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CE

FE4P25-32C-SM-001-2023

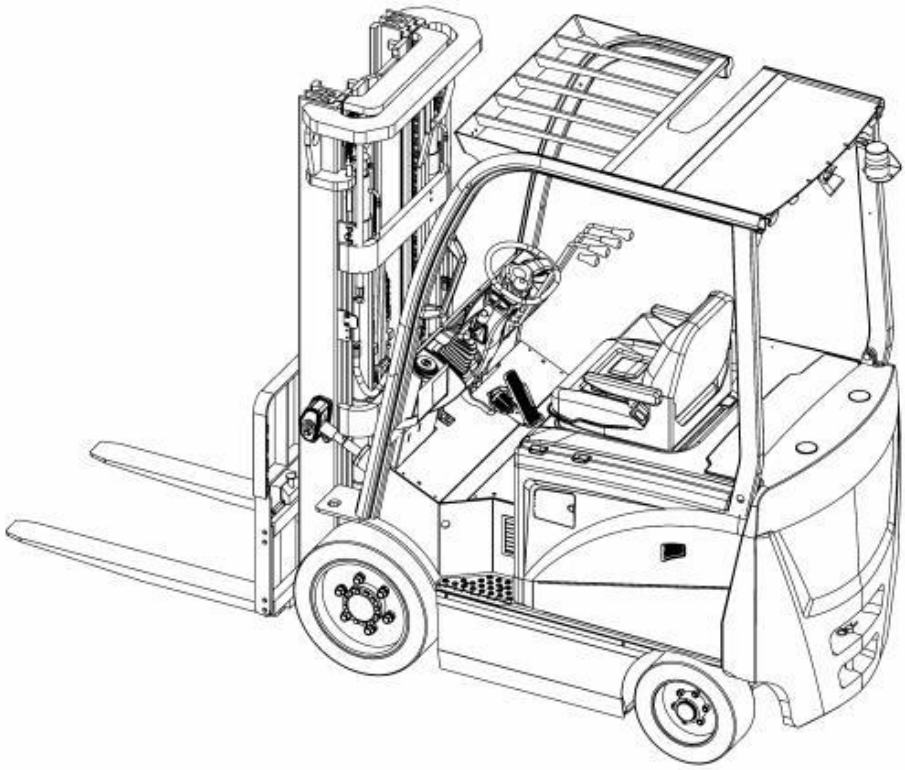
⚠ WARNING

You must read this manual before using

And all kinds of warning stickers on the Forklift!

Keep it for future use!

Warning: This truck is limited to use in factory areas, tourist attractions, and playgrounds



Service Manual

FE4P25C-32C electric counterbalance short wheelbase forklift

NOBLELIFT Intelligent Equipment Co., Ltd.

Catalogue

1. General

1-1. How to use this manual

1-1-1. Composition of this manual

This service manual mainly provides engineers and technicians service information for forklift repair and maintenance, which excludes vehicle operation instructions.

The introduction section of this manual introduces the functions of the vehicle with attention to its different components. More detailed specific information is available in the main body of this manual for you, including the schematic diagram of the vehicle components, the principle they work, the check lists, the maintenance procedures as well as the data and information as needed for maintenance and repair

To facilitate a quick and easy access to the services and training information as required by the readers, the sections of this manual are categorized as per different systems of the vehicle (Please refer to the table below).

Section	Headings
1	Foreword
2	Electronic System
3	Driving/Braking System
4	Hydraulic System
5	Lift/tilt/support system
6	Steering System
7	Schematic Diagram

8	Other
9	Battery Charger

1-1-2 Definitions of Warning Signs

The following three warning signs are applicable to this Manual: "Danger", "Warning" and "Caution". Each label is intended to indicate the severity and nature of the potential hazard, the consequences, as well as preventive measures against hazards. You will find these signs throughout this manual. Please ensure your careful attention to such signs, as they are included for your safety intensively.

⚠ Danger

This signs represents a dangerous situation that could result in death or serious injury if not avoided

⚠ Warning

This signs represents a dangerous situation that could result in death or serious injury if not avoided

⚠ Note

The label indicates a dangerous situation that could result in minor injuries if not avoided

1-2 Glossary

The terms referred in this service manual and their descriptions are as follows.

Item	Descriptions
Accelerator	A device that converts mechanical motion to an analog voltage mode and transmit to a controller to control the speed at which a vehicle is driven
Actuator	A device (e.g. a hydraulic cylinder and motor) that converts hydraulic power into mechanical force and motion.
Ampere (A)	A measurement unit of current. The current of a voltage passing through an ohmic resistor.
Battery	Two or more batteries, which are inter-connected with each other to provide current.
Coulomb meter	(Battery Discharge Indicator) an electrically controlled display that shows the operator the current charge of a battery.
Busbar	A re-conducting conductor that wired to other smaller conductors.
Communication Modes	CAN (Controller Area Network) is the standard for communication among microcontrollers and/or devices.
Condenser	A device for short-time electrical energy storage.
Goods Holder	A supporting structure on which a fork is mounted
Check Valve	A valve that allows oil to flow in one direction rather than in the other
Circuit	A path along which current can travel from the positive (+) side of the source to the negative (-) side. This can be obtained with wires and electrical components.
Connector	A part of a wire assembly or harness wired to another wire assembly or harness to for an easier Disassembly and Assembly operation.
Co-contactor	A switch, relay, or part of a contactor that opens or closes a circuit.
Components of Co-contactor	An electrical element consisting of an electromagnetic coil and a set of heavy contact tips, which controls current flow through the coil, create a magnetic field, and close or open contact tips
Coil of Co-contactor	An electromagnet used to open or close contact tips in a contactor component.
Control Valve	A valve unit includes multiple directional blocks, each of which has a corresponding actuator
Counterweight	The weight mounted on the back of the forklift to ensure a stable status, especially when lifting heavy loads
Current Limiting	The maximum permissible armature current of the stopped drive motor during the pulse.
Oil Cylinder	A container that maintains pressurized oil and converts hydraulic power into rectilinear motion
DC-DC Convertor	A device that converts a high-voltage DC onto a low-voltage DC.
Digital Signal	A signal in which the element can be either of two different values, e.g. high voltage and low voltage.
Diode	A semiconductor device that allows current to flow from the anode to the cathode in one direction
Directional Valve	A valve that directs the flow of oil according to the position of the valve element.

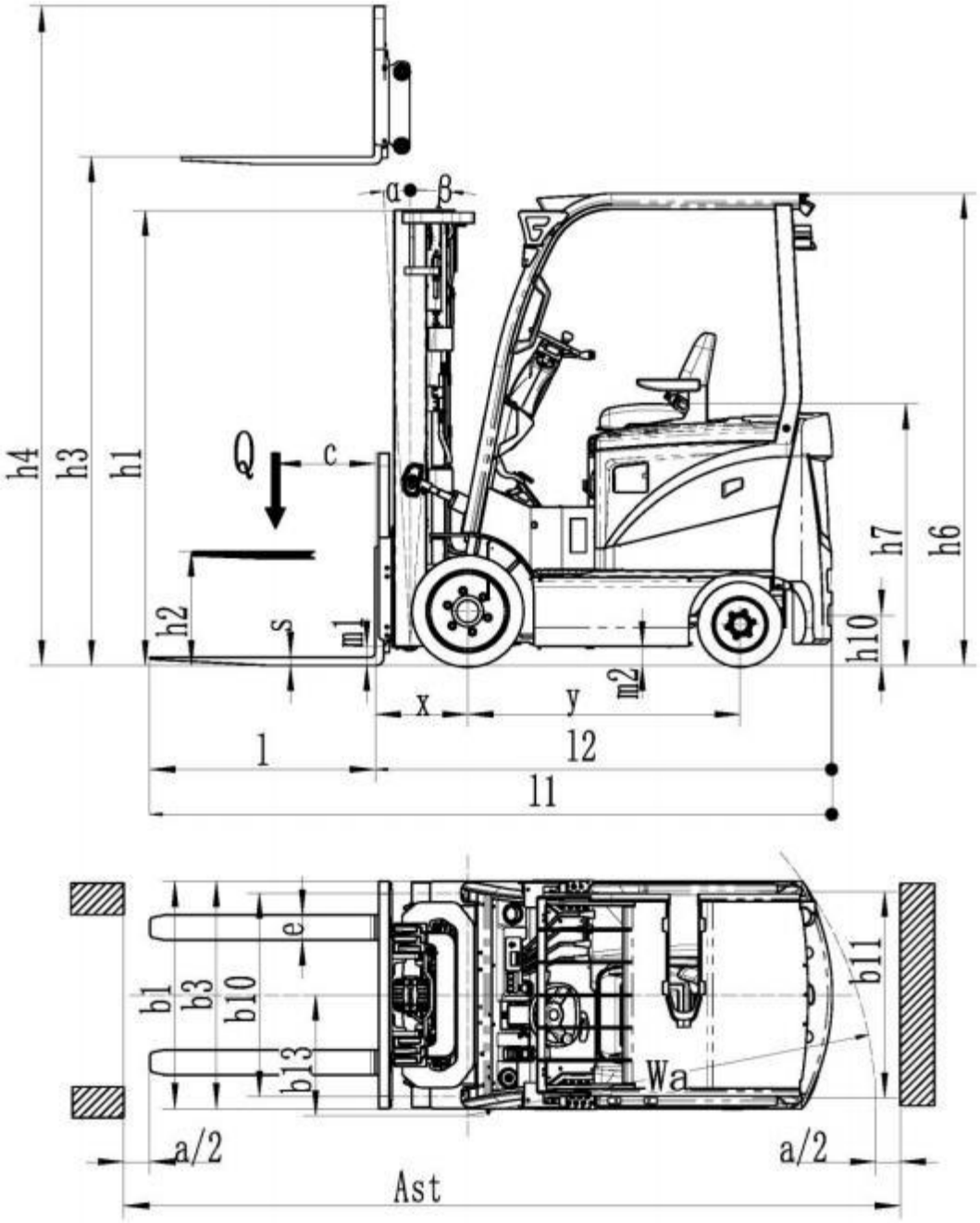
Instrument	An electrical device that converts voltage input into a visual output.
Drive Axle	A device that receives power from a driving motor
Driving Controller	A control device to drive an electric motor, which includes an inverter and a logic circuit.
Handheld Programmer	A maintenance tool program to calibrate and diagnose CURTIS controllers of trucks.
Parking Brake	A pair of brakes that electromagnetically activate their respective motors upon the stationary of the vehicle.
Encoder	A device that detects the direction and speed of a motor to produce a pulse signal.
Fan	A device that generates an airflow to cool an electric motor and a controller.
Filter	A mechanical device used to accommodate a filter element, or a filter device used to prevent contamination flow through a system
Flow Protector	A valve that prevents the hydraulic oil extraction of the control valve from the lifting cylinder when the hydraulic line breaks unexpectedly, which prevents the backstay from dropping suddenly.
Flow Regulator	A valve that reduces the pressure by limiting the flow of a hydraulic line
Pallet Fork	L shape rod for cargo pickup
Friction Plate	When meshing with helical gears, the friction disc stops the drive shaft movement when it is compressed by the steel plate
Fuse	A component of a circuit that opens upon an overlarged current flowing through a given part of the circuit
Fixture	A fitting o secure an assembly consisting of two or more wires
Radiator	A mounting frame for cooling semiconductors.
Hydraulic System	A hydraulic element circuit to convey oil pressure
Hydraulic Oil Tank	A chamber for the oil storage in a hydraulic system
Mandatory Sign	A symbol indicating the state of a vehicle when it is on or flashing.
Seat Switch	A switch to disable the vehicle movement when the operator leaves the seat.
Main Hydraulic Pump	A gear pump uses mechanical power from an electric motor to pressurize the oil stored in a tank and distribute to various actuators
Portal	The front vertical structure of the forklift extends and retracts to lift and lower the load.
Master Cylinder	The hydraulic cylinder which is responsible for the start-up of the driving brake
Needle Valve	A valve to lower the backstay manually when the lifting lever is not available.
Normal State	A term used with switches or relays. Their "normal state" means that they are not under any control of stress, temperature, pressure or electricity.
Ohm (Ω)	A resistance unit. The resistance will be such that one volt shall push one ampere of current through it only.
Timely	The time it takes for a current to flow through a transistor.
Open Circuit	A connection or component of a circuit without continuity.
Hole	A limited passage in a hydraulic circuit, including a limited flow or pressure generation in a given chamber(e.g. a small bore).
Top Cover	A overhead frame structure which protects the operator from falling objects
Overload	A condition that the existing voltage or current is greater than the capacity of a given circuit or component.
Piston Rod	A part that push oil into the cylinder chamber

Suffocated	The part of an electric brake in which the current generated is directed back to the armature.
Port	An input or output point on a hydraulic element
Power Socket	A connecting socket that installed on the forklift.
Pressure	a fluid force as per unit area
Proximity Detector	A sensor which can detect the presence of objects nearby without any physical contact.
Pump Controller Unit	A control device for a hydraulic motor, which includes an inverter and a logic circuit.
Safety Valve	A valve that limits the pressure of the hydraulic system by releasing excess oil
Resistance	A component made of a material with a specific current impedance.
Return Filter	A filter to collect contaminants in oil returned to a hydraulic tank
Rotor	A part of rotating motor.
Outline	A bar chart of an electrical or electronic component that uses symbols to show the individual components as well as how the wires and connectors work electrically
Serial Port	A port that communicates one-to-one with the controller.
Service Brake	A pair of brakes built into the drive shaft to enable the vehicle when the operator applies the pedal for stationary
Short Circuit	An unwanted electrical connection between two or more components.
Side Shifter	An accessory that moves the fork and its load to the left and right
Socket	The male contact of the connector which slides over the male contact of the other connector (pin).
Magnetic Valve	A directional valve that moves the valve element when the magnetic coil is equipped with a magnetic valve.
Solid State	A term that refers to semiconductor components or circuits that wired without moving parts, e.g. diodes and transistors.
Stator	a fixing part in the motor
Steering Shaft	A column that connects the steering wheel to the steering gear to allow the operator to use steering wheel controller
Jociey Stick	A hydraulic component that deliver oil to the right or left side of the steering cylinder as required by the operator
Steering System	Hydraulic element loop, including steering unit, circuit and actuator
Steering Gear	A axle mounted on the rear wheel of a vehicle
Switch（SW）	The component to control a circuit by opening or closing the circuit.
System	Electrical components, circuits, and connections that provide power for specific tasks.
Thermal Sensor	A sensor activated at a pre-conditioned temperature.
USB	A connecting device providing a power supply of 5V.
Valve	A component that controls the pressure, direction, or velocity of a hydraulic system
Voltage	A measurement unit of electrodynamic force. A volt is the force that required for an ampere of current to pass through an ohmic resistor in a circuit.
Watt	A unit of power measurement. The power for one volt to push one ampere of current through an ohmic resistor.

	The outcomes of amperage (current) multiplied by volts (voltage) is watts (power).
Wire	A path of conductors to provide for current flow in and out of different electrical components.
Wiring Diagram	A visualized figure that represents a component in the way it actually looks, which is used to show the locations of components, and the connections between them.
Zener Diode	A special diode to regulate voltage or protect a system from overvoltage.

1-3 Appearance and Specifications

Overall dimensions of the vehicle



Model FE4P25C-32C parameter table

Model	FEXC		
Specification number		FE4P25C	FE4P32C
Drive :		electric	
Type of operation		seated	
Load capacity/rated load Q	lb(kg)	5000(2270)	6500(2950)
Load center distance C	in(mm)	24(600)	24(600)
Front overhang x	in(mm)	17.3(440)	17.5(445)
wheelbase y	in(mm)	51(1295)	55(1395)
Service weight incl. battery	lb(kg)	9405(4350)	10175(4850)
Axle load at full load, front/rear	lb(kg)		
Axle load at no load, front/rear	lb(kg)		
Tires: Solid Rubber/Super Elastic/Pneumatic		Solid Rubber	
Tyres size,front		21×7-15PR	21×8-15PR
Tyres size,rear		16x6-10.5PR	16x6-10.5PR
Wheels,number front/rear (×=driven wheels)		2×/2	2×/2
Track width,front b10	in(mm)	34.7(882)	35.5(902)
Track width,rear b11	in(mm)	36.3(922)	36.3(922)
Mast/fork carriage tilt forward/backward α/β	°	6/8	6/8
lowered mast height h1	in(mm)	85.4(2170)	85.4(2170)
Free lift h2	in(mm)	4.7(120)	4.7(120)
Lift height h3	in(mm)	118.1(3000)	118.1(3000)
Extended mast height h4	in(mm)	156.6(3977)	160.6(4079)
Overhead load guard h6	in(mm)	88.6(2280)	88.6(2280)
seat height h7	in(mm)	49.2(1250)	49.2(1250)
Coupling height h10	in(mm)	11.6(295)	11.6(295)
Overall length l1	in(mm)	127(3225)	127(3225)
Length to face of forks l2	in(mm)	84.8(2155)	91.1(2315)
overall width b1	in(mm)	42.5(1080)	44.7(1135)
Fork dimensions s/e/l	in(mm)	1.6/4.7/42.1(40/120/1070)	1.6/4.9/42.1(45/125/1070)
Fork carriage width b3	in(mm)	40.9(1040)	43.3(1100)
Ground clearance ,laden,under mast m1	in(mm)	4.3(110)	4.3(110)
Ground clearance,centre of wheelbase m2	in(mm)	4.7(120)	4.7(120)
Turning radius Wa	in(mm)	76.8(1950)	80.7(2050)
Travel speed,laden/unladen	mph(km/h)	9.3/9.3(15/15)	9.3/9.3(15/15)
Lift speed,laden/unladen	fpm(mm/s)	67/79(340/400)	67/79(340/400)
lowering speed,laden/unladen	fpm(mm/s)	＜118(＜0.6)	＜118(＜0.6)
Max.Gradient performance,laden/unladen S2 5 min	%	15/20	15/20
Drive motor rating S2 60 min	hp(kW)	16.1(12)	16.1(12)

Lift motor rating at S3 15%	hp(kW)	21.4(16)	21.4(16)
Battery voltage,nominal capacity K5	V/Ah	Lithium battery 80/412 (optional 80/554) Lead acid (80/480)	Lithium battery 80/412 (optional 80/554) Lead acid (80/480)
Type of drive control	AC		
Operating pressure for attachments	psi(bar)	2538(175)	2538(175)
Oil volume for attachments	l/min	570(36)	570(36)
Sound level at driver's ear according to EN 12 053	dB(A)	73	73

1-4 Safety Notes

Precautions for use

1.Transportation

Pay attention to the following items when shipping forklifts in containers or cars:

(1). Apply the parking brake;

(2). Steel wires should be used to fix the mast and the counterweight front and rear, and the corresponding positions of the front and rear tires should be wedged firmly with wedges;

(3). When lifting, lift according to the position marked on the "lifting sign" of the forklift.

2. Storage

(1). The mast is lowered to the lowest position;

(2). Turn off the electric lock, put all the levers in the empty space, and unplug the power plug;

(3). Tighten the hand brake lever;

(4). The front and rear tires are padded with wedges;

(5). When the forklift is out of service for a long time, the wheels should be elevated. The battery should be recharged once a month.

3、Prepare before use

(1). Check whether the instruments are normal;

(2). Check the tire pressure;

(3). Check the condition of each handle and pedal;

(4). Check whether the voltage of the battery pack is within the working range, whether the specific gravity of the electrolyte and the height of the liquid level are appropriate;

(5). Check whether the contacts and plugs of the electrical system are reliable;

(6). Check whether the hydraulic oil, electrolyte, and brake fluid are leaking;

(7). Check the tightness of the main fasteners;

(8). Check whether the lighting and signal lights are normal;

(9). Release the parking brake;

(10). Carry out test actions of mast lifting, forward and backward tilting, steering and braking;

(11). The pollution degree of the hydraulic oil is not more than 12 grades.

4.Operation

(1). Drivers who have been trained and hold a driver's license can drive;

(2). Operators should wear shoes, hats, clothing and gloves that can be used for safety protection;

(3). Pay attention to the performance and working status of mechanical, hydraulic, electrical and MOSFET governors during use;

(4). Turn on the power, first turn on the key switch, select the position of the direction switch, turn the steering wheel to see if the vehicle is running normally, and slowly step on the speed control pedal to maintain proper starting acceleration;

(5). Pay attention to observe the voltage of the voltmeter. When the forklift is working, if the voltage of the voltmeter is lower than 41V or 72V, stop the operation immediately, charge the battery or replace the battery with sufficient power;

(6). The load should not exceed the specified value during handling, the distance and position of the forks should be appropriate, and the forks must be inserted under the goods to make the goods evenly distributed on the forks to avoid partial load;

(7). When the center of gravity of the cargo is less than or equal to 500mm from the fork arm, the maximum load is the rated lifting capacity. If the center of gravity of the cargo is greater than 500mm from the fork arm, the lifting capacity should be less than the rated lifting capacity;

(8). After the fork is loaded, the mast should be tilted backward to the maximum position, the fork arm should be in contact with the cargo, and the fork should be raised about 200mm from the ground before driving;

(9). Standing people are prohibited under the fork, and lifting is prohibited on the fork;

(10). When the cargo is lifted and lowered, the initial speed should not be too fast;

(11). It is not allowed to operate the vehicle and accessories at positions other than the driver's seat;

(12). When the mast is tilted forward or backward to the limit position or the fork is lifted to the maximum height, the handle must be quickly returned to the middle position;

(13). When the mast is lifted, it is not allowed to drive or turn;

(14). Pay attention to pedestrians, obstacles and potholes when driving, and pay attention to the

gap above the forklift;

(15). Be careful when driving on a slope. When driving on a slope that is more than one-tenth of the slope, you should drive forward when going uphill and reverse when going downhill. Do not turn when going uphill or downhill. carry out loading and unloading operations;

(16). Slow down when turning on wet or slippery roads; be careful and slow when driving on docks or temporary auxiliary boards;

(17). For high-lift forklifts with a lifting height greater than 3 meters, attention should be paid to the falling of the cargo above, and protective measures should be taken if necessary;

(18). Do not carry unfixed or loosely stacked goods, and handle larger-sized goods carefully;

(19). When the forklift is driving with a load, emergency braking should be avoided;

(20). When leaving the car, lower the fork to the ground, put the gear handle in neutral, disconnect the power supply, and stop on a ramp. Will

Pull the parking brake device well, and use wedges to cushion the wheels when parking for a long time;

(21). The safety valve pressure of the multi-way valve and the safety valve pressure of the steering gear have been adjusted before the forklift leaves the factory. The user should not adjust it arbitrarily during use, so as to avoid damage to the entire hydraulic system or hydraulic components and motor burnout caused by excessive pressure adjustment;

(22). The tire inflation pressure shall be inflated according to the air pressure value specified on the "tire pressure" sign;

(23). A forklift with attachments should be operated as a loaded forklift when it is running empty.

5.Use of lithium battery

Please use the battery pack in strict accordance with the conditions specified in the battery pack instruction manual, otherwise it may not be covered by the warranty

(1). Do not operate electric vehicles with lithium batteries in environments where the temperature exceeds 55°C or is lower than -25°C

(2). In a low temperature environment below 0°C, please charge the vehicle immediately after use

(3). Do not wash the battery box directly to prevent water from entering the battery box

(4). Non-professionals, please do not touch, move, disassemble the battery pack and the corresponding high-voltage cables, or other components with high-voltage warning signs

(5). If the vehicle is subjected to a strong collision while driving, stop the vehicle in a safe area and check whether the battery pack area of the vehicle is damaged

(6). When the vehicle or battery pack catches fire, leave the vehicle quickly to a safe distance, and use a dry powder fire extinguisher to deal with it. Using water to extinguish the fire or using an incorrect fire extinguisher may cause electric shock. According to the characteristics of the battery, the battery within the three-package period Capacity attenuation range is 0% to 25%

(7). The charging temperature temperature range is: 0-40°C. High-rate charging in a low-temperature environment below 0°C will cause damage to the battery. In a low-temperature environment below 0°C, please charge the vehicle immediately after use.

(8). Discharge temperature range: -20～50℃, the discharge capacity at low temperature (-20～0℃)

may be lower than that at normal temperature. The battery can be used at an ambient temperature of 40～50℃, but The temperature of the battery is too high, especially if the battery is in a high temperature environment for a long time, it will accelerate the aging of the internal materials of the battery and shorten the service life of the battery, so it is not recommended to use it at this temperature for a long time.
(9). If the ambient temperature exceeds the above charging and discharging temperature range, it will negatively affect or damage the performance of the battery and may shorten the service life of the battery. Please avoid it.

6.Use of lead-acid battery

(1). When charging the battery pack for the first time and supplementary charging, strictly abide by the provisions of the battery manual;
(2). When the forklift is working, when the voltage of the battery pack drops to 41V, or when the voltage of any single battery drops below 1.7V, or the instrument gives an alarm, the forklift should stop working immediately, and it can only be started after charging or replacing the battery pack. continue to use;
(3). When charging, check the specific gravity, liquid level and temperature of the electrolyte at any time;
(4). After the forklift is used, the battery must be charged as soon as possible, and the storage time should not exceed 24 hours. When charging, it is necessary to prevent undercharging and overcharging to avoid damage to the battery;
(5). Forklifts in normal use should be charged once a month to adjust the proportion of each battery in the battery pack.
For detailed charging methods and usage and maintenance, please refer to relevant chapters in this manual.

◆The following safety sections contains the following subsections: general, personal safety, maintenance safety, compressed air hazards, hydraulic oil hazards, mechanical hazards, electrical hazards, and fire & burning hazards. Each heading are attached with the precautions you should take
for your safety while working in your vehicle.

◆Readers are advised with responsibility to read this manual thoroughly, and understand and follow all the following precautions. Please also note that the safety instructions listed below are not only for the safety of the readers, but also for those around them. Therefore, please be sure to read the following instructions carefully for the purpose of your own personal safety and the safety of those around you:

General

Safety Instructions

Please be familiar with the visible safety instructions on the vehicle, which includes warning signs, stickers, carvings, etc. Make sure to read the them before operating, lubricating, or repairing the vehicles (Please refer to the safety section of the Operations and Maintenance Manual).

Make sure that all safety rules, regulations and instructions are followed when performing maintenance tasks. Special attention is required to the danger warning in this manual, which will detail you the potential dangerous conditions.

Do not assume that you can replace the steps outlined in this manual with your previous maintenance experience of similar models. Weight and specifications vary from different models and care is required to avoid any dangerous condition, injury and/or component damage.

Personal Safety

Do not operate or service a vehicle without authorization or training.

Do not operate or service a vehicle after alcohol or drugs taking which will impair your judgement.

If you have any disease or condition that restricts physical activity, please do not operate or service the vehicle.

Working Garment

If you are wearing baggy clothes or have long hair that is not handled safely, please do not operate the vehicle or carry out maintenance.Both can be caught by any moving part and cause serious injuries

Appropriate protective equipment is required when performing maintenance tasks. Protective gear may include a hard helmet, glasses/visor, ear protectors,
gloves and protective shoes.

Masks are required when polishing the body and an air breathing device is advised when painting.

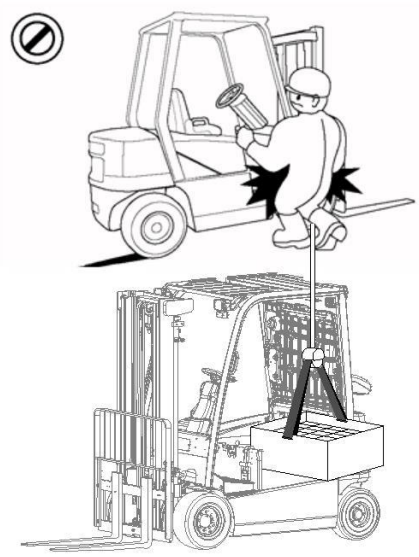
Welder gloves, welding masks/goggles, aprons and other suitable welding clothing are required when welding.

