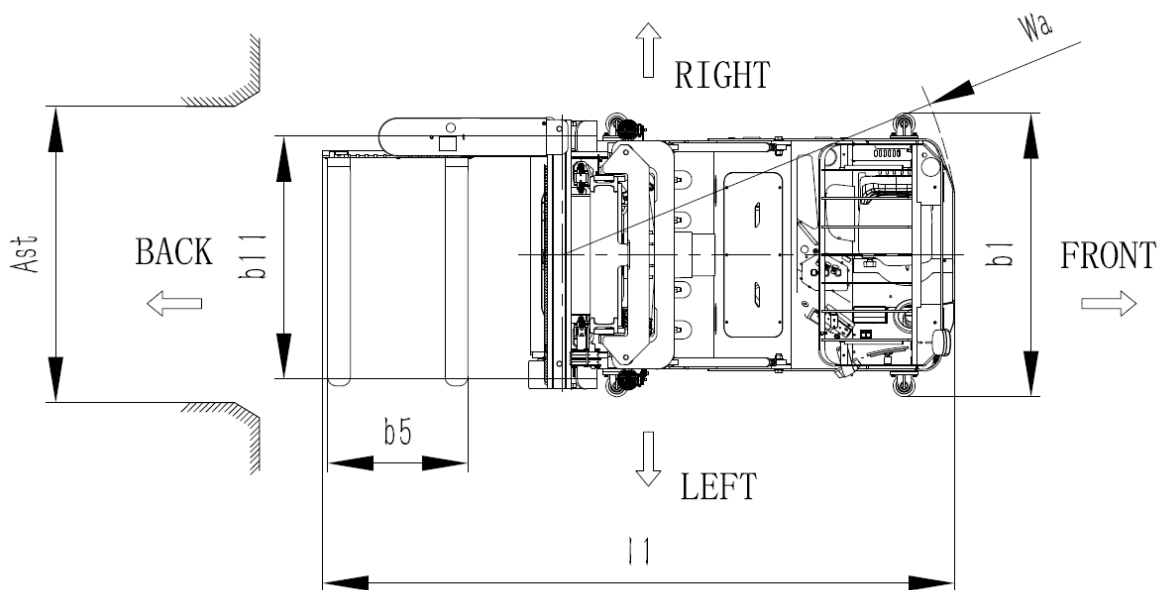


Fig.1-1 schematic diagram of vehicle direction indication

1.3 Main components of MCA series forklifts

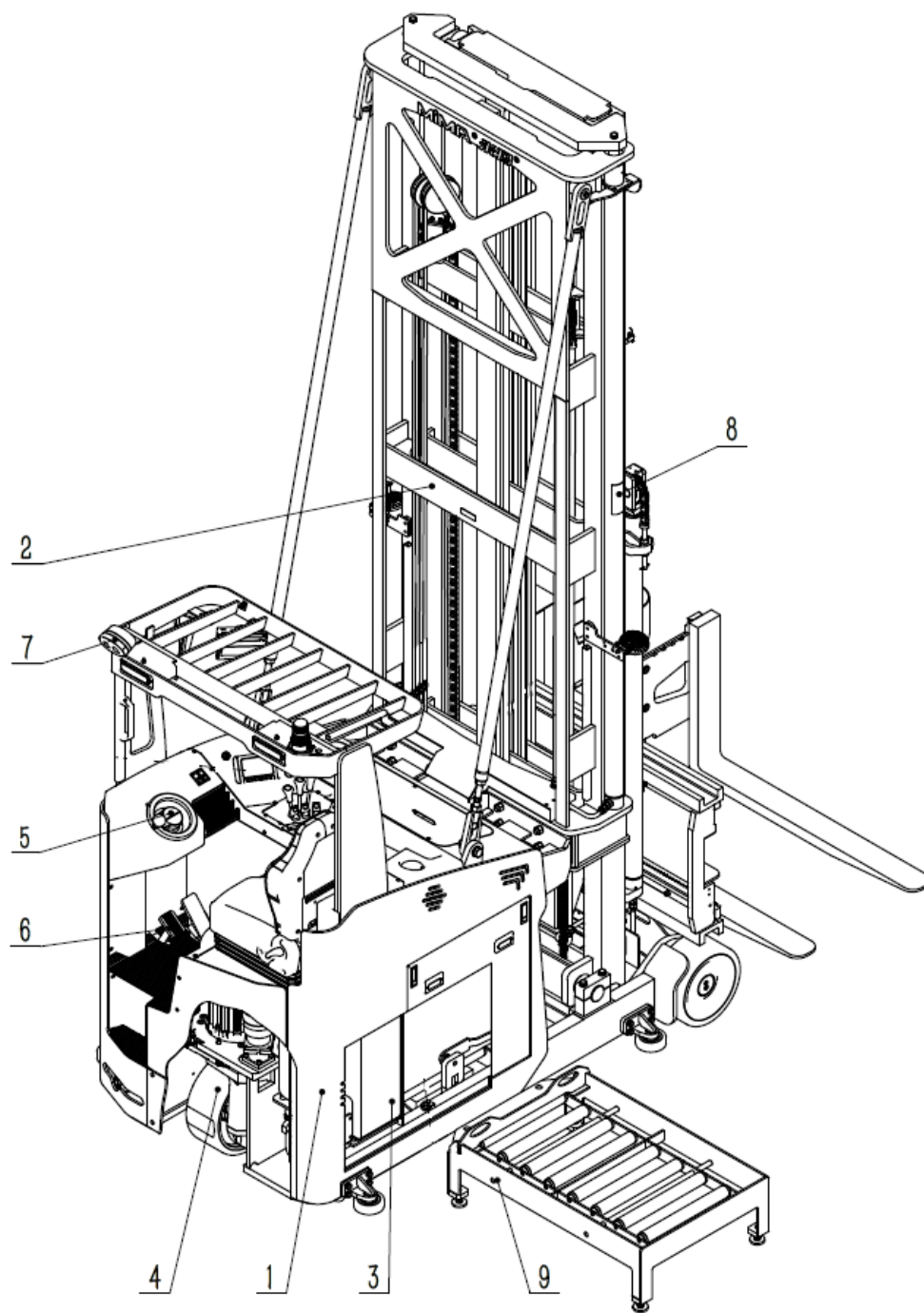


Figure 1-2 Schematic diagram of vehicle structure and appearance

- | | | | |
|--------------------|-------------------|----------------------|-----------------|
| 1. Body system | 2. Lifting system | 3. Hydraulic system | 4. Drive system |
| 5. Steering system | 6. Braking system | 7. Electrical system | 8. Label |
| 9. Battery rack | | | |

1.3.1 Overview of body system structure

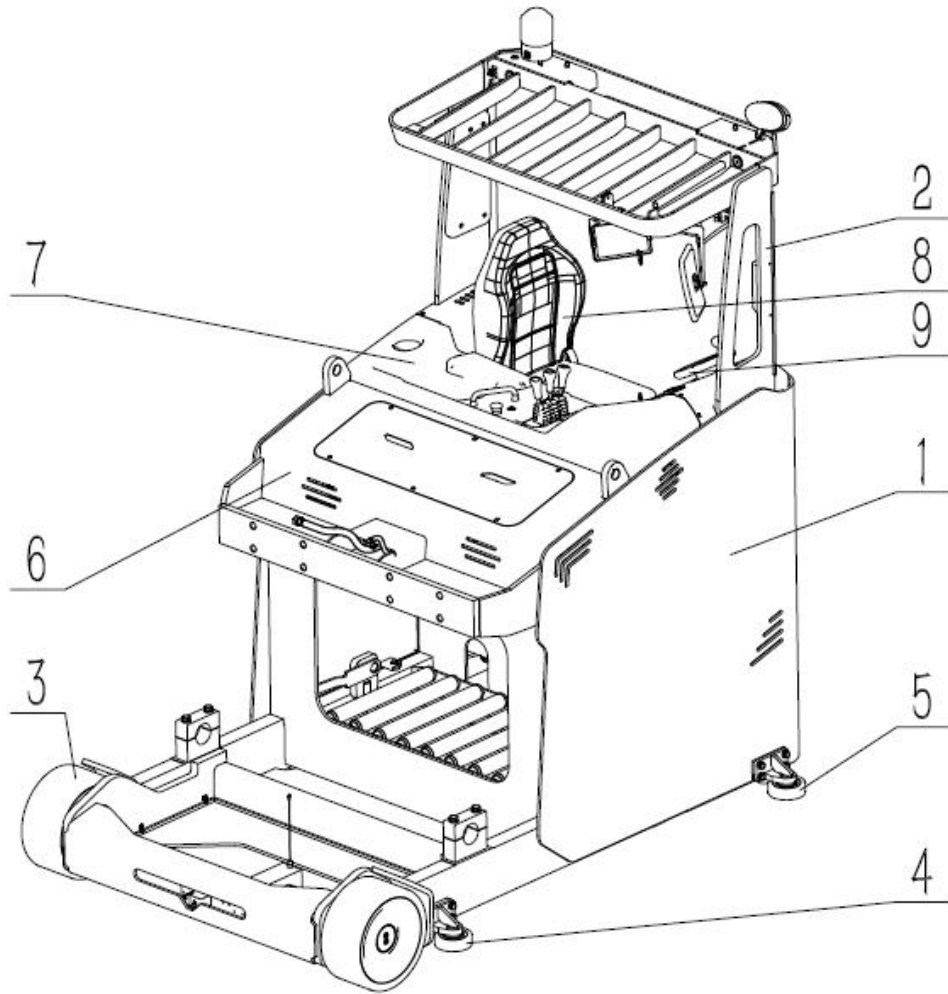


Fig. 1-3 Schematic diagram of body structure and appearance

- | | | | |
|---------------------|----------------------|----------------|----------------------|
| 1. Frame welding | 2. Roof guard | 3. Front wheel | 4. Front guide wheel |
| 5. Rear guide wheel | 6. Upper cover plate | 7. Upper cover | 8. Seat |
| 9. Operation panel | welding | | |

① Overhead guard

The overhead guard is used to protect the driver from falling cargo from above. The overhead guard beam adopts a divergent structure design, so that the roof guard has sufficient strength and at the same time has a full view when stacking goods; The rear headlight group, LED blue light, rearview mirror and video display are installed on the overhead guard.

② Seat mounting kit (rear cover)

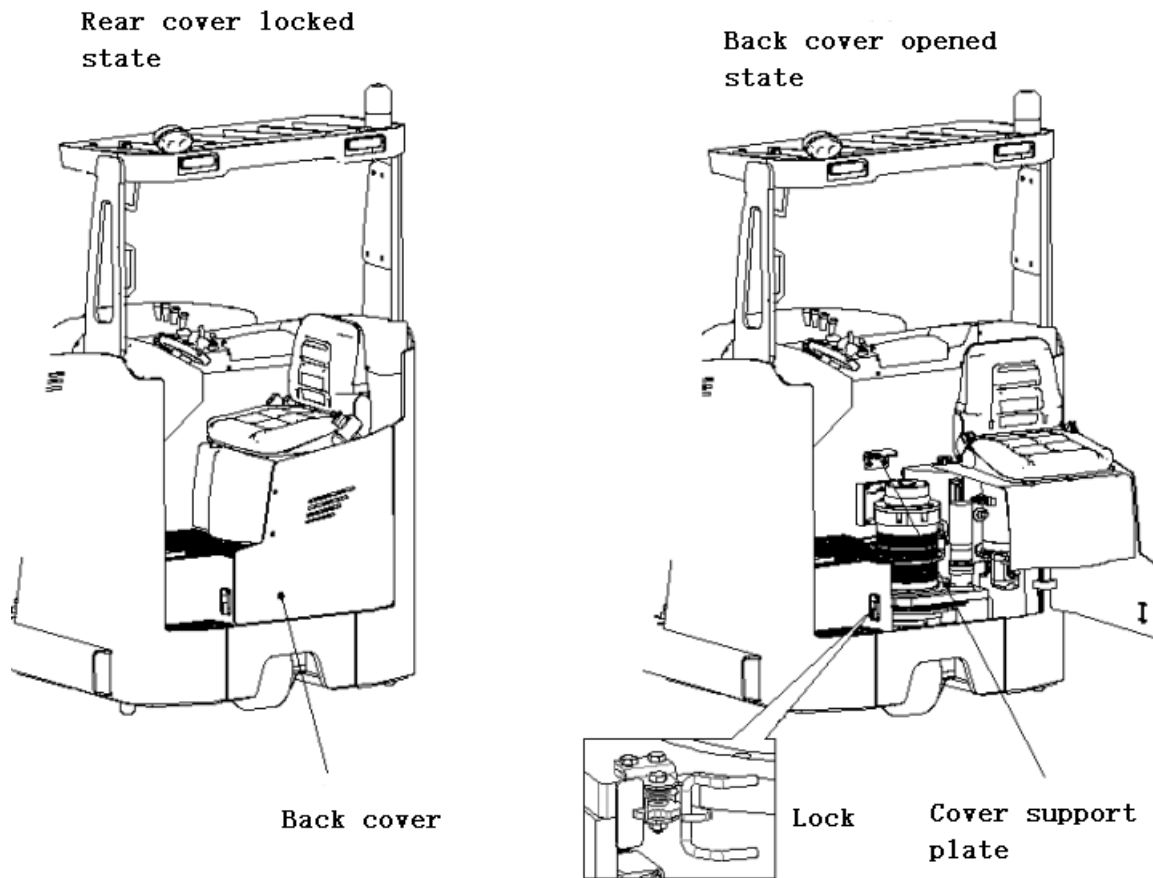


Fig. 1-4 Schematic diagram of the body rear cover

Opening the rear cover: As shown in the figure above, pull the lock catch plate outwards and simultaneously pull the seat cover outwards to easily open the rear cover;

Closing the rear cover: Just push the rear cover inward, and the cover will be locked after hearing a "click".

Note: Check whether the lock of the rear cover is firm and reliable before getting on the vehicle. If the rear cover is loose, please adjust the position of the lock inward or increase the height of the cover support plate.

The large opening and closing angle of the rear cover is very convenient for the inspection and maintenance of the motors, fuel tank and other components in the vehicle body. But when opening and closing the rear cover, please pay attention to safety to prevent your fingers from being caught!

◆ Seat adjustment

When you sit on the seat, you can adjust the seat back to the most comfortable position by pulling the lever at the bottom right of the seat. The front and back adjustment stroke is about 150mm.

③ Protective parts

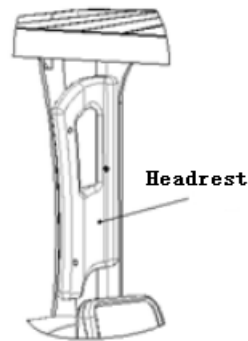


Fig. 1-5 Schematic diagram of headrest

The headrest is located behind the seat, on the inner arc surface of the right column of the overhead guard. The circular-arc design of the headrest conforms to ergonomics and protects your head from impacts and other injuries.

④ Tank

·The volume of the fuel tank

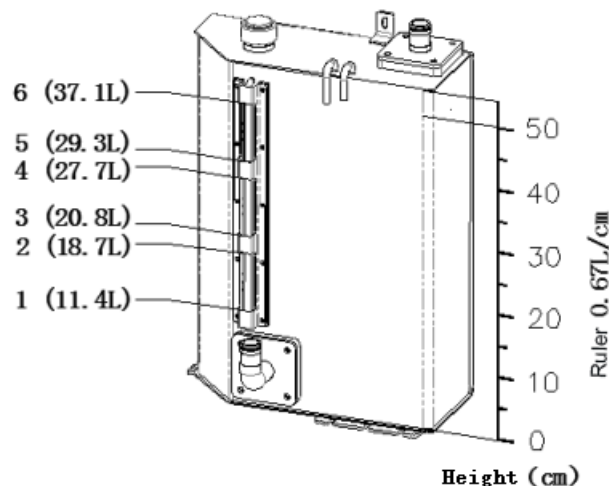


Fig. 1-6 Schematic diagram of fuel tank

Liquid level: When observing the liquid level transparent tube from the front of the oil tank, when the liquid level is at positions 1 to 6, respectively it represents the capacity of hydraulic oil in the oil tank at this time.

Scale: indicates the relationship between the hydraulic oil volume in the oil tank and the liquid level.

◆The amount of oil that should be added for the first time

When the forklift mast is lowered ^{note ①} , The level of the fuel tank of the triplex mast model should be 6.

| Model | Liquid level | Hydraulic oil capacity of tank |
|---|--------------|--------------------------------|
| Triplex mast model (lifting height 4.5m to 10m) | ≥ 6 | (Not less than) 37L |

Note: The mast lowered state of the forklift refers to the state where the mast of the forklift is completely lowered and recovered to the vehicle body, and the hydraulic oil is recovered to the fuel tank to the maximum extent;

The mast fully extended state of the forklift refers to the state in which all hydraulic actions such as the mast are fully extended as opposed to the fully retracted state, and the hydraulic oil is released to the maximum.

Chapter 2 Switches, display and operation mode of MCA series forklift

2.1 Schematic diagram and components of the multi-way valve operation panel of a standard vehicle:

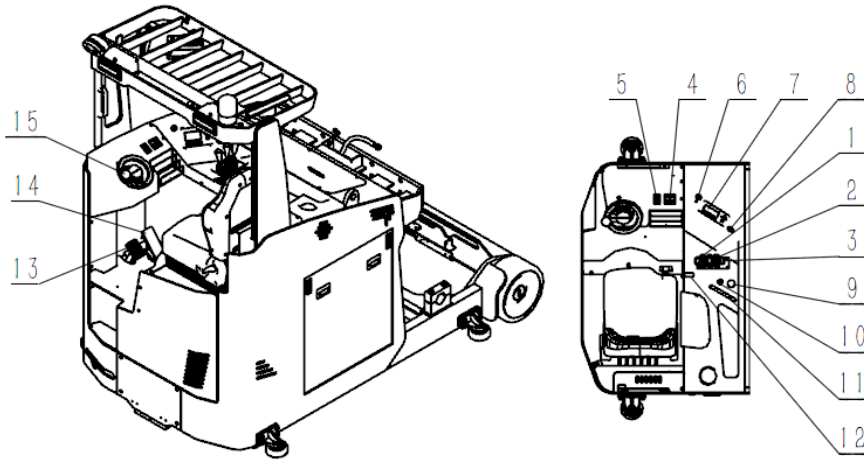


Fig. 2-1 Standard vehicle instrument switch and position mark of each control mechanism

- | | | | |
|-------------------------------|-----------------------------------|------------------------------|------------------------------|
| 1. Lifting control joystick | 2. Side shifting control joystick | 3. Rotating control joystick | 4. Light switch |
| 5. Electronic brake switch | 6. Key switch | 7. Meter | 8. USB socket |
| 9. Emergency power off switch | 10. Horn button | 11. Handrail | 12. Direction control switch |
| 13. Brake pedal | 14. Accelerator pedal | 15. Steering wheel | |

2.2 Schematic diagram and component parts of the proportional valve operation panel of optional models:

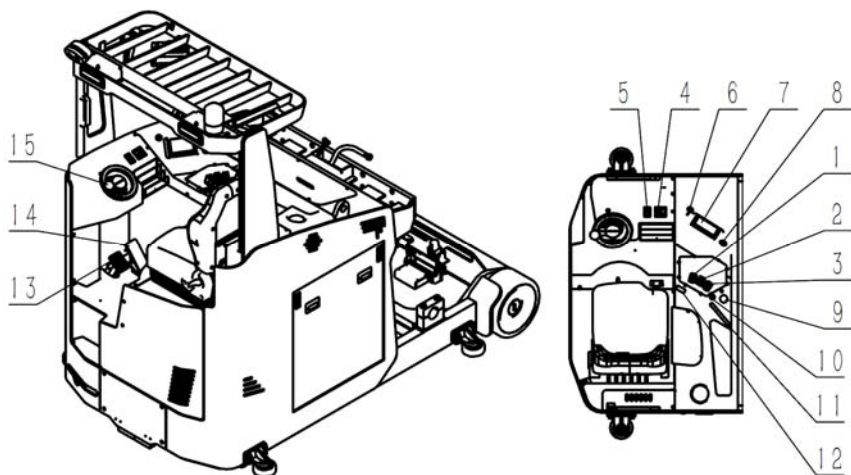


Fig. 2-2 Optional model instrument switch and position mark of each control mechanism

