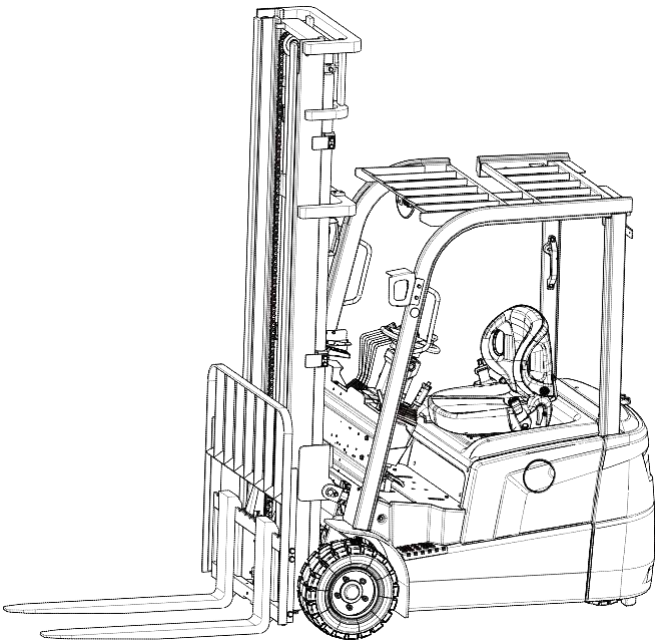
Quality Changes the World

Lithium Battery Counterbalance Forklift Truck

SCP16S/20S



Safety, Operation and Maintenance Manual

SCP16S/20S Lithium Battery Counterbalance Forklift Truck

Safety, Operation and Maintenance Manual

⚠ Warning

Read and follow the safety precautions and instructions in this manual and on the machine nameplate. otherwise, serious injury, death or property damage may result. Keep this manual together with the machine for future reference.

SANY Group

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Disclaimer

Important Statements

Electric forklift trucks are widely used in various industrial and commercial environments for handling and stacking materials. They can be equipped with different accessories, such as side shifters, tilters, clamps, etc. to meet needs in different scenarios, including paper industry, food and beverage, manufacturing production lines, cement tiles, ports and wharfs, warehousing and logistics centers, etc. Any use beyond the specified purpose is outside the scope of intended use.

SANY shall not be liable for any consequences resulting from use other than for the intended purpose.

SANY assumes no liability for any adverse consequences arising from the following situations:

- Failing to use the equipment as stipulated in this manual.
- Unauthorized change or modification of the equipment.
- Any equipment damage or accident caused by the use of untested or unauthorized parts and tools other than Sany's genuine accessories.
- Machine failure or damage caused by force majeure such as natural disasters (earthquakes, typhoons, etc.), wars, and so on.
- Others caused by other factors not attributable to Sany.

It is impossible for SANY to foresee all possible hazards at the working site. Therefore, operators and customers should attach great importance to safety issues.

It is possible that stricter operation regulations are imposed in different regions by the local authority where the forklift is used. In case of conflict between those operation regulations and the safety operation instructions specified herein, the most stringent safety operation regulations shall prevail.

Forklift trucks are equipped with a variety of attachments. The use of these attachments must be approved by the manufacturer. Modifications or alterations to the attachments are strictly prohibited.

Responsibilities of Sany Manufacturer

Ensure that the quality of the forklift trucks provided is qualified and the attached documents are accurate.

Fulfill the after-sales service commitment, and document all the maintenance and repair work performed by after-sales service personnel.

Provide trainings to the equipment operators and maintenance staff as required.

Responsibilities of Customers or Other Authorized Personnel Concerned

- Relevant personnel can operate and maintain the forklift truck only if they have received adequate training and have fully understood the contents of the equipment parts book and Safety, Operation and Maintenance Manual.
- Make certain that the operators and the maintenance personnel of the equipment are qualified for this job and know the corresponding responsibilities.
- Regularly check the safety awareness of relevant personnel while working.
- In the event of any fault that may affect safety, stop the equipment operation immediately.
- The SANY service personnel have the right to carry out relevant safety inspections on the equipment when necessary.
- In addition to the inspections specified by SANY, the equipment needs to be inspected according to the relevant national and regional laws and regulations.
- Ensure timely maintenance and repair of electric forklift trucks.
- Carefully and consciously plan the equipment use.

Responsibilities of All Operation Personnel

- If there is any abnormal phenomenon that may indicate abnormal operation of the equipment or potential hazards, report to the supervisor immediately, or correct it promptly if possible.
- All personnel working around the equipment must follow all warning signs and be alert to the threats to their and others' safety.
- All the workers should know the operation project content and procedure.
- Observe to see whether there is a danger, and warn the operator and the signalman if any. E.g., high-voltage power lines, unauthorized personnel, poor ground conditions, etc.

Responsibilities of Management

- Ensure that the operator is well trained, fully understands the content of the Safety, Operation and Maintenance Manual provided by SANY, is in good health, and has an operation certificate. Otherwise, the operator is not allowed to operate the equipment.
- Ensure that the operator has good judgment, cooperation awareness, and psychological quality. Otherwise, the operator is not allowed to operate or maintain the equipment.
- Make sure that the signalman has good visual and auditory judgment ability, grasps the standard command signal and sends out clear and accurate signals. At the same time, he or she should have enough experience to identify risk factors and inform the operator to avoid them in time.
- Ensure that the assistant can correctly determine the model and working condition of the equipment and select the appropriate equipment.
- Ensure that the awareness of safety operation is communicated to all project operators. Clearly inform the operators of the safety notes that should be paid attention to during the operation.

Contents

Foreword

1. Foreword

1.1 Introduction

This manual briefly introduces the technical parameters of our lithium battery counter-balanced forklift truck, the structure, working principle, operation, maintenance, and other aspects of the main units. It can help operators to use the lithium battery forklift truck properly, so that the forklift truck can achieve maximum efficiency. We hope that operators and equipment management members will carefully read this manual before operating the lithium battery forklift truck.

During use, operators shall strictly follow the provisions and precautions in this manual, and keep your forklift truck in optimal working condition for maximum efficiency.

As components and devices are constantly being improved, the relevant content in this book will be updated accordingly without further notice. We appreciate your understanding.

1.2 Safety

The safety section lists basic safety protection knowledge. The content and location of warning decals and signs on forklift trucks. Before operating a forklift truck or lubricating, maintaining, or repairing a forklift truck, please read and understand the basic safety precautions in the safety section.

1.3 Operation

The operation section is applicable to new drivers and experienced drivers. This section includes descriptions of instruments, switches, forklift truck and attachment controls, transportation and hauling.

Photos and illustrations are used to guide the operator in the correct way to inspect, start, operate and stop the forklift truck. The operating methods listed in the manual are the most basic. Once the functions of the forklift truck and its knowledge are mastered, the driver's skills and techniques may be improved.

1.4 Maintenance

The maintenance section is a guide for servicing your equipment. The maintenance intervals consist of each maintenance step as shown in the illustration. Items without a specified period are listed under the subject "maintenance as required". The maintenance intervals description is detailed below.

1.5 Maintenance intervals

Use a maintenance hour meter to determine maintenance intervals. A interval display (daily, weekly, monthly, etc.) can replace a maintenance hour meter if it can more conveniently display the maintenance date and approximately indicate the maintenance hours. Periodic maintenance must be performed. Whichever interval comes first.

Working in heavy, dusty, or humid environments may require shorter lubrication intervals than those specified in the "maintenance intervals".

Previous maintenance items are to be repeated. For example, when “every 500 hours of operation or 3 months of maintenance”, the items of “every 250 hours of operation or monthly maintenance” and “every 10 hours of operation or daily maintenance” should be performed at the same time.

1.6 Important safety information

Most accidents related to operation, maintenance, and repair are caused by ignorance of basic safety rules and protection knowledge. Accidents can often be avoided by being aware of potential hazards in advance. The driver must be alert to potential hazards and must be trained, skilled and properly understand the functions of the tools used.

⚠ Warning

Safety warnings are indicated on the machine and in the manual, which, if not heeded, could result in death or injury to you or others.

Improper operation, lubrication, maintenance or repair of this machine may be dangerous and result in injury, death.

Read and understand the related information before operating the equipment and performing lubrication, maintenance or repair work.

- There are several types of safety warning signs: Warning! DANGER! Attention! Note!
- Information warning of danger may be written or illustrated on the machine and in this manual.
- Operations that may cause damage to the machine are indicated by caution decals on the machine and in this manual.
- It is impossible to list all possible dangerous situations, so the warnings on the machine and in this manual do not cover all dangers. If the tool, operating process, working method and operating technique are not specified by our company, you must implement it under conditions that ensure the safety of you and others, and ensure that the operation, lubrication, maintenance and repair methods may not damage the machine or make it unsafe.
- The information, specifications and illustrations in this manual are based on the information available when this manual was prepared. Specifications, torques, pressures, measurements, adjustments, illustrations and other items are subject to change, which changes affect the maintenance of the machine. Receive complete and up-to-date information before doing any work, and SANY agent can provide you with the latest information.

Safety

2. Safety

2.1 Overview

Some of the safety rules and regulations in this manual are refer to representative parts of the Occupational Safety and Health Act (OSHA), but not all of them are extracted from it. And the reference contents are translated rather than copied word for word.

The most effective way to avoid serious injury or death to the driver and other personnel is that the driver should be proficient in unique operation of the forklift truck and be alert to and avoid activities or hazardous conditions that may lead to accidents.

Do not operate the forklift truck when it needs repair, is faulty or in any unsafe condition. Faults and unsafe conditions must be reported immediately. Do not make any adjustments or repairs without training or authorization.

Warning decals and warning signs

This chapter lists the warning information and warning signs of SANY forklift trucks. Please be sure to take the time to know these warning information and warning signs well.

Make sure you read these safety symbols. If you cannot clearly read the text or see the symbols, clean or replace the decal. Clean the decal with a cloth, water, and soap rather than solvents, gasoline, etc. If the decal is damaged, missing, or illegible, it must be replaced. If the unit to which the decal was attached is replaced, make sure the same decal is attached to the new unit. Please contact SANY forklift truck agent to apply for a new decal. When replacing it, be sure to put the new decal in its original place.

⚠ Warning

Risk of casualties!

Misoperation may cause personal injury or death.

Be sure to operate the forklift truck strictly in accordance with the warning decals on the forklift truck.

2.2 Warning decals

2.2.1 Operation or maintenance training warning signs

The sign is located on the front right side of the steering wheel.

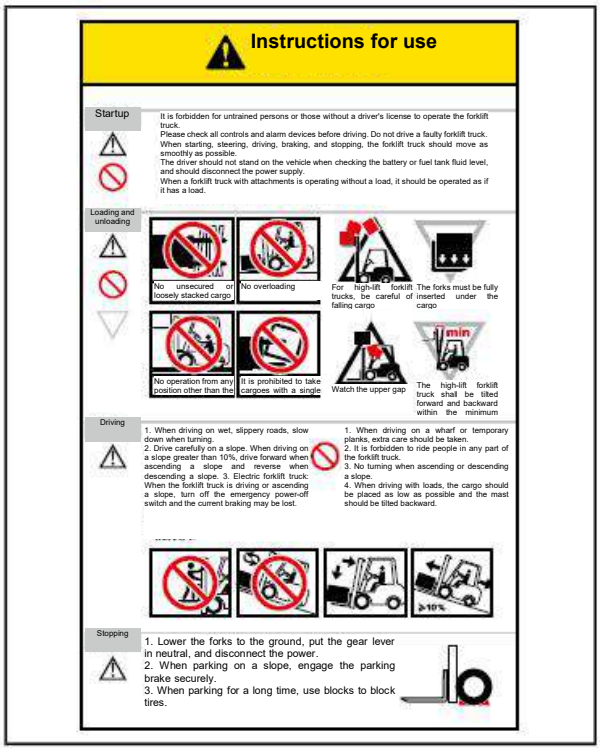


Figure 2-1

Warning

Danger of personal injury or death!

Improper operation or maintenance can cause death or injury.

Do not operate or work on a forklift truck without training. Please read and understand the Safety, Operation and Maintenance Manual.

Supplementary manuals can be provided by SANY forklift truck agents.

Information on forklift truck load capacities is also available.

2.2.2 General warnings to drivers

Warning

Only trained and authorized personnel may operate this vehicle.

For sake of safety, please read the Safety, Operation and Maintenance Manual and operate the forklift truck accordingly and be alert to the following warnings.

1. Before starting, check all controllers and alarm devices.

2. Refer to the load curve sign of the vehicle and do not overload. When operating a forklift truck with an attachment, which should be considered as part of the load when it is not loaded.

3. Before the “ON-OFF” switch is turned on, the reversing controller or shift lever is placed in neutral.

4. Starting, steering and braking should be smooth. Slow down on slippery and uneven roads and when turning. Avoid loose objects and pits on the road. Be alert when turning on a slope.

5. When driving with loads, the cargo should be lowered as much as possible and tilted backward. If the cargo obstructs vision, you can drive in reverse.

6. When operating on a slope, the load should face the top of the slope.

7. Watch pedestrians and obstacles and ensure good forward visibility.

8. Riding on the forks or forklift trucks is not allowed at any time.

9. No one is allowed to stand or pass under lifting device of the forklift truck.

10. Make sure the road in the operating area can safely support the forklift truck.

11. The forklift truck and its attachments may only be operated from the seat.

12. Unstable or loose cargoes cannot be transported.

13. Use the minimum tilt angle when taking and placing cargoes.

14. Be careful when moving long, wide or high cargo.

15. The forks should be fully inserted under the cargo, and the distance between the forks should be maximized if possible.

16. Forklift trucks should be equipped with overhead guards or appropriate protection. If necessary, a shelf should also be provided. Be especially careful if not.

17. When parking, lower the lifting device to the ground. Place the directional controller and gear shift lever in the neutral position. Apply the parking/secondary brake. Turn off the ON–OFF switch. If the machine is on a slope, use wheel chocks. Before storing the electric forklift, disconnect the lithium battery.

18. When replacing the lithium battery of an electric forklift, observe all safety procedures.

19. The emergency stop switch is to be used only in genuine emergency situations. Frequent use of the emergency stop switch via the push-button may cause critical failures of the machine.

2.2.3 No touching

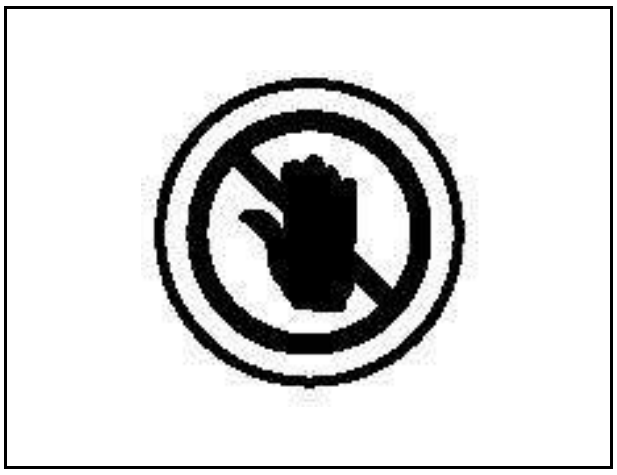


Figure 2-2

Warning

No touching!
Do not place your hands in this area.
Do not touch, lean on or reach the mast, and do not allow others to do so.

• The warning decal is located on the mast.

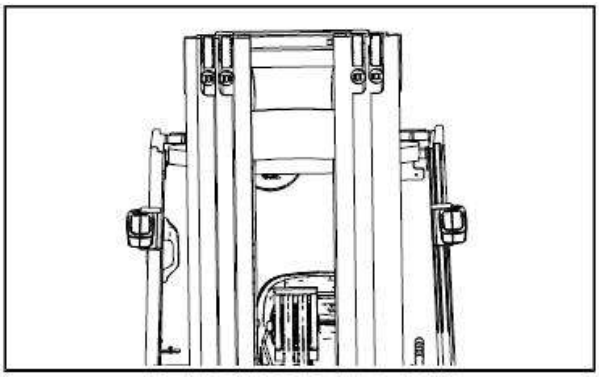


Figure 2-3

2.2.4 No standing on/under the forks

• The sign is located on the lift cylinder.

Figure 2-4

Warning

Do not stand or sit on the forks!
Do not stand or sit on the pallet or cargo!
Do not stand or walk under the forks!

2.2.5 Load backrest must be in the indicated position

• The sign is located on the load backrest.

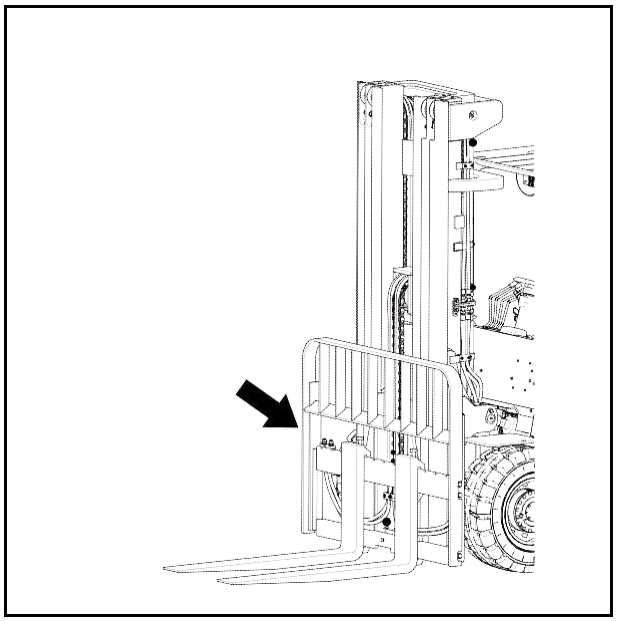


Figure 2-5 Load Backrest

Warning

Risk of personal injury or property loss!
It is very dangerous to operate if the load backrest is not in the designated position.
The load backrest must be in the designated position.

2.2.6 Proper installation of overhead guard

Warning

It may be dangerous if this device is not available!
The overhead guard complies with relevant regulatory standards.
The device has passed a crash test of appropriate value.

• This warning is located on the overhead guard.

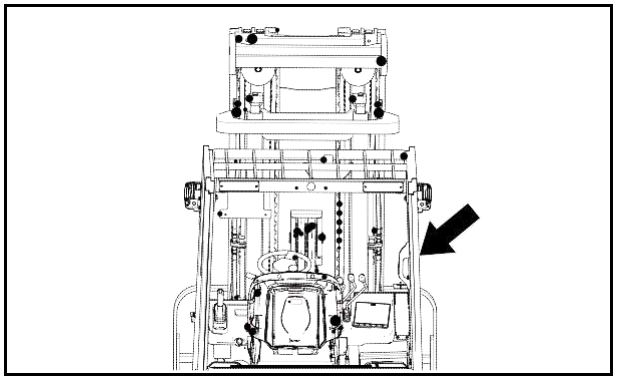


Figure 2-6 Overhead Guard

2.2.7 Safe driving warning

• The sign is located next to the seat.

Figure 2-7

Warning

Risk of personal injury!
In order to avoid personal injury, it is strictly forbidden to ride passengers.
Only one driver is allowed on a forklift truck with no passengers.

2.2.8 Parking brake warning

Located at the upper-left of the machine cover.

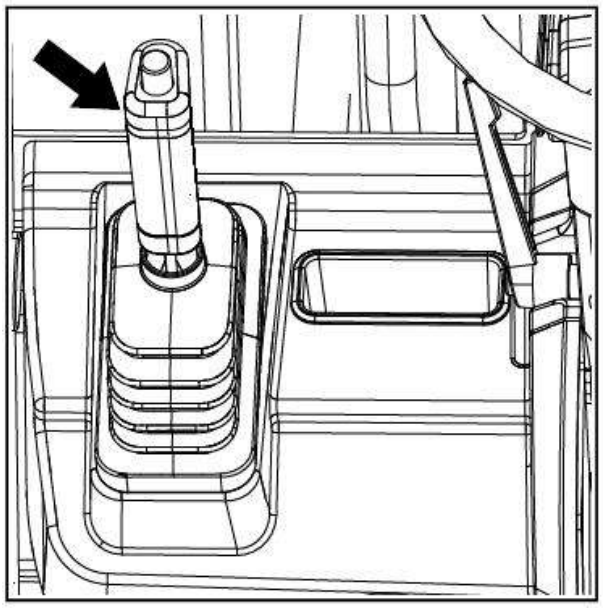


Figure 2-8 Parking brake

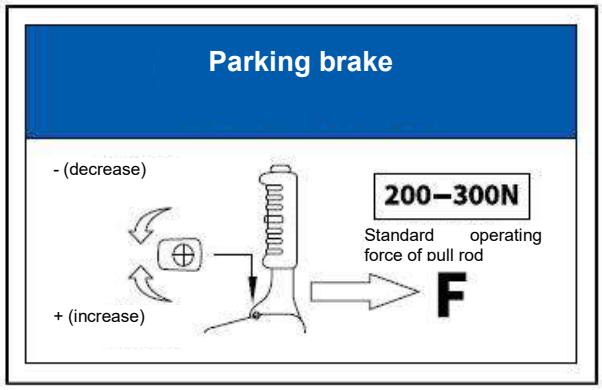


Figure 2-9 Parking Brake Sign

Warning

Risk of personal injury and property loss!
The parking brake will not apply automatically.
Always apply the parking brake when leaving the vehicle.

2.2.9 Warning: Disconnect lithium battery before maintenance

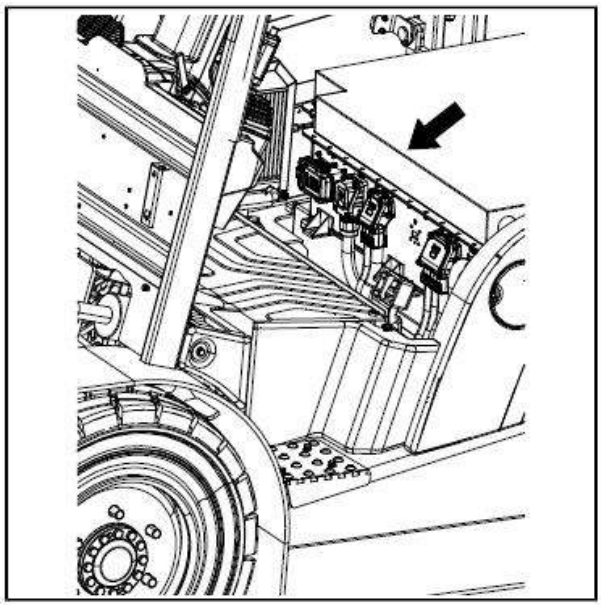


Figure 2-10 Battery

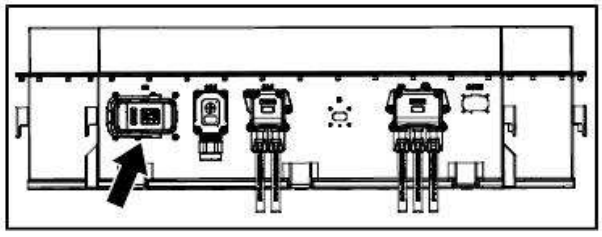


Figure 2-11 MSD Switch on the Battery

Warning

Risk of personal injury and property loss!

Before repairing the forklift truck, be sure to unplug the MSD switch on the battery to disconnect the high-voltage circuit perform maintenance and other work safely. Warning It's danger and has a risk of electrocution due to high voltage inside the battery. Unauthorized personnel are not allowed to disassembly the battery cover.

2.2.10 Seat switch warning

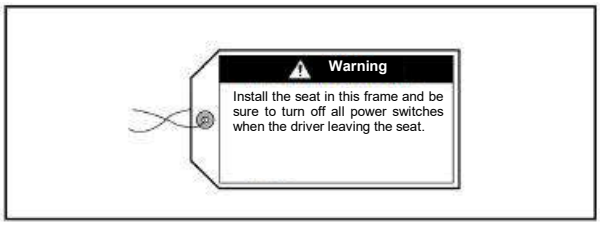


Figure 2-12

Note

The seat is mounted in this frame.

Be sure to turn off all power switches when the driver leaving the seat!

2.2.11 Other important signs

1. Vehicle nameplate

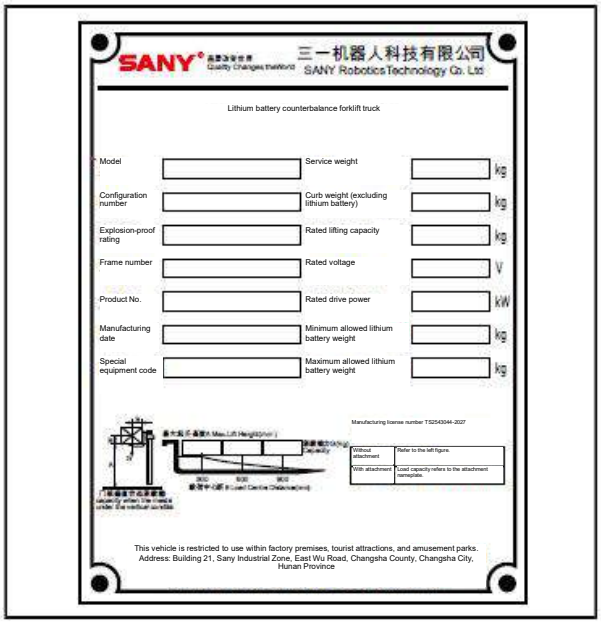


Figure 2-13

2. Lubrication system decal

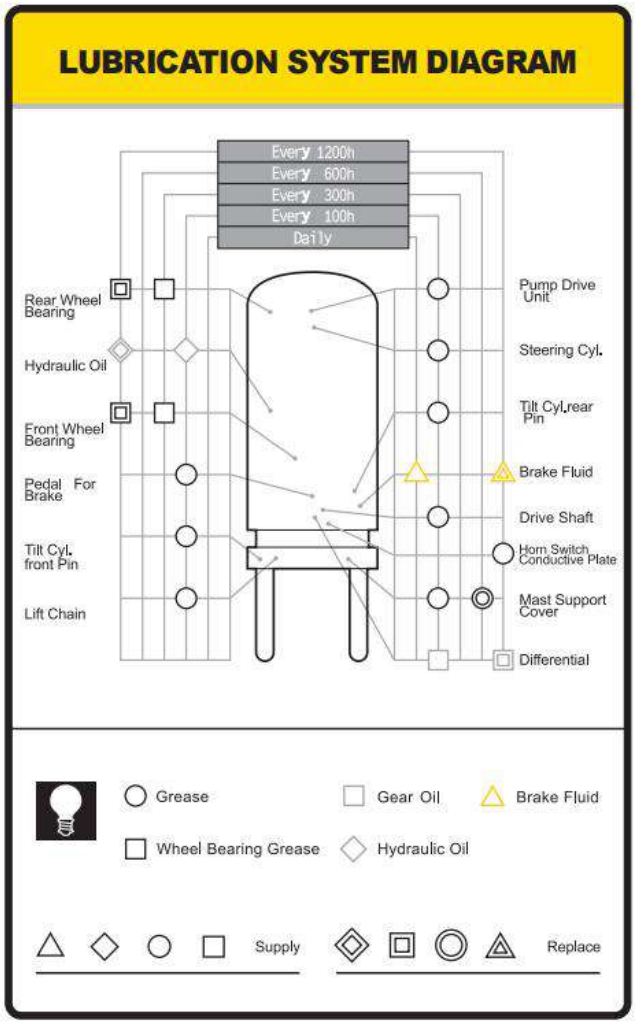


Figure 2-14

3. SCP16S Load Curve

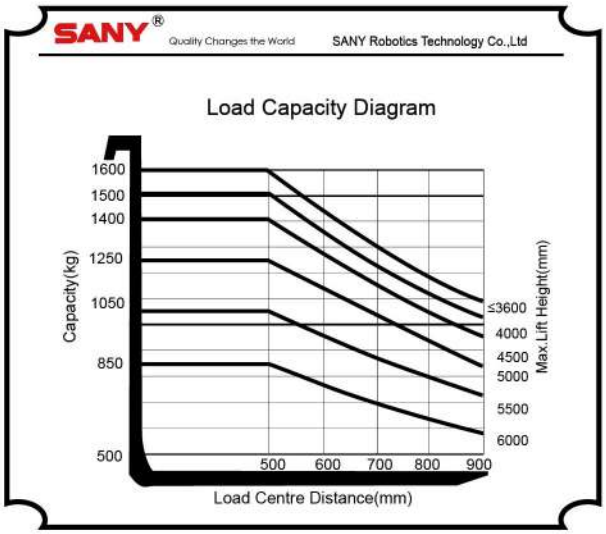


Figure 2-15

4. SCP20S Load Curve

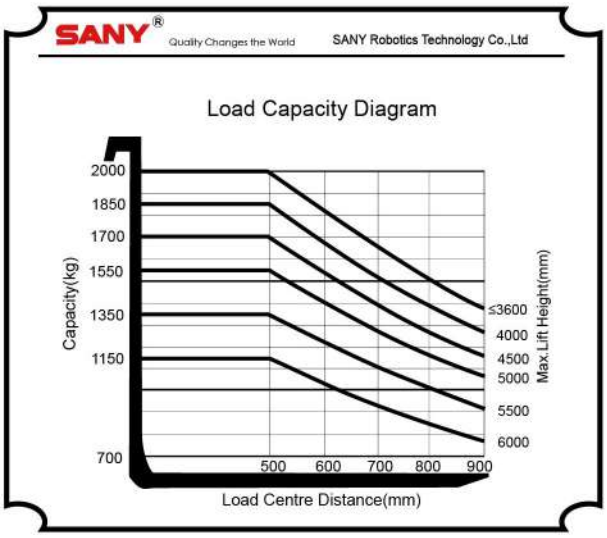


Figure 2-16

5. Pre-start inspection guidelines decal

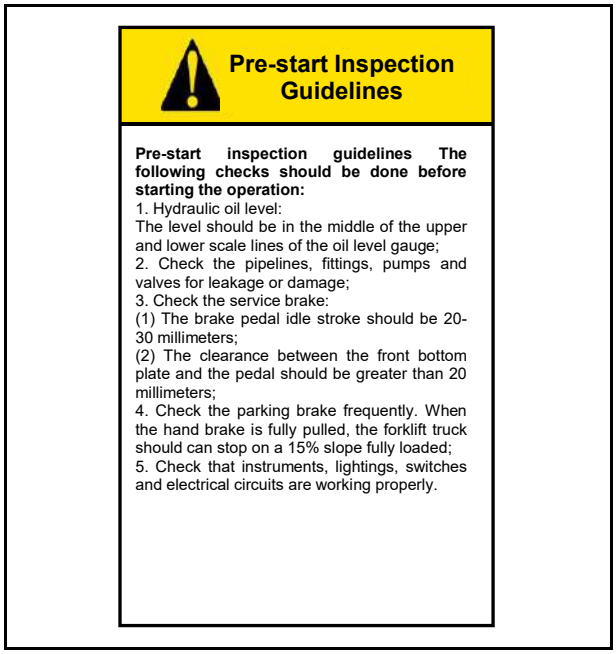


Figure 2-17

6. “Hydraulic oil filling” sign

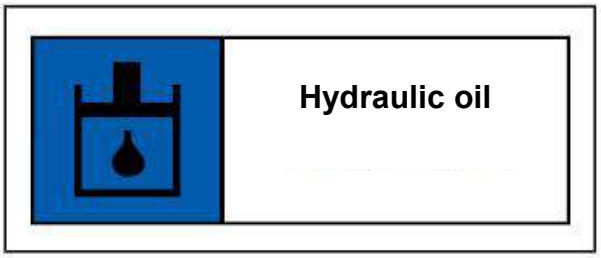


Figure 2-18

7. Lifting sign

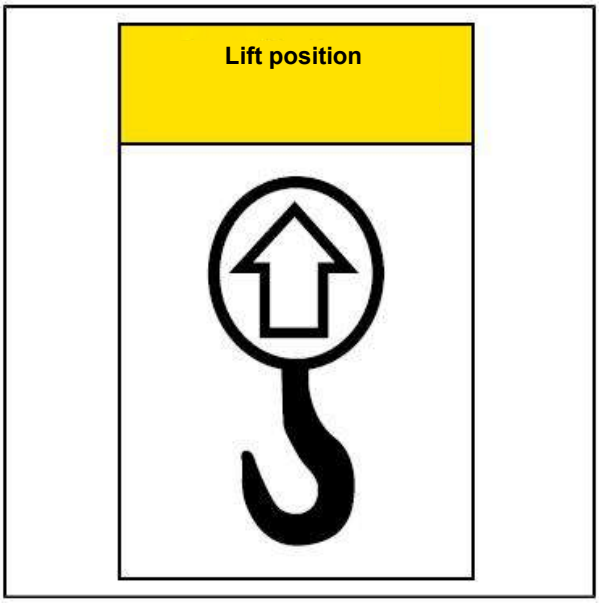


Figure 2-19

8. “No entry to the space behind the mast” sign

Figure 2-20

9. “Watch hand injury” sign

Figure 2-21

10. “Emergency power-off switch” sign

Figure 2-22

11. “High voltage hazard” sign

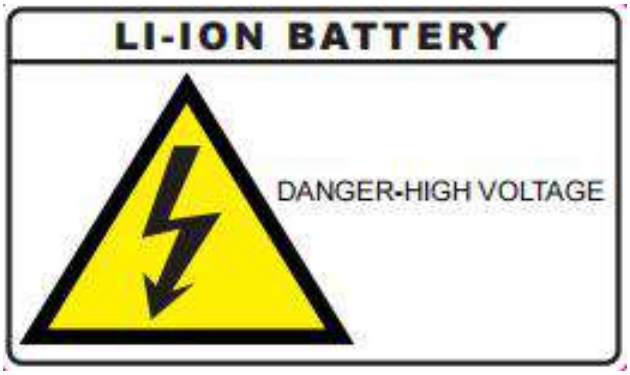


Figure 2-23

12. “High voltage and no trampling” sign

Figure 2-24

13. Lever sign

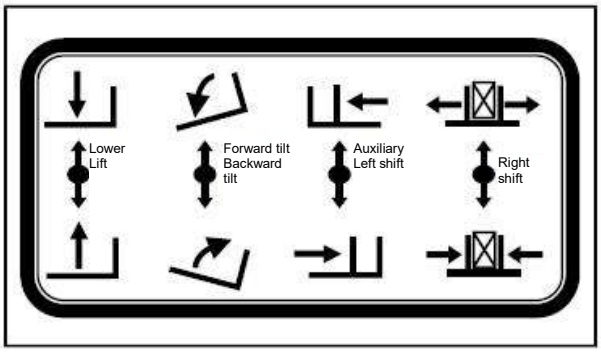


Figure 2-25

14. “Charge for new vehicle” sign

Figure 2-26

15. “Seat belt fastening” sign

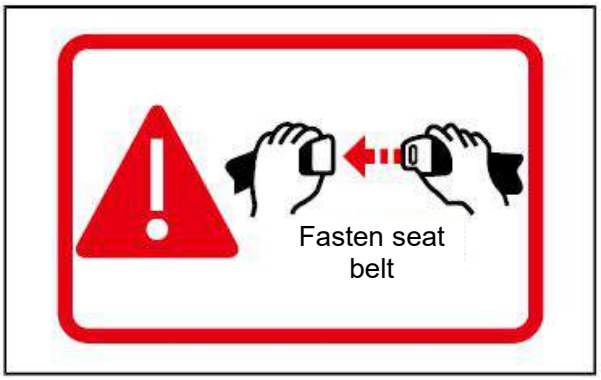


Figure 2-27

2.3 General hazard information

For driver safety

- The driver's hands, feet and head should be within the range of seat, and do not hold the overhead guard when operating the forklift truck. Do not climb on any part of the mast or overhead guard and do not allow others to do so.
- Unauthorized persons shall not be allowed to ride on the forks or any part of the forklift truck at any time.
- Driver should know the width of the forklift truck attachment and maintain proper clearance when the forklift truck is operating near fences or around obstacles.
- Always use overhead guards, which protect the driver from overhead obstacles and falling objects.
- When handling small items, or the load is uneven, a load backrest must be used to secure the cargo.
- If overhead guards cannot be used due to limited overhead clearance, be alert when operating. Ensure that there is no possibility of objects falling from any work area or nearby rack. Make certain the cargo is stable and fully supported by the carriage or load backrest (if equipped).
- Do not lift the load above the required height. After removing the overhead guard, never lift the load above 1830mm (72 in).
- When the forks or attachments cannot fully bear the load, a load backrest should be used. The load backrest is used to prevent any part of the load from falling backwards onto the driver's position.
- When operating a forklift truck, do not rely on the flashing lights or the reverse alarm (if available) to warn passers-by.
- Always watch pedestrians and only operate the forklift truck after they have noticed the forklift truck and kept a certain distance from the forklift truck or load.
- Do not drive the forklift truck towards anyone standing in front of an object.
- Obey traffic regulations and warning decals.
- When the vehicle is operating inside a building or wharf, consider the bearing capacity of the ground and the overhead clearance.
- The driver should understand the gesture language on the construction site and know who is giving the gesture and only receive signals from one person.
- Wear a safety helmet, safety glasses or other protective equipment as required by working conditions.
- Do not wear loose clothing or jewelry to avoid catching on the controller or other parts.

Maintenance safety information

- When servicing or repairing a forklift truck, a "No Operation" or similar warning sign should be

attached to the start switch or joystick.

- Do not start or service the forklift truck if there is a "No Operation" or similar sign on the start switch or joystick.
- Inhalation of Freon gases through a lit cigarette or other smoking methods, or inhalation of fumes produced by combustion of Freon, can cause bodily injury or death. No smoking during air conditioner maintenance or in any place where Freon gas may be present.
- Report all items to be repaired.

Other safety information

- On the forklift truck, especially on the floor and the footrests, debris, oil, tools and other foreign objects are prohibited.
- Secure all loose items such as lunch boxes, tools and other foreign objects.
- Do not place curing liquid in glass containers.
- Use all cleaning solvents carefully.
- Do not use steam, solvents or high pressure gases to clean electronic components.

2.4 Lifting chain

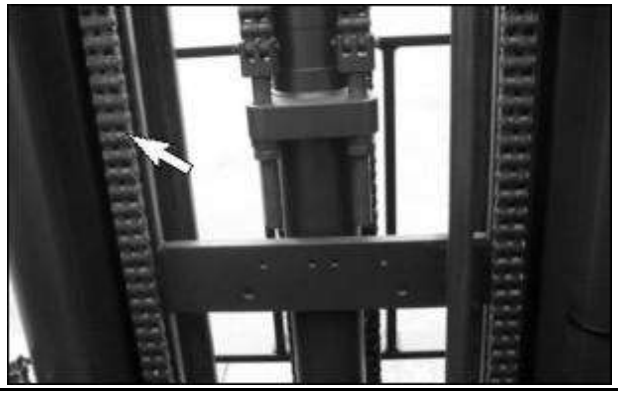


Figure 2-28

1. Check the portion of the chain that passes over the cross fitting sprocket during normal operation. As the chain bends around the sprockets, the movement of the units against each other creates wear.
2. Check and confirm that the chain pin does not extend out of the pin hole.
3. Pins extend beyond the chain may have broken off in the hole.
4. Check the wear of the chain and pins.

⚠ Warning

Risk of personal injury and property loss!

Incorrect repairs, adjustments and maintenance may result in hazardous factors during operation.

- Do not change the set adjustment parameters (including motor speed settings) unless you are authorized and have received special training. In particular, safety devices and switches must not be removed or incorrectly adjusted.

Note: Please contact SANY agent for inspection, repair, adjustment, maintenance and any other work related to the forklift truck. We shall remind you that SANY is not responsible for any secondary damage caused by improper operation, inadequate maintenance, incorrect repair or the use of components other than SANY spare elements.

2.5 Operational information

2.5.1 Getting on and off

• Be careful when getting on and off the forklift truck.

• Clean your shoes and hands before getting on the forklift truck.

• Use both hands firmly and face forward when getting on and off the forklift truck.

• Hold the handrails when getting on and off the forklift truck.

• Do not get on and off the forklift truck while holding tools or other items.

• Do not use any handles when sitting or leaving the seat.

• Never get on or off a forklift truck while it is moving. Jumping from a forklift truck is prohibited.

• Avoid slippery substances on your hands and steering wheel.

2.5.2 Start the forklift truck

Do not start the forklift truck or move any of the operating lever when a "No Operation" or similar sign is attached to the start switch or joystick.

2.5.3 Before operating forklift truck

• “Walk around” the forklift truck before starting it. Refer to the “Walk-Around Inspection” in the “every 10 hours of operation or daily maintenance” section of this manual.

• Adjust the seat so that the driver can lean against the backrest when pressing the pedals.

• The forklift truck is equipped with a lighting system as required.

• All hydraulic control levers are in the “HOLD” position.

• The reversing control lever is in “NEUTRAL”.

• The parking brake is engaged.

• Before starting or driving the forklift truck, make sure that no one is standing and/or working on, near or under the forklift truck.

• The forklift truck can only be operated and controlled when sitting the seat.

• Confirm that the horn, lights, reverse warning lights (if any) and other facilities of the forklift are working properly.

• The mast and attachments are in proper operating condition. Pay special attention to unusual noises and unusual movements that indicate a fault.

• The service and parking brakes, steering and reversing controllers are functioning properly.

• All personnel are clear of the forklift truck and the driving route.

• Refer to the “forklift truck Operation” instructions in the “Operation Section” of this manual for detailed startup instructions.

2.5.4 Before operating forklift truck

• The brakes, steering controllers, horns and other facilities are working properly. Report all faulty items and do not operate the forklift truck until repairs are complete.

• Understand how forklift truck works, safety equipment, and the purpose of attachments. Before operating forklift truck, a walk-around inspection should be performed. Keep steady during starting, steering and braking.

• The driver shall always check that the forklift truck is working properly.

2.5.5 Operating forklift truck

• Always keep the forklift truck under control.

- Obey traffic regulations and warning signs.
- Never leave the forklift truck with the motor running or the parking brake not engaged.
- Regardless of whether there is a load or not, the mast needs to be lowered before turning or driving, otherwise it will cause rollover. Watch obstacles above the overhead guard.
- Consider the bearing capacity of the ground and the overhead clearance.
- Starting, steering and braking should be smooth, and slow down when turning, driving on slopes and slippery or uneven roads.
- Be alert when driving on slopes. Do not turn on a ramp or drive at an angle. Do not operate forklift truck on slippery slopes. The forks should face down the slope when traveling without load, and face up the slope with load.
- Do not overload or carry offset, unstable or loosely stacked cargoes. Refer to the load curve sign on the forklift truck. Be careful when handling overhanging, extra-long, extra-wide, or extra-high cargoes.
- Only in the unloading area can the load be tilted forward when it is lifted and lowered as far as possible.
- No stunt driving or playing.
- Always observe and maintain a clear view of driving route.
- If cargoes or accessories obstruct view, you can drive in reverse and be alert.
- Forklift trucks should be parked on designated routes, away from wharf edges, ditches, steep slopes, and roads that cannot safely bear the forklift truck.
- Slow down and be alert when passing through doorways, intersections, and other areas with poor visibility.
- When passing through passages, corners, slopes, potholes, uneven or slippery roads, or areas with heavy traffic, slow down and give way to pedestrians, other vehicles, obstacles, potholes, or other dangerous objects on your route.
- Overhead guards should always be used unless operating conditions prohibited. Do not operate the forklift truck without overhead guards and with high stacking.
- When stacking, watch falling objects and use load backrest and overhead guard.
- Refer to the "Operation Technical Requirements" in the "Operation Section" of this manual.

2.5.6 Loading and unloading on vehicles/trailers

- Do not operate a forklift truck on a vehicle or trailer that is not allowed to operate the forklift truck.
- Before driving the forklift truck or trailer, make sure the forklift truck or trailer is braked and the wheels are wedged (or the unit is secured to the loading platform).
- If the trailer is not coupled to the towing vehicle, make sure the trailer anchors are securely in place. Some trailers require additional support to prevent tipping or corners sinking.
- The platform plate is in good condition, properly positioned, and securely fastened. Do not exceed the rated load capacity of the platform plate or ramp.

2.5.7 Forklift truck parking

When leaving the seat, park the forklift truck in a designated location and do not block traffic.

- Park the forklift truck horizontally with the forks lowered, the mast tilted forward, and the fork tips touching the ground.
- Set the reversing control lever to "NEUTRAL".
- Engage the parking brake.
- Turn off the key switch and remove the key.

• Place the disconnection switch in “OFF” position (if any).

• Wedge the sprocket wheel when the forklift truck is parked on a slope.

2.6 Maintenance information

2.6.1 Overview

Normally, please perform maintenance on the vehicle as follows:

1. Park the forklift truck horizontally in the designated area.
2. Lower all forks, tilt mast forward, and lower the fork tips to the ground.
3. Set the reversing control lever to “NEUTRAL”.
4. Engage the parking brake.
5. Remove the ignition switch key and set the Disconnect switch to "OFF" position (if installed).
6. Wedge the sprocket wheels when the forklift truck is parked on a slope.

2.6.2 Compressed air

Compressed air can injure people. Wear a protective mask, protective clothing and protective shoes when using compressed air for cleaning. The maximum pressure of compressed air for cleaning must be less than 205 kPa (30 psi).

2.6.3 Fluid leakage

⚠ Danger

Danger of personal injury or death!

Leaking fluid under pressure, even though a small hole, can enter the body and cause serious injury or even death.

Use a board or cardboard to check for leaks. If the liquid enters your body, seek medical attention immediately.

2.6.4 Prevention of crushing or cutting

• Properly support equipment and attachments when working on or under it. Do not rely on hydraulic cylinders for support. If a control lever is moved or a hydraulic hose ruptures, any attachment may fall.

• Unless otherwise specified, no adjustments are allowed while the forklift truck is moving or the motor is running.

• In areas with interlocking equipment, the gap in the interlocking area increases or decreases as the equipment moves.

• Keep a distance from all rotating and moving equipment.

• Keep objects away from the fan's rotating blades, which can cause dropped or inserted objects or tools to be severed or thrown out.

• Do not use knotted or frayed cables, and wear gloves when taking cables.