Security of Service

Pre-service

Make sure that the vehicle is kept in a clean, open environment, and is free from any traffic and personnel

Please ensure that the vehicle is parked safely and will not move suddenly. Place the wooden props in front and back of the wheels and make sure that the parking brakes will mesh correctly.



Make sure that the vehicle is empty and unoccupied, the cargo forks are lowered, all the hydraulic controls are in neutral position and the key is switched to OFF. Place a "do not operate" or similar warning signs to the start switch or the controller before repairing or servicing the forklift.

Make sure the tools are in good condition.

Disassembly and Installation

Make sure the working environment is clean, clean and dry before installing the vehicle.

When using steps, ladders or walkways for installation or removal, please face the vehicle.

Please follow these steps and grab the handle to install or remove parts.

When you are unable to follow these steps, please use a ladder, scaffold, or work platform to perform maintenance operations safely.

Work platform is advised to perform maintenance for safe operations.

Lifting

Check the weight of each component before removal. Partial components of the vehicle may so heavy that it may cause serious injuries

When removing any components, please use appropriate lifting procedures

A hoist is required avoid back injuries when lifting parts weighing 23kg (50lbs) or more.

Ensure all chains, hooks, slings and the like are in good condition and in correct capacity. Make sure the hook is positioned correctly. Lifting ring bolts should not be loaded laterally during lifting operation.

Disassembly/Assembly

Make sure that the assembly/disassembly site is kept clean and dry and that hand tools are kept clean.

When tightening/loosening bolts and nuts, please use a properly sized wrench and always pull towards the body. A wrench with the wrong size or pushing off the body to loosen/tighten the bolt or nut may cause an accident as the handle slips.

If two or more people are working together, signs or signals are required for communication so that the work is done in an agile manner as if it were done by one person.

Be careful when removing the cover. Slowly loosen the last bolt or two opposite direction nuts from the cover plate unit, twist the cover plate to loosen tension or other pressure, and then completely remove the last bolt or two nuts.

Re-install all fasteners with the same numbered part. If any fasteners need to be replaced, please use qualified fasteners and be careful to not use metric system fasteners with British fasteners together.

Hazards of Compressed Air

Please wear protective mask, protective clothing and protective shoes in cleaning operation.

The maximum air pressure for cleaning must be less than 205 kPa (30 psi).

Hazard of Hydraulic Oil

Please follow the following safety instructions for hydraulic system maintenance carefully.

Oil removal under pressure, even if the pinhole size leaks, can penetrate the body elements and cause serious damage and possibly death.

Please wear gloves, goggles, and make sure that your arms and legs are completely covered.

Release all pressure from the hydraulic system before disconnecting or removing any piping, fittings or related item, and wait for the runner system to cool down.

Do not touch the pressurized hose by hand, or bending or striking.

Do not check pinhole leakage by hand, which is the most common method of oil-related injury! Please use cardboard or other solid surfaces instead.

When removing the filler cover, vent and plug, please place the cloth on the port to prevent pressured liquid spraying or splashing

A container shall be prepared to capture any hydraulic fluid that may flow from the hose/port.

Make sure that all raised components are properly locked.

When reinstalling lines, make sure tighten them to the correct torque, and ensure that all heat shields, fixtures and guards are properly installed to avoid overheating, vibration or friction with other components during operation.

Lines must be installed correctly to prevent oil from being sprayed into the shield on the hot exhaust components in case of any pipe or seal failure.

Mechanical Hazards

Keep all the objects away from the fan blades, or they will throw or cut any object or tool that falls or is pushed in.

Do not operate the machine when any rotating parts are damaged and do not touch any other parts during the operation. Please check the balance of any damaged or changed high-speed rotating part before re-use.

The equipment shall be properly supported and the component shall be installed when working under the vehicle.

Do not expect the hydraulic cylinder to be always mounted. If the control lever is moved or the hydraulic line breaks, any accessories may fall off.

Debris or other debris will fly away from the object upon impact.

Make sure the flying debris doesn't hurt anyone before hitting the object.

Electrical Hazards

Do not damage any wire during disassembly operation. When re-installing wiring, make sure it is installed correctly

Do not wire to any oily cable.

Do not smoke or expose batteries to any spark or flame when checking, charging or repairing the batteries.

The chain and metal tools shall be kept away from the top of the battery.

Electrolyte is an acid that can cause injury if it comes into contact with the skin or eyes.

Fire and Burning Hazards

Attention shall be paid to the hot parts on the machine that has just stopped and to the hot oil in the pipes and compartments to avoid scalding.

All hydraulic oils, many lubricants and some coolant mixtures are flammable. If the pipe is loose or damaged, there may be a fire.

All hydraulic oils and lubricants shall be stored in appropriately marked containers and be away from unauthorized personnel.

All oily rags or other flammable materials shall be stored in a protective container and kept in a safe place.

Do not weld or flame cut pipes or pipe containing easy fuel.

Before welding or flame cutting, please clean them thoroughly with a nonflammable solvent.

Remove all residual flammable materials from the forklift and then collect, like fuel and oil.

1-5 Maintenance

The following provides the key items and replaceable components to be checked during maintenance intervals.

Note: all maintenance and repair should be carried out by a qualified authorized engineer except for the routine inspection of the vehicle driver.

Note: careless disposal of waste oil is not only harmful to the environment, but also to human health. Waste oil should always be kept in containers and disposed of by authorized personnel at a designated locations.

1-5-1 Regular maintenance

·Forklifts require regular inspection and maintenance to ensure they are in good performance condition.

·Use genuine spare parts from Noblelift.

·When replacing or refueling, do not use different types of oil.

·The replaced oil and battery should not be casually dumped or discarded, and should be disposed of in accordance with local environmental protection laws and regulations.

·Develop a comprehensive maintenance and repair plan.

·A complete record should be made after each maintenance and repair.

·Without training, it is prohibited to repair forklifts.

⚠Smoking and fire are strictly prohibited.

·Before maintenance, the key switch should be turned off and the battery plug should be unplugged. (In addition to conducting partial obstacle elimination tests).

·Clean the electrical parts with compressed air and do not use water for cleaning.

·Do not extend your hands, feet, or any part of your body between the mast and instrument panel.

·Even if the key switch is turned off, due to the capacitor inside the controller being charged, it is possible to prevent electrical injury when touching the controller.

Regular maintenance schedule √ - inspection, correction, adjustment ×— replace

（(1) Battery

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Battery	Check battery charge		√	√	√	√	√
	Check for loose terminals		√	√	√	√	√
	Check if the connecting wire is loose		√	√	√	√	√
	Check battery surface cleanliness		√	√	√	√	√
	Check whether there are tools placed on the surface of the battery		√	√	√	√	√
	Check if the vent cover is tight and the vent is unblocked			√	√	√	√
	stay away from fireworks		√	√	√	√	√

（2）Controller

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Controller	Check contact wear					√	√
	Check whether the mechanical movement of the contactor is in good condition					√	√
	Check whether the pedal micro switch works normally					√	√
	Check whether the connection between the motor, battery and power unit is in good condition					√	√
	Check the controller fault to judge whether the system is normal						For the first 2 years

（3）Motor

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Motor	Remove foreign matter from the motor casing				√	√	√
	Clean or replace bearings						√
	Whether the wiring is correct and firm				√	√	√
	Clean the small groove of the commutator piece and the carbon powder on the surface of the commutator					√	√

（4）Transmission system

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Gearbox and wheel reduction mechanism	check for noise		√	√	√	√	√
	check for leaks		√	√	√	√	√
	oil change						×
	Check brake operation		√	√	√	√	√
	Check gear operation					√	√
	Check the looseness of the bolts at the connection with the frame				√	√	√
	Check hub bolt tightening torque	torque wrench	√	√	√	√	√

（5）Wheels (front and rear wheels)

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Wheels	Check tire pressure		√	√	√	√	√
	Check for wear, cracks or damage		√	√	√	√	√
	Check the tires for nails, stones or other foreign objects				√	√	√
	Check for rim damage		√	√	√	√	√

（6）Steering system

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
steering wheel	Check gap		√	√	√	√	√
	Check axial looseness		√	√	√	√	√
	Check radial looseness		√	√	√	√	√
	Check operating status		√	√	√	√	√
Steering gear and valve block	Check if the mounting bolts are loose				√	√	√
	Check the leakage of the contact surface between the valve block and the steering gear		√	√	√	√	√
	Check the sealing condition of each interface joint		√	√	√	√	√
Rear axle	Check whether the rear axle mounting bolts are loose				√	√	√
	Check for bends, deformation, cracks or damage				√	√	√
	Check or replace the lubrication condition of the axle support bearings					√	√
	Check or replace steering hub bearing lubrication					√	√
	Check Steering Cylinder Operation		√	√	√	√	√
	Check steering cylinder for leaks		√	√	√	√	√
	Check rack and pinion meshing					√	√
	Check sensor wiring and working conditions					√	√

（7）Brake system

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Brake pedal	Check for empty travel	scale	√	√	√	√	√
	Check pedal travel		√	√	√	√	√
	Check operation		√	√	√	√	√
	Check brake lines for air		√	√	√	√	√
Parking Brake Manipulation	Check whether the brake is safe and reliable and has enough travel		√	√	√	√	√
	Check handling performance		√	√	√	√	√
Rods, cables, etc.	Check handling performance				√	√	√
	Check for loose connections				√	√	√
	Check the wear of the joints connected to the gearbox					√	√
Pipeline	Check for damage, leaks, ruptures				√	√	√
	Check connections, clamping parts, looseness				√	√	√
Brake Master Cylinder Slave Cylinder	Check for leaks		√	√	√	√	√
	Check oil level, change oil		√	√	√		×
	Check the action of master cylinder and slave cylinder					√	√
	Check the leakage and damage of master cylinder and slave cylinder					√	√
	Check the wear and damage of master cylinder, slave cylinder piston cup and check valve, replace						×

（8）Hydraulic system

Internal/ Item	Maintenance content	Tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Hydraulic tank	Oil level check, oil change		√	√	√	√	×
	Clean the oil suction filter						√
	Exclude foreign matter						√
Control stem	Check for loose connections		√	√	√	√	√
	Check operation		√	√	√	√	√
Multi-way valve	Check for oil leaks		√	√	√	√	√
	Check safety valve and tilt lock valve operation				√	√	√
	Measure safety valve pressure	Oil pressure gauge					√
Pipe joint	Check for leakage, looseness, rupture, deformation and damage				√	√	√
	replace tube						× 1～2Years
Hydraulic pump	Check the hydraulic pump for oil leakage or noise		√	√	√	√	√
	Check the wear of the driving gear of the hydraulic pump				√	√	√

（9）起升系统

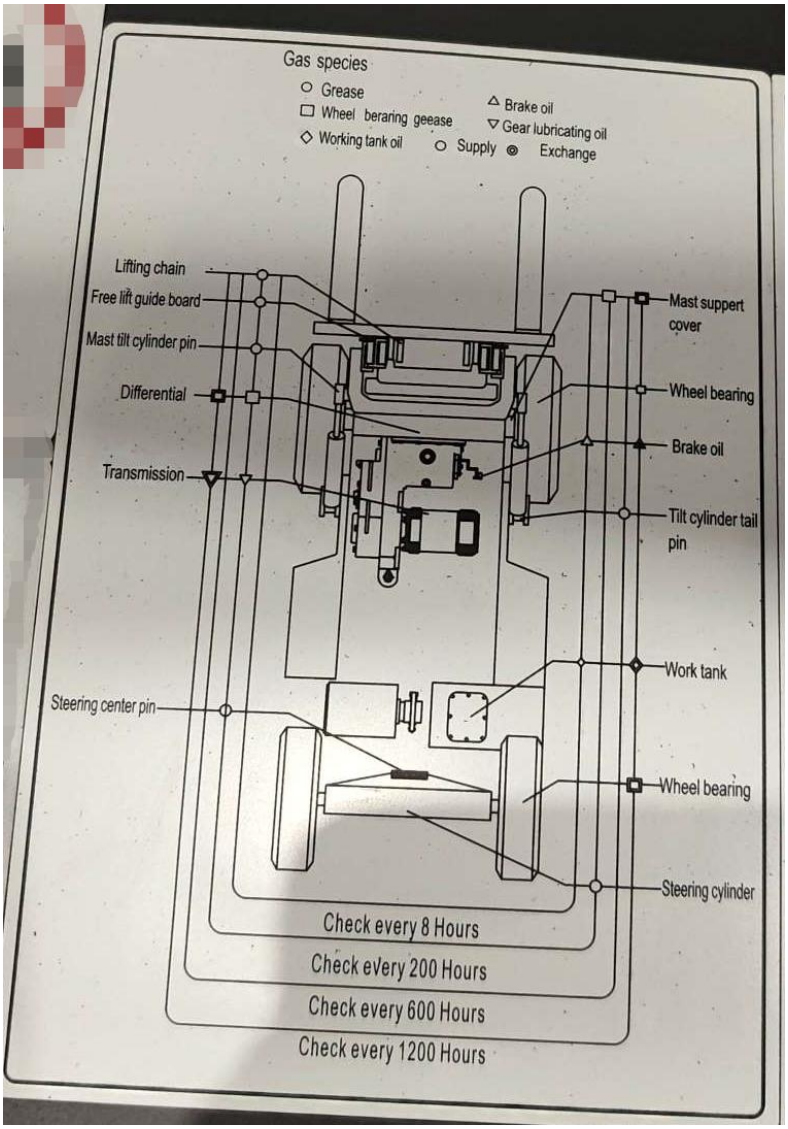
Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Chain sprocket	Check the tension state of the chain, whether it is deformed, damaged or corroded		√	√	√	√	√
	chain refueling				√	√	√
	Check riveting pins and looseness				√	√	√
	Check the deformation and damage of the sprocket				√	√	√
	Check for loose sprocket bearings				√	√	√
Attachment	Check if the status is normal				√	√	√
Lift and Tilt Cylinders	Check the piston rod, piston rod thread and connection for looseness, deformation and damage		√	√	√	√	√
	Check operation		√	√	√	√	√
	Check for leaks		√	√	√	√	√
	Check pin and cylinder steel back bearings for wear and damage				√	√	√
Fork	Check the damage, deformation and wear of the fork				√	√	√
	Check the damage and wear of the positioning pin					√	√
	Check the cracking and wear of the welding part of the hook at the root of the fork				√	√	√
Mast Fork Rack	Check whether the inner mast, outer mast and crossbeam are welded for cracks or damage				√	√	√
	Check whether the welding between the tilting cylinder bracket and the mast is poorly welded, cracked or damaged				√	√	√
	Check whether the inner and outer masts are poorly welded, cracked or damaged				√	√	√
	Check the fork frame for poor welding, cracking or damage				√	√	√
	Check the rollers for looseness				√	√	√

	Check the wear and damage of the mast bearing bush						√
	Check whether the mast support cover bolts are loose	Detection Hammer			√		√
	Check whether the bolts on the piston rod head of the lifting cylinder and the bolts on the bent plate are loose	Detection Hammer			√		√
	Check the roller, roller shaft and welding part for cracking and damage				√	√	√

（10）Other

Internal/ Item	Maintenance content	tool	Every day (8 hours)	weekly (50 hours)	Monthly (200 hours)	3 Months (600 hours)	6 Months (1200 hours)
Roof guards and shelves	Check that the installation is secure	Detection Hammer	√	√	√	√	√
	Check for deformation, cracks, damage		√	√	√	√	√
turn signal	Check work and installation		√	√	√	√	√
trumpet	Check work and installation		√	√	√	√	√
lamps and bulbs	Check work and installation		√	√	√	√	√
reversing buzzer	Check work and installation		√	√	√	√	√
meter	Check the working condition of the instrument		√	√	√	√	√
electric wire	Check wiring harness for damage and loose fixation			√	√	√	√
	Check for loose electrical connections				√	√	√

1-5-2 Inspection if necessary



1-5-3 Regular replacement of critical safety parts

There are some parts that are difficult to detect damage or breakage through regular maintenance. To further improve safety, users should replace the parts given in the table below on a regular basis.

If these parts become abnormal before the replacement time comes, they should be replaced immediately.

Critical Safety Part Name	Service life (years)
Brake hoses or hard hoses	I～2
Hydraulic hoses for lifting systems	I～2
Lifting chain	2～4
High pressure hoses and hoses for hydraulic systems	2
Brake fluid oil cups	2～4
Brake master cylinder cover and dust sleeve	1

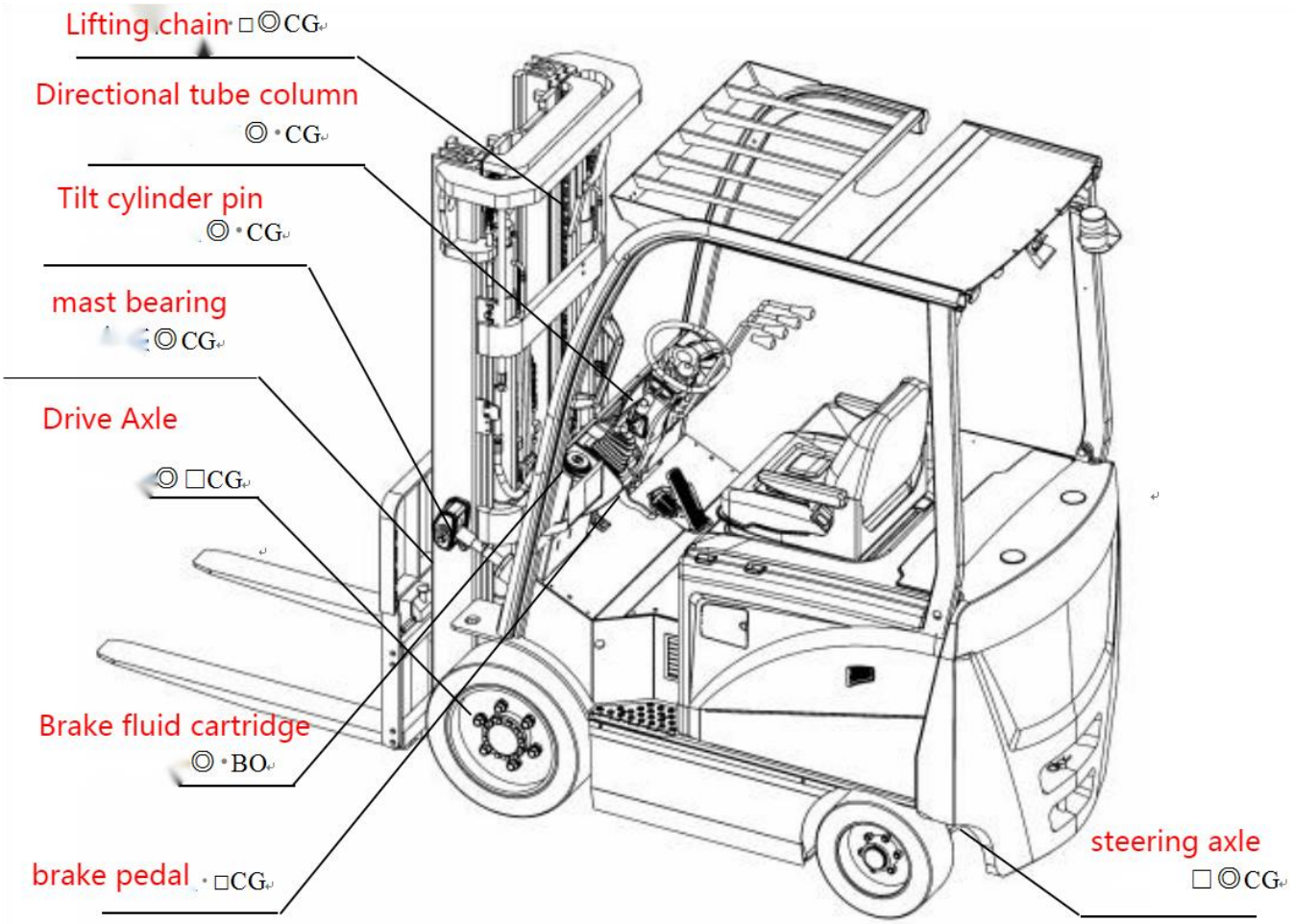
Internal seals and rubber parts for hydraulic system	2

1-6 Lube

The following is a detailed description of the lubricant as required and the parts to be lubricated.

1-6-1 Lubricating Oil Specification

○：Replacement FO：Hydraulic oil
◎：Refill GO：Gear oil
□：Check and adjust CG：Grease
BO：Brake fluid



1-6-2 Recommended lubricants

Item	Grade, Code	Capacity (L)	Remark
Hydraulic oil	L-HM32	30	Operating temperature≥-5℃
	L-HV32		Operating temperature≥-20℃
Gear Oil	85W/90GL-5	3.3	Operating temperature -15℃~+49℃
	80W/90GL-5		Operating temperature -25°C~+49°C
Brake fluid	Caltex DOT3	0.2	
Grease	3# general purpose lithium base grease		

Lube specification

The following lubricants are recommended for chains and connecting rods:

Item	Specification
1	DIN 51825 Standard Oil and Grease

Hydraulic Oil （HYDO）

Hydraulic oils shall be qualified with anti-wear, anti-foam, anti-rust and anti-oxidation additives for heavy duty use as described by the oil supplier. ISO viscosity grade 46 is usually preferred.

Note: the correct hydraulic oil should be used to for the maximum service life and performance of hydraulic system components. The above hydraulic oils are recommended for most hydraulic and hydrostatic systems.

If the hydraulic fluid becomes cloudy, it is evidenced that the water or air has entered the system. Water or air in the system will cause pump failure.
Drain all hydraulic oil, re-tighten all hydraulic suction clamps, and then clean and refill the system.

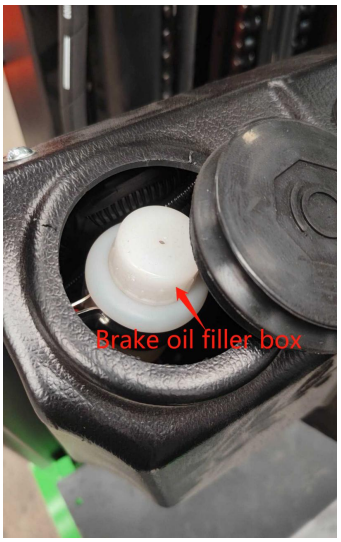
Gear oil

Failure to comply with recommendations will result in excessive wear of gears leading to shortened service life.
API GL-4 or SAE 80W oil is acceptable

Note: Noblelift does not mix multi-stage oils for transmissions. Multistage oils with high molecular weight polymers as vi improvers lose their viscosity effectiveness due to the permanent and temporary shear of vi improvers and hence are not recommended for use in drives and compartments of drive system

Brake oil

Use certified heavy-duty hydraulic brake fluid from a qualified supplier



1-7 Instructions of Disassembly/Assembly

The following parts of Disassembly/Assembly include the following sections: the preparation before disassembly, the inspection and test before disassembly, the matters to be attended during disassembly, the matters to be attended after disassembly, the matters to be attended during assembly, the handling of common parts and hydraulic piping fittings.
The precautions to be taken for proper disassembly/assembly operations are listed in each heading.

Preparation before disassembly

Remove dust and contaminants from the vehicle before transferring to the maintenance centre. Dust or contaminants that enter the maintenance centre may contaminate parts and enter inside to introduce scratches. The electric forklift are operating on an electrical system.

No water shall be allowed inside the system.

To avoid unnecessary disassembly, please prepare necessary tools and place parts inside boxes with priority to site cleaning

Check and test before disassembly

Be sure to record any problems before starting the disassembly, which can prevents unnecessary disassembly, loss of replacement parts, and repeated failures as caused by the same problem.

To prevent failures, record failures and replace required parts are required.

The following information shall be also checked and recorded:

Vehicle model number, serial number and operation hours

Reasons of the vehicle needs to be dismantled

Check for symptoms, locations and causes of failures (repeat the same failure if needed)

Check any part which is not suitable.

Check the parts for damage or looseness.

If possible, check the maintenance condition of the vehicle.

Notes for disassembly

Disassembly：

Determine the way of parts assembly (front/rear, left/right and up/down) for the sequence of disassembly.

Before starting to disassemble parts, attention shall be paid to the join points of parts with arrow marks to avoid misplacing parts during assembly

Please use the right tools to remove specific parts.

If no part is removed, even when mounting bolts and nuts, do not use excessive force.

Do not overstrain. Check and find the causes

Put the disassembled parts on one side in the order of disassembly, and place signs or marks on similar parts.

Store bolts, nuts and other common parts in an orderly manner.

Check and test in disassembly

The cause of the fault is sometimes found in the process of disassembly. Therefore, it is important to carefully examine the condition of the friction surfaces and the contact parts.

During disassembly, gaps, deformations, projections and other factors that may cause failures shall be measured and recorded.

Keep the distance

Make sure that the installed spacers and gaskets will produce the required specific clearance.

Remove pressure fittings

Remove any dent or mark that caused by area hammering and polishing.

If any pressing part is released, please identify and eliminate the cause to avoid problems during assembly.

Bearing Disassembly

Do not remove the bearing forcibly, and a bearing puller is advised.

Notes after disassembly

Be clean

Clean disassembled parts and keep them away from contaminants.

Special attention should be paid to removing contaminants from the oiling or component lines.

When cleaning special parts, increase the number of detergent containers and clean several times.

Kerosene or neutral anhydride diesel is suitable for cleaning viscous oils in bearings.

When using dangerous chemical cleaners, be careful to avoid a skin or eye contact.

Used oil should be disposed of in designated containers at designated locations.

Dustproof

A dust cover is advised to keep cleaned parts free of dust and contaminants and to block up the ends of all pipes.

Any part you may store should be rust-proof before re-installing.

Notes for assembly

Parts installation

All parts shall be kept clean before assembly. All surfaces shall be checked for defects and repaired if necessary. Any contaminant shall not be smeared or rubbed on the surface, which may shorten the service life of the parts.

Before starting assembly, a cleaner is required to remove the rust inhibitor from the parts.

Before assembly, the markings that put the parts together shall be identified.

Bearings, bushings, and seals shall be assembled with press tools and specific parts shall be handled with specified tools.

Before pressing parts, the surface shall be lubricated with lube.

Tighten the bolts and nuts

To ensure a uniform torque of bolts and nuts, the tighten order shown in figure 1-19 shall be followed and then the other end of the other side shall be tightened. This method is known as the "template method", which gradually repeats loosening and fastening to ensure even contact.

Fix the bolts, nuts or other important fasteners that cannot be visually inspected with wires, cotter pins, lock washers or other components as shown in figure 1-20.

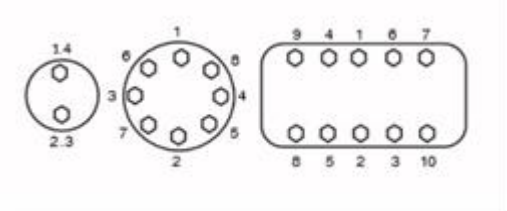


Figure 1-19

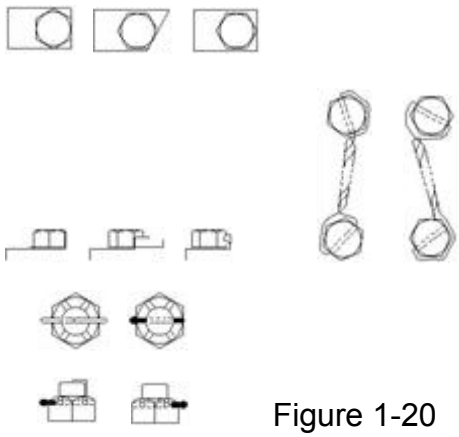


Figure 1-20

Assembly Inspection

At each step of the assembly process, each part's number shall be checked and recorded.