- | | | | |
|-----------------------------|-----------------------------------|------------------------------|-----------------|
| 1. Lifting control joystick | 2. Side shifting control joystick | 3. Rotating control joystick | 4. Light switch |
|-----------------------------|-----------------------------------|------------------------------|-----------------|

- | | | | |
|-------------------------------|-----------------------|--------------------|------------------------------|
| 5. Electronic brake switch | 6. Key switch | 7. Meter | 8. USB socket |
| 9. Emergency power off switch | 10. Horn button | 11. Handrail | 12. Direction control switch |
| 13. Brake pedal | 14. Accelerator pedal | 15. Steering wheel | |

2.3 Instrument (display panel)

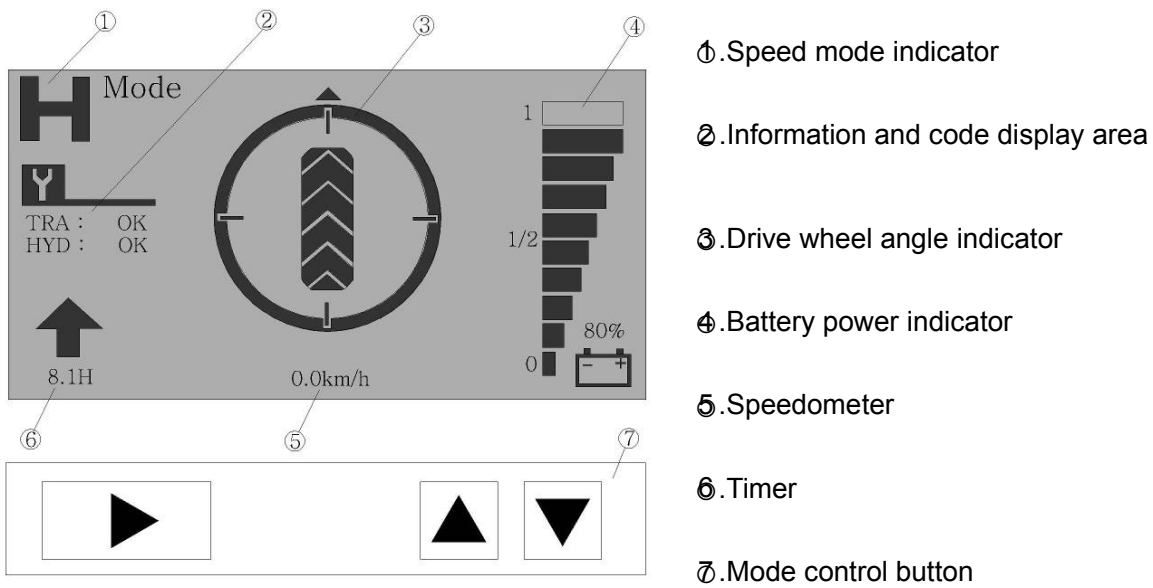





Fig. 2-3 Illustration of the instrument panel

·Speed mode indicator

The system has set three speed mode states.

When the display is H, it means that the system is set to high-speed mode. At this time, press in the mode control button  , it will switch to E normal speed mode; When E is displayed, it means that the system is set to normal speed mode. At this time, press the mode control button  , it will switch to slow speed mode;

When the display is S, it means that the system is set to low speed mode. At this time, press in the mode control button  , it will switch to E normal speed mode;

Only in the slow speed mode, the forklift will have the turning speed limit and forward speed limit function (safety protection function) when the forklift lifts to the high position. If the user needs to increase the high driving speed and forward speed, the S gear can be switched to the H gear or E gear!



·Information and code display area

This area displays the status information provided by the controller, and the system self-checks after turning on the key switch.

TRAVEL OK Represent: good running status;

HYD OK Represent: The pump system is in good condition;

When the system fails, the display area will display the fault code and English comments. If there are two or more faults, the fault code will scroll through the display.

Case: When it shows **23 Undervoltage Cutback** the code is 23, meaning: Low voltage performance reduction.

Warning: When a fault code appears, please stop the operation immediately and contact the local after-sales service department in time until the fault is removed.



·Driving wheel direction indicator

The driving wheel direction indicator indicates the current driving wheel position, that is, the angle between the driving wheel and the driving direction of the vehicle.

·Battery power indicator

As shown in Figure 1-3, the current battery capacity is about 80% of the total capacity. When the battery power is less than 20%, you should stop working immediately and charge it in time. (Reminder: Enter voltage protection mode at this time, and the vehicle speed will slow down) Do not over discharge! Excessive discharge may shorten the life of the battery.




·Speedometer

Display the actual driving speed of the forklift.



·Timer

Shows the total boot time since the first use.

·Mode control button

Press  to enter the administrator setting interface, but this button is only designed for the manufacturer. The manufacturer has adjusted the parameters before delivery. Please do not change the parameters at will!



 and  are the page up and down buttons respectively.

2.4 steering wheel

The MCA 3 way pallet stacker is equipped with electric steering.

When driving, you need to hold the steering wheel handle with your left hand and lean against the armrest pad with your right hand.

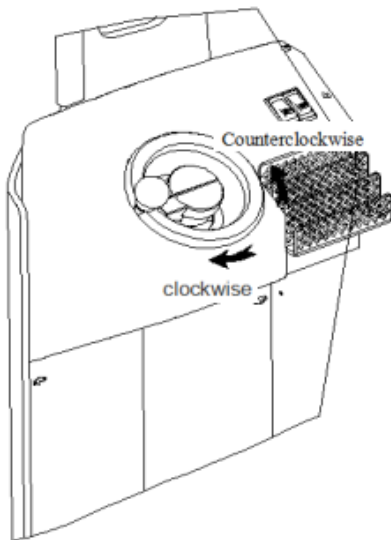


Figure 2-4 Appearance of steering wheel

·Forklift steering control method

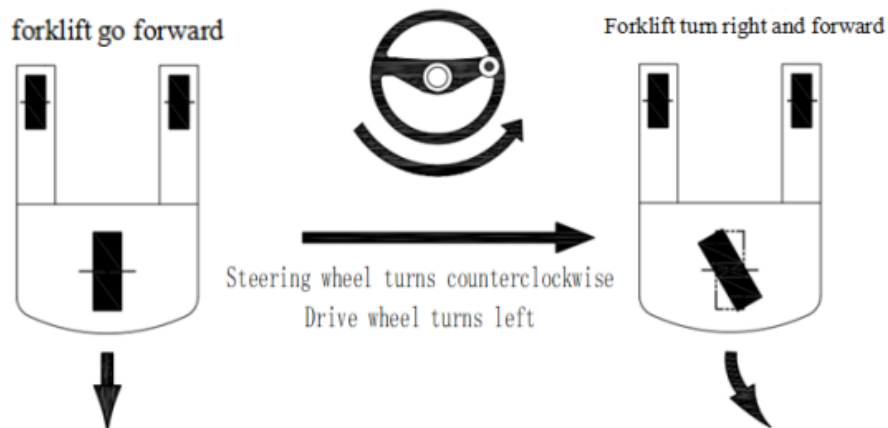
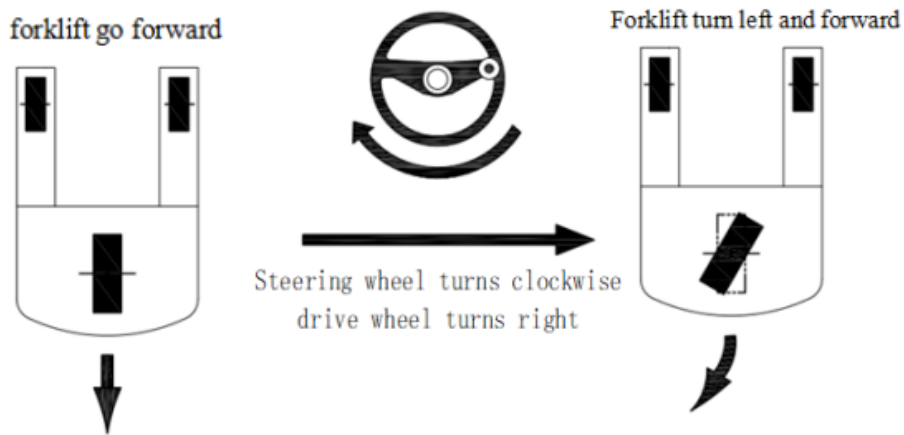
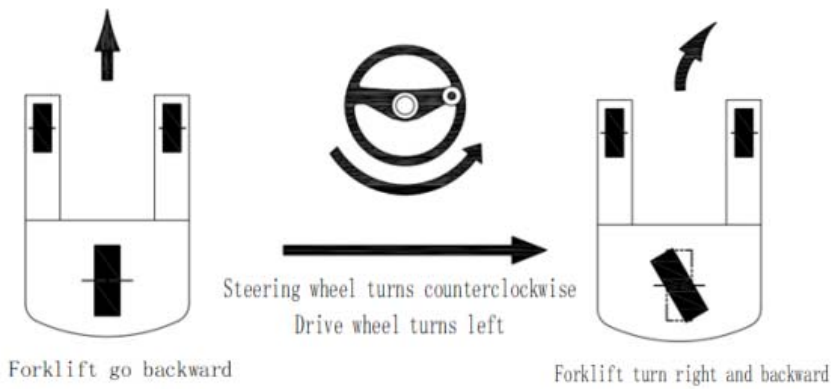
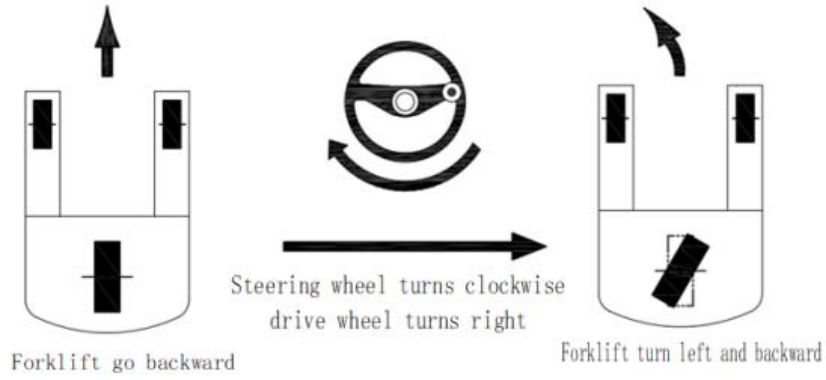


Figure2-5 Forklift steering control method

2.5 Pedal

·Accelerate pedal

Before the forklift starts to move forward, the accelerator pedal should be slowly stepped on to make the driving speed rise steadily. The driver can control the driving speed of the forklift according to the depth of pedaling!

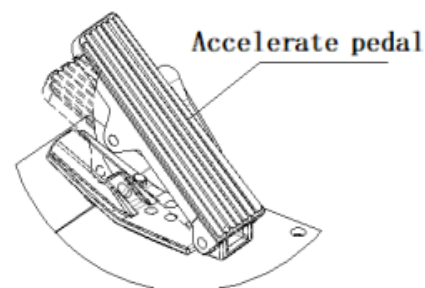


Figure2-6 acceleration pedal

Note: When turning on the key switch, please do not step on the accelerator pedal, otherwise the instrument display will display a fault.

The correct step is: turn on the key switch, confirm that the surrounding conditions are safe, step on the foot switch, and press the direction control switch, then you can step on the accelerator pedal!



When the brake pedal is depressed, the forklift will quickly slow down or stop.

Note: Do not depress the accelerator pedal and the brake pedal at the same time!



·Structure composition and stroke of foot brake

The composition of the foot brake is shown in the figure below. When the brake pedal is stepped on, the brake pedal ① rotates around the rear axle to drive the ejector rod ④ to push the brake pump ②, and the brake pump ② transfers the brake hydraulic pressure to the brake, which expands and brakes the wheel hub contacts to produce a braking effect; at the same time, the micro touch ⑤ leaves the contact of micro-switch ⑥, and the micro-switch ⑥ transmits braking information to the electronic control system.

The full stroke of the brake pedal is approximately 120mm.

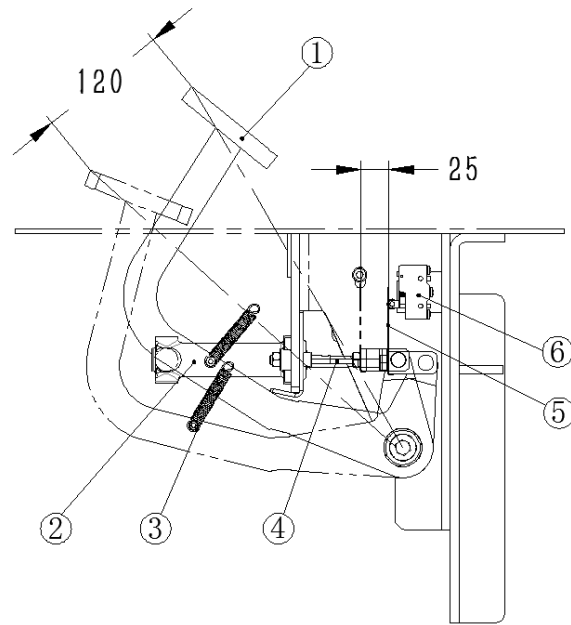


Figure 2-7 Schematic diagram of brake pedal structure

- ①. Brake pedal ②. Brake pump ③. Pull back spring
- ④. ejector rod ⑤. Micro touch ⑥. Micro Switch

2.6 Switch and operating handle

·Headlights, key switches and electronic brake switches

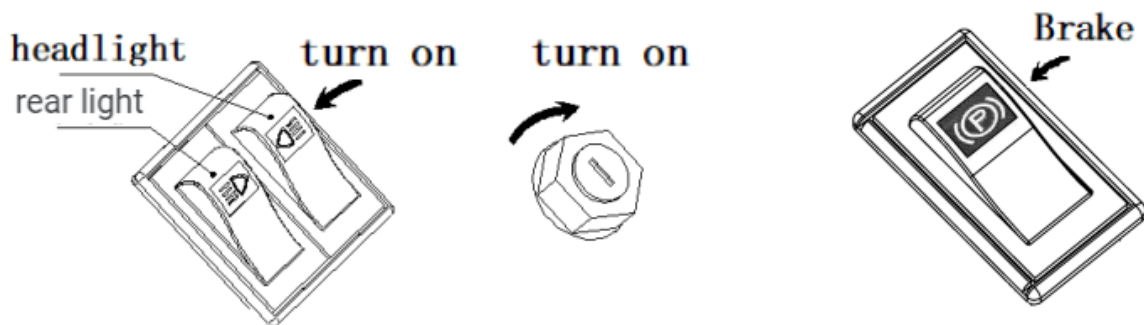


Figure2-8 Schematic diagram of brake pedal structure

The front and rear headlight switches respectively control the turning on and off of the front and rear headlights, and the front and rear headlights will light up at the same time when pressed simultaneously;
Insert the key into the key switch and turn it clockwise to turn on the power;
Press the P end of the electronic brake switch to park the forklift, and press the other end to release the parking brake;

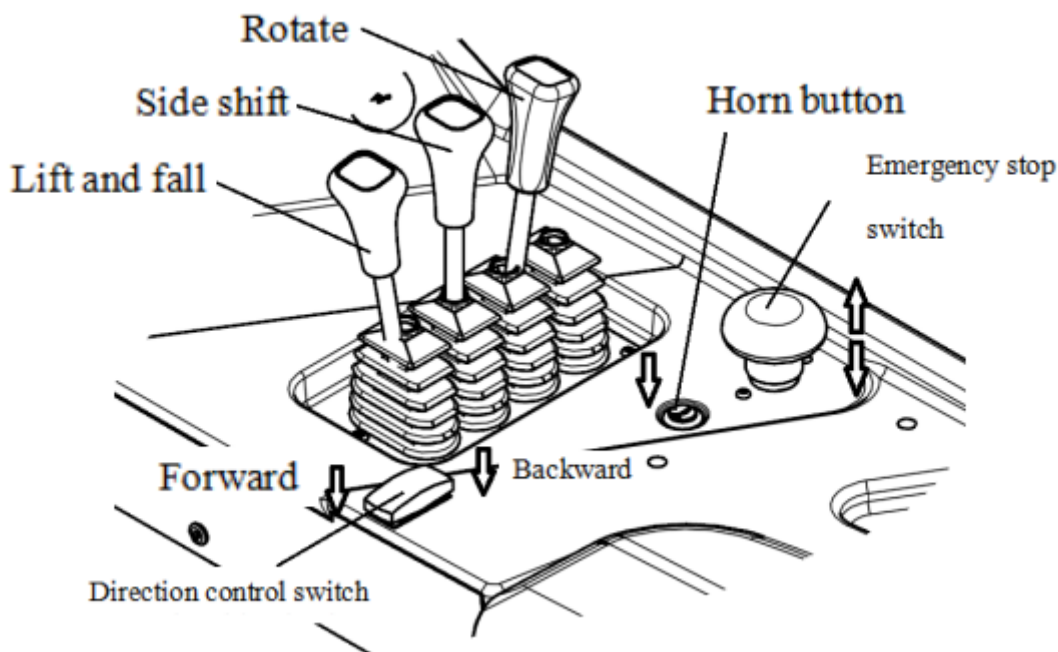


Figure2-9 Schematic diagram of control switch

※The control method of the operating handle is shown in the figure above. In addition, the following points should be noted when operating:

The overhead guard is used to protect the operator from falling cargo from above. The roof guard beam adopts a divergent structure design; in an emergency, please press the red emergency switch to cut off the entire forklift circuit.

·Operating handle

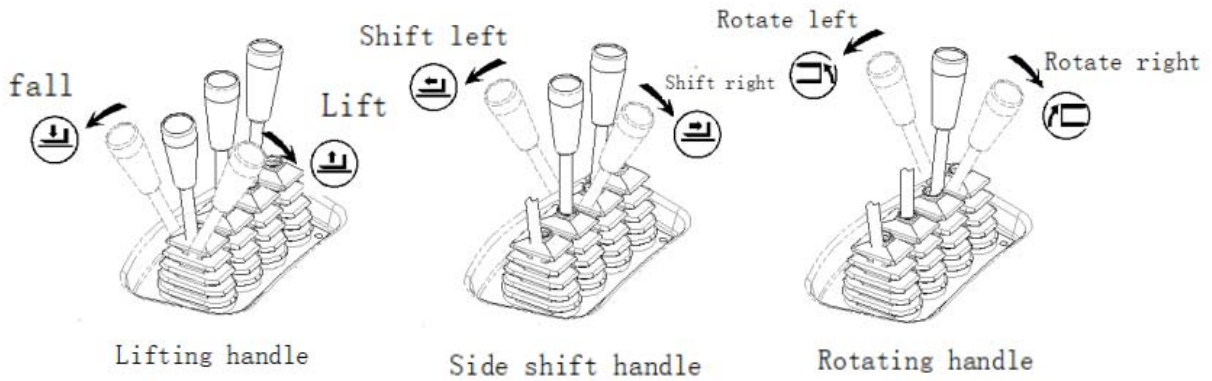


Figure 2-10 Operation handle diagram

The control method of the operating handle is shown in the figure above. In addition, the following points should be noted when operating:

- ※ The stroke of the operating joystick can control the speed of each action, please do not suddenly move or release the operating handle;
- ※ Please note that if you move the lifting handle forward before turning on the key switch, the fork will automatically lower; at this time, the forklift will have no action response to other operations.