• When the locating pin is struck hard, fragments and iron filings may fly out and injure nearby personnel. Before striking the locating pin, make sure there are no other people around.

• When you hit an object, fragments and iron filings may fly out. Before striking any part, make sure no one will be injured by flying fragments.

2.6.5 Fall protection structure

• Overhead guard is an attachment located above the cab to protect the forklift truck.

• To avoid impairing the function of fall protection structure, consult SANY agent before adding weight, welding, cutting or drilling on the overhead guard.

- Overhead guard cannot protect against all possible impacts, such as objects that penetrate the seat position from the side or end of the forklift truck.
- Forklift trucks are usually equipped with standard overhead guards. If an object falling overhead could penetrate the overhead guard, the guard would have small holes or a Plexiglas cover.
- Any changes not expressly authorized by SANY are beyond the scope of SANY Overhead Guard Certification's responsibility. If the structure is damaged, which is not completely within the scope of overhead guard certification. If a forklift truck is involved in an accident such as tipping or being hit by falling objects, its structure may be damaged.
- Do not weld brackets or drill holes in the overhead guard to mount items such as fire extinguishers, first aid kits, and lights. Consult SANY agent for installation instructions.

2.6.6 Prevention of burns

Hydraulic oil

Lithium batteries

⚠ Warning

Danger of burns!

At operating temperature, the hydraulic tank is hot and under pressure. Hot oil and units can cause personal injury. Do not allow hot oil or units to come into contact with skin.

- Remove the hydraulic tank filler cap only when the motor is stopped and the cap is cool enough to be removed by hand.
- Slowly unscrew the hydraulic tank filler cap to release pressure.
- Release air pressure, oil pressure, or cooling system pressure before disconnecting or removing any lines, units, or related units.

⚠ Warning

Risk of personal injury!

Lithium batteries can emit flammable gases that may explode. Explosive gases are particularly dangerous when lithium battery is approaching fully charged because the lithium battery is almost full capacity. The electrolyte is an acid and can cause personal injury if it comes in contact with skin or eyes.

- Only trained and designated personnel can inspect, charge and replace lithium batteries.
- Wear protective glasses when handling lithium batteries.
- Lithium battery maintenance, replacement and disposal may only be performed in authorized areas when proper safety and ventilation facilities are provided.
- Do not smoke or expose the lithium battery to sparks or flames when checking, charging or maintaining the lithium battery. Keep chains and metal attachments away from the top of the lithium battery.

Note: Refer to the "Lithium Battery Maintenance" in Chapter 4 "Battery System" of this manual.

2.6.7 Prevention of fire or explosion

- All fuels, most lubricants and coolants are flammable.
- Do not smoke when replacing lithium batteries or in areas where flammable materials are stored.
- Clean and tighten all electrical connectors. Check wires daily for looseness and wear. Before operating the forklift truck, repair or replace all loose, tightened, and worn wires.
- Store all fuels and lubricants in marked containers and keep unauthorized personnel away from them.
- Put any oily rags or other flammable items in protective device and place them in a safe place.

- Do not weld or use a cutting torch to cut pipes containing flammable liquids. Clean with flame retardant solvent before welding or gas cutting.
- Remove fuel, oil and other flammable debris before it accumulates on the forklift truck.
- Try not to place the forklift truck in a smoke or burning environment.
- Do not operate the forklift truck in locations where explosive gases are or may be present.

Fire Extinguisher

Equip with a fire extinguisher having a minimum capacity of 1.0 kg. Mount it on the overhead guard rear bracket hook. Know how to use it. Check and maintain it according to the instructions on its nameplate.

Pipes, hoses and rubber hoses

1. Do not bend or knock the high-pressure pipeline. Do not use bent or damaged high-pressure pipelines, hoses, and rubber hoses.

2. Repair loose or damaged oil lines, hoses and rubber hoses. The leakage may cause a fire. Please contact Sany agent to repair or replace.

3. Check the pipelines, hoses and rubber hoses carefully. Check for leaks with boards or cardboard rather than bare hands. Refer to "Liquid Leakage" in the Safety Section for details. Tighten all fittings to the specified torque. Replace them when the following situations are found.

- The fitting is damaged or leaked.
- The outer layer is worn and cut, exposing the metal layer.
- Local bulges in the outer layer.
- The rubber hose is visibly twisted or crushed.
- The protective layer is pressed into the outer layer of the hose.
- The joint has shifted.
- Any clips, guards or insulation are properly installed to prevent excessive heat from vibration and wear on other units during operation.

Tire information (applicable to pneumatic tires)

- The heat generated by the burning gas inside the tire causes tires explode. Heat from welding or gas cutting of steel rim units, external flames, and excessive use of brakes can all cause superheated gases to burn.
- A tire explosion is much more violent than air leakage. Explosion can propel tires, rims and drive units 500m (1500ft) or further from the forklift. The explosive force and flying fragments can cause personal injury and property loss.

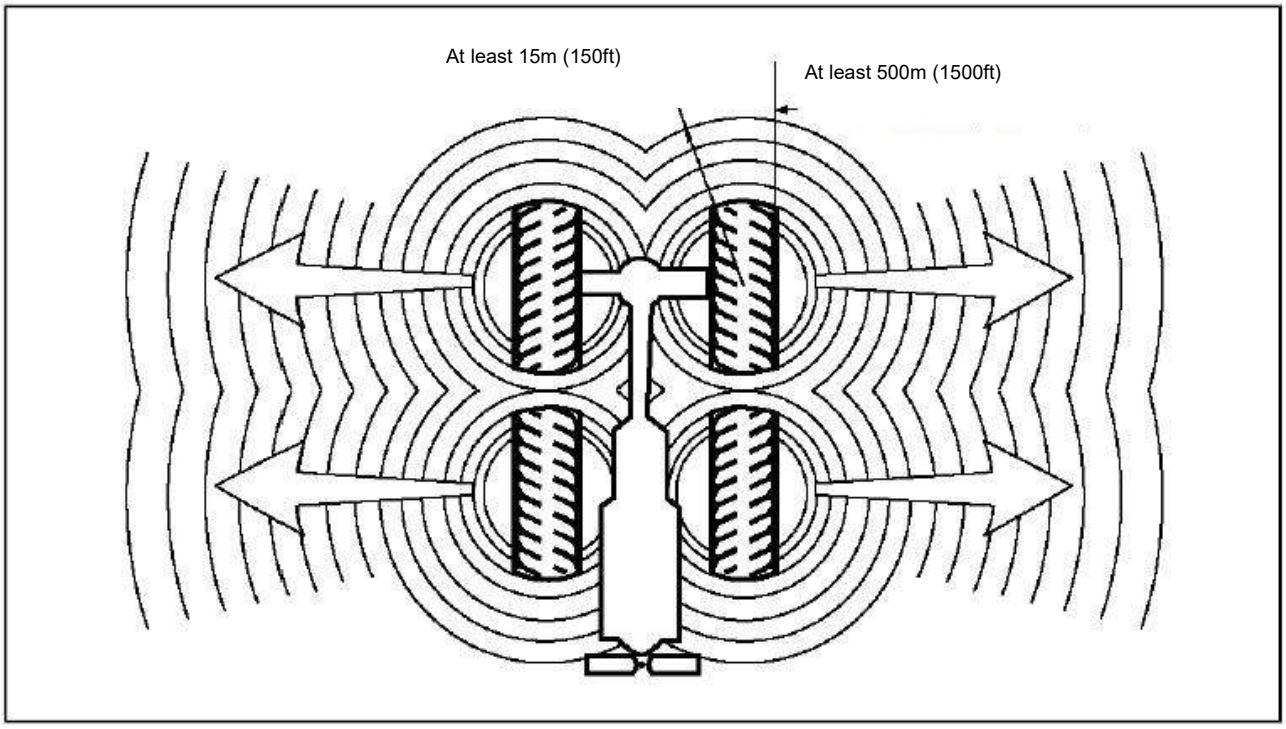


Figure 2-29

Do not enter the area around the tires as shown above.

- Dry nitrogen (N2) is recommended for inflating tires. Even if the tire is filled with air originally, nitrogen is preferred to regulate the pressure. Nitrogen and air can be mixed appropriately.
- Since nitrogen is non-combustible, tires filled with nitrogen will reduce the risk of explosion. And nitrogen helps prevent oxidation and the resulting aging of the rubber and corrosion of rims.
- To avoid over-inflation, appropriate nitrogen inflation equipment and necessary training are required. Improper use or abuse of the equipment may cause tire deflation or rim failure.
- When inflating tires, stand behind tires and use the self-locking clamp.

⚠ Warning

Danger of personal injury or death!

If proper procedures are not followed when repairing tires and rims, the components may explode suddenly and cause serious injury or death.

- Repairing and replacing tires and rims can be dangerous and should only be performed by trained personnel using appropriate tools and procedures.
- Follow the detailed information provided by the tire or rim service provider or dealer.

2.7 Driver safety system

2.7.1 Seat adjustment

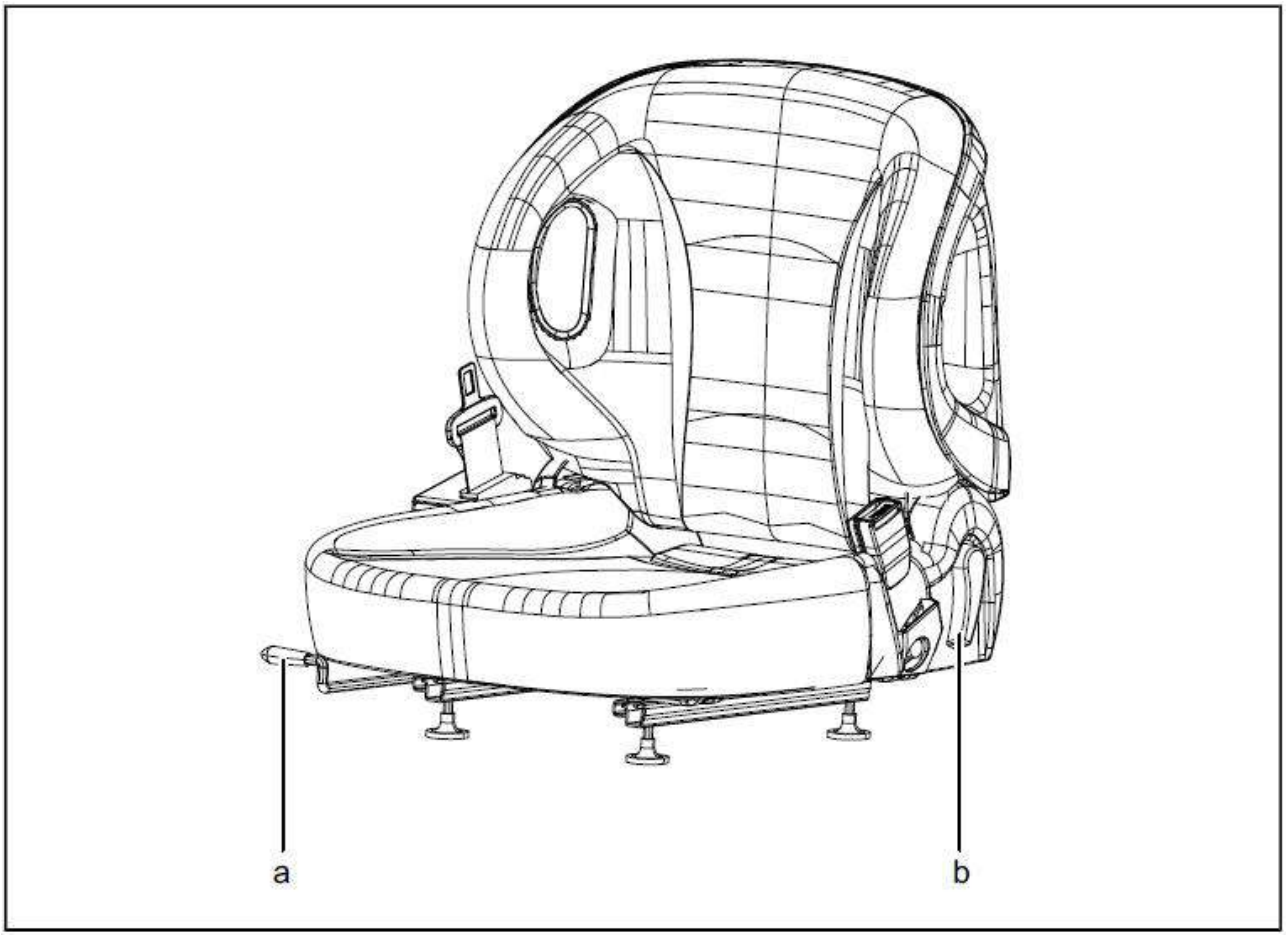


Figure 2-30 Standard Seat

a. Front and rear adjustment lever b. Seat back tilting lever

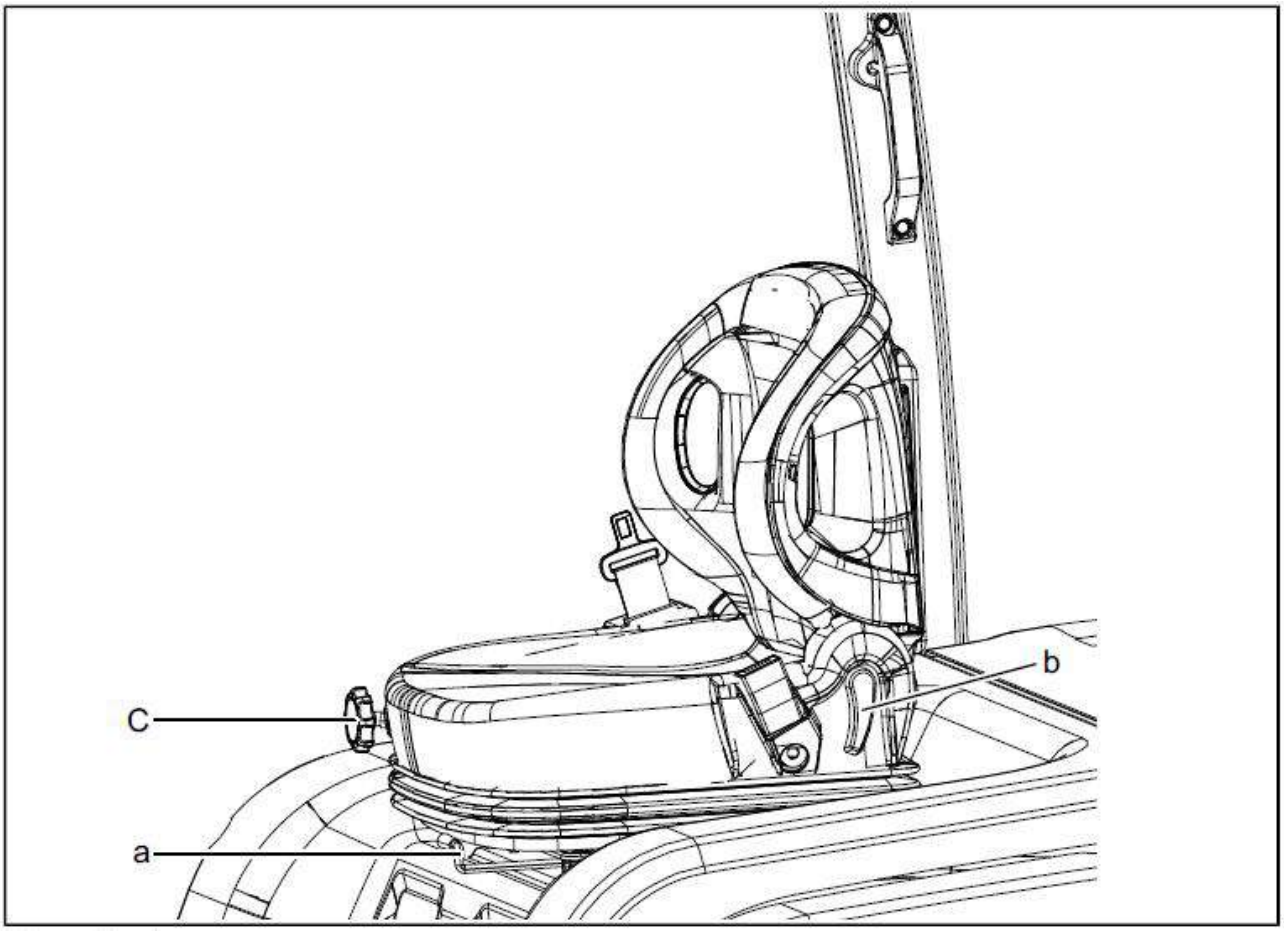


Figure 2-31 Suspension Seat (Optional)

a. Forward and backward adjustment lever b. Seat back tilting lever c. Weight adjustment lever

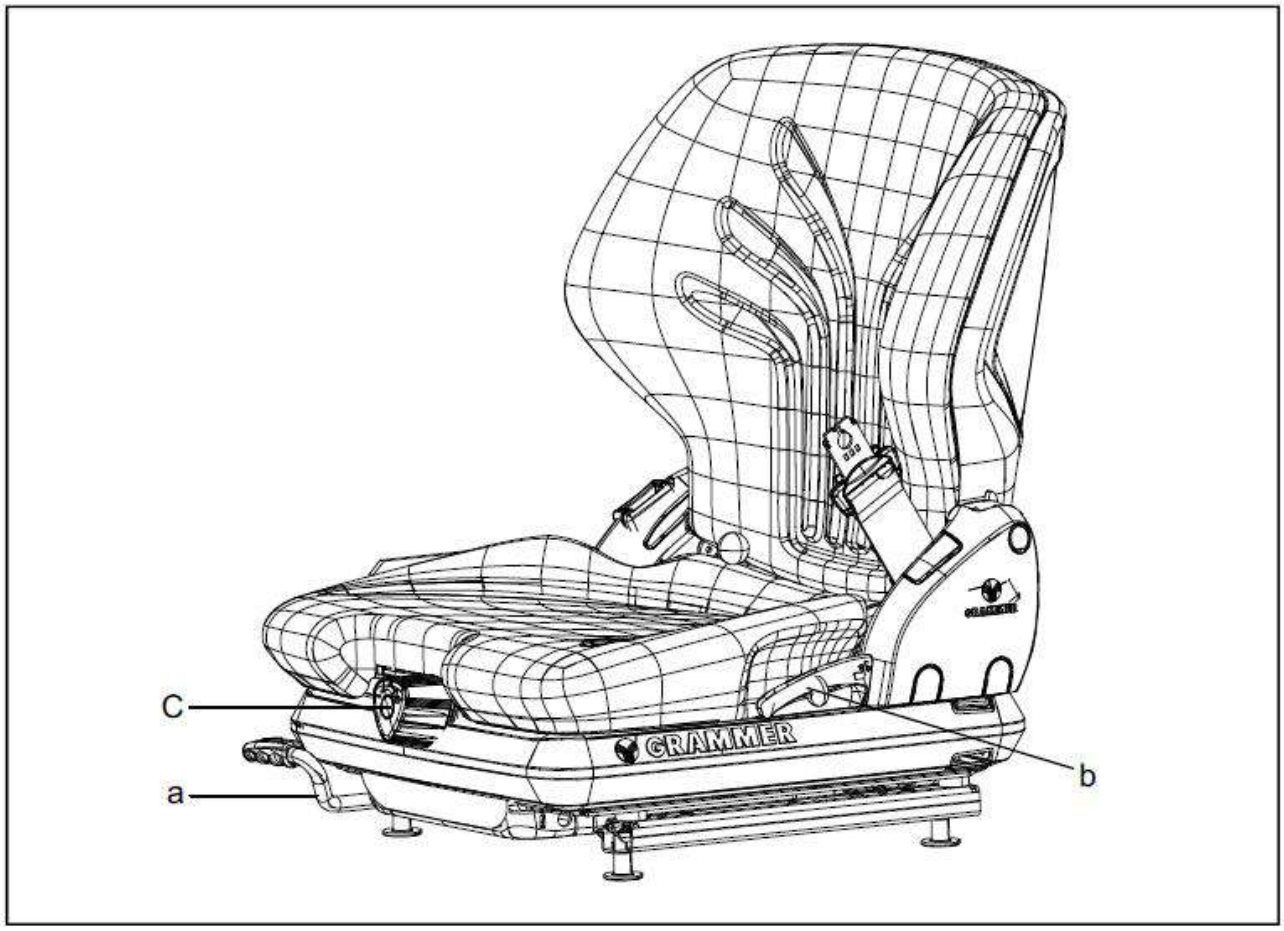


Fig. 2-32 Suspension Seat (Optional for Overseas Models)

a. Forward and backward adjustment lever b. Seat back tilting lever c. Weight adjustment lever

Fore and aft adjustment

The seat is adjusted using the left-hand control lever (a).

Adjust the seat before operating forklift truck. After making adjustments, shake the seat to check it is properly secured. Do not adjust the seat while the forklift truck is driving.

Backrest tilt

Use the left-hand control lever (b) to adjust the backrest angle of inclination.

Weight adjustment

Turn the weight adjustment lever (c) left and right.

Adjust seat height to suit driver weight.

Warning

Risk of personal injury!

Do not place your hands under the seat as the seat can cause serious injury to your hands when it moves up and down.

2.7.2 Steering wheel angle adjustment

After adjusting the driver's seat, the steering wheel angle can be adjusted according to driving preferences as follows:

1. The driver should sit on the seat, place the right hand on the steering wheel (b), and loosen the steering column locking lever (a) by turning it upward with the left hand. Then, pull the lever outward horizontally by 20 mm and hold it in place. See the right figure;

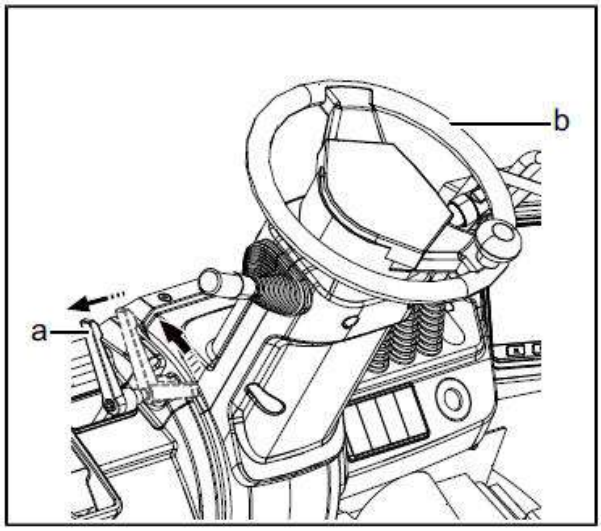


Figure 2-33

a. Steering column locking lever b. Steering wheel

2. The steering wheel angle is now unlocked and adjustable. The driver should adjust the steering wheel to a comfortable angle based on personal preference. See the right figure.

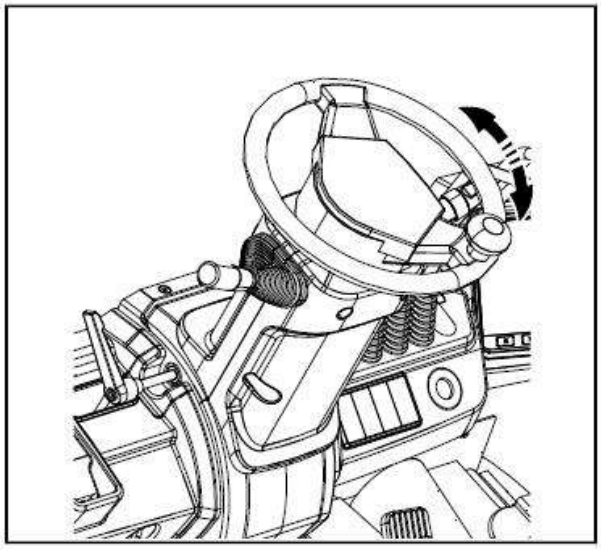


Figure 2-34

3. Release the locking lever - it will retract automatically. While holding the steering wheel in position, turn the locking lever downward to tighten and lock it. The steering wheel angle is now set. See the right figure.

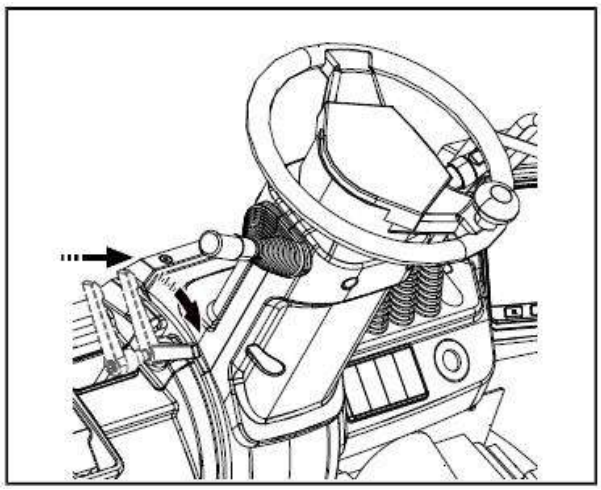


Figure 2-35

2.7.3 Seat belt

The driver safety system prevents the driver from being ejected from the cab when the forklift truck tilts forward or tipping from one side. This system is designed to secure the driver to the seat in the event of a rollover.

Detection

1. If the seat belt cracks, or gets stuck while being extended, or the seat belt cannot be inserted into the buckle properly, replace the entire seat belt.

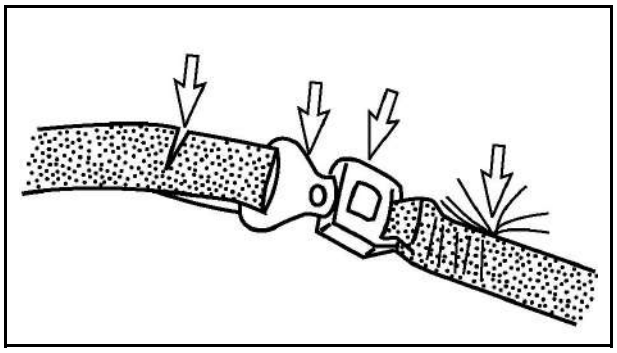


Figure 2-36

2. Check the seat belt switch and OPS mechanical valve switch. From 2024, seat belt switches and OPS mechanical valve switches (applicable to 5-ton forklift trucks with mechanical valves) will become standard for 5-ton electric forklift trucks, so checking their effectiveness is a must.

Methods: Turn on the forklift truck key switch after the driver is in place. If the forklift truck can start normally, it can be considered that the two switches work. If the vehicle cannot start properly, it is necessary to check the two switches first.

Figure 2-37 Seat Belt Switch Diagram

3. Seat belt maintenance - Maintenance every 500 hours of operation. Check that the seat belt are in good condition and that the reeled-in portion does not twist when pulled violently. Check that the seat belt is properly fastened on the seat. Check that the seat is securely positioned between the hood and chassis. Check that the fasteners are intact visually, otherwise contact the safety manager.

4. If the vehicle rolls over, check the seat and safety system for damage. Replace it if necessary.

Note: Driver safety system inspections should be included in regular maintenance items. If the following conditions are found, it is recommended to replace the safety system.

- Cracked or worn seat belt
- Worn or damaged units including fixed pins
- Buckle or end bracket failure
- Loose junction
- Seat belt switch and OPS mechanical valve switch failure

Warning

Seat belt may cause the driver to hunch over.

If you are pregnant or suffer from abdominal diseases, consult your doctor before operating forklift truck.

Fasten seat belt

1. Hold the buckle (a) and pull the belt out of the end bracket. Then insert the tongue (b) into the buckle until you hear a snap. Pull on the belt to make sure it is fastened.

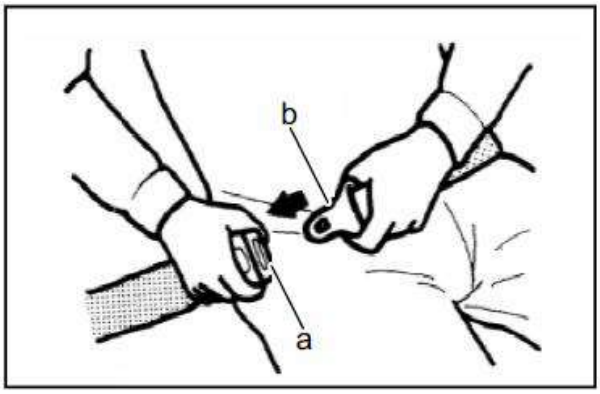


Figure 2-38

a. Buckle b. Clip

2. Make sure the seat belt is not twisted.

3. Make sure the seat belt is fastened on the hips, not the abdomen.

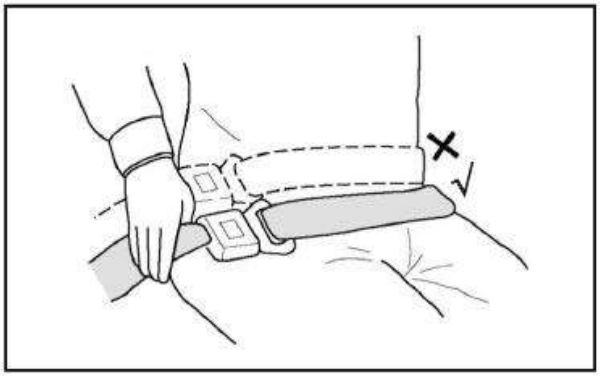


Figure 2-39

Warning

Risk of personal injury!

If you wear your seat belt across your abdomen, your abdomen may be injured in case of an accident.

Always wear the seat belt across the hips.

Note: The belt length automatically adjusts to your size and movement. In the event of an accident, when the seat belt is suddenly tightened, the retractor will pull the belt back.

Release the seat belt

1. Press the button on the buckle to loosen the belt.

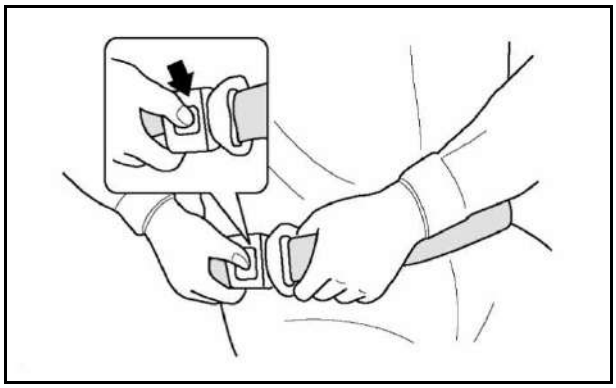


Figure 2-40

2. Grab the tongue and let the belt retract automatically.

2.8 Avoid forklift truck rollover

2.8.1 Forklift truck stability

The balance design principle of the forklift truck is to maintain the balance of weight in opposite directions on both sides of the fulcrum (front axle). The weight of load on the forks must be balanced with the weight of forklift truck.

The central location of the forklift truck and the load is an important factor, which is the basic principle of lifting cargoes. The ability of a forklift truck to lift cargo depends on the center of gravity and the front as well as the lateral and longitudinal balance of the forklift truck.

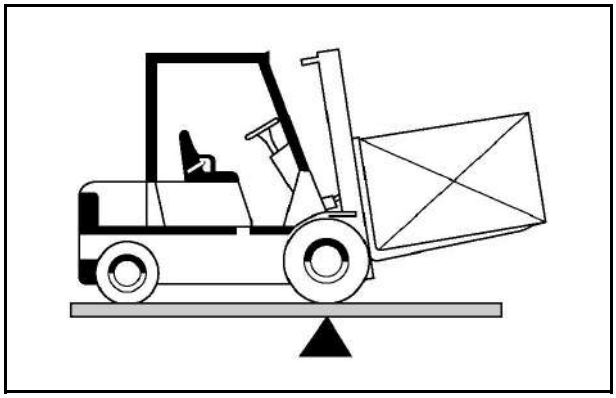


Figure 2-41

2.8.2 Center of gravity

The point within an object that can be considered as the point where the complete weight of the object is concentrated is called the center of gravity or CG.

If the object is regular, then its geometric center coincides with its center of gravity.

If it is irregular, the center of gravity may be outside the object.

When a forklift truck lifts cargo, the forklift truck and the cargo forms a new center of gravity.

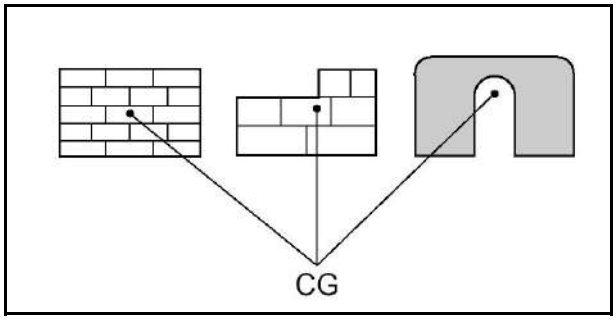


Figure 2-42

2.8.3 Stability and center of gravity

The stability of a forklift truck is determined by the position of its center of gravity. If the forklift truck is lifting cargo, it is determined by the new center of gravity of the forklift truck and the cargo.

A forklift truck has moving parts, so its center of gravity is also moving.

When the mast tilts forward or backward, the center of gravity of the forklift truck also shifts forward or backward. When the mast moves up or down, the center of gravity of the forklift truck also shifts up or down.

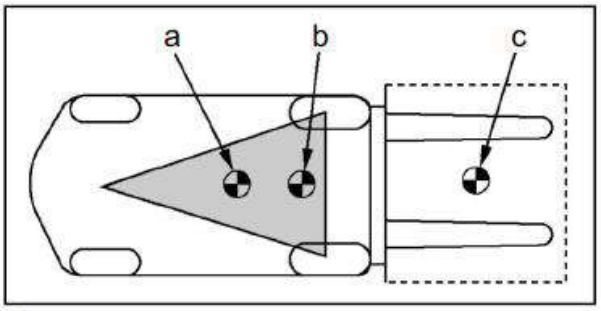


Figure 2-43

a. Center of gravity of forklift truck c. Center of gravity of goods

b. Composite center of gravity

Therefore, the center of gravity and stability of a forklift truck that is lifting a load are affected by many factors:

- Size, weight, shape and location of the load
- The height to which the cargo is lifted
- Forward or backward tilt angle
- Tire pressure
- The power generated when the forklift truck accelerates, brakes or turns
- Road conditions and slopes when operating the forklift truck

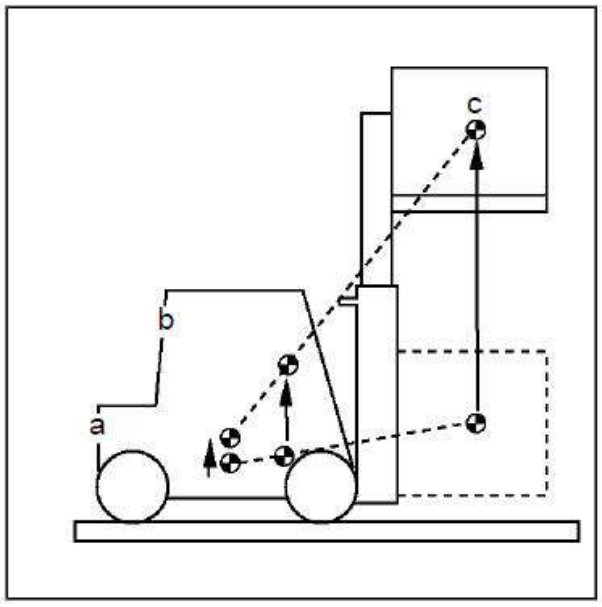


Figure 2-44

a. Center of gravity of forklift truck c. Center of gravity of goods

b. Composite center of gravity

These factors are equally important for forklift trucks that are not loaded. They are more likely to tip over on both sides than forklift trucks loaded with low-positioned cargo.

2.8.4 Basic stability area of forklift truck

To remain stable (not tipping over forward or to both sides), the center of gravity must be maintained in the stable basic area - the triangular area between the front wheels and the steering wheel pivot of the forklift truck. If the center of gravity moves in front part of the front axle, the forklift truck may tip forward. If the center of gravity moves to the outside of the stable area, the forklift truck may tip over to both sides.

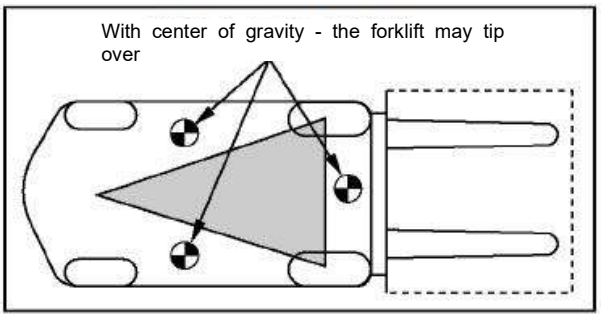


Figure 2-45

Warning

The power of forklift truck (braking, accelerating, turning) can also affect stability and may cause a turnover even when the center of gravity is within the stability triangle.

Rated load (weight and load center distance)

1. The rated load capacity of forklift truck is indicated on the rated load capacity/nameplate of the forklift truck. It is related to weight and loading center distance. The load center of gravity of cargoes is determined by the location of the cargo's center of gravity.

2. The load center shown on the sign is the horizontal distance between the vertical section of the fork or the load-bearing surface of the attachment and the center of the cargo.

3. The vertical position of the center of gravity is the same as the horizontal scale.

4. Keep in mind that, unless otherwise specified, the rated load capacity shown on the nameplate is for a standard forklift truck equipped with a standard backrest, forks and mast, and no special attachments.

5. In addition, the premise of meeting the rated load capacity is that the distance between the load center and the top of forks cannot be greater than the distance between it and the backrest. If these conditions fail, the driver must reduce the safe operating load as the forklift truck's stability may be reduced. If the forklift truck's rated load capacity/nameplate does not indicate the rated load capacity, then it must not be operated.

Note: If the cargo is irregular in shape, the heaviest end should be close to the backrest and on the center of the forks.

Note

It is forbidden to replace the factory nameplate!

The rated load capacity instructions/nameplate attached when they leave the factory shall not be removed, changed or replaced without the permission of Sany.

Sany is not responsible for forklift trucks put into use without the Sany nameplate.

2.9 Safety regulations

1. Forklift trucks may only be operated by formally trained and authorized personnel. Wear a safety helmet and protective shoes when operating forklift truck. Do not wear loose clothing.

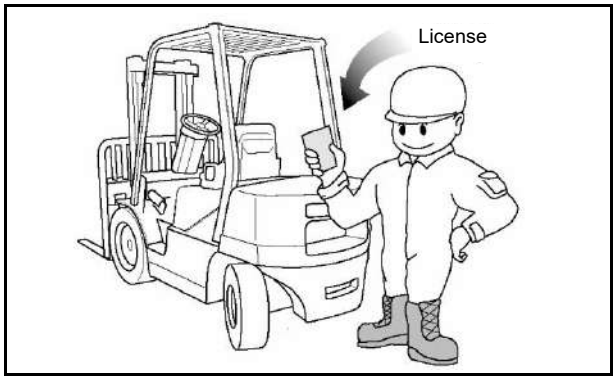


Figure 2-46

2. Before operating forklift truck, check and test the forklift truck according to the operator inspection checklist. in case of any obvious fault or need for repair, report it to the supervisor immediately.

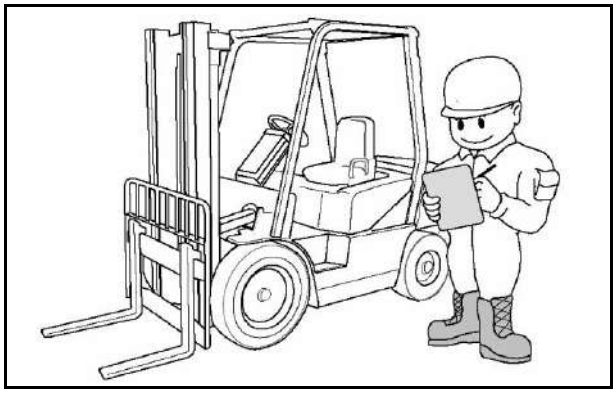


Figure 2-47

3. Forklift trucks can only be operated in designated areas. Know the forklift truck well and keep in mind of safety consciousness. Don't ignore safety issues. Obey all safety regulations and know all warning symbols.

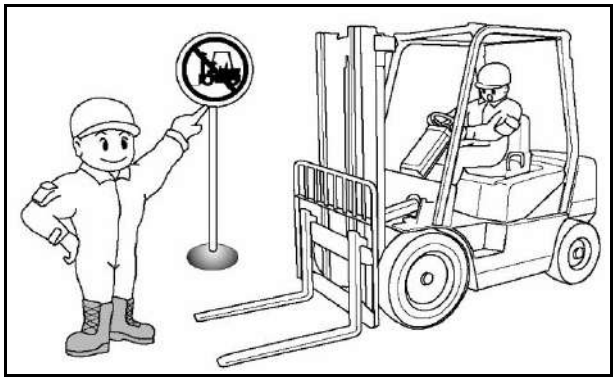


Figure 2-48

4. The forklift truck can only be operated while sitting in the seat. Keep all limbs in the cab. Do not extend any part of your body out of the cab or place any part of your body in the mast structure or between the mast and the forklift truck.

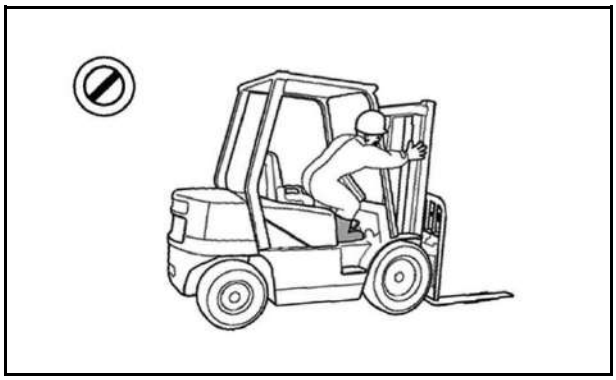


Figure 2-49

5. Do not start, stop, turn or change direction suddenly, and do not drive the forklift truck at high speed. Sudden movement can cause the forklift truck to tip over. Reduce the speed of forklift truck and honk the horn when approaching corners, exits, entrances, and around people. If the forklift truck is equipped with a steering knob, do not operate the knob violently to avoid accidents.

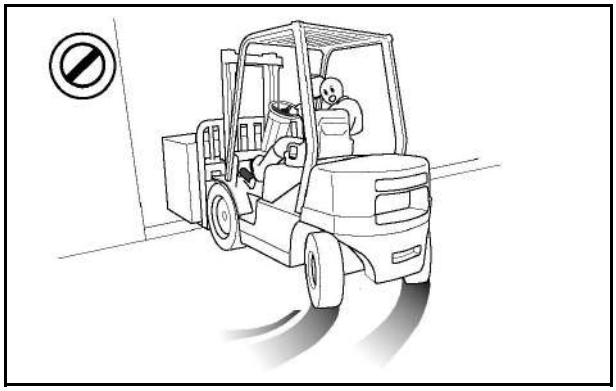


Figure 2-50

6. Never operate the forklift with wet hands or shoes. Never operate the levers with greasy hands. This helps prevent your hands or feet from slipping off the controls and avoids potential accidents.

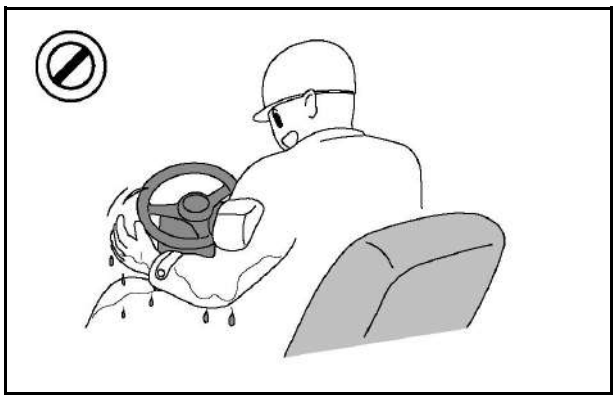


Figure 2-51

7. Do not lift people with forks unless using an approved safety lift. Do not allow other people to stand on the forklift truck. Forklift trucks are used to transport loads, not people.

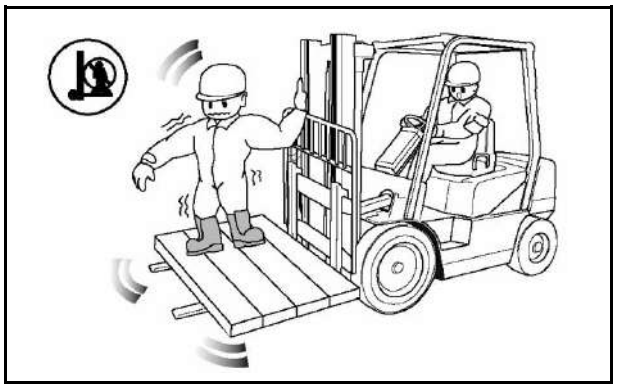


Figure 2-52

8. Do not operate the forklift truck without a load backrest and overhead guard installed. Tilt the mast backward so that the load rests on the backrest.

Figure 2-53

9. Do not lift or move unsecured loads. Do not take irregularly placed loads as this may cause the forklift truck to tip over sideways. The load is stacked flatly and rests on both forks. Be sure to use an appropriately sized pallet. The forks should be as wide as possible. Lift the load smoothly and keep balanced. Do not take the load with one fork.

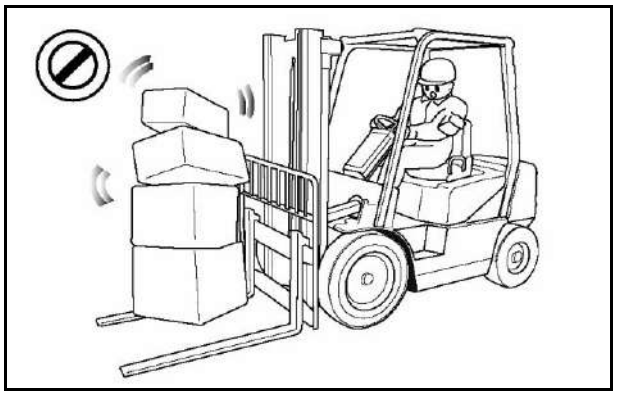


Figure 2-54

10. Don’t overload. Do not exceed the load curve of nameplate on the forklift truck. Do not add counterweights to the forklift truck. Overloading may cause the forklift truck to roll over, resulting in personal injury and damage to the forklift truck.