Reassemble the gaskets

Install the gasket and washer in the same position as before, and then check the gap for correctness.

Assembly adjustment

If no adjustments are required, assemble them to the same length as before

Assemble pressed parts

Scratches and dents shall be repaired as needed and be kept clean before insertion.

Please note that press fittings that are not adequately tightened may become loose.

Assemble keys and keyways

Check if the keyway and key are loose and in contact with the key head. If the keyhead touches the keyway, then the rest of the keyhead shall be removed.

Handling the general parts

Handling the packaging

Packing, as well as gaskets &copper packing should be replaced as instructed. After using the adhesive, please assemble the gasket specified in this maintenance manual. The followings shall be noted when applying the adhesive to the gasket:

Old adhesive, scratches, dust, paint and grease shall be thoroughly removed from the washer surface.

Apply appropriate sealant evenly to both sides of the washer and wait a few minutes until dry.

Once the sealant is dry enough to touch, it won't stick to your hand.

Assemble the parts

Please soak the leather package in oil before use.

Handling the O-rings

Please remember to check the condition of the O rings.

Hardened O-rings shall not be stored for long.

The O-rings to be used shall be the specified once in the parts list. For example, the O rings used in engine oil are made of special materials, such as silicone rubber, and are resistant to heat and aging.

Installing different types of O-rings in this situation can cause serious damage to the system and its components.

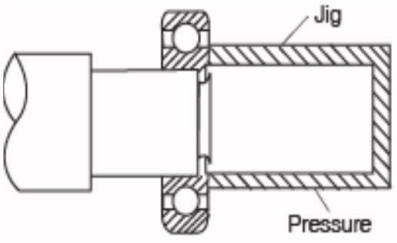
The O-rings shall be lubricated to avoid surface scratching during installation. Silicone rubber O rings are prone to damage, hence attention is required to avoid overstretch.

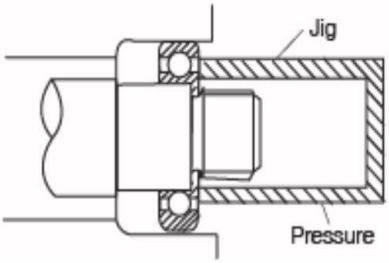
Handling the oil seal

Oil seals shall be prevented from dust sedimentation, especially on the lips, and there shall be no rust or scratch.

Lips opposite to the seal shall be lubricated evenly.

The surface of the shaft where the seal is installed shall be checked for contamination, rust, or scratches and grease or lubricant shall be applied so that the seal can be easily installed.





Oil seal installation.

By gently rubbing the wire on the surface, please check the surface of the oil seal lip for scratches.

If there is any scratch, please replace the oil seal.

When inserting the oil seal, please use the guide device and fixture as shown in figure 1-22 to avoid any damage to the oil seal.

After the oil seal is inserted, the inclination shall be checked (tilt tolerance: 0.2 mm /00 mm, diameter 0.008 in. /3.937 in.).When applying adhesive to oil seal, make sure that there is no adhesive in contact with the lip surface. All residual adhesive shall be removed from the guide and fixture before inserting another seal.

Bearing handling

The followings shall be noted to properly assemble bearings and avoid damage to bearings:

The dust and other contaminants that may shorten the service life of the bearing shall be thoroughly removed.

The bearing shall be kept packaged until it is installed.

Do not affect the bearing.

Do not over-turn the bearing to remove the purifier by compressed air.

The oil seal ring shall be installed in the correct direction.

Please note the following when installing the bearing.

Neither hit the outer ring with a hammer for installation, nor hit the inner ring to insert the outer ring. Such hammer strike may damage the bearing track.

When you are insert the inner ring of the bearing with a reasonable tolerance, the fixture shown in figure 1-23 is required with pressure to the inner ring. For hot insertion, the bearing shall be heated to 120℃（248℉）. However, please note that excessive heating can reduce the hardness of the bearing surface.

When inserting non-split bearings with inner and outer rings with reasonable tolerances, the fixture shown in figure 1-24 shall be applied and both inner and outer rings shall be pressed.

Handle the retainer

When removing or installing the retainer, a pair of right ring tongs is required and attention shall be paid against over-pressure on retainer. After installing the retaining ring, the retaining ring shall be checked for correct insertion.

Hydraulic circuit fittings

1. For metal tube to hose installation, the tube shall be installed and all bolts shall be tightened by hands.
2. Tighten the bolt at the rigid end.
3. Install hose and tighten all bolts by hands
4 .Place all the hose in a position where it will not contact with the machine or other hoses.
5. Tighten the bolts at both joints
6. Start up the engine.
7. Move the control lever to full position.
8. Inspect the hose during tool movement. Make sure that the hoses do not contact any machines or other hose.
9. Shut off the motor
10. If necessary, place the hose in a new position so that it will not touch the position when moving the tool.

Fitting assembly with straight thread and O rings (for different applications)

1. Place the lock nut (3), support washer (4) and o-ring seal (5) as far away from the fitting body (2) as possible.
2. Tie the joints to the part it is using until the support washer (4) just touches the surface of the part.
3. Place the joint assembly in the correct position, and

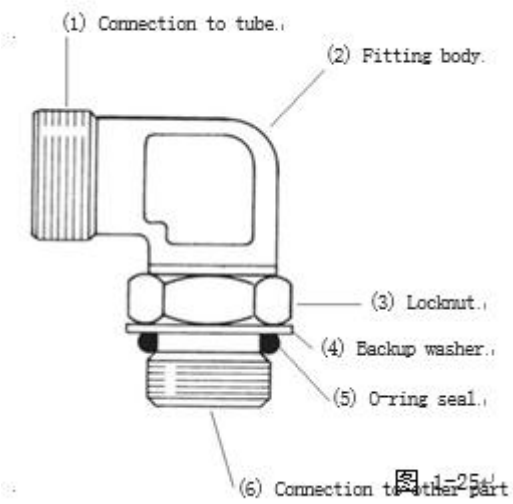


图 1-25

turn the joint body (2) outward to 359°(counter-clockwise) .

4. Tighten the locking nut (3) to the torque as shown in the correct diagram for the used fitting.

5. If the end shape of the fitting body is the same as shown in figure 1-25 (elbow or straight), please place the sleeve over the tube before connecting the tube to the end.

Note: if the joint is a connector (direct connector), then the lock nut on the main body shall be replaced by the hexagon nut. To install this type of joint, the hexagon joint shall be tightened to the surface of the parts into which it enters.

Tighten accessories of other types

Pipe fittings (shear sleeve) of high load: please turn the nut with a wrench until a slight reduction in torque is felt after the pipe passes through the nut and touches the shoulder in the fitting body, which indicates that the sleeve has been removed from the nut

High seal fittings: place the nut and sleeve on the pipes with the short end of the sleeve toward the end of the pipes. Press the pipe end against the counterbore in the body of the fittings and tighten the nut until it is above the last thread of the body. As soon as the fitting is removed and reinstalled, the remaining space will be available.

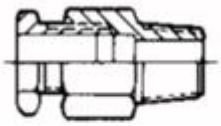


Figure 1-26

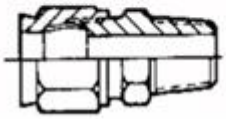


Figure 1-27

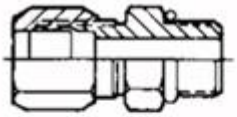


Figure 1-28

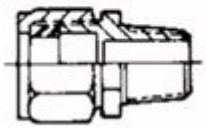


Figure 1-29

Flexible fittings: please place the nuts and sleeves on the pipes and push the pipes as far as possible into the countersunk holes of the fitting bodies. Tighten the nut until it touches the hexagonal part of the body.

1-8 Standard Torque

1-8-1 Standard torque of bolts and nuts

Be careful that the metric and British size fasteners shall not be mixed in used. Mismatched or incorrect fasteners may cause damages or malfunctions to the vehicle or personal injuries.

Exceptions to these torques may be provided in the service manual if required.

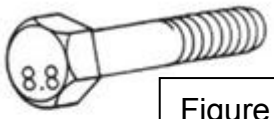
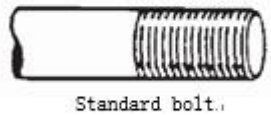


Figure 1-30

Before installing any hardware, make sure that the components are close to a new state. Threads of bolts and nuts shall not be worn or damaged. Hardware shall be free from rust and corrosion.

Hardware shall be cleaned with a non-corrosive cleaner with oil application to threads and bearing surfaces. Oil shall be not applied if thread locks or other compounds are to be used.



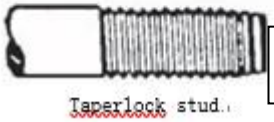


Figure 1-31

The fastener shall be kept in good condition and reused only in fine conditions after loosening.

Make sure to choose the same size and grade of fasteners for replacement.

Generally, you can identify the strength of the bolts based on the numbers marked on the heads (e.g. 8.8 or 10.9) as shown in figure 1-30. The following table are listing the standard torques for typical bolts, nuts and the taper bolts as shown in figure 1-31.

For metric fasten

Thread size(mm)	Metric nuts and bolts		Metric taperlock stud	
	（N · M）	Pounds/feet	（N · M）	Pounds/feet
M6	12 ± 3	9 ± 2	8 ± 3	6 ± 2
M8	28 ± 7	20 ± 5	17 ± 5	13 ± 4
M10	55 ± 10	40 ± 7	35 ± 5	26 ± 4
M12	100 ± 20	75 ± 15	65 ± 10	48 ± 7
M14	160 ± 30	120 ± 22	–	–
M16	240 ± 40	175 ± 30	110 ± 20	80 ± 15
M20	460 ± 60	340 ± 44	170 ± 30	125 ± 22
M24	800 ± 100	600 ± 75	400 ± 60	300 ± 45
M30	1600 ± 200	1200 ± 150	650 ± 80	480 ± 60
M36	2700 ± 300	2000 ± 225	870 ± 100	640 ± 75

For British fasteners

Thread size(inch)	British nuts and bolts		British taperlock stud	
	（N · M）	Pounds/feet	（N · M）	
1/4	12 ± 3	9 ± 2	8 ± 3	6 ± 2
5/16	25 ± 6	18. 0 ± 4. 5	17 ± 5	13 ± 4
3/8	47 ± 9	35 ± 7	35 ± 5	26 ± 4
7/16	70 ± 15	50 ± 11	45 ± 10	33 ± 7
1/2	105 ± 20	75 ± 15	65 ± 10	48 ± 7
9/16	160 ± 30	120 ± 20	–	–
5/8	215 ± 40	160 ± 30	110 ± 20	80 ± 15
3/4	370 ± 50	275 ± 35	170 ± 30	125 ± 22
7/8	620 ± 80	460 ± 60	260 ± 40	190 ± 30
1	900 ± 100	660 ± 75	400 ± 60	300 ± 45
1 1 / 8	1300 ± 150	950 ± 100	500 ± 70	370 ± 50
1 1 / 4	1800 ± 200	1325 ± 150	650 ± 80	480 ± 60
1 3 / 8	2400 ± 300	1800 ± 225	750 ± 90	550 ± 65
1 1 / 2	3100 ± 350	2300 ± 250	870 ± 100	640 ± 75

1-8-2 Standard torques for fastening fittings

Standard torques for O-ring surface seal fittings

Thread size(inch)	Accessories for straight thread o-ring	
	(N·M)	Pounds/feet
5/8-16	5.0±1.5	45±15
3/4-16	12±2	110±20
2 7/8-16	20±4	15±3
1/2-20	40±5	30±4
9/16-18	40±5	30±4
3/4-16	100±15	75±10
7/8-14	135±15	100±10
1 1/16-12	200±25	150±20
1 3/16-12	250±25	185±20
1 5/16-12	300±40	225±30
1 5/8-12	300±40	225±30
1 7/16-12	300±40	225±30
2 1/16-12	300±40	225±30

Thread size(inch)	Sealing joint nuts for O-ring face	
	(N·M)	Pounds/feet
9/16-18	16±3	12±2
11/16-16	30±4	22±3
13/16-16	50±7	37±5
1-14	90±10	65±7
1 3/16-12	120±15	90±10
1 7/16-12	160±20	120±15
1 11/16-12	190±20	140±15
2-12	215±25	160±20

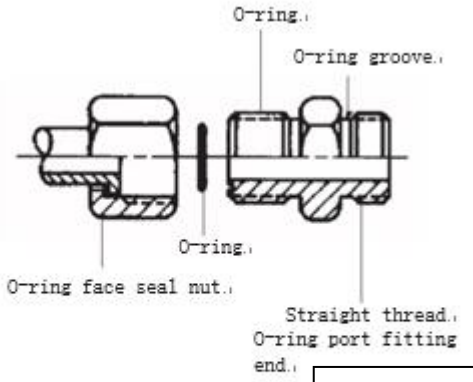


Figure 1-32

Hose clamp - belt type

Clamp width	New hose torque	Torque for re-tightening
7.9 mm (0.312 in)	0.9±0.2 N·m (8±2 lb·in)	0.7±0.2 N·m (6±2 lb·in)
10.5 mm (0.531 in)	4.5±0.5 N·m (40±5 lb·in)	3.0±0.5 N·m (25±5 lb·in)
15.9 mm (0.625 in)	7.5±0.5 N·m (65±5 lb·in)	4.5±0.5 N·m (40±5 lb·in)

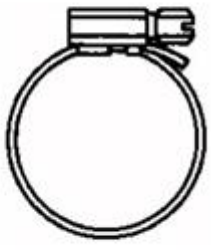


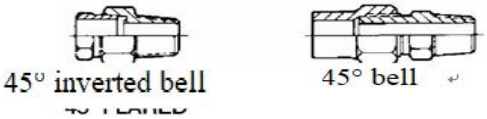
Figure 1-33

37° bell and straight threaded O - ring accessories

Pic 1-34

37℃ bell and straight threaded O - ring accessories（Sealing accessories for O - ring surface are excluded）				
Nominal pipe external diameter		Thread diameter（in）	Standard torque	
Metric	Inch	Inch	(N·M)	Ponds/Feet
3↓18	0.125	5/16	5.0±1.5	4±1
4↓76	0.188	3/8	11.0±1.5	8±1
6↓35	0.250	7/16	16±2	12±1
7↓94	0.312	1/2	20±5	15±4
9↓52	0.375	9/16	25±5	18±4
9↓52	0.375	5/8	35±5	26±4
12.70	0.500	3/4	50±7	37±5
15.88	0.625	7/8	65±7	48±5
19.05	0.750	1-1 / 16	100±10	75±7
22.22	0.875	1-3 / 16	120±10	90±7
25.40	1.000	1-5 / 16	135±15	100±11
31.75	1.250	1-5 / 8	180±15	135±11
38.10	1.500	1-7 / 8	225±15	165±11
50.80	2.000	2-1 / 2	320±30	240±22

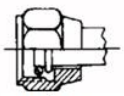
45° bell shape and 45° inverted bell fittings



1-35

45° bell shape and 45° inverted bell fittings				
Nominal pipe external diameter		Thread diameter（in）	Standard torque	
Metric	Inch	Inch	（N·M）	Ponds/Feet
3↓18	0.125	5/16	5.0±1.5	4±1
4↓76	0.188	3/8	8.0±1.5	6±1
6↓35	0.250	7/16	11±2	8±1
7↓94	0.312	1/2	17±3	13±2
9↓52	0.375	5/8	30±3	22±4
11.11	0.438	11/16	30±3	22±2
12.70	0.500	3/4	38±4	28±3
15.88	0.625	7/8	50±5	37±4
19.05	0.750	1-1 / 16	90±8	65±6
22.22	0.875	1-1 / 4	100±10	75±7

Thread fittings for air conditioning and conical pipes



o-rings

45 ° flare

1-36

AC Accessories						
Thread diameter (in.)	Mounting end of O-rings		45° flaring end			
			steel tube		aluminum pipe	
	(N · M)	Ponds/Feet	(N · M)	Ponds/Feet	(N · M)	Ponds/Feet
5/8 8-18	18 ± 4	13 ± 3	30 ± 3	22 ± 2	23 ± 3	17 ± 2
3/4 4-16	37 ± 4	27 ± 3	52 ± 5	38 ± 4	33 ± 4	24 ± 3
7/8 8-14	40 ± 4	30 ± 3	60 ± 7	44 ± 5	38 ± 4	28 ± 3
1 1 / 16-14	45 ± 5	33 ± 4	75 ± 8	55 ± 6	50 ± 5	37 ± 4

Thread fittings for conical pipes				
Thread diameter (in.)	Threads with le2200e sealant		Threads without sealant	
	(N · M)	Ponds/Feet	(N · M)	Ponds/Feet
1/4 16-27	15	11	20	15
1/4 8-27	20	15	25	18
1/8-14	25	18	35	26
3/4 8-18	35	26	45	33
1/4 2-14	45	33	60	45
3/4 4-14	60	45	75	55
1 11 1/2	75	55	90	65
1 1 / 4-11 1/2	95	70	110	80
1 1 / 2-11 1/2	110	80	130	95
2 11 1/2	130	95	160	120

2 Electronic System

2-1 General

This model is equipped with an electrical system with the following components:

1. The battery supplies the power to the electrical system [Section 2-2]
2. The emergency switches may be pressed in emergency to turn off all DC and AC circuits [Section 2-3]
3. Motors, controllers, and associated equipment are providing the necessary drive and pump power to the vehicle based on their interactions with sensors, switches, relays, actuators, as well as various parameter settings. [Section 2-4]
4. When the load is supplied at a current above the limit, the fuse will protect all DC loads from overcurrent by cutting off the load's power supply. [Section 2-5-1]
5. The DC-DC converter converts the high voltage of the battery to a low voltage or a low voltage load [section 2-5-2]
6. Other DC loads that activated by the operator's direct requirements will work independently of the controller. First, such DC loads not regulated by controllers and are not the purpose of controllers' signals. However, they may interact with controllers in some configuration. Such loads include light sets and horns.[Section 2-5-3 to 2-5-5]
7. The instrument board monitors the vehicle, informs the user of its condition and provides basic functions for mode setting, diagnosis and calibration [Sections 2-6]
8. The handheld programmer provides the same functions as the instrument board, but are detailed [sections 2-7]

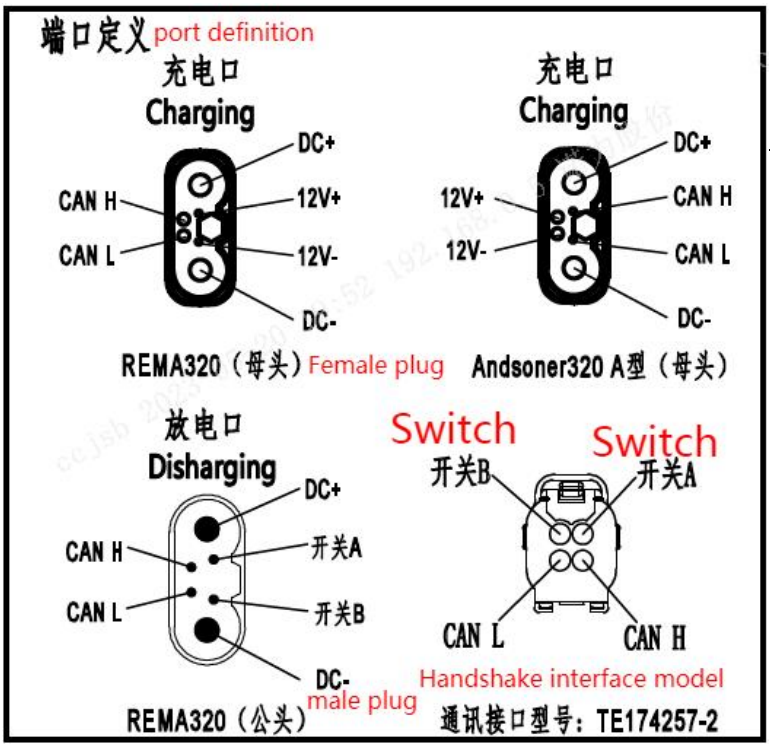
2-2 Battery (Lead Battery)

2-2-1 Appearance and Specifications

Battery System Parameters			
1	Battery Type	Lithium Iron Phosphate (LiFePO4)	
2	Rated voltage	76.8V	
3	Rated Capacity	200/277/412/554 Ah	
4	Operating Voltage	2.5V*N string~3.65V*N string	N=24
5	Standard charging current (A)	0.5C, 100A	
6	Standard discharge current (A)	0.5C, 100A	
7	continuous discharge current	200A	
8	Peak discharge current	400A/5s	
9	charging protocol	BMS charging protocol NL-CD01 (modified version V01)	
10	discharge agreement	Nuoli-Lithium Battery CAN Communication Association (Balanced Forklift)	
11	cooling method	natural cooling	
12	Seismic performance	Meet the standard: UN38.3.4.3	
13	IP protection level	IP54	
14	working environment humidity	Humidity is ≤85%RH	
15	Working temperature	Charging: 0℃～55℃	
		Discharge: -20℃～60℃	Pay attention to ventilation and heat dissipation when the temperature is >45°C
16	Insulation resistance	Any electrode of the battery pack relative to the box>50MΩ, 500V test voltage	
17	Recommended Storage Conditions	-15°C~60°C, 65%SOC±5%, recommended long-term storage temperature is 0°C~35°C, humidity ≤85%RH	

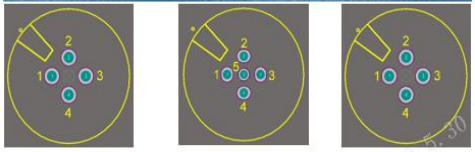
2-2-2 Interface definition description

Charging port



放电口

Lithium battery debugging port description



Interface	No	Port	Definition	Note
Debug1	1	4-2	12V+	**Pay attention to the direction of the notch**
	2	4-1	B 485	
	3	4-4	A 485	
	4	4-3	12V-	
Debug2	1	4-2	KSI	
	2	4-1	KSI	
	3	4-4	CAN-L 1	
	4	4-3	CAN-H 1	

2-2-3 Lithium battery fault analysis and description

Fault repair list of battery pack system					
No.	Fault type	Preliminary estimate	Test method	Failure confirmation	Countermeasure
1	The battery pack shall have no output after starting, and the switch indicator light shall be on	1. Abnormal communication with forklift ; 2.System internal components damaged	1. Check the alarm code on the locomotive display to confirm the specific fault. If it is confirmed as CAN communication problem, the discharge connectors shall be disconnected, and the both ends of the battery pack discharge connectors of CAN communication shall be checked for 120 Ω resistance;	1. If the resistance is measured to be infinite, the the CAN communication wire harness is indicated as disconnected. In this case, the CANH and CAN CAN shall be checked for normal breakover between the discharge connector and the panel communication port, and then the panel communication harness CAN shall be checked for breakover. 2. If there is resistance and is far bigger than 120 Ω, damage may be indicated inside the BMS CAN chip.	1. Replace damaged wiring harness ; 2. Replace damaged BMS
			1. Disconnect the discharge plug and start the battery pack separately to check whether the discharge plug has an output.	If there is an output, the locomotive may have an internal circuit error which will result disability of the battery pack output	Check the locomotive communication and power lines
			1. Remove the battery	Broken fuse	Before replacing the

			box cover and high pressure box cover, check whether the fuse is normal (in the case of shutdown, select the lead file of the multimeter and use the meter pen to check the two ends of the fuse. If there is a drop of sound, then it is normal. If there is no sound, then the fuse is damaged.)		fuse, check whether there is a short circuit between the positive and negative discharge of the locomotive and the battery pack. If there is no short circuit, then replace the fuse; if there is a short circuit, first deal with short circuit fault, and then replace the fuse.
2	The battery pack have no output after starting, and the switch indicator light is not on	1.System internal components damaged； 2.Insufficient system voltage	1.Select the DC voltage mode of the multimeter, test the total positive and negative voltages at both ends with the meter pen, and check whether the total voltage of the system is normal;	The system voltage is low, and BMS cannot work normally	Charge the battery pack first
			2.Select the lead mode of the multimeter, and check if the communication harness S1_A and the S1_B of the panel have normal lead	Turn on the light and confirm the fault of BMS to replace BMS preliminarily	Replace panel communication harness
			3. After the voltage harness is connected normally, press the start switch to check if the BMS is on;	After pressing the start switch, the BMS does not turn on the light, and the fault of BMS is preliminarily confirmed	Replace BMS
3	The battery pack cannot be charged. The indicator light of the battery pack is on	1. Abnormal communication with forklift； 2. System internal components damaged	1. Check if the 12V charging socket harness , GND, CANH and CNAL harness is normal	The conduction is abnormal	Replace the cable harness of the charging socket
			2. Connect the charger to check the fault code of the charger display; switch off to see if there's any loose for	If no120 Ω resistance is detected, then the CAN chip is damaged	Replace BMS

			charging terminals and terminal jump; check the CAN communication if there are 120 Ω resistance on both ends		
4	The battery pack cannot be charged. The indicator light of the battery pack is not on	1. The charger has no 12V auxiliary power output; 2. System internal components are damaged	1. Disconnect the charger and battery pack, and check the charger for 12V auxiliary power output separately after starting up;	1.The charger has no 12V auxiliary power output	Replace the battery charger
			2. Check if the 12V charging socket harness , and GND harness are normal	Wire harness is not working properly	Replace the cable harness of the charging socket
			3. Confirm if the 12V auxiliary power output of the charger is normal, and the wiring harness of the charging socket is normal. Keep the charger on and connect to the battery pack, and then check if the BMS is on.	The BMS does not turn on the light, and the fault of BMS is preliminarily confirmed	Replace BMS
5	The battery pack cannot shut down	1. Car key switch get a short circuit, 2. Internal components of battery pack system are damaged	1. Car key switch get a short circuit, 2. Internal components of battery pack system are damaged	The battery pack can switch the machine normally and the locomotive switch harness is short-circuited	Check the wire harness of forklift switch
			2. After disconnect the battery pack from the forklift and pressing the start switch button on the battery pack, the battery pack cannot be shut down normally. After disconnecting the battery box panel and the wire harness on the switch, the battery	The battery pack can switch the machine normally and the locomotive switch harness is short-circuited	Replace the start-up switch

			can be shut down normally		
			3. Disconnect the battery pack from the connection to the forklift and the wiring harness on the switch.	BMS fault	Replace BMS

Discharge fault threshold and its response mode

Note: In the "disabled" state, the following thresholds are considered invalid; all input boxes need to be filled in, and fill in '/' if not used;

1. The horn only alarms when the battery is low;

2. Report the secondary fault of discharge to limit the power of the whole vehicle;

No	Fault name	Failure level	Choice	Unit	Fault value	Time delay	Release value	Time delay	Troubleshooting
1	Total discharge voltage T> 5 ℃	1	Enable	V	72	5S	74.4	3S	Alarm
		2	Enable	V	69.6	5S	72	3S	Alarm
		3	Enable	V	64.8	5S	84	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	/					
2	Total discharge voltage low T≤5℃	1	Enable	V	69.6	5S	72	3S	Alarm
		2	Enable	V	64.8	5S	67.2	3S	Alarm
		3	Enable	V	55.2	5S	84	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	/					
3	Cell discharge low T>5℃	1	Enable	V	3	5S	3.1	3S	Alarm
		2	Enable	V	2.9	5S	3	3S	Alarm
		3	Enable	V	2.7	5S	3.5	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	/	/	/	/	/	/
4	Cell discharge low T≤5℃	1	Enable	V	2.9	5S	3	3S	Alarm
		2	Enable	V	2.7	5S	2.8	3S	Alarm
		3	Enable	V	2.3	5S	3.5	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	/	/	/	/	/	/
5	High total discharge voltage	1	Enable	V	88.8	3S	87.6	3S	Alarm
		2	Enable	V	91.2	3S	87.6	3S	Alarm
		3	Enable	V	93.6	3S	87.6	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	V	/	/	/	/	/