2.7 Connector

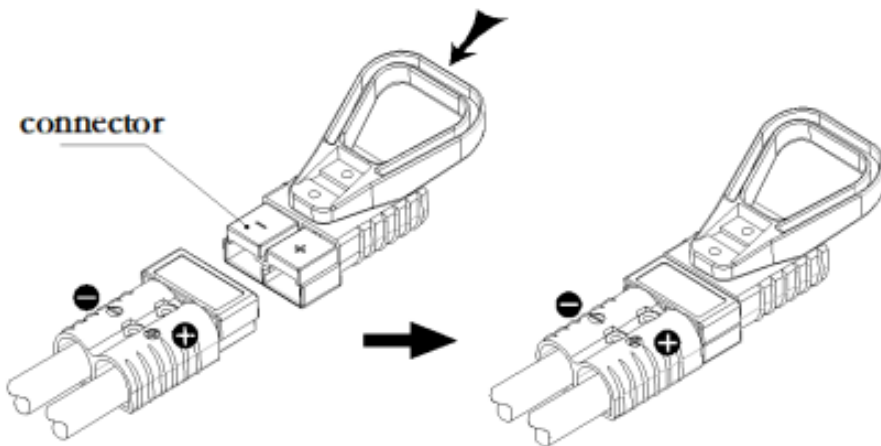


Figure2-10 Schematic diagram of battery connector

Please pay attention to the positive and negative signs when installing the connector, and install it in the correct way as shown in the figure!

Please unplug the connector when removing the battery for charging or long-term storage of the forklift! See for details Chapter 5 Battery Maintenance



Chapter 3 Safety Marks and Nameplates

Safety signs and nameplates are installed on the forklift to remind the operator of potential hazards and precautions.



If you find that the safety signs and nameplates on the forklift are unclear or displaced, please immediately contact the local agent to replace the safety signs and nameplates.

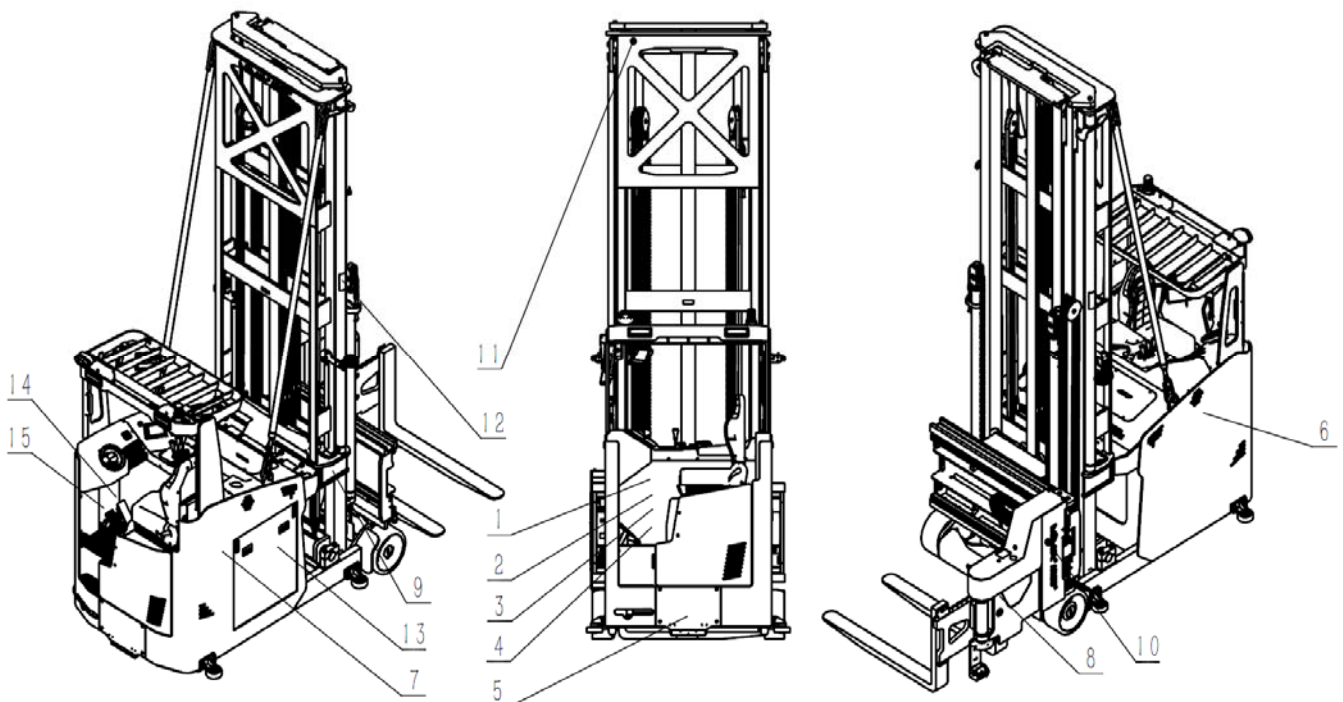
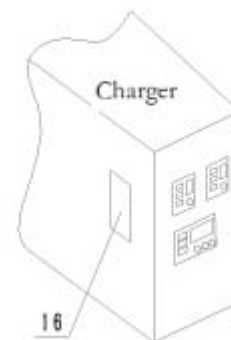
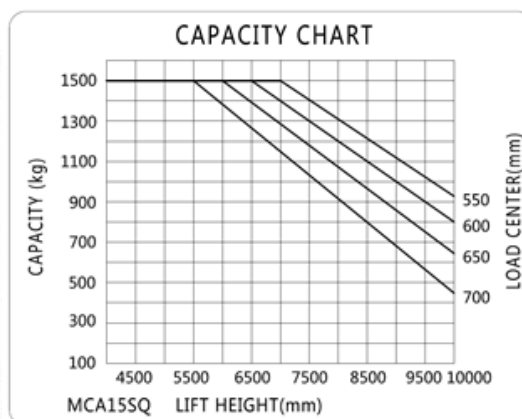


Fig. 3-1 The position of the nameplate and marks for MCA forklift

- 1.nameplate
- 2.Load chart
- 3.QR code
- 4.Safety marks
- 5.Frame number
- 6.M series left sign
- 7.M series right sign
- 8.Anti-pinch hand warning sign
- 9.No climbing sign
- 10.Near the fork hazard sign
- 11.Hoist sign
- 12.Sign
- 13.Battery use notice sign
- 14.accelerate sign
- 15.Brake sign
- 16.Instructions for using the charger



1



2

Safety Tips

Starting

- People without training or permission can not be allowed to operate forklift.
- Check all safety switches, equipments, warning plates, loading chart and fastener before operating every day to guarantee work security. Keep hands and feet clean during operation.
- It is forbidden to use broken forklift, which should be maintained by professional staff.

Loading and Unloading

- Goods should be placed between forks evenly, which are forbidden to be put on single fork. Take safety protection measures when loading and unloading big or heavy goods.
- Prohibit putting on single fork.

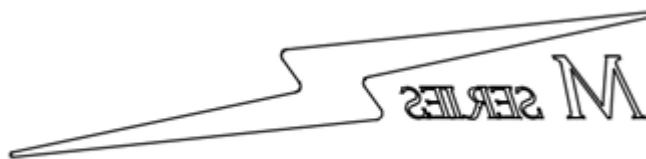
Driving

- Electric forklift should be driven on flat ground. Be careful and slow down when loading, press horn when driving in high speed, and avoid emergency brake and turning.
- When driving on slope, keep goods to the lowest position, and drive in low speed straightly to avoid turning around.
- Forks ground clearance height can not exceed 200mm except for loading and unloading, avoid lifting and lowering goods at the same time, put goods behind if with bad sight, ask other people to guide if necessary, keep safety distance to people and object nearby.
- Keep goods in the lowest position when operating on slope.

Parking

- After parking, put forks to the lowest position and brake, avoid parking on slope and crowded place.
- Prohibit if not using for long time.

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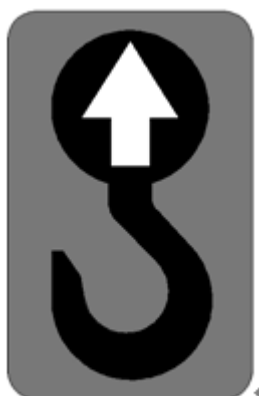
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9



10



11

Battery Use Instruction

Charge

- The electrolyte temperature should not exceed 45°C during charging.
- Open the water cap of all battery cells when charging, and it is strictly forbidden to approach open flames;

Use

- Please strictly follow this use instruction, and don't undercharge, overcharge or overdischarge.
- Once the battery cell voltage is lower than 1.7V, it should be charged in time.
- The electrolyte density should be adjusted to 1.28g/cm³;

Maintenance

The replenishing liquid must be battery special water without any sundries, otherwise it will cause self-discharge or produce toxic gas.

Do not add too much water and please keep battery surface clean and dry, otherwise it will reduce the battery capacity and shorten its service life.

The service engineer shall check liquid level and connection wires once a week. If the liquid level is too low, it will cause accidents such as battery heat or burn.

If the battery will not be used temporarily, it should be fully charged, stored in a ventilated and dry place, and recharged once a month.

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15

Charger Use Instructions

Environment

- It is forbidden to be used outdoors;
- It is forbidden to be operated and stored in inflammable, explosive, poisonous, harmful and dusty environment.
- Keep good ventilation during charging.

Attention

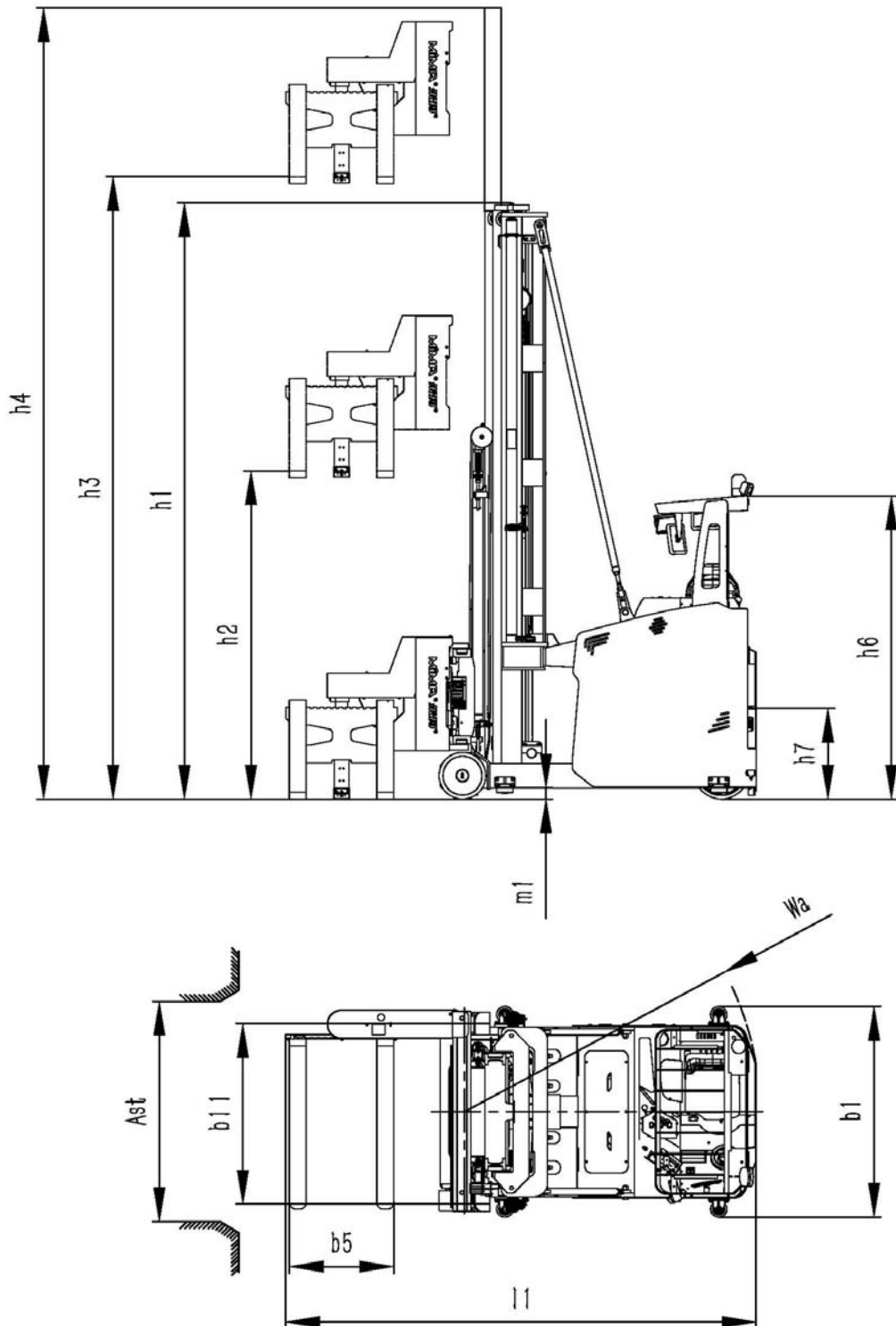
- Make sure charger with good grounding.
- Connect DC current first(step 1), then connect AC current(step 2).

step1

step2

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Chapter 4 Main parameters



| MCA series 3 way pallet stacker parameters | | | | |
|---|------|--|-----------|-------------------------|
| Characteristic | 1.1 | Serie | | MCA |
| | 1.2 | Model | | MCA15SQ |
| | 1.3 | Power type | | Battery |
| | 1.4 | Operation type | | Seated |
| | 1.5 | Rated capacity | Q(kg) | 1500 |
| | 1.6 | Load center | C(mm) | 600 |
| | 1.7 | Front overhang | x(mm) | 887 |
| | 1.8 | Wheelbase | y(mm) | 1900 |
| Weight | 2.1 | Service weight(include battery) | kg | 6345 |
| | 2.2 | Axle load with full load | kg | |
| | 2.3 | Axle load without load | kg | |
| Wheels | 3.1 | Wheel type | | PU |
| | 3.2 | Bearing wheel | mm | φ343×150 |
| | 3.3 | Drive wheel | mm | φ400×160 |
| | 3.4 | Wheel qty, front/rear(x=drive wheel) | | 2 / 1X |
| | 3.5 | Wheel tread | b11(mm) | 1315 |
| Dimension | 4.1 | Mast closed height | h1(mm) | 2884 |
| | 4.2 | Free lift height | h2(mm) | 1734 |
| | 4.3 | Lift height | h3(mm) | 4500 |
| | 4.4 | Mast extended height(with load-backrest) | h4(mm) | 5700 |
| | 4.5 | Overhead guard height | h6(mm) | 2230 |
| | 4.6 | Standing board height | h7(mm) | 665 |
| | 4.7 | Overall length | l1(mm) | 3450 |
| | 4.8 | Overall width | b1(mm) | 1550 |
| | 4.9 | Fork size | l/e/s(mm) | 1200/125/50 |
| | 4.10 | Installation class | | Class II model B |
| | 4.11 | Fork outside with | b5(mm) | 270~780 |
| | 4.12 | Min ground clearance | m1(mm) | 80 |
| | 4.13 | Aisle width(pallet 1200x1200mm) | Ast(mm) | 1600 |
| | 4.14 | Turning radius | Wa(mm) | 2180 |
| Performance | 5.1 | Travelling speed, laden/unladen | km/h | 8/8 |
| | 5.2 | Lifting speed, laden/unladen | mm/s | 300/300 |
| | 5.3 | Lowering speed, laden/unladen | mm/s | 340/340 |
| | 5.4 | Parking brake mode | | Electromagnetic |
| Drive | 6.1 | Drive motor(S2-60min) | kw | 8 AC |
| | 6.2 | Lift motor(S3-15%) | kw | 15 AC |
| | 6.3 | Battery, voltage/capacity | V/Ah | 48/900 |
| | 6.4 | Battery weight | kg | 1380 |
| | 6.5 | Steering type | | Electric power steering |
| Others | 7.1 | Battery change replacement | | Side pull |
| Note: Above parameters are based on standard type, it may change according to different configuration | | | | |

Chapter 5 Safety operation and regulations

Operators and management staff of forklift must keep in mind "safety first" and perform safe operations in accordance with the forklift maintenance instructions.

5.1 Forklift transportation

Forklifts are generally used for cargo handling and short-distance transportation. It is not suitable for long-distance transportation. If the forklift needs to be transported for a long distance, you need to use a container, heavy truck and others. According to different mast lift height, there are two transportation modes: transportation with mast dismantlement and transportation without mast dismantlement.

When forklift with low mast, do not need to dismantle mast, just use forklift or container to transport.

Forklift with medium and high mast, need to dismantle mast, should put mast on metal pallet, pack mast and forklift body, use truck or container to transport.

Please pay attention to the following items when transport with containers or trucks:

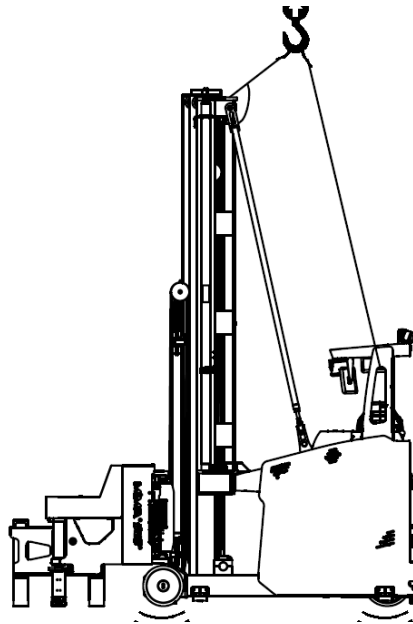
When lifting the forklift, hung the position shown by symbol, no lifting door frame separately.



When transport the body, the frame and the protecting top frame need to be fixed firmly with the steel wire rope, and the front and rear tires need to be tightened with a wedge pad. Fork release to the lowest position, and to maintain the level of the ground.



5.2 Forklift hoisting



As shown above, when hoist forklift, use a wire rope or a lifting sling fixed on the hole of cross beam of the door frame, body plate on the left side and the right side plate as three point hoisting.

- ※ When lifting the forklift, the forklift must ensure to be stable and level, otherwise it will easily cause the body to swing and accidents;
- ※ When hoisting the forklift, do not directly lift the overhead guard;
- ※ Refer to the weight of the whole forklift, please ensure that the wire rope, sling and lifting device are safe and reliable.

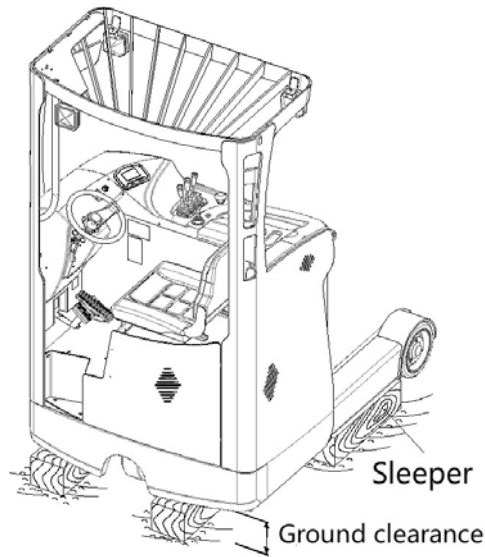


5.3 Forklift parking

Turn off electronic brake switch, turn off key switch and emergency switch, remove key.



◆ Long time parking



If parked for a long time, you need to unplug the battery connector connector, put the forklift tire overhead, and use wooden blocks to pad under the forklift and left and right outriggers to reduce the load on the driving wheels and load wheels.

The wood block must be strong and durable enough to bear the weight of the forklift: The wooden block should not be too large, and the ground clearance is 150mm ~ 200mm; After supporting the body with wooden blocks, swing the body back and forth to check whether it is stable and safe.



When the forklift is parked for a long time, other issues that should be notes:

- ※ The forklift should be parked in a dry, ventilated, smoke-free environment, and the temperature is $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$;
- ※ During the parking period, the battery needs to be balance charged once every 15 to 20 days;
- ※ Every other month, remove the sleepers at the bottom of the forklift, move the mast forward, up and down several times to prevent the rollers and chains from rusting.

5.4 Operator's preparation before use

Before use, the operator must carefully read the operation and maintenance manual and other accompanying documents, be familiar with the position of the instrument, switches and various operating mechanisms, and understand the structure and performance of the forklift. The driver must have a driving license.

Operators should wear safety helmets, work clothes, and work shoes.



The operator must maintain a clear consciousness and a good attitude before getting on the truck. If taking drugs or drink wine, please do not operate the forklift, otherwise it may cause serious casualties!