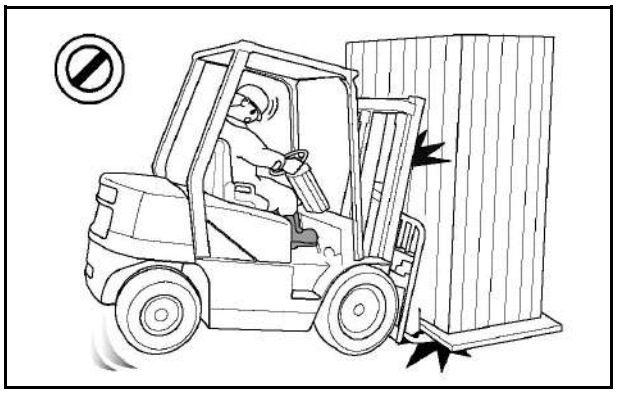


Figure 2-55

11. Do not drive a forklift truck on soft ground. Observe the regulations, especially those regarding maximum bearing capacity, lift capacity and clearance height. Handle the load carefully, check its stability and balance.

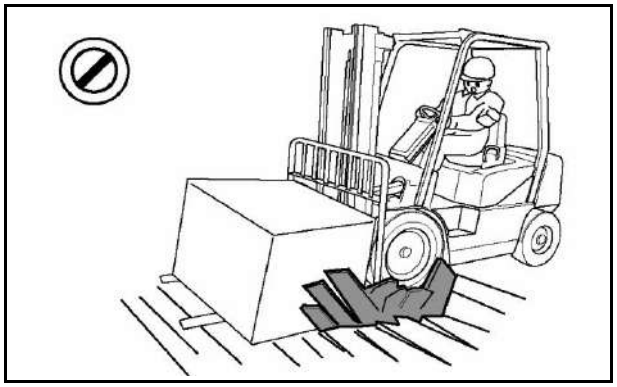


Figure 2-56

12. Do not drive on wet or slippery roads. Sand, gravel, ice or mud can cause tipping over. If necessary, drive at a reduced speed.

Figure 2-57

13. Do not allow anyone to stand or walk under the load or lifting device. The load may fall and injure anyone standing underneath it.

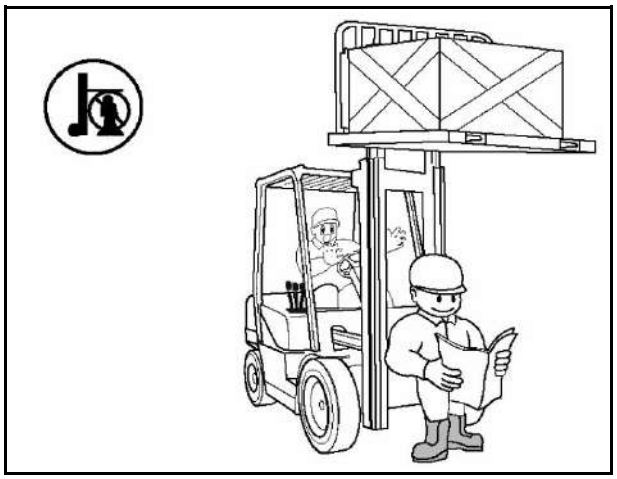


Figure 2-58

14. Watch overhead obstacles when lifting or stacking loads. Do not operate the forklift truck with the load raised. Do not operate the forklift truck with the mast raised. The forklift truck could roll over and injure the driver or other people.

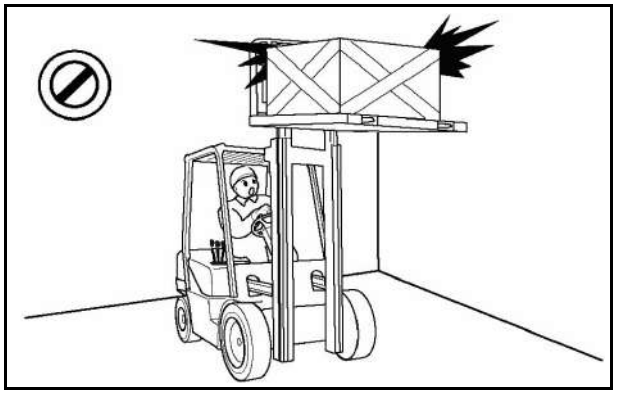


Figure 2-59

15. Do not move loose loads higher than the load backrest. Be careful when stacking loads and do not let the load fall. Tilt the load backward while driving and keep the forks as low as possible. This improves the forklift truck and load stability and provides better visibility.

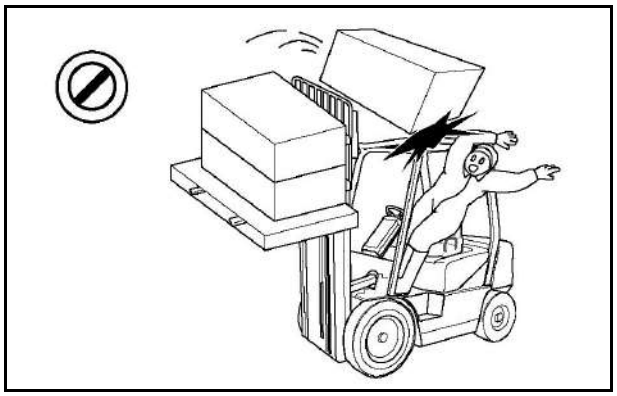


Figure 2-60

16. Do not lift loads when the mast tilts forward. Do not tilt a raised load forward, which may cause the forklift truck to tilt forward.

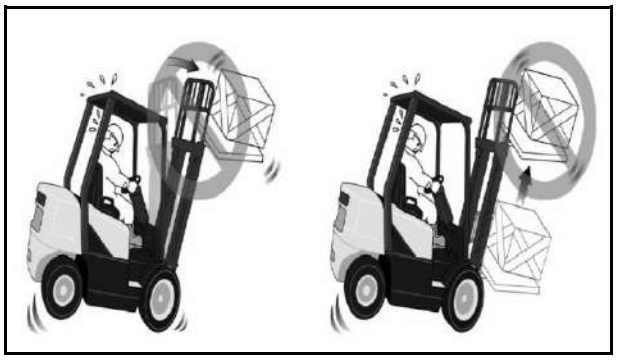


Figure 2-61

17. Do not jump off the forklift truck when it starts to tip over; sit on seat to escape.

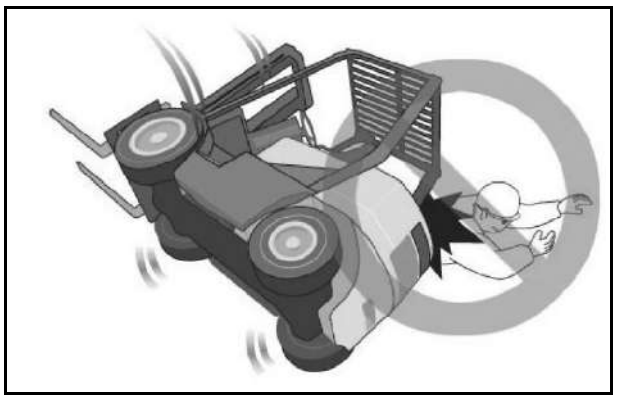


Figure 2-62

18. When driving on a slope, the load should face the top of the slope. Do not lift loads on the slope. Drive in a straight line. Use auxiliary tools when carrying heavy loads ascending or descending a slope.

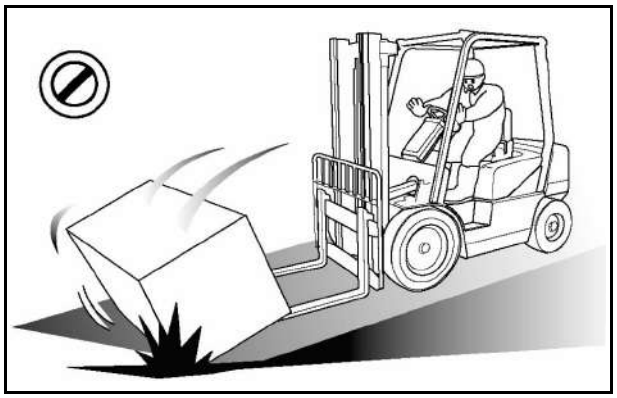


Figure 2-63

19. Do not stack loads or make turns on the slope. Do not lift or lower a load if the forklift truck is not stable. Do not turn or drive sideways on a slope.

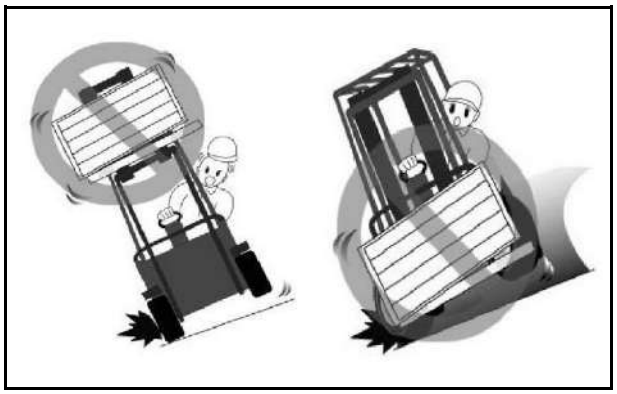


Figure 2-64

20. Do not drive on rough roads. If necessary, slow down. When passing rails, drive slowly and diagonally, because the loaded forklift truck may sway. Drive on rails with wheels one by one.

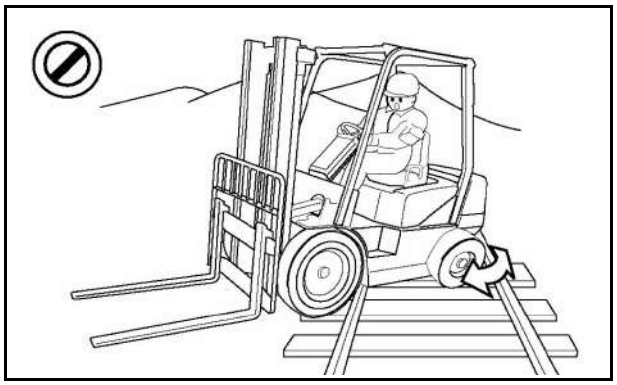


Figure 2-65

21. Do no drive over loose objects. Watch out for pedestrians and obstacles in the direction of travel. The driver must be able to have full control of the forklift truck at all times.

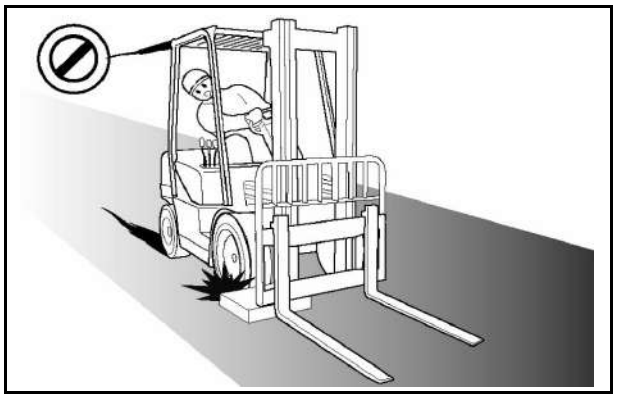


Figure 2-66

22. Do not drive forward when the load obstructs your view. If you are not driving on a slope, drive in reverse to have a clear view.

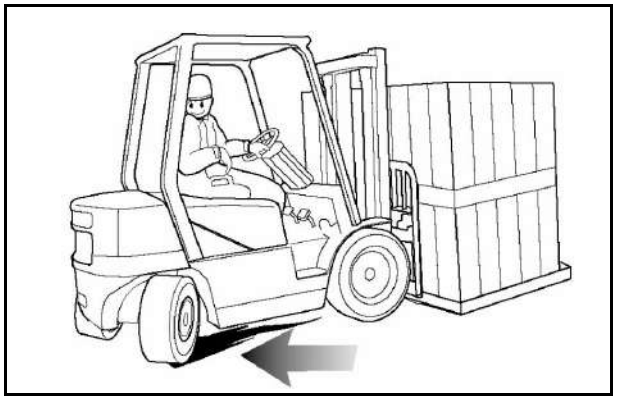


Figure 2-67

23. Be alert when operating forklift truck on the edge of a wharf or on a slope. Maintain a safe distance from wharf edges, slopes and platforms. Do not let the tail swing, or the forklift truck could fall off the edge causing injury or death.

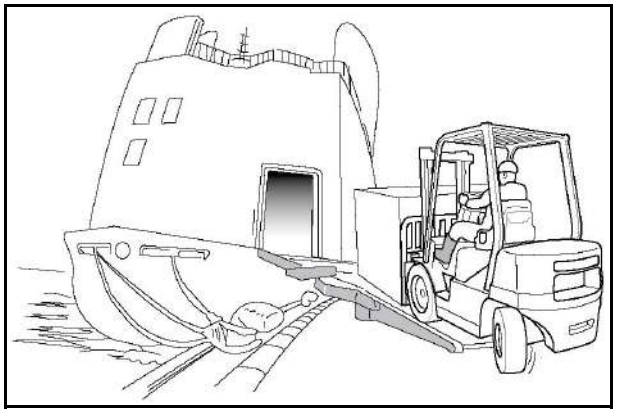


Figure 2-68

24. Do not operate a forklift truck on a ramp if the ramp cannot bear the forklift truck and its load. Make sure all parts are positioned correctly. Wedge the forklift truck to prevent it from moving.

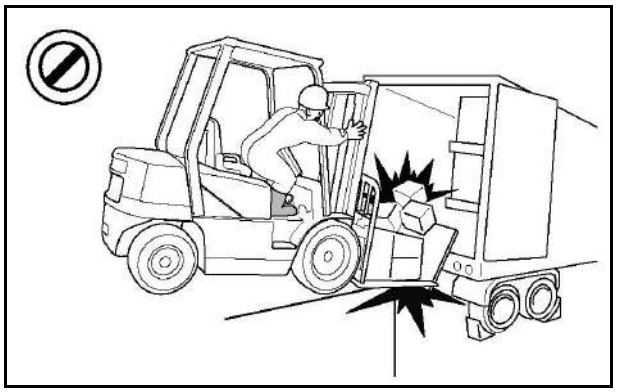


Figure 2-69

25. Do not operate two forklift trucks too close to each other. Keep a safe distance from other forklift trucks to park the forklift truck safely. Overtaking is prohibited.

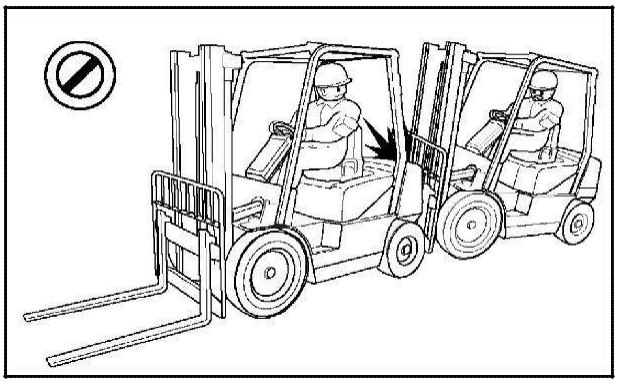


Figure 2-70

26. Do not use a forklift truck to push or tow other vehicles. Do not use other forklift trucks to push or tow your forklift truck. If the forklift truck does not move, consult the service technician.

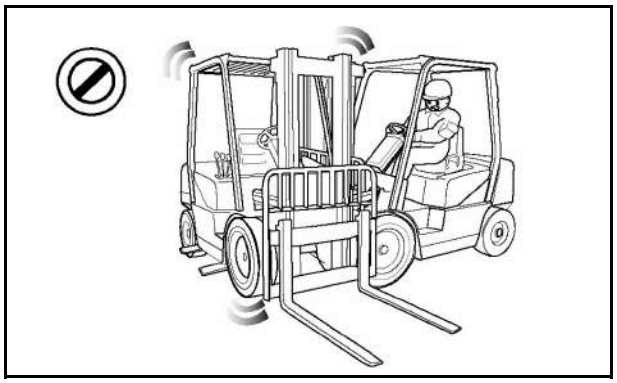


Figure 2-71

27. The electric forklift may only replenish hydraulic oil at designated service areas. During refueling operations, the forklift must be powered off completely. Ignition sources including smoking and open flame handling are strictly prohibited in hydraulic oil charging zones. Prior to restarting the equipment, ensure thorough cleanup of oil spills and verify the hydraulic oil tank filler cap is properly sealed.

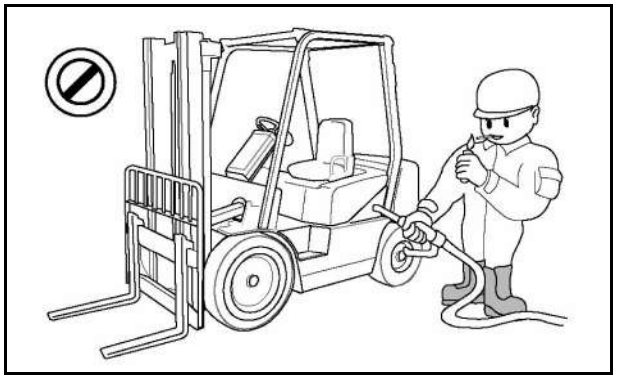


Figure 2-72

28. Forklift trucks can only be parked in designated areas. Fully lower the forks to the ground, put the reversing controller in neutral, engage the parking brake, turn off the key switch, remove the key, and place the wedges behind the wheels to prevent the forklift truck from moving. Turn off the forklift truck when leaving. Check the forklift truck at the end of operation.

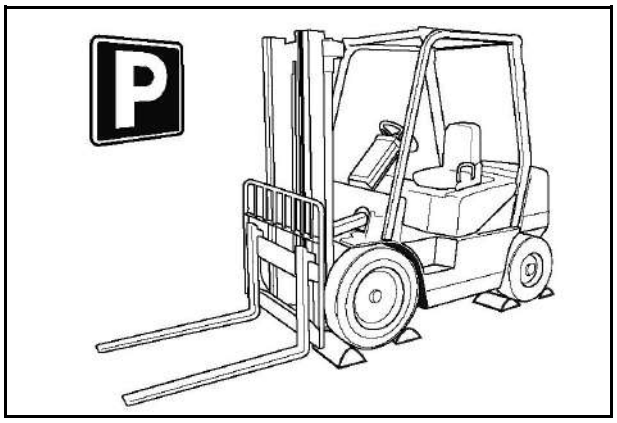


Figure 2-73

29. Do not operate the forklift truck around flammable materials. To prevent materials from discoloring, deforming, or burning (e.g. wood, plywood, paper products, and other similar items), park at least 30cm (12 inches) away from materials.

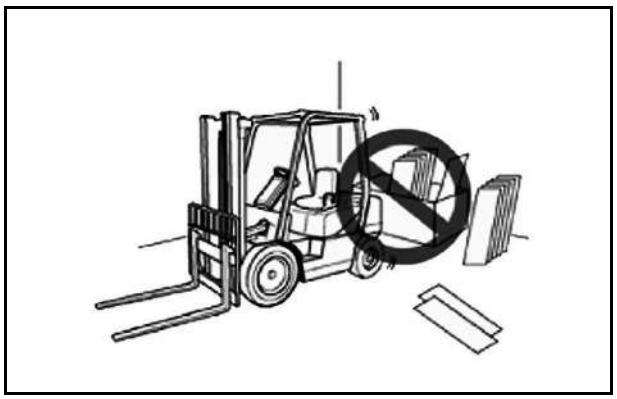


Figure 2-74

30. The forklift truck is not a car. It has small tires, no suspension, and are very heavy. The forklift truck's center of gravity may also change when transporting a load. Avoid uneven bumps, potholes, and other hazards whenever possible.

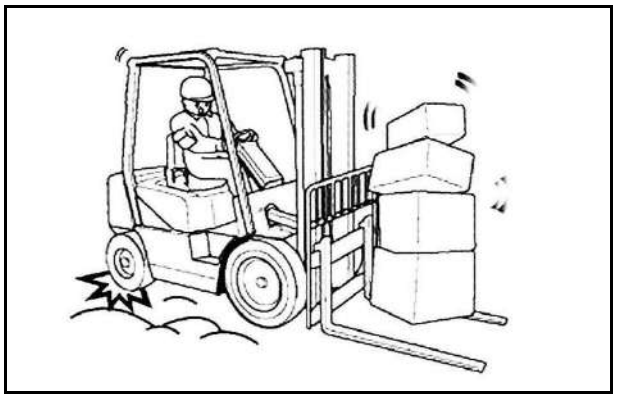


Figure 2-75

31. Transporting loads suspended on chains or cables may cause the forklift truck to unbalance. Be alert when transporting suspended loads near pedestrians, as the load may swing and even hit pedestrians.

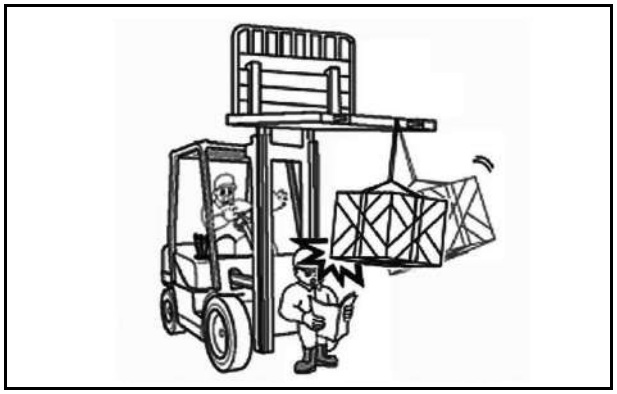


Figure 2-76

32. An unloaded forklift truck is more likely to tip over than a loaded forklift truck. When driving without load, it's prone to lateral tipping.

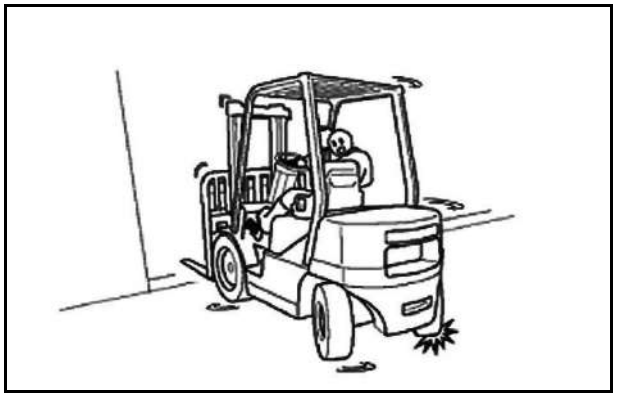


Figure 2-77

33. The forks can be replaced with many attachments. It is strongly recommended to follow all transportation safety regulations and receive specific training.

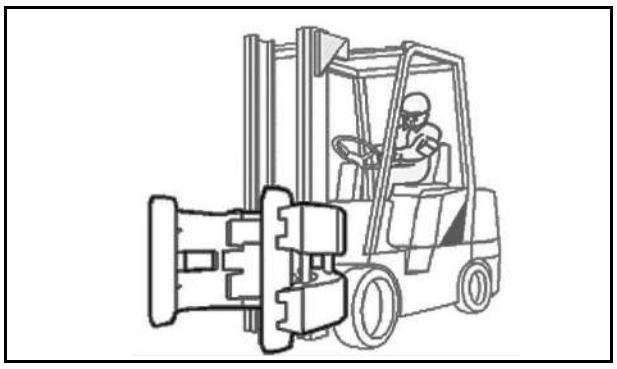


Figure 2-78

34. The counterweight drawbar shall not be used to tow a forklift truck or other forklift trucks. It is recommended that only a trained operator should tow the forklift truck not exceeding 2km/h to a location for convenient maintenance in emergency.

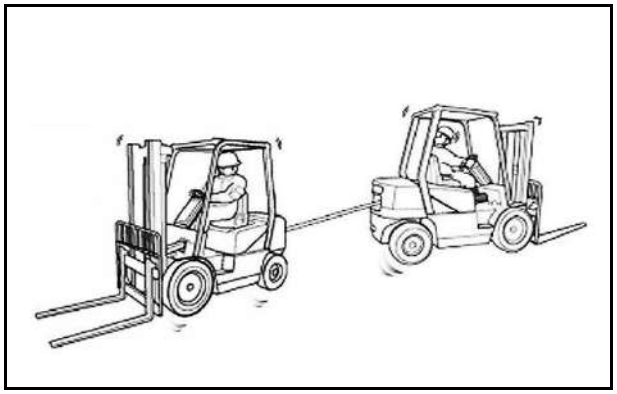


Figure 2-79

2.10 The way to escape when forklift truck tipping (if equipped with a driver restraint system)

Warning

Danger of personal injury or death!

In case of rollover, the driver can reduce the risk of serious injury or death by using the driver restraint system and following the instructions.

Be sure to use the driver restraint system.

1. Fasten the seat belt

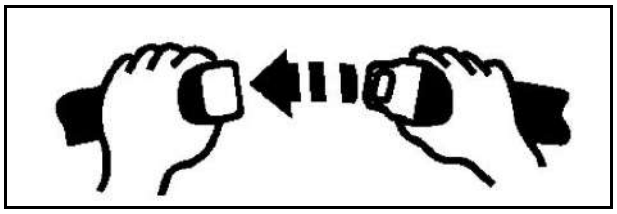


Figure 2-80

2. Do not jump off the forklift truck.

Figure 2-81

3. Hold the steering wheel.

Figure 2-82

4. Spread your legs in the cab, but do not extend them outside the cab.

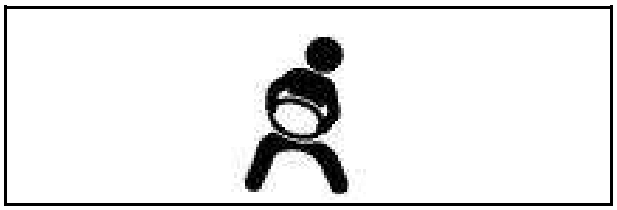


Figure 2-83

5. Tilt your body in the opposite direction of tipping.

Figure 2-84

6.Tilt forward.

Figure 2-85

Operation

3. Operation

3.1 Overview

Forklift truck drivers and management members must always prioritize safety, operate safely according to the forklift truck's Safety, Operation and Maintenance Manual, and standardize operations.

3.2 Main units of forklift truck

3.2.1 Main exterior units of forklift truck

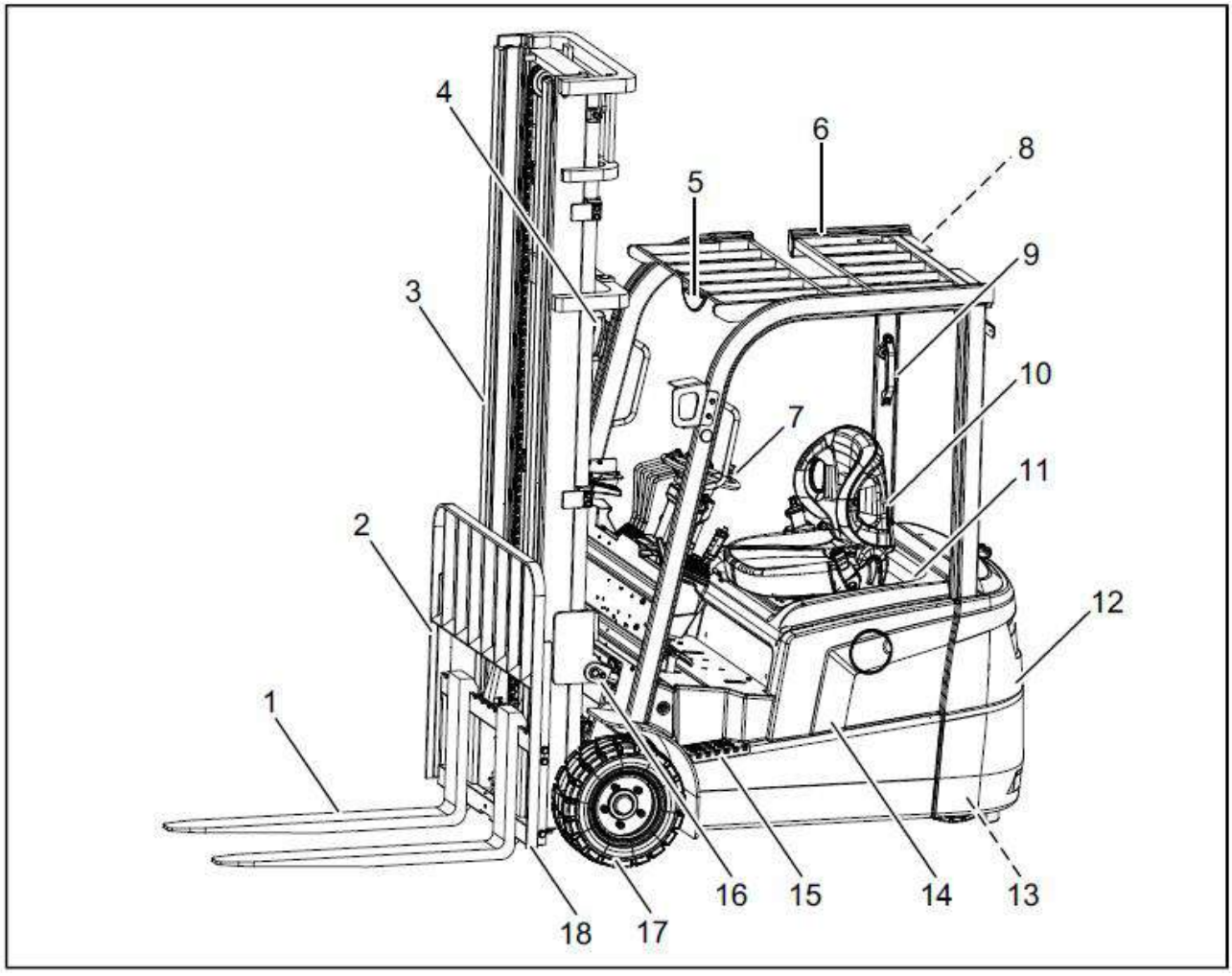


Figure 3-1

1. Fork	2. Load backrest	3. Mast	4. Headlamp	5. Rearview mirror
6. Overhead guard	7. Steering wheel	8. Rear tail light	9. Rear armrest horn button	10. Seat
11. Hood	12. Counterweight	13. Rear wheel	14. Side plate	15. Step
16. Tilt cylinder	17. Front wheel	18. Carriage		

3.2.2 Main units of cab

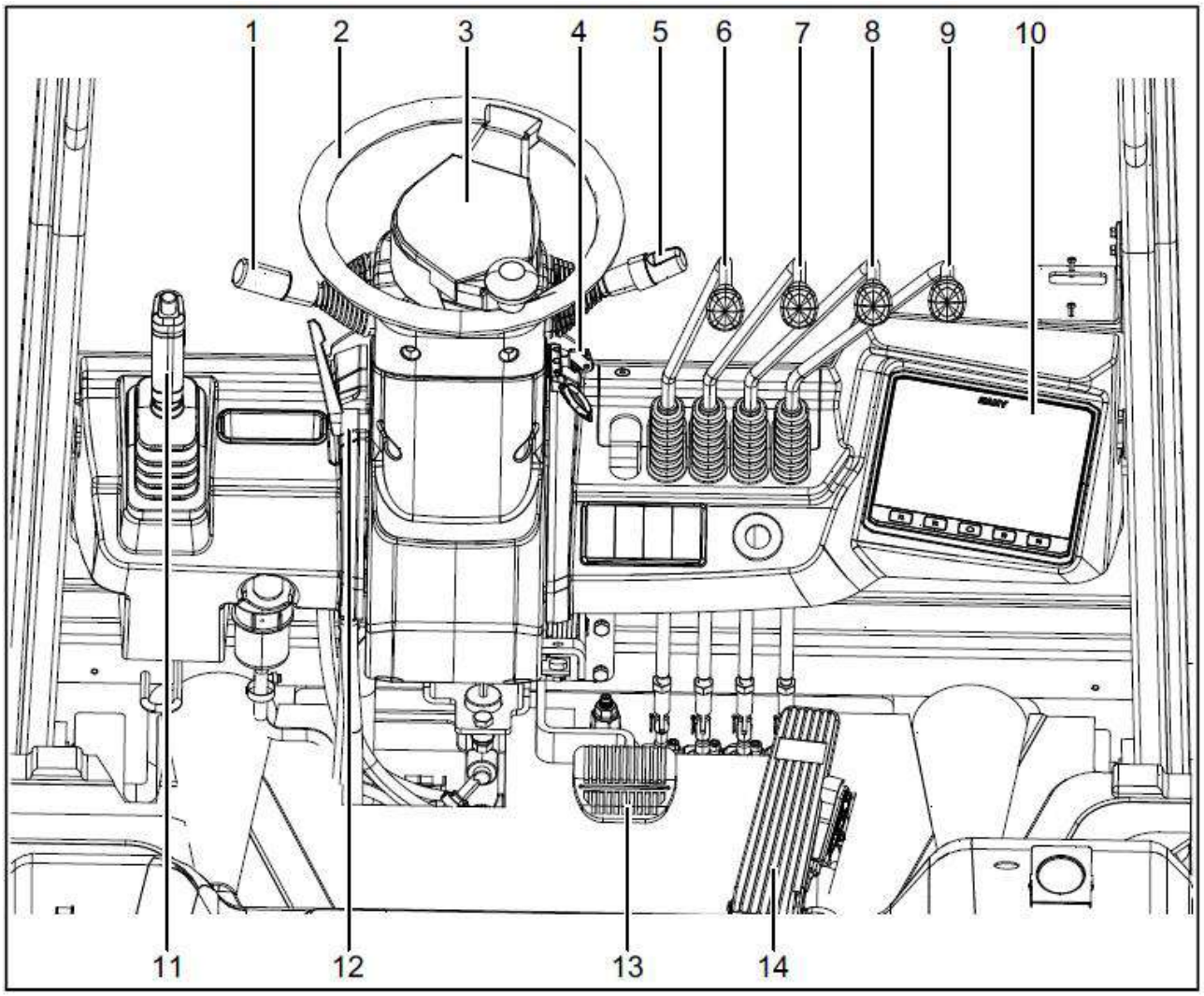


Figure 3-2

1. Shift switch (F/N/R)	2. The steering wheel	3. Horn	4. Key switch
5. Light and turn switch	6. Lift lever	7. Tilt lever	8. Attachment lever 1
9. Attachment lever 2	10. Instrument	11. Parking brake lever	12. Steering column locking lever
13. Brake pedal	14. Accelerator pedal		

Fingertip Control System (Optional)

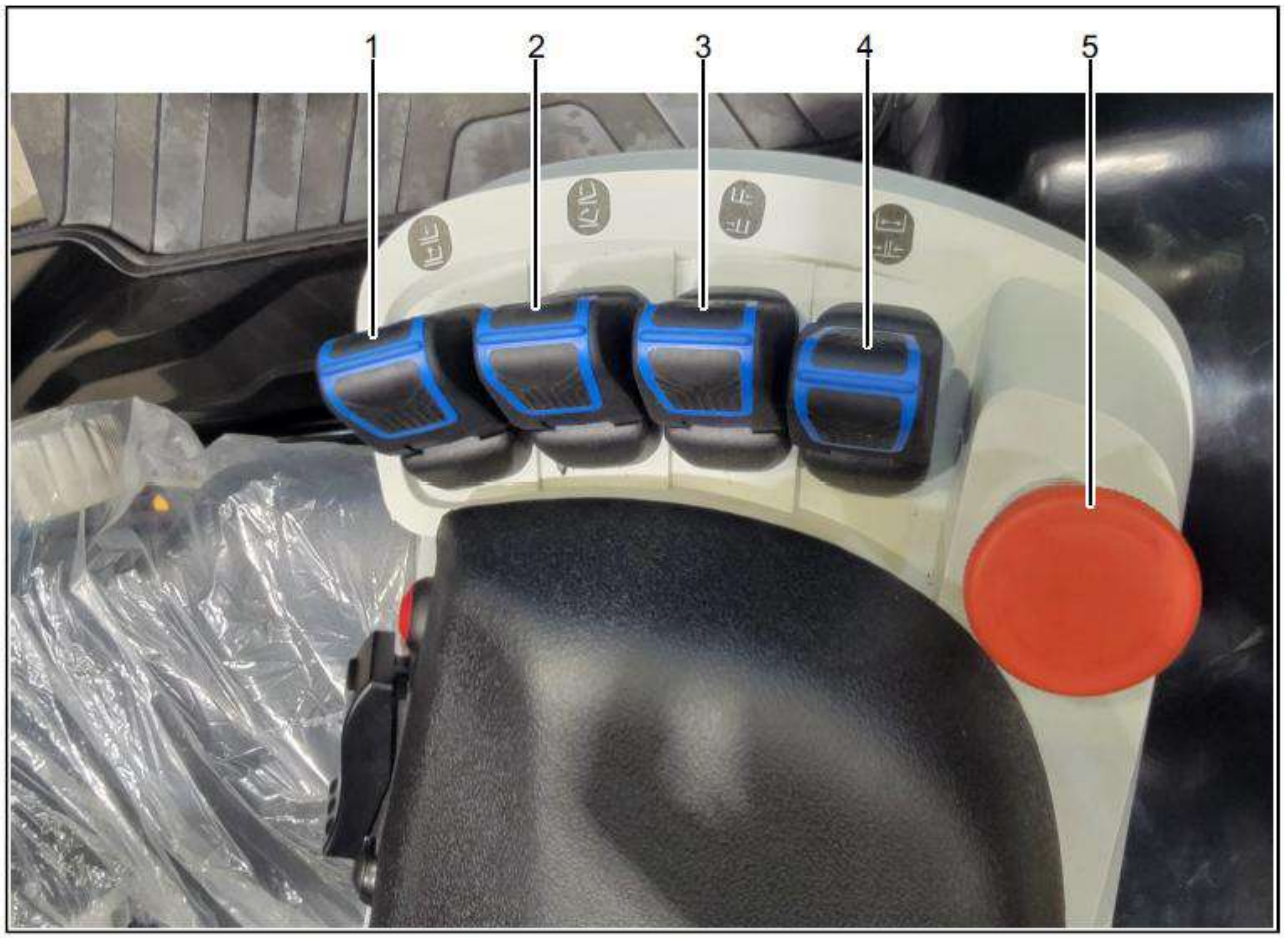


Figure 3-3

1. Mast lifting/lowering
2. Mast tilt forward/backward
3. Side shifter left/right
4. Attachment switch
5. Emergency stop switch

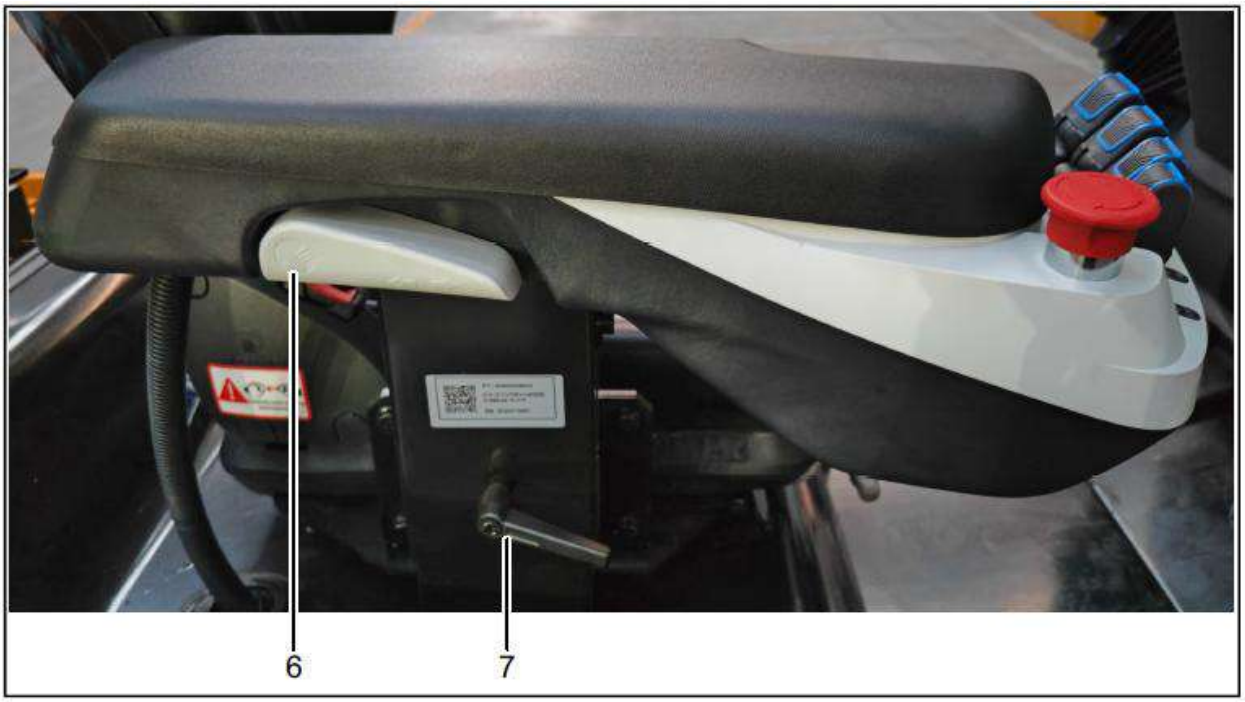


Figure 3-4

6. Front and rear adjustment button 7. Up and down adjustment button

Figure 3-5

8. Enable button 9. FNR gear switch 10. Horn switch

Cross Joystick System (Optional)

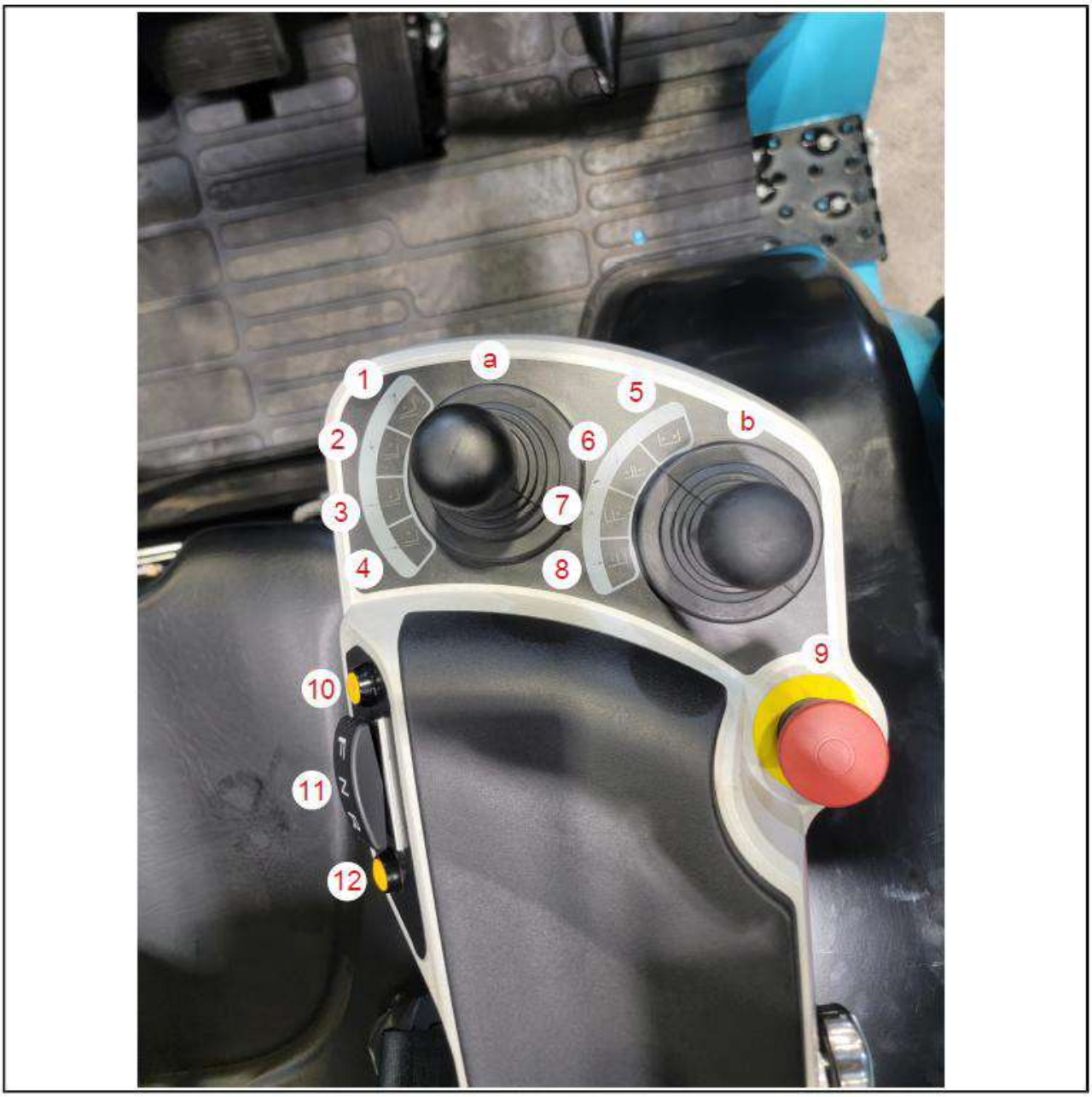


Figure 3-6

1. Mast tilt forward
2. Mast tilt backward
3. Mast lowering
4. Mast lifting
5. Attachment open
6. Attachment close
7. Side shifter left
8. Side shifter right
9. Emergency stop button
10. Enable button
11. Gear switch
12. Horn

a. Multi-directional lever
b. Cross lever

3.2.3 Body

Seat

1. Adjust the seat to suit the operator's physique, and the impact and vibration of the vehicle can be absorbed, sitting comfortably. At the maximum unloaded operating speed, the seat's integrated acceleration is 1.5m/s².