6	Cell Feedbacks high	1	Enable	V	3.7	3S	3.65	3S	Alarm
		2	Enable	V	3.8	3S	3.65	3S	Alarm
		3	Enable	V	3.9	3S	3.65	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	V	/	/	/	/	/
7	Cell discharge Differential pressure	1	Enable	V	500	5S	300	3S	Alarm ;
		2	Enable	V	700	5S	500	3S	Alarm
		3	Disable	V	800	5S	100	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	V	/	/	/	/	/
8	Discharge high temperature	1	Enable	℃	50	5S	45	3S	Alarm ;
		2	Enable	℃	55	3S	50	3S	Alarm
		3	Enable	℃	60	1S	25	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	℃	/	/	/	/	/
9	Discharge low temperature	1	Enable	℃	-10	5S	-5	3S	Alarm ;
		2	Enable	℃	-15	5S	-10	3S	Alarm,50% Discharge power down to 50% ; Discharge power reduction to 50%;
		3	Enable	℃	-20	5S	25	3S	Alarm ; Disconnect the discharge relay ;
		4	Disable	℃	/	/	/	/	/
10	Discharge temperature difference	1	Enable	℃	10	5S	5	3S	Alarm ;
		2	Enable	℃	15	5S	12	3S	Alarm
		3	Enable	℃	20	5S	15	3S	Alarm ; Disconnect the discharge relay ;

		4	Disable	℃	/	/	/	/	/
11	Transient Discharge overcurrent	1	Disable	A	/	/	/	/	/
		2	Disable	A	/	/	/	/	/
		3	Disable	A	/	/	/	/	/
		4	Disable	A	/	/	/	/	/
12	Continuous Discharge overcurrent	1	Enable	A	210	600S	200	3S	Alarm
		2	Enable	A	300	300S	250	3S	Alarm
		3	Enable	A	450	5S	/	/	Alarm ; Disconnect the discharge relay ;
		4	Disable	A	/	/	/	/	/
11	Feedback Overcurrent	1	Disable	A					
		2	Disable	A					
		3	Enable	A	10	5min	/	/	Alarm ; Disconnect the discharge relay ;
		4	Disable	A	/	/	/	/	/

Charging fault threshold and its response mode (full charging without sleep, unless the sleep condition is met)

No	Fault name	Failure level	Choice	Unit	Fault value	Time delay	Release value	Time delay	Troubleshooting
1	Total charging voltage high	1	Enable	V					
		2	Enable	V	86.4	3S	79.92	3S	No alarm; stop charging; disconnect the charging relay;
		3	Enable	V	87.6	3S	79.92	3S	Alarm; stop charging; disconnect the charging relay;
		4	Disable	V					/
2	Cell charging voltage high	1	Enable	V					
		2	Enable	V	3.6	3S	3.33	3S	No alarm; stop charging; disconnect the charging relay;
		3	Enable	V	3.65	3S	3.33	3S	Alarm; stop charging; disconnect the charging relay;
		4	Disable	V	/	/	/	/	/
3	Total charging voltage low	1	Enable	V	55.2	3S	60	3S	Alarm
		2	Enable	V	48	3S	60	3S	Alarm, BMS controls charging to reduce current by 50%;
		3	Enable	V	43.2	3S	60	3S	Alarm; off charging relay;
		4	Disable	V	/	/	/	/	/
4	Cell charging voltage low	1	Enable	V	2.3	3S	2.5	3S	Alarm
		2	Enable	V	2	3S	2.5	3S	Alarm, BMS controls charging to reduce current by 50%;
		3	Enable	V	1.8	3S	2.5	3S	Alarm; off charging relay;
		4	Disable	V	/	/	/	/	/
5	Cell charging differential pressure	1	Enable	V	500	3S	450	3S	Alarm
		2	Enable	V	700	3S	650	3S	Alarm, BMS controls charging to reduce current by 50%;
		3	Disable	V	800	3S	500	3S	Alarm; off charging

									relay;
		4	Disable	V	/	/	/	/	/
6	Charging high temperature	1	Enable	℃	50	3S	48	3S	Alarm
		2	Enable	℃	53	3S	50	3S	Alarm
		3	Enable	℃	55	3S	25	3S	Alarm; off charging relay;
		4	Disable	℃	/	/	/	/	/
7	Charging low temperature	1	Enable	℃	5	3S	8	3S	Alarm
		2	Enable	℃	3	3S	5	3S	Alarm
		3	Enable	℃	0	3S	/	/	Alarm; off charging relay;
		4	Disable	℃	/	/	/	/	/
8	Charging temperature difference	1	Enable	℃	10	3S	5	1S	Alarm
		2	Enable	℃	15	3S	12	1S	Alarm, BMS controls charging to reduce current by 50%;
		3	Enable	℃	20	3S	15	1S	Alarm; off charging relay;
		4	Disable	℃	/	/	/	/	/
9	Charging overcurrent	1	Enable	A	/	/	/	/	/
		2	Enable	A	210	5S	205	3S	Alarm
		3	Enable	A	215	5S	/	/	Alarm; off charging relay;
		4	Disable	A	/	/	/	/	/

other faults

No	Fault name	Failure level	Choice	Unit	Fault value	Time delay	Release value	Time delay	Troubleshooting
1	voltage cable disconnected	1	Disable	/	/	/	/	/	/
		2	Enable	/	defective	5S	retrieval	30S	Alarm Charging power reduction by 50%;
		3	Enable	/	defective	30S	/	/	Alarm; off charge and discharge relay;
		4	Disable	/		/	/	/	/
2	temperature sensor cable disconnected	1	Disable	/	/	/	/	/	/
		2	Enable	/	fall off two and less	5S	retrieval	30S	Alarm
		3	Enable	/	fall off more than two	5S	/	/	Alarm; off charge and discharge relay;
		4	Disable	/	/	/	/	/	/
3	Intranet handshake	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/					
		4	Disable	/	/	/	/	/	/
4	Quick charging socket high temperature	1	Disable	℃	/	/	/	/	/
		2	Disable	℃	/	/	/	/	/
		3	Disable	℃	/	/	/	/	/
		4	Disable	℃	/	/	/	/	/
5	Slow charging socket high temperature	1	Disable	℃	/	/	/	/	/
		2	Disable	℃	/	/	/	/	/
		3	Disable	℃	/	/	/	/	/
		4	Disable	℃	/	/	/	/	/
6	Charger handshake failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Enable	/	defective	5S	retrieval	1S	, Alarm, prohibit charging
		4	Disable	/		/		/	/
7	Vehicle handshake failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/

8	Charging socket temperature sense is abnormal	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/
9	Precharge failed	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/
10	Abnormal current	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Enable	/	defective	3S	/	/	Alarm Charging power drops to 0%; Alarm; off charge and discharge relay;
		4	Disable	/	/	/	/	/	/
11	BMS initialization failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Enable	/	defective	5S	/	/	Alarm Charging power drops to 0%; Alarm; off charge and discharge relay;
		4	Disable	/	/	/	/	/	/
12	High voltage interlock failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/					
		4	Disable	//					
13	Relay welded failure	1	Disable	/		/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Enable	/	defective	1S	/	/	Alarm Charging power drops to 0%; Alarm; off charge and discharge relay;
		4	Disable	/	/	/	/	/	/
14	Insulation leakage fault	1	Disable	Ω/V					
		2	Disable	Ω/V					
		3	Disable	Ω/V					
		4	Disable	Ω/V	/	/	/	/	/
15	SOC SOC is too high	1	Enable	%	101	1S	≤100	1S	Alarm
		2	Disable	%	/	/	/	/	/
		3	Disable	%	/	/	/	/	/

		4	Disable	%	/	/	/	/	/
16	SOC Low SOC	1	Enable	%	15	5S	20	3S	Alarm; sound for 1S, stop for 3S
		2	Enable	%	10	5S	15	3S	Alarm; sound for 3S, stop for 1S
		3	Enable	%	5	5S	10	3S	Alarm;long beep
		4	Disable	%	It is only established in the discharge state, and the SOC low fault and buzzer alarm are not reported during charging.				
17	heating failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/
18	Collision failure	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/
19	Abnormal low-voltage power supply	1	Disable	/	/	/	/	/	/
		2	Disable	/	/	/	/	/	/
		3	Disable	/	/	/	/	/	/
		4	Disable	/	/	/	/	/	/
20	CC2 CC2 connection failure	1	Disable	Ω	/	/	/	/	/
		2	Disable	Ω	/	/	/	/	/
		3	Disable	Ω	/	/	/	/	/
		4	Disable	Ω	/	/	/	/	/

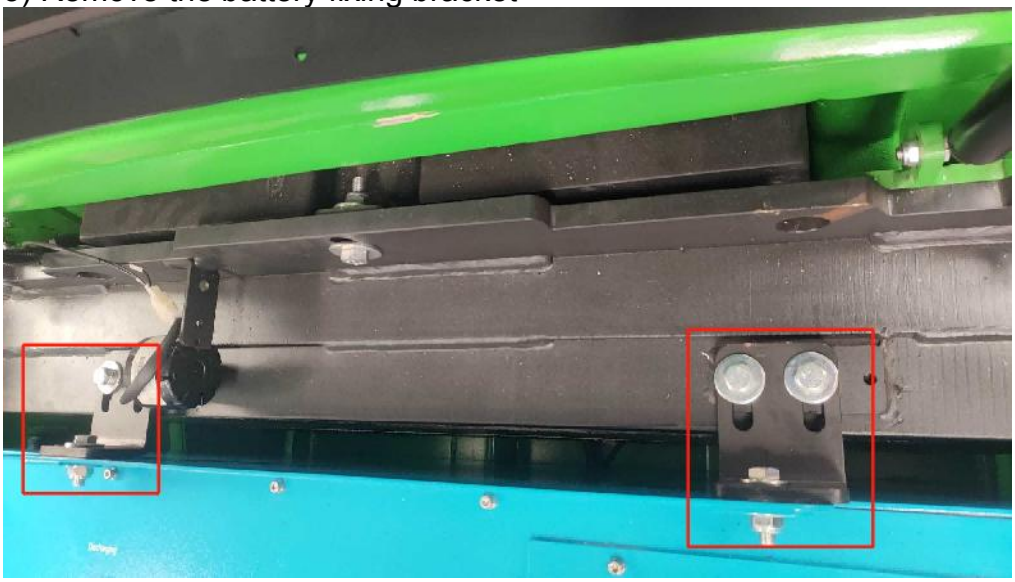
2-2-4 Disassembly and Installation

When installing and replacing the lithium battery, it should be fixed and reliable, and tipping is strictly prohibited; it is strictly forbidden to hit the pole and lead chuck with tools; during the handling process, strong impact should be avoided.

1) Unplug the battery discharge connector, open the battery cover

2) After opening the battery cover

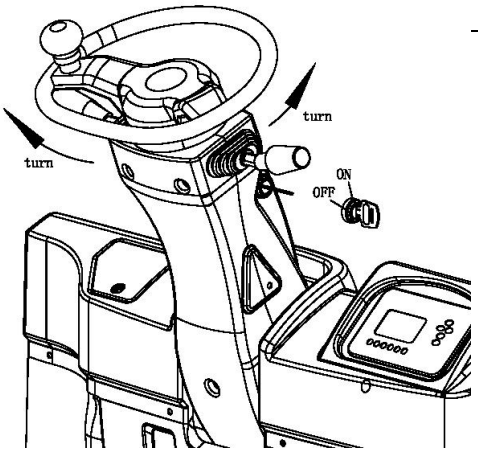
3) Remove the battery fixing bracket



4) After dismantling all the connections between the battery and the car body, please use special lifting tools to lift the parts from both sides of the battery, and safely lift the battery slowly and move it out to the designated location

2-3 Emergency Switch

2-3-1 Appearance and Specifications



Item	Specification
Part Number 1010434024	CE4T-10R-01

2-3-2 Function

The emergency switch is used to shut off the current in the electrical system in case of emergency, and thereby stopping the operation of the vehicle. When pressed the key, all DC and AC circuits are open except the speaker circuit.

(1) Emergency stop switch

In case of emergency, press the red mushroom head button to cut off the control power of the vehicle, without walking, steering or lifting. Rotate in the direction indicated by the arrow above the button to restore.

(2) Key switch

The key switch can turn on or off the control power

Off (0FF): In this position the switch is off and the key can be inserted and withdrawn.

Open (0N): Rotate forward from the off position, the switch is turned on, and the forklift starts.

⚠ ·Do not depress the accelerator pedal while turning on the key switch.

·When leaving the forklift, take the key away to prevent misuse by others.

·When parking the forklift or charging on the forklift, take the key away to prevent misuse by others.

DC circuit open

When the emergency switch is opened, the positive terminal of the battery is disconnected from the key switch, thus cutting off all the load power supplied through the key switch. As a result, all DC loads except the horn will be cut off

2-4 Controller and Related Equipment

2-4-1 Appearance and Specifications

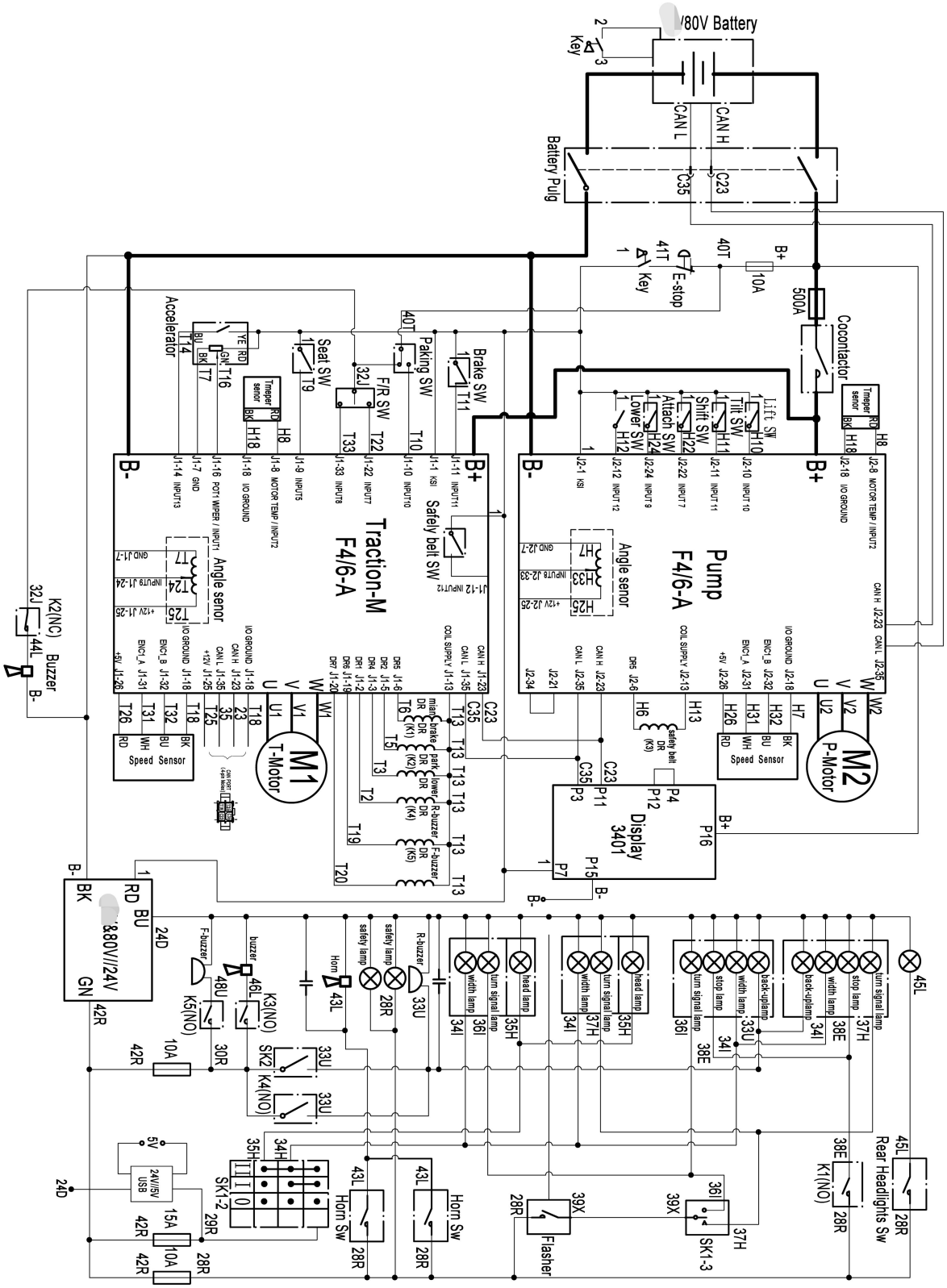
Curtis Controller

Inmotion Controller

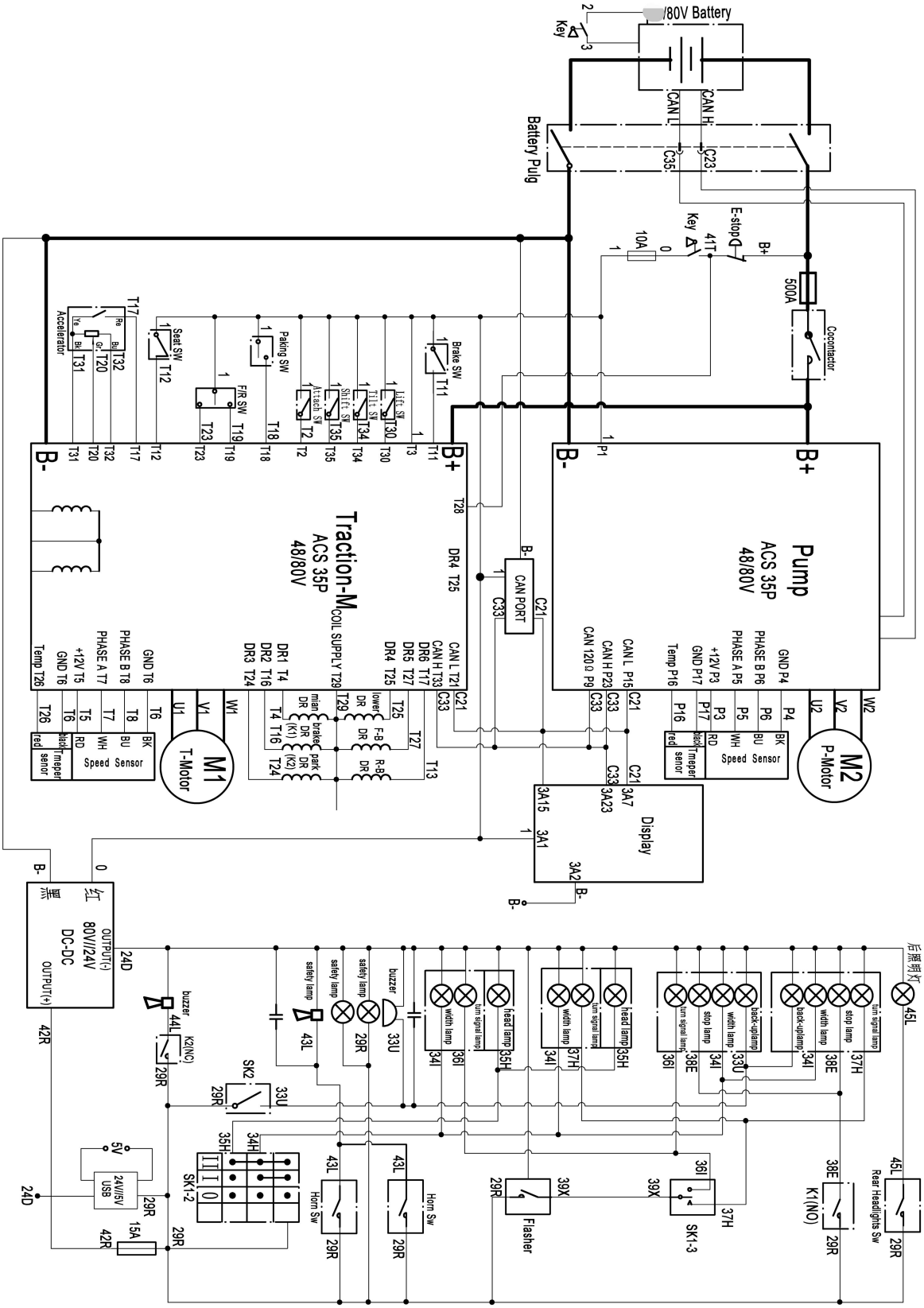
Technical specifications

No	Item	Specification	No	Item	Specification
1	PWM operating frequency	10KHZ	8	accelerator control signal	2-wire 0-5KΩ/5KΩ-0, 3-wire potentiometer, 0-5V, current source, electron accelerator
2	Dielectric strength with radiator	>500Vac	9	speed control type	Single-ended/swing/VCL input
3	Logic port input voltage	Falling edge > 1.5V is high; rising edge > 4.4V is high	10	Working temperature	-40℃to50℃
4	KSI input current	<1.0A	11	storage environment temperature	-40℃to50℃
5	Logic terminal input current	<10mA	12	over temperature current limiting	85°C current limit, 95°C cutoff
6	output frequency	300Hz	13	low temperature limiting	-40℃ cut off
7	Drive total current	<10A	14	tightness	IP65perIEC529
15	Related standards	1) 1) EMC interference: EN50081-2/08.93; immunity: EN50082-2:1995 2) 2) Safety, anti-speed car: EN1175 3) 3) UL certified components 4) 4) Meet UL583 insulation test			

2-4-2 Circuit, functional and electrical schematics



Curtis F-Series Electrical Schematics



Inmotion System Electrical Schematic

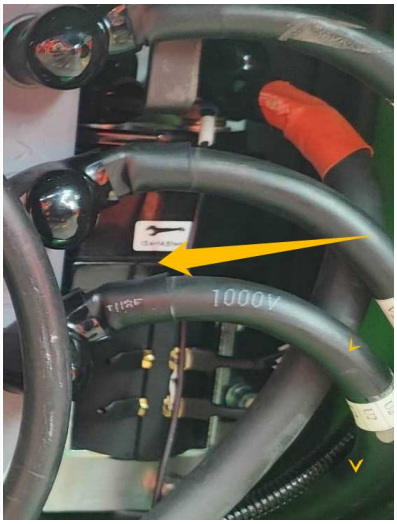
Critical Power Supply of Controller

This model is equipped with a drive motor and a pump motor, which are controlled by different controllers.

The forklift is powered by the controllers through key switches and then turned on.

Current to the contactor of the line Power supply of controller

Once the controller is energized, a magnetic coil built into the line contactor will receive power from the driven motor controller. The two contact points, which act like switches, will then touch each other and connect the lines between the battery and the two controllers. Therefore, the controller becomes a three-phase and three-wire AC power supply and is transmitted to the motor through each UVW connections. The line contactor is equipped with 500A fuse to prevent



Line contactor

The two controllers are connected through the following sensors, switches, relays and actuators.

Key switch
Emergency Switch
Forward/revise units
Accelerator
Seat Switch
Brake pedal switch
Parking brake switch
Hydraulic control switch
Horn relay

These devices provide DC power and interact with controllers that activate or receive data based on a number of parameter settings to control the motor.

The two motor controllers are identical to hardware, but each controller is programmed with different types of firmware to achieve different functions.

The safety & high efficiency performance and complete operation function of electric forklift can be realized by properly setting the motor technical parameters and control technical parameters and function values of the controllers.

1. The crawling speed of electric forklift is adjustable. The crawl speed setting function of the controller enables a long-time operation of electric forklift at a low speed.

2. The acceleration rate is adjustable. The acceleration rate refers to the "soft and hard" feeling of accelerator pedal when operating electric forklift. By setting the acceleration rate, the forklift can meet the requirements of acceleration operation in different working conditions.

3. Plug braking and regenerative braking. The reverse braking signal will be generated when the direction bar is in opposite position, which controls the traction motor to give a braking torque through the motor driver for the purpose of vehicle deceleration. The power level is controlled by the accelerator pedal. Regenerative braking is generated by the controller under the condition that the speed of the vehicle is relatively higher than the speed of the traction motor, of which the braking energy of the vehicle will be converted into electric energy and fed back to the battery. Especially when the electric forklift is on the downhill slope, the regenerative braking to properly reduce the speed of the vehicle on the downhill slope can be achieved through a proper lifting and releasing accelerator foot plate, which thus extends the driving distance of the battery for any single charge.

4. Slope anti-backward slip function. The electric forklift with AC traction motor has the excellent function of staying non-slip on the slope.

5. The maximum driving speed is adjustable. Reasonable setting on maximum driving speed of electric forklift can prevent any overloading of traction motor due to high speed.

6. Static reply switch off. In the event that the seat switch or key switch is disconnected, the control will be turned off and the directional control lever shall be pushed back into the neutral position to restart. If the driver leaves the vehicle and returns at any time, the direction control lever shall be pulled back into the neutral position before restarting. This function may help to avoid any unexpected unsafe operation A time delay of several seconds is provided at the input end of the seat switch to allow instantaneous disconnection of the seat switch against turbulence.

7. Safety protection function If the power component of the controller is damaged during operation, the controller will disconnect the main contactor in the shortest time, and the controller will automatically limit the armature current of the motor upon the temperature over rise of the controller. When the battery voltage is too low, the controller will also stop working to ensure safety.

8. Both traction motor controller and oil pump motor controller are functioned with self-diagnosis. When the lead controller come across a fault during operation, the fault code will be displayed on the display instrument and the controller will stop working automatically for the safety of the operating system.

9. The amount of battery power and accumulated working hours will be indicated in display instrument.

2-4-3 Diagnosis and Troubleshooting

There is a way to view the current fault code without an display board or handheld programmer: a built-in LED light is set on each controller to indicate the entire fault code list.

Each code consists of two digits. The red LED indicator which flashes once indicates that the first number of the code that will follow; the yellow LED then flashes the appropriate number of times to indicate the first number. Red LED which flashes twice indicates the second code that will follow; the yellow LED indicator flashes the appropriate number of times to indicate the second number.

For example, if the current fault code is "23", the LED will display as follows:

Display	Status
All LEDS not on	The controller is not powered on; or running out of battery; or seriously damaged
Yellow LED flashes	Controller works normally
Yellow and Red LEDs is fully on	The controller is in flashing mode
Red LEDs is fully on	hardware failure. To cycle KSI to cleanup, and reload the software or replace the controller if necessary

2-4-4 Test

A. Controller

The diode voltage of AC MOSFET circuit inside the controller shall be tested and checked for any burn out damage.

According to the table below, each test item shall be tested repeatedly for more than 3 times.

Item	Multimeter terminals		Range of normal value	
	Red indicating pen	Black indicating pen	Polarity measurement	Resistance measurement
1	B+	U/V/W/B-		1MΩand above
2	B-	U/V/W		1MΩand above
3	U/V/W	B+	0.3-0.6V	
4	B-	U/V/W	0.3-0.6V	

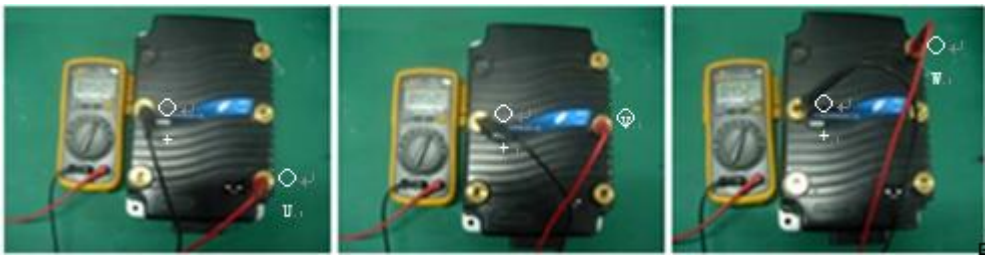
Pull multimeter to Ω mode (resistance). Pull the multimeter to the diode mode (polarity measurement)

1） Remove the cables and wires that connected to the controller, and release all the internal power of capacitor (discharge the B + and B - terminals with 30 Ω resistance).