5.5 Inspection before using

◆ Items and contents

| Part name | Inspect Item | Content |
|-----------------|--|---|
| Instrument | Display function | Turn on the key switch and observe whether the |
| Lamp and Horn | Headlights and Horns | Switch, sound |
| | Display (optional) | Whether the monitor is normal and the image is |
| Steering system | Steering wheel turning | Rotation tightness and rotation force |
| Brake system | Foot brake (pedal) | The depth and strength of the foot brake |
| Tire | Tire | Whether there is abnormal wear, cracks, etc.or |
| Hydraulic | Various hydraulic components (valves, motors, cylinders, tube, | Check whether the function is normal and whether there is abnormal noise during operation |
| | | Check for hydraulic oil leakage |

| | | |
|---------|---------------|--|
| | Tank | Check whether the amount of hydraulic oil is sufficient |
| | Lifting chain | Check the tightness of the left and right chains |
| Battery | charging | Check whether the connector is connected reliably and the power condition in the instrument. |
| Others | others | Any abnormal condition |

◆ Instrument inspection

In normal condition, system will make self-inspection when turn on switch, and “system is normal” is displayed on instrument.

If the system displays abnormally or displays a fault code, please eliminate the fault before operating the forklift.



◆ Inspection of lights and horns

Check whether the condition of front and rear lights, horn buttons; When installing an optional monitor, check whether the image display is clear and stable or not.

If the headlight switch or the horn button cannot operate normally, please troubleshoot as soon as possible before operating the forklift. See page 32 for troubleshooting methods.

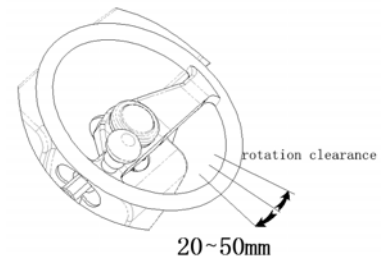


◆ Checking the steering system

Check the rotation clearance of the steering wheel. Under normal conditions, it is 20-50mm;

Check the turning force of the steering wheel: under the parking brake, rotate the steering wheel clockwise or anticlockwise to check whether the steering wheel is stuck.

Note: the turning resistance of the steering wheel is smaller than that of in-situ rotation when driving!



If the steering resistance is too large, resulting in normal operation, please remove the fault as soon as possible before operating the forklift.

◆ Checking the braking system

• Foot brake (pedal)

Check the depth of the brake pedal and the strength of feedback.

The correct braking distance when driving without load (4km/h) is: no more than 2.5 meters.

If the braking distance exceeds the normal range, adjust the tightness of the brake pads.



• Checking the brake fluid

Pull the battery forward out of the forklift body, and you can see the brake fluid oil pot from the observation hole on the front panel to observe whether the brake fluid volume is within the scale range. If the fluid volume is insufficient, please replenish the brake fluid.

If the brake pipeline is mixed with air, the braking effect will be greatly reduced, and even the phenomenon of unable to brake will occur. How to remove air: Open the vent on the brake drum (pictured above), step on the brake pedal repeatedly, and squeeze to remove air.

Notes:

- ※ Please use pure brake fluid, do not mix different brands of brake fluid;
- ※ Not to splash the brake fluid on the painted surface, otherwise the paint will be damaged;
- ※ When adding brake fluid, prevent dust and water from mixing into the brake ;

◆ Checking the wheel

Check the appearance of the wheels (driving wheels, load-bearing wheels) for abnormal wear or cracks. If the surface of the wheels is severely worn or damaged, it will affect the driving performance and braking performance of the vehicle. Please replace the wheels in time. Please consult after-sales department or local agent, there will be professional technicians to guide you how to replace new wheels.



◆ Checking the hydraulic system and mast

- Checking hydraulic operations

Operate the lifting, side shifting, and rotating handles respectively to check whether the lifting, side shifting, and rotating movements of the mast are smooth and there is no abnormal noise. If you find a fault, please eliminate it immediately.

Check the lifting cylinder, motor valve group and corresponding pipeline for hydraulic oil leakage. If you find a fault, please eliminate it immediately.

- Checking the fuel tank

Check whether the hydraulic oil level meets the system requirements. If it is found that the hydraulic oil level is insufficient, please replenish the hydraulic oil immediately.

- Checking the lifting chain

Lift the fork to about 300mm from the ground, press the lifting chain group with your thumb, and judge whether the pressing force is consistent. If they are different, adjust the fixing bolts to ensure that the left and right cylinders or the front free cylinder are balanced.
Please tighten the lock nut after adjustment!



- ◆ Checking the battery

Check whether the connector is connected reliably and the power condition in the meter.
For more complicated situations, please refer to [Chapter 6 Battery Maintenance and Maintenance].

5.6 Precautions for forklift operation

- ※ It is forbidden to stand under the fork and lift on the fork;
- ※ It is not allowed to operate outside the driver's seat;
- ※ When getting on the truck, you should hold the handle on the left side instead of the steering wheel;



- ※ Turn on the power: first turn on the power switch, then pull up the red emergency power off switch, press one end of the electronic brake switch, select the position of the direction switch, and slowly depress the accelerator pedal to maintain proper acceleration;
- ※ Start, turn, drive, brake and stop smoothly, and slow down in advance when turning;
- ※ When the mast moves sideways, rotates to the extreme position, or rises to the maximum height position, the joystick must be quickly returned to the neutral position;

- ※ When moving goods, the load should not exceed the specified value, the forklift spacing and position should be appropriate, the forks need to be inserted under the goods, so that the weight is evenly distributed on the forks to avoid partial load;
- ※ When loading and driving, the goods should be lowered as much as possible, the fork should be rotated to the left or right basic position, and the bridge side should be moved to the left and right extreme positions. Driving with the mast raised is prohibited;
- ※ When driving, pay attention to pedestrians, obstacles and potholes, and pay attention to the clearance above the forklift;
- ※ Avoid emergency braking when the forklift is driving with load;

※ When leaving the vehicle, lower the fork to the ground, place the direction control switch in neutral, disconnect the power, press the P end of the electronic brake switch, and remove the key;

※ The pressure of the multi-way valve or solenoid valve safety relief valve has been adjusted before the forklift leaves the factory, please do not adjust it at will;

※ The chain should be checked regularly during use to ensure the load safety;

※ The maximum noise value outside the forklift truck should not exceed 80dB.



When an emergency occurs, press the red emergency power switch to cut off the circuit.



Chapter 6 Driving and Operation

- ※ Please operate the forklift after the daily inspection;
- ※ Please make sure that the forklift is properly maintained and in good working condition before operation.



6.1 Start preparation

- ※ Confirm that the direction control switch is in neutral position;
- ※ Confirm that the electronic brake switch is in the braking state;
- ※ Hold the steering wheel firmly and turn on the key switch;
- ※ Adjust fork operation:
Turn the lifting handle to lift the fork to about 300mm from the ground;
Turn the rotating handle to rotate the fork to the left or right;
Move the side shift handle to move the fork side to the left or right basic position.



6.2 Driving

◆ Start

- ※ Move the direction control switch to determine the direction of forward or backward driving;
- ※ Press the electronic brake button to release the parking brake;
- ※ Slowly depress the accelerator pedal and the forklift will start to move.



◆ Steering

When driving a forklift, follow the principle of "slow, stable and accurate";

Slow: slow down when turning;

Steady: The left hand should hold the steering wheel handle firmly, and the right hand should be steady against the armrest pad;

Standard: The control of direction and the prediction of space should be accurate.

◆ Braking and parking

When the forklift is running, lightly depress the brake pedal to complete the deceleration and stop actions.

Do not brake suddenly, especially during the transportation of the goods, it may cause the goods to fall, or even the serious accident of overturning!



◆ Parking

※ When parking the forklift, please retract the mast completely, the fork is in the left or right basic position and landed to the ground;

※ Before leaving the forklift, please press the electronic brake switch, press the emergency brake switch, and remove the key.



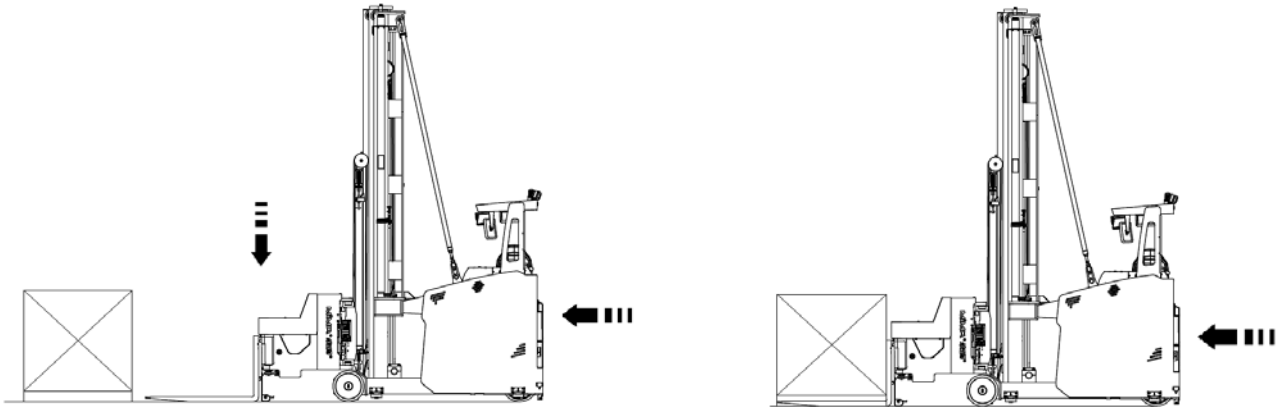
It is forbidden to park the forklift on the slope!



6.3 Stacking operation

Please pay attention to the following steps when stacking goods:

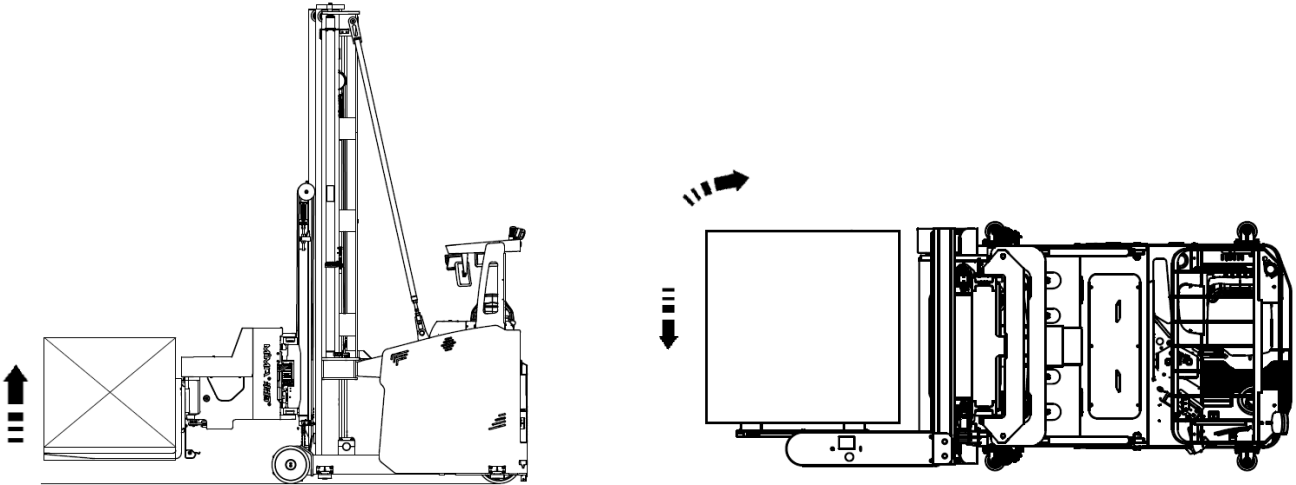
1. Slow down, stop the forklift in front of the stacking area, and slowly lower the fork to the lowest position (the bottom surface of the fork is about 10mm above the ground), adjust the position and direction of the fork, align the fork with the pallet, and then slowly Drive forward until the vertical surface of the fork touches the pallet;



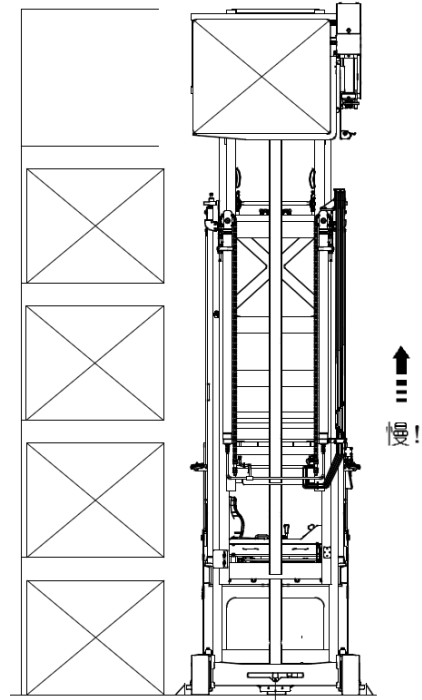
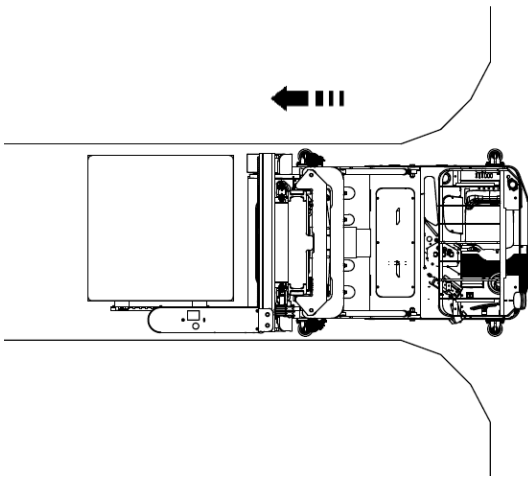
Please pay attention to observe the surrounding safety conditions, and operate it after confirming safety!



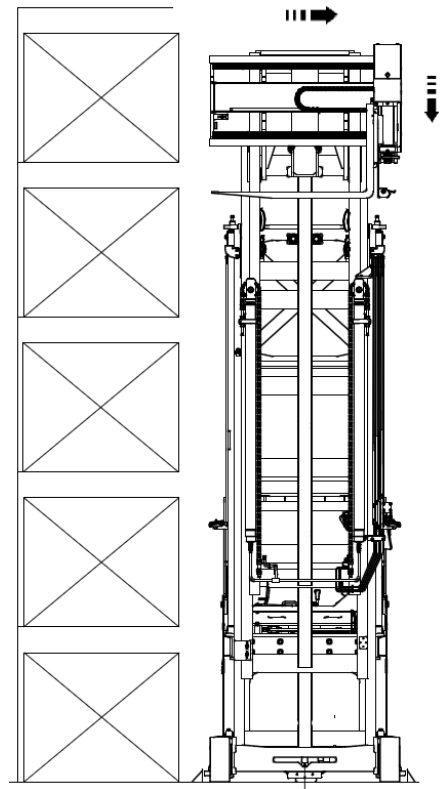
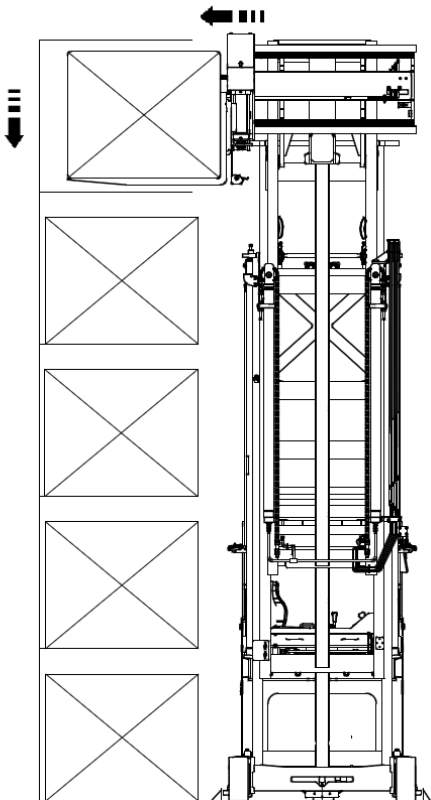
2. Slowly lift the fork and cargo about 300 mm above the ground, then move the fork side to the most left or right end, and rotate the fork to the left or right basic position.



2. Drive the forklift carefully into the aisle, drive the forklift along the rails to the stacking position of the goods; slowly lift the goods to the required height, observe the shelf position through the camera, and slightly adjust the fork position ;



4. Move the three-way fork to the side, and drop the goods on the shelf after reaching the required position; after the goods are stable, move the three-way fork to the side and lower the fork, and the goods stacking operation is completed.



- ※ It is very dangerous to stack or pick up goods at high position. Please read the above operation procedure carefully. If it is violated, it may lead to serious consequences;
- ※ It is strictly prohibited for untrained and qualified personnel to operate this forklift;
- ※ When picking up goods, please follow the reverse process of stacking operation;
- ※ When high stacking is forbidden, the multi-way valve handles are operated simultaneously;
- ※ When driving a vehicle, it is prohibited to operate the multi-way valve handle;
- ※ When stacking at high positions, personnel are forbidden to stand under the forks and around the mast;
- ※ No lifting with people!



Chapter 7 The Maintenance of battery

7.1 Safe operation for battery

- (1). Before operating the battery, the forklift must be parked in the specified position according to the regulations.
- (2). The charging, maintenance and replacement of the battery can only be carried out by specially trained technicians. The operation instructions and the relevant regulations of the battery and charger manufacturer must be strictly followed during the operation.
- (3). Do not smoke or use open flames around the battery. Do not place flammable materials and equipment that may generate sparks within at least 2 meters of the forklift that needs to be charged. The work site must have good ventilation conditions and be equipped with fire extinguishing equipment.
- (4). The battery and charger must be kept dry and clean, and avoid water splashing. Terminals and cable lugs must be tightened, clean, and a small amount of special grease should be applied for protection. If the battery electrode is not insulated and protected, or the protective layer falls off, a non-slip insulating pad must be covered on the electrode for protection.
- (5). Disposal of used batteries must strictly abide by the country's environmental protection regulations or relevant regulations on waste disposal. During the waste disposal process, you must strictly follow the battery manufacturer's instructions.
- (6). The liquid in the battery is corrosive. Therefore, you must wear protective clothing and protective glasses before performing any operations on the battery, and absolutely avoid direct contact with the battery liquid. If liquid from the battery accidentally gets on clothing, skin, or eyes, you must immediately rinse the contact area with plenty of water. If there is skin or eye contact, you must promptly check by a doctor. The spilled battery liquid must be neutralized or diluted immediately.
- (7). When closing the battery box door, you must check whether the battery cable is damaged.
- (8). The battery can only be used when the battery box door is closed.
- (9). The weight and size of the battery have a great impact on the operation safety of the forklift. The replacement of the battery or battery auxiliary equipment delivered with the truck must be approved by the company.

7.2 Battery charging

- (1). Park the forklift in the charging area according to regulations, and press the emergency stop switch after powering off the vehicle.
- (2). Only when the forklift and charging facilities are in a power-off state, the battery plug can be inserted or removed.
- (3). In order to ensure a good heat dissipation effect during charging, the surface of the battery must be exposed.
- (4). Before charging the battery, you must check all cable connections and plug connections for obvious damage, and there must be no other metal objects on the surface of the battery.
- (5). The relevant safety regulations of the battery and charging equipment manufacturers must be strictly followed.