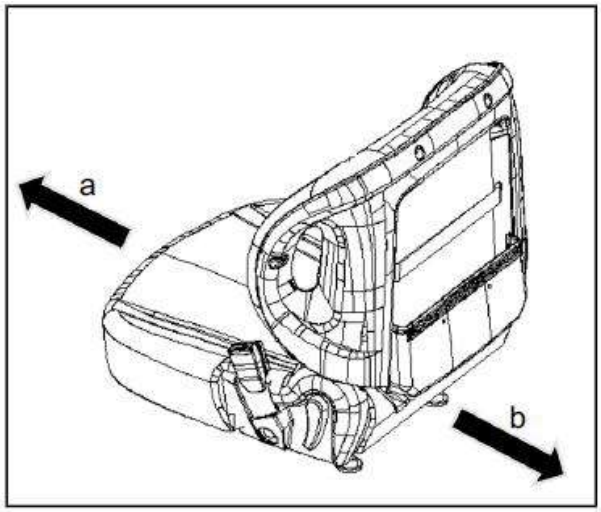


Figure 3-7

a. Forward b. Backward

2. Pull the lever upwards to release the fixation. Gently move the seat forward and backward to confirm whether it is securely locked.

3. Seat position adjustment range: Fore and aft 120mm.

Note: If the seat is equipped with a seat belt, be sure to fasten it. In case of a rollover, the driver must hold the steering wheel and lean his body to the side in opposite direction. Do not jump out of the vehicle.

Top guard frame

⚠ Warning

Danger of personal injury or death!

The overhead guard is an important part that prevents objects from falling and protects the safety of the operator. If the installation is loose, it is very dangerous to use it after removal or modification, which may lead to serious accidents.

Be sure to use the overhead guard correctly.

Towing pin

The towing pin is only used in the following situations:

• Used to escape when unable to drive (such as tires stuck in the ditch, etc.);

• When loading or unloading the forklift truck from trucks.

Note: The towing pin must never be used for towing or being towed.

Fork locating pin

The fork locating pin locks the fork in a certain position. To adjust the fork spacing, pull up the fork locating pin, turn it 1/4 turn, and adjust the fork to the required position. The adjustment of the fork spacing should be based on the cargo to be handled.

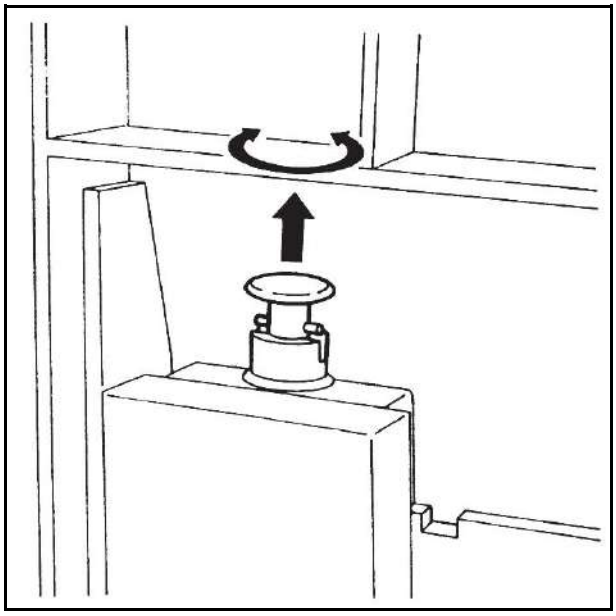


Figure 3-8

Note

According to the principle that the center of gravity of the cargo should be align with the center of gravity of the vehicle, the spacing of forks should be adjusted to equal distances on the left and right. Then use the fork locating pin to firmly fix the fork.

When adjusting the fork spacing, lean your body against the load backrest, stand firmly, and use your feet to push the forks. Never make adjustments by hand!

Footrests and handlebars

Footrests are provided on both sides of the body, and the handlebar is located on the left front support rod of the overhead guard. Use the footrests and handlebars when getting on and off the vehicle to ensure safety.

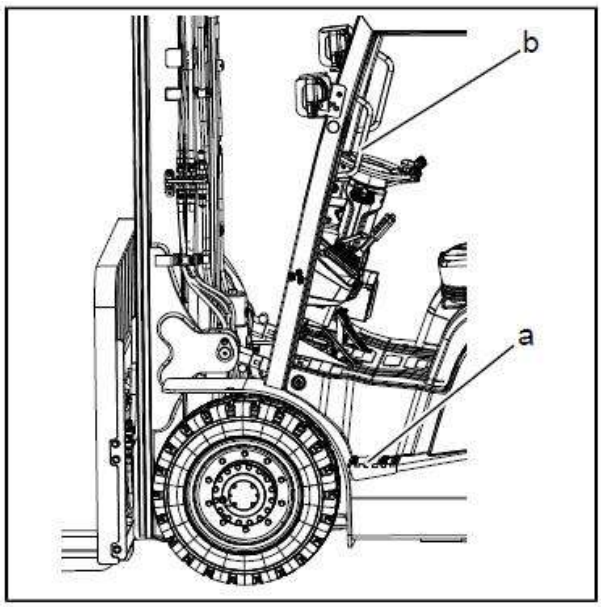


Figure 3-9

a. Pedal b. Handle

Fuse box

The fuse box is installed on the top of the battery box.

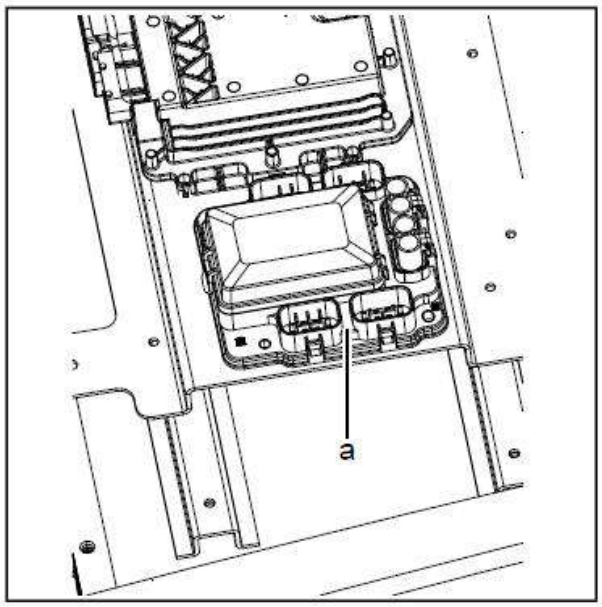


Figure 3-10

a. Fuse box

Brake fluid reservoir

The brake fluid reservoir is mounted on the left side of the instrument panel. The translucent container allows the brake fluid level to be checked from the outside.

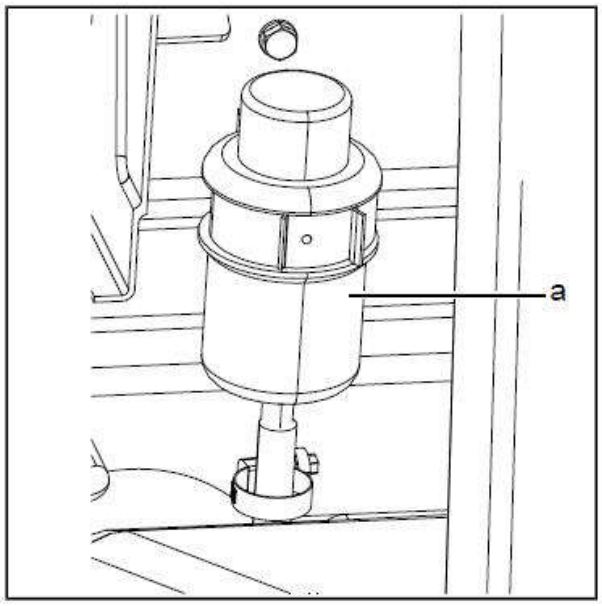


Figure 3-11

a. Brake fluid reservoir

Hydraulic tank cap

According to the instructions on the hydraulic oil filling sign, inject hydraulic oil through the oil filler of the hydraulic tank cap. There is an oil dipstick on the cap.

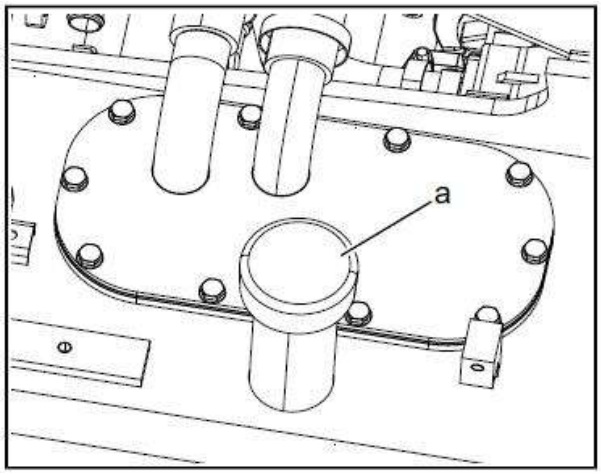


Figure 3-12

a. Hydraulic tank filler cap

Lights (optional)

Front combination lights (front lighting lamps, turn signal lights, and width indicator lamps) are installed on the front side of the vehicle. The rear side is equipped with a rear combination lights, including four functions: turn signal lights, brake lights, width indicator lamps, and reverse lights. Rear lighting lamps, warning lights, and perimeter lights are optional.

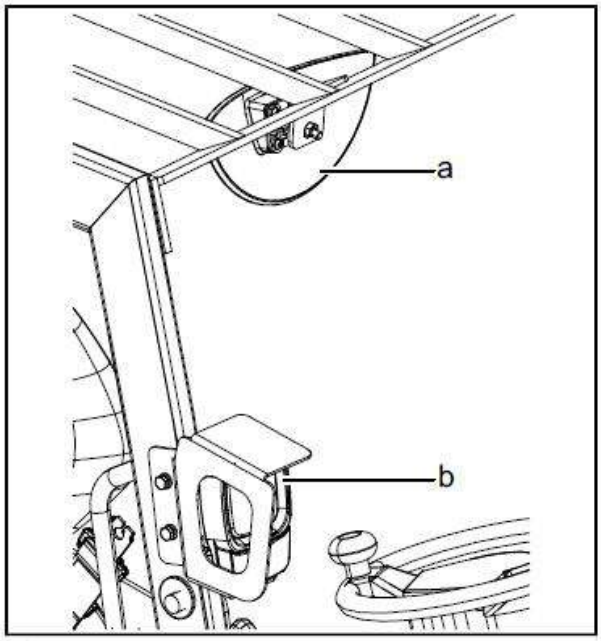


Figure 3-13

a. Rearview mirror b. Front combination light

Note:

- Check the working condition of lights. If the bulb is burned out, the lampshade is damaged or dirty, replace or repair it immediately.
- If you need to install rear lighting lamps, warning lights, and perimeter lights, please contact the SANY sales department and we will assign someone to install them.

Rearview mirror and horn button rear lever

The rearview mirror is installed on front foot of the overhead guard, with one on each side; or installed on the right front of the overhead guard, only one.

The rear lever of horn button is installed on the right rear outrigger, which is convenient for the driver to press the horn to alert people behind when reversing.

Note: The rearview mirror should be kept clean. The rearview mirror should be adjusted to a position where you can see the rear best.

Lithium battery charging muzzle and charging socket

Warning

Warning! Fire.

Foreign objects may cause poor contact between the charging gun and the charging socket, resulting in heat or even fire.

Before charging, make sure there is no dust, water or other foreign objects in the charging gun and charging socket. If any, clean it up before charging.

Frame number

- The frame steel seal number is on the right side of the frame
- Description of frame steel seal number

For example: 10121030001410162

101: Electric forklift

21: Indicate year

03: Indicate month

0001: Indicate serial number

410162: Indicate frame manufacturer

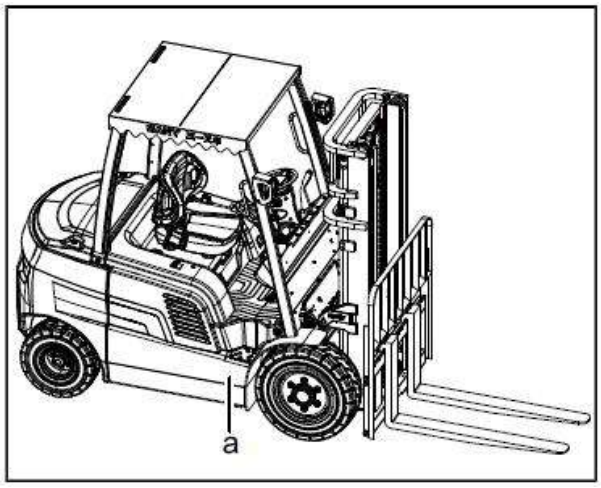


Figure 3-14

3.3 Use of new forklift truck

3.3.1 Use of new vehicle

In order to keep the vehicle in good performance, safe use and economical operation, here are some precautions for correct driving. The service life of the vehicle depends on the use of new vehicle. During the first 200 hours of operation, please pay attention to the following matters:

- Hydraulic oil systems must undergo warm-up cycling when ambient temperature drops below 10°C.
- Perform regular maintenance according to the maintenance interval.
- Use the forklift truck properly and do not operate it roughly.
- Add lubricating oil, grease and change oil in time.

3.3.2 Relationship between load and forklift truck stability

According to the load curve, the forklift truck uses the center of front wheel as the fulcrum to keep the load on the vehicle body and the fork balanced, paying attention to the loads and load center to maintain the stability of vehicle.

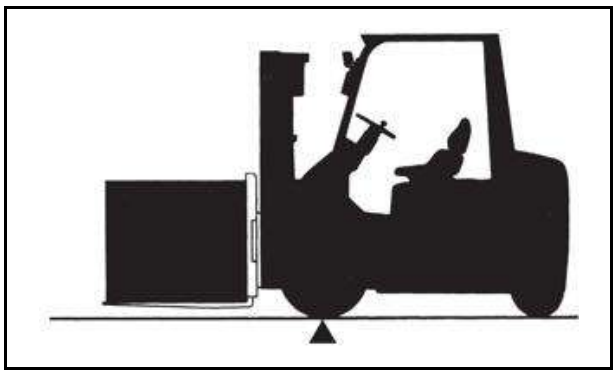


Figure 3-15

Warning

Danger of tipping!

If the load curve is exceeded, the rear wheels are in danger of being lifted and in a bad condition, and the forklift truck may tip over, resulting in a serious accident.

As shown in the figure above, placing the cargo close to the fork tips has the same result as increasing the cargo weight. In this case, the load should be reduced accordingly.

3.3.3 Load center and load curve

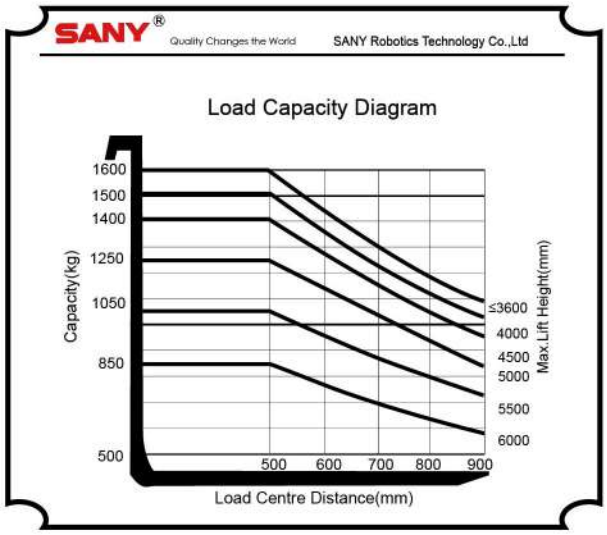


Fig. 3-16 SCP16S Load Curve

The load center is the distance from the end of forks to the center of gravity of the cargo. The above load curve chart shows the relationship between the load center and the allowable load of a 1.6 t/2 t forklift truck (permissible load). The load curve nameplate is affixed to the vehicle. If the nameplate is damaged or lost, replace it with a new one.

Note: If the vehicle is equipped with attachments for handling cargoes, such as side shifters, buckets or swivel forks, its permissible load ratio should be reduced.

Note: The reasons for the reduced load ratio of a standard vehicle (without any attachments) are as follows:

1) Reduce the load by an amount equal to the weight of attachment.

2) Since the length of attachment causes the load center to move forward, the allowable load is reduced by the same principle.

The installation of attachments causes the load center to move forward, which is called "load center loss".

Note: Do not exceed the permissible loads specified on the load curves attached to the vehicle or attachment.

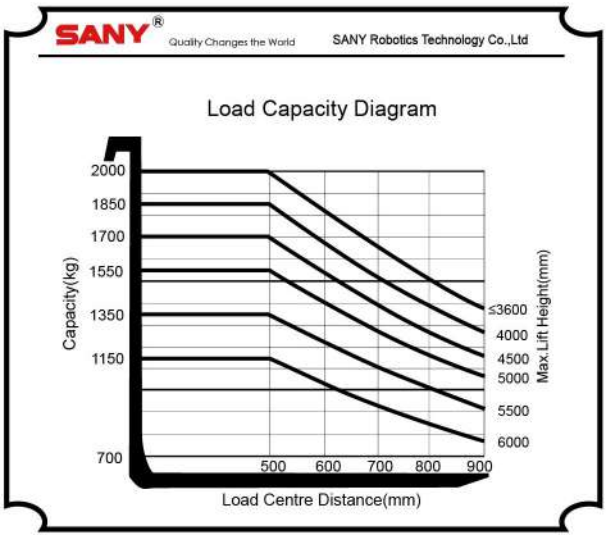


Fig. 3-17 SCP20S Load Curve

3.3.4 Stability of forklift truck

The stability standards for forklift trucks are specified in ISO or other standards. However, the stability described is not applicable to all operating conditions. The stability of forklift trucks varies with the operating conditions.

Maximum stability is ensured under the following operating conditions:

1. The ground is flat and hard.

2. Operate under standard no-load or load conditions.

Standard no-load state: The fork or its load-bearing accessories are 30cm off the ground, and the mast is tilted backward in place without load.

Standard load state: The fork or other load-bearing accessories are 30cm off the ground. Load the permissible load at the standard load center and tilt the mast backward in place.

Warning

When handling cargoes, try to minimize forward and backward tilting. Never tilt forward unless the load is securely fixed or a rigid shelf + or low lifting height is used.

3.4 Starting, controlling and driving a forklift truck

3.4.1 Starting forklift truck

Key switch

OFF: The switch is open and the key can be inserted and removed.

ON: Turn the switch to the right from the off position to turn it on and the forklift truck starts.

Note
Do not depress the accelerator pedal while turning on the key switch. The key must be removed when leaving the forklift truck. When parking the forklift truck or charging the forklift truck, remove the key.

Lights switch

This switch is a 3-position rotary switch.

Emergency power-off switch

The switch is installed on the right side of seat, or on the left side of instrument panel, or on the right side of instrument panel. In case of emergency, press the switch to cut off the power supply.

Seat switch

The switch is installed under the seat. When the driver sits on the seat, the switch is turned on and the travel electronic control system can be powered, otherwise the forklift truck cannot move.

3.4.2 Forklift truck control

Steering wheel and steering wheel ball knob

The steering wheel (a) is operated normally, that is, when the steering wheel is turned to the right, the forklift truck turns right; when the steering wheel is turned to the left, the forklift truck turns left. The steering wheels are mounted at the rear of the forklift truck, which allows the rear of forklift truck to swing outward when turning.

When turning, hold the steering wheel ball knob (b) with your left hand, and hold the multi-way valve joystick or steering wheel with right hand.

Fully hydraulic steering system and tilt gearing device are standard equipment on the forklift truck.

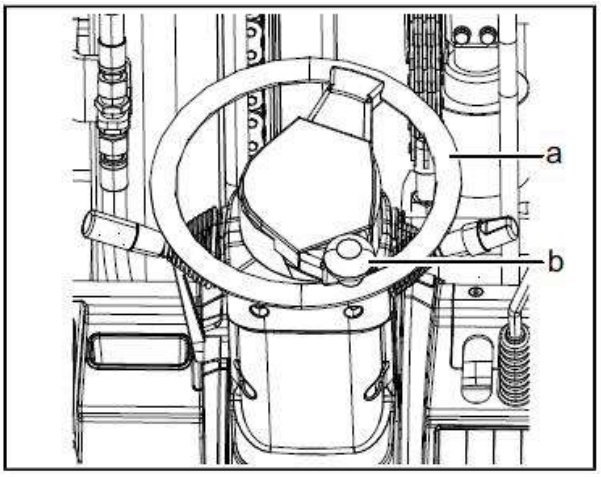


Figure 3-18

a. Steering wheel b. Ball knob

Adjust the steering wheel to the best angle according to the driver's position.

After adjusting the steering wheel tilt angle, lock the steering column with the steering column lock lever (a).

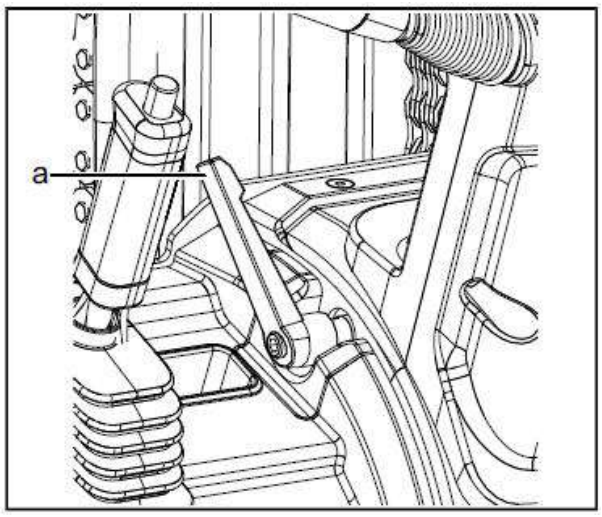


Figure 3-19

a. Steering column lock lever

Horn button

Press the central rubber cover of steering wheel to hear a beep.

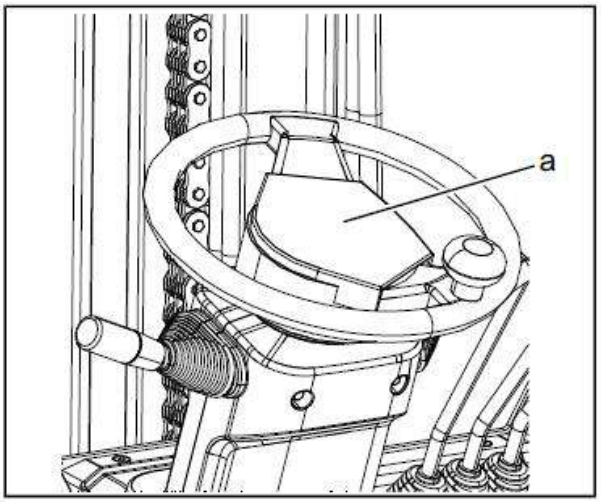


Figure 3-20

a. Horn

Brake and accelerator pedals

Brake pedal: When you press the brake pedal (a), the vehicle is braked and the brake lights illuminate.

Accelerator pedal: Depress the accelerator pedal (b) slowly. The speed of forklift truck is controlled by the angle at which the accelerator pedal is depressed. From left to right, they are the brake pedal and accelerator pedal.

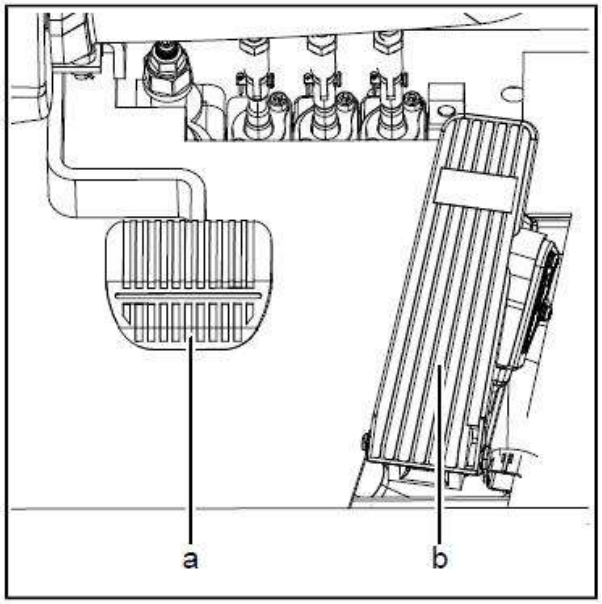


Figure 3-21

a. Brake pedal b. Accelerator pedal

Shift lever

Forward (F): Push the lever forward and depress the accelerator pedal.

Reverse (R): Pull the lever backward and depress the accelerator pedal.

When parking the forklift truck, the direction switch lever should be placed in neutral (N).

Note: Do not slam the accelerator pedal to avoid the forklift truck starting or accelerating suddenly.

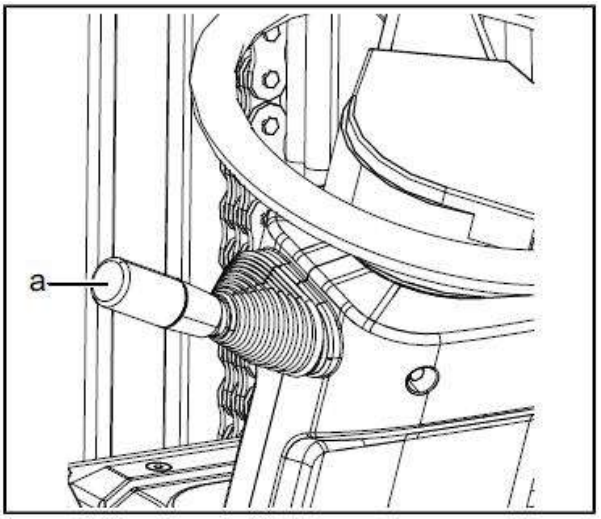


Figure 3-22

a. Shift lever

Parking brake lever

To prevent the forklift truck from moving, fully apply the parking brake lever when parking the forklift truck.

Before moving the vehicle, push the parking brake lever all the way forward.

Note: While operating the parking brake lever, depress the brake pedal.

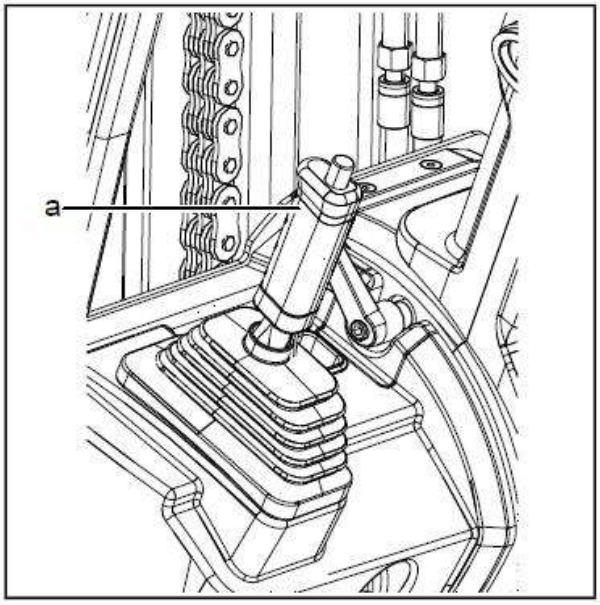


Figure 3-23

a. Parking brake lever

Lift lever and tilt lever

Lift lever (a): Pull the lift lever backward to raise the fork, and push the lift lever forward to lower the fork. The lifting and lowering speed can be controlled by the tilt angle of lever. The larger the angle, the greater the speed.

Note: When the key switch is turned on and the lift lever is pushed or pulled at the same time, lifting cannot be completed. Do not lower forks suddenly and do not stop suddenly when lowering forks.

Tilt lever (b): Pull the tilt lever backward to tilt the mast backward, push the tilt lever forward to tilt the mast forward. The tilting forward and backward speed can be controlled by the tilt angle of lever. The larger the angle, the greater the speed.

Note: Pull or push the tilt lever while turning on the key switch with no tilting action.

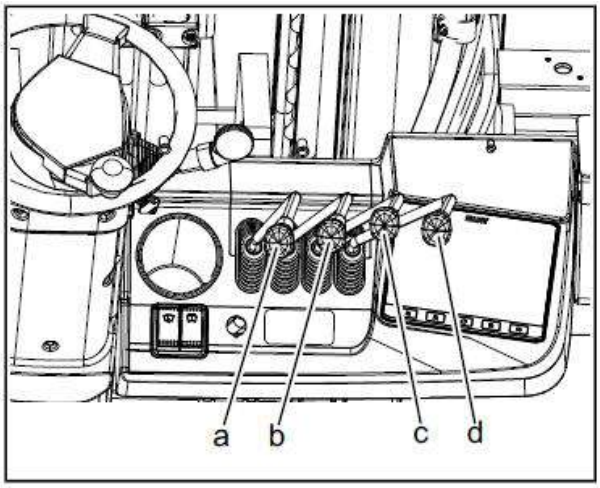


Figure 3-24

a. Lift lever
b. Tilt lever
c. Attachment lever 1
d. Attachment lever 2

3.4.3 Preparation before driving

1. Check that the emergency stop switch is working. Please turn on the emergency stop switch first.
2. Check the position of direction switch lever and place the direction switch lever in neural (N).

3. Engage key switch.

Grasp the steering wheel ball knob, then turn on the key switch and put the key switch in "ON" position.

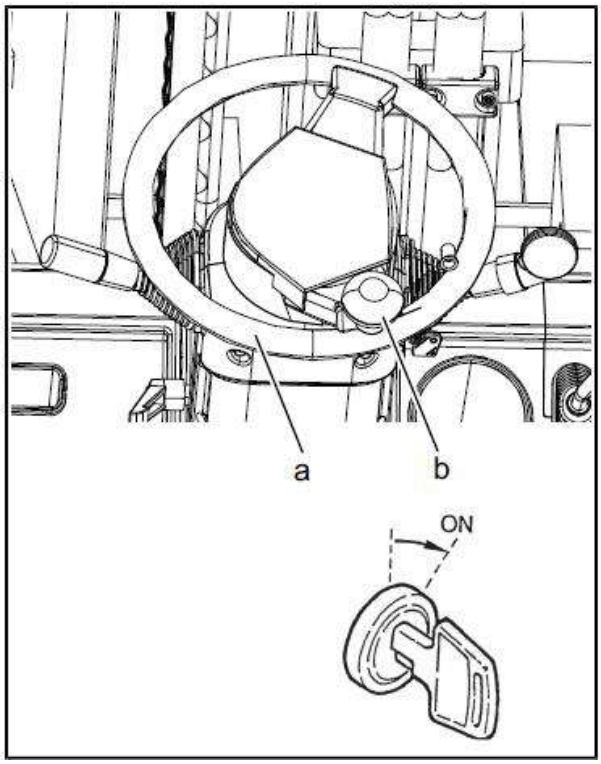


Figure 3-25

a. Steering wheel b. Steering wheel ball knob

Note
Even if the key switch is turned to "ON", it takes about 1 second from the start of brake circuit to the start of vehicle. Before the key switch is turned to "ON", the vehicle cannot start if the shift rod is in the forward "F" or reverse "R" position. At this time, turn the shift rod to neutral "N". If you press the accelerator pedal quickly, the vehicle may accelerate suddenly, so be careful.

4. The mast tilts backward.

Pull the lifting lever backward to raise the fork 150-200mm off the ground, and pull the tilt lever backward to tilt the mast backward.

5. Operate the direction switch lever. The direction switch lever determines the driving direction. Forward (F): Push the direction switch lever forward. Backward (R): Pull the direction switch lever backward.

6. Release the parking brake lever. Depress the brake pedal. Fully release the parking brake lever forward, or in a negative braking system, when the driver steps on the brake pedal, the brake is automatically released under the action of hydraulic pressure, hold the steering wheel with left hand, and gently place right hand on the steering wheel.

3.4.4 Forklift truck driving

Startup

Remove your foot from the brake pedal and gradually depress the accelerator pedal, and the forklift truck moves.

The change in acceleration is related to the stroke of the accelerator pedal is depressed.

Note: Do not start or brake suddenly, otherwise the cargo may fall.

Deceleration

Slowly release your foot from the accelerator pedal. If necessary, you can press the brake pedal.

If it is not an emergency brake, release the accelerator pedal and slowly decelerate until the vehicle stops. However, even if the accelerator pedal is released rapidly, emergency braking cannot be achieved.

In an emergency, press the brake pedal for emergency braking.

Note

Slow down in the following situations:
- Turning at an intersection
- Approaching cargoes or pallet
- Approaching cargo pile
- In narrow passages
- Poor ground/road surface

When reversing, look behind you to confirm that the rear is safe. Do not solely rely on the rearview mirror to reverse.

For forklift trucks equipped with a horn button rear lever, which can be used as a reminder during the reversing.

Turning

Forklift trucks are different from cars because they depend on rear-wheel steering. When turning, slow down and watch the swing of the rear of forklift truck when turning the steering wheel.

Note

Risk of tipping over!

When turning, the faster the speed and the smaller the turning radius, the vehicle is prone to overturning.

Simultaneous operation of driving and lifting (inching operation)

1. Drive the machine to allow the front end of the fork is 3-5 meters away from the cargo.
2. Fully depress the brake pedal. (Driving stops)
3. Press the accelerator pedal to reach the appropriate operating speed.
4. Operate the lift lever to allow the fork to perform lifting operations.

Warning

The simultaneous operation of driving and lifting (inching) requires a high proficiency. It is necessary to correctly understand the shape, center of gravity and other characteristics of the cargo, confirm the stability of the rear vehicle, and perform the cargo lifting and lowering operation at a low speed. Be careful!

Tilt operations with high lifting heights and long lifting time are very dangerous. Do not perform any operations other than fork in and out operations on the cargo on the platform.

In order to reduce the danger of driving at high lifting heights and long lifting time, lifting operations should start when approaching the cargo platform.

Temporary parking

• Parking spaces should be as wide and flat as possible.

• When an unloaded vehicle has to stop on a slope, the mast is tilted downward to stop the wheels.

• Park the vehicle in a safe place or designated location away from the work site.

• Use caution signs and signal lights when necessary.

• Park on very hard road surfaces and be alert to sliding or downthrow.

• When forks cannot be lowered due to a vehicle malfunction, hang a cloth on the fork tip, facing the direction where people and vehicles cannot pass.

• Pay special attention to slippery and collapsed roads.

• Do not jump from the vehicle.

• Lower forks after the vehicle has come to a complete stop. It is very dangerous to lower the forks while the vehicle is moving.

• When getting off the vehicle, you must face the direction of the vehicle and use the footrests.

To decelerate, press the brake pedal, stop the vehicle, and turn the shift rod to neutral “N”.

Park the forklift truck in a place that does not obstruct other vehicles and follow the steps below.

1. Pull the parking brake lever backward to activate the parking brake.

2. Lower forks to ground.

3. Turn the key switch to "OFF".

4. Remove the key and keep it properly.

Parking forklift truck

When leaving the forklift truck, fully pull up the parking brake lever and tilt the mast forward slightly. Lower forks to the ground. When parking forklift truck on a slope, place blocks under the wheels.

When leaving the forklift truck, remove the key.

Emergency repair of faulty forklift truck

If a forklift truck suddenly breaks down during use, it should be towed away for repair promptly to avoid interfering with the operation of other vehicles or personnel.

3.5 Forklift truck operation

Warning

Only drivers who have been trained and hold a driver's license are allowed to drive.

Do not stand on the forks or ride on the forklift truck. Do not stand or walk under the forks.

It is not allowed to operate the vehicle and attachment from a position other than the driver's seat.

When checking the battery or fuel tank level, the driver should not be in the vehicle, and the vehicle should be turned off.

When operating a forklift truck, please note:

1. Operators should wear safety shoes, hats, clothing, and gloves when operating.

2. Check all controls and alarm devices before driving. If any damage or defects are found, they should be repaired before operation.

3. The load should not exceed the specified value during handling. The forks must be fully inserted under the goods and the goods should be placed evenly on the forks. Do not use a single fork tip to pick up cargoes.

4. Start, steer, drive, brake, and stop smoothly. When steering on wet or slippery surfaces, reduce speed.

5. When driving with a load, the cargo should be placed as low as possible and the mast should be tilted backwards.

6. Drive carefully on slopes. When driving on a slope greater than one-tenth, drive forward when ascending a slope and reverse when descending a slope. Avoid turning the steering wheel on slopes. Do not perform handling operations when driving downhill.

7. Pay attention to pedestrians, obstacles, potholes on the road, and the clearance above the forklift truck when driving.

8. When operating a forklift truck with a lifting height greater than 3 meters, be alert to falling objects from above, and protective measures should be taken when necessary.

9. When operating a forklift truck with a high lifting height, the mast should be tilted backward as much as possible, and handling operations should be carried out with minimal forward tilt.

10. When driving on a wharf or temporary planks, be alert and drive slowly.

11. When a forklift truck with attachments is operating without a load, it should be operated as if it has a load.

12. Do not handle unsecured or loosely stacked cargo, and be careful when handling larger-sized cargoes.

13. When leaving the vehicle, lower the forks to the ground, put the gear lever in neutral, turn off the vehicle and disconnect the power supply. When parking on a slope, engage the parking brake, and if parked for a long time, use wedges to block the wheels.

14. Before leaving the factory, the pressure of multi-way valve and safety valve has been adjusted. Users should not adjust them at will during use to avoid causing damage to the entire hydraulic system and hydraulic components due to excessive pressure.

15. Inflate the tires to the pressure value specified on the “Tire pressure” decal.

16. The maximum noise value outside the forklift shall not exceed 80dB(A), and the test method shall be conform to JB/T3300.

17. Be familiar with and pay attention to the functions and uses of various decals on the forklift truck.

3.6 Lithium battery usage guidelines for forklift truck

3.6.1 Charging of lithium batteries

1. Use the special lithium battery charging equipment designated by Sany, and strictly follow the Safety, Operation and Maintenance Manual of the charging equipment.

• Charge after turning off the key switch.

• Please charge the vehicle in a relatively safe environment (such as avoiding environments with liquids, fire, etc.).

• Necessary safety fire-fighting devices must be installed around the charging equipment so that emergency fire-fighting can be carried out in extreme situations.

• Before charging, confirm that there is no dust, water or other foreign objects in the charging gun and charging socket. If any, clean up before charging. Otherwise, it will cause poor contact between the charging gun and the charging socket, generating heat and causing fire.

• Do not modify or disassemble the charging port and charging equipment, as this may cause charging failure and cause fire.

• To avoid serious personal injury, take the following precautions when the vehicle is charging:

1) Do not touch the charging port or the metal terminals inside the charging gun.

2) Do not charge or touch the vehicle when there is lightning. Lightning strikes may damage the charging equipment and cause personal injury.

• After charging, do not disconnect the charging equipment with wet hands or while standing in water, as this may cause electric shock and personal injury.

• When the battery power capacity is less than 20%, it should be recharged in time. Over-discharging is strictly prohibited.

• The battery should be charged immediately after use and should be fully charged, but overcharging is strictly prohibited.

• To avoid damage to charging equipment, please note the following:

1) Do not close the charging port cover with the charging port cap open.

2) Do not pull or twist the charging cable.

3) Do not subject the charging equipment to impact.

4) Do not use the charging equipment in an environment with a temperature higher than 55°C.

5) It is forbidden to directly plug or unplug the charging gun when the charging equipment is outputting current. This may cause electric arcing, resulting in property loss and personal injury.

6) Do not place the charging equipment near a heater or other heat source.

3.6.2 Charging operation steps

Step 1: Charging preparation

1. Make sure the key switch of the vehicle to be charged is in off state, that is, the vehicle is not powered.

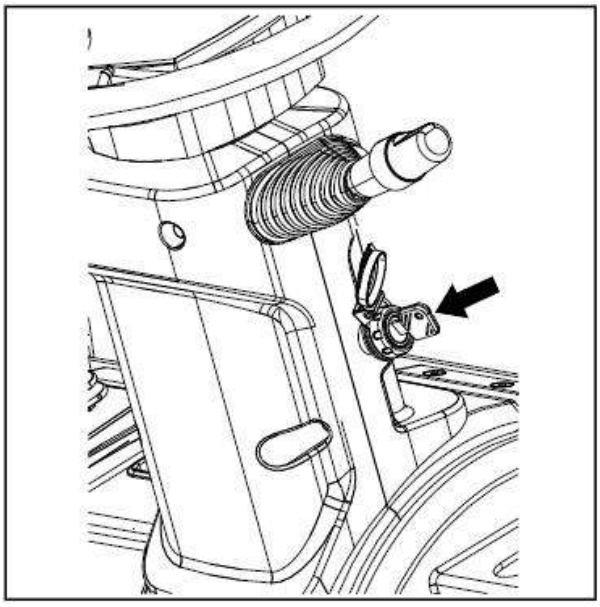


Figure 3-26 Turn off the Key Switch

2. Remove the charging gun from the charging equipment.

Note: There is a button lock integrated on the charging gun tip as shown in the illustration, which must be pressed to perform normal plug and unplug operations.

Figure 3-27 Lock Button

3. Check for any foreign object at the connection end of charging gun.

Figure 3-28

4. Check for any foreign object at the charging socket connection.

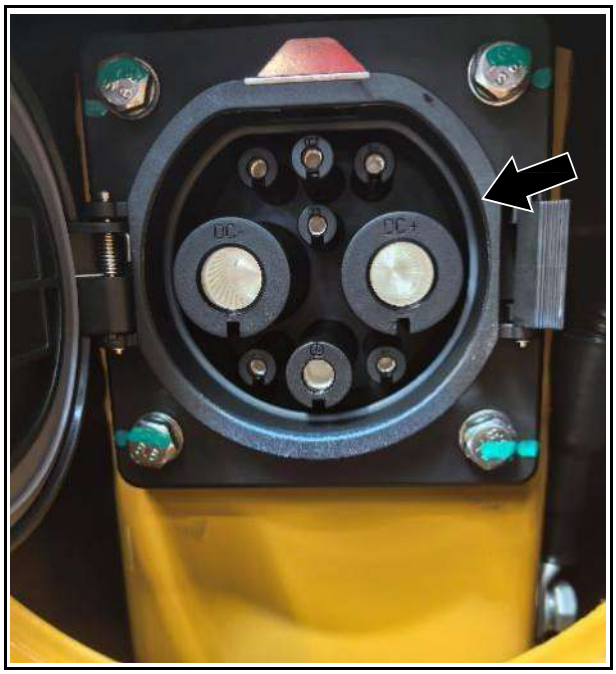


Figure 3-29

Note
Check the charging gun and the battery charging socket on vehicle end to ensure that there is no water or foreign objects in the port, and that the metal terminals are not damaged or affected by rust or corrosion.

5. There is a power switch on the rear of the charging equipment. Push the power switch and the power indicator light illuminates. Since the charging gun is not connected to the forklift truck, the charging equipment is in standby or shutdown state.

Step 2: Complete the charging connection

Plug the charging gun into the lithium battery charging socket at the vehicle body. The charging equipment will self-check and communicate with the lithium battery. When there is no fault in the whole system, about 15S later, the internal relay of the charging equipment will be energized and the charging starts. The indicator light illuminates, and the charging voltage, charging current value, charging time, charging faults and other information will be displayed on the instrument

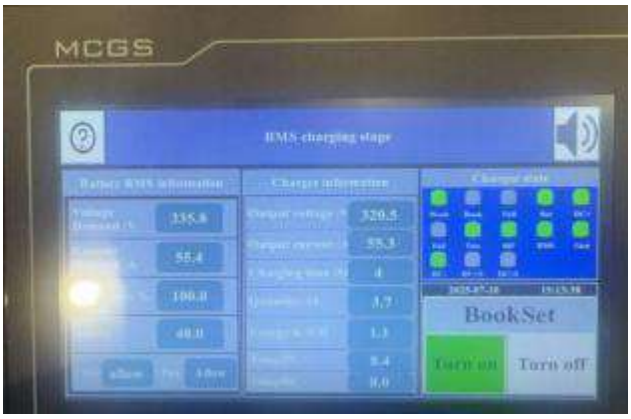


Figure 3-30

3.7 Stacking and destacking by forklift truck

3.7.1 Stacking

Note
Before operating forklift truck, check the following items: No cargo falls or gets damaged in the loading area. No objects or piles of cargo that obstruct safety.