2） Test the diode voltage (0.3-0.6v) with a multimeter and check if it is normal.

Test1：Read the diode voltage, through which the red wire is B-, the black wires are U, V and W.

Test 2：Read the voltage of the diode to U, V and W, and the black lead to B + with red wires.

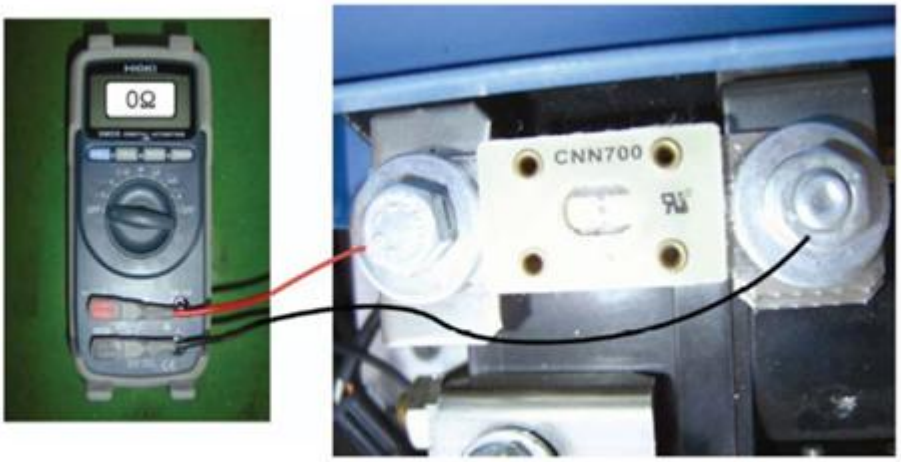


Notes: The multimeter pointers shall not be inverted in use

B. Line contactor and fuse

Line contactors

Figure 2-22



Line fuse

Figure 2-23

For line contactors and line fuses, an ohmmeter shall be connected at the point shown in the figure and shall be tested for the specified value.

2-4-5 Disassembly and Installation

Access to control panel

1. Disconnect the battery connector.
2. Keep the key switch open to discharge the power module. Twice for 30 seconds.
3. Close the key switch
4. Remove the side panels to access the drive motor controller and pump motor controller.

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

Disassemble/install drive motor controllers

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

1. Disconnect the control harness from the controller connectors
2. Disconnect U, V and W cables. Tightening torque：9.5±1 N·m（7.0±0.7 lb·ft）
3. Remove B+ and B- wires from the drive motor controller
4. Loosen and remove the drive motor controller
5. Perform the above steps in reverse order to install the drive motor controller

Disassemble/install pump motor controllers

1. Disconnect the control harness from the controller connectors
2. Disconnect U, V and W cables. Tightening torque：9.5±1 N·m（7.0±0.7 lb·ft）
3. Remove B+ and B- wires from the drive motor controller
4. Loosen and remove the drive motor controller
5. Perform the above steps in reverse order to install the pump motor controller

Disassembly/installation of line contactor

1. Disconnect the cable from both terminals.
2. Remove the line B+ from the line contactor.
3. Loosen the bracket screw.
4. Remove the line contactor
5. Perform the above steps in reverse order to install the line contactor

Disassembly/installation of line fuse

1. Remove B+x line from line fuse.
2. Remove the line fuse.
3. Perform the above steps in reverse order to install the line fuse

2-5 Miscellaneous Load

2-5-1 Fuse holder

A.The function and composition

To protect DC load from overcurrent, the fuse box is equipped with the following terminals:

Description	Specification
FU1	15A
FU2	10A
FU3	10A
FU4	10A

B.Disassembly and Installation

Preliminary steps

1. Close the key switch
2. Disconnect the battery connector.
3. Remove the cover.

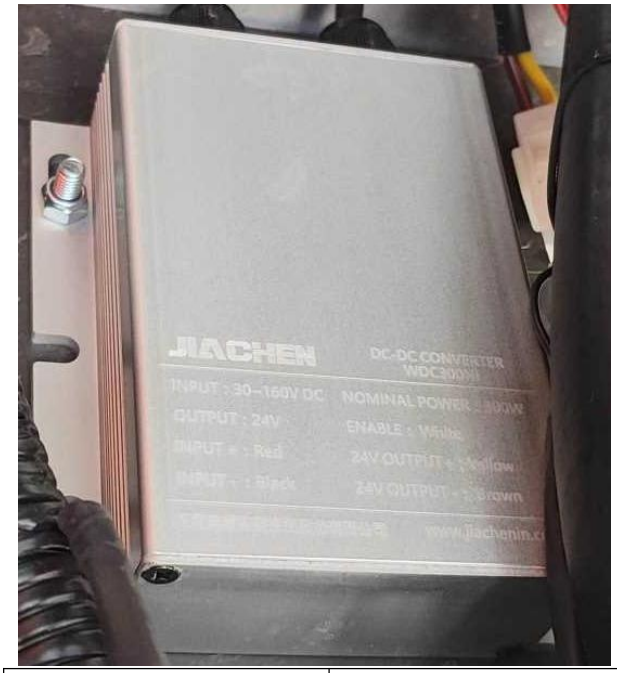
Procedure

1. Disconnect the two harness connections from the fuse box.
2. Remove the bolts and washers, and then remove the fuse holder
3 .Perform the above steps in reverse order to install the fuse holder

Note: when replacing fuses, new fuses of the same type and specification shall be used to avoid any electrical damage. If the fuse blows out frequently, there may be an electrical fault.

2-5-2 DC-DC Convertor

A.Appearance and Specifications



Item	Specification
Maximum power	IN 300W
Input voltage	DC 48V
Output voltage	DC 24V

B. Circuits and Functions

The DC-DC converter power supply (80 V) into a 24 V power supply, which is suitable for various loads.

The functions of each terminal are as follows:

1. The INPUT terminal receives power from the battery to activate the DC-DC converter.
2. The OUPUT terminal Green (24V+) is connected to the terminal of the fuse box, which covers the load powered from the converter, and then sent to the load through the fuse box. OUPUT terminal Terminal Blue (24V-) is connected to the negative side of the load to be applied at 24V.

2-5-3 Lamp Bank

This model is equipped with a variety of lamps, each of which has a different purpose.

Headlights (L/R) illuminate the path in front of the vehicle

The rear lights illuminate the path behind the vehicle

The reverse lights will turn on during reverse operation

Press the brake pedal and the brake light will turn on

2-5-4 Horn

The horn is powered directly by a battery. It is used to sound an alarm to warn people around.

2-6 Instrument panel

2-6-1 Display introduction

A new type of combination instrument is adopted to realize auxiliary control function and provide driver's vehicle condition display interface. It consists of control circuit, accumulated time counter (LCD), battery power meter, fault code display and other display circuits. According to the current demand of electric vehicles, this instrument has made a new design in the control circuit and display form, which can provide intuitive vehicle status information for drivers, with compact structure, beautiful appearance, high degree of automation and reliable quality.

2-6-2 Function

Instrument display function (Curtis system)

1	Parking	13	steering angle
2	seat	14	Instrument menu
3	brake brake	15	Instrument menu
4	lift lock	16	Instrument menu
5	Fault ID	17	Instrument menu
6	seat belt	18	H (high performance)
7	forward, backward	19	S (regular performance)
8	battery power	20	E (economic performance)
9	operating hours	21	Turtle mode
10	Driving speed	22	Cancel/-
11	speed mode	23	confirm/+
12	error code	24	none

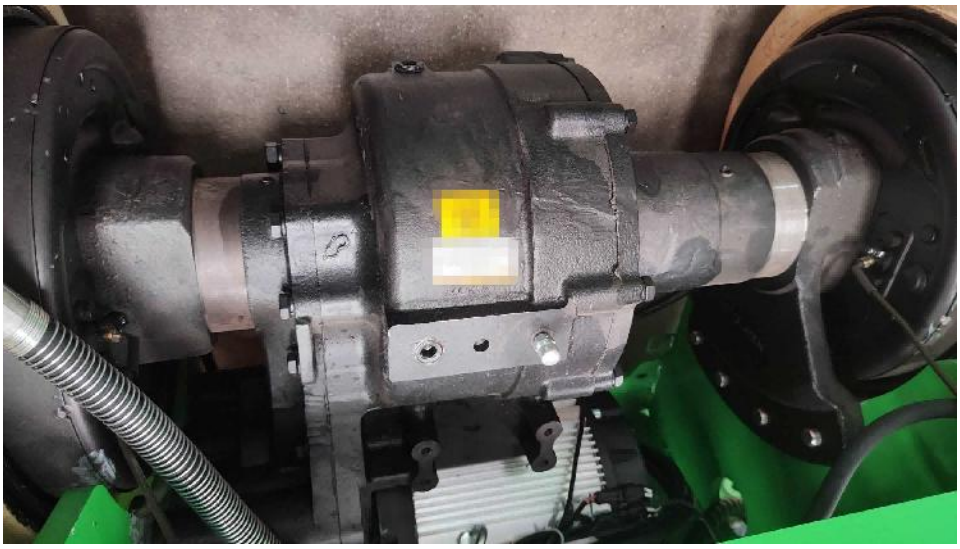
Instrument display function (Inmotion system)

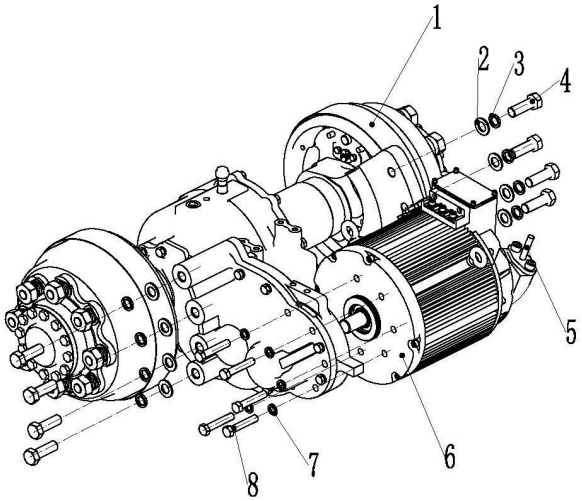
1	Turtle Tips	13	battery power
2	Troubleshooting	14	Driving speed
3	Battery alarm	15	steering angle
4	Prompt lock	16	forward, backward
5	Seat Tips	17	speed mode
6	parking reminder	18	operating hours
7	Cancel		
8	confirm		
9	Turtle button		
10	high performance button		
11	General performance button		

3 Drive/Brake system

3-1 overview

3-1-1 Assembly





NO	SN	ITEM	QTY
1	253613513001	Drive axle box assembly (AQ small wheelbase)	1
2	910400100012	Flat washer GB97.1-20-200HV	8
3	910400500012	Spring washer GB93-20	8
4	253713521001	Reaming hole bolt M20x1.5x60	8
5	255098513251	Encoder (Hepu)	1
6	253732010001	Motor (AC) HPQ12-80NL-6P	1
7	910400500009	Spring washer GB93-14	5
8	910100200024	Bolt GB5785-M14x1.5x75-10.9	5

The drive/brake system consists of the followings:

1 The drive motor regulated by the respective controller transmits the rotating force to the drive shaft (electric mechanical power).

2 The drive shaft converts the rotational force transmitted from the drive motor into torque and speed suitable for driving through its gear set and sends them to the corresponding wheels (mechanical power). They also contain service brakes, which are actuated by depressing the brake pedal to produce braking power (hydraulic power friction).

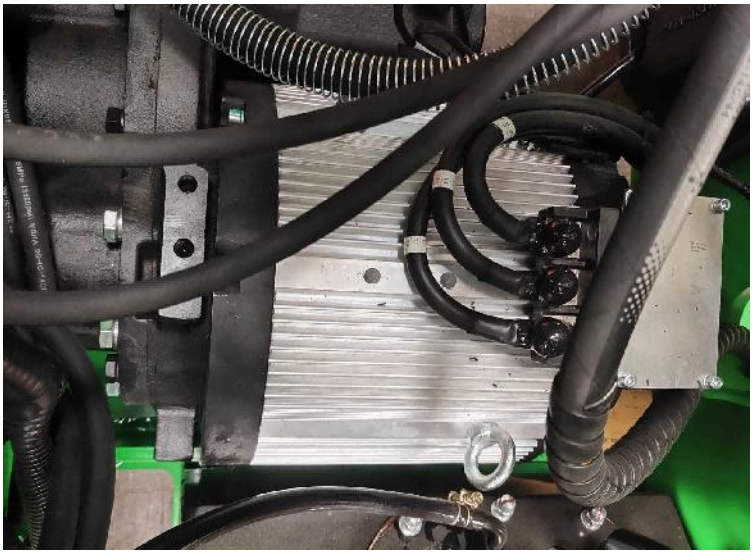
3 The accelerator sends an electrical signal to the drive motor controller to accelerate the motor (analog signal digital signal).

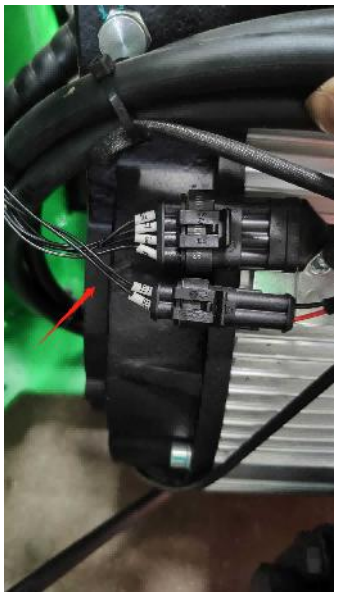
4 The F / R unit sends an electrical signal to the drive motor controller to determine the drive direction of the motor (analog signal digital signal).

5 The service brake pedal assembly injects brake fluid into the drive shaft to drive the service brake (hydraulic power friction).

6 The parking brake built into each drive axle secures the motor shaft when engaged to ensure that the vehicle is stationary (mechanical power friction).

3-2 Drive motor





The encoder is located inside the motor cover

3-2-1 Function

Electrically, the drive motors rotate their respective drive wheels so that the vehicle can move forward / backward

Controlled by controller

Each drive motor is connected to the controller through U, V and W lines. The controller operates the drive motor according to inputs from multiple switches and sensors and internal parameter settings.

The drive motor operates when the following conditions are met:

1 the key switch is turned off to supply power to the controller,

2 operator seat (seat switch),

3 determine the driving direction (F / R unit),

4 accelerator pedal pressed (accelerator)

Motor speed detection (encoder operation)

Each drive motor is equipped with an encoder, which is used as the speed sensor of the motor. It includes two hole sensors, and a gear is installed on the drive shaft of the motor to interact with the two hole sensors. The gear rotates simultaneously with the drive shaft so that the gear teeth periodically pass through the magnetic field of each hole sensor. When the top platform of the gear passes through the magnetic field, it is close to the hole sensor, so the magnetic flux increases. On the other hand, when the bottom platform passes through the magnetic field, the distance increases and the magnetic flux decreases accordingly

The cycle occurs again and the magnetic flux has a waveform that generates a voltage pulse. The controller analyzes the amplitude of the pulse to calculate the speed of the motor. The smaller the amplitude, the higher the speed of the motor.

Like other sensors, the encoder generates a main signal (signal a) and a reference signal (signal B) through two hole sensors. The order of the generated signals varies according to the direction of rotation.

Overheat protection (thermal sensor operation)

Each drive motor is equipped with a thermal sensor to prevent overheating. Once the motor is heated to 145 ° C (293 ° f), the overheat alarm is activated and the operating performance of the motor is limited.

3-2-2 Drive motor disassembly/assembly and test

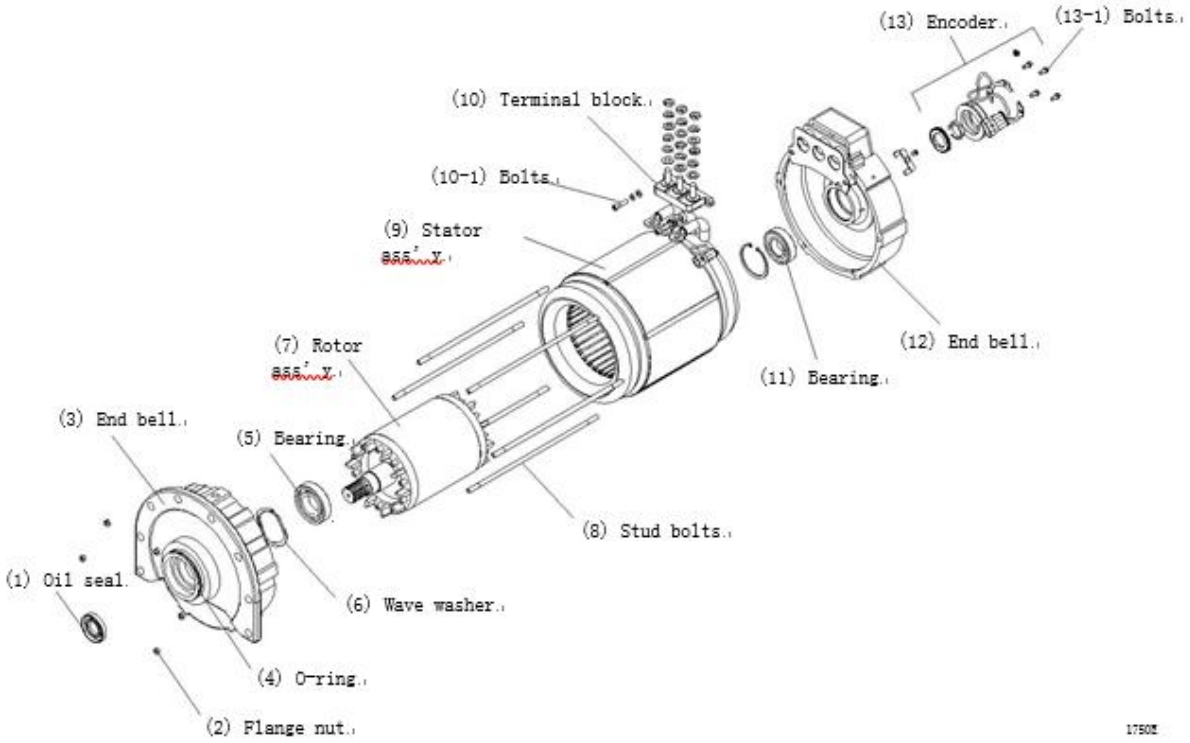


图 3-9

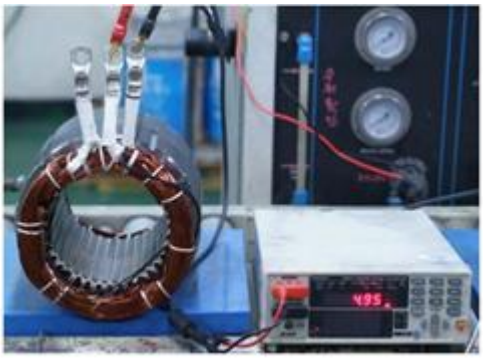
Disassembly/assembly

1.After removing the terminal protector, loosen the screw (10-1) and remove the terminal row (10).
2.Loosen bolts (13-1) and remove encoder (13).
3.Remove the O ring (4) and oil seal (1).
4.Loosen the backing nut (2) and remove the end cover (3).
5.Remove the stator assembly (9) by hand or with a tool.
6.Remove the corrugated washer (6) and bearing (5) from the rotor assembly (5).
7.Remove the bearing (11) and rotor assembly (7) from the end cover (12).
8.It is recommended to use a bearing puller, as shown in the figure.

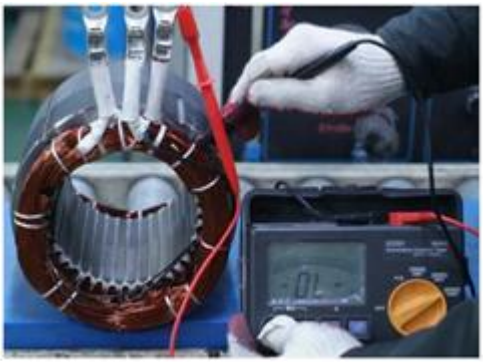
Follow the above steps in reverse order to assemble the drive motor.
Note: Before reassembling the motor, you can test its components as follows.

The test of the stator

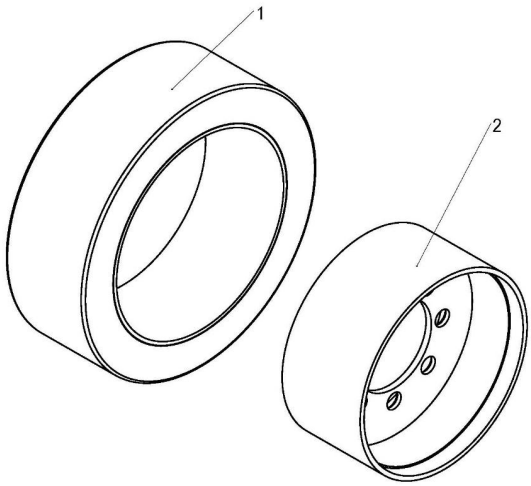
Use a clean cloth dipped in alcohol to carefully wipe the contaminants on the surface of the stator.
Note: Contaminants in the stator may cause damage to the coil and therefore to the stator itself.
2 Use milliohm meter to measure the resistance of each phase (UV, VW, WU).
Rated resistance: 0.4Ω



3 Test insulation at 1000 VAC and Min. 10MΩ Use insulation tester.
If there is a problem with the insulation, replace the stator with a new one.



3-2-3 Drive wheel removal/installation



1. Place a jack or wooden block under the forklift to free the wheel and loosen the nut.
Installation torque: 450±70 N-m (331.9±51.6 lb-ft)
2. Remove the nut and drive the tire (1).
3. Perform the above steps in reverse order to install the drive wheel.

Wheel Mounting

(1). The hub is filled with 100ml of grease and then mounted on the shaft. (Figure 2-4)
(2). Tighten the adjusting nut using a torque of about 9.8N-m and then return 1/2 turn.
(3). Hang the spring scale on the bolt to measure the hub starting torque, and when it reaches the specified value, slowly lock the nut.
Starting torque: 49N-m - 147N-m. (Figure 2-5)
(4). Install the locking tab and locking nut, and wrench up the locking tab to lock the stop.
(5). Tire assembly
Install the air catch lever and cap on the tire and assemble the rim, noting the following:
Note: (a). The valve stem is at the rim notch and facing outward;
(b). The rim bolt head should be installed facing outward toward the vehicle.

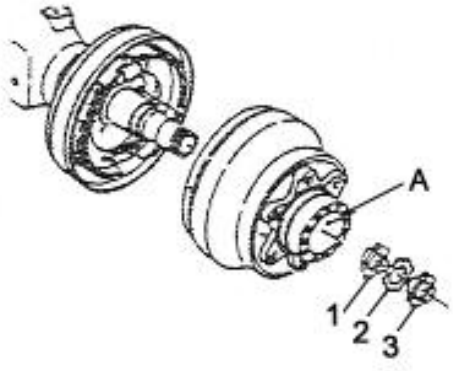


Fig. 2-4 Grease filling

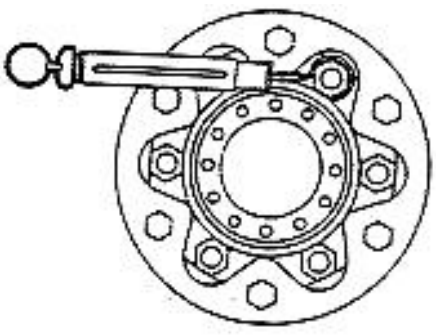


Fig. 2-5 Measuring the starting torque

Fault Analysis

Table: Troubleshooting and correction

Fault items	Possible causes	Alignment method
High vibration	Loose fastening bolts at each mounting coupling	Tighten
Oil temperature is too high	Deterioration of gear oil	Replace
	Abnormal oil level	Replenish or reduce
	Stuck moving parts	Adjustment
Oil leakage	Loose bolts on the joint surface	Tighten
	Seal ring broken	Replace
Noise	Damaged rotating gear	Replace
	Damaged bearing	Replace

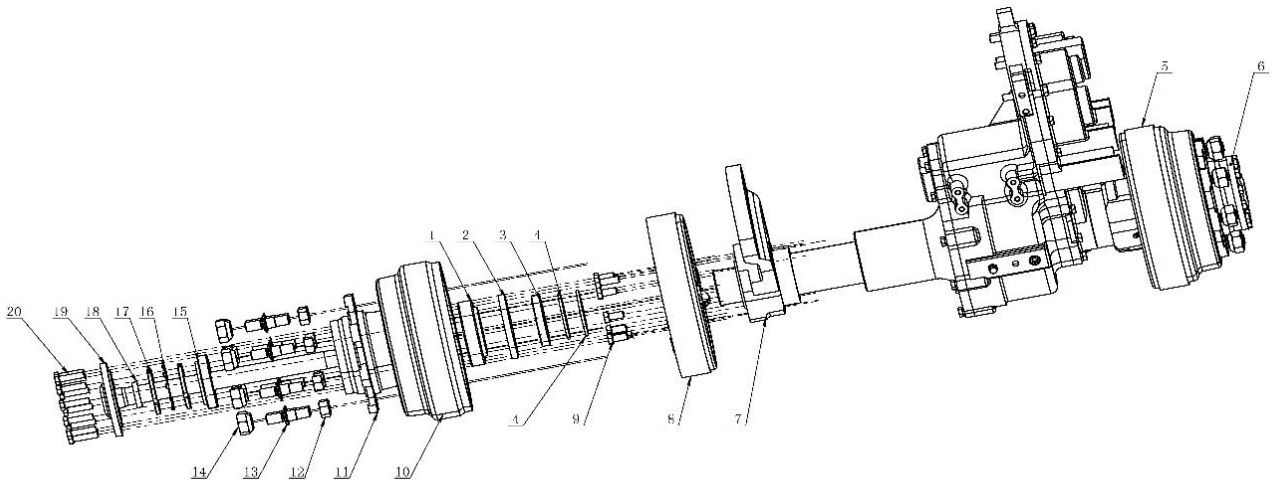
3-3 Drive axle

Drive axle

The drive axle consists of axle housing, wheel hub and brakes, which are installed in the front of the frame.