Chapter 8 General fault diagnosis

8.1 lifting system fault diagnosis and treatment

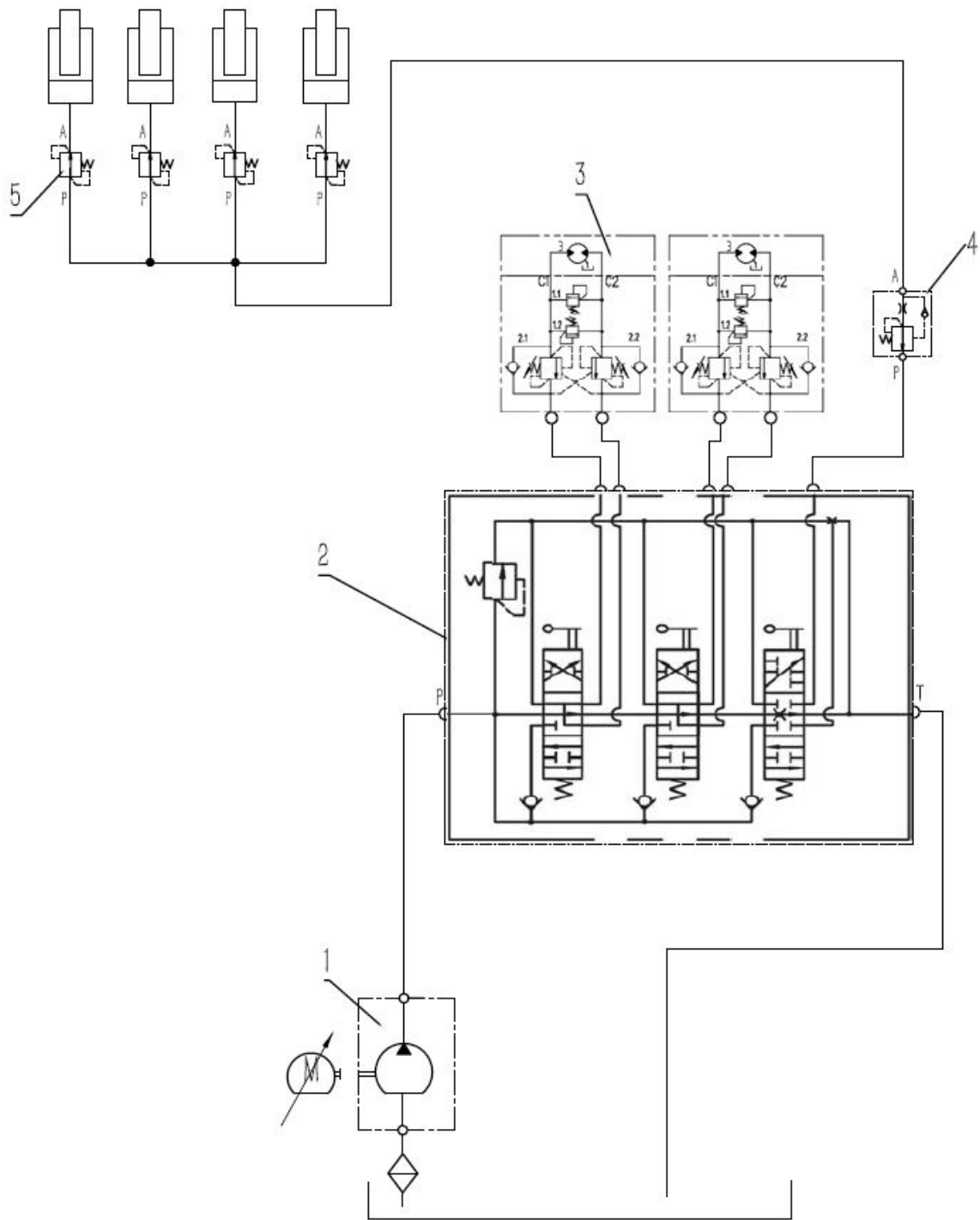
| Fault | Reasons | Elimination methods |
|-------------------------------------|--|---|
| fork carriage lifting is not smooth | Improper adjustment of fork carriage | Adjust the gap between the channel steel guide rail and the side rollers. |
| | Insufficient clearance between roller and mast groove | Adjust the roller gap |
| | Dirt between moving parts | Eliminate dirt |
| | Insufficient lubrication | Grease the contact surface of the guide rail |
| | The inner mast is skewed or the fork frame is bent | Repair or replace |
| Uneven fork lifting | The lifting chain is not adjusted properly | Adjust the chain tightness on both sides to be consistent |
| Lifting roller does not rotate | Hardening of grease or dirt on rollers | Clean and lubricate the rollers |
| | Incorrect adjustment of lifting roller | adjust |
| noisy during lifting process | Inadequate lubrication | lubrication |
| | Uneven adjustment of side roller on fork carriage | Adjust the gasket of roller and side roller |
| Inability or inability to lift | Oil pump gear and pump body wear too much, large clearance | Replace worn parts or oil pumps |
| | Lifting cylinder piston sealing ring wear, internal leakage | Replace the sealing ring |
| | Safety valve spring failure | Replace the spring |
| | Multi-way valve Stem and body are worn and leak much oil (for standard models) | Replacement |

| | | |
|--|--|--|
| | Leakage between multipath valve bodies (for standard models) | After grinding, treassembled and assembled in order |
| | Oil leakage in hydraulic line | Check and repair |
| | Hydraulic oil temperature is too high, hydraulic oil is too thin, flow is insufficient | Replace the unqualified hydraulic oil and check the cause of excessive oil temperature |

8.2 Hydraulic system

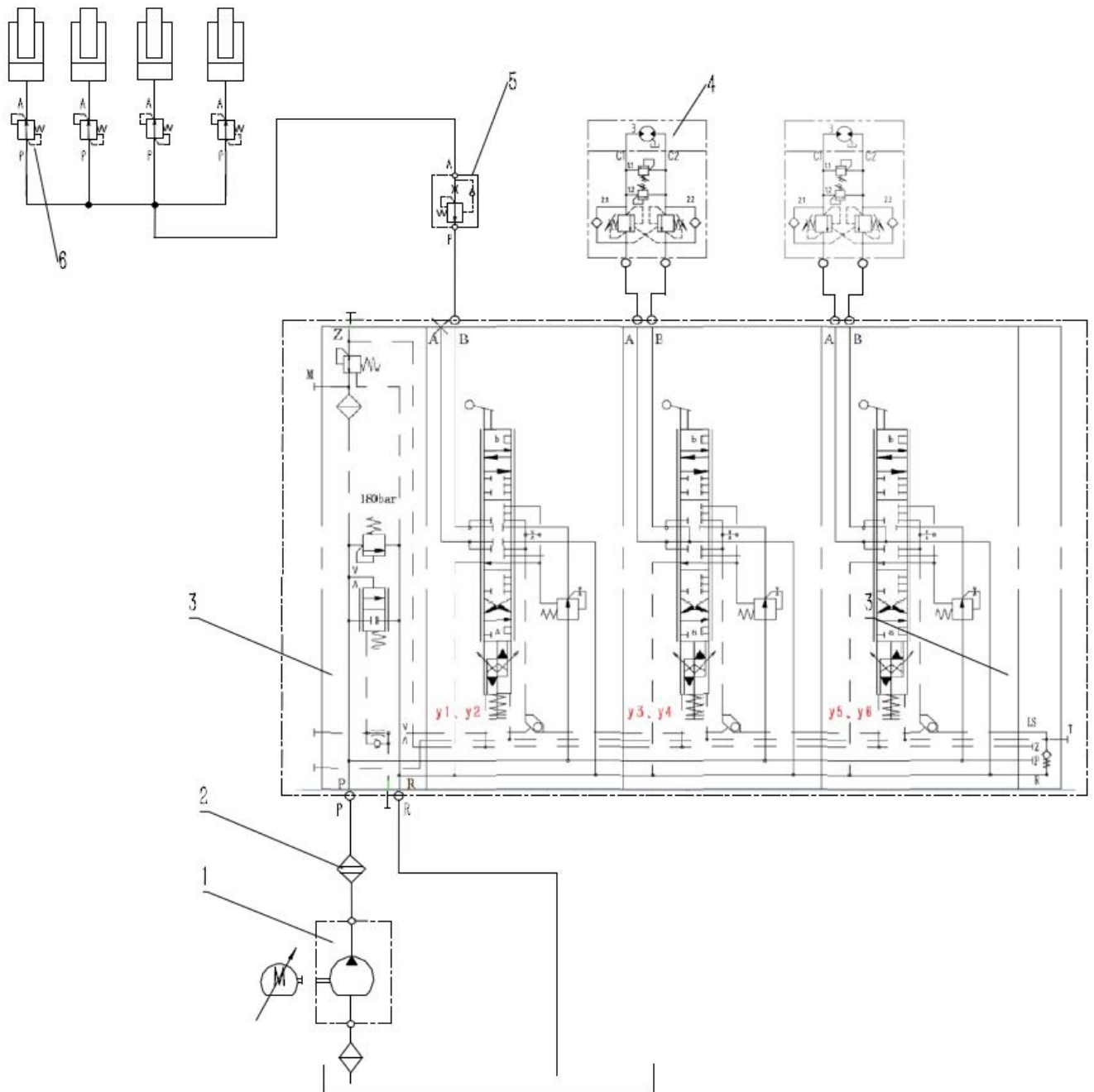
8.2.1 hydraulic principle diagram

- ① For the standard model (multi-way valve operation), its hydraulic principle diagram is as follows: :



1. Gear pump 2. Multiple valve 3. Motor valve block assembly 4. Speed limit valve 5. Cut-off valve assembly

② When selecting proportional valve to operate, the hydraulic principle diagram is as follows:



- 1. Gear pump
- 2. Pressure filter
- 3. Proportional valve
- 4. Motor valve block assembly
- 5. Speed limit valve
- 6. Cut off valve assembly

8.2.2 Main hydraulic components models and specifications

| | | |
|--|-------------------------|----------------------------|
| gear oil pump | model | DSG05C25F9H1-R019C |
| | Displacement | 25ml/r |
| | nominal pressure | 206bar |
| | maximum pressure | 226bar |
| | rated speed | 2000r/min |
| Multi-way valve (For standard models) | model | DCDB1C-F15L-T-YYB |
| | type | relief valve type |
| | set pressure | 200bar |
| Proportional valves (For optional vehicles) | model | PSL 31-180-3 |
| | type | relief valve type |
| | set pressure | 180bar |
| Lifting oil cylinder | type | single acting plunger pump |
| | Piston mast diameter | φ55mm |
| | cylinder inner diameter | φ63mm |
| | Stroke | According to the models |
| governor valve | model | NXSF2-16-2-49L |
| shut-off valve | nominal flow-rate | 80L/min |
| | Regulating Range | 10~30Mpa |

8.2.3 hydraulic system fault diagnosis and treatment

1. Failure diagnosis of multi-way valve (for standard models)

| Fault | Reason | Elimination methods |
|---|---------------------------------------|------------------------------|
| The pressure of the lifting oil circuit cannot be increased | Spool valve stuck | Cleaning after decomposition |
| | Oil hole blocked | Cleaning after decomposition |
| shock Pressure rises slowly | Spool valve stuck | Cleaning after decomposition |
| | Insufficient exhaust | Fully exhaust |
| Can't reach the | Improper adjustment of overflow valve | adjustment |

| | | |
|----------------------|---------------------------------------|------------------------------------|
| required oil volume | | |
| Noisy | Improper adjustment of overflow valve | adjustment |
| | Sliding surface wear | Replace the overflow valve |
| External oil leakage | Aging or damaged O type sealing ring | Replace sealing ring |
| Low setting pressure | Spring is damaged | Replace the spring |
| | valve seat surface damaged | Adjust or replace the relief valve |
| Internal oil leakage | valve seat surface damaged | Corrected valve seat face |
| High set pressure | Valve stuck | Cleaning after decomposition |

2. Failure diagnosis proportional valve (for optional models)

| Fault | Reason | Elimination methods |
|---|---------------------------------------|--------------------------------------|
| The pressure of the lifting oil circuit cannot be increased | Spool valve stuck | Cleaning after decomposition |
| | Oil hole blocked | Cleaning after decomposition |
| shock Pressure rises slowly | Spool valve stuck | Cleaning after decomposition |
| | Insufficient exhaust | Fully exhaust |
| Can't reach the required oil volume | Improper adjustment of overflow valve | adjustment |
| Noisy | Improper adjustment of overflow valve | adjustment |
| | Sliding surface wear | Replace the overflow valve |
| External oil leakage | Aging or damaged O type sealing ring | Replace sealing ring |
| Low setting pressure | Spring is damaged | Replace the spring |
| | valve seat surface damaged | Adjust or replace the overflow valve |
| Internal oil leakage | valve seat surface damaged | Corrected valve seat face |

| | | |
|-------------------------------------|------------------|------------------------------|
| High set pressure | Valve stuck | Cleaning after decomposition |
| Proportional valve does not respond | Loose connection | rewiring |

3. Safety valve pressure adjustment

| | |
|---|--|
| Pressure regulation value of safety valve | 20.0MPa (For standard models) Or 18.0MPa (For optional proportional valve models) |
|---|--|

4. Safety valve pressure adjustment method

The pressure of the safety valve should not be adjusted at will. If it must be adjusted, please follow the steps below:

- 1) Unscrew the measuring hole screw plug at the inlet of the multi-way valve (for standard models) or proportional valve (for optional models), and install an oil pressure gauge capable of measuring 25MPa;
- 2) Operate the lifting handle (for standard models) or the lifting thumb switch (for optional models) to measure the pressure when the cylinder stroke reaches the end;
- 3) When the oil pressure is different from the specified value, loosen the lock nut of the overflow valve, turn the adjusting screw left and right to adjust to the specified value, turn left when the pressure is high, and turn right when the pressure is low;
- 4) Finish adjusting, tighten the nut.

5. Working principle of shut-off valve

A shut-off valve is installed at the bottom of the lifting cylinder to prevent the cargo from falling sharply when the high-pressure hose suddenly ruptures. The oil from the lifting cylinder passes through the shut-off valve slide valve. The oil hole around the slide valve creates a pressure difference between the two chambers. When the pressure difference is less than the spring force, the slide valve does not move; if the high pressure hose suddenly ruptures, there is a large pressure difference between two chambers, which makes the spool valve move to block the oil holes around it, and only a small amount of oil flows through the small holes at the end of the spool valve, causing the fork to slowly drop.

6. Working principle of speed limit valve

The speed limit valve controls the descent speed of the fork and plays a safety role in unexpected situations such as the high-pressure hose rupture. When a large amount of oil return from the lifting cylinder enters the valve cavity of the speed limit valve, the pressure difference between the two sides of

the valve core will cause the valve core to move to the low pressure direction, thus narrowing the oil return passage, thus reducing the amount of oil return. The lowering speed of the fork becomes slower.

7. Gear pump Failure diagnosis

| Fault | Reason | Elimination methods |
|------------------------|--|--|
| Low oil discharge | Low oil level in fuel tank | Refuel to the specified amount |
| | Oil pipe or oil leaker blocked | Clean or replace |
| Low pump pressure | Liner damage Support damage Bad sealing ring, bushing seal or retaining ring | Replacement |
| | Improper adjustment of overflow valve | Use a pressure gauge to adjust the pressure of the relief valve to the specified value |
| | air in the system | Re-tighten the suction side oil pipe Refuel Replace oil pump oil seal |
| Noisy during operation | Damaged suction pipe or filter blocked | Check the pipe or repair the oil filter |
| | Loose or air leakage on the suction side | Fastening loose side |
| | Oil viscosity is too high | Replace the viscosity oil suitable for the pump operating temperature |
| | Bubbles in the oil | Find out the cause of bubbles and take action |
| Pump leaks | Damaged pump oil seal or sealing ring | Replacement |
| | Pump damage | replacement |

8.3 drive system

8.3.1 Overview of drive system structure

| driving wheel | PU wheel |
|------------------------------|----------|
| Drive wheel diameter x width | Φ400x160 |
| weight | 66kg |
| Gear oil capacity | 6.2L |
| Oil Type | 85W/90 |

The transmission device of the three-way stacker is mainly a mechanical gearbox. The drive wheel is fastened to the flange of the drive half shaft through the hub bolt, and the power of the drive shaft is transmitted through the mechanical gearbox to drive the drive wheel to rotate.

The mechanical gearbox is mainly composed of box body, box cover, gears, gear shafts and seals, etc. The power of the motor is transmitted to the input shaft through the gear, and the power of the input shaft is transmitted to the output shaft through a pair of spiral bevel gears, thereby driving the driving wheel to rotate. . The entire space of the box is filled with gear oil to lubricate all parts.

8.3.2 Drive system adjustment essentials

1. Remove the drive wheel

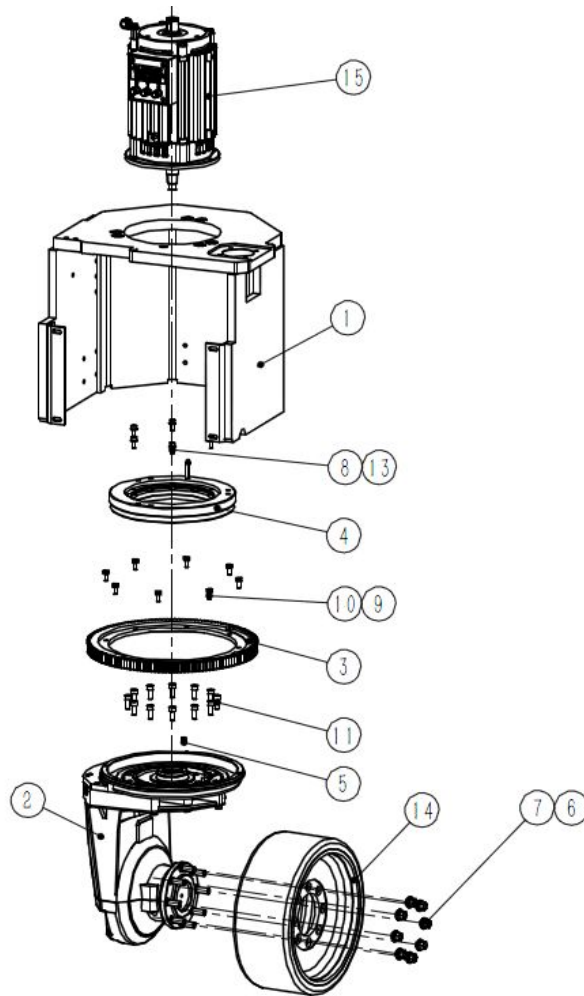
1) Padded the rear of the frame:

Note: Use counterbalance forklift to lift the rear cob of stacker slightly, and pad with sleepers under the stacker side leg, lower the frame onto the sleepers.

- 2) Turn the steering wheel, to make the side of the driving wheel backward;
- 3) Remove all bolts of the drive wheel;
- 4) Replace the bolt in the hub center with bolt that used in driving wheel;
- 5) Tighten the center bolt of the hub and push out the driving wheel.

2. Install the driving wheel

- 1) Align the hub bolt mounting hole and drive shaft screws, then install driving wheel .
- 2) Screw the bolt (apply anti-loose glue to the thread part)
- 3) Tighten to the specified torque (tightening torque: 650~900kg.cm)
- 4) tightening torque: 650~900kg.cm



1. Drive motor mounting plate welding 2. Gear box assembly 3. Steering large toothed ring
 4. Rotary support assembly 5. Air plug 6. Spherical spring washer 7. Nut 8. Hexagon socket cylindrical head bolt 9. Spring washer 10. Hexagon head bolts
 11. Hexagon socket cylinder head screw 12. Hydraulic pneumatic O-type rubber sealing ring 13. Flat washer
 14. Drive wheel 15. Drive motor

- 5) Assemble the hub bolt;
- 6) Turn the steering wheel to make the driving wheel go straight
- 7) Remove sleepers.

3. Adding gear oil

When adding gear oil to the gear box, please follow the instructions below: :

- 1) filled the gear box from vent pipe installation part adding with gear oil.
- 2) After about ten minutes, check the amount of oil from the reference hole. If it is insufficient, add it from vent pipe installation part.