When stacking, follow procedures as below:

1. Slow down when approaching the stacking area.

2. Park the vehicle in front of the stacking area.

3. Check that the area around the stacking area is safe.

4. Adjust the forklift truck to stop in front of the position where the cargoes are placed in the stacking area.

5. The mast is vertical to the ground and the fork is raised beyond the stacking height.

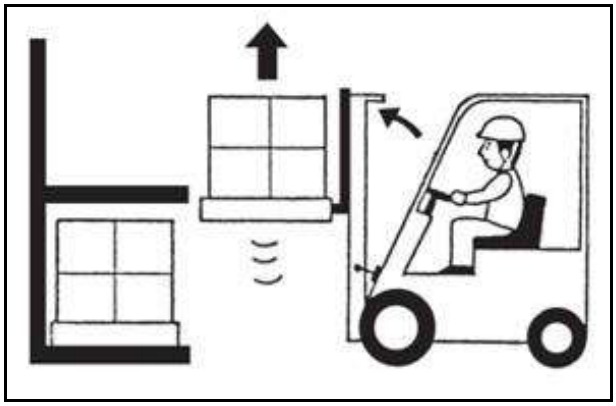


Figure 3-31

6. Check the stacking position and drive forward, then stop at a suitable location.

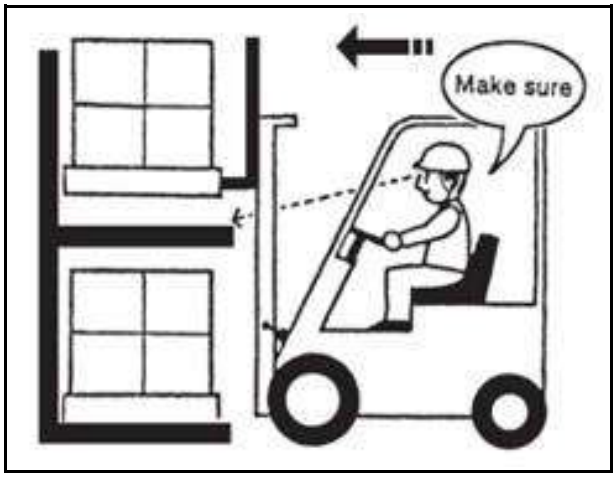


Figure 3-32

7. The cargoes are above the stacking position, slowly lower the forks, and make sure the cargoes are placed properly.

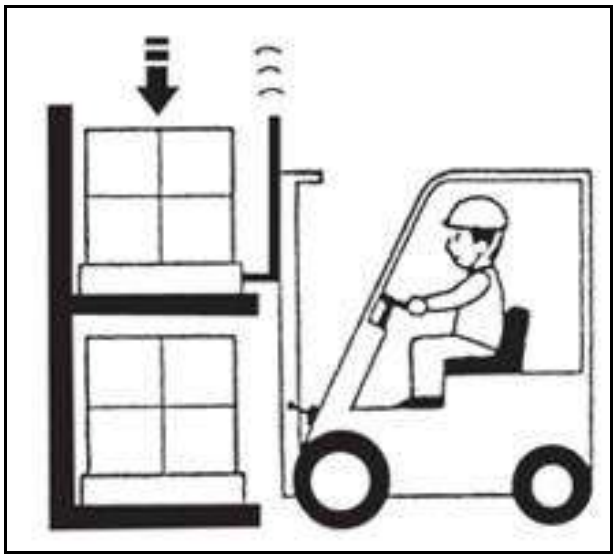


Figure 3-33

When the cargoes are not fully placed on the rack or bracket:

1. Lower the forks until they are no longer bear weight, and move the forklift truck backward 1/4 of the fork length.

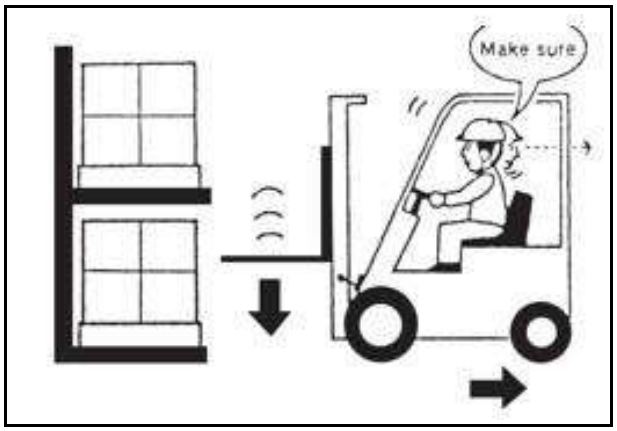


Figure 3-34

2. Raise forks by 50-100mm.

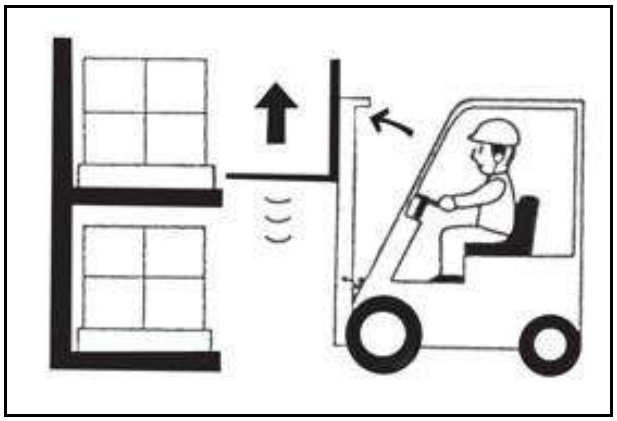


Figure 3-35

3. Move the forklift truck forward and place the cargo in the appropriate stacking position.

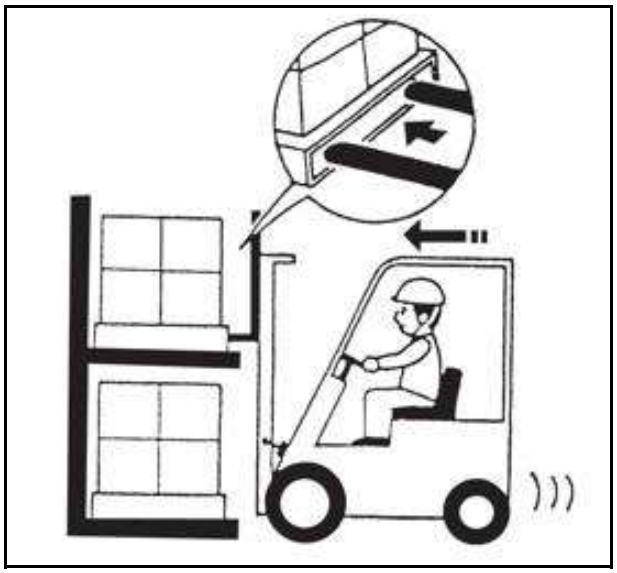


Figure 3-36

4. Check the space behind the forklift truck and drive the forklift truck backwards to avoid collision between the forks and the pallet or cargo.

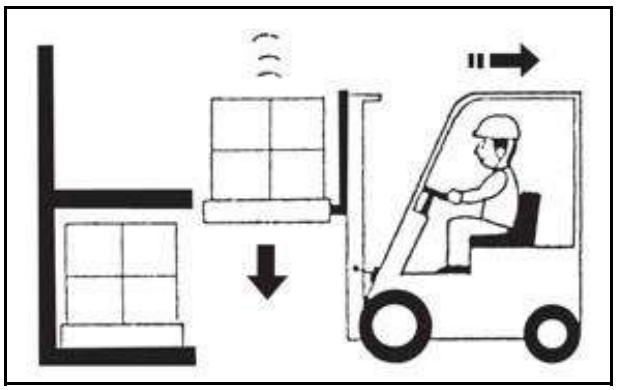


Figure 3-37

5. Make sure the front of the fork is away from the cargo or pallet, and lower the fork to move (150-200mm from the ground).

Figure 3-38

3.7.2 Destacking

When destacking, follow following as below:

1. Slow down when approaching the cargo to be handled.

2. Stop the vehicle in front of the cargo (the cargo should be 30cm away from the fork tip).

3. Adjust the forklift truck position in front of the cargo.

4. Ensure that the cargo is not overloaded.

5. The mast is perpendicular to the ground.

6. Observe the position of forks and move the forklift truck forward until forks are fully inserted into the pallet.

When forks are difficult to fully insert into the pallet:

1. Insert 3/4 of forks length and lift the pallet a little (50-100mm), pull out the pallet about 100-200mm, and then lower the pallet.

2. Fully insert the forks into the pallet.

3. After the fork is inserted into the pallet, lift the pallet (50-100mm).

4. Observe the surrounding space and move the forklift truck backwards until the cargo is lowered.

5. Lower the cargo until it is 150-200mm from the ground.

6. The mast tilts backward to ensure stability of the cargo.

7. Transport cargo to destination.

3.8 Transportation and handling of forklift truck

When loading the forklift truck onto a truck, the following matters should be noted:

1. The forklift truck has been parked using the parking brake.

2. The mast and counterweight should be firmly fixed with steel wires at the front and rear.

3. Use wedges to secure the front and rear tires.

4. When lifting, follow the lifting position indicated on the forklift truck's "Lifting nameplate".

3.9 Storage

1. Before storing the forklift truck, clean it thoroughly and check it according to the following procedures:

1) Use a piece of cloth and water to remove any oil and grease from the vehicle body as needed.

2) When cleaning the vehicle, check the overall condition, especially check whether there are dents or damages on the body, whether the tires are punctured, and whether there are nails or stones embedded in the tread.

3)Check for oil leakage.

4)Add grease as required.

5) Check whether the joint surfaces of hub nut and cylinder piston rod are loose, and whether there are dents and scratches on the surface of piston rod.

6)Check whether the mast roller rotates smoothly.

7) Raise the lifting cylinder to the top to allow the oil to fill the cylinder.

⚠ Warning

In case of repairing, malfunction or unsafe factors, the situation should be reported to the manager and the forklift truck should be stopped from use until it is restored to a safe condition.

2. Regular storage

1) Park the forklift truck at the designated location and use wedges to block wheels.

2) Put the shift lever in neutral and engage the parking brake lever.

3) Remove the key and keep it properly.

3. Long-term storage

On the basis of "regular storage" maintenance, the following maintenance and inspections are performed:

1) Considering the rainy season, park the vehicle on high and hard ground.

2) For lithium battery forklift truck, if it is stored for a long time, the power should be kept at 40% to 60%. Do not fully charge the battery and press the emergency power-off switch. Replenish the battery according to the battery instructions during storage, and fully charge the battery before use. The self-discharge of lithium batteries is affected by ambient temperature and humidity. High temperatures and humidity will accelerate the self-discharge of the battery. It is recommended to store the battery in a dry environment at -10°C to 45°C.

3) Apply anti-rust oil to exposed parts such as cylinder piston rods and shafts that may rust.

4) Cover parts that are prone to moisture.

5) For lithium battery forklift trucks, the battery should be fully charged and discharged at least once a month.

6) Do not park the forklift truck on soft roads such as asphalt surface in summer.

7) Disconnect the cables from the 12V battery and recharge the battery once a month to prevent over-discharge. The storage temperature should be between 5°C and 35°C. When disconnecting: First remove the negative cable, then remove the positive cable. When connecting: First attach the positive cable, then attach the negative cable (if a 12V battery is installed).

4. Operation of forklift truck after long-term storage

1) Remove the moisture-proof covering.

2) Remove the anti-rust oil from exposed units.

3) Clear foreign matter and water from the hydraulic tank.

4) After the battery is charged, install it on the forklift truck and connect the battery plug.

5) Perform a careful pre-startup inspection.

3.10 Forklift truck cleaning

1. Do not wash the vehicle and battery with water.

1) Do not wash the oil pipes, steam filters and other parts in the vehicle with water. As a last resort, wash the area below the tire, and remove the front bottom plate for washing. In this case, do not place it on the axle or remove it from the axle.

2) Keep the surface of the lithium battery dry and clean, and do not wash the lithium battery with water.

2. Do not wash electrical devices with water, such as:

• Controller, contactor

• Motors (drive motors, pump motors)

• Transformer (inside the side cover)

• Batteries, battery sockets

• Lithium batteries, lithium battery sockets

• Instrument housing

• Accelerator (under the front bottom plate)

3. Washing tips

1) Stop the vehicle and pull up the parking handle.

2) Turn the ignition key to OFF and remove it.

4. After washing

1) Use compressed air to blow away moisture and dry it thoroughly.

2) Perform a test run before use to check for any abnormalities.

SANY

Electrical system

4. Electrical system

4.1 Electrical system overview

Three-wheel counterbalance lithium battery forklift truck electric control system adopts a 96V power platform, which can achieve quiet, efficient, smooth, smooth, and safe control of the whole vehicle.

It is mainly composed of CAN bus instrument, VCU2.0 vehicle control unit, MCU motor control unit, traction motor, pump motor, lithium battery pack, control switch and lighting device, connecting wiring harness, etc.

Note: The manufacturer reserves the right to continuously improve the product. If there is any discrepancy between the physical product and the manual, please consult the manufacturer.

4.2. Instrument

4.2.1 Integrated instrument panel

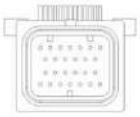
The integrated instrument panel assembly SYSD-2123 is a multifunctional, CAN bus-based color screen operating terminal that can display vehicle speed, working time, battery level, fault codes, etc. It can also allow users to modify vehicle parameters, customize personalized user interfaces, and menu structures.

Technical Specifications

1. Working humidity: 10%-95% non-condensing
2. Working temperature: -30℃ - +70℃
3. Working voltage: 9V - 36V
4. Protection level: IP65 (front panel)
5. Storage temperature: 40℃ - +85℃

4.2.2 Electrical interface

The interface of instrument uses AMP connector, with specific models and PIN definitions as shown in the table below.

Plug	Pictures
5–6447223–0	

Pin	Function	Description	Remarks
A-11	Key switch	Key switch 24V power supply	
A-14	24V	System power supply+	
A-13	24VP	DO power supply+	
A-19	24VP	DO power supply+	

Pin	Function	Description	Remarks
A-20	GND	System power supply-	
A-15	GND	AI analog power supply-	
A-12	GND	DO power supply-	
A-10	GND	DO power supply-	
A-26	GND	5V power supply-	
A-1	5V OUT	5V power output	Rated current 1mA
A-16	CAN0_H	CAN0 bus high	The terminal resistance cannot be configured and is set by default.
A-17	CAN0_L	CAN0 bus low	
A-8	CAN1_H	CAN1 bus high	
A-9	CAN1_L	CAN1 bus low	
A-18	AI-01/DI-01	AI/DI	
A-23	AI-02/DI-02		
A-22	AI-03/DI-03		
A-21	AI-04/DI-04		
A-24	AI-05	AI	
A-25	AI-06		
A-02	DO-01/PWM-01/CC-01	DO/PWM/CC	
A-03	DO-02/PWM-02/CC-02		
A-04	DO-03/PWM-03/CC-03		
A-05	DO-04/PWM-04/CC-04		
A-06	DO-05/PWM-05	DO/PWM	
A-07	DO-06/PWM-06		

4.2.3 Introduction of main panel

Figure 4-1

After power on, the instrument displays the SANY logo interface, followed by the card swipe interface. Upon successful card authentication, the main interface is displayed as shown in the figure above.

4.2.4 Function and application

Instrument main interface overview

Symbol	Display content	Function	Remarks
	Parking brake signal	The parking brake is engaged	VCU-CAN Send
Speed mode	Economy Standards High efficiency	Current speed level mode of the vehicle	Switch via the instrument "Quick Settings"
Battery	0～100%	0 ～ 100% Current battery percentage display;	VCU-CAN transmission, minimum 1%20% blue, 10-20 yellow, 5-10 red, 0-5 red + flashing
Forward/Reverse	F/R/N	Vehicle is in forward, reverse, or neutral mode	VCU-CAN Send

Symbol	Display content	Function	Remarks
Accumulated mileage	Corresponding value	Total vehicle mileage	Instrument self-calculation
Subtotal mileage	Corresponding value	Vehicle single start mileage	VCU-CAN Send
Boot time	Corresponding value	Total vehicle startup time	Instrument self-calculation
Single working time	Corresponding value	Single working time of the vehicle	Instrument self-calculation
Steering angle	-90°～90°	Steering wheel angle	VCU-CAN Send
Small battery voltage	Corresponding value	Current voltage of small battery	Instrument self-check
Cargo weight	Corresponding value	Vehicle current forklift truck weight	VCU-CAN Send
Quick Settings	Speed mode setting, lighting setting, heating and air conditioning setting	Quickly set speed mode, light settings, etc.	CAN Send
System menu	Secondary interface, view vehicle parameters	Read or change vehicle parameters, change language settings, time settings, etc.	CAN Send

Introduction to functions of instrument keys

Keys	Function
F1	1) Except for main interface, press this button to return to the previous interface. 2) If an input keyboard is set, press this key to exit the input keyboard.
F2	Except for the main interface, press this button to move up or left.
Home	Except for main interface, press this button to return to main interface.
F3	Except for the main interface, press this button to move down or right.
F4	Function confirmation button.

4.2.5 Fault information event number description

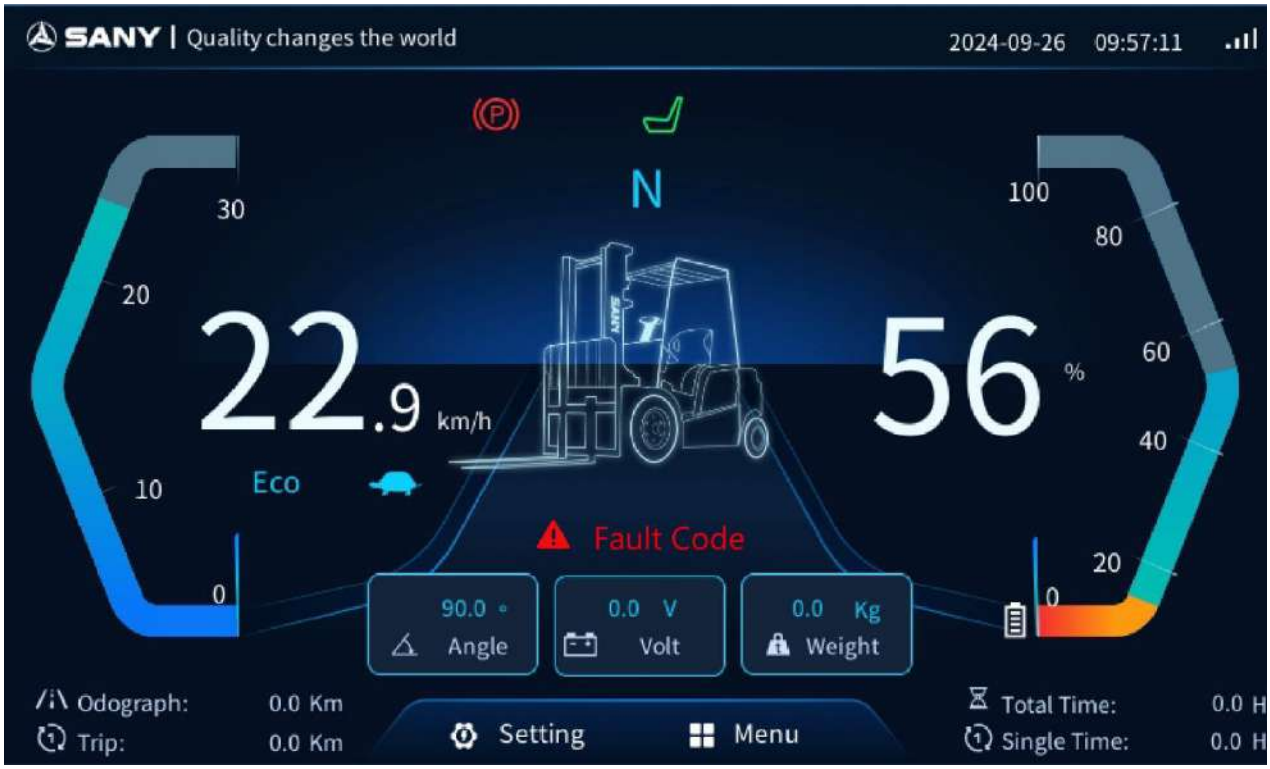


Figure 4-2

When the words "Fault Alarm Information" appear on main interface as shown above, it indicates that there the vehicle is faulty. You can quickly enter the fault information interface by clicking "Fault Alarm Information" on main interface. Vehicle fault information is shown below.

User reminder category

Event number	Fault description	Troubleshooting method	Note (Fault Level)
1	Power-on with gear signal detected	Re-engage the gear.	
2	Power-on with throttle signal detected	Release the electronic throttle pedal.	
4	Power-on with thumb control signal detected	Release the thumb control.	
8	No seat signal detected for extended period	Return to the driver's position.	
16	Drive motor offline	Check the motor fuse and wiring harness connections.	
32	Oil pump motor offline	Check the motor fuse and wiring harness connections.	
64	Main positive relay not closed, both forward and reverse gear signals present, motor fault level 3 or higher, high battery discharge or regeneration power, low battery temperature	Check the main interface to verify if both forward and reverse gear signals are active simultaneously. Navigate to the fault interface to check for motor or battery-related faults, and contact the relevant engineer.	

VCU DTC

Event number	Fault description	Troubleshooting method	Note (Fault Level)
1	Abnormal signal from one path of electronic throttle pedal sensor	Check the electronic throttle pedal connector and measure voltage with a multimeter. If abnormal, replace the electronic accelerator pedal (When the pedal is not pressed, the power voltage is 5V±0.1V, one signal voltage is 1.1V±0.1V, and the other signal voltage is 0.55V±0.05V)	
2	Abnormal signals from both paths of electronic throttle pedal sensor	Check the electronic throttle pedal connector and measure voltage with a multimeter. If abnormal, replace the electronic accelerator pedal (When the pedal is not pressed, the power voltage is 5V±0.1V, one signal voltage is 1.1V±0.1V, and the other signal voltage is 0.55V±0.05V)	
4	Pull up the handbrake, acceleration pedal fault	Release the parking brake before reapplying the electronic throttle pedal.	

Travel motor fault code, oil pump motor fault code

Event number	Fault description	Troubleshooting method	Note (Fault Level)
1	Hall overcurrent fault	If the fault persists after the equipment is restarted, contact the supplier.	3
2	IGBT CE pole current too high	If the fault persists after the equipment is restarted, contact the supplier.	3
3	Drive power undervoltage fault	Check if battery power is too low; if yes, charge it immediately Or check if the battery voltage is normal. If abnormal, contact the battery engineer Or check if the motor cable connections are normal; if abnormal, perform repair If none of the above applies, contact the supplier.	3
4	Control power supply too low	Check if the auxiliary battery voltage is below 9V. If yes, inspect the DC converter. If not, check whether the motor's low-voltage 23-pin interface is abnormal. If none of the above applies, contact the supplier.	3
5	Bus overvoltage fault	Check if the battery voltage is normal. If abnormal, contact the battery engineer; if normal, contact the supplier.	3
7	Encoder abnormal fault	Check the motor's low-voltage 23-pin interface for abnormalities. If yes, reconnect the 23-pin connector. If not, contact the supplier.	3
8	Output lack of phase	If the fault persists after the equipment is restarted, contact the supplier.	3

Event number	Fault description	Troubleshooting method	Note (Fault Level)
10	Bus undervoltage fault	Check if battery power is too low; if yes, charge it immediately Or check if the battery voltage is normal. If abnormal, contact the battery engineer Or check if the motor cable connections are normal; if abnormal, perform repair If none of the above applies, contact the supplier.	3
11	Current detection fault	If the fault persists after the equipment is restarted, contact the supplier.	3
17	Active discharge fault	If the fault persists after the equipment is restarted, contact the supplier.	3
26	Fast undervoltage fault	Check if battery power is too low; if yes, charge it immediately Or check if the battery voltage is normal. If abnormal, contact the battery engineer Or check if the motor cable connections are normal; if abnormal, perform repair If none of the above applies, contact the supplier.	3
29	Hardware overvoltage fault	If the fault persists after the equipment is restarted, contact the supplier.	3
36	CAN2 initialization fault	If the fault persists after the equipment is restarted, contact the supplier.	2
37	CAN2 transmission timeout fault	Restart the equipment. If the fault persists, check the motor's low-voltage 23-pin interface for abnormalities. If yes, reconnect the 23-pin connector. If not, contact the supplier.	2
40	EEPROM reading/writing failure	If the fault persists after the equipment is restarted, contact the supplier.	3
41	CAN2 reception timeout fault	Restart the equipment. If the fault persists, check the motor's low-voltage 23-pin interface for abnormalities. If yes, reconnect the 23-pin connector. If not, contact the supplier.	2
45	CAN chip reports Busoff fault	If the fault persists after the equipment is restarted, contact the supplier.	2
64	Controller NTC overtemperature alarm	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	2

Event number	Fault description	Troubleshooting method	Note (Fault Level)
65	Controller NTC overtemperature fault	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	3
66	Controller overload alarm	If the fault persists after the equipment is restarted, contact the supplier.	2
67	Controller TJ overtemperature alarm	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	2
68	Controller TJ overtemperature fault	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	3
69	Motor overtemperature alarm	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	2
70	Motor overtemperature fault	Check whether the vehicle is operating under high-intensity conditions. If yes, shut it down for cooling. If not, check whether the MCU water pump is functioning properly. If abnormal, replace the MCU water pump. Alternatively, check if the coolant level is insufficient. If low, refill the coolant. Also check whether the water hoses are properly connected. If not, perform repairs. If none of the above applies, contact the supplier.	3
72	Motor temperature sensor fault	If the fault persists after the equipment is restarted, contact the supplier.	2
73	Operation sequence protection alarm	Incorrect vehicle operation sequence. Re-engage the gear correctly.	2

Event number	Fault description	Troubleshooting method	Note (Fault Level)
74	High-speed shutdown protection alarm	If the fault persists after the equipment is restarted, contact the supplier.	2
75	High-speed mis-shift protection alarm	If the fault persists after the equipment is restarted, contact the supplier.	2
76	High torque shutdown protection alarm	If the fault persists after the equipment is restarted, contact the supplier.	2
77	Motor overspeed	Check if the electronic throttle pedal was fully pressed during downhill operation. If yes, remind the customer to operate the vehicle properly. If not, restart the equipment. If the fault persists, contact the supplier.	3
127	Bus undervoltage warning	Check if battery power is too low; if yes, charge it immediately Or check if the battery voltage is normal. If abnormal, contact the battery engineer Or check if the motor cable connections are normal; if abnormal, perform repair If none of the above applies, contact the supplier.	2
128	Bus overvoltage warning	Check if the battery voltage is normal. If abnormal, contact the battery engineer; if normal, contact the supplier.	2

Battery Management System (BMS) fault code

Event number	Fault description	Troubleshooting method
1	Cell voltage too high	Immediately stop charging, power off the entire vehicle, lock it, and let it remain stationary for 2 minutes. After clearing the fault, resume operation or discharge. If the fault persists, a service engineer should inspect whether the voltage sampling line is broken, has a cold solder joint, or if the acquisition board is abnormal.
2	Cell voltage too low	Charge the vehicle promptly. If the fault persists, a service engineer should inspect whether the voltage sampling line is broken, has a cold solder joint, or if the acquisition board is abnormal.
3	Total voltage too high fault	Immediately stop charging, power off the entire vehicle, lock it, and let it remain stationary for 2 minutes. After clearing the fault, resume operation or discharge. If the fault persists, a service engineer should inspect whether the voltage sampling line is broken, has a cold solder joint, or if the acquisition board is abnormal.
4	Total voltage too low fault	Charge the vehicle promptly. If the fault persists, a service engineer should inspect whether the voltage sampling line is broken, has a cold solder joint, or if the acquisition board is abnormal.
5	Pressure difference consistency fault	Charge the vehicle promptly. If the fault is not resolved, a service engineer shall determine the fault level and perform battery balancing maintenance or after-sales repair

Event number	Fault description	Troubleshooting method
6	Temperature difference fault	After powering off the entire vehicle, let it stand to allow the battery to cool down naturally. If the fault remains, a service engineer should check the temperature sensor, acquisition board, cooling circuit, or heating circuit. Event number Fault description Troubleshooting method
7	Temperature too high fault	Discontinue use; power down vehicle and cool battery by natural or forced methods If the fault remains, a service engineer should check the temperature sensor, acquisition board, cooling circuit
8	Temperature too low fault	When operating in a low-temperature environment, the vehicle may require charging heating or stationary heating. If the fault persists, a service engineer should inspect the temperature sensor, acquisition board, heating element, and heating circuit.
9	Low SOC fault	Charge the vehicle promptly.
10	Insulation fault	Ensure the vehicle is in a well-ventilated and dry environment, and check for any moisture ingress in high-voltage components. If the fault is not resolved, a service engineer shall disconnect high-voltage outputs one by one to identify the faulty high-voltage component by whether the issue clears. Check the power harness for damage or exposed insulation. Verify that the high-voltage connectors on the battery box are dry. If all above are normal, proceed with internal inspection of the battery box.
11	Excessive feedback power fault	If the vehicle experiences sustained high-current regeneration, immediately stop driving, power off the entire vehicle, lock it, and remain stationary for 2 minutes.
12	Excessive discharge power fault	If the vehicle experiences sustained high-current discharge, immediately stop driving, power off the entire vehicle, lock it, and remain stationary for 2 minutes.
13	Overall fault status	For non-specific faults, the highest-level battery fault will be displayed.
14	Low-voltage power supply too high	After powering off the entire vehicle, let it stand for 2 minutes, then restart. If the fault persists, a service engineer should check whether the DC power output voltage is normal and whether the low-voltage wiring harness connections are intact.
15	Low-voltage power supply too low	Replace the 12V power supply and check if the fault is cleared after starting the vehicle. If the fault persists, a service engineer should check whether the DC unit is functioning normally, whether the DC relay is engaging properly, and whether the DC fuse is intact.
16	SOC Jump fault	Power off the vehicle and let it stand; the fault should be cleared.
17	Charging socket overtemperature	Stop charging and determine whether the sensor is faulty based on the ambient temperature of the vehicle. Allow the charging port to cool down naturally. If the fault persists after reattempting charging, a service engineer shall inspect the temperature sensor of the charging port and its wiring harness.
18	Abnormal temperature rise during heating	A service engineer shall check the heating relay, heating element, and heating circuit.
19	MSD interlock fault	A service engineer shall inspect the MSD and verify the

		interlock circuit connection. Caution must be exercised during troubleshooting. If the cause cannot be identified, seek assistance from qualified technical personnel.
20	VCU offline fault	Check whether the vehicle communication connectors are securely connected. If the fault persists, a service engineer should check the VCU and related wiring harness for abnormalities.
21	BMS internal communication fault	A service engineer shall inspect the power supply lines and communication lines, eliminate sources of interference, and replace the BMS board to confirm whether the fault is cleared.

Event number	Fault description	Troubleshooting method
22	Thermal runaway fault	Immediately stop using the vehicle. A service engineer shall check the battery for external and internal structural damage, and review historical data, temperature sensor readings, and cell status via the upper computer
23	Cell voltage detection fault	The service engineer shall use the upper computer to locate the voltage detection fault, check the reliability of the nickel sheet connection, and check for broken FPC, insecure connections, or a faulty acquisition board
24	Current detection fault	The service engineer shall verify the shunt connection, inspect the current detection circuit for integrity and reliability, and replace the current sensor or main control board using a substitution method for troubleshooting.
25	Balance circuit fault	Power off the vehicle and let it stand; the fault should be cleared. If the fault persists, replace the board.
26	High temperature in balanced area	Power off the vehicle and let it stand; the fault should be cleared. If the fault persists, replace the board.
27	PCB board internal temperature too high	Power off the vehicle and let it stand; the fault should be cleared. If the fault persists, replace the board.
28	Main negative relay adhesion fault	The service engineer shall use the upper computer to force disengage the relay to check for sticking, and replace the relay if necessary.
29	Main negative relay failure fault	A service engineer shall use the upper computer to force the relay to engage and determine whether it can operate normally. If the relay fails to engage, check whether the relay power supply is normal. If the relay still cannot engage normally, replace the relay or main control board.
30	Main positive relay adhesion fault	The service engineer shall use the upper computer to force disengage the relay to check for sticking, and replace the relay if necessary.
31	Main positive relay failure fault	A service engineer shall use the upper computer to force the relay to engage and determine whether it can operate normally. If the relay fails to engage, check whether the relay power supply is normal. If the relay still cannot engage normally, replace the relay or main control board.
32	Fast charge relay adhesion fault	The service engineer shall use the upper computer to force disengage the relay to check for sticking, and replace the relay if necessary.
33	Fast charge relay failure fault	The after-sales engineer shall use the upper computer to forcibly pull in the relay to determine whether it can be pulled in normally. If not, check whether the relay power supply is normal. If it cannot be pulled in normally, replace the relay or main control board.
34	Heating relay adhesion fault	The service engineer shall use the upper computer to force disengage the relay to check for sticking, and replace the relay if necessary.
35	Heating relay failure fault	A service engineer shall use the upper computer to force the relay to engage and determine whether it can operate normally. If the relay fails to engage, check whether the relay power supply is normal. If the relay still cannot engage normally, replace the relay or main control board.
36	Cell temperature detection fault	The service engineer shall use the upper computer to locate the temperature detection fault, and check for

		broken acquisition wires, insecure connections, or a faulty acquisition board.

Event number	Fault description	Troubleshooting method
37	Charging socket NTC fault	Stop charging and allow the system to stand and cool down. If the fault persists, the service engineer shall inspect the sensor and wiring harness connections for reliability.
38	Fast charging current abnormal fault	Immediately stop charging, power off the entire vehicle, lock it, and let it remain stationary for 2 minutes. If the fault persists after reattempting charging, a service engineer shall inspect the shunt, acquisition board, and acquisition circuit wiring for proper connection and function.
39	DC relay fails to close alarm	A service engineer shall use the upper computer to force the relay to engage and determine whether it can operate normally. If the relay fails to engage, check whether the relay power supply is normal. If the relay still cannot engage normally, replace the relay or main control board.
40	DC relay fails to open alarm	The service engineer shall use the upper computer to force disengage the relay to check for sticking, and replace the relay if necessary.
41	Precharge relay fails to close alarm	A service engineer shall use the upper computer to force the relay to engage and determine whether it can operate normally. If the relay fails to engage, check whether the relay power supply is normal. If the relay still cannot engage normally, replace the relay or main control board.
42	Charging gun connection signal exception	Unplug and reinsert the charging gun, then reattempt charging. If the fault persists, a service engineer shall inspect the charging socket wiring harness and vehicle wiring harness.
43	Fast charging communication fault	A service engineer shall collect communication logs for technical analysis, and troubleshoot the vehicle, battery, charger status, and cable connections.
44	Precharge failure fault	A service engineer shall collect communication logs for joint technical analysis, and inspect the precharge circuit, precharge relay, precharge resistor, wiring connections, and the BMS board. Troubleshoot the vehicle's electronic control system.

DCDC converter fault code

Event number	Fault description	Troubleshooting method	Note (Fault Level)
1	DCDC output overvoltage	Use a multimeter to measure the output voltage. If the voltage exceeds 16V, the DC converter is abnormal and must be replaced.	2
2	DCDC output undervoltage	Use a multimeter to measure the output voltage. If the voltage is below 9V, the DC converter is abnormal and must be replaced.	2
3	DCDC overtemperature	Stop the vehicle and check whether the cooling fans are operating properly. Alternatively, check whether the vehicle is operating under excessive load.	2

		Or verify whether the DC converter's heat dissipation surface is firmly attached to the vehicle frame.	
4	DCDC output overcurrent	Power off and disconnect the DC output cable, then restart the system to check if the fault persists. If an output overcurrent fault is still reported, replace the DC converter. If the fault disappears, check for a short circuit on the vehicle side.	2
Event number	Fault description	Troubleshooting method	Note (Fault Level)
5	DCDC input overvoltage	Check whether the DC input voltage is within the range of 250V–450V. If yes, replace the DC converter; if not, contact the battery engineer.	2
6	DCDC input undervoltage	Check whether the DC input voltage is within the range of 250V–450V. If yes, replace the DC converter; if not, contact the battery engineer.	2

4.3 Vehicle control unit

4.3.1 Overview

The SANY Vehicle Control Unit VCU is a new product specially developed for more advanced industrial vehicles and engineering machinery control systems.

The controller adopts advanced multi-core technology, which provides the controller with higher computing power and execution speed, making the control software more efficient and reliable.

With independent multi-channel I/O control ports and CAN communication; with an IP67 protection level, its compact housing design can withstand extreme humidity, vibration, temperature changes, and mechanical loads.

Note: The manufacturer is responsible for the quality assurance of motor controller. In case of fault, the manufacturer should be notified in time to provide after-sales service. If you are not authorized by the manufacturer, do not open and repair it without independently. If personal injury or property loss is caused by unauthorized repair by the user, the responsibility shall be borne by the user.

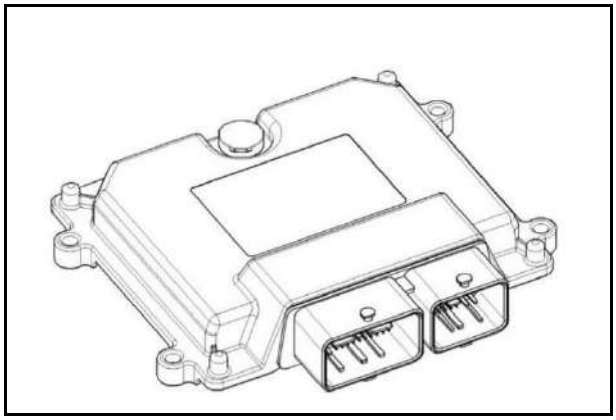


Figure 4-3

4.3.2 Inspection and Maintenance

1. Non-professionals are strictly prohibited from equipment installation, wiring, maintenance, testing, or components replacement.

2. Do not perform wiring operations with the power on, as there is a risk of electric shock.

3. Before wiring, please turn off the power of equipment. After cutting off the power supply, there is residual voltage inside the equipment. Please wait at least 10 minutes before wiring or other operations.

4. Be sure to ensure good grounding for the equipment and products, otherwise there is a risk of electric shock.

5. Follow the steps specified in the Electrostatic Discharge (ESD) prevention measures, and wear an antistatic wrist strap for wiring operations to avoid damaging the circuits inside the equipment and products.

6. It is strictly prohibited to connect the input power supply to the output terminal of the equipment or product, as it may cause damage to the equipment or even lead to a fire.

7. When connecting the drive device to the motor, make sure that the phase sequence of the actuator and motor terminals is accurate to avoid motor reverse rotation.

8. After wiring is completed, make sure there are no dropped screws or exposed cables inside the equipment and products.

4.4 Motor electronic control

4.4.1 Overview

The electric drive assembly is a 2-in-1 electric drive assembly that highly integrates the motor and electronic control system.

Utilizes high-performance chips for optimized performance.

Software noise reduction and jitter suppression.

4.4.2 Security statement

- This chapter explains the safety precautions that need to be observed when using this product. Before using this product, please read the user manual and understand the relevant information about safety precautions. Failure to comply with the provisions of the safety precautions may result in death, serious injury, or equipment damage.
- This product should be used in an environment that meets the design specifications, otherwise faults may occur, and any abnormal functions or unit damage caused by non-compliance with relevant regulations are not covered by the product warranty.
- If any personal safety accidents or property losses are caused by not complying with the contents of this book or operating the product in violation of the rules, we will not assume any legal responsibility.
- All operations should be completed by qualified professionals, who must be electrical engineers with the following capabilities:

1. Have received professional training;

2. Have knowledge and experience in the field of electrical engineering;

3. Have a sense of danger.

- Professionals must be able to complete assigned tasks independently, recognize possible dangers, and establish necessary protective measures.

4.4.3 Safety precautions

Safety level definitions

- Danger indicates a hazardous situation that, if not avoided, will result in death or serious injury.
- Warning indicates a hazardous situation that, if not avoided, could result in death or serious injury.
- Caution indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

Note: The illustrations of the products in this manual sometimes show the products with the outer cover or safety cover removed to display product details. When using this product, be sure to install the outer cover or cover as required and operate according to the instructions in the manual.

Note: The product illustrations in this manual are for reference only and may differ slightly from the product you ordered. Please refer to the actual product you ordered.

Unboxing acceptance

Warning

If you find any damage, rust, signs of previous use, etc. on the product and its accessories when unpacking, do not install it!
If you find water inside the product, missing units, or damaged units when unpacking, do not install it!
Please carefully check the packing list. Do not install if the packing list does not match the product name!

Note

Before opening the box, please check that the outer packaging of the equipment is intact, damaged, wet, damp, deformed, etc.
Please open the packaging in order, and do not hit it violently!
When opening the box, please check for any damage, rust, scratches, etc. on the surface of the equipment and accessories.
After opening the box, please carefully check the packing list to verify if the equipment and accessories are complete in quantity and information.

Installation

Danger

Non-professionals are strictly prohibited from operating!
Only professionals with electrical training and knowledge are allowed to operate.

Warning

Please read the user manual and safety precautions carefully before installation!
Do not install this product in places with strong electric fields or strong electromagnetic interference!
Before installation, ensure that the mechanical strength of the installation location is sufficient to support the weight of the equipment to avoid mechanical hazards.
Do not wear loose clothing or ornaments during installation work to avoid the risk of electric shock!
When installing the product in a closed environment (such as a cabinet or chassis), use cooling devices (such as cooling fans or air conditioners) for sufficient cooling to meet the installation environment requirements, otherwise it may cause the product to overheat or catch fire.

Warning

Modification of this product is strictly prohibited!
Do not twist the fixed bolts of product parts and components with red marked bolts!
When installing this product in a cabinet or terminal equipment, the cabinet or terminal equipment should be equipped with corresponding protective devices such as fireproof enclosure, electrical protection enclosure, and mechanical protection enclosure. The protection level should comply with relevant IEC standards and local laws and regulations.
When installing devices that require transformers and other strong electromagnetic interference, please install shielding protective devices to avoid malfunctions of this product!
Please install the product on a fire-resistant object such as metal, do not let flammable materials come into contact with the product or adhere to the product, as this may cause a fire.

Note

When performing installation work, cover the top of the product with cloth or paper to prevent metal shavings, oil, water, and other foreign objects from entering the interior of the product during drilling, leading to product fault.
After the operation is completed, remove the cover to prevent the cover from blocking the ventilation holes and affecting heat dissipation, causing abnormal heating of the product.
When changing the speed of a mechanically operated device that runs at a constant speed, resonance may occur. At this time, installing anti-vibration rubber under the motor frame or using vibration suppression function can effectively reduce resonance.

Wiring

Danger

Non-professionals are strictly prohibited from installing, wiring, maintaining, inspecting, or replacing parts of the equipment!
Before wiring, please cut off the power supply of equipment. After cutting off the power supply, there is residual voltage in the internal capacitors of the equipment. Please wait for at least the time specified on the warning label before wiring or other operations. Measure the DC voltage of the main circuit to confirm that it is below the safe voltage, otherwise there is a risk of electric shock.
Please perform wiring operations, remove product covers, or touch circuit boards only when the power is disconnected to avoid the risk of electric shock.
Ensure proper grounding of equipment and products to prevent the risk of electric shock.

Warning

It is strictly prohibited to connect the input power supply to the output terminal of the device or product, as it may cause damage to the equipment or even lead to a fire.
When connecting the drive equipment to the motor, make sure that the product's phase sequence matches the motor terminals to avoid motor reverse rotation.
The cables used for wiring must meet the corresponding requirements for wire diameter and shielding. The shielding layer of shielded cables needs to be reliably grounded at one end.
Tighten the terminal screws according to the specified torque in the manual. Insufficient or excessive torque may cause overheating and damage to the connection, leading to the risk of fire.
After wiring is completed, ensure that all cable connections are correct and there are no dropped screws, gaskets, or exposed cables inside the product, as there may be a risk of electric shock or product damage.

Note

Follow the steps specified in the Electrostatic Discharge (ESD) prevention measures, and wear an antistatic wrist strap for wiring operations to avoid damaging the circuits inside the equipment or products.
When wiring the control circuit, use twisted pair shielded cable and connect the shielding layer to the grounding terminal of the product, or it may cause abnormal operation.

Power on

Danger

Before powering on, confirm that the product is properly installed, the wiring is secure, and the motor device allows for restart.
Before powering on, please make sure the power supply meets the product requirements to avoid product damage or fire hazards!
Opening the product cabinet door or protective cover, touching any terminal of the product, disassembling any device or component of the product while it is powered on is strictly prohibited, as there is a risk of electric shock!

Warning

After wiring and parameter setting are completed, please conduct a machine trial run to confirm that the machine can operate safely, otherwise it may result in injury to personnel or equipment damage.
Before powering on, please ensure that the rated voltage of the product matches the power supply voltage. Using the wrong power supply voltage can lead to fire hazards.
Before powering on, please ensure that there are no personnel around the product, motor, and machinery to avoid injury or death.

Operation

Danger

Non-professionals are strictly prohibited from operating the product to prevent the risk of injury or death!
Do not touch any terminal of the equipment, disassemble any device or parts of the equipment or product while it is running to avoid the risk of electric shock!

Warning

Do not touch the equipment housing, fan, or resistor to test the temperature while it is running to prevent burns!
During operation, avoid other items or metal objects from falling into the equipment to prevent fire or product damage!

Maintenance

Danger

Non-professionals are strictly prohibited from installing, wiring, maintaining, inspecting, or replacing parts of the equipment!
Maintenance of equipment is strictly prohibited while the power is on, or there is a risk of electric shock!
After cutting off the power supply of equipment, please wait for at least the time specified on the warning label before performing maintenance operations on the equipment.
When using a PM motor, even if the power of the product is turned off, there will be induced voltage on the motor terminals during motor rotation. Do not touch the motor terminals, as there may be a risk of electric shock.

Warning

Please perform daily and regular inspections and maintenance of equipment and products according to maintenance requirements, and keep maintenance records.

Repair

Danger

Non-professionals are strictly prohibited from installing, wiring, maintaining, inspecting, or replacing parts of the equipment!
Do not perform equipment repair while the power is on, as there is a risk of electric shock!
After cutting off the power to equipment, please wait for at least the time specified on the warning label before performing equipment inspection, repair, or other operations.

Warning

Please follow the product warranty agreement for equipment repairs.
When a fuse blows, a circuit breaker trips, or a earth leakage circuit breaker (ELCB) trips, please wait for at least the time specified on the warning label before restoring power or operating the machine, as failure to do so may result in personal injury or equipment damage.
When equipment malfunctions or is damaged, it must be troubleshooted and repaired by professional personnel according to the repair instructions, and repair records must be kept.
Please follow the instructions for replacing vulnerable parts of the product.
Do not use a damaged machine, as it may cause personal injury or further damage to the product.
After replacing the equipment, be sure to recheck the equipment wiring and parameter settings.

Scrapped

Warning

Please scrap equipment and products in accordance with relevant national regulations and standards to avoid property loss or personal injury!

Dispose of scrapped equipment and products in accordance with industrial waste disposal standards to avoid environmental pollution.

Safety signs

To ensure safe operation, please strictly follow the safety signs pasted on the equipment and do not damage or remove them. Description of safety signs:

Warning

Before installation and operation, be sure to read the user manual to avoid the risk of electric shock!

Before maintenance, inspection, and wiring, switch the power on the input and output sides, wait for 10 minutes, and start work after the power indicator light is completely off.

Do not touch the radiator after power on to avoid burns!