The wheel hub is supported by tapered roller bearings on the axle housing. The power is transmitted to the half-shaft through the differential, and the wheel hub is driven by the half-shaft and drives the front wheel to rotate, and the half-shaft only bears the torque transmitted to the wheel hub. The left wheel hub is equipped with an internal oil seal to prevent water and dust from entering or leaking oil. The diagram below shows

3-3-1 Appearance and specifications



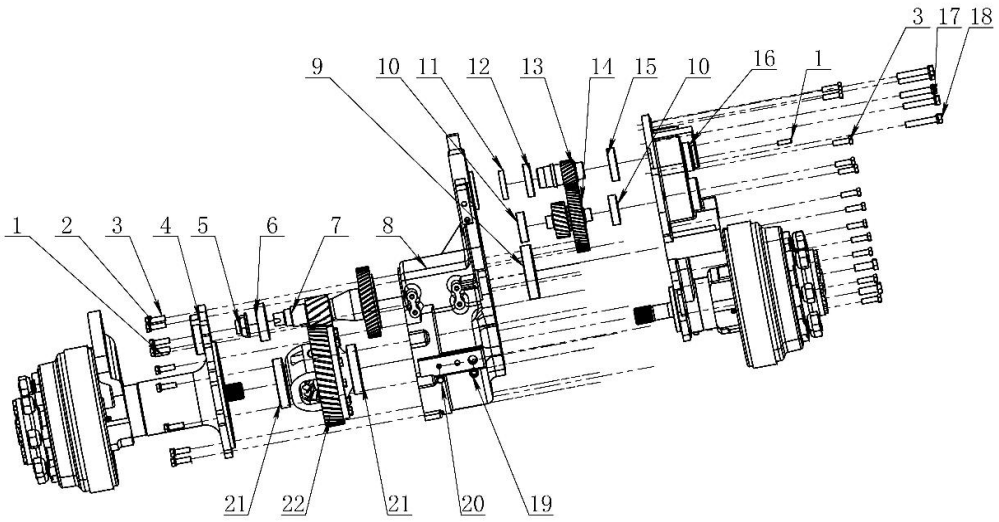
NO	SN	Item	QTY
1	253698523523	Tapered roller bearing	2
2	253698523524	Oil seal φ110×φ140×12-Z6650-11004	2
3	253698523525	Oil seal retaining ring AQ-AE773-10001	2
4	253698523526	O-ringφ90×5.3-Z6501-09004	2
5	253698523527	Left brake assembly AQ-HK2S3-00401	1
6	253698523528	Right half shaft AQ-AE773-02051	1
7	253698523529	Connection plate AQ-AE773-02091	1
8	253698523530	Right brake assembly AQ-HK2S3-00501	1
9	253698523531	Bolt (for 3t brake) A22A3-02051	12
10	253698523532	Brake drum AQ-AE773-02071	2
11	253698523533	Wheel hub AQ-AE773-02081	2
12	253698523534	Nut M20×1.5-B4223-00020B	16
13	253698523535	Bolt 25303-02102B	16
14	253698523536	Wheel nut 23913-02041B	16
15	253698523537	Tapered roller bearing 32015	2
16	253698523538	Thrust washer 75-B5512-00075	2
17	253698523539	Round nut M75×2-10T11-02030	4
18	253698523540	Simmerring oil sealφ42×φ55×10-AQ-A7S33-02221	2
19	253698523541	Right half-shaft AQ-AE773-02051	1
20	253698523542	Half-shaft bolt 24453-02061B	24

3-3-2 Transmission System

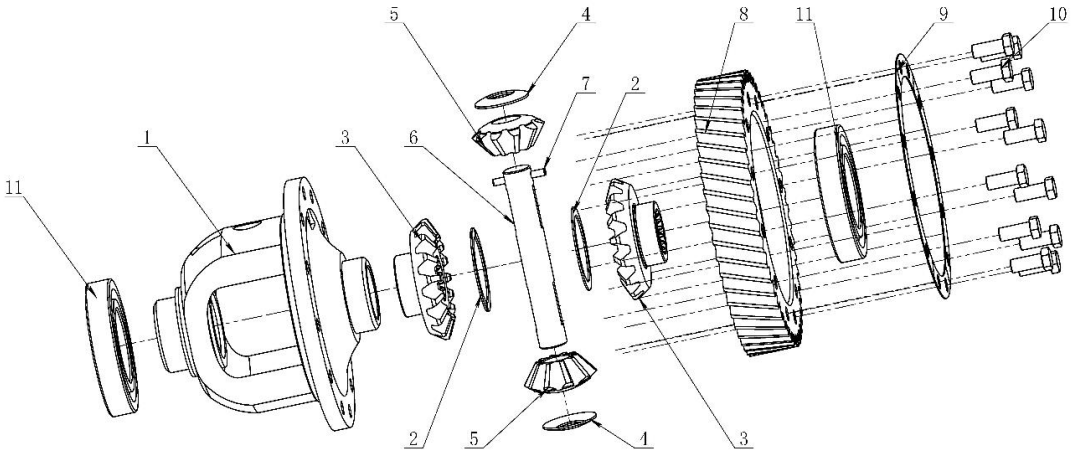
The transmission system of forklift truck is composed of gearbox assembly, differential assembly and drive axle. The active gear of the reducer is directly connected with the running motor, and the running speed of the forklift truck increases with the increase of the motor speed, and the driving direction is changed by changing the rotation direction of the motor and the real view.

Gearboxes & Differentials

The reduction gearbox is located between the drive axle and the travel motor. The two pairs of cylindrical helical gears of this mechanism reduce the speed from the output shaft of the travel motor and increase the torque from the transmission shaft, which is then transmitted to the differential. The diagram below shows



NO	SN	Item	QTY
1	253698523501	Cylindrical pinφ10×35-B3130-10035	2
2	253698523502	Spring pad 12-B5050-00012B	22
3	253698523503	Bolt M12×40-AQ-A7S33-02241	22
4	253698523504	Right housing AQ-A6S53-02011	1
5	253698523505	Lock nut AQ-A7S33-02371	1
6	253698523506	Four-point contact ball bearing Z-6308-4P	1
7	253698523507	Duplex gear 2-AQ-A7S33-02161Z	1
8	253698523508	Intermediate reduction housing AQ-A6S53-02001Z	1
9	253698523509	Four-point contact ball bearing Z-6215-4P	1
10	253698523510	Deep groove ball bearing Z-6306	2
11	253698523511	Simmerring oil sealφ48×φ70×12-AQ-A7S33-02231	1
12	253698523512	Deep groove ball bearing Z-6010-C3	1
13	253698523513	Pinion gear AQ-A7S33-02181	1
14	253698523514	Duplex gear 1-AQ-A7S33-02171	1
15	253698523515	Deep groove ball bearing Z-6208	1
16	253698523516	Left axle housing AQ-AE773-02041	1
17	253698523517	Spring pad 14-B5050-00014B	5
18	253698523518	Bolt M14X80-B0330-14080B	5
19	253698523519	Plug 22193-03001	3
20	253698523520	Cover 4CC11-10-01	1
21	253698523521	Deep groove ball bearing Z-6213	2
22	253698523522	Gear ring AQ-A7S33-02151	1



Differentials

NO	SN	Item	QTY
1	253698523543	Differential housing AQ-A7S33-02101BA	1
2	253698523544	Half-shaft gear pad AQ-A7S33-02141	2
3	253698523545	Half-shaft gear AQ-A7S33-02121	2
4	253698523546	Thrust washer AQ-16113-52121A	2
5	253698523547	Planetary gear AQ-A7S33-02111	2
6	253698523548	Elastic cylindrical pin φ6×50-B3352-06050	1
7	253698523549	Gear ring AQ-A7S33-02151	1
8	253698523550	Locking piece AQ-A7S33-02321	6
9	253698523551	Bolt M12×1.25×30AQ-G2FB3-82061	12
10	253698523552	Deep groove ball bearing Z-6213	2

3-3-3 Function

Driving function

The drive shaft is responsible for transmitting the output of the drive motor to the wheels, reducing speed and multiplying torque according to the specific gear ratio generated by its internal gear train. This is to make the motor's high speed suitable for driving and obtain enough force to withstand the load of the vehicle and other external conditions.

When the motor shaft rotates, the pinion to which it is connected also rotates, and then the helical gear is rotated and the spline is connected to the pinion. Since a helical gear has several times more teeth than a pinion, the first deceleration occurs between the two gears and a corresponding doubling of torque:

The sun gear meshing with the helical hearing rotates simultaneously with the helical hearing rotation. The rotation of the sun gear causes the three planetary gears to move around the sun gear. Planetary gears, such as those contained in ring gears, maintain their circular motion without becoming out of mesh. The cogs are so named because the way they work together can be compared to the orbits of the planets around the sun.

Braking function

Once the brake pedal is pressed, brake oil is injected into the drive shaft through the master cylinder to push the piston. Then, the pushed piston compresses the friction disc and the steel disc overlapped with each other; There is friction between them. Thus, the friction disc loses its rotating

power. When the friction disc loses power, all other rotating parts, including the wheel, slow down and stop together. After the brake pedal is released, the brake oil is discharged, the return spring returns the compression disc to the original position, leaves a gap between the inner disc and the outer disc, and rotates to release the brake. Therefore, all
Other rotating parts become free to rotate.

3-3-4 drive gear oil replacement

Preliminary steps

Park the vehicle on level ground. Check that the parking brake indicator light is on, then place the F/R switch in neutral.

Procedure

1) Lift the mast and support it with a support block.

2) Turn off the key switch.

3) Unscrew the level check plug and remove the drain plug to drain the oil.

4) Clean the drain plug and install it.

5) Unscrew the filling plug and fill the oil. Keep the proper oil level by checking the dipping stick.

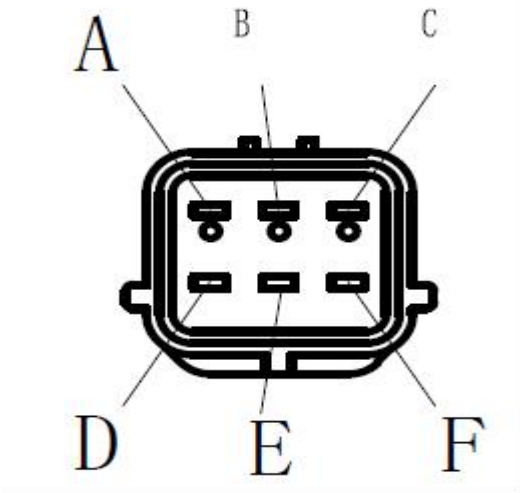
6) Install the oil level check plug and tighten the oil filling plug together.

7) Lift the mast and remove the support block.

3-4 accelerator

3-4-1 Appearance and Specifications

number	definition	color
A	power supply +12V-+80V	red
B	Signal output terminal,0-10V	green
C	Ground cable 1	black
D	CAM（common port）	white
E	Idle switch signal	blue
F	blank	blank



3-4-2 Function

Electric vehicles run on the power generated by a drive motor. Therefore, the accelerator that determines the speed of the vehicle is connected to the drive motor controller.

The accelerator is powered from the drive motor controller at 5 V and generates signal A in F and signal B in R. This output determines that the speed of the vehicle is proportional to the Angle at which the accelerator pedal is pressed.

As shown above, the signal A or B sent by the accelerator is communicated by CAN to the controller. In principle, the two signals should have the same value. If their difference exceeds the tolerance, it will be identified as a problem in the electrical system or accelerator, and a fault code will appear on the display.

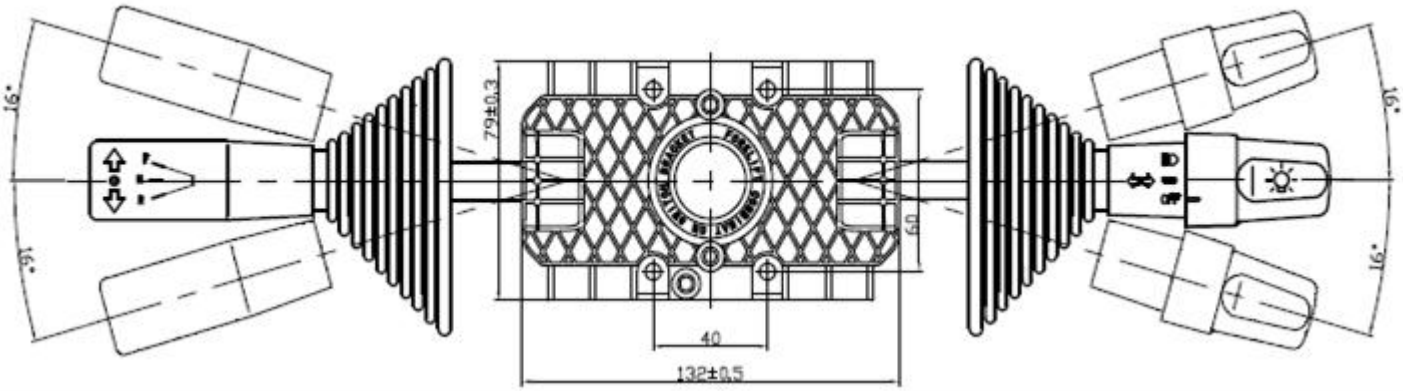
3-4-3 Removal and installation

Preliminary steps
1 Turn off the key switch.
2 Remove the floor MATS that cover the floor

Procedure
1) Lift the soleplate slightly and perform the following steps:
2) Remove the accelerator pedal connector from the main harness.
3) Release the three sets of bolts and nuts, and then remove the accelerator.
4) Perform the above steps in reverse order to reinstall the throttle pedal.

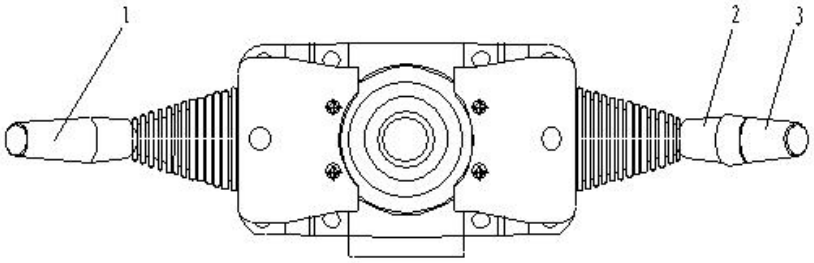
3-5 F / R Unit

3-5-1 Appearance and Specifications



3-5-2 function

Combination switch is a combination of direction switch, turn signal switch and small or large light switch.



1-F/R direction switch 2- turn signal switch 3- small or large light switch

The direction switch controls the driving direction of the vehicle and transmits the signal to the instrument for display. The handle pushes forward, the handle pulls back, and the middle position is neutral. When the handle is in the reverse position, the backing light and warning light will be on and the backing buzzer will sound.

The turn signal switch indicates the turning direction of the forklift. When the switch handle rotates to the turning position, the turn signal flashes.

Push forward	The left turn signal is flashing
middle	The median
Draw back	The right turn signal flashes

The switch controls the lighting and extinguishing of the light. This switch has two gears. Rotate to first gear and light up. Rotate to second gear and light up.

gear / light	OFF	The first gear	The second gear
In width modulation	×	○	○
The tail lamp	×	○	○
headlamps	×	×	○

○:light on ×:light off

(4) Rear headlight switch

After the headlight switch is a single file switch, control the light and extinguish after the headlight, pull the starting point after the light, push off the headlight.

The F/R direction switch (forward/backward) is used to enable the operator to select the direction of the vehicle by using a combination switch connected to the F/R.

The F/R orientation switch has A connector (6-pin connector, A-direction) that can interact with multiple devices, as shown below：

DJ7061-6.3-10

Direction Switch	1	3	2	5	6
Connector					
Color	Brown	Red	Green	Yellow	Red and blue
Size	0.75	0.75	0.75	0.75	0.75
Length	320	325	320	320	325
Power	60W	+	60W	60W	+
Forward		—			
Stop					
Backward			—	—	

The 6-pin connector pins of the F/R directional switches are connected to the F/R switches to provide a 5V power supply and receive operator requirements through forward, reverse, or undirected switches.

When the switch is in neutral, it sends voltage signals from the forward and reverse terminals.

Connectors in the B and C directions are light switch connectors for the vehicle, as shown below.

C向

DJ7021-6.3-20

B向

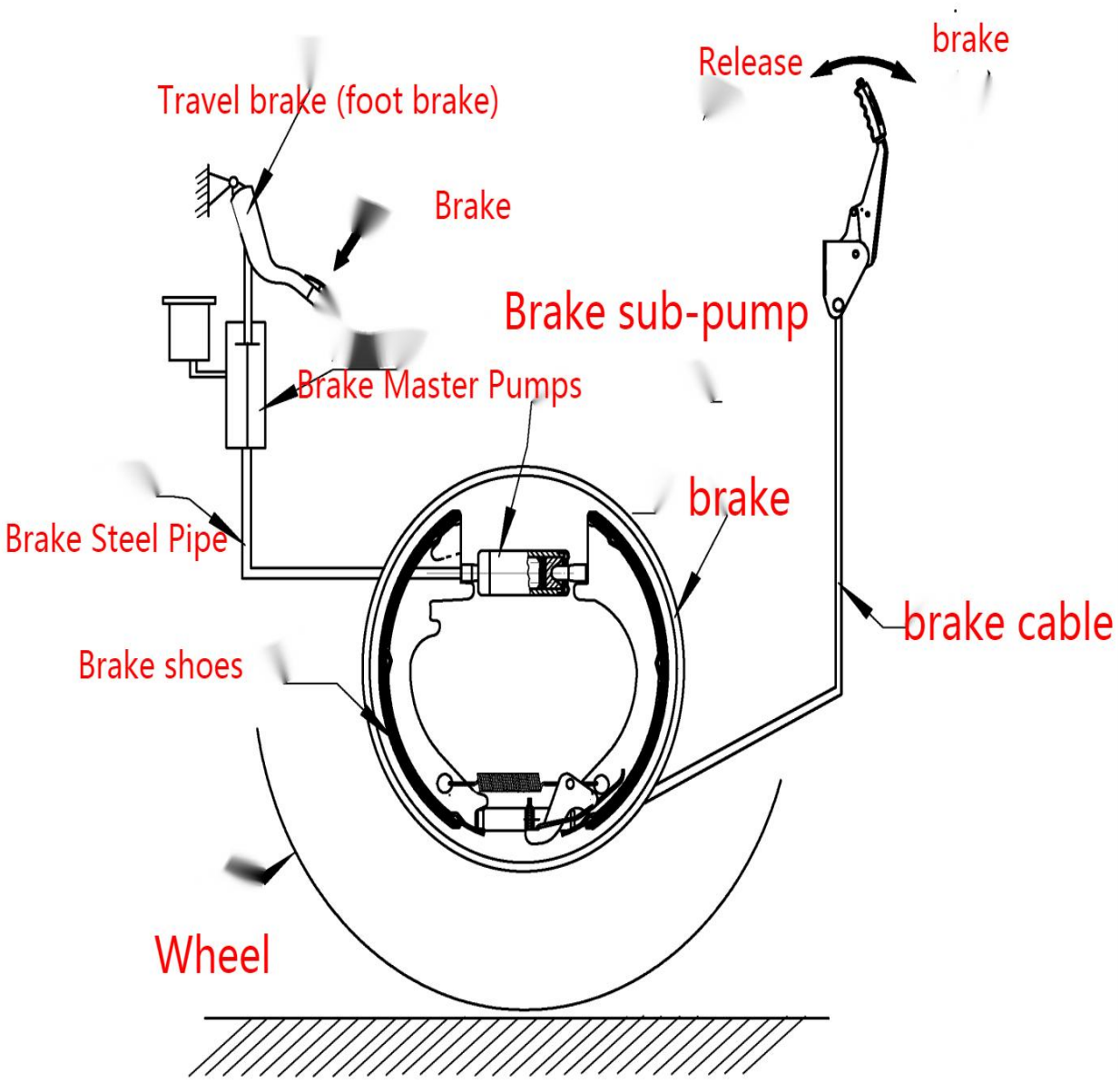
DJ7061-6.3-20

Direction Switch		Connector	8	7	9	10	11	12
		Color	Black and yellow	Orange	Grey	Brown	Yellow	Red
		Size	0.75	0.75	0.75	1.0	0.75	1.5
		Length	320	320	325	445	440	445
		Power	60W	60W	+	60W	50W	+
Right				—	—	—	—	—
	▬			—	—		—	—
	OFF			—	—			
Off						—	—	—
	▬						—	—
	OFF							
Left			—	—	—	—	—	—
	▬		—	—	—		—	—
	OFF		—	—	—			

3-6 service braking

3-6-1 overview

The brake system consists of brake pedal, brake master cylinder and wheel brakes, which are internal expansion oil pressure type for the front 2 wheel brakes.



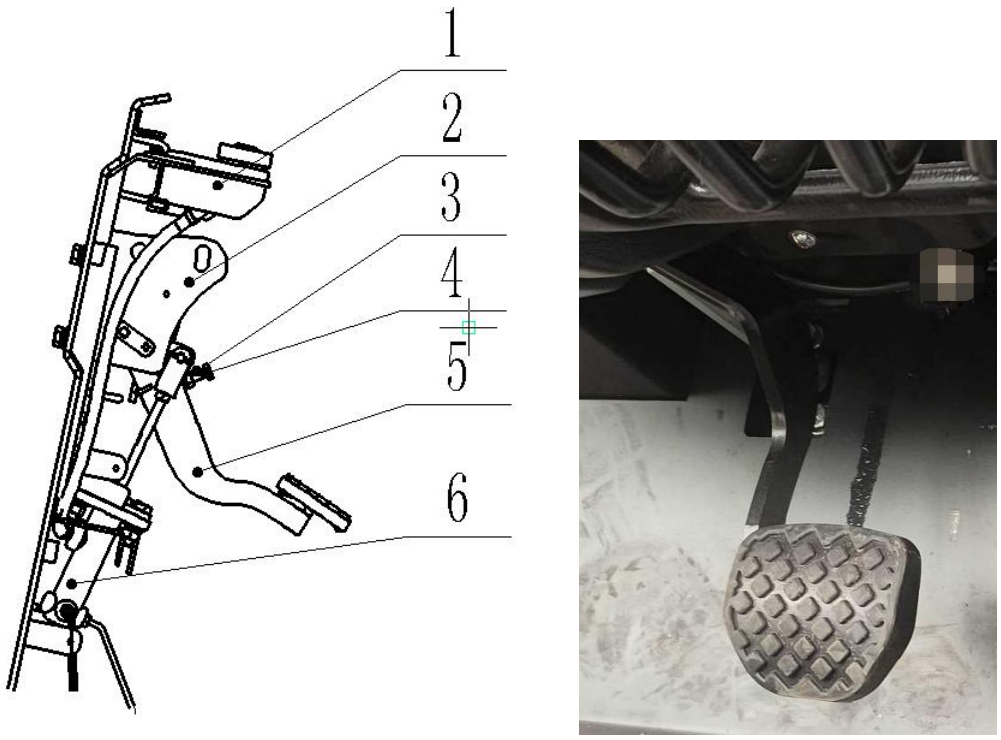
（Braking schematic）

1）When driving, when the foot brake is pressed, by pushing the brake fluid in the brake master pump through the brake steel pipe into the brake sub-pump, pushing open the brake shoes so as to achieve the driving brake, and release the pedal to cancel the driving brake.

2）When parking, when pulling back the hand brake, the brake shoes are pulled apart by the brake cable, thus realizing the parking brake; release the pedal to cancel the parking brake.

3-6-2 Brake pedal

The structure of the brake pedal is as shown in the figure. The pedal converts the pedal force acting on the pedal into the brake oil pressure through the push rod of the brake master cylinder.



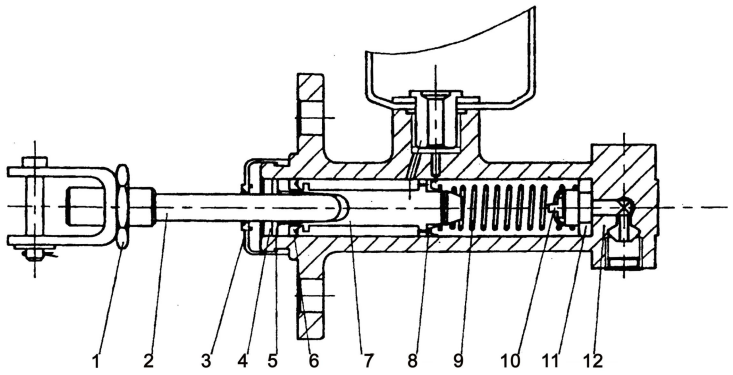
1. Brake oil cup
2. Brake mount
3. Brake sensor
4. stop bolt
5. Brake pedal
6. Brake master cylinder

Figure Brake pedal assembly

3-6-3 Brake master cylinder

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

piston acts by operating the brake pedal through the push rod. When the brake pedal is pressed, the push rod pushes the piston forward, and the brake fluid in the pump body flows back to the oil storage tank through the oil return port until the main leather cup blocks the oil return hole. After the main cup is pushed through the oil return port, the brake fluid in the front chamber of the master cylinder is compressed and the check valve is opened to flow to the slave cylinder through the brake pipeline. In this way, the piston of each slave cylinder extends outward to make the brake shoe friction plate contact with the brake drum to achieve the effect of deceleration or braking. At this time, the piston rear chamber is supplemented by brake fluid from the oil return port and oil inlet port. When the brake pedal is released, the piston is pressed back by the return spring. At the same time, the brake fluid in each brake wheel cylinder is also compressed by the return spring of the moving shoe, so that the brake fluid returns to the master cylinder (piston front chamber) through the one-way valve, the piston returns to its original position, and the brake fluid in the master cylinder flows back to the oil storage tank through the return port, The pressure of the check valve is adjusted to a certain proportion to the residual pressure in the brake pipeline and the brake wheel cylinder, so that the leather cup of the wheel cylinder is correctly placed to prevent oil leakage and eliminate the possible air resistance during emergency braking.

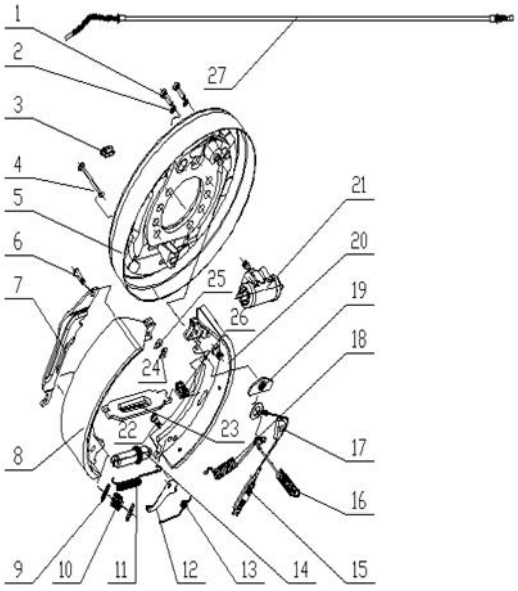


1.Lock nut	2.Push rod	3.Dust cover.	4.Lock wire
5.Lock washer	6.Auxiliary seal cup	7.Piston.	8.Main seal cup
9.Spring.	10.Check valve	11.Seat.	12.Pump body

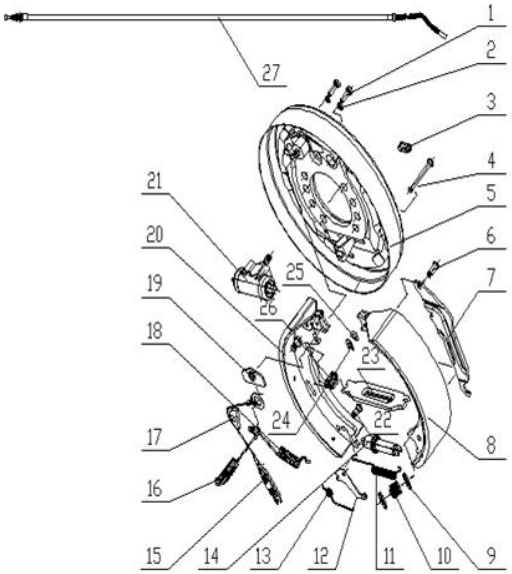
Figure Brake master cylinder

3-6-4 Brake

The brake is a double shoe brake, which is installed on both sides of the drive axle.The brake consists of two sets of brake shoes, brake cylinder and regulator.One end of the brake shoe is in contact with the fixing pin and the other end is in contact with the adjusting device.Press the parking brake part against the return spring and pressure spring rod.In addition, the brake is also equipped with a parking brake mechanism and an automatic adjusting device.