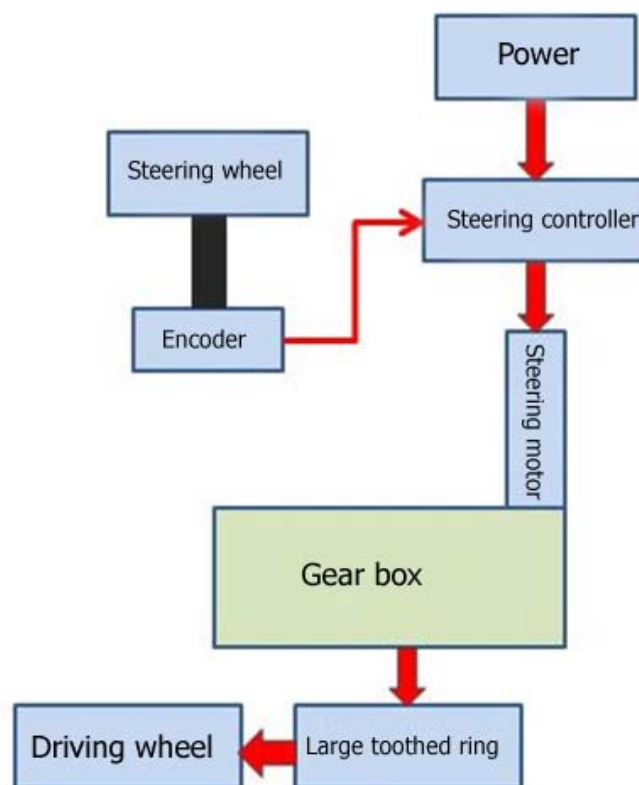
8.4 Steering system

8.4.1 Outline of steering system structure

The MCA series 3-way stacker is with electronic steering system, This is a nonlinear control steering system without connecting rod, mainly used for steering wheel steering electric forklift, the steering wheel transmits a rotating electrical signal to a steering motor via a steering encoder , then the drive wheel rotation is driven by the steering motor, the steering angle of the wheel and the angle of the handle are synchronized in real time.

8.4.2 Principle of electronic steering system

As shown in the following figure: after the power switched on, the driver rotates the steering wheel, the encoder under the steering wheel transmits the rotation signal to the steering controller, which controls the steering motor and drives the driving wheel to rotate through the large toothed ring.



In conclusion, the core components of this system are encoder, steering controller and steering motor. Therefore, the stable operation of the system must ensure that the steering controller program protection function is perfect and the encoder assembly debugging is accurate.

8.4.3 Electronic steering system advantage



The structure of electronic steering system adopts modular design, easy installation and good maintenance performance. light steering, reduce the control force, real-time direction follow, good road sense; the controller has the self-diagnosis function, and the fault is output by the indicator light; no pollution, low noise, in all kinds of driving conditions can save energy about 80%.

8.4.4 Matters need attention

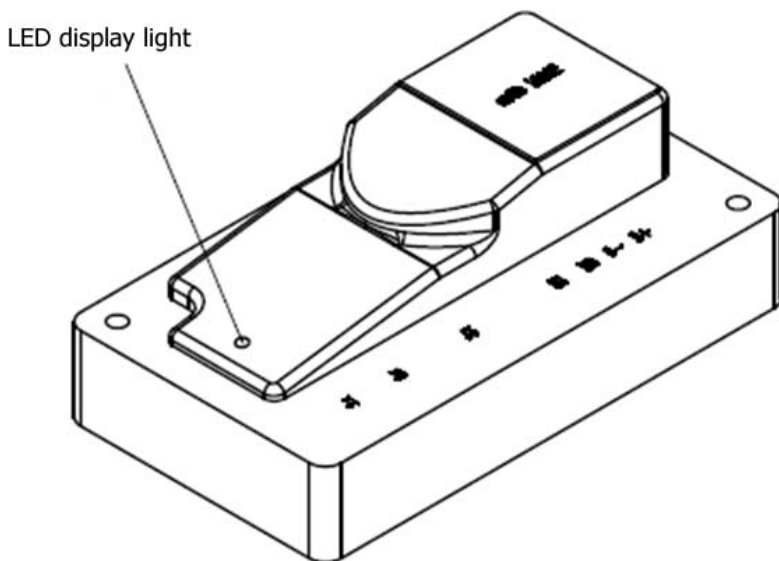
Electronic steering system is a kind of steering system with high precision, sensitive work, energy saving, environmental protection and high performance. correct use and maintenance can ensure the performance of the steering system and improve the service life of the steering system. The following rules must be strictly observed during use::

- 1) Keep the battery in good condition: the battery without power will affect the steering and the normal operation of other electronic control systems in the forklift;
- 2) All connectors of the system must be in good contact: the connectors should avoid being placed in a humid and high-temperature environment and ensure good conductivity;
- 3) Wiring harness shall not be shared with other electronic control systems: the wiring harness and fuse used for electronic steering are dedicated to the electronic steering system. wiring harness shall not be shared with other electronic control systems in the forklift to avoid affecting its power supply performance;
- 4) The controller should not be placed in a humid and hot place;
- 5) During testing and use, all plug-in are strictly prohibited to be plugged in with live power;
- 6) Pay attention to the fixation and protection of wiring harness.

8.4.5 LED display light of electric steering controller

The electric steering controller is equipped with an LED display light, which flashes and changes to

display different information. as shown in the figure below.



| LED display information description | |
|--|---|
| Display | Information |
| The LED is not bright | The controller is not powered on; or the battery of the vehicle is exhausted; or other serious faults. |
| The yellow LED lights flash normally | The controller works normally |
| Yellow LED lights are always on | The controller is in the program load state |
| The yellow and red lights flickered continuously alternately | The controller detects a fault and the fault display code consists of two digits. the number of flashing yellow light after a long interval is the first digit, and the number of flashing red light after a short pause is the second digit. |

After the failure occurring, find the corresponding fault content according to the fault code displayed by the controller, and then check whether the corresponding components are fastened loose, whether the wiring harness is intact, whether the terminals are dropped or loose, whether the components are damaged or not.

8.4.6 Common fault code table

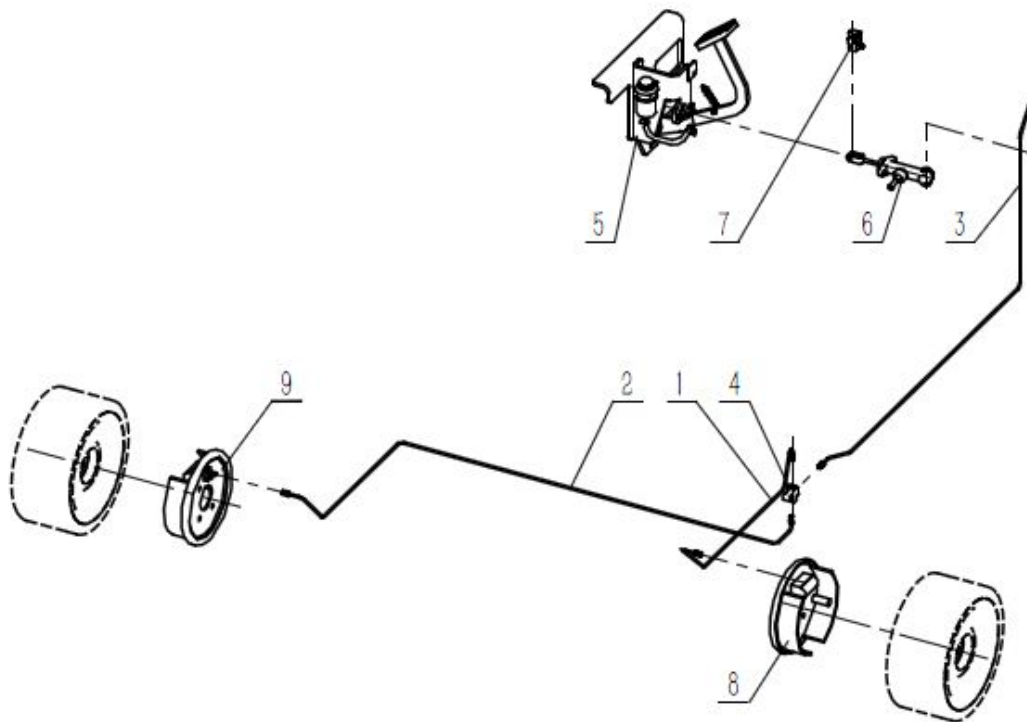
| Fault code | Fault phenomenon | Failure cause | Troubleshooting |
|---|--|--|--|
| 43 | Motor running in one direction over time, no power assisted action | The mechanical part of the motor is separated from the steering system. The motor runs in one direction over the set protection time When the steering wheel is in free state, the linear potentiometer deviates from the set median too much and exceeds the dead zone | The motor shall be properly connected with the steering system, and the motor shall not be operated apart from the steering system Adjust the linear potentiometer of the steering wheel in free state to adjust the resistance (or voltage) from the sliding end to the two fixed ends to be equal or less different |
| 44 | Motor disconnected protection, no booster action | Motor connection or carbon brush connection failure, motor cannot turn normally | Check motor connection and motor carbon brush |
| 51 | Temperature protection of the controller, no booster action | The controller detects temperature beyond the allowed range, or the controller temperature detects circuit fault , and protects it | The controller can only work normally within a certain temperature range. confirm the controller temperature; or controller failure |
| 52 | Key switch voltage protection, no booster action | The controller detects that the voltage of port 1 exceeds the allowed range and protects it | The controller can only work normally within a certain voltage range. Confirm the voltage of port 1 to port B-;Or controller failure |
| 54 | Relay suction failure, no booster action | The internal relay of the controller fails to snap properly | Controller failure |
| 99 | Keep the median state | When the operation of the middle position is completed, disconnect the short connection of the middle position and power on again | Prompt display section |
| The part that does not have a fault code prompt | | | |
| Always bright | The indicator light was on all the time after the power was on, with no booster action | Operate the steering wheel while the power is on, or the linear potentiometer median deviation, the linear potentiometer deviation from the set median excessive beyond the dead zone range | Do not operate the steering wheel or adjust the linear potentiometer median while powering on |

| | | | |
|---------|---|--|--|
| Without | Direction side light, side heavy, every time on power, power sometimes not | The linear potentiometer deviates from the set median; Power failure; Dc contactor has bad contact; Connectors have poor contact; Poor contact of wire harness terminal; | Adjust the median of linear potentiometer; to determine the fault point by detecting the voltage condition; replace or reinstall; dc contactor in bad contact; emergency measures can be used to remove the contactor top cover; sharp objects such as knives will contact the four contact points of the contactor; scraping the flat |
| Without | There's no power in one direction, but when you go in the opposite direction and you come back, there's power in that direction again | The single direction is subject to great resistance, resulting in excessive steering current. after a period of time, the controller will be protected and no longer output the power in this direction. the linear potentiometer will be released after returning to the middle dead zone | Detect whether the drive system steering is stuck and eliminate it |
| Without | After assembly or repair, the steering wheel is triggered and immediately rebounds and swings back and forth | The potentiometer line connection is reversed (namely, the potentiometer high-end and low-end connection), or the motor line connection is reversed, both of which will cause the fault; but when the high and low end of the potentiometer is connected with the motor line at the same time, the above faults will not occur | In this case, the power should be cut off immediately. Under normal circumstances, the fault can be eliminated by directly switching the two lines at the motor end |

8.5 Braking system

The braking system of all models in this series includes two aspects: driving braking and parking braking.

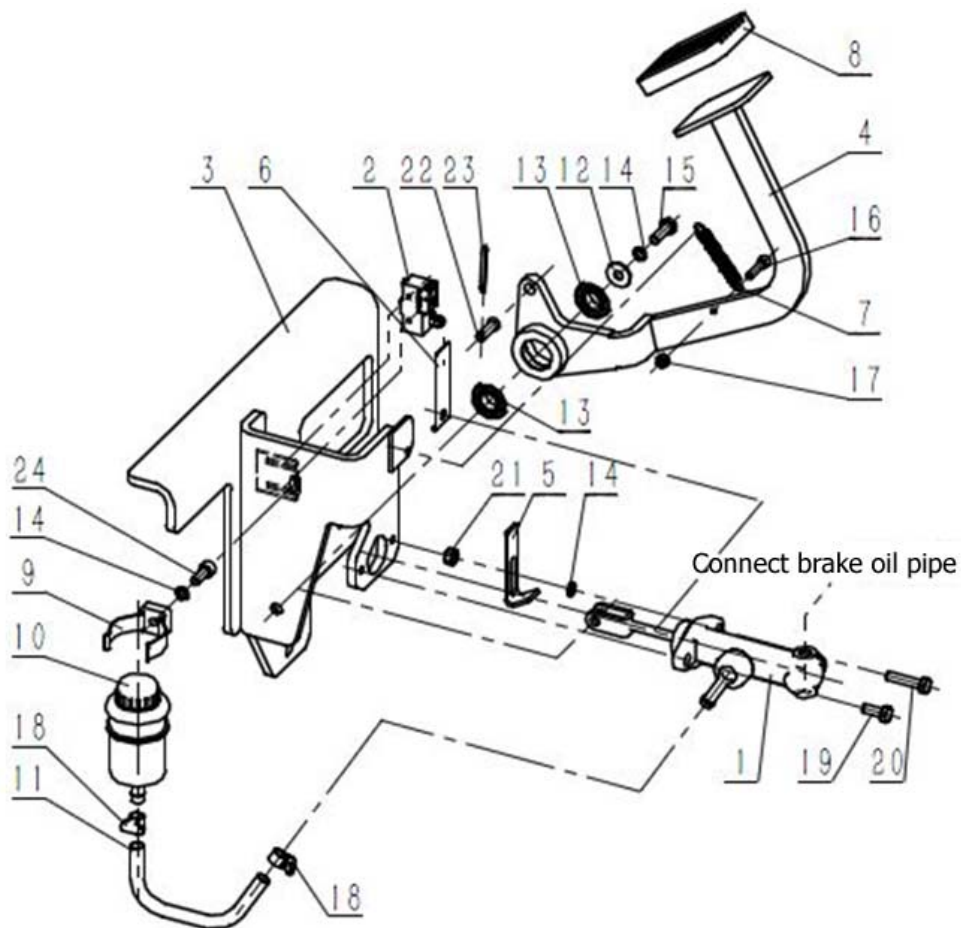
8.5.1 Driving brake structure



- 1.Left front brake tubing 2. Right brake tubing 3. Left rear brake tubing 4. Three way brake joint
 5. Foot brake assembly 6.Brake master pump 7. Micro switch 8. Left front wheel brake
 9.Right front wheel brake

As shown in the figure , the driver's foot is on the accelerator pedal during the normal operation of the forklift., When it is necessary to brake, release the accelerator pedal with your foot and press down the brake pedal (No. 5). The forklift will stop accelerating. Brake oil pump (No. 6) converts external force applied by pedal assembly into oil pressure, The pressure is transferred to the left and right front wheel brakes (no. 8 and 9) through the oil pipe (No. 1, 2 and 3), and the brakes act on the forklift to realize braking. The degree of pedal relaxation will affect the size of braking force, skilled drivers can control the release of the pedal how much or how fast to achieve different braking effects.

The detailed structure of the foot brake assembly is shown in the figure as below:



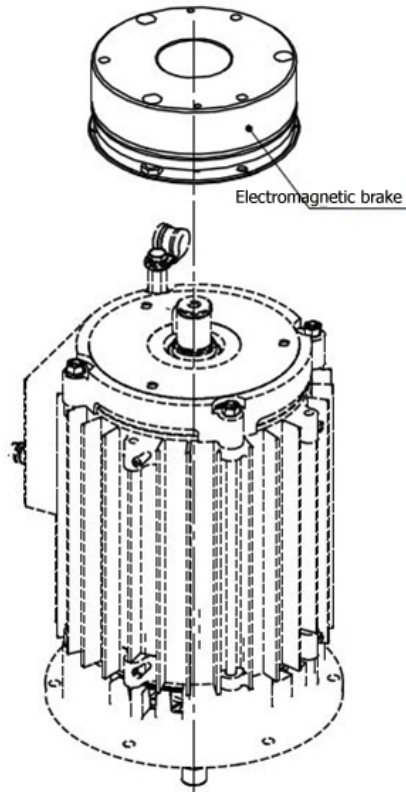
- 1.Brake master pump 2. Micro switch 3. Foot brake mounting bracket 4.Brake pedal 5. Brake limit plate
 6. Switch contacts 7.Foot brake spring 8. Foot brake rubber pad 9. Brake oil cup clip 10.Brake oil cup
 11. Rubber hose 12. Large gasket 13.Deep groove ball bearing 14. Spring washer 15. Hexagon head bolt
 16.Hexagon socket cylindrical head screw 17. Type hexagon nut 18. Throat band 19. Hexagon head bolt
 20. Hexagon head bolt 21.Hex nut 22. Pin shaft 23. Cotter pin 24. Hexagon socket head screw

When running normally, the switch contact plate (No. 6) and the micro switch (No. 2) shall remain in constant contact, and the walking system shall operate normally. When the brake pedal is pressed down, the push and pull rod of the brake oil pump will drive the switch contact and act on the micro switch (No. 2). The speed of the walking driving motor will decrease accordingly according to the analog signal of the micro switch.

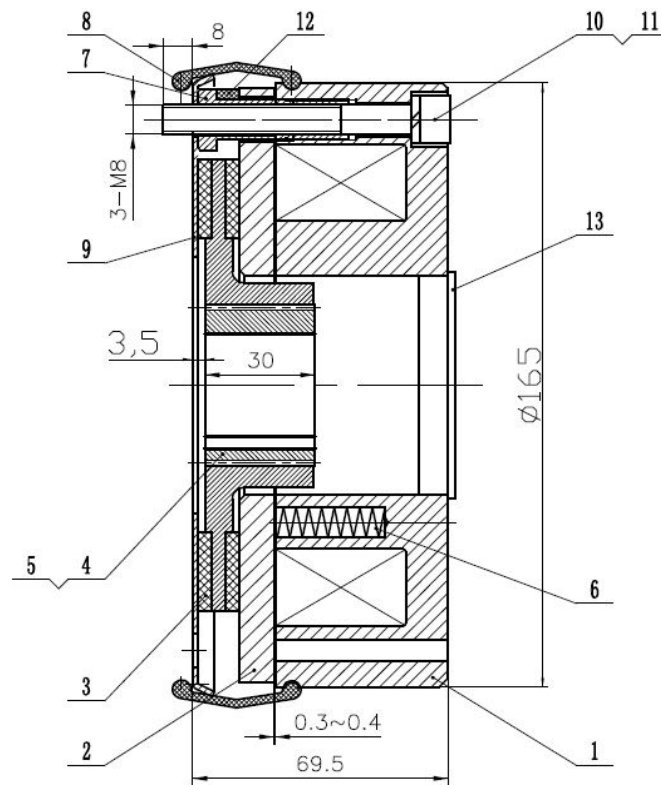
8.5.2 Parking brake structure

This series of forklifts use electromagnetic brakes for parking braking. The rotor of the brake (No. 3) is connected to the shaft of the driving motor through the flat key. The braking signal is automatically provided by the system without the need for driver operation. In the unstarted state of the vehicle, the brake is in the

state of power off, and the armature (No. 2) presses the surface of the rotor under the push of the spring (No. 6) to make it in a static state. When the vehicle starts, the coil inside the brake gets electric and pulls the armature away from the rotor so as to relieve the pressure on the rotor and release the braking state. When the vehicle is closed, the braking state is restored.