4.4.4 Description of motor units

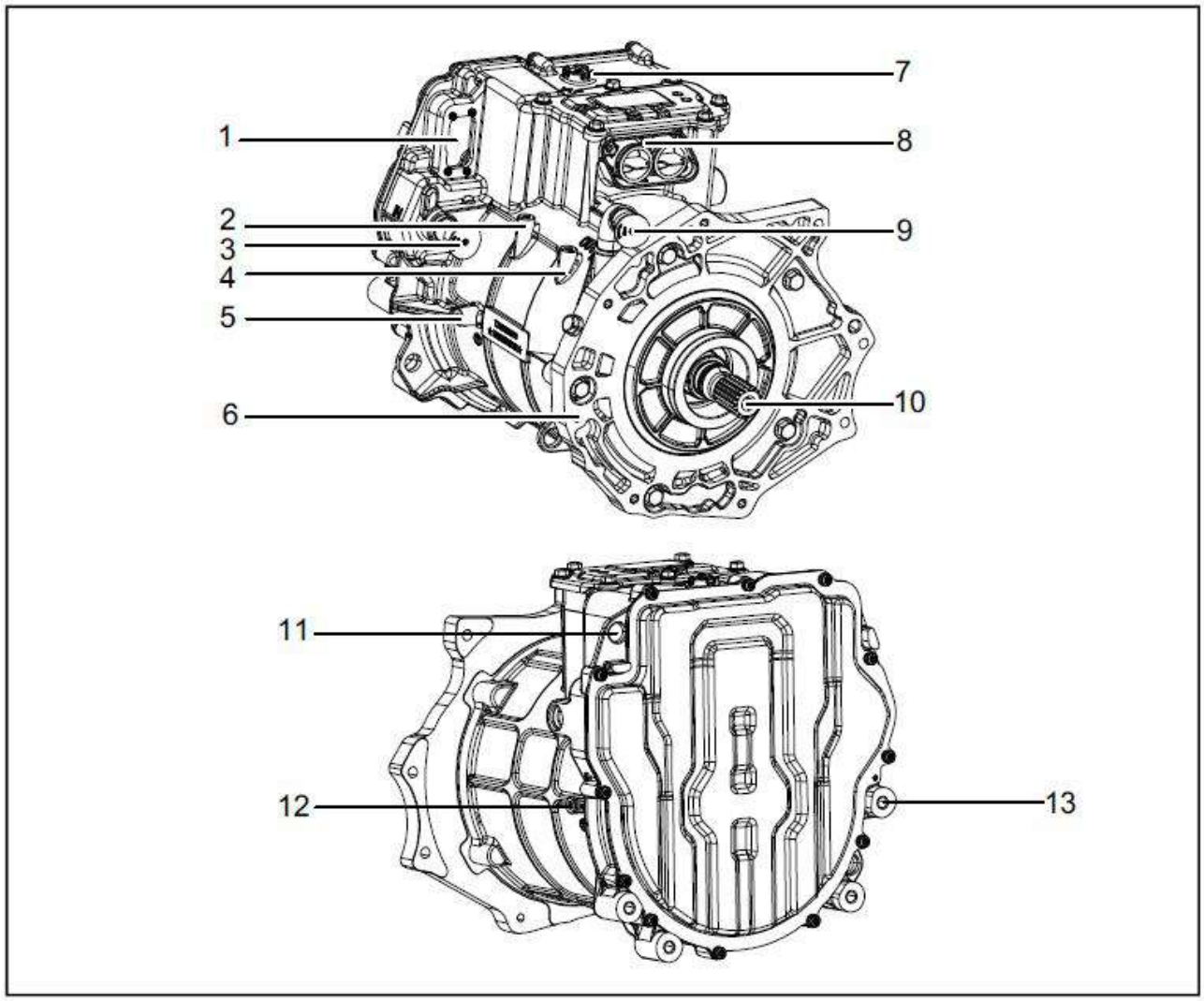


Figure 4-4

1. 23Pin low voltage socket
2. Low-voltage communication cable tie-down point
3. Inlet tap
4. Water inlet hose securing point
5. Grounding point
6. Rear suspension fixed hole
7. Waterproof breathing valve
8. High-voltage terminal block
9. Outlet tap
10. Motor axes (including interface spline)
11. Lug
12. Grounding point
13. Rear suspension fixed hole

4.4.5 Motor installation environment requirements

1. Avoid installing in dusty or oily places.

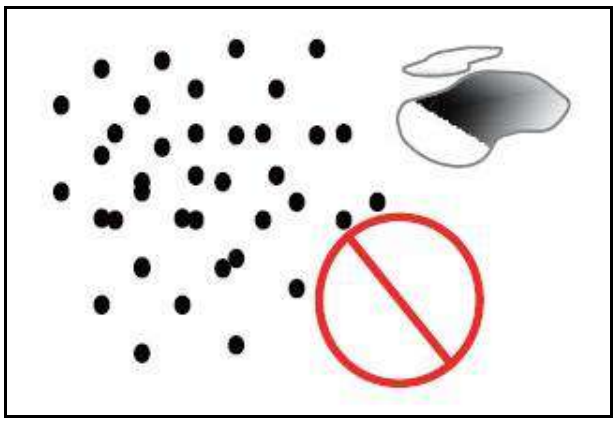


Figure 4-5

2. Avoid installing in environments with ambient temperatures of -40°C to +85°C or humidity exceeding 98%

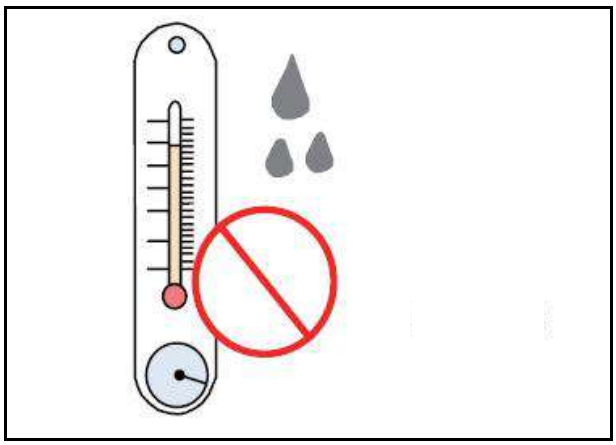


Figure 4-6

3. Avoid installing near heat sources.

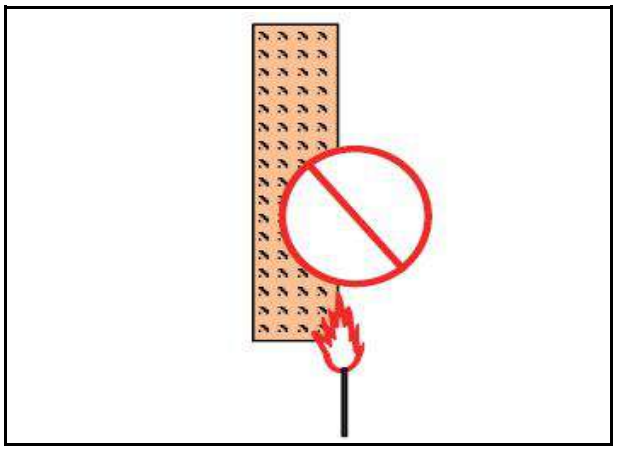


Figure 4-7

4. Avoid installing in places with flammable, explosive, or corrosive gases.

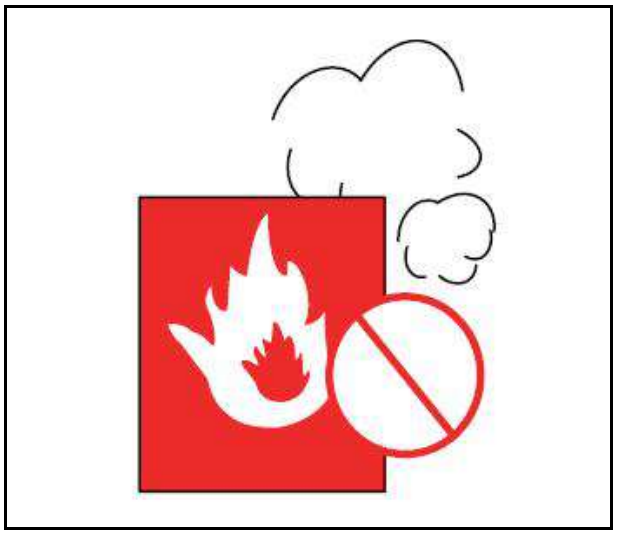


Figure 4-8

4.4.6 Motor assembly procedures

1. Unpack.
2. Check before installation.
3. Install the whole machine.
4. Install water pipes.
5. Install ground wires.
6. Install weak cables.
7. Install power cables.
8. Check after installation. Notes:

• Steps 3-4 are mechanical installation steps, and steps 5–7 are electrical installation steps.

• If you need to disassemble the product, please first remove the water pipe, clean the coolant inside the product, and then disassemble the power cable and weak cable to avoid coolant flowing into the terminal and causing a short circuit.

4.5 Battery system

4.5.1 Use of lithium batteries

The correct use and daily maintenance of lithium batteries have a significant impact on the performance and service life of the batteries. Therefore, users should use, maintain, and care for lithium batteries in accordance with the specifications in this manual.

To avoid unnecessary personal injury and property damage, please read this manual before using the electric forklift truck and follow the procedures or methods specified in this manual for normal use and operation.

If you have any questions or uncertainties, please contact our company's after-sales service department or relevant technical department.

4.5.2 Safety precautions of lithium batteries

1. Ensure that the battery is kept away from dangerous substances or environments, such as conductive dust particles, corrosive chemicals, flammable materials, hazardous mechanical equipment, high-temperature environments, etc.

2. Improper use of this series of products may result in smoking, such as external short circuits, overcharging, high ambient temperatures, etc. In case of smoking, cut off the power supply in time, use sand and dry powder extinguishers for treatment, evacuate the crowd promptly and report to the police.

3. Improper use of this series of products may cause individual batteries to swell, and in severe cases, the outer shell may crack or develop cracks. In this case, stop using the battery immediately and contact our after-sales service department or relevant technical department for handling methods.

4. It is forbidden to disassemble, squeeze, puncture, place in high temperature, or bake the battery pack, to avoid excessive vibration, external impact, or falling from a height, which may cause personal injury or property loss.

5. Do not short-circuit the positive and negative poles of the battery directly, avoid the positive and negative poles of the battery being short-circuited by pressing the battery pole tightening bolts and any metal or other conductive objects outside the conductive strip. This operation may cause personal injury or property loss.

6. Do not expose the battery to an environment above 55°C or place it for a long time, and do not attempt to heat or throw the battery into the fire. This operation may cause personal injury or property loss.

7. It is prohibited to charge the battery without installing a reasonable charging protective device (such as lithium-ion battery protection circuit board, battery management unit, etc.) or using charging equipment not approved by the battery manufacturer (chargers, DC power supplies, etc.), as this operation may cause personal injury or property loss.

8. It is prohibited for unauthorized personnel to disassemble or assemble the battery, as this operation may cause personal injury or property loss.

9. It is prohibited to immerse the battery in water or other conductive liquids, as this operation may cause personal injury or property loss.

10. Before using this product, please read the product manual carefully. It is prohibited for children and other untrained personnel to use this series of products.

11. It is prohibited to connect this series of products in series or in parallel with other models or types of batteries, as this operation may cause personal injury or property loss.

12. It is prohibited to connect the entire power system containing lithium-ion battery protection circuit boards or battery management units in series or parallel again, as this operation may cause personal injury or property loss. If necessary, please contact the manufacturer's relevant technical department for correct technical support.

4.5.3 Use precautions of lithium batteries

1. The charging temperature range is: 0-55°C. In environments below 0°C, the battery system has electric heating function. When connecting the charger/charging pile, the battery pack will first enter pure heating mode, and then switch to charging mode after the battery pack warms up. It is recommended to charge the vehicle immediately after use to fully utilize the residual heat of the battery pack and improve charging efficiency.

2. The discharge temperature range is: -20 to 60℃. The discharge capacity at low temperature (-20 to 0℃) may be lower than that at normal temperature, which is normal.

3. The battery can work at an ambient temperature of 45-60℃, but if the ambient temperature is too high, especially if the battery is in a high temperature environment for a long time, which may accelerate the aging of internal materials of the battery and shorten the battery life. Therefore, it is not recommended to use it at high temperature for a long time.

4. Due to factors such as driving habits, working conditions, vehicle usage time, temperature (low temperature in winter), etc. , the vehicle's operating time after a full charge may fluctuate, which is normal.

5. It is strictly prohibited to store or operate the battery below -20°C or above 55°C for extended periods.

6. If lithium batteries are not used for a long time, they should be charged to 40%-60% of their capacity, stored in a dry and cool environment, and recharged according to the battery's instructions to prevent irreversible capacity loss due to excessive self-discharge caused by prolonged storage.

7. The self-discharge of lithium batteries is affected by ambient temperature and humidity. High temperatures and humidity will accelerate the self-discharge of the battery. It is recommended to store the battery in a dry environment at -10°C to 45°C.

8. Non-professionals should not touch, move, disassemble battery packs and corresponding high-voltage cables, or other units with high-voltage warning signs.

9. If the vehicle is subjected to a strong impact during driving, stop the vehicle in a safe area and check that the battery pack area is damaged.

10. If leakage (liquid or smoke) or damage is found in the battery, please move away to a safe distance and contact the manufacturer's after-sales service personnel.

11. Do not touch the electrolyte if it leaks; if accidentally touched, rinse with plenty of water quickly, and seek medical attention promptly if severe.

12. In case of vehicle or battery fire, quickly move away from the vehicle to a safe distance, use sand and dry powder extinguisher for handling, strictly prohibit using water or incorrect fire extinguisher for extinguishing.

13. Please use designated lithium battery charging equipment for charging, strictly prohibit using inferior or other types of charging equipment to charge the battery.

14. During transportation, ensure that the battery is disconnected from the vehicle and charging equipment, with no form of charging or discharging activities.

4.5.4 Lithium battery maintenance

1. When the vehicle is first used after leaving the factory, please charge it to full (the charger/charging pile stops), and use it when the battery level shows 100%.

2. During normal use of the vehicle, in order to calibrate the battery level, it is recommended to fully charge it once or twice a week, and at least once every two weeks.

3. When the battery level is below 20%, please recharge it promptly to prevent over-discharging of the battery. It is forbidden to turn the key switch to the "on" position when the battery level is low.

4. If the vehicle needs to be stored for a long time, please keep the battery level at 40%-60% and do not fully charge it.

5. If the vehicle is not used for a long time, the battery should be maintained every 3 months. The maintenance method is as follows:

1) Charge the vehicle to 100% capacity;

2) Adjust SOC to 50%-70%;

3) Keep the vehicle powered on (on position) and leave it stationary for more than 12 hours. No manual supervision is required during the period.

6. Regularly check the lithium battery charging socket to ensure that the bracket is secured, the socket cover is well sealed, the internal terminals of the socket are not corroded and free of dust, rainwater, and other foreign objects.

7. Keep the surface of the lithium battery dry and clean, and do not wash the lithium battery with water.

4.6 Driver Information Collection Function

4.6.1 Card Reader (Standard)

Basic Information of Card Reader

The working voltage range of the card reader is 12V~60V, and it is equipped with two IC cards with CAN communication.

It is mainly used to unlock the vehicle, upload the unlocking card number, and record the accumulated working time.

Fig. 4-9 Card Reader

The card reader is bound with the driver ID card.

Figure 4-10

Query the binding record or card swiping record.

Figure 4-11

Card Reader Hardware Starting conditions

Card reader hardware opening conditions: turn on the key switch, the delay relay K2 is closed, the output voltage closes the main relay 2, the output voltage supplies power to the fuse F23, and the card reader is powered to work.

Troubleshooting of Card Reader Failure

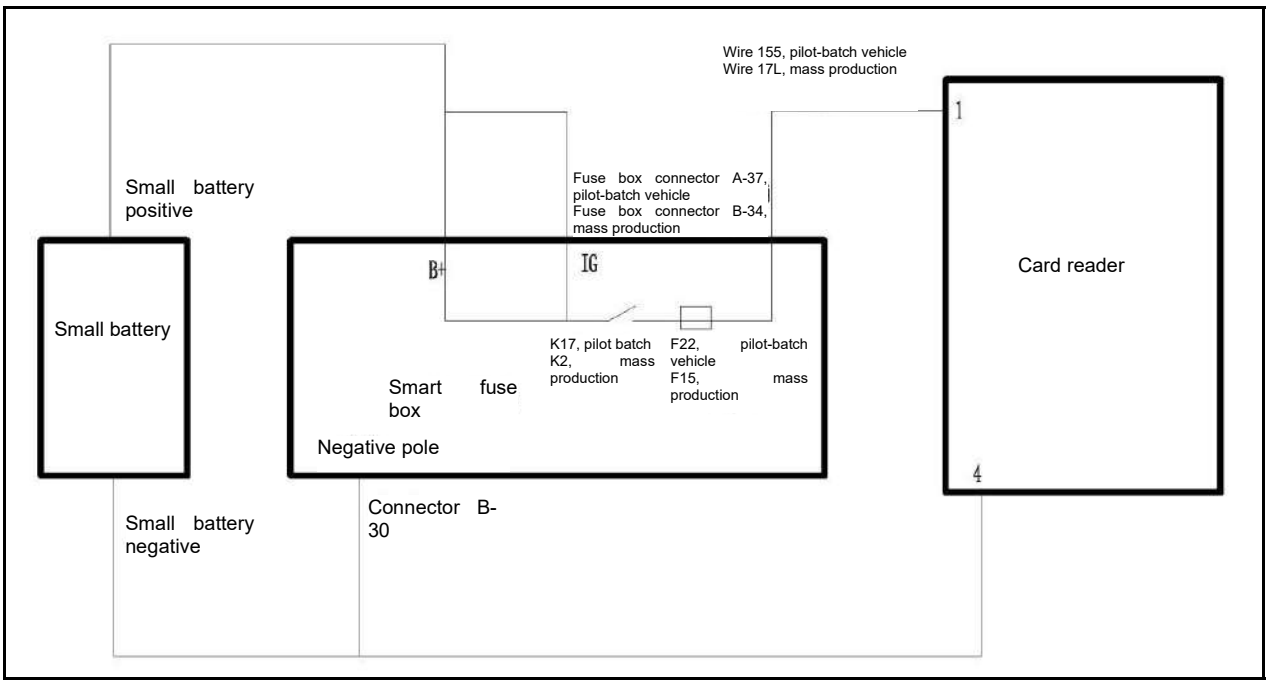


Fig. 4-12 Hardwire Connection Diagram of Card Reader

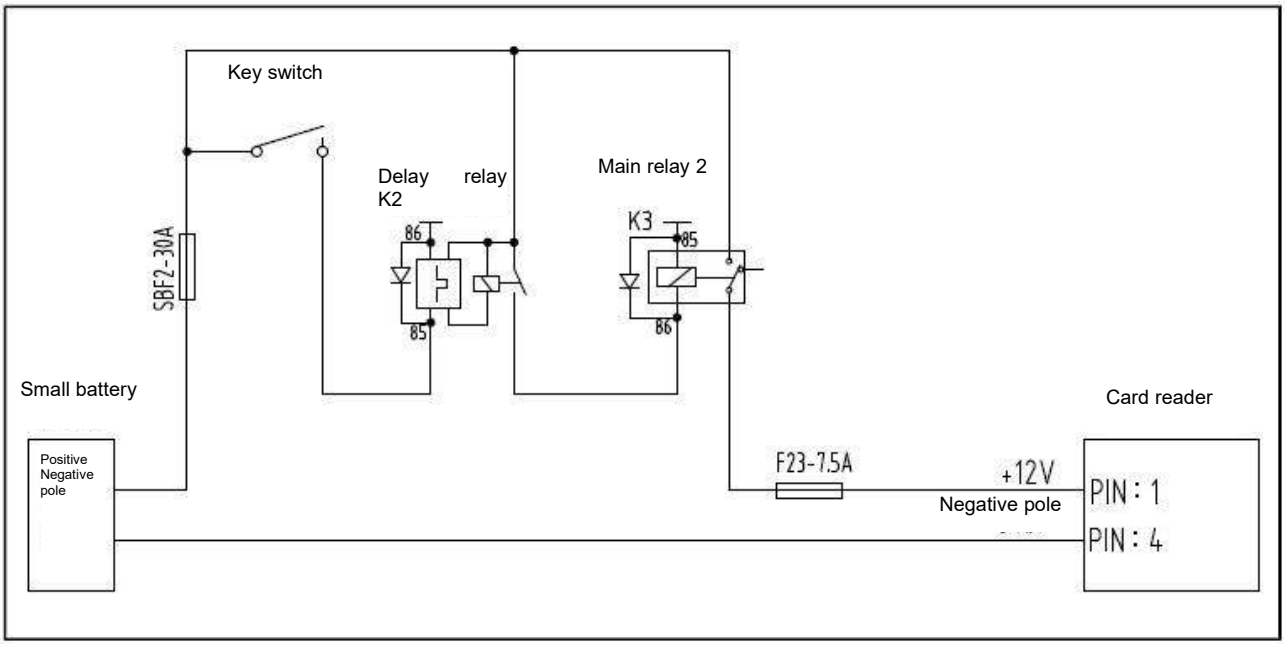


Fig. 4-13 Schematic Diagram of Fault Tree for Card Reader Start Failure

Serial No.	Fault point	Fault	Troubleshooting
1	SBF2–30A fuse blown	Card reader start failure	Measure the voltage between pins 1 and 4 of the card reader with a multimeter at the DC voltage position. If there is 12V power, it indicates that the card reader is damaged and needs to be replaced with a new one. If the voltage is less than 9V, it indicates that the power supply is faulty. Check whether the fuse F23 is damaged; check whether the main relay 2 is damaged; check whether the delay relay is damaged; check whether the key switch is damaged; check whether the small battery is fully charged.
2	Key switch		
3	Delay contactor K2		
4	Main contactor 2		
5	F23-7.5A fuse blown		
6	Card reader is faulty		Replace the card reader

4.6.2 ADAS System (Optional)

The three main functions of the ADAS system: booting by face recognition, driver behavior monitoring, and AI pedestrian recognition.

Booting by Face recognition

Figure 4-14

1. DMS camera	2. Panoramic surveillance camera	3. Intelligent terminal display and control

Process of booting by face recognition:

1. Turn on the vehicle key to start the vehicle, and face the DMS recognition camera; after the recognition is successful, and the vehicle can be used normally; if recognition fails, the vehicle cannot run normally and the mast operation cannot be carried out.

2. During normal driving of the vehicle, continuously monitor whether the driver is in the driving position. If the driver leaves the seat, face recognition needs to be performed again for operation.

Note: It takes **20-30 seconds** to boot the **ADAS system**, which affects the driving experience.

Driver behavior monitoring

Driver behavior monitoring includes the following four functions:

1. Fatigue driving alarm
2. Smoking alarm
3. Illegal call handling during driving alarm
4. Driver leaving the seat alarm

Figure 4-15 Fatigue Driving Monitoring (Cloud Platform Capture)

AI pedestrian recognition

AI pedestrian recognition function (only active when the vehicle is reversing):

During reversing:

1. When a person is detected in the warning zone, the vehicle will issue an audio alarm and automatically reduce speed.

2. When a person is detected within the danger zone, the vehicle will issue a critical audio alarm and automatically apply the brakes.

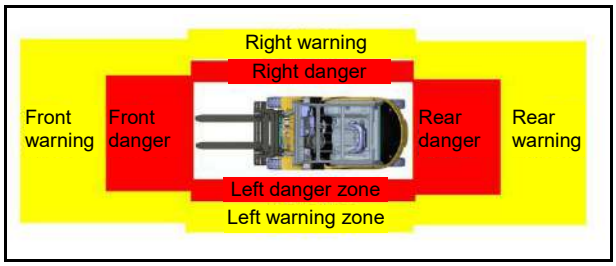


Figure 4-16

Note:

1) Since automatic speed reduction requires a brief period to take effect, the driver must use the foot brake or steer to avoid a collision if the vehicle is moving at high speed;

2) This function is designed as an assistive feature only. Due to a certain probability of misjudgment, it should not be relied upon as the sole safety measure.

Introduction to ADAS System

Introduction to configuration:

Standard version: booting by face recognition

Advanced version: booting by face recognition, driver behavior detection, AI pedestrian recognition

4.7 OPS protection function

When the driver is seated (seat switch signal detected), the OPS lowering solenoid valve closes, allowing travel motor and fork movement.

When the driver leaves the seat (no seat switch signal), the OPS lowering solenoid valve opens, disabling travel motor and fork operation.

If the driver leaves the seat during travel (no seat switch signal), the vehicle will stop. Travel will resume only after the driver returns to the seat and the gear signal returns to neutral, followed by a forward or reverse operation.

During fork lifting, tilting, or side shifting, if the driver leaves the seat, these actions will stop. Upon returning to the seat, the forks will not automatically resume operation; the control must be returned to neutral before related functions can be reactivated.

Maintenance

5. Maintenance

5.1 Transmission system

5.1.1 Transmission system overview

The reduction gearbox is at the end of the transmission system, and is used to change the magnitude and direction of the torque transmitted by the prime mover. The reduction gearbox is composed of the gearbox body, gearbox cover, gear, planetary carrier, gear ring, bearing, brake disc, friction plate and other components. The gear, planetary carrier, bearing, etc. are the transmission mechanism and belong to the transmission system. The brake disc and friction plate belong to the brake system. The gearbox body and gearbox cover are used to install these mechanisms and bear gravity and other external forces.

5.1.2 Installation and usage precautions

1. All parts must be cleaned before assembly, without scratches, and no debris should be brought into the casing. The cleanliness should not be less than 300mg.

2. To avoid damaging the product, do not disassemble or dismantle the product at will.

3. Prevent hitting and damaging the installation surfaces, exposed bearings, oil seals, gears, etc. , to avoid affecting installation and usage.

4. The normal operating oil temperature is 70°C - 95°C, with a maximum not exceeding 110°C.

5. The working oil should be kept clean. The first oil change should be done after 3000 hours of use, and then new oil should be changed every approximately 1000 hours of use.

6. The oil level of the drive axle assembly should be located at the position where the oil level plug is located.

5.1.3 Working principle

The drive motor generates power, which is input to the reducer through spline. The speed is reduced and the torque is increased through the structure of the reducer. Then, the power after deceleration and torque increase is transmitted to the rim through the half shaft at the output end of the reducer. By driving the rim, the power is transmitted to the drive wheel, driving the wheel to rotate.

Service brake

Braking when moving forward: by operating the brake wheel cylinder, the piston is pushed by the brake fluid to drive the brake pull rod, which presses the pressure disc downwards together with the ejector rod, and the pressure disc presses the friction plate and the brake disc tightly to provide the braking force of the vehicle.

The braking action during reverse movement is carried out in the opposite direction and the braking force is the same as during forward movement.

Parking brake

The parking brake is mechanical, which drives the hand brake pull rod by pulling the cable. The pull rod presses down the pressure disc together with the ejector rod, and the pressure disc presses the friction plate and the brake disc tightly to provide the braking force of the vehicle.

5.1.4 Axle Removal

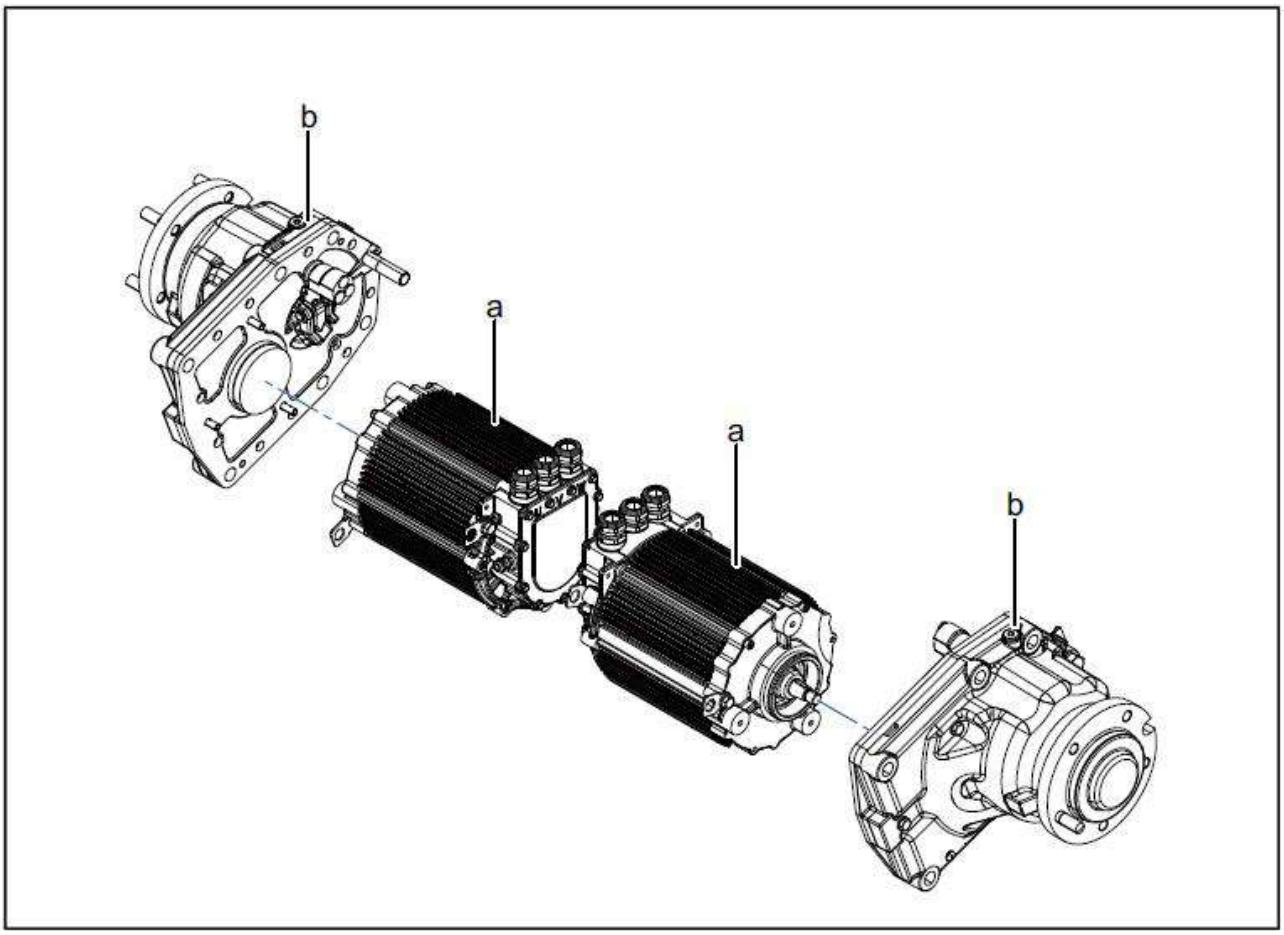


Figure 5-1

a. Motor b. Reduction gearbox

Disassembly:

1. Remove the bolts M8×50 and M8×80 on the reduction gearbox (b), and then remove the reduction gearbox;

2. Remove the slotted self-locking nut and washer on the motor (a), and take out the pinion.

Components description	Characteristics requirements	Tooling, tools
Motor		
Reduction gearbox	Tightening torque of pinion: 68Nm; tightening torque of bolt: 23Nm	Torque wrench, clamp, M8 socket, M14 slotted self-locking nut socket

5.1.5 Axle Installation

1. Install the pinion (1) onto the motor drive shaft until it cannot be pushed gently;

2. Fit a washer (2), and then screw a new slotted self-locking nut (3) onto the drive shaft;

3. Hold the pinion (4) with a clamp (5) and tighten it with a socket wrench (tightening torque 68Nm);

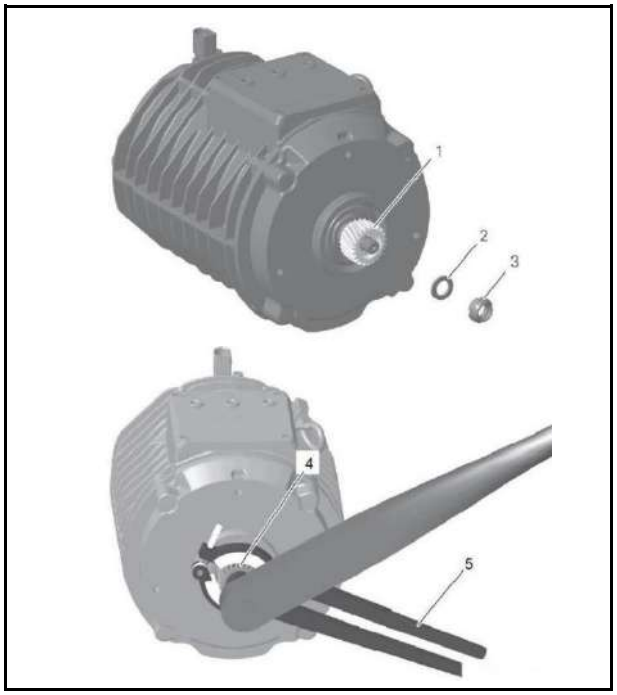


Figure 5-2

1. Fix the motor and gearbox with bolts: use bolts M8×55 at position a; use bolt M8×75 at position b (tightening torque: 23Nm);

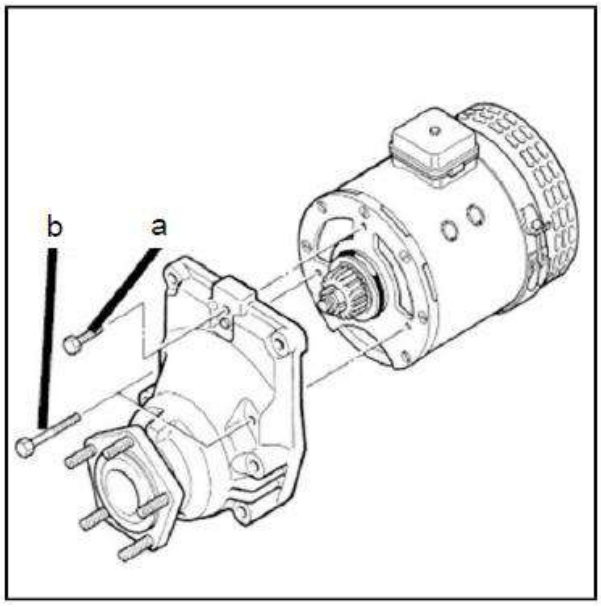


Figure 5-3

When installing:

- 1. The gearbox shall be fixed on a dedicated bracket to ensure that the axle can rotate freely.
- 2. Vertically lift the motor to the top and carefully lower it down. Gently rotate the axle to engage the gears. When the tooth surfaces are fully aligned and engaged, lower the motor until it stops.

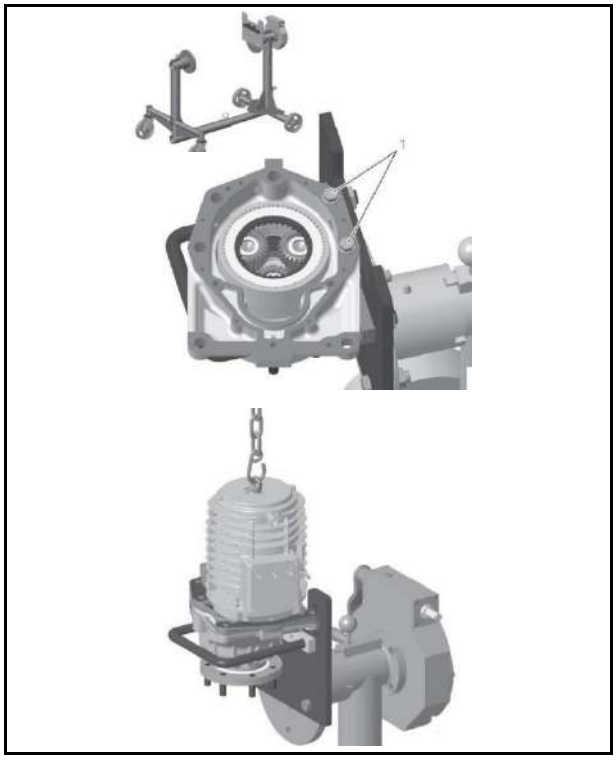


Figure 5-4

5.1.6 Disassembly and assembly of parking brake cable

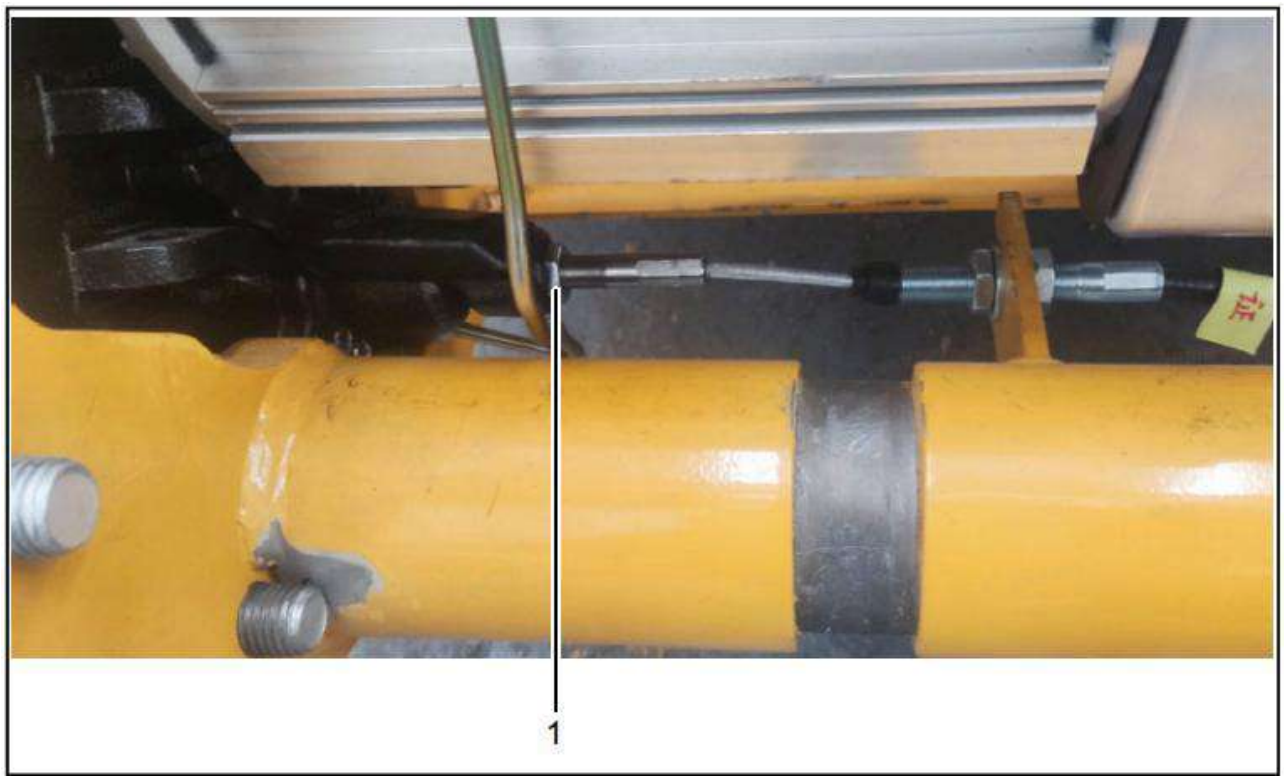


Figure 5-5

1. There is a M10 threaded hole at the end of the drive axle of the right cable, and there is a M10 stud at the end of the right cable. During assembly, screw the stud into the threaded hole.

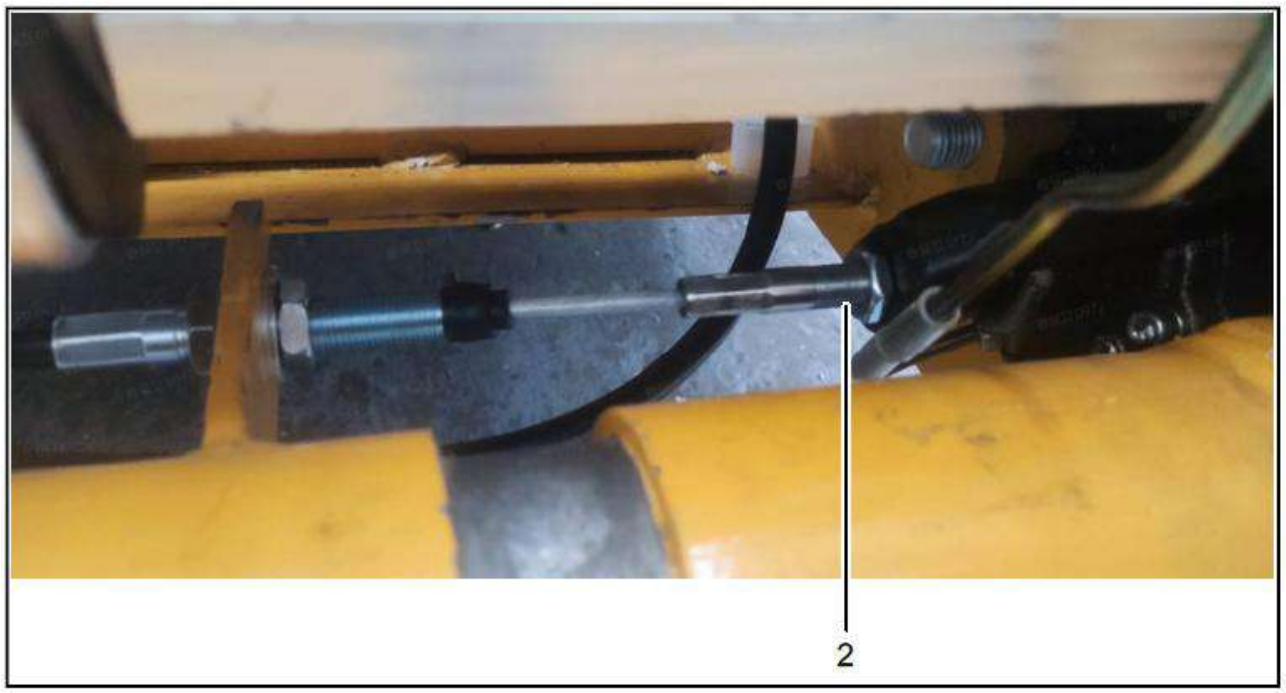


Figure 5-6

2. Left cable

There is a M10 threaded hole at the end of the drive axle, and a M10 stud at the end of the left cable. Screw the stud into the threaded hole during assembly.

Figure 5-7

The other end of the left and right cable is installed on the hand brake.

5.1.7 Drive axle installation

5.1.7.1 Drive axle installation and connection

1. Install the drive assembly on the frame, install the tire, and finally tighten it with the hub nut.

Note: Please add **0.45L** of transmission oil (Mobil **424**) to the drive axle before use.

2. Open the screw plug at the oil filler, fill the transmission oil into the reduction gearbox body of 0.45L, and finally tighten the screw plug.

Note: Remember to change the transmission oil regularly.

3. Before installation, check the cleanliness of all components, especially the internal components of the drive axle must meet cleanliness requirements.

4. Exhaust the air in the brake wheel cylinders and brake fluid pipes on both sides.

5.1.8 Drive axle removal

1. Remove the components, classify them, and label them to prevent misplacement during assembly.

2. Place all disassembled components into clean containers.

3. Inspect all vulnerable parts:

1) Check for any damage to bearings (such as deformation of the retainer, wear or deformation of the rollers, wear or deformation of the inner and outer rings, etc.).

2) Check for damage to oil seals (such as scratches on the lip, deformation of the oil seal, detachment of the internal spring of the oil seal, etc.).

3)Check the brake assembly. If the friction plate is ablated abnormally or the thickness of the friction plate is less than 3 mm, replace the friction plate.

4) Check the brake wheel cylinder, if it is leaking oil, replaced it.

4. If there are dents and scratches on the surface of the axle, touch-up painting and rust prevention are required.

5.2 Braking system

5.2.1 Braking system overview

The braking system consists of a brake pedal, a master cylinder, and wheel brakes, which are internally expanding hydraulic brakes for the front dual wheels.

5.2.2 Brake pedal

The brake pedal structure is shown in the illustration. The pedal is installed on the frame through a bracket. The leg power acting on the pedal is converted into brake oil pressure through the push rod of the master brake cylinder.

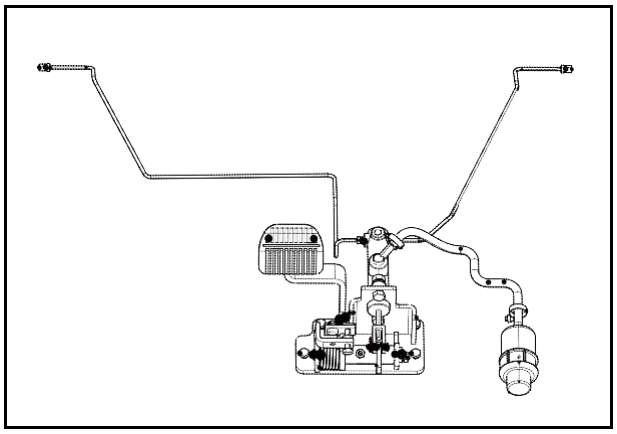


Figure 5-8 Foot Brake

5.2.3 Master Brake Cylinder

The master cylinder consists of a valve seat, a check valve, a return spring, a cup, a piston and an auxiliary cup. The end is fixed with a retaining washer and retaining wire, and the exterior is protected by a rubber dust cover.

The master cylinder piston is actuated by the push rod through operating the brake pedal.

Figure 5-13 Brake Master Cylinder

1. Connecting rod 2. Push rod

At the same time, the brake fluid in each brake wheel cylinder is also compressed by the brake shoe return spring, so that the brake fluid returns to the master cylinder (front chamber of the piston) through the check valve, and the piston returns to the original position. The brake fluid in the master cylinder flows back to the oil tank through the oil return port. The pressure of the check valve is adjusted to a certain proportion with the residual pressure in the brake pipeline and brake cylinder, so that the brake liquid in the brake cylinder flows back to the tank through the oil return hole. The pressure of the check valve is adjusted to a specific proportion with the residual pressure of the brake pipeline and brake wheel cylinder, so that the wheel cylinder cup is placed correctly to prevent oil leakage, and the possible air resistance during emergency braking is eliminated.