Left brake



Right brake

1. Bolt GB21-76	2.Spring washer GB91-76	3. Rubber plug 24433-70040G	4. compression spring tie rod 24433-70010G
5. Left and right brake bottom plate assembly	6. Hand lever pin 24433-70150G	7.Left and right hand brake puller	8.Brake shoe with friction pad assembly 23653-73021TC

9.Pressure spring seat 24433-70020G	10.Pressure spring 24433-70030G	11.Pulling spring 24433-70050G	12.Left and right detent
13.Left and right torsion spring	14.Left and right clearance adjuster assembly	15.Spring pulling device 24433-73000G	16.Left and right return spring (rear)
17.Guide block 24433-70081G	18.Left and right return spring (front)	19. Guide plate 24433-70060G	20. Left and right brake shoes with friction plate and hanging spring pin assembly
21.Left and right brake distributor pump assembly	22.Detent pin 24433-70110G	23.Left and right hand brake push rod	24.Rod pin retaining ring 24433-70170G
25.elastic shim 24433-70160G	26.Spring 24433-70130G	27.Left and right brake cable assembly	

(1) Brake action

The brake wheel cylinder presses the brake drum with the same force as the main brake shoe and the secondary brake shoe until the upper end of the secondary brake shoe is against the fixed pin, and the brake shoe moves towards the rotation direction of the brake drum.After holding the fixed pin, the friction force between the friction plate and the brake drum increases. Because the main brake shoe gives the auxiliary brake shoe a much greater pressure than the brake cylinder pressure, a great brake force is generated.

The brake action in reverse is the opposite of that in forward.

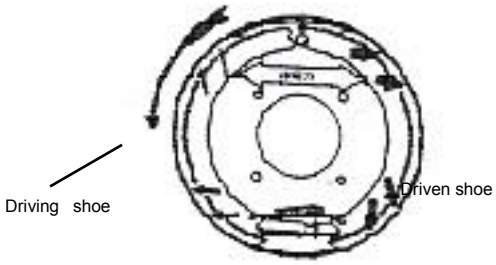


Figure forward action

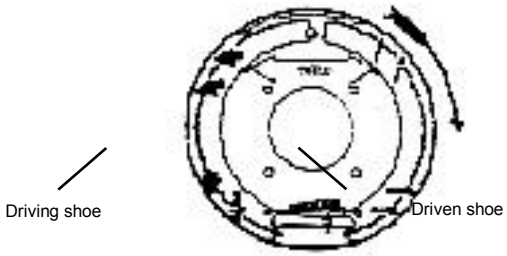


Figure backward action

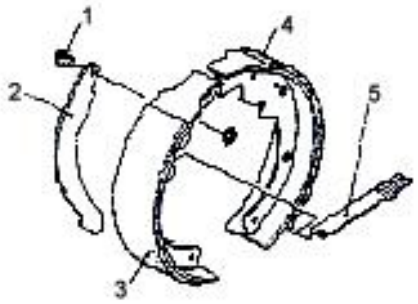
(2) Parking brake

The parking brake device is assembled in the wheel brake and consists of a pull rod and a push rod.The pull rod is installed on the side of the main brake shoe by the pin and pulled

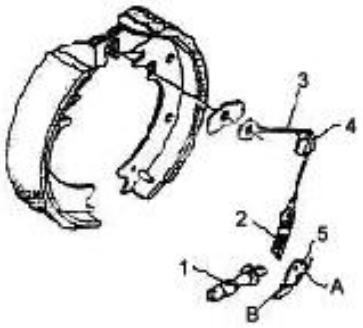
The action of is transmitted to one side of the auxiliary brake shoe through the push rod.

(3) Clearance self-adjusting mechanism

The clearance self-adjusting mechanism can maintain proper clearance between the friction plate and the brake drum.The clearance self-adjusting mechanism only operates when reversing.



1.Pin 2.Pull rod 3.Driving shoe 4.Driven shoe 5.Strut



1.Regulating mechanism 2.Spring 3.Inhaul cable 4.Guide slot 5.Pull rod

(4) Action of clearance automatic adjustment mechanism

When the forklift is backing up, brake operation is carried out. The auxiliary brake shoe contacts with the main brake shoe and rotates together to make the pull rod turn right around point a, as shown in the figure, point B is raised. After the brake is released, the pull rod turns left under the action of spring force, and point B drops.When the clearance between the friction plate and the brake hub becomes larger, the vertical distance of point B rotation increases, the adjuster is moved by a tooth, the adjusting rod becomes longer, and the clearance decreases accordingly.The

clearance adjustment range is 0.40mm-0.45mm.

3-6-5 Parking brake control

The parking brake handle is cam type, and the brake force can be adjusted by the adjuster located at the end of the brake handle.

Adjustment of braking force: turn the adjuster clockwise to increase the braking force; turn the adjuster anticlockwise to reduce the braking force.

Tensile force: 196N ~ 294N.

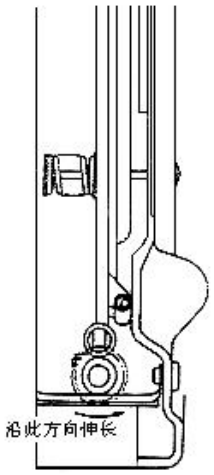


Figure Clearance self adjusting mechanism

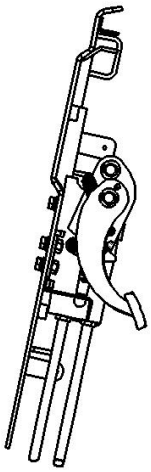


Figure Parking brake pedal

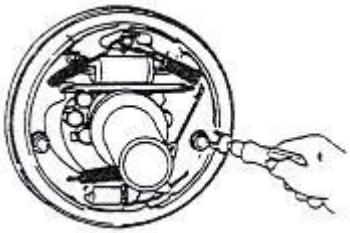
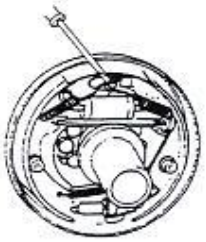
3-6-6 Key points of brake disassembly and adjustment

When the wheel and hub are disassembled, the disassembly, assembly and adjustment of the brake and the adjustment method of the brake pedal.

1.Brake disassembly

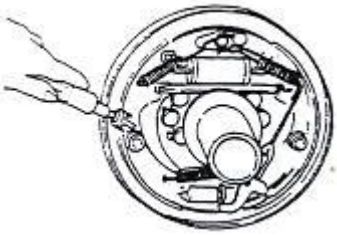
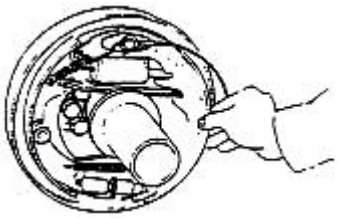
(1) Remove the support pin, adjusting rod, adjusting device and spring on the auxiliary brake shoe.

(2) Remove the shoe return spring.

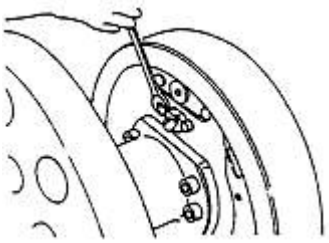
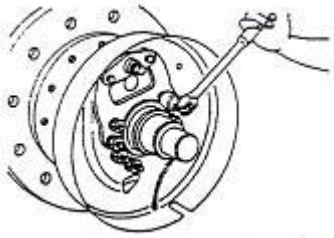
(3) Remove the fixed spring from the main brake shoe.

(4) Remove the main brake shoe and auxiliary brake shoe. Remove the adjuster and adjuster spring at the same time.

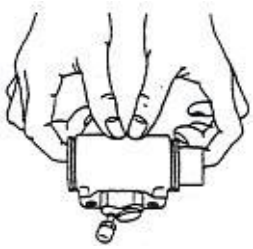



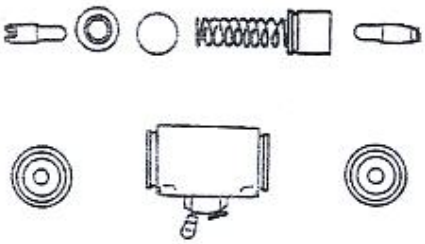
(5) Remove the brake pipe from the brake cylinder.Then remove the mounting bolts of the brake cylinder and remove the brake cylinder from the brake base plate.

(6) Remove the E-ring used to fix the brake cable on the brake base plate.Then:, remove the bolts that install the brake base plate, and remove the brake base plate from the drive axle.

(7) Disassemble the brake cylinder: remove the dust ring.Press one side of the piston to push out the other side of the piston, and then press this side of the piston with your fingers.





2.Brake inspection

Inspection of all parts, repair or replacement of damaged parts.

(1) Check whether there is rust on the inner surface of the cylinder and the outer circumference of the piston; then measure the clearance between the piston and the pump body.

Standard size: 0.03mm-0.10mm; limit size: 0.15mm

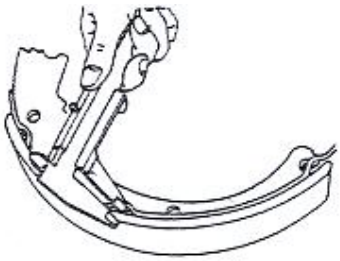
(2) Visually check whether the piston cup is damaged and deformed, and replace it if there is any abnormality.

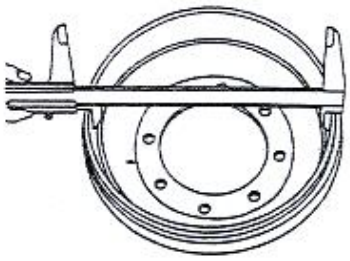
(3) Measure the free length of the brake cylinder spring, and replace it when it exceeds the reference.

(4) Measure the thickness of the friction plate and replace it when it exceeds the wear limit.Standard value: 8.0mm; limit value: 2.0mm

(5) Visually inspect the inner surface of the brake drum. If there is damage or partial wear, grind it for correction. If it exceeds the correction limit, replace it.

Standard value: 314mm; limit value: 316mm.



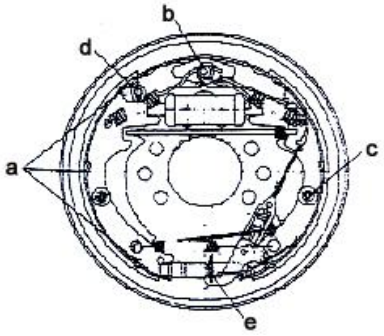


Brake assembly

(1) Apply brake fluid on the cup and piston of the brake cylinder, and assemble the spring, piston cup, piston and anti ring in sequence.

(2) Install the brake cylinder on the brake base plate.

(3) Install the brake base plate on the drive axle.



(4) Apply heat-resistant grease all over as shown in the figure.

Be careful not to apply it to the friction plate.

(a) the contact surface between the base plate and the brake shoe;
(b) fixing pins;
(c) the contact surface between the shoe and the spring seat;
(d) hand brake pull rod support pin;
(e) adjusting mechanism threads and other rotating parts.
(5) The parking brake cable is clamped with E-shaped retaining ring.
(6) Install the brake shoe with the fixed spring.
(7) Install the compression spring onto the hand brake push rod, and then install the push rod onto the brake shoe

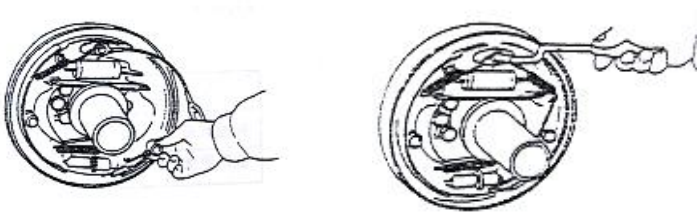


Fig 2-28

(8) Install the brake shoe guide plate onto the support pin, and then install the brake shoe return spring.Install the main shoe first, then the auxiliary shoe.As shown in Figure 2-28

(9) Install the adjuster, adjuster spring, ejector rod and ejector rod return spring. Note the following:

(a) The thread direction of the adjuster and its installation direction;

(b) Adjuster spring direction (the adjuster teeth are not allowed to contact with the spring);

(c) The direction of the return spring of the ejector pin (the spring hook at the end of the support pin shall be fixed on the opposite side of the ejector pin);

(d) The lower end of the adjusting lever must be in contact with the tooth part of the adjuster.

(10) Connect the brake oil pipe to the slave cylinder.

(11) Measure the inner diameter of the brake drum, the outer diameter of the brake shoe and adjust the regulator so that the difference between the inner diameter of the brake drum and the outer diameter of the brake shoe friction plate is 0.3mm-0.5mm

4. Operation test of automatic gap adjuster

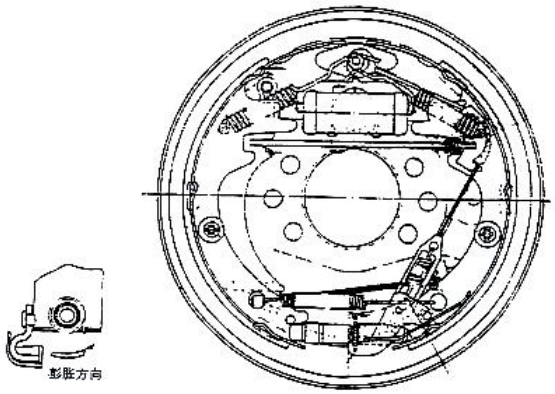
(1) First, make the diameter of the brake shoe close to the specified installation size, and pull the adjusting lever by hand to make the adjuster rotate. When the hand is released, the adjusting lever returns to its original position, while the adjuster gear does not rotate.

Note: the adjuster can work normally even when the hand is released and the adjuster gear returns together with the adjusting lever.

(2) If the adjuster fails to do the above actions when pulling the adjusting lever, the following inspection shall be carried out:

(a) Install the adjustment lever, top bar, top bar spring and compression spring seat firmly;

(b) Check whether the ejector return spring and adjuster spring are damaged, and then check whether the rotation of adjuster gear and its engagement part are excessively worn or damaged.Check whether the lever is in contact with the gear.



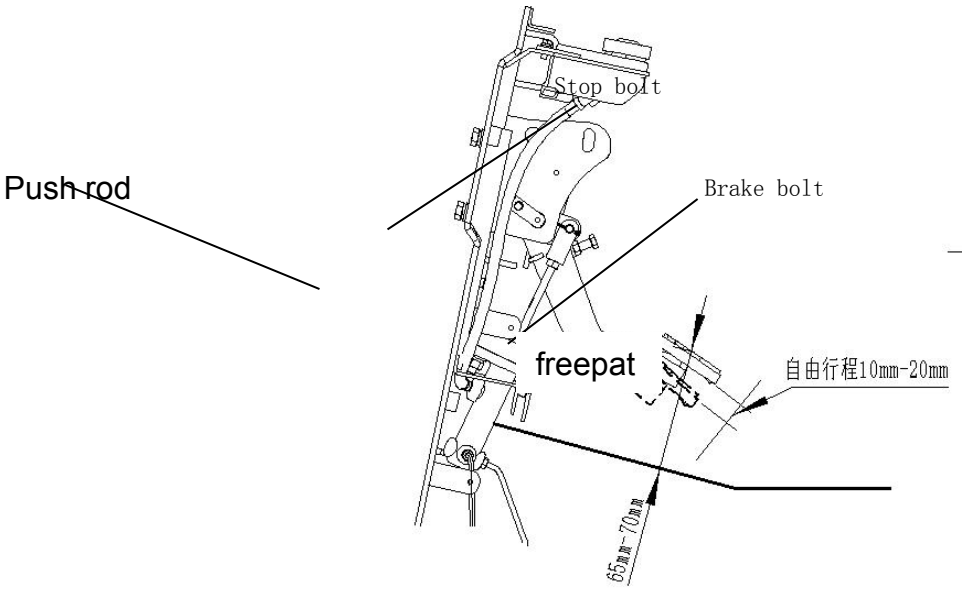
3-6-7 Brake pedal adjustment

(1) Shorten the push rod;

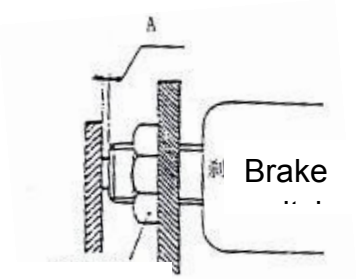
(2) Adjust the pedal stop bolt and the pedal height;

(3) Lengthen the push rod until the front end of the push rod contacts with the piston of the master cylinder, and then return 1-2 turns to ensure the free stroke of the pedal is between 10 mm and 20 mm;

(4) Lock the push rod nut and pedal stop bolt nut.



free stroke



(5) Adjustment of brake switch

(a) After the height of the brake pedal is adjusted, loosen the lock nut of the brake switch;

(b) Pull off the plug to separate the wire;

(c) Turn the switch so that the clearance A = 1mm;

(d) Make sure that the brake light is on when the brake pedal is depressed;

(e) Finally lock the nut.

3-6-8 Fault analysis and troubleshooting

Problem	Cause analysis	Exclusion method
Poor braking	1 Brake system oil leakage	Repair
	2 Brake shoe clearance not adjusted	Regulator
	3 Brake overheating	Check for slipping
	4 Poor contact between brake drum and friction plate	Resetting
	5 Impurities attached to friction plate	Repair or replace
	6 Impurities mixed into brake fluid	Check brake fluid
	7 Improper adjustment of brake pedal (micro valve)	Adjustment
Brake noise	1 The surface of friction plate is hardened or foreign matters adhere to it	Repair or replace
	2 The base plate is deformed or the bolt is loose	Repair or replace
	3 Brake shoe is deformed or installed incorrectly	Repair or replace
	4 Friction plate wear	replace
	5 Loose wheel bearing	Repair or replace
Uneven braking	1 Oil stain on the friction plate surface	Repair or replace
	2 Brake shoe clearance not adjusted	Regulator
	3 Sub pump failure	Repair or replace
	4 Brake shoe return spring damaged	Replace
	5 Brake drum deflection	Repair or replace
Poor braking power	1 Brake system oil leakage	Repair or replace
	2 Brake shoe clearance not adjusted	Regulator
	3 Air in the brake system	Deflation
	4 Brake pedal is not adjusted correctly	Resetting

3-6-9 Maintenance and service

① Before running in test, the new drive axle shall be filled with gear oil (the selection of gear oil shall be strictly in accordance with the specification, and the specific model shall refer to table 2-1).Oil shall be injected from the oil filling hole on the upper part of the axle housing until oil overflows from the oil level hole in the middle of the axle housing.

② The thickness of the friction plate on the brake shoe is 8mm.The minimum thickness allowed is 2mm.These two parts are key parts of the brake system, which shall be checked once a month. If excessive wear is found, it shall be replaced in time to avoid accidents.

③ Technical maintenance every 50h:

I. After the new bridge works with the main engine for 50h, the gear oil shall be replaced.When changing oil, clean the bridge and add new oil.

II. Check the fastening of each fastener. If it is loose, fasten it immediately.

III. Check whether there is oil leakage at the connection between the wheel half shaft and the hub. If there is any leakage, reapply the sealant.

④ Monthly technical maintenance:

I. Check the wear condition of brake drum to see if there is destructive wear.

II. Check the wear condition of the brake shoe. When the wear has not met the use requirements, replace it immediately.

III. Check whether the oil level of the axle housing meets the requirements. If the oil level drops, make up in time.

⑤ Technical maintenance every half a year: replace the gear oil in the bridge every half a year.

⑥ Annual technical maintenance: the work shall be disassembled and inspected for one year.

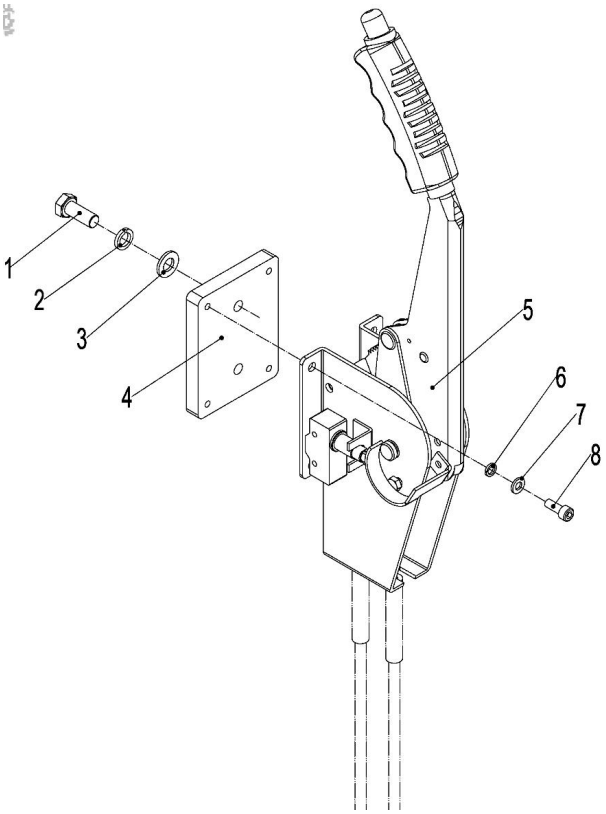
⑦ Requirements for inspection and commissioning items during installation:

When reinstalling the drive axle hub, pay attention to adjusting the brake clearance adjuster so that the clearance between the brake drum and the friction plate is between 0.3mm and 0.5mm.The tapered roller bearing on the hub shall be filled with about 100ml of 3 × lithium grease.

Adjustment of wheel hub bearing clearance: tighten the lock inner nut until the wheel hub brake drum can only barely rotate.Then turn the lock inner nut backward by 1 / 8 turn. At this time, the hub brake drum shall be able to rotate freely without jamming, obvious axial clearance and yaw. Then assemble the lock washer, and finally lock it with the lock outer nut.

3-7 Parking Brake

3-7-1 Appearance and specifications



NO	SN	Description
1	910100300035	Bolt GB5783-M10x20-8.8
2	910400500007	Spring washer GB93-10
3	910400100007	Flat washer GB97.1-10-200HV
4	256812020005	Backing plate (hand brake)
5	XG1801542747	Hand brake assembly
6	910400100005	Flat washer GB97.1-6-200HV
7	910400500005	Spring washer GB93-6
8	910100300010	Bolt GB5783-M6x16-8.8

3-7-2 Function

For this model, the parking brake is built into each drive shaft.Once the operator pulls the lever, the cable assembly pulls the brake lever, which in turn presses the brake piston and the resilient disc.This causes the compression discs to produce friction braking forces in the drive shaft.In this case, all rotating parts in the drive shaft are no longer able to move,

thus keeping the drive wheel stationary.And once the lever is pushed back, the cable no longer pulls the lever, releasing the brake.In addition, the parking brake switch is installed behind the lever.The switch opens when the lever moves to engage the parking brake and closes when the lever moves to release the brake.

3-7-3 Parking brake test

Warning
If the parking brake is not properly adjusted, the vehicle rolls over, resulting in a dangerous situation: If the parking brake fails during this process, be prepared to operate the driving brake.

1. Place rated load capacity on fork

2. Tilt the vehicle up 15%.

3. Stop the forklift with the service brake at the half of the tilt, and the brake will automatically engage as the parking brake.

4. If the parking brake has been adjusted correctly, the vehicle shall remain stationary If the vehicle descends, refer to Section 3-8-3 parking brake failure exclusion.

图 3-64

3-8 Troubleshooting

3-8-1 Drive motor

problem	Probable cause
Drive motor not working	Switch not closed (battery connector, key switch, seat switch, F/R switch or parking brake switch) : Turn off the switch. If it still does not work, use a voltmeter to test the power supply on the control panel and the current on each switch. However, the service brake switch should be turned on.
	Bad reception. Fuse blown: Check the battery connection. Check the connection of the battery connector. Check fuses, drives and logic. Replace the fuse wire if the fuse is broken. Check the drive motor and control panel for possible fuse failure. Some of the reasons are: Operating under excessive load, current limit is too high
	Low battery power: Check the battery terminal voltage. If it's too low, charge the battery. Check if there is one or more defective cells in all cells. Check the specific gravity of each monomer. The maximum density difference from the highest cell to the lowest cell shall not exceed.020 Sg (specific gravity）
	Incorrect operation of control panel: See "2-3-5 Motor Controller Testing" and "2-7 Diagnosing/Calibration/Handling Faults.”.
Drive motor not working	Encoder failure
Traction cannot be operated during normal operation, but hydraulic operation is normal	Defective brakes cause too much resistance. Heat increases, causing the motor to stop running. Check the brake adjustment.
	There is too much heat in the control panel for the following reasons: Overweight traction load: reduces duty cycle load. Temperature Sensor Failure: Refer to "Section 2-7 on Dashboard. Handle the failure on ". These can cause the drive motor to be obstructed, Control panel malfunction or open drive fuse
Neither traction nor hydraulics will last the entire normal operation period	Vehicles are equipped with batteries that are too small:
	The battery is not fully charged during battery charging: Check if the battery is charged Check if the battery charger is faulty
	The battery replacement interval is too long or the replacement battery cooling time is too short
	The battery has one or more defective individual batteries, resulting in the rated capacity and capacity of the battery below

	the normal value:
	The drive system is consuming too much battery power due to a drive system failure. Check the brake adjustment. Inspect wheel bearings, axles and other mechanical parts for correction to eliminate faults. Switch to tires with less friction
	The hydraulic system consumes too much battery power due to lifting and tilting faults, or the hydraulic conditions of the working cycle are incorrect: Reduce the hydraulic relief valve setting to only used capacity. Replace with a smaller hydraulic pump. Check the mast for restrictions during operation.
	After one shift, the forklift is operating beyond its designed capacity without available power:
The positive electrode (+) or negative electrode (-) of the battery is in direct contact with the forklift frame (body) or the drive motor	The battery is dirty and the electrolyte is on top of the battery and in contact with the frame. Current flows through the battery box, which imposes a voltage on the forklift frame: Clean the battery with baking soda and an aqueous solution.
	Cable connection of battery or control panel in contact with forklift frame: Perform continuity tests and move wire contacts. Remove the wires in sequence until the fault is cleared. The fault will break at the end of the wire
	Dirty motor:
	Wet motor:
The vehicle did not reach its maximum speed	The battery is not fully charged or the battery is poor: Charge the battery. Check the single battery. Replace the single battery if necessary.
	Failure in drive motor, control panel or driveline: Check forklift speed in both directions. If you need to adjust the control panel, do so in accordance with the appropriate section of "Section 2 Electrical Systems". If the drive motor fails, test the motor assembly
Vehicle accelerates slowly	Drive control overheating, temperature sensing switch on. Note: If the temperature is 145°C (293°F), the thermal switch will emit a warning.

3-8-2 Drive axle

Problem	Possible causes
Noise or vibration in the transmission	Incorrect oil level: Meet the correct oil level
	Use non-standard oil: Replace the oil with standard oil.
	Gear damaged or dented: Replace the gear.
	Bearing damage: Replace the bearing.
	Loose mounting bolts: Apply thread compound to the threads of the bolts and retighten to the specified torque.
Noise or vibration in the brake disc pack	Use non-standard oil or friction materials: Replace oil or friction materials with standard materials.
	Incorrect oil level: Meet the correct oil level
	Foreign matter (water) introduced into oil: Replace the oil.
	Friction plate wear: Replace the friction plate.
Leakage of installation part	Loose mounting bolts: Apply thread compound to the threads of the bolts and retighten to the specified torque.
	Damaged mounting surface: After removal, readjust or replace the components.
	O-ring damage: Replace the O-ring.
Hub leakage	Damaged oil seal: Oil seal replacement
	O-ring damage: Replace the O-ring.
Input shaft leakage	Damaged oil seal: Replace the oil seal.
	Motor O-ring damaged: Replace the motor O-ring.
	Damaged motor mounting part or housing: Replace the components.
Air respirator leakage	Too much oil: Meet the correct oil level
	Air respirator damaged: Clean or replace vent
	Use non-standard oil: Replace the oil with standard oil.
Brake disc pack leakage	Brake seal damaged:

	Replace sealing ring
	Brake seal not installed correctly: Reinstall or replace the seal.
	The sliding parts of the brake seal (damaged shaft, bearing seat or piston: Replace damaged components.
	The outer particles are placed on the sliding parts of the seal: Clean sliding parts and master cylinder and replace them if damaged parts are found
	Material or oil passage damage: Replace damaged parts
	Gear damaged or dented: Replace the gear.
	Bearing damage: Replace the bearing.
	Loose mounting bolts: Apply thread compound to the threads of the bolts and retighten to the specified torque.