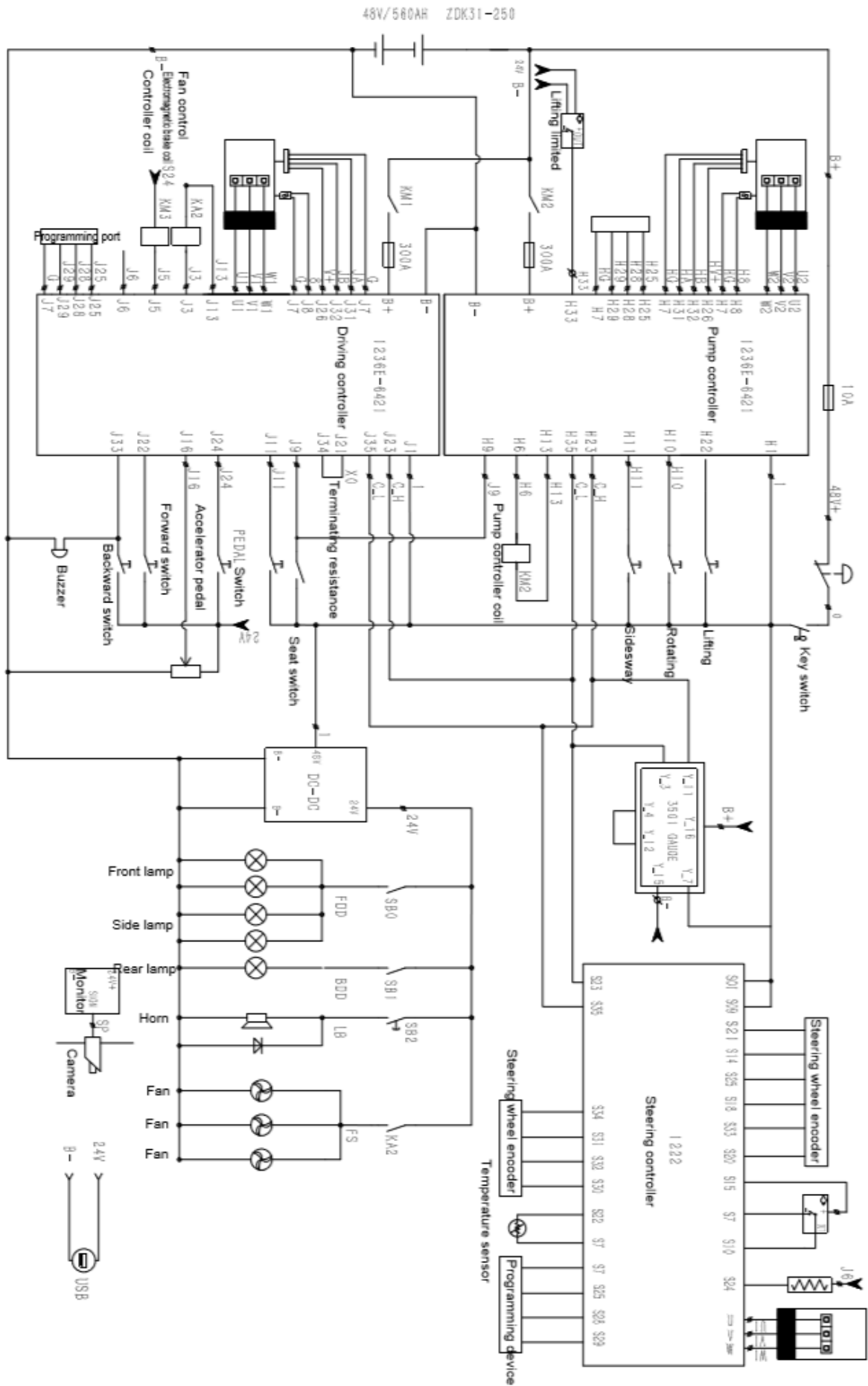
The detailed structure of electromagnetic brake is shown in the figure as below:



- 1.Stator 2. Armature 3. Rotor 4. Spline sleeve 5. O-ring 6.Torque spring 7. Hollow screw 8. Dustproof sleeve
 9. Friction plate 10. Hexagon socket screw 11. Spring washer 12.Anti-loose card 13. Dust cover

8.6 Electric System

8.6.1 Electrical schematic diagram



8.6.2 AC motor failure analysis

| fault | Cause of issue | Remedial and preventive measures |
|---|--|--|
| unload current unbalance, large three-phase difference | <ul style="list-style-type: none"> ● winding end-to-end wrong connection ● voltage unbalance of power supply ● The winding has faults such as short circuit between turns and reverse coil connection | <ul style="list-style-type: none"> ● Check and correct ● Measure the power supply voltage and try to eliminate the imbalance ● Eliminate winding faults |
| Abnormal noise during operation | <ul style="list-style-type: none"> ● Bearing wear or foreign matter such as sand particles in the oil ● Loose rotor core ● Bearing lack of oil ● power supply voltage is too high or unbalanced | <ul style="list-style-type: none"> ● Replace bearing or clean bearing ● Check the rotor core ● Add oil ● Check and adjust the power supply voltage |
| Difficult to start, when the rated load, the motor speed is much lower than the rated speed | <ul style="list-style-type: none"> ● power supply voltage is too low ● Wrong connection of surface connection motor ● Unwelded or broken rotor ● Wrong or reverse connection of rotor local coil ● Increase the number of turns when repairing the motor windings ● Motor overload | <ul style="list-style-type: none"> ● Measure the power supply voltage and try to improve ● Correct connection ● Check and repair open soldering and breakpoints ● Find out the wrong connection point and correct it ● Restore the correct number of turns ● Load reduction |
| can't rotate after power on, but there is no abnormal noise, no smell and smoke | <ul style="list-style-type: none"> ● power is not connected (at least two phases are not connected) ● The fuse is blown (at least two phases are blown) ● The overcurrent relay is adjusted too small ● Incorrect wiring of control equipment | <ul style="list-style-type: none"> ● Check the power circuit switch, whether there are breakpoints at the fuse and junction box, repair ● Check the fuse type and cause of fusing, and replace it with a new one ● Adjust the relay setting value to cooperate with the motor ● Correct the wiring |
| Large motor vibration during operation | <ul style="list-style-type: none"> ● The bearing clearance is too large due to wear ● Uneven air gap ● Unbalanced rotor ● Bent shaft ● Coaxiality of the coupling (pulley) is too low | <ul style="list-style-type: none"> ● Check and repair the bearing and replace if necessary ● Adjust the air gap to make it even ● Correct rotor dynamic balance ● Straighten the shaft ● Recalibrate to make it meet the requirements |
| motor does not rotate after power on | <ul style="list-style-type: none"> ● There is an open circuit in the rotor winding (one-phase disconnection) or one-phase power loss ● The beginning and the end of the winding lead wire are connected incorrectly or the inside of the winding is connected | <ul style="list-style-type: none"> ● Find out the breakpoint and fix it ● Check the polarity of the winding to determine whether the end of the winding is correct ● Tighten loose wiring screws, use a multimeter to judge whether each |

| | | |
|------------------------------------|--|--|
| | <p>reversely</p> <ul style="list-style-type: none"> ● The power circuit contacts are loose and the contact resistance is large ● The motor load is too large or the rotor is stuck ● The power supply voltage is too low ● The small motor assembly is too tight or the grease in the bearing is too hard ● The bearing is stuck | <p>connector is falsely connected, and repair it</p> <ul style="list-style-type: none"> ● Reduce load or detect and eliminate mechanical failure ● Check whether the specified surface connection method is wrongly connected, and whether the voltage drop is too large due to the thin power wire, and correct it ● Reassemble to make it flexible; replace qualified grease ● Repair the bearing |
| Bearing overheating | <ul style="list-style-type: none"> ● Too much or too little grease ● Poor oil quality contains impurities ● Improper fit between bearing and journal or end cover (too loose or too tight) ● The bore of the bearing is eccentric and rubs against the shaft ● Motor end cover or bearing cover is not installed flat ● The coupling between the motor and the load is not calibrated, or the belt is too tight ● The bearing clearance is too large or too small ● The motor shaft is bent | <ul style="list-style-type: none"> ● Add grease as required (1/3-2/3 of the volume) ● Replace clean grease ● If it is too loose, it can be repaired with adhesive. If it is too tight, it can be used to grind the inner hole of the journal or end cap to make it fit. ● Repair the bearing cover to eliminate rubbing points ● Reassembly ● Recalibrate and adjust belt tension ● Replace with new bearings ● Correct the motor shaft or replace the rotor |
| The motor overheats or even smokes | <ul style="list-style-type: none"> ● The power supply voltage is too high ● The power supply voltage is too low, the motor is running with rated load, and the current is too high to cause the winding to heat up ● When repairing and removing windings, improper thermal dismantling method is used, which will burn the iron core ● Motor overload or frequent start ● Motor lacks phase, two-phase operation ● Insufficient paint dipping is scheduled for winding after rewinding ● The surface of the motor is dirty with high ambient temperature, or the air duct is blocked | <ul style="list-style-type: none"> ● Reduce the power supply voltage (such as adjusting the power supply transformer tap) ● Increase the power supply voltage or change the thick power supply wire ● Check and repair the iron core and troubleshoot ● Reduce load; control start according to the specified number of times ● Resume three-phase operation ● Adopting secondary dipping and vacuum dipping process ● Clean the motor, improve the ambient temperature, and adopt cooling measures |

8.6.3 Battery fault analysis

| Malfunction | Feature | Cause | Remedial and |
|-------------|---------|-------|--------------|
|-------------|---------|-------|--------------|

| | | | preventive measures |
|----------------------------------|--|--|---|
| Irreversible sulfation of plates | <ul style="list-style-type: none"> ● The battery capacity is reduced. ● The electrolyte density is lower than normal. ● Battery voltage is too high at the beginning of charging and charging. ● Bubbles are generated when bubbles are charged prematurely or when charging starts. ● The electrolyte temperature rises too quickly during charging. | <ul style="list-style-type: none"> ● Insufficient charge at the beginning. ● Has been discharged or semi-discharged for too long. ● Long-term charge is insufficient. ● Always over-discharge. ● The electrolyte density exceeds the specified value. ● The electrolyte level is too low, causing the liquid level to appear on the plates. ● Failed to perform balanced charging in time. ● The discharge current is too large or too small. ● The electrolyte is impure. ● Internal short circuit acts locally or leaks electricity. | <ul style="list-style-type: none"> ● The lighter method uses balanced charging. ● Severe use of "hydrotherapy." ● Do not over discharge. ● The electrolyte density cannot exceed the specified value. ● The electrolyte level and impurity content should be within the specified range. |
| Battery internal circuit failure | <ul style="list-style-type: none"> ● The battery voltage at the time of charging is very low, even close to zero. ● Less bubbles or no bubbles at the end of charging. ● The temperature of the electrolyte rises quickly when charging, the density rises slowly, or even does not rise. ● The battery has a low open circuit voltage and prematurely drops to the termination voltage during discharge. ● Serious self-discharge. | <ul style="list-style-type: none"> ● The plate bends and the active material expands or falls off, causing the separator to break down and causing a short circuit. ● Too much precipitated material causes a short circuit. ● The battery falls into the conductive material, causing a short circuit. | <ul style="list-style-type: none"> ● Replace the partition. ● Remove deposits and conductive materials. ● Replace the plates. |
| Battery life decay | <ul style="list-style-type: none"> ● Battery capacity decreases. ● The electrolyte is cloudy. ● Excessive sediment. | <ul style="list-style-type: none"> ● The electrolyte does not meet quality standards. ● Charge or discharge is too frequent or overcharged or over discharged. ● The electrolyte temperature is too high when charging. ● When discharging, the external circuit is | <ul style="list-style-type: none"> ● Light to remove sediment, ● Retirement |

| | | | |
|--|--|------------------|--|
| | | short-circuited. | |
|--|--|------------------|--|

8.6.4 Common controller fault code analysis

| NO | Programmer display content | Code | Possible cause of failure | Deep fault reason/solution |
|----|---|------|--|---|
| | Failure performance | | | |
| 1 | Controller Over current Motor stops working The main connector is disconnected Accelerator failure brake Pump stops working | 12 | 1.Motor external U, V or W connection short circuit 2.Motor parameters do not match 3.Controller failure | Reason: The phase current exceeds the limiting current Solution: Restart the key switch |
| 2 | Current Sensor Fault Motor stops working The main connector is disconnected Electromagnetic brake disconnected Accelerator failure brake Pump stops working | 13 | 1. The motor U, V, W through the stator short circuit to the body, causing leakage 2. Controller failure | Cause: Controller current sensor reading deviation Solution: Restart the key switch |
| 3 | Precharge Failed Motor stops working The main connector is disconnected Electromagnetic brake disconnected Accelerator failure brake Pump stops working | 14 | 1. The positive terminal of the capacitor is connected to the external load so that the capacitor cannot be charged normally | Reason: The key switch input voltage fails to charge the capacitor Solution: Reset via VCL function precharge() or re-enter the interlock switch |
| 4 | Controller Severe Undertemp Shutdown Motor; Shutdown Main Contactor; Shutdown EMB rake; Shutdown Throttle; Full Brake; Shutdown Pump. | 15 | Controller is operating in an extreme environment. | Set: Heat sink temperature below -40°C. Clear: Bring heat sink temperature above -40°C, and cycle interlock or KSI. |

| | | | | |
|----|---|----|---|---|
| 5 | Controller Severe Over temp Shutdown Motor; Shutdown Main Contactor; Shutdown EMB rake; Shutdown Throttle; Full Brake; Shutdown Pump. | 16 | 1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. | Set: Heat sink temperature above +95°C. Clear: Bring heat sink temperature below +95°C, and cycle interlock or KSI. |
| 6 | Severe Under voltage Reduced drive torque. | 17 | 1. Battery Menu parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. The fuse is broken, or the main contactor is not connected | Set: Capacitor bank voltage dropped below the Severe Under voltage limit with FET bridge enabled. Clear: Bring capacitor voltage above Severe Under voltage limit. |
| 7 | Severe Overvoltage Shutdown Motor; Shutdown Main Contactor; Shutdown EMBrake; Shutdown Throttle; Full Brake; Shutdown Pump. | 18 | 1. Battery menu parameters are misadjusted. 2. Battery resistance too high 3. Battery disconnected while 4. regen braking | Capacitor bank voltage exceeded the Severe Overvoltage limit with MOSFEET bridge enabled. Clear: Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI. |
| 8 | Controller Undertemp Cutback There is no failure (unless the VCL is set to produce a failure phenomenon) | 21 | 1. Controller is performance-limited at this temperature. 2. Controller is operating in an extreme environment. | Set: Heatsink temperature exceeded 85°C. Clear: Bring heatsink temperature below 85°C. |
| 9 | Controller Overtemp Cutback Reduced drive and brake torque. | 22 | 1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. | Set: Heatsink temperature exceeded 85°C. Clear: Bring heatsink temperature below 85°C. |
| 10 | Under voltage Cutback Reduced drive torque. | 23 | 1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. | 原因：电容电压过低 解决：提升电容电压 Set: Capacitor bank voltage is too low. Clear: Increase capacitor voltage |

| | | | | |
|----|---|----|---|--|
| | | | <p>3.Non-controller system drain on battery.</p> <p>4.Battery resistance too high.</p> <p>5.Battery disconnected while driving.</p> <p>6.The fuse is disconnected or the main contactor is disconnected.</p> | |
| 11 | Overvoltage Cutback Reduced brake torque. | 24 | <p>1.regen braking currents elevated the battery voltage during regen braking.</p> <p>2. Battery parameters are misadjusted.</p> <p>3. Battery resistance too high for given regen current.</p> <p>4. Battery disconnected while regen braking.</p> | <p>Set: Capacitor bank voltage exceeded the Overvoltage limit with the MOSFEET bridge enabled.</p> <p>Clear: Bring capacitor voltage below the Overvoltage limit.</p> |
| 12 | +5V Supply Failure None, unless a fault action is programmed in VCL. | 25 | <p>1.External load impedance is too low.</p> | <p>Set: +5V supply outside the +5V±10% range.</p> <p>Clear: Bring voltage within range.</p> |
| 13 | Digital Out 6 Failure Digital Output 6 driver will not turn on. | 26 | <p>1.External load impedance is too low.</p> | <p>Set: Digital Output 6 current exceeded 15 mA.</p> <p>Clear: Remedy the overcurrent cause and use the VCL function Set_DigOut() to turn the driver on again</p> |
| 14 | Digital Out 7 Over current Digital Output 7 driver will not turn on. | 27 | <p>1.External load impedance is too low.</p> | <p>Set: Digital Output 7 (pin 20) current exceeded 15 MA.</p> <p>Clear: Remedy the over current cause and use the VCL function Set_DigOut() to turn the driver on again.</p> |

| | | | | |
|----|--|----|---|--|
| 15 | Motor Temp Hot Cutback Reduced drive torque. | 28 | <ol style="list-style-type: none"> 1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back. 2. Motor Temperature Control Menu parameters are mis-tuned. 3. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off. | <p>Set: Motor temperature is at or above the Temperature Hot parameter setting.</p> <p>Clear: Bring the motor temperature within range.</p> |
| 16 | Motor Temp Sensor Fault Max Speed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled. | 29 | <ol style="list-style-type: none"> 1. Motor thermistor is not connected properly. 2. If the application doesn't use a motor thermistor, Motor Temp Sensor Enable should be programmed Off. | <p>Set: Motor thermistor input is at the voltage rail (0 or 10V).</p> <p>Clear: Bring the motor thermistor input voltage within range.</p> |
| 17 | Coll 1 Driver Open/Short ShutdownDriver1. | 31 | <ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. | <p>Set: Driver 1 (pin 6) is either open or shorted. This fault can be set only when Main Enable = Off.</p> <p>Clear: Correct open or short, and cycle driver.</p> |
| 18 | Main Open/Short Shutdown Motor; Shutdown Main Contactor; Shutdown EMBrake; Shutdown Throttle; Full Brake; Shutdown Pump. | 31 | <ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. | <p>Set: Main contactor driver is either open or shorted. This fault can be set only when Main Enable = On.</p> <p>Clear: Correct open or short, and cycle driver</p> |
| 19 | Coll 2 Driver Open/Short ShutdownDriver2. | 32 | <ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. | <p>Set: Driver 2 is either open or shorted. This fault can be set only when EM Brake Type = 0.</p> <p>Clear: Correct open or short, and cycle driver.</p> |

| | | | | |
|----|--|----|---|---|
| 20 | EM brake Open/Short Shutdown EMBrake; Accelerator failure Full Brake. | 32 | 1.Open or short on driver load. 2.Dirty connector pins. 3.Bad crimps or faulty wiring. | Set: Electromagnetic brake driver (pin 5) is either open or shorted. This fault can be set only when EM Brake Type > 0. Clear: Correct open or short, and cycle driver. |
| 21 | Coll 3 Driver Open/Short ShutdownDriver3. | 33 | 1.Open or short on driver load. 2.Dirty connector pins. 3.Bad crimps or faulty wiring. | Set: Driver 3 (pin 4) is either open or shorted. Clear: Correct open or short, and cycle driver. |
| 22 | Coll 4 Driver Open/Short ShutdownDriver4. | 34 | 1.Open or short on driver load. 2.Dirty connector pins. 3.Bad crimps or faulty wiring. | Set: Driver 4 (pin 3) is either open or shorted. Clear: Correct open or short, and cycle driver. |
| 23 | PD Open/Short Shutdown PD. | 35 | 1.Open or short on driver load. 2.Dirty connector pins. 3.Bad crimps or faulty wiring. | Set: Proportional driver (pin 2) is either open or shorted. Clear: Correct open or short, and cycle driver. |
| 24 | Encoder Fault Encoder failure Shutdown Throttle. | 36 | 1.Motor encoder failure. 2.Bad crimps or faulty wiring. | Set: Motor encoder phase failure detected. Clear: Cycle KSI. |
| 25 | Motor Open Shutdown Motor; Shutdown Main Contactor; Shutdown EMBrake; Accelerator failure Full Brake; Shutdown Pump. | 37 | 1.Motor phase is open. 2.Bad crimps or faulty wiring. | Set: Motor phase U, V, or W detected open. Clear: Cycle KSI. |
| 26 | Motor Open Shutdown Motor; Shutdown Main Contactor; Shutdown EMBrake; Accelerator failure Full Brake; Shutdown Pump. | 38 | 1.Main contactor tips are welded closed. 2.Motor phase U or V is disconnected or open. 3.An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor | Set: Just prior to the main contactor closing, the capacitor bank voltage was loaded for a short time and the voltage did not discharge. Clear: Cycle KSI |
| 27 | Main Contactor Did Not Close Shutdown Motor; | 39 | 1.Main contactor did not close. 2.Main contactor tips are | Set: With the main contactor commanded closed, the capacitor bank |