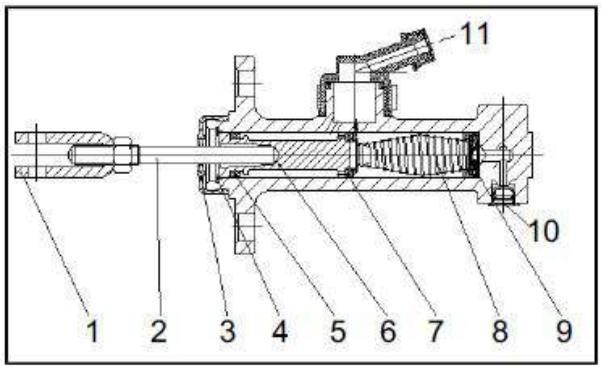


Fig. 5-9 Master Brake Cylinder

1. Connecting rod
2. Push rod
3. Dust cover
4. Elastic retaining ring
5. Auxiliary cup
6. Piston
7. Main cup
8. Spring
9. Check valve
10. Wheel brake
11. Self-storage tank

5.2.4 Brake pedal adjustment

Adjusting pedal height

1. Shorten the push rod (a).
2. Adjust the catch bolt (b), and the pedal height.
3. Step on the brake pedal, adjust the push rod to lengthen until the front end of the push rod contacts the master cylinder piston.
4. Tighten the push rod lock nuts.

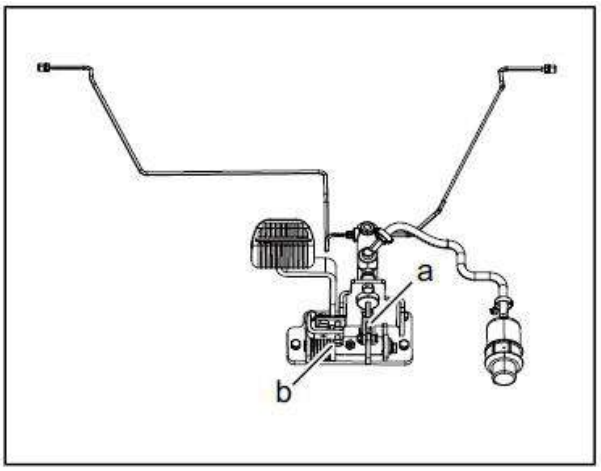


Figure 5-11 Brake Pedal

a. Push rod b. Catch bolt

Adjusting brake switch

1) After adjusting the height of the brake pedal, loosen the lock nut (b) of the brake switch (c).

2. Pull out the plug to disconnect the wire.

3. Turn the switch to make the clearance (a) = 1mm.

4. Confirm that the brake lights should come on when the brake pedal is depressed.

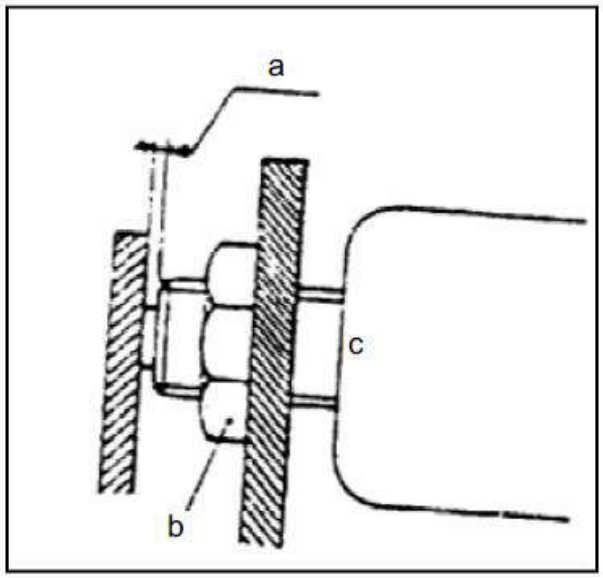


Figure 5-12
a. Clearance c. Brake switch
b. Lock nut

5.2.5 Parking brake control device

The parking brake lever is a ratchet-type manual brake that can provide different braking forces on slopes and flat surfaces.

Adjustment of braking force: Turn the adjuster (a) clockwise to increase the braking force; turn the adjuster counterclockwise to decrease the braking force.

Tension force: 20-30kg

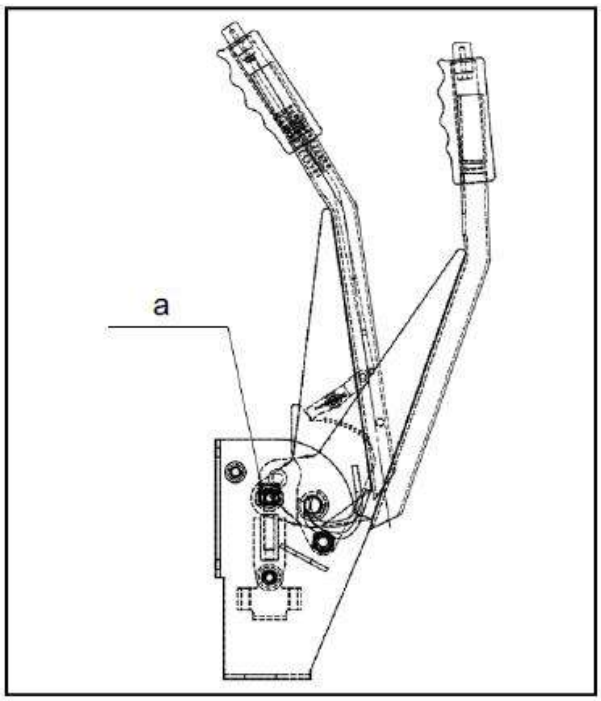


Figure 5-13 Parking Brake Lever
a. Adjuster

5.3. Steering system

5.3.1 Steering system overview

- The role of the forklift truck steering system is to change the direction of travel of the forklift truck or keep the forklift truck traveling in a straight line. The performance of the steering system directly affects the forklift truck's driving safety, operational efficiency, and the driver's labor intensity.
- The steering system is divided into two categories according to the power source used for steering: mechanical steering system (manual steering system) and power steering system.
- The mechanical steering system relies entirely on the driver's physical strength to control the steering and overcome the steering resistance torque.
- In a power steering system, the energy consumed to overcome the steering resistance torque is provided by the prime mover, and the driver only exerts a small force to control the steering.
- Due to the narrow working conditions and driving lanes of forklift trucks, frequent changing of directions during operation, and the need for minimum radius turns, the steering system is required to be reliable and easy to operate.
- When the forklift truck is unloaded, the steering axle load accounts for about 60% of the vehicle weight. In order to reduce the driver's workload, our company's series of forklift trucks are equipped with a full hydraulic power steering system.

5.3.2 Working principle

- When the forklift truck is steering, the driver applies a steering torque on the steering wheel (steering control mechanism), causing the steering wheel to rotate and transmit to the hydraulic steering gear through the steering shaft. The hydraulic steering gear delivers the appropriate volume of hydraulic oil to the steering cylinder through the pipeline based on the angle of rotation of the steering wheel. The cylinder drives the steering wheel through the steering trapezoidal mechanism to achieve steering.
- The main difference between the full hydraulic steering device and the hydraulic power steering device is that the full hydraulic steering gear replaces mechanical steering gear and longitudinal pull rods with hydraulic components, and connects the full hydraulic steering gear and the steering cylinder with high-pressure oil pipes.
- The load-sensing full hydraulic steering system circuit is equipped with a priority valve, which ensures the allocation of flow to the steering system under any working conditions, ensuring sufficient oil supply. When the steering gear is in the neutral position, only a small amount of flow passes through the hydraulic steering gear to achieve energy savings.

5.3.3 Steering system composition

The system includes a steering gearbox (a) and a hydraulic steering gear (b), with the steering gear consisting of a steering gear housing, steering wheel, steering column, combination switch, start switch, lock handle.

1. Steering gear angle adjustment range: initial 17° backward, no adjustment range forward, operating voltage 24V.

2. Electrical component wiring requirements: The negative wire is not allowed to be connected to the housing and needs to be wired separately.

3. The connector is 100mm below the mounting base, and the connector has 4 outputs: horn switch, left multipurpose switch, right multipurpose switch, and rocker switch.

4. Key switch: motor start and shutdown control, with two independent circuits.

5. Functional definition of combination switch (left): electronically controlled shift switch, neutral position, forward, reverse, fast and slow gears for forward and reverse.

6. Function definition of combination switch (right): combination lamp switch, left and right turning lights, first gear headlamps, second gear width indicator lamps.

7. The rocker switch assembly consists of the following functions from left to right: wiper (with high and low speed settings), washer spray (self-resetting momentary action), hazard warning lights (momentary action), work lights (momentary action), and fan (momentary action), with the remaining positions covered by blank plates.

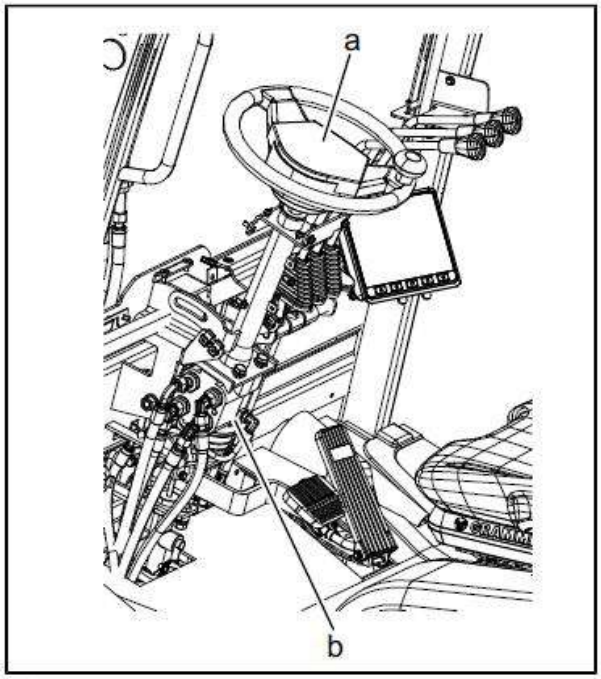


Figure 5-14

a. Steering gear b. Hydraulic steering gear

5.3.4 Steering axle

5.3.4.1 Steering axle overview

The axle is a cast steering axle structure, which consists of steering axle body, piston, gear rack and wheel hub and other parts. The steering axle adopts a gear rack structure, and the piston pushes the gear rack mechanism to turn to achieve the steering function.

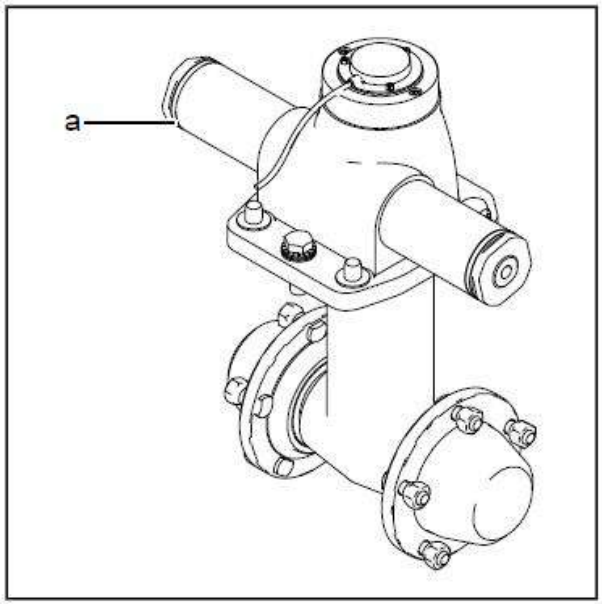


Figure 5-15

a. Rear axle

5.4. Hydraulic system

5.4.1 Hydraulic system overview

The hydraulic system consists of components such as oil pump, multi-way valve, hydraulic steering gear, lifting cylinder, tilting cylinder, and suction oil return filter. The lifting motor drives the oil pump to convert electrical energy into hydraulic energy. The oil pump inputs high-pressure oil into the system, and the high-pressure oil is distributed to various working components through the multi-way valve.

5.4.2 Oil pump

The vehicle is equipped with an external gear pump, which consists of a pump body, end cover, drive gear, driven gear, liner plate, and oil seal. It features good self-priming performance, strong contamination resistance, and low noise operation.

Working principle:

The driving gear is driven to rotate by the motor, and the driven gear is driven to rotate by the driving gear.

The driving gear and the driven gear are surrounded by the pump body and the end cover. The path of contact between the driving gear and the driven gear divides the inside of the oil pump into two areas: oil suction and oil pressure.

In the oil suction area, the enclosed space formed by the meshing of the gears gradually increases with the rotation of the driving gear, creating a vacuum. This allows the hydraulic oil in the oil tank to enter the pump suction chamber through the suction pipe under the action of atmospheric pressure, filling the space formed by the meshing of the gears.

In the oil pressure area, the enclosed space formed by the meshing of the gears gradually decreases with the rotation of the driving gear, allowing the hydraulic oil to be pressed into the high-pressure pipeline. With the drive of the motor, the gears keep rotating, allowing the oil pump to continuously suck and discharge oil.

5.4.3 Manual multi-way valve

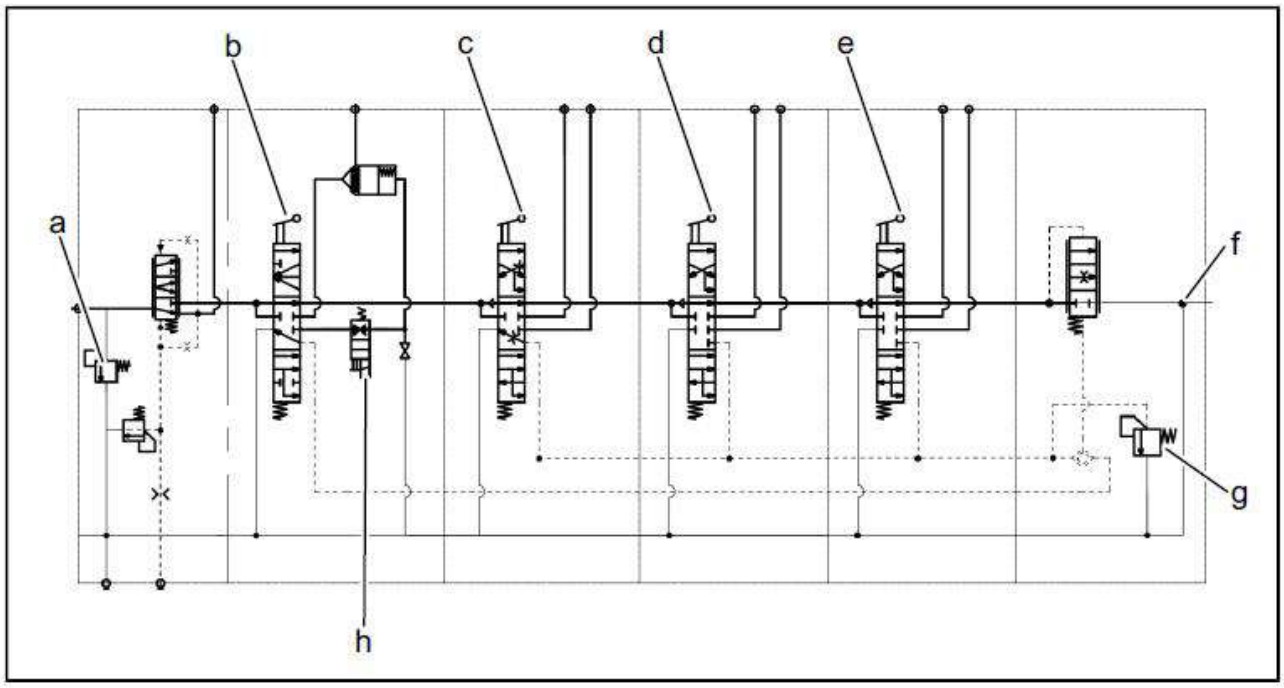


Figure 5-16 Schematic Diagram of Manual Multi-way Valve

a. Main safety valve	b. Lifting unit	c. Tilting unit	d. Attachment section 1
e. Attachment section 2	f. Oil return unit	g. Overload valve	h. OPS solenoid valve

The manual OPS multi-way valve adopts a spool structure. The hydraulic oil output from the oil pump enters the valve through the feed gear. After being divided by the priority valve, part of the hydraulic oil flows to the steering gear and hydraulic steering cylinder through the CF port, while the other part flows to the lifting unit (b), tilting unit (c), and attachment unit (d, e).

The oil inlet unit is equipped with a main safety valve (a), which can control the maximum working pressure of the hydraulic system.

The lifting unit (b) is equipped with an OPS solenoid valve (h) to enable automatic fork locking when the operator is not present.

The tilting unit (c) is equipped with a self-lock valve to prevent serious consequences caused by misoperation of the tilt cylinder without pressure oil drive.

A check valve is installed at the inlet of each valve section to prevent hydraulic oil backflow.

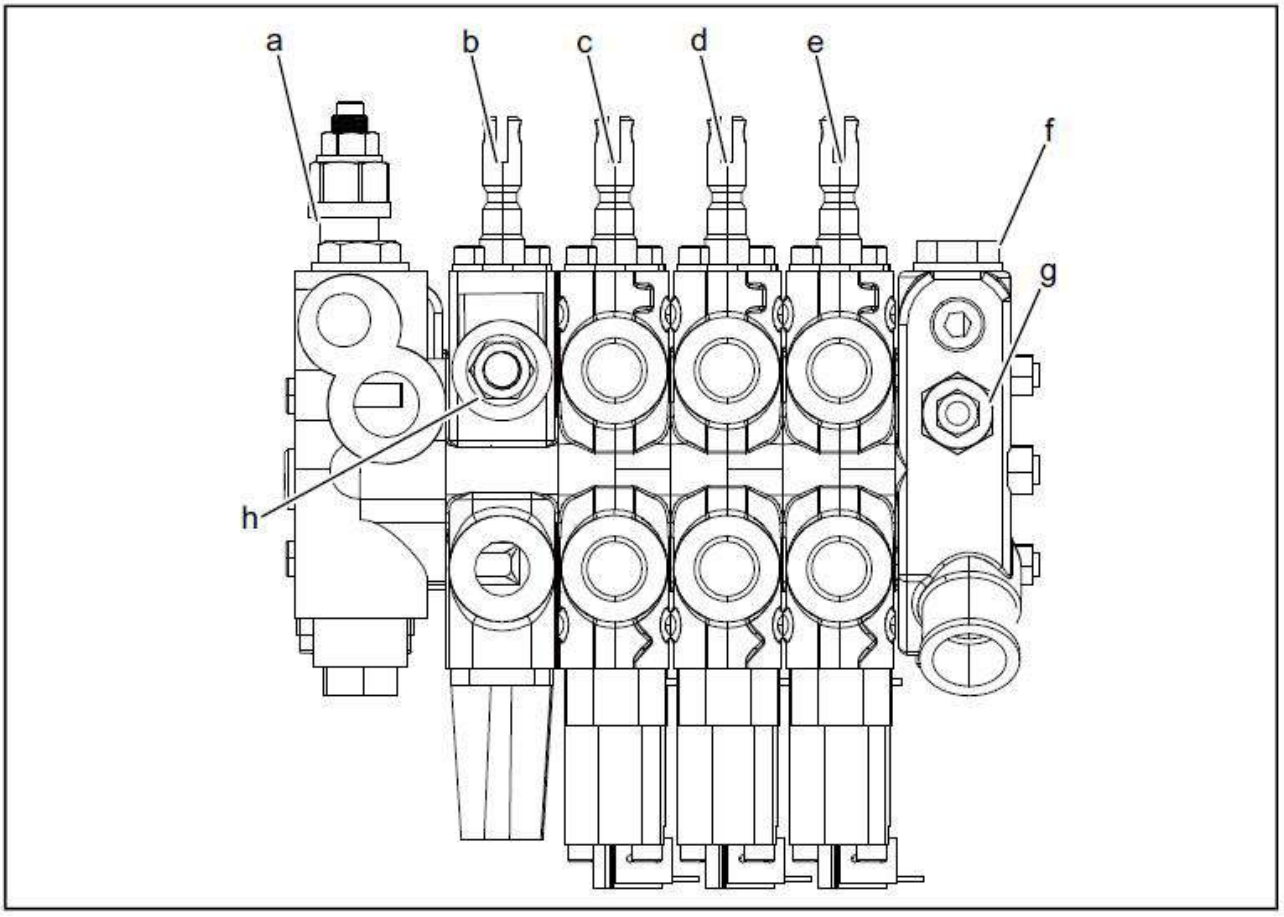


Figure 5-17 External View of Manual Multi-way Valve

a. Main safety valve
b. Lifting unit
c. Tilting unit
d. Attachment section 1
e. Attachment section 2
f. Oil return unit
g. Overload valve
h. OPS solenoid valve

Pressure adjustment of main safety valve

The main safety valve pressure of the multi-way valve has been adjusted before leaving the factory, and users are not allowed to adjust it at will. If adjustment is necessary, please follow the steps below.

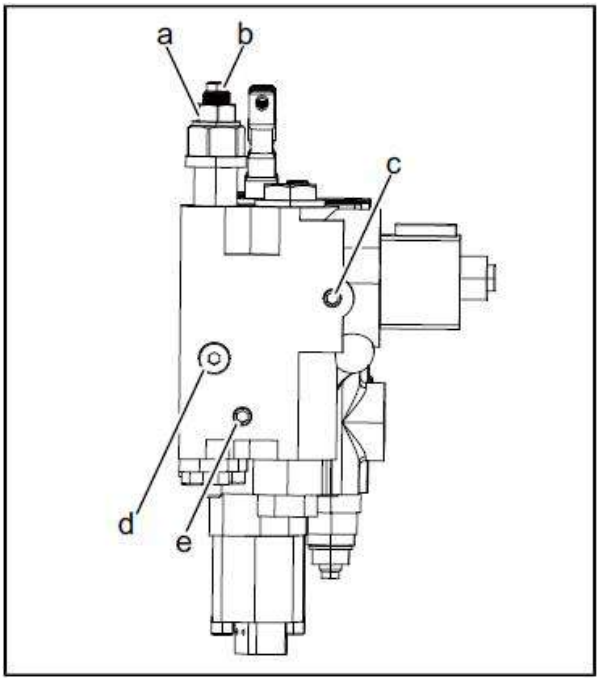


Figure 5-18 Pressure Test Ports of Manual Multi-way Valve

a. Lock nut
b. Adjusting screw
c. System pressure test port
d. Oil return port
e. Steering pressure test port

1. Unscrew the plug of the pressure test port (c) PT1. The thread specification of the measuring port is M10×1. Install the pressure test adapter and a pressure gauge with a range of 25MPa.

2. Operate the lifting lever and test the pressure at the full lift cylinder stroke.

3. When the oil pressure is different from the specified value, loosen the lock nut (a) of the main safety valve, turn the screw (b) to the right to increase the pressure, and turn it to the left to decrease the pressure. Turn the adjusting screw counterclockwise when the pressure is high, and clockwise when the pressure is low.

4. After adjusting to the specified value, tighten the lock nut.

5.4.4 Proportional multi-way valve

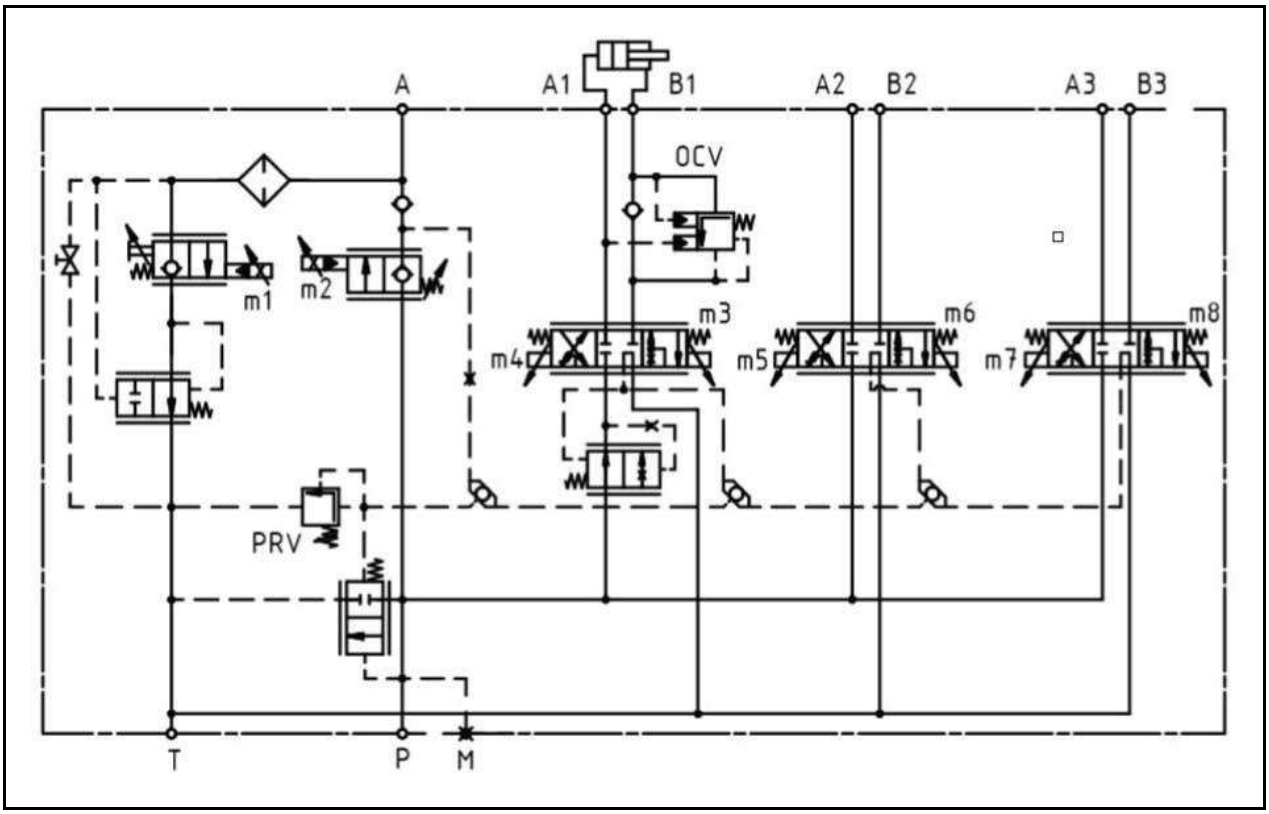


Figure 5-19 Proportional Valve Schematic Diagram

The switching action of the proportional multi-way valve is driven by the proportional solenoid coil, and the lifting and lowering are divided into two two-way plug-in proportional directional valves.

The descending action is coordinated with the pressure-compensated valve to make the descending smoother.

A strainer is built into the down pipe to prevent large particles of impurities from entering the valve spool.

A pressure-compensated valve is provided before the tilt valve to make the tilt action smoother and reduce the impact of load changes on the tilt cylinder.

The B1 port of the tilting unit is equipped with an integral hydraulic lock to ensure smoother forward tilting and prevent the mast from tilting forward automatically when stopped.

Pressure adjustment of main safety valve

The safety valve pressure of the multi-way valve has been adjusted before leaving the factory, and users are not allowed to adjust it at will. If necessary, please follow the steps below.

1. Remove the plug of the pressure measuring adapter, install the pressure measuring adapter and a pressure gauge with a range of 25MPa.

2. Operate the lifting lever and test the pressure at the full lift cylinder stroke.

3. When the oil pressure is different from the specified value, loosen the lock nut of the safety valve, turn the screw to the right to increase the pressure, and turn it to the left to decrease the pressure. Turn the adjusting screw counterclockwise when the pressure is high, and clockwise when the pressure is low.

4. After adjusting to the specified value, tighten the lock nut.

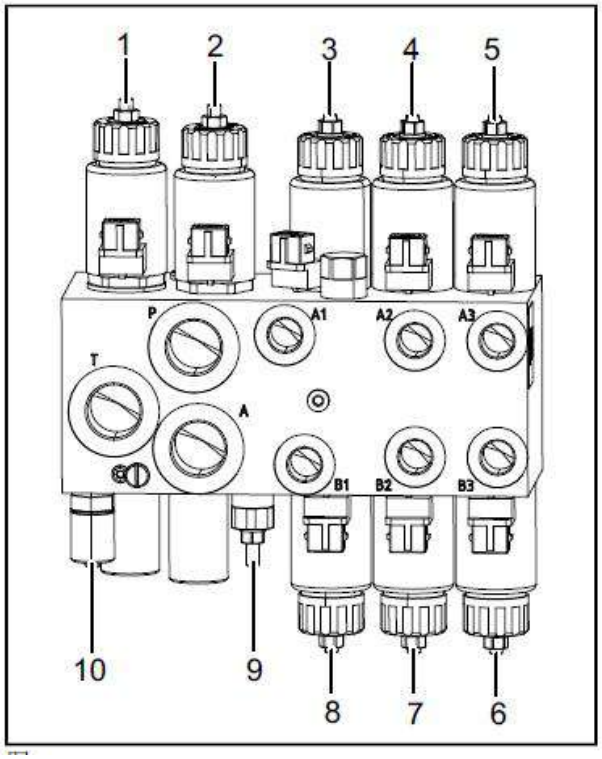


Figure 5-20

1.m1	6.m8
2.m2	7.m6
3.m3	8.m4
4.m5	9. Safety valve PR V
5.m7	10. Pressure test adapter

5.4.5 Hydraulic tank

The hydraulic tank is used to store hydraulic oil, filter impurities in the hydraulic oil circuit and dissipate heat.

The oil suction filter can filter the oil in the tank before it is sucked into the gear pump to prevent impurities from entering the hydraulic elements and causing system failure.

The return oil filter can filter the oil in the hydraulic system when it flows into the tank to ensure the cleanliness of oil in the tank.

The filler cap assembly is integrated with an air filter, which balances the pressure inside and outside the tank and filters impurities in the air.

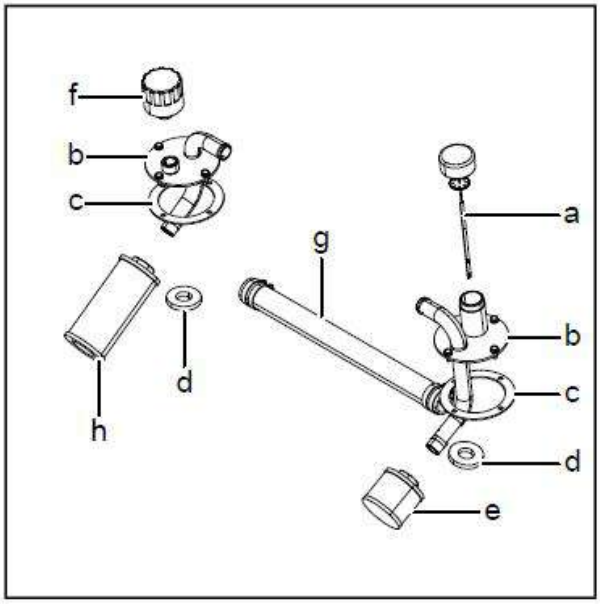


Figure 5-21 Hydraulic Tank Parts

a. Filler cap assembly
b. Cover plate assembly
c. Gasket
d. Magnet
e. Oil suction filter
f. Air filter
g. Connecting hose
h. Return oil filter

5.4.6 Hydraulic system schematic diagram

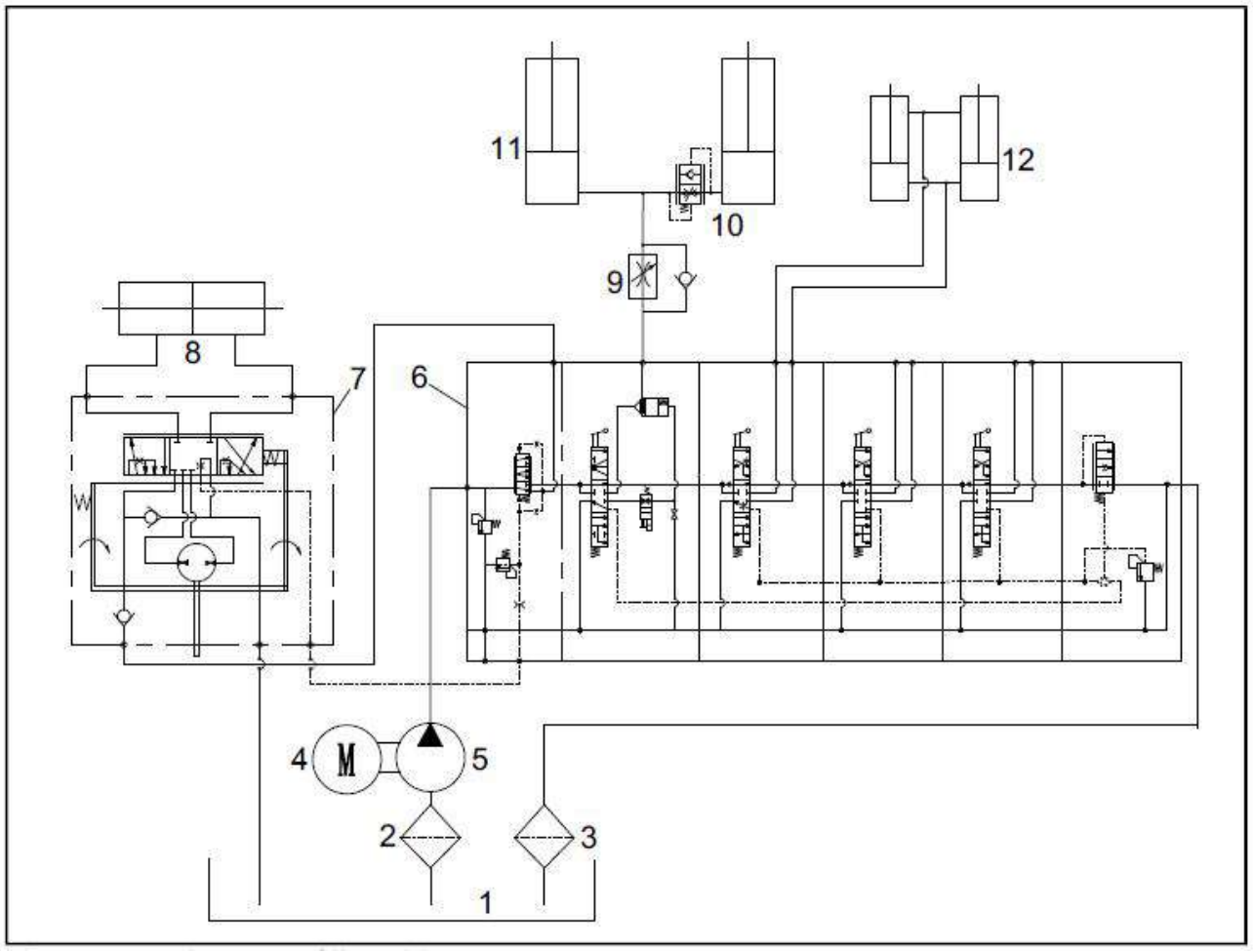


Figure 5-22 Schematic Diagram of Manual OPS Multi-Way Valve Hydraulic System

1. Oil tank
2. Oil suction filter
3. Oil return filter
4. Motor
5. Gear pump
6. Multi-way valve
7. Hydraulic steering gear
8. Steering cylinder
9. Speed limit valve
10. Explosion-proof valve
11. Lift cylinder
12. Tilt cylinder

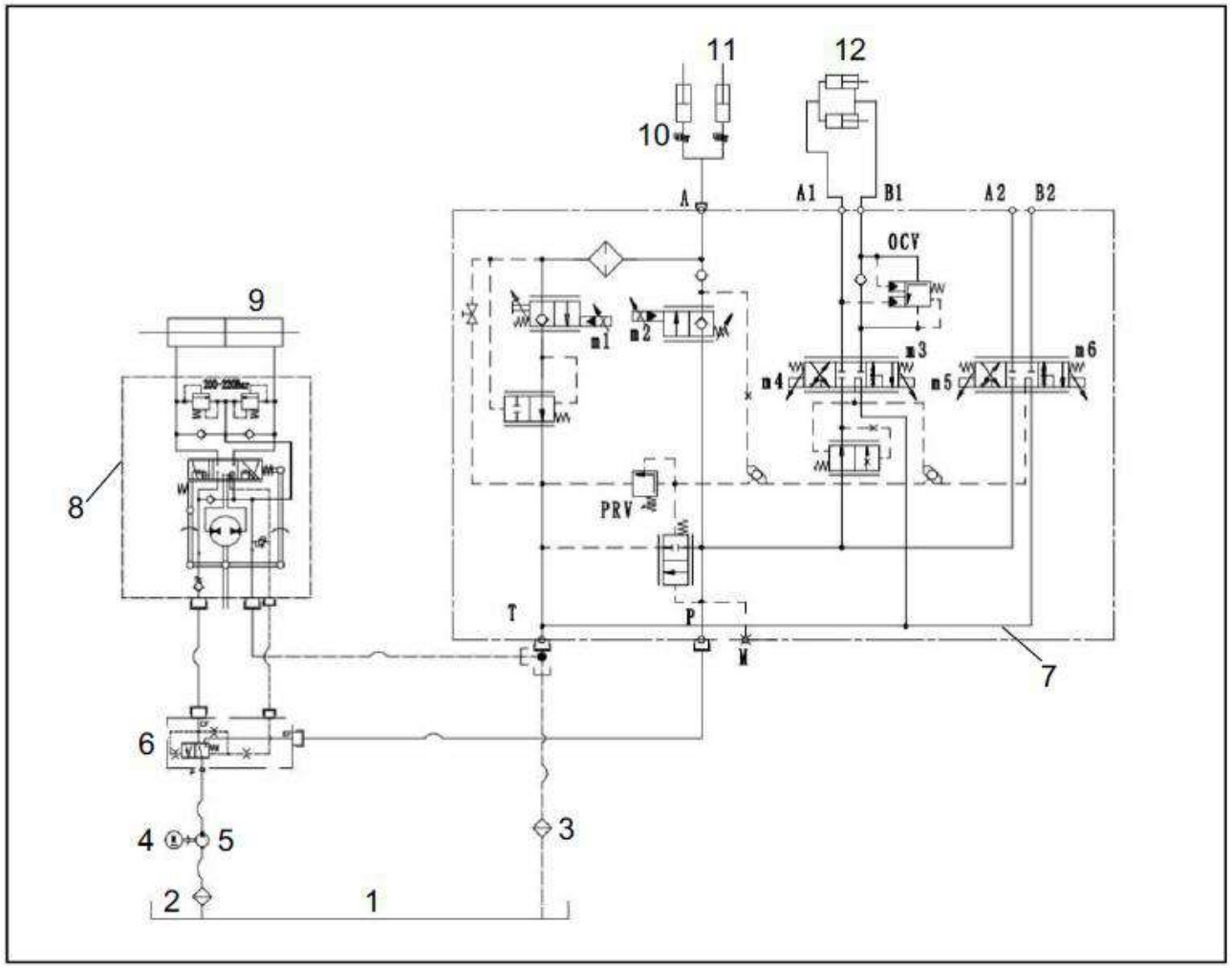


Fig. 5-23 Schematic Diagram of Proportional Multi-way Valve Hydraulic System

1. Oil tank
2. Oil suction filter
3. Oil return filter
4. Motor
5. Gear pump
6. Flow priority valve
7. Multi-way valve
8. Hydraulic steering gear
9. Steering cylinder
10. Explosion-proof valve
11. Lift cylinder
12. Tilt cylinder

5.5 Lifting System

5.5.1 Lifting System Overview

The lifting system of electric forklift truck is composed of the inner/outer mast, carriage, load backrest, rollers, drag chain, lift cylinder, tilt cylinder, and hydraulic piping on the mast side. It constitutes the working device of the forklift truck with the hydraulic system on the vehicle side, and is the executive component for the forklift truck to carry out loading and unloading, stacking, and handling operations.

We have complete mast series, including standard duplex lifting mast, full free duplex lifting mast, and full free duplex lifting mast.

The standard duplex mast consists of a fixed outer mast and a liftable inner mast.

The bottom of the lifting cylinder is fixed on the cross member of the outer mast with bolts, and the piston rod end is connected to the upper end block of the inner mast, and the middle section of the cylinder is fixed on the fixed plate of the outer mast with a clamp.

Two lifting cylinders are arranged behind the mast to achieve a wide field of view.

The structure of the duplex full free lifting mast is similar to the standard duplex mast, with the difference of an additional front lifting cylinder installed on the cross member under the inner mast, which can lift the fork frame without increasing the height of the mast.

The triplex fully free lifting mast adds an inner mast and a front lifting cylinder on the basis of the standard duplex mast.

The fork frame is installed in the inner mast channel through main and side rollers.

The pressure oil from the multi-way valve enters the lifting cylinder through the speed limiting valve, pushing the piston rod of the lifting cylinder to rise, and at the same time driving the inner mast and chain to move, lifting the fork to achieve the purpose of lifting cargoes.

Our company supplies the standard duplex 3.0m mast as the basic type, and the requirements for non-standard orders are as follows:

• Duplex wide-view mast: 3m, 3.5m, 4m, 4.5m, 5m

• Full free duplex mast: 3m

• Full free triplex mast: 4.5m, 5m, 5.5m, 6m

5.5.2 Assembly and debugging data

Inspection and adjustment

Detection position (mm)	Assembly clearance	Repair (no replacement parts) clearance
Between the mast and the side roller	0.1~0.8	0.1–0.8 (Composite roller, screw adjustment)
Gasket between the mast and the support guide plate	0.1~0.8	0.2~1.0
	0.2/0.5/1.0	
Gasket between the inner mast and the side roller of the fork frame	0.1~0.6	0.2~1.0
	0.2/0.5/1.0	
Sag of the lifting chain	25~30	

5.5.3 Tightening torque of main parts

Position	Unit: N·m
Lifting chain counter-holding lock nut	245~314（M20）
Connection Between Mast and Drive Axle	280~300（M14,M16,M20）
Lock nut of tilt cylinder	89~118（M10）
Lifting cylinder piston rod head	80~90（M12×1.25）
The bottom of the lifting cylinder	80~90(M12×1.25)
Lifting cylinder fixed bolt	29~39（M10）

Note: The straddle bridge mechanism, which connects the mast to the drive axle, requires regular maintenance. Check the anti-loosening line of the straddle bridge bolts every **500** hours. If the anti-loosening line is found to be misaligned, the bolts need to be retightened according to the standard bolt torque requirements **(M14: 204±20Nm, M16: 290±29Nm, M20**: **600±60Nm)**

5.5.4 Mast disassembly, assembly and adjustment

5.5.4.1 Inner and outer masts

The inner, middle and outer masts are welded components, with the main body consisting of two sets of symmetrically distributed channel steels, with the weight mainly supported on the axle housing.

The bottom of outer mast is connected to the axle housing through a Hough clamp, and the middle of the outer mast is connected to the carrier frame through a tilt cylinder, which can tilt forward and backward under the action of the tilt cylinder.

The channel steels of the inner/outer masts are H/C-shaped. The upper part of 2 channel steels for outer mast is equipped with main rollers and side rollers, while the lower part of 2 channel steels for inner mast is equipped with main rollers and side rollers. The inner mast can move smoothly up and down within the outer mast through the rolling of the main and side rollers.

Maintenance of the main and side rollers on the upper part of the outer mast is considered high-level maintenance and should be done with caution for safety reasons.

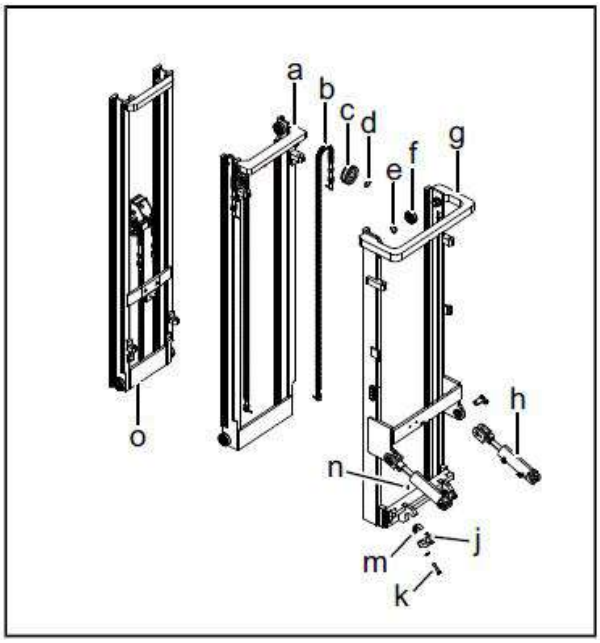


Figure 5-24 Mast Structure Diagram

a. Middle mast
b. Chain
c. Sprocket
d. Sprocket retainer ring
e. Roller retaining ring
f. Main roller
g. External mast
h. Tilt cylinder
j. Lower clamp
k. Bolt
m. Wear-resistant clamp pad
n. Grease fitting
o. Inner mast

5.5.4.2 Carriage

The carriage is equipped with 6 main rollers and 4 side rollers, which are symmetrically set on the roller frame. Among them, the middle set of main rollers has a slightly smaller outer diameter compared to the other two sets.

2 sets of main rollers are set at the top and 1 set of main rollers at the lower part.

The main roller shaft is welded on the roller frame, it is fixed on the roller shaft through the shaft retaining ring, and the side roller is fixed on the roller frame through bolts.

The longitudinal load is borne by main rollers. When the carriage has not been lifted to the top, the middle set of main rollers has a smaller outer diameter, so the longitudinal load is borne by the upper and lower sets of main rollers. When lifted to the top, the top main roller protrudes from the top of the inner mast, the longitudinal load is borne by the two middle sets of main rollers, and the lateral load is borne by side rollers. Throughout the entire movement of the fork frame, lateral loads are entirely borne by the side rollers.