3-8-3 Service brake

Problem	Possible causes
Pedal resistance is not firm (spongy)	Leakage or low level
	Air in the brake hydraulic system.
	Master cylinder loosening
Too much pressure of pedal when braking	Mechanical resistance on the brake pedal.
	Limit the brake lines.
	Bad master cylinder
Pedal towards the floor	Leakage or low level.
	Bad master cylinder.
Excessive pedal travel	Incorrect pedal adjustment.
	Leakage or low level
	Air in the brake hydraulic system.
	Bad master cylinder.
Brake not applicable	Leakage or low level.
	Air in the brake hydraulic system.
	The linkage is not adjusted correctly or bent.
	There is oil or brake fluid on the brake disc.
	Bad master cylinder.
Uneven braking or roughness (flutter) during braking	There is oil or brake fluid on the brake disc.
	There is poor contact between the steel plate and the friction plate.
	Uneven (uneven) brake discs
	Pressure plate bearing loose
	Bad disk and friction disk assembly

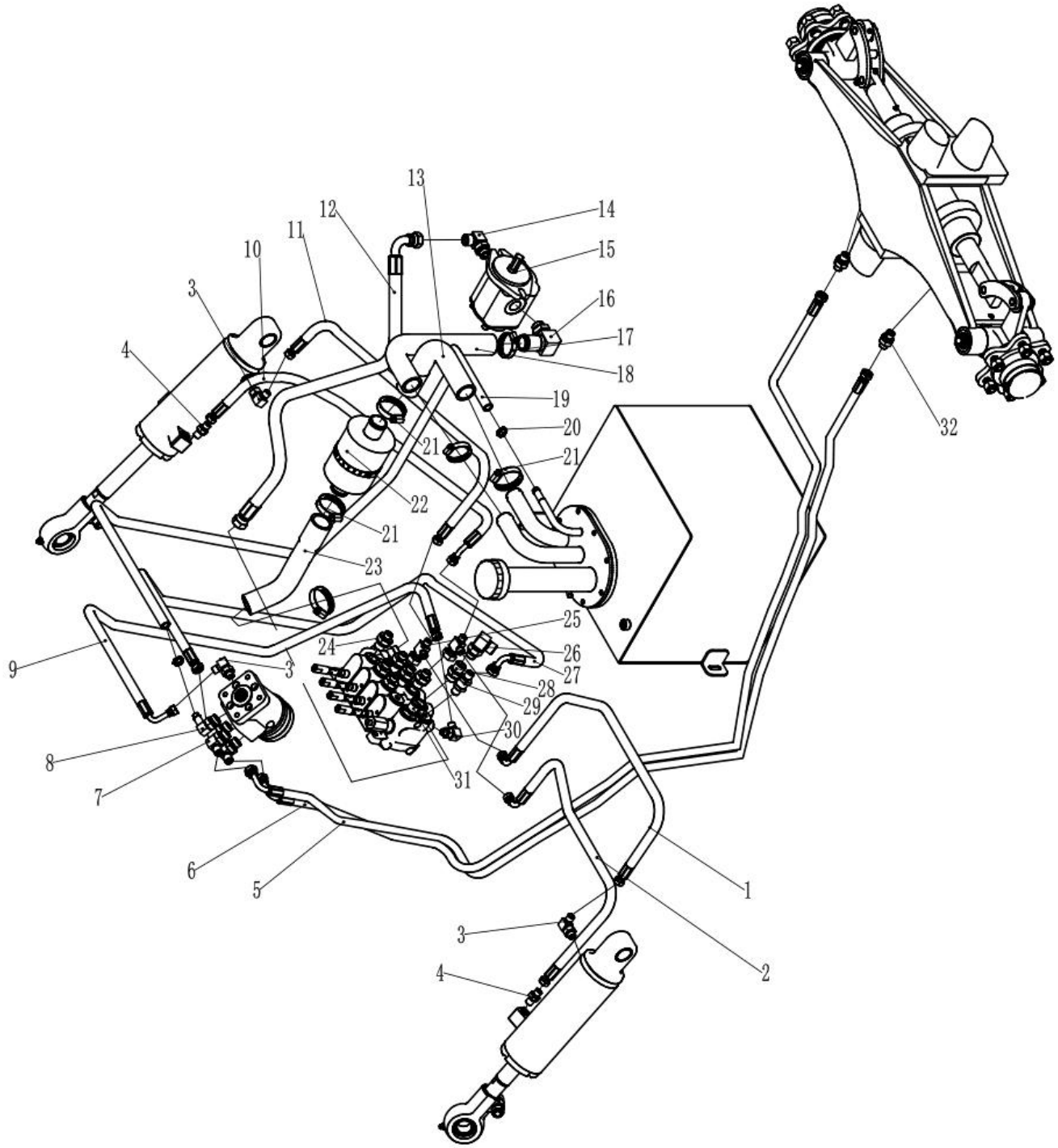
3-8-4 Parking brake

Problem	Possible causes
Brake not engaged	The parking brake is not adjusted correctly.
	The parking brake cable is not adjusted correctly.
	The brake disc is too worn

4 Hydraulic system

4-1 overview

4-1-1 component



NO	SN	Item
1	253623521008	Hydraulic tube assembly(90°)8-L800-1SC-24°
2	253623521007	Hydraulic tube assembly (straight) 8-L650-1SC-24°
3	251223510003	Fitting(locking bend)6-G1/4-M14x1.5-24°
4	251223520007	Fitting (straight) 6-G1/4-M14x1.5-24°
5	253623521005	Hydraulic tube assembly (90°) 10-L2300-1SC-24°
6	253623521006	Hydraulic tube assembly(90°)10-L2050-1SC-24°
7	282323520008	Fitting (locking bend) 10-M20x1.5-M16x1.5-24°
8	255023510008	Fitting (locking bend)11-M20x1.5-0
9	253623521011	Hydraulic tube assembly (90°) 8-L1250-1SC-24°
10	253623521010	Hydraulic tube assembly(90°)8-L700-1SC-24°
11	253623521009	Hydraulic tube assembly (straight) 8-L500-1SC-24°
12	253623521010	Hydraulic hose assembly(90°)15-L950-2SC-24°
13	253623521001	Oil return hose (rear)
14	251223520035	Fitting(locking bend)12-G1/2-M22x1.5-24°
15	256523512006	Gear pump (Pomke 20cc)
16	255023510005	Fitting(steering bend)25-G1-Φ32
17	911000600006	Hose QC/T390-(40-45)
18	256523520013	Hose 2(oil suction)
19	900200401001	Oil return hose 23x5
20	911000600003	Hose QC/T390-(22-26)
21	911000600004	Hose QC/T390-(34-38)
22	253623511020	External oil return filter
23	253623521002	Oil return hose (front)
24	255023520033	Fitting(straight)8-M20x1.5-M16x1.5-24°
25	251223510012	Fitting (Tee) 7-2xM14x1.5-M16x1.5-24°
26	282323520007	Fitting (locking bend) 12-M20x1.5-M22x1.5-24°
27	253623521012	Hydraulic tube assembly (90°) 10-L1320-1SC-24°
28	282323520007	Fitting (locking bend) 12-M20x1.5-M22x1.5-24°
29	251223520034	Fitting (straight) 8-2xM16x1.5-24°
30	253623521013	Fitting (locking bend) 6-M12x1.5-M14x1.5-60°
31	251223520030	Fitting (straight) 15-M22x1.5-M22x1.5-24°
32	251223520034	Fitting (straight) 8-2xM16x1.5-24°

The hydraulic system operates multiple brakes with pressurized oil from the main hydraulic pump and draws oil from these actuators.

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

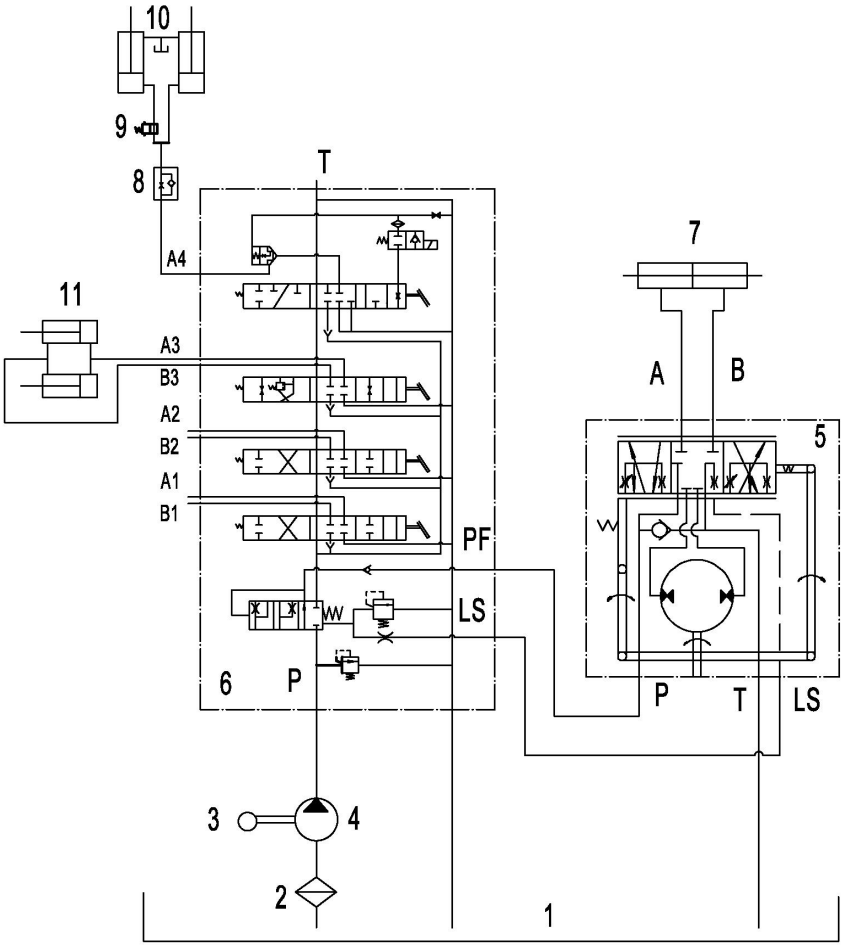
2.The main hydraulic pump uses the rotating force output from the motor to pressurize the oil in the hydraulic tank and send the oil to the priority valve.

3.The priority valve determines which device is preferred between the steering and the control valve, and then supplies most of the pump oil to the priority valve.

4.The hydraulic tank stores the hydraulic oil that is returned from the actuator.The stored oil is drawn in by the main hydraulic pump for reuse.

4-1-2 hydraulic schematic diagram

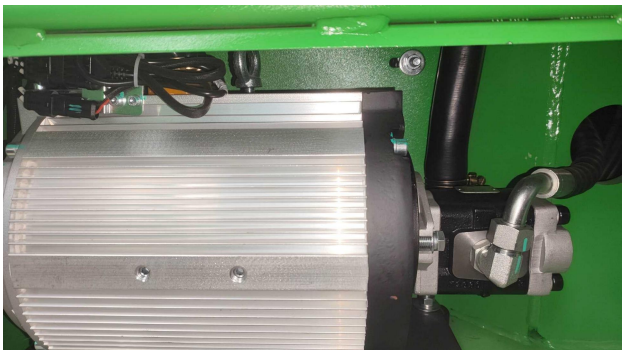
The hydraulic system consists of working oil pump, multi-way valve, lifting oil cylinder, tilting oil cylinder and pipeline and other components. The hydraulic oil is supplied by the hydraulic oil pump connected with the motor, and then the multi-way valve distributes the oil to each cylinder.



hydraulic schematic diagram

1. Hydraulic oil tank	2. Oil suction filter	3. Pump motor	4. Gear pump
5. Steering gear	6. Multi way valve	7. Steering cylinder	8. Speed limiting valve
9. Shut off valve	10. Lifting cylinder	11. Tilt cylinder	

4-2 Pump motor



4-2-1 How does it work

The pump motor electrically transfers power to the main hydraulic pump for pumping hydraulic oil to operate the hydraulic system.

The pump motor is connected to the pump motor controller through U, V and W lines.The controller operates the pump motor based on inputs from multiple switches and sensors and internal parameter settings.

The pump motor operates when the following conditions are met:

The key switch is off.

With the operator seated, turn off the seat switch.

One of the hydraulic control switches, the F / R switch or the accelerator switch signals the controller.Turning the F / R switch to forward or reverse will trigger the pump motor to run at idle for 6 seconds.It then goes into PP mode to stop unless it's in six seconds

The clock signals from the accelerator.To restart the pump motor, the operator shall return the F / R switch to neutral before switching it forward or backward, or move one of the hydraulic levers to turn on the corresponding switch.

Motor speed detection (encoder operation)

The pump motor is equipped with an encoder, which is used as the speed sensor of the motor.The controller analyzes the amplitude of the pulse to calculate the speed of the motor.The smaller the amplitude, the higher the speed of the motor.

Like other sensors, the encoder generates the main signal (signal a) and the reference signal (signal B) through two hole sensors.As shown in Figure 4-6, the sequence of the generated signals varies according to the direction of rotation.

Overheat protection (thermal sensor operation)

The pump motor is equipped with a thermal sensor to prevent overheating.Once the motor is heated to 145 ° C (293 ° f), an overheat alarm is activated and the motor's performance is limited.

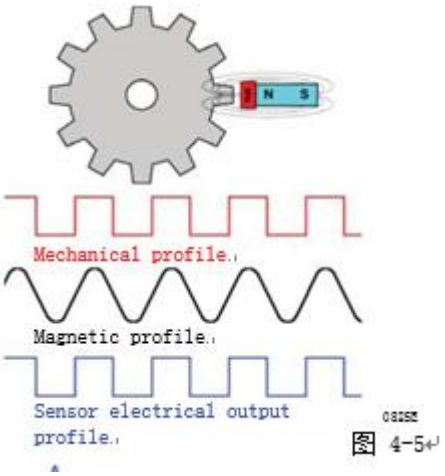


图 4-5

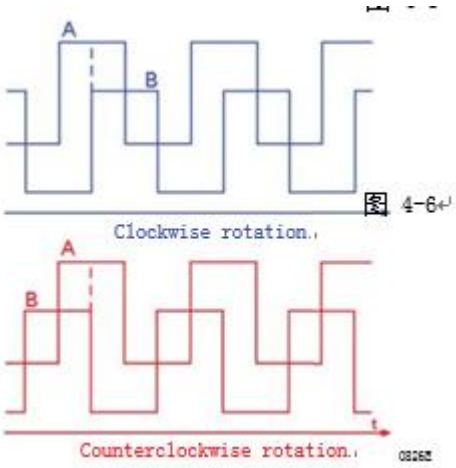
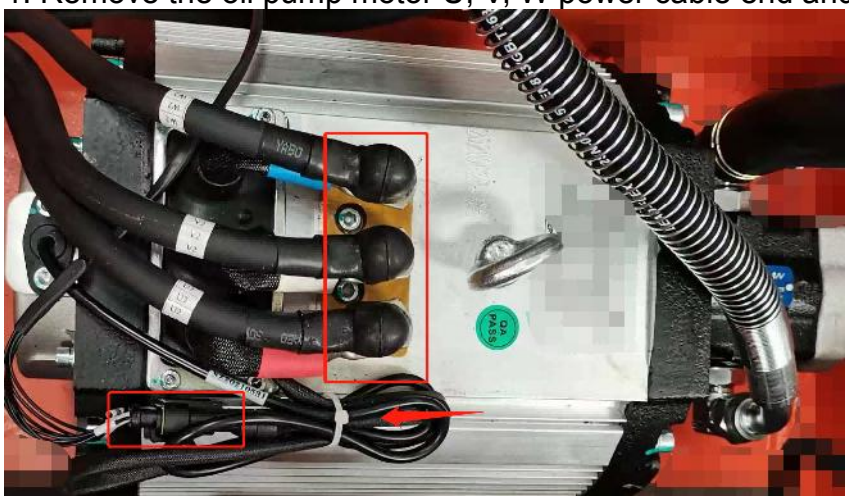


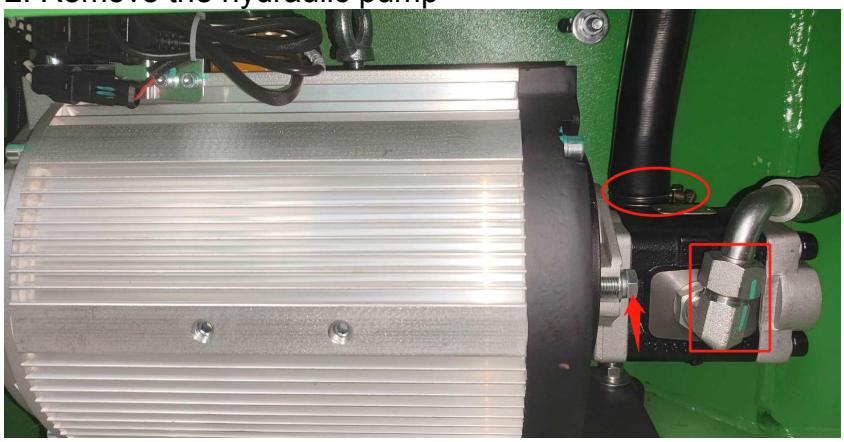
图 4-6

4-2-2 Pump motor and master hydraulic pump removal / installation

1. Remove the oil pump motor U, V, W power cable end and encoder heat sensing harness



2. Remove the hydraulic pump



3. Remove the fixing screws to remove the motor

4-3 Main hydraulic pump

4-3-1 Function

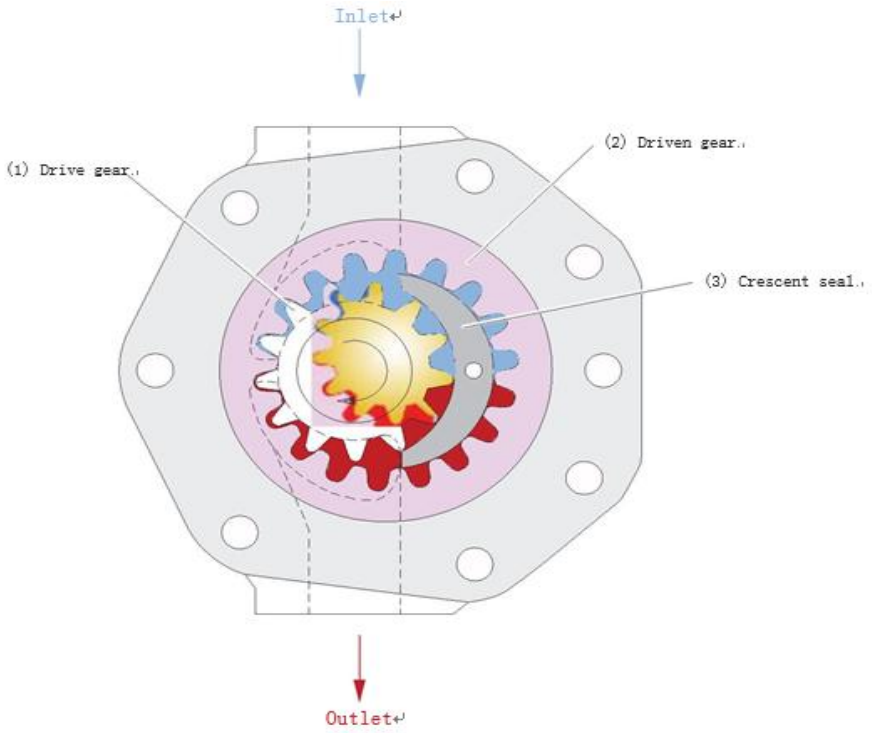
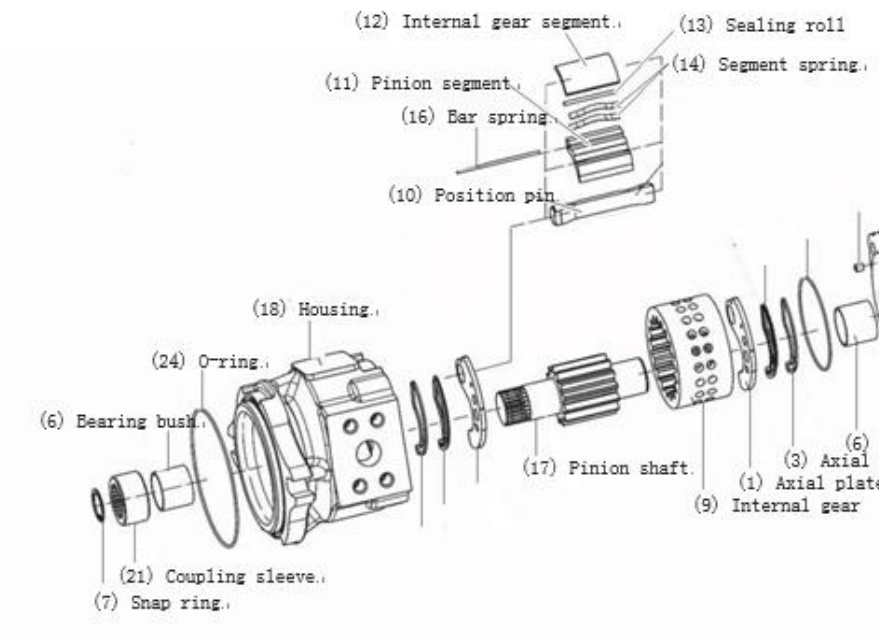


图 4-13

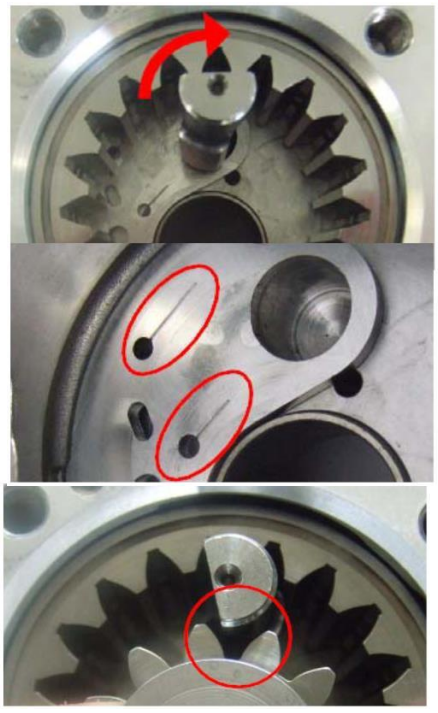
This model uses an internal gear pump as its main hydraulic pump.
Internal gear pump includes driven gear (2) [outer gear] and drive gear (1)
[Inner Gear], as shown in the figure. Of or relating to the area where the drive and driven gears engage
The volume increases as they rotate and absorb oil.
Then place the suction oil cage in both gear grooves and crescent seals (3)
(the bright area in the figure) and decreases with the volume of the gear meshing area
And taken to the exit.
The high pressure chamber (discharge) and low pressure chamber (suction) are composed of crescent seals (3)
Seal. In theory, the internal gear pump than the external gear pump has a smaller pulsation.

4-3-2 Disassembly and assembly



Disassembly

1. Loosen and remove the 4 screws (position 22)
2. Carefully remove cover plate (position 9)
3. Remove shaft plate II (2), pinion shaft (17), rod spring (16),Section (11,12),sectional springs(14,15) and sealing rolls (13).Note the position of the pinion shaft (17), which may be positioned through
Pin (10) locked, as shown.
4. Remove the inner gear (9) and rotate the locating pin (10) approximately 90°.After this, pull out the locating pin（10）
5. Remove shaft plate I（1）Below are the spare ring (4) and the axial seal (3).



Parts

1. Make sure that the axial seal (3) and the left support ring (4) are intact in the machined recess. The groove of the shaft plate I (1) must look upwards as shown in the figure.
2. First install the locating pin (10) as shown in the figure. Then place the inner gear (9) and turn the locating pin (10) about 90°

3. Install the pinion shaft (17) and make sure it is not blocked by the locating pin (10), as shown in the figure.

4. Install the pinion segment (11) and the internal gear segment (12). Make sure that the side of the inner gear segment (12) with two bevels is shown on top of the pinion segment (11) (marked in green).

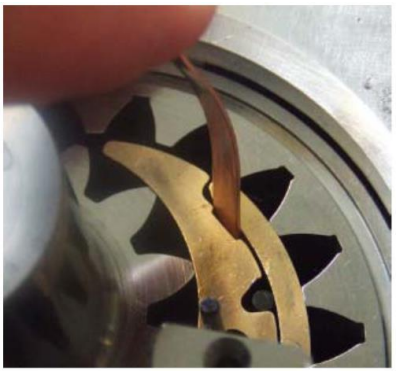
5. Place the seal roller (13) and the rod spring (16). The rod spring (16) is fixed in the housing (18) by the shaft plate I (1).

6. Place segment spring II (15) so that 2 bows are pressed against the seal roller as shown in the figure.

7. Install in the same manner as the bowed member pressed against the inner gear section (12)

8. Install the shaft plate II (2) close to the housing, otherwise the bearing bushings (6) in the cover plate (19) may be damaged.

9. Check the green O-ring (20) and check the position on the cover plate (19). First install
flexible axial seal (3), then install the right side ring (5). Cover with grease the axial
seal (3) and the right side backup ring (5) with grease is helpful, which makes assembly easier.
The straight pin must be located in the cover (19) or housing (18).



10. Measure the clearance between the cover plate (19) and the housing (18).
If the clearance is greater than 0.6 mm (0.024 in.), the axial plate or seal may
will slide, thus disassembling the pump again!

11. Tighten the four screws with 50 N-m (37 lb-ft).

NOTE: If the pump is assembled correctly, the pinion shaft should be able to be turned by hand.

4-4 Multi-way valve

4-4-1 Appearance and specifications

The multiway valve adopts two-piece four-body type, the hydraulic oil from the working oil pump is controlled by the multiway valve stem, and the high pressure oil is distributed to the lifting cylinder or tilting cylinder. There are safety valve and self-locking valve inside the multiway valve. The safety valve is located on the upper side of the inlet of the multiway valve to control the system pressure; the self-locking valve is located on the tilting valve piece, mainly used to prevent the tilting cylinder in the case of no pressure source, due to misoperation of the lever and cause serious consequences. There is a check valve between the oil inlet and the suction port of the lifting valve and between the oil inlet of the lifting valve and the oil inlet of the tilting valve.

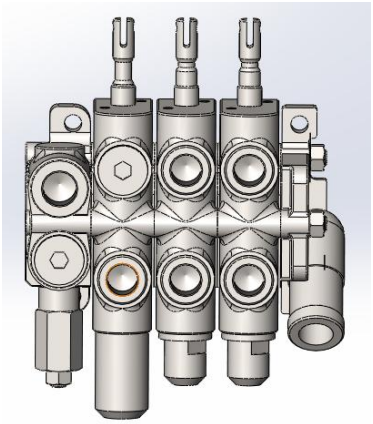


Figure 2-15 Multi-way valve contour drawing

1. The relief valve
2. The lifting
3. The tilt
4. The fittings
5. Return oil mouth