| | | | | |
|----|---|----|--|--|
| | Shutdown Main Contactor; Shutdown EMBrake; Accelerator failure Full Brake; Shutdown Pump. | | oxidized, burned, or not making good contact. 3.External load on capacitor bank that pre- vents capacitor bank from charging. 4.Blown fuse. | voltage (B+ connection terminal) did not charge to B+. Clear: Cycle KSI. |
| 28 | Throttle Wiper High Shutdown Throttle. | 41 | 1.Throttle pot wiper voltage too high. | Set: Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function Setup_Pot_Faults()). Clear: Bring throttle pot wiper voltage below the fault threshold. |
| 29 | Throttle Wiper Low Shutdown Throttle. | 42 | 1. Throttle potentiometer voltage too low. | Set: Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function Setup_Pot_Faults()). Clear: Bring throttle pot wiper voltage above the fault threshold. |
| 30 | Pot2 Wiper High Full Brake. | 43 | 1. Pot2 wiper voltage too high. | Set: Pot2 wiper (pin 17) voltage is higher than the high fault threshold (can be changed with the VCL function Setup_Pot_Faults()). Clear: Bring Pot2 wiper voltage below the fault threshold. |
| 31 | Pot2 Wiper Low Full Brake. | 44 | 1. Pot2 wiper voltage too high. | Set: Pot2 wiper (pin 17) voltage is lower than the low fault threshold (can be changed with the VCL function Setup_Pot_Faults()). Clear: Bring Pot2 wiper voltage below the fault threshold. |
| 32 | Pot Low Over current Shutdown Throttle; Full Brake. | 45 | 1. Combined pot resistance connected to pot low is too low. | Set: Pot low (pin 18) current exceeds 10mA. Clear: Clear pot low over |

| | | | | |
|----|--|-------|---|---|
| | | | | current condition and cycle KSI. |
| 33 | EEPROM Failure Motor stop Main contactor stop EM brake stop Accelerator stop Interlock stop 1-4 circuit output stop Proportional drive stop Brake Pump stop | 46 | 1. Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller. | Reason: Controller operating system tried to write to EEPROM memory and failed. Solution: Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI. |
| 34 | HPD/Sequencing Fault Accelerator invalid | 47 | 1.key switch start, interlock, direction, and accelerator input order set error 1.2.Connect, start key switch, interlock, direction or accelerator input fault | Reason: Due to key switch start, interlock, direction and accelerator input set error, lead to high pedal protection and starting order Solution: Input according to correct order |
| 35 | Emer Rev HPD Emergency reverse high speed pedal protection Accelerator invalid | 47 | 1.Emergency reverse operation is over, but accelerator, forward, reverse input and interlock are not resetting | Reason: When emergency reverse is over, other inputs are not resetting, lead to fault. Solution: Input according to correct order |
| 36 | Parameter Change Fault Motor stop Main contactor EM brake Stop Accelerator invalid Brake Pump stop | 49 | 1.In order to make safety, for change of some specific parameter, must be efficient after restarting key switch | Reason: Change of parameter need to restart key switch Solution: Restart key switch |
| 37 | OEM Faults | 51-67 | 1.User can do custom fault for some phenomenon , show them by using VCL code | Based on user-defined |

| | | | | |
|----|--|----|---|--|
| 38 | VCL RunTime Error Moto stop Main contactor stop EM brake stop Accelerator stop Interlock stop 1-4 circuit output stop Proportional drive stop Brake Pump stop | 68 | 1.VCL code for running time is timeout | Reason: Running time VCL code error Solution: Edit VCL application software error removal, check new software parameter match correct, restart key switch |
| 39 | External Supply Out of Range | 69 | 1.The external load is too large or too small at 5V and 12V power supply current 2.Parameters error in the checking menu, for example “ExtSupply Max”, “ExtSupply Min” | Reason: The external power supply current (total current: 5V (26 pins) and 12V (25 pins)) exceeds the limit. The upper limit is defined by ExtSupply Max and the lower limit is defined by ExtSupply Min. Solution: Adjust external current |
| 40 | OS General Motor stop Main contactor stop EM brake stop Accelerator stop Interlock stop 1-4 circuit output stop Proportional drive stop Brake Pump stop | 71 | 1.Internal controller invalid | Reason: Internal controller invalid Solution: Restart key switch |
| 41 | PDO Timeout Interlock stop Set up CAN NMT State to Proportional | 72 | 1.CAN PDO information receiving time is out of PDO time limited | Reason: CAN PDO information receiving time is out of PDO time limited Solution: Restart key switch, or receive CAN NMT information |
| 42 | Stall Detected EM brake stop Control model switch to LOS(limited operation status) | 73 | 1.Motor blocked 2.Motor encoder invalid 3.Wrong line connect 4.Input motor encoder power supply failure | Reason: Motor encoder cannot be detected Solution: Restart key switch, or detect valid signal of motor encoder in LOS model, and set parameter to |

| | | | | |
|----|---|----|--|---|
| | | | | Throttle Command=0, Motor RPM=0 |
| 43 | Motor Characterization Fault Motor stop Main contactor stop EM brake stop Accelerator stop Brake Pump stop | 87 | | Reason: Motor matching process failed Solution: correct the error, restart key switch |
| 44 | Motor Type Fault | 89 | 1. Motor type parameter value is out of range | Reason: Motor Type parameter is set to an invalid value Solution: reset and restart the key switch |
| 45 | VCL/OS Mismatch Motor stop Main contactor stop EM brake stop Accelerator stop Interlock stop 1-4 circuit output stop Proportional drive stop Brake Pump stop | 91 | 1.Controller VCL program does not match OS program | Reason: Controller VCL program does not match OS program Solution: Update the correct VCL and OS program |
| 46 | EM Brake Failed to Set EM brake invalid Accelerator invalid | 92 | 1.Fork still moving after EM brake command is set 2.EM brake power is too small | Reason: Forklift is still moving after EM brake is locked Solution: check whether accelerator is normal |
| 47 | Encoder LOS (Limited Operating Strategy) | 93 | 1.Due to motor stalling or encoder failure, limited operation status is activated 2.Incorrect line connect 3.Forklift stalling | Reason: Due to motor stalling or encoder failure, limited operation status is activated Solution: Restart key switch,if caused by motor stalling, please make sure that the encoder is working normally, Throttle Command=0, Motor RPM=0 |

| | | | | |
|----|--|----|--|---|
| 48 | Emer Rev Timeout EM brake invalid Accelerator invalid | 94 | 1. The emergency reverse timeout is activated due to the expiration of the EMR Timer 2. The emergency reverse switch is always in On position | Reason: Emergency reverse function is activated and in operation until emergency reverse timing is over Solution: check emergency reverse switch status |
| 49 | Illega Model Number motor stop main contactor stop EM brake stop Accelerator stop Brake,pump stop | 98 | 1.Controller model can not be identified 2.Software and hardware are not matched 3.controller damage | Reason: Controller model can not be identified Solution:choose correct controller, download correct controller software |
| 50 | Dualmotor ParaMCAter Mismatch Turn off controller Turn off main contactor Turn off electric brake Turn off accelerator Turn off brake, pump | 99 | The Enable parameter of the dual motor is set to OS, and the control mode selection parameter is not set to 0 (Speed Mode Express) or 1 (Speed Mode) | Reason: When dual-drive software is enabled, the control mode selection should be set to 0 (Speed Mode Express) or 1 (Speed Mode), otherwise a malfunction will occur Solution: adjust to the appropriate value and switch KSI |

Chapter 9 Maintenance

9.1 Driving Permits: Forklifts can only be operated by specially trained technicians. Operators must be proficient in the skills of driving and load handling.

9.2 Driver's Rights, Obligations, and Code of Conduct: The driver must understand his rights and obligations, be trained in the use and handling of ground conveyor equipment, and be familiar with the contents of the operating instructions.

9.3 Non-workers are forbidden to use the equipment: The driver takes full responsibility for the equipment during the use of the forklift. Non-workers should be prohibited from driving or operating forklifts. Do not use a forklift to carry or get up persons.

9.4 Equipment Damage and Defects: If damage or other defects are found on the forklift truck and its attachments, it must be immediately reported to the supervisor or professional maintenance personnel. Forklifts with imperfect operating performance, such as severe tire wear or brake failure, must not be used without maintenance.

9.5 Equipment maintenance: The driver shall not repair or modify the forklift without special training and permission. The driver must never disable or adjust the safety devices and switches.

9.6 Dangerous areas: Dangerous areas are areas where people are vulnerable. These dangers mainly come from the forklift truck itself, its load carrying parts, and the driving and lifting movements of heavy goods. Hazardous areas also include areas that may be at risk due to falling or rollover of load-bearing objects. Non-workers must stay away from dangerous areas. Warning signs must be hoisted in hazardous areas.

9.7 Safety Devices and Warning Signs: All safety devices, warning signs, and warning instructions in this manual and on the vehicle must be strictly observed.

9.8 Security Rules for Maintenance Work

Only after system learning can maintenance work be carried out.

- (1) Keep the maintenance site clean and hygienic.
- (2) Do not bring any loose items or valuables on the body during maintenance.

When repairing the forklift electrical system, if the metal comes into contact with the energized electronic components, it may cause a short circuit or burn. So, take off your watch, earrings or other accessories.

(3) Before repairing the forklift, unplug the power outlet and disconnect the power supply.

(4) Close the key switch of the truck before opening the left and right covers or electrical systems.

(5) Before checking the hydraulic system, lower the fork and release the system pressure.

(6) When checking the oil leakage condition of the body, wipe it with paper or cardboard, and do not touch it directly with your hands. To avoid burns.

(7) Please note that the oil temperature in the transmission or hydraulic system may be high. Cool the forklift first, then replace the gear oil or hydraulic oil to prevent the oil from burning and causing high oil temperature.

(8) The hydraulic system should be filled with new clean oil.

If the hydraulic oil is not clean, it will affect the precision hydraulic components, so that the entire hydraulic

system capacity is reduced.

If different brands of hydraulic oil are used, damage to the hydraulic components will also affect the system capacity. Therefore, when adding or replacing hydraulic fluid, pay attention to the use of a unified grade.

(9) Observe the relevant laws and regulations, protect the environment, store and discharge the oil according to regulations, and do not discharge it to the sewer.

(10) Body welding, to disconnect the battery power. Because welding current may enter the battery during welding, to avoid this kind of situation, please cut off the battery.

(11) When working under a forklift, the forklift should be supported securely. Improper support may cause the forklift to tip over and hurt people. If the forklift is not protected by lifting equipment or supports, it is prohibited to work under the forklift.

9.9 Cleaning the Forklift

Regular cleaning every week is very important to ensure its reliability. Please pay attention to remove the power socket before cleaning to avoid short circuit and damage to the electrical system.

External cleaning

(1) Remove attachments on wheels every day to keep them flexible.

(2) After the cleaning is completed, lubricate the lubrication points of the forklift specified in the lubrication table.

When cleaning electrical components, use compressed air to blow motor dust. Cannot be flushed with high pressure flushing device.

Do not damage the electrical components on the circuit board. In order to maintain the position of electrical components, avoid short circuits.

9.10 Battery Maintenance

(1) The battery fluid plug and breathable cover should be kept clean, removed or opened when charging, and should be installed or closed after charging. The battery surface, connecting wires and screws should be kept clean and dry. If there is sulphuric acid, wipe off the lye with cotton gauze and be careful not to allow lye to enter the battery.

(2) After the charging is completed, check the battery level and add distilled water in time to maintain the liquid level. Do not add dilute sulfuric acid under normal conditions.

(3) After the storage battery is used, it should be charged in time, and the storage time should not exceed 24 hours.

(4) Good ventilation should be maintained during charging, and fireworks are strictly prohibited.

(5) When the following conditions occur, the battery needs to be charged evenly.

a. Normally used batteries (equalize charge every 3 months).

b. Lay unused battery for a long time.

c. There is a "backward battery" in the battery pack (backward battery refers to a battery whose voltage value is lower than other batteries or has been overhauled during charge and discharge). At this time, the equalization charge is performed only for the backward battery.

(6) Balanced charging method.

a. First perform normal charging.

b. Stop charging for 1 hour until fully charged and recharge with 0.25I5 for 1 hour.

Press b to repeat several times until the charger is turned on. There will be bubbles in the battery.

(7) When the battery is not in use, one month after the expiration of the storage period, a supplementary charge should be made according to the normal charging method.

(8) The storage battery should be protected from direct sunlight. The distance from the heat source should not be less than 2M.

(9) Avoid contact with any liquids and harmful substances. Any metal impurities must not fall into the battery.

9.11 Motor maintenance:

(1) Inspection and maintenance The motor should be operated under power off.

(2) Measure the cold insulation resistance of the motor with a 250-volt megohmmeter every three months. The resistance of the motor should be greater than 0.5 MΩ. If the resistance is less than 0.5 MΩ, dry the insulation.

(3) Check if the connecting wire of the motor outlet is correct and firm.

(4) Check whether the reversing film is clean. The brush should slide freely in the brush box.

(5) Check that all fasteners are tight.

(6) Check brush wear every three months and replace brushes as appropriate.

(7) Do a complete motor maintenance every year.

9.12 Maintenance of Electromagnetic Brake

1) Use it in a humid environment for a long time. To prevent rust, rust may affect the use of the suction surface. Please remove the rust.

2) The friction surface must not be directly touched by hand, and there must be no oil pollution. Otherwise, the maximum torque cannot be reached. Please clean and wipe the clean friction surface.

3) When the temperature in the use environment is high, please install it in a place with ventilation and ventilation. Generally, the ambient temperature is -10°C~40°C.

4) The torque value at the initial stage of use is low. After using for a period of time, the torque value tends to be stable.

5) Please check regularly. Regular inspection items include: whether the switch operation is normal; whether there is noise; whether there is abnormal heat; whether the foreign matter or oil is mixed in the friction part and rotating part; if the clearance of the friction part is appropriate, whether the excitation voltage is normal.

9.13 Maintenance work

1) Daily maintenance and Safety check

(1) It is the operator's responsibility to carry out daily maintenance and inspection of the forklift.

(2) Forklifts do not carry out routine maintenance, which will affect the safety and reliability of the forklifts and can easily lead to serious accidents.

(3) Checking for problems or discovering faults should immediately begin to repair and stop using them.

Checklist as below:

| No. | Item | Content |
|-----|------------------------|--|
| 1 | Operation control | Check whether the function is normal |
| 2 | Safety switch | Check whether the function is normal |
| 3 | Horn | Check whether the function is normal |
| 4 | Steering | Check whether the function is normal |
| 5 | Hydraulic device | Check whether the function is normal |
| 6 | Meter | Check whether the function is normal |
| 7 | Hydraulic system | Check oil level and whether oil leaking |
| 8 | Drive device | Check abnormal noise and whether oil leakage |
| 9 | Electromagnetic Clutch | Check whether working properly and poor contact |
| 10 | Transmission | Check whether the function is normal |
| 11 | Wheel | Check whether damage, remove oil contamination and metal chips |
| 12 | Frame | Check whether damage, remove oil contamination |
| 13 | Battery | Check electrolyte level |
| 14 | Fork | Check whether deformation or cracks |
| 15 | Lift device | Check whether damage, remove oil contamination |
| 16 | Oil cylinder | Check whether damage and oil leaking |

2) The maintenance work can be completed within 1 day, 1 week and 1 month indicated in the maintenance table.

3) Other maintenance sections given in the table. This only can be done by our maintenance personnel or our approved repair organization.

The maintenance table is as follows:

| No. | Interval | 8 H | 60H | 240H | 720H | 1400H | 2800H | 5700H |
|-----|--|-----|-----|------|------|-------|-------|-------|
| 1 | Body system | | | | | | | |
| 1.1 | Check cover plate(Left, right) | | | | ★ | | | |
| 1.2 | Check battery firmed spare parts | | | | ★ | | | |
| 1.3 | Check whether frame crack | | | | ★ | | | |
| 1.4 | Check whether forklift body firmly installed | | | | ★ | | | |

| | | | | | | | | |
|-----|---|---|---|---|---|---|--|--|
| 2 | Motor | | | | | | | |
| 2.1 | Check whether the connection is loose | | | ★ | | | | |
| 2.2 | Cleaning the motor | | | ★ | | | | |
| 2.3 | Check whether bolts are firm | | | ★ | | | | |
| 2.4 | Check whether abnormal bearing noise | | | ★ | | | | |
| 2.5 | Check insulation resistance | | | | ★ | | | |
| 2.6 | Check commutator and carbon brush | | | | ★ | | | |
| 3 | Drive system | | | | | | | |
| 3.1 | Check whether leaks | | | | | ★ | | |
| 3.2 | Check oil level | | | | ★ | | | |
| 3.3 | Check noise | | | | | ★ | | |
| 4 | Wheel | | | | | | | |
| 4.1 | Check drive wheel worn and bolt | ★ | | | | | | |
| 4.2 | Check universal wheel and shaft good and firm or not | | | | ★ | | | |
| 4.3 | Check support wheel rotate,joint place is firmed or not | | | | | ★ | | |
| 4.4 | Check the wear of the support wheel | | | | ★ | | | |
| 4.5 | Remove and lubricate the wheel bearing | | | | | ★ | | |
| 5 | Brake part | | | | | | | |
| 5.1 | Clean brake part | | | | ★ | | | |
| 5.2 | Check the wear of the brake pads | | | | ★ | | | |
| 5.3 | Check the brake condition when the brake is released | | | ★ | | | | |
| 6 | Electric control board | | | | | | | |
| 6.1 | Cleaning and installation inspection | | | | ★ | | | |
| 6.2 | Tight cable connector | | | | ★ | | | |
| 6.3 | Check contactor contacts | | | | | ★ | | |
| 6.4 | Check contactor | | | | | ★ | | |
| 7 | Battery | | | | | | | |
| 7.1 | Check electrolyte liquid level(on the plate 10-15mm | | ★ | | | | | |
| 7.2 | Check whether the connection between the battery and the charger is tight | | ★ | | | | | |

| | | | | | | | | |
|------|--|---|---|---|---|---|--|--|
| 7.3 | Check whether each battery and its insulation sheath are displaced | | ★ | | | | | |
| 7.4 | Check electrolyte gravity temperature | | | ★ | | | | |
| 7.5 | Clean battery | ★ | | | | | | |
| 8 | Hydraulic system | | | | | | | |
| 8.1 | Check whether pipeline and joints leaks | | | | | ★ | | |
| 8.2 | Check the wear of pipeline | | | | | ★ | | |
| 8.3 | Check whether oil tank leaks | | | | | ★ | | |
| 8.4 | Check oil level | | | | | ★ | | |
| 8.5 | Replace oil | | | | | | | |
| 9 | Cylinder | | | | | | | |
| 9.1 | Check leak situation | | | | | ★ | | |
| 9.2 | Check install situation | | | | | ★ | | |
| 10 | Mast | | | | | | | |
| 10.1 | Check whether damage or cracks | | | | | ★ | | |
| 10.2 | Check roller wheel | | | | | ★ | | |
| 10.3 | Check whether lift chains and chain wheels damage | | | | ★ | | | |
| 10.4 | Check whether forks broken | | | | ★ | | | |
| 11 | Handle Arm | | | | | | | |
| 11.1 | Check installation situation | | | | | ★ | | |
| 11.2 | Check brake switch | | | | ★ | | | |
| 11.3 | Check whether fasten screws loose | | | | | ★ | | |
| 11.4 | Check the function of safety switch | | | | | ★ | | |
| 11.5 | Check whether damp spring normal and adjust | | | | | ★ | | |

9.14 Lubrication parts table

| Part No | Lubrication | Interval time (h) | | | Types of lubricating oil and grease |
|---------|---------------------------------------|-------------------|------|------|-------------------------------------|
| | | 500 | 1000 | 3000 | |
| 1 | Wheel bearing (including steering) | | L | | A |
| 2 | Hydraulic system | H | O | | B |
| 3 | Driving gearbox | H | | O | C |
| 4 | Lifting chains | L | | | D |
| 5 | Lifting system bearing | L | | | G |

L

=Lubrication H=Inspection O=Oil change

| Grease type | | Specification | | Applicable parts |
|-------------|------------------|--|--------------------------------------|---------------------|
| | | ≥-15℃ | <-15℃ | |
| A | Grease | 3#Lithium grease drop point170 | | Bearing and sleeve |
| B | Hydraulic oil | HM46 | HV32 | Hydraulic system |
| C | Transmission oil | 85W/90 (AbroadSAE80W/90) | 70W/75 (AbroadSAE75W) | Gear box |
| D | Lubricating oil | CC30 (Normal temperature SAE20W) | CC15W (Low temperature SAE10W) | Chains and pipe |
| G | Grease | 3#Lithium grease drop point170 | | Lift system bearing |