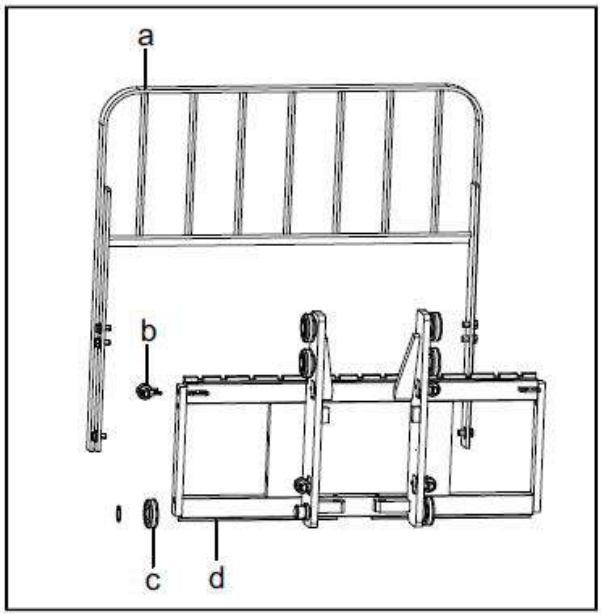


Figure 5-25 Fork Frame Structure Diagram

a. Load backrest
b. Side roller
c. Main roller
d. Fork frame

5.5.4.3 Roller adjustment and adaptation

Requirements

Before loading the door frame, the roller clearance needs to be adjusted to ensure smooth movement of the inner mast and fork frame without jamming. The gap between the side roller and the channel steel surface should be controlled at 0.1~0.8mm, and the roller surface and the contact surface of the door frame need to be fully lubricated with grease.

Side roller clearance adjustment method

The side rollers are fixed with bolts and adjusting shims. The clearance adjustment is done by adding or reducing adjusting shims, with the total clearance on both sides controlled within 0.2-1.6.

Main roller adaptation

The opening size of 12H channel steel is 77.9mm, and that of 12C channel steel is 78.7. Therefore, the main roller is designed with two outer diameters. The outer diameter of main roller (small) is 78.2mm, and the outer diameter of main roller (large) is 78.38mm.

5.5.4.4 Lift cylinder adjustment

When replacing the lifting cylinder, inner mast, or outer mast, the stroke of the lifting cylinder needs to be readjusted. The method is as follows:

1. Install the piston rod head of the lift cylinder into the cylinder top block of the inner mast without adding adjusting shims.

2. Slowly raise the mast to the maximum stroke of the cylinder and check that the two cylinder strokes are synchronized. If it shakes at the highest, it indicates that the left and right cylinder strokes are not synchronized. Adjust the synchronization of the strokes by adding or removing adjusting gaskets between the piston rod and the cylinder top block. The thickness of the adjusting gaskets is 1mm and 0.5mm.

3. Slowly lower the inner mast and check that the end points of the two cylinders are synchronized. You can refer to the adjustment method for synchronous lifting.

4. Adjust the tension of the chain.

Note: The adjustment of the lifting cylinder is also part of the high-level maintenance and safety should be taken into consideration.

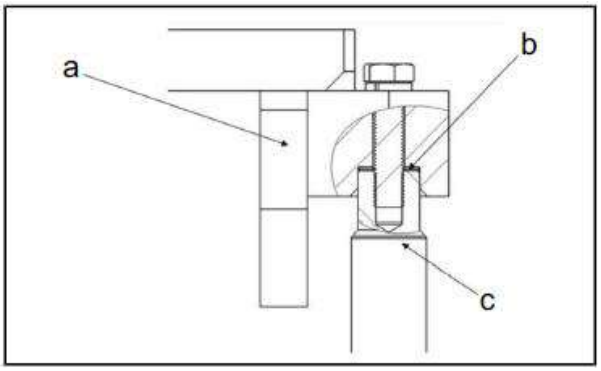


Figure 5-26 Installation Diagram of Lift Cylinder

a. Cross member on the mast
b. Adjusting shim
c. Rear lift cylinder

5.5.4.5 Chain Adjustment

1. Park the truck on level ground and position the mast vertically.

2. Operate the lift/lower lever to lower the forks to ground contact.

3. Adjust the adjusting nuts at the upper ends of the chains to achieve uniform tension across both chains.

5.5.4.6 Replacement of carriage rollers

Replacement steps:

1. Place a pallet on the forks and park the vehicle on a level ground.

2. Lower the forks and pallet to the ground.

3. Disconnect the connecting pin (c) of the long screw at the upper end of the chain (b), and remove the chain from the sprocket (a).

4. Lift the inner mast.

5. After confirming that the carriage has been detached from the inner mast, remove the carriage.

6. Replace the main roller:

1) Remove all spring retaining rings, take off the main roller with a pulling tool, and be sure to retain the adjusting shim.

2) Confirm that the new roller is the same as the one being replaced, replace the old roller with the new one, and install the elastic retaining ring at the same time.

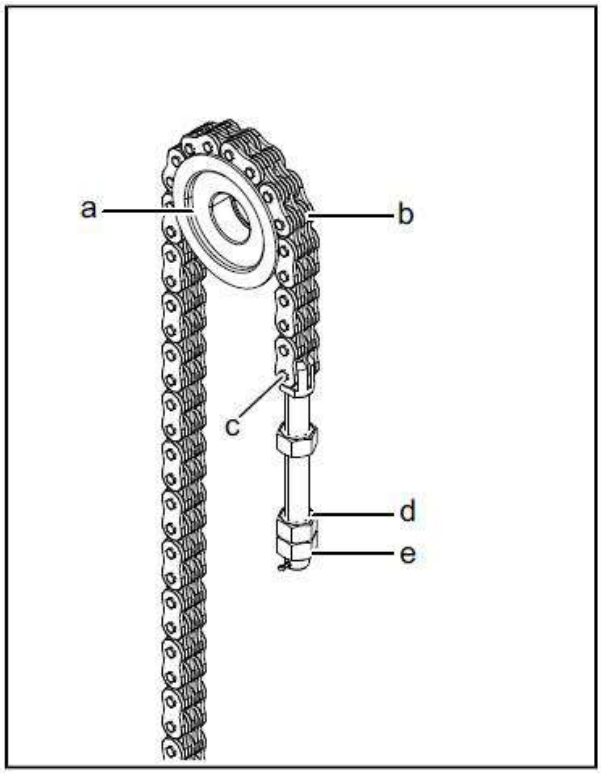


Figure 5-27 Chain Structure

a. Sprocket
b. Chain
c. Connecting pin
d. Adjusting nut
e. Lock nut

5.5.4.7 Replacement of mast rollers

1. Follow the same method as replacing the carriage rollers in last section to remove the carriage from the inner mast.

2. Drive the forklift truck to a level ground and lift the front wheels 250-300mm off the ground.

3. Pull up the handbrake and use wedges to block the rear wheels.

4. Remove the fixing bolts of the lifting cylinder and inner mast. Lift up the inner mast, do not to lose the adjusting shims on the piston rod.

5. Remove the connecting bolts between the lifting cylinder and the bottom of the outer mast. Remove the lifting cylinder and the oil pipe between the two cylinders. Do not loosen the oil pipe connector.

6. Lower the inner mast, remove the main roller at the bottom of the inner mast, and at the same time, the main roller at the top of the outer mast will also be exposed from the top of the inner mast and can also be removed.

7. Replace the main roller:

1) Remove the upper main roller using a pulling tool, and ensure that the adjusting shim is not lost.

2) Install the new roller and the adjusting shim removed in step 1) together.

8. Lift the inner mast until all rollers enter the mast.

9. Install the lifting cylinder and carriage in the opposite order of disassembly.

Maintenance

6. Maintenance

6.1 Daily maintenance of forklift truck

6.1.1 Overview

A comprehensive inspection in advance can prevent the forklift truck from malfunctioning and failing to achieve its expected service life. The hours listed in the maintenance procedure are based on the working 8 hours a day and 200 hours a month. For safe operation, the forklift truck should be maintained according to the maintenance procedure.

6.1.2 Startup instructions

1. Hydraulic oil level: The oil level should be in the middle position of the oil level gauge.

2. Check for leaks and damage in pipes, joints, pumps, and valves.

3. Check the service brake: The brake pedal idle stroke should be 40mm; the gap between the front bottom plate and pedal should be greater than 20mm.

4. Check the function of the hand brake: When the hand brake lever is pulled to the end, it should be braked on a 20% slope (no load).

5. Instruments and lighting fixtures, etc. : Check that the instruments, lightings, connectors, switches, and electrical circuits are working properly.

6.1.3 Forklift truck radiator and coolant (some models may not have this configuration)

Forklift truck radiators need to be checked regularly every month. Check the dust accumulation on the back of the radiator fan regularly, clean the dust and foreign objects from the radiator regularly to ensure the radiator's cooling effect.

The factory capacity of the coolant is 10 L, with a minimum operating temperature of -45°C. The specific parameters are as follows:

Name	Density	Freezing point	Boiling point	PH value	Standard code
Coolant	1074kg/m³	-45℃	108℃	8.66	GB 2943-2013

The coolant needs to be checked regularly every month. Check the coolant level and add supplementary coolant as needed after the pump motor starts to ensure the equipment's normal and stable operation. During normal operation, open the drain valve to drain the water according to specific conditions to ensure smooth pipeline flow.

6.1.4 Recommended maintenance fluid list

Name	Original oil	Model and temperature
Hydraulic oil	Great Wall	Use L-HV46# anti-wear hydraulic oil when the temperature is ≥-5°C Use L-HV32 low temperature anti-wear hydraulic oil when the temperature is ≥-20°C (open air cold area) Use L-HS32 ultra-low temperature hydraulic oil in cold storage environment when -30 °C ≤ temperature ≤ -18 °C
Brake fluid	Chongqing Yiping	4604 Synthetic brake fluid GB12981 HZY4
Grease	Great Wall	3# General lithium grease at -20℃ to +120℃
Transmission oil	Mobil	Use Mobil 424 transmission oil at -40~170°C

6.1.5 Forklift truck inspection procedure

Check the brake pedal.

Check the braking condition and ensure that when the brake pedal (a) is fully depressed, the downward stroke of brake pedal should exceed 50mm from the bottom plate. The braking distance of forklift truck when unloaded is approximately 2.5m.

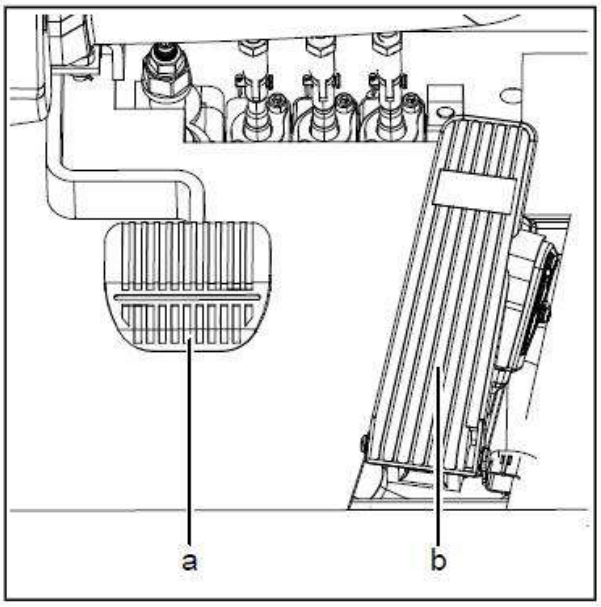


Figure 6-1

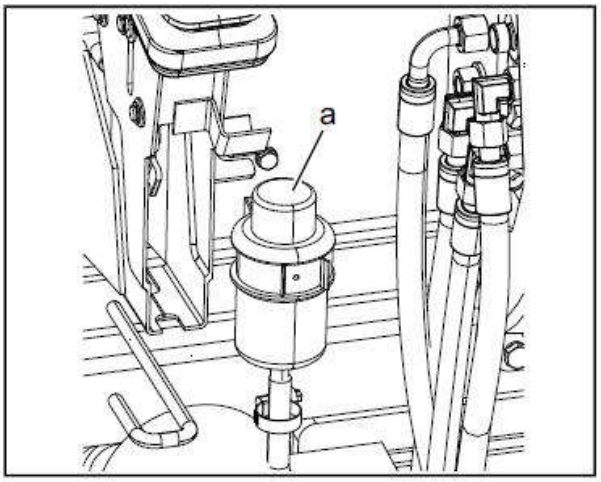
a. Brake pedal b. Accelerator pedal

Check brake fluid

Note: Open the brake fluid reservoir cap (a) and check the brake fluid level and other conditions.

Figure 6-2

a. Brake fluid cap



a. Brake fluid cap

Check parking brake lever

Check parking brake lever (a). Push the parking brake lever forward and observe the following conditions:

• Whether the tension stroke is appropriate.

• The amount of braking force.

• Whether the parts are damaged.

Whether the lever operating force (standard: about 17-22kg) is suitable for the operator.

The operator can make adjustments via a screw mounted on the top of lever.

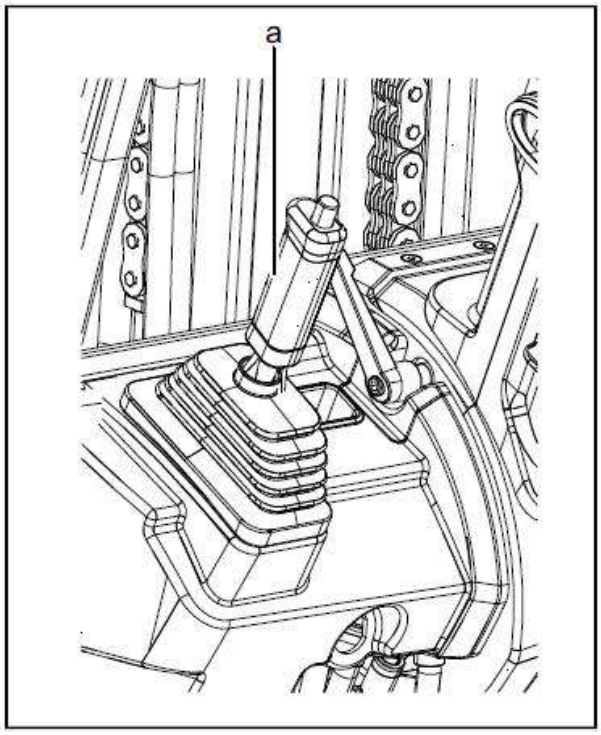


Figure 6-3

a. Parking brake lever

Check steering wheel rotation

Gently turn the steering wheel clockwise and counterclockwise to check whether it returns. The appropriate return stroke (a) is 50-100mm. The steering wheel can be adjusted forward and backward to a certain angle.

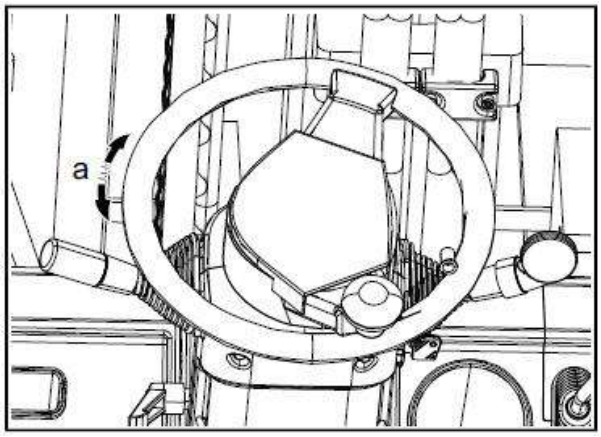


Figure 6-4

a. Return stroke

Check power steering function

Check power steering operation by turning the steering wheel clockwise and counterclockwise.

Check functions of hydraulic system and masts

Check that lifting and tilting operations are smooth and normal.

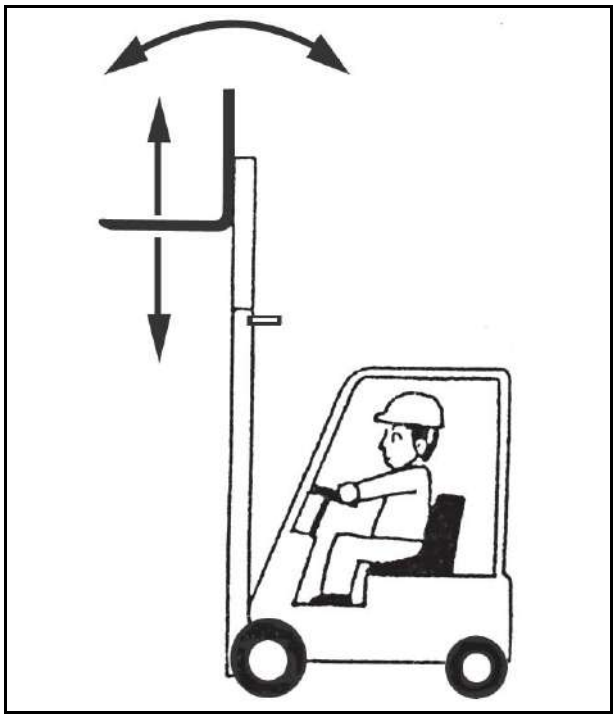


Figure 6-5

Check oil pipe

Check lift cylinder, tilt cylinder and all pipelines for oil leaks.

Check hydraulic oil

Lower forks to the ground and check the hydraulic oil level with an oil level gauge (a). When the oil level is between H and L, the level is within the appropriate range.

The mast can be lifted to its maximum height. During the lifting process, the speed must be uniform, the gear pump noise must be smooth without cavitation noise.

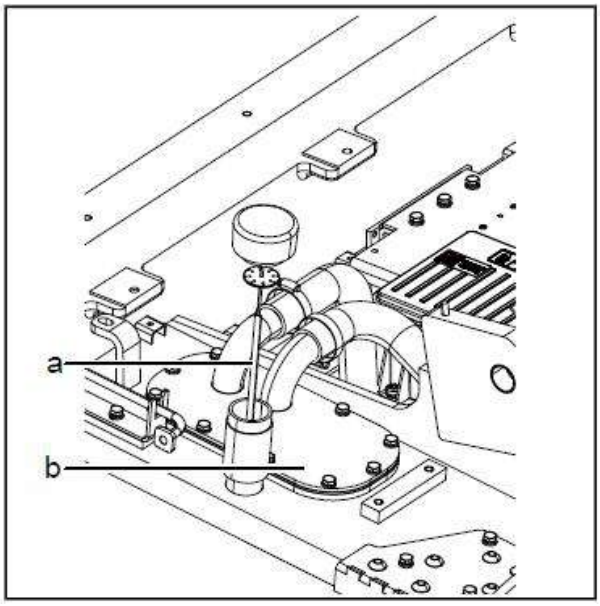


Figure 6-6

a. Oil level gauge b. Hydraulic oil tank

Note

Open the brake fluid reservoir cap and check the brake fluid level and other conditions.

Check lifting chain

Lift forks to 200-300mm off the ground and ensure that the left and right chains (a) are of the same tightness. Check that the absorber finger is in neural. If the tightness is different, adjust it via the chain joint (b).

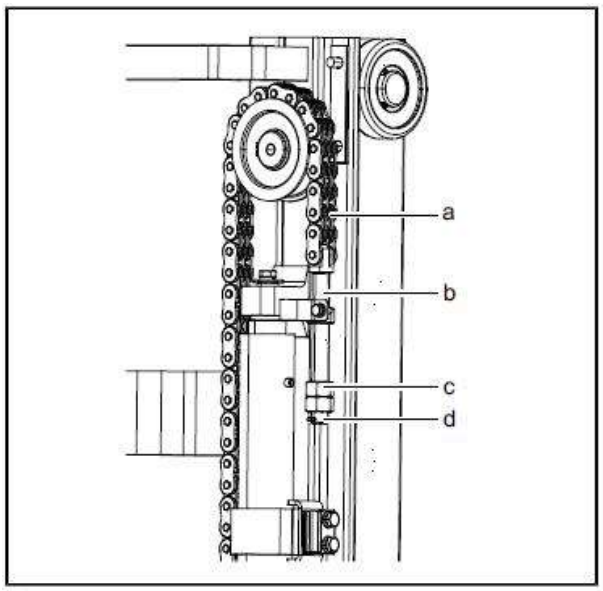


Figure 6-7

a. Lifting chain
b. Chain joint
c. Double nut
d. Pin

Note

After adjustment, the double nuts should be tightened securely.

Tire inspection

Pneumatic tire pressure standard

Unit: kPa

Front wheel	1000
Rear wheel	1000

Remove the valve cap and measure the tire pressure with a gauge. After checking the air pressure, make sure the valve is not leaking before installing the valve cap.

Note: The air pressure of forklift truck tires is higher than that of car tires, and the air pressure should not exceed the specified pressure value.

Check that tires and sides are damaged or cracked, and whether the rims and locking collars are deformed or damaged.

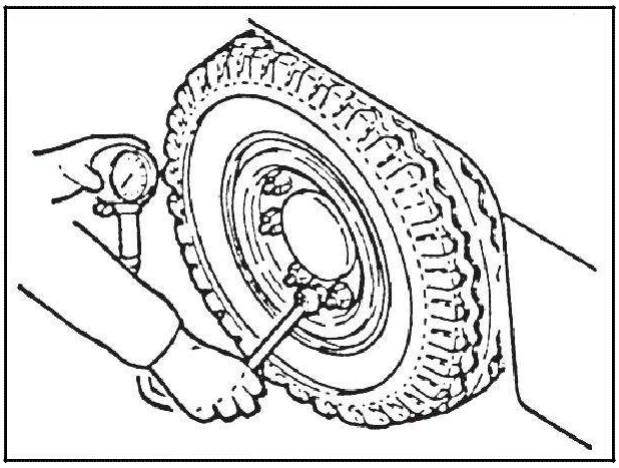


Figure 6-8 Check Tires (Solid)

Warning

Danger of tipping!
Loose wheel nuts are very dangerous. If they become loose, the wheel may fall off, causing the vehicle to overturn.
Be sure to check tires to make sure parts such as the wheel nuts are not loose.

Check charging status and instrument panel functions

Check that the vehicle has sufficient battery power.

Check that the instrument panel displays normally a few seconds after the key switch is turned on.

Under normal conditions, the instrument panel will display as shown in the figure below a few seconds after the ignition key is turned on.

Figure 6-9

Note

In addition to checking lights and operation, always turn off the key switch and disconnect the lithium battery MSD plug before checking the electrical system.

Check the headlamps, turn signals and horn

Check that the headlamps and turn signals are on normally. Check that the horn sounds properly. The horn sounds when the area indicated by the arrow is pressed.

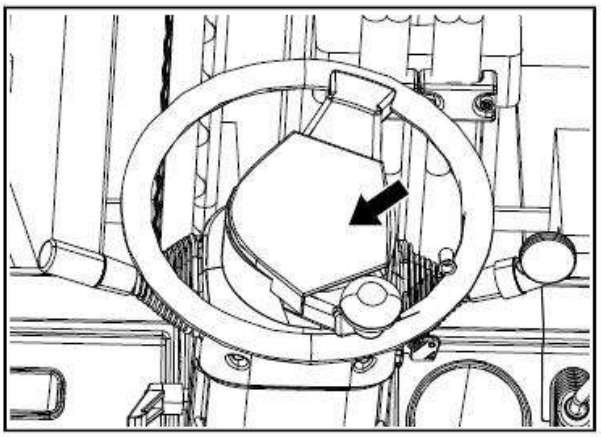


Figure 6-10

Check overhead guard and load backrest

Check that the bolts and nuts are loose.

Other inspections

Check other parts for abnormalities.

Inspection after forklift truck operation

After completing works, clean the dirt on the forklift truck and inspect the forklift truck as below:

- Check all parts for damage or leakage.
- Check for deformation, distortion, damage or breakage.
- Add lubricant as required.
- Lift the forks to maximum height for several times after work. (When forks are not raised to their highest level during daily work, this will allow the oil to flow through the entire stroke of the cylinder to prevent rust.)
- Replace abnormal parts that cause fault during operation.

Note

A small mistake can lead to a major accident. Do not operate or move the vehicle until repair work has been completed and inspections have been performed.

6.1.6 Maintenance interval

Weekly maintenance (50 hours)

Before using the forklift truck, perform a preliminary inspection as described in the previous section “Post-operation Inspection of forklift truck”.

Monthly maintenance (200 hours)

In addition to weekly maintenance (50 hours), the following maintenance is also required.

If it is required to have adjustment and replacement after inspection, contact our company's maintenance personnel to perform maintenance (monthly maintenance records must be kept).

System	Serial No.	Parts and contents		Remarks
Whole vehicle	1	Overall condition	Deformation, cracks and abnormal noise	
	2	Horn	Sound	
	3	Accessories (headlamps, turn signals)	Function	
	4	Tire	Wear condition	
Battery	5	Plug	Damage and cleanliness	
Charger	6	Key switch	Function	
electrical system	7	Contactor	Contact and function	
	8	Inching switch	Function	
	9	Controller	Function	
	10	Gearbox	Oil level, seepage and unusual noises	
	11	Motor appearance	Damaged or not	
	12	Fuse	Looseness	
	13	Wiring harnesses and terminal blocks	Looseness	
Drive steering hydraulic brake	14	Steering wheel	Operation and adjustment	
	15	Steering link	Lubrication	
	16	Gearbox	Oil level, seepage and unusual noises	
	17	Tire mounting nuts	Looseness	
	18	Lifting chain	Lubrication and tightness	
	19	Cylinder mount pin	Looseness and damage	
	20	Fork frame	Adjustment, lubrication, cracks and deformation	
	21	Fork	Cracks and deformation	
	22	Carriage roller	Adjustment and lubrication	

System	Serial No.	Parts and contents		Remarks
	23	Mast roller	Adjustment and lubrication	
	24	Inner/outer mast	Shaking	
	25	Lift cylinder	Function and penetration	During storage or idle periods, the equipment must be

				operated monthly at 10% of the maximum lifting speed to perform two full lifting cycles, one tilting cycle, and one steering cycle. This ensures lubrication of the cylinder inner walls and prevents rust. A record of anti-corrosion lubrication operation shall be maintained.
	26	Tilt cylinder	Function and penetration	During storage or idle periods, the equipment must be operated monthly at 10% of the maximum lifting speed to perform two full lifting cycles, one tilting cycle, and one steering cycle. This ensures lubrication of the cylinder inner walls and prevents rust. A record of anti-corrosion lubrication operation shall be maintained.
	27	Multi-way valve	Function and penetration	
	28	Hydraulic tank	Oil volume, penetration	
	29	High-pressure rubber hose	Oil volume, deformation	
	30	Overhead guard, load backrest	Damage, cracks and deformation	
	31	Brake lever	Lubrication and movement	
	32	Hand brake and various movement points	Adjustment and lubrication	
	33	Bolts and nuts	Looseness	
	34	Hydraulic steering	Function	During storage or idle periods, the equipment must be operated monthly at 10% of the maximum lifting speed to perform two full lifting cycles, one tilting cycle, and one steering cycle. This ensures lubrication of the cylinder inner walls and prevents rust. A record of anti-corrosion lubrication operation shall be maintained.

Maintenance every three months (600 hours)

During the three-month maintenance, repeat the monthly maintenance process. When parts must be adjusted or replaced, contact our maintenance personnel.

Maintenance every six months (1200 hours)

During the six-month maintenance, repeat the three-month maintenance process. If parts must be adjusted or replaced, contact our maintenance personnel.

Inspection site	Check item
Front axle	Change the transmission oil.
Brake fluid	Replace brake fluid.
Steering wheel conductive plate	Supplementary grease (for forklift trucks with steering wheel conductive plate).

Maintenance every year (2400 hours)

During the annual maintenance, repeat the six-month maintenance process. If parts must be adjusted or replaced, contact our maintenance personnel.

Inspection site	Check item
Hydraulic oil	Replace hydraulic oil.
Filter	Replace filter.
Gear pump and oil pump motor spline connection	Fully lubricate the internal spline of the motor with grease.

6.1.7 Lubrication system diagram

This is the lubrication system diagram of this model.

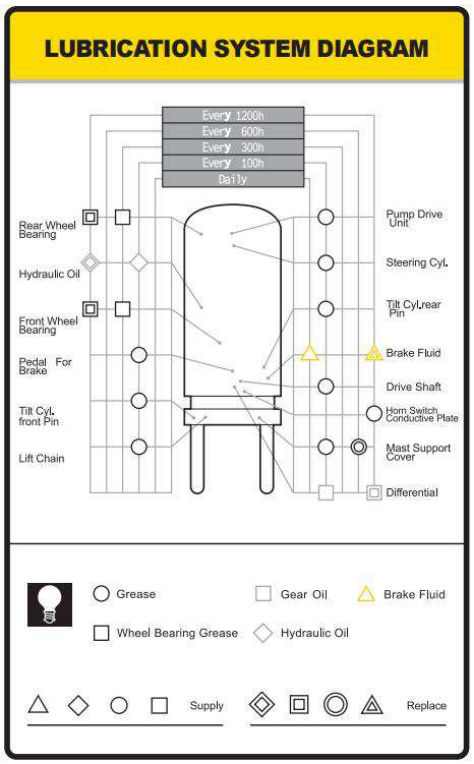


Figure 6-11

6.2 Drive System Maintenance

Regular and correct maintenance is essential for the safe operation of the drive system. Therefore, the maintenance interval schedule must be strictly observed. The maintenance intervals listed below are based on the normal operating conditions of the forklift. According to the actual operating conditions of the forklift, the maintenance interval can be shortened appropriately after consultation with the operator.

The following factors may require a shorter maintenance interval:

• Dirty road and poor road conditions

• Dusty or salty air

• High ambient humidity

• Extremely high or low ambient temperatures (e.g. in cold storage) and large temperature fluctuations

• Long multi-shift continuous operation

Routine maintenance interval

Maintenance interval	Maintenance work
After every 100 hours of operation or 50 km of driving	Retighten the wheel nuts to the specified tightening torque.
After every 1,000 hours of operation or after 6 months	Check the transmission oil level and add it if necessary.
	Check the bolt connection between the reduction gearbox and the chassis, and re-tighten it if necessary.

Maintenance interval	Maintenance work
	Check the bolt connection between the frame fixing device and the reduction gearbox and re-tighten it if necessary.
	Check the bolt connection between the motor and the reduction gearbox and re-tighten it if necessary.
	Check hydraulic connections, hoses or pipes for leaks or damage and re-tighten it if necessary.
	Check mechanical connections (e.g. brake cable) for damage and re-tighten it if necessary.
	Check whether the electrical connections and plugs on the motor and brake are secure and check for damage.
Every 2,000 hours of operation or after 2 years	Change the brake fluid for the integrated service brakes. Check the friction plate for wear, and replace it if worn.

Note: Each of the above maintenance intervals is subject to whichever comes first. Product-specific maintenance intervals

Maintenance interval	Reduction gearbox model	Maintenance work
Every 4,000 hours of operation or after 4 years	GP25	Change the transmission oil.
Every 10,000 hours of operation or after 8 years	GP25	Change the transmission oil.

Visual inspection	Inspection
Every 50 hours of operation or at least once a week	Check the overall condition of the drive wheels, including damage, wear and foreign matter in the tire pattern.
Every 500 hours of operation or after 6 months	Check the transmission system and vent valve for oil leakage.
	Check the overall condition of the reduction gearbox and whether the housing is damaged or cracked.
	Check the overall condition of the brake lever and its connection to the reduction gearbox housing to ensure that there is no leakage or damage.

Note: Each of the above maintenance intervals is subject to whichever comes first.

6.3 Steering system maintenance

- The steering king pin and its related tapered roller bearings should be inspected every 40 hours and lubricated every 300 hours (the greasing frequency should be increased according to the actual working conditions in outdoor sites with heavy dust and rain).
- Check the steering cylinder piston rod and connecting rod, left and right steering knuckle arms and connecting rod slewing joints every 300 hours, and confirm whether to add lubricating grease.
- It is recommended to replace the lubricating grease of the bearings at the wheel hub every 1200 hours.
- When changing the grease, observe whether the end face oil seal falls off. If yes, replace it with a new one.

Steering System Maintenance Interval

The steering system maintenance schedule is set based on standard working hours and operating conditions. If the forklift truck operates under harsh conditions, maintenance should be performed in advance.

Inspection items	Check item	Tools	Every day (8 hours)	Every month (200 hours)	3 months (600 hours)	6 months (1200 hours)	Every year (2400 hours)
Tire	Tire pressure	Barometer	•	•	•	•	•
	Abnormal wear condition		•	•	•	•	•
	Check if there are nails, stones, or other foreign objects in the tires.			•	•	•	•
	Check if the wheel hub nuts are loose.	Inspection hammer	•	•	•	•	•
Bearing	Check for looseness and noise in the wheel hub bearings.			•	•	•	•
Axle body	Check the deformation, cracks, or damage of the axle body			•	•	•	•
Steering cylinder	Check the operation condition		•	•	•	•	•
	Check for oil leakage		•	•	•	•	•
	Check if the cylinder head and installation bolts are loose	Inspection hammer	•	•	•	•	•

6.4 Hydraulic system maintenance

1. Check for any leakage at the rubber hose connectors, oil pump, oil cylinder, steering gear and multi-way valve of the hydraulic system before and after use.

2. Check for sufficient hydraulic oil in the hydraulic tank.

3. Replace the hydraulic tank air filter (hydraulic oil filler cap) every 2400 hours or 12 months, whichever comes first.

4. Replace the suction and return filters for the first time after 300 hours of operation, and subsequently every 2400 hours or 12 months, whichever occurs earlier.

5. Change the hydraulic oil every 2400 hours of use, and do not mix hydraulic oils of different grades.

Troubleshooting

7. Troubleshooting

7.1 Braking system troubleshooting

Fault category	Possible Causes	Troubleshooting method
Poor braking	Braking system oil leakage	Repair it
	Brake overheating	Check for slippage
	Poor contact between brake drum and friction lining	Adjustment
	Impurities in brake fluid	Check the brake fluid.
	Brake pedal (micro valve) not adjusted correctly	Adjustment
Brake has noise	Brake return spring failure	Replacement
Uneven braking	Friction plate sintering or wear	Replacement
Brake failure	Braking system oil leakage	Repair or replace it
	Air is mixed in the brake system	Release air
	Brake pedal not adjusted correctly	Readjust as needed
Gearbox abnormal noise	Gear oil deteriorated	Replacement
	Bearing damage	Repair or replace it
	Adjusting shim worn	Repair or replace it
	Gear clearance not adjusted properly	Repair it
	Gear worn	Repair or replace it
Oil leakage	Oil seal worn or damaged	Repair or replace it
	Seal gasket worn	Repair or replace it

7.2 Steering system discharge

Fault category	Possible Causes	Troubleshooting method
Steering wheel cannot turn	Damaged or faulty oil pump	Replacement
	The priority valve (multi-way valve) is blocked or damaged	Clean or replace this part
	Rubber hose or joints damaged or pipeline blocked	Clean or replace this part
Steering operation is laborious	Steering relief valve (in multi-way valve) pressure is too low	Adjust pressure
	There is air in the oil circuit	Remove air
	Control oil circuit blocked	Clean or replace this part
	Priority valve (in multi-way valve) itself is faulty	Check and replace it.
	Hydraulic steering gear reset failure, positioning spring plate broken or insufficient elasticity	Replace the spring plate
	Excessive leakage in steering cylinder	Check piston seal
Abnormal noise	Low oil level in tank	Refill oil

Fault category	Possible Causes	Troubleshooting method
	Suction pipe or oil filter blocked	Clean or replace this part
	Insufficient lubricant	Apply or add albany grease
	Bolt or nut loose	Fasten
	Incorrect installation of axle end axle adjusting shim	Adjustment
	Damage to connecting rod end oscillating bearings	Replacement
Unstable driving	Loose wheel nut	Fasten
	The wheel bearing exceeds the adjustment range	Adjustment
	Incorrect installation of axle end axle adjusting shim	Adjustment
Oil leakage	The steering cylinder guide sleeve seal is damaged or the pipeline or joint is damaged.	Replacement

7.3 Hydraulic system discharge

Fault category	Possible Causes	Troubleshooting method
Low output pressure of the oil pump	The oil pump is sucking in air, causing insufficient hydraulic oil	Add hydraulic oil and remove air
	The suction pipe or filter is blocked	Clean the oil circuit and oil tank. If the hydraulic oil is turbid, replace it.
	Worn bearing, damaged end cover seal ring	Replace the gear pump.
	Oil pump gear is worn	Replace the oil pump.
	Incorrect rotation direction of the oil pump	Correct it
	Incorrect adjustment of the safety valve	Adjust the oil pressure gauge to the specified pressure
The oil pump is making noise.	The suction side hose is twisted or the filter is clogged, causing cavitation.	Adjust the pipeline and clean the filter.
	Air is sucked in due to loose suction joint.	Tighten the joint
	The high viscosity of the hydraulic oil leads to cavitation.	Replace hydraulic oil suitable for oil pump operation
	Insufficient hydraulic oil causing air to be sucked into the oil pump	Add hydraulic oil to the specified level
The pressure of the safety valve is unstable or cannot be regulated	Loose adjusting screw	Adjust the pressure gauge and tighten the lock nut
	Deformation or damage of the pressure control spring	Replace the pressure control spring or safety valve
	Wear or jamming of the safety valve spool	Replace the safety valve or disassemble, clean, and reassemble
	The oil pump is heavily worn.	Maintenance or replacement of the pump
When the machine is stopped, operate the tilt valve lever, and the mast can tilt forward	Wear or damage of the tilt self-locking valve	Replace the valve spool and tilt self-locking valve as an assembly
	Damage to the O-ring of the tilt valve stem	Replace the O-ring

	Deformation or damage of the self-locking valve spring	Replace the spring
The mast significantly drops when the lifting control valve stem is in the neutral position	Wear of the valve body or valve stem, resulting in excessive clearance	Replace the valve stem with appropriate clearance
	The valve stem position is not returning to the neutral position	Put the valve stem in the neutral position
	Damage to the cylinder piston seal causes internal leakage	Replace seal ring.

Fault category	Possible Causes	Troubleshooting method
	There is external leakage in the lifting pipeline	Tighten the rubber hose connectors and replace the damaged rubber hose
The valve stem cannot return to the neutral position	Impurities between the valve stem and the valve body	Clean
	Deformation or damage of the reset spring	Replace the spring
External leakage	Damaged seal ring at the oil leakage site	Replace seal ring.
	Mismatched sealing form of the oil port joint	Replace with the correct sealing form
	Loose joints or fasteners	Tighten the oil leaking joints or fasteners
Heavy steering	Insufficient oil supply from the pump, light steering at low speeds and heavy steering at high speeds	Check if the motor speed or oil pump is normal
	Low pressure of the steering safety valve or blocked by impurities	Adjust the pressure of the safety valve or clean the safety valve
	Deformation or breakage of the priority valve spring	Replace the priority valve spring
	The oil viscosity is high.	Use the recommended hydraulic oil
	Small clearance in steering gearbox spline shaft	Check the clearance of the steering gearbox spline shaft and replace the steering gear if necessary.

7.4 Lift System Troubleshooting

Fault category	Possible Causes	Troubleshooting method
Lifting cylinder, tilting cylinder not holding pressure	The spool of the directional valve is stuck by impurities and cannot return to the neutral position.	Filter the hydraulic oil, clean the spool and valve body, or replace the multi-way valve.
	Wear of the cylinder seal ring.	Replace the piston seal ring or the cylinder.
	The control valve stem spring of the multi-way valve is malfunctioning.	Replacement
The lifting of the inner mast and fork frame is not smooth	Insufficient lubrication	Apply grease to the surface of the roller track
	Foreign objects exist between the roller and the track	Check the track and remove foreign objects
	Deformation of the mast and fork frame	Replacement or repair
The inner mast and carriage are obviously skewed during the lifting	Inconsistent tension of the two side chains	Adjust the chains to make the tension consistent
	Improper adjustment of side	Adjusting side rollers

	rollers	
	Synchronous adjustment of lifting cylinders	Roller not rotating
	Lubricating grease hardens, rollers blocked by foreign objects	Clean and lubricate rollers
The roller does not rotate	The grease hardens, and the roller is stuck by foreign objects	Clean and lubricate the roller
Mast too large noise	Insufficient lubrication	Apply grease to the surface of the roller track
	Limit block collision	Adjust the chain to the correct position
	The upper end roller of the fork frame collides significantly with the inner mast when retracted	Adjust side roller
Lifting is weak or unable to lift	The piston seal of the lifting cylinder is worn and leaking internally	Replace seal ring.
	Hydraulic pipeline oil leakage	Check if the seal and joints are damaged, tighten the joints
	Oil leakage between valve bodies of multi-way valve	After grinding, reassemble and tighten the screws in order

Fault category	Possible Causes	Troubleshooting method
	Hydraulic oil temperature is too high, oil becomes thin, and flow is insufficient	Check the reasons for the high oil temperature and consider replacing the high-temperature resistant hydraulic oil
	Overloading	Reweighing of cargo

Technical parameters

8. Technical parameters

8.1 Forklift truck main technical parameters

Category		Unit	Parameters	
Overview	Product type designation	/	SCP16S	SCP20S
	Rated load capacity	Q (kg)	1600	2000
	Load center distance	c (mm)	500	500
	Load distance, centre of drive axle to fork	x (mm)	365	370
	Wheelbase	y (mm)	1300	1390
Weight	Service weight	kg	2950	3325
	Axle loading, laden front/rear	kg	3900/550	4826/544
	Axle loading, unladen front/rear	kg	1330/1620	1423/1902
Tire	Tire type	/	Solid tires	Solid tires
	Tire size, front	/	18×7-8	200/50-10
	Tire size, rear	/	15×4.5-8	140/55-9
	Tread, front	b10(mm)	945	961
	Tread, rear	b11(mm)	190	200
Dimensions	Tilt of mast, forward/backward	α/ β（°）	5/7	5/7
	Height, mast lowered	h1(mm)	2060	2060
	Free lift	h2(mm)	100	100
	Lift height	h3（mm）	3000	3000
	Height, mast extended	h4(mm)	4092	4092
	Height of overhead guard	h6(mm)	2040	2040
	Overall length (to front end face of fork)	L2(mm)	1868	1969
	Overall width	b1（mm）	1110	1140
	Fork size (thickness / width / length)	s/e/l(mm)	35/100/920	40/122/920
	Spacing of forks	mm	1040/200	1040/200
	Min. ground clearance at mast	m1(mm)	90	90
	Min. ground clearance at axle center	m2(mm)	110	110

Category		Unit	Parameters	
	Right-angle stacking aisle width (1m x 1.2m transverse pallet)	Ast(mm)	3200	3310
	Right-angle stacking aisle width (0.8m x 1.2m longitudinal pallet)	Ast(mm)	3320	3430
	Min. turning radius	Wa (mm)	1500	1610
Performance	Max. travel speed (laden/unladen)	km/h	16/16	16/16
	Max. lifting speed (laden/unladen)	mm/s	510/530	510/530
	Lowering speed (laden/unladen)	mm/s	500/580	500/580
	Drawbar pull (laden/unladen)	N	13000	14100
	Gradeability (laden/unladen)	%	22	22
	Service brake	/	Hydraulic	Hydraulic
	Parking brake	/	Mechanical	Mechanical
Motor battery	Drive motor (S260min)	kW	6 × 2	6 × 2
	Lift motor (S315%)	kW	20	20
	Battery voltage/ Nominal capacity	V/kWh	96/22	96/22
	Battery weight	kg	220	220
Controller	Type of drive control	-	Permanent magnet synchronous	Permanent magnet synchronous
	Hydraulic oil pressure for controlling attachments	Mpa	16	18

8.2 Transmission system parameters

Product type designation	SCP16S/20S
Gear ratio	26.75
Weight	31 kg
Maximum Static Load	2400 kg
Lubricant	Mobil 424 transmission oil
Maximum input torque	65 Nm
Maximum input speed	5500 rpm
Maximum output torque	1600 Nm
Maximum output speed	206 rpm

Tire Specifications	200/50-10
Braking Form	Wet brake

8.3 Steering axle parameters

Weight	55 kg
Maximum Static Load	1950 kg
Maximum internal turning angle	90°
Maximum external turning angle	90°
Tire Specifications	140/55-9

8.4 Drive Motor Parameters

Name	Requirements
Product type designation	TZ160X8H-96SY-L / TZ160X8H-96SY-R
Motor type	Permanent magnet synchronous motor
Operating voltage range	72-115VDC
Rated voltage	96VDC
Rated power	8kW
Peak power	12kW
Rated speed	1500rpm
Maximum speed	5500rpm
Number of pole pairs	4
Cooling mode	Natural cooling
Working system	(See the following table for working conditions)
Rated torque	50.9N.m
Peak torque	65N.m
Protection level	IP67
Insulation grade	Grade H
Maximum counter electromotive force	Maximum no-load counter EMF: 129V /5500rpm
Rated current	165A
Peak current	205A
Highest efficiency	≥90%
Weight	≤28±1kg

Note: Power off when checking and maintaining the motor to avoid accidents.

8.5 Oil Pump Motor Parameters

Name	Requirements
Product type designation	P25-50-96SY
Motor type	Permanent magnet synchronous motor
Operating voltage range	72-115VDC
Rated voltage	96VDC
Rated power	20kW
Peak power	25kW
Rated speed	5300r/min
Maximum speed	6000r/min
Number of pole pairs	4
Cooling mode	Natural cooling
Working system	(See the following table for working conditions)
Rated torque	36N.m
Peak torque	50N.m
Protection level	IP67
Insulation grade	Grade H
Maximum counter electromotive force	Maximum no-load counter EMF: 50VPeak@6000r/min
Rated current	237A
Peak current	310A
Highest efficiency	≥90%
Reduction ratio of gearbox	2
Maximum input speed of reduction gearbox	9000r/min
Maximum input torque of reduction gearbox	100N.m

Note: Power off when checking and maintaining the motor to avoid accidents.

8.6 Lithium battery parameters

Item	Parameters
Cell system	Lithium iron phosphate
Nominal voltage/capacity	96V/230Ah
Rated energy	22kWh
Operating voltage range	75~109.5V
Rated charging current	200A
Charging temperature	0~55℃
Discharging temperature	-20℃~60℃

8.7 Hydraulic system parameters

Oil pump (gear pump)

Load conditions	Normal load
Drive type	Directly connected to motor
Gear	Single
Displacement	26 mL/r
Rated Pressure	18 Mpa
Max. Pressure	20.6 Mpa

Multi-way directional control valve

Main unloading set pressure	SCP16S: 15.5~16Mpa SCP20S: 18.5~19Mpa
Safety valve type	Plug in
Slide valve type	Axial, spring reset
Rated flow	65 L/min

Proportional multi-way directional valve

Main unloading set pressure	SCP16S: 15.5~16Mpa SCP20S: 18.5~19Mpa
Safety valve type	Plug in
Slide valve type	Axial, spring reset
Rated flow	65 L/min
Control voltage	12VDC

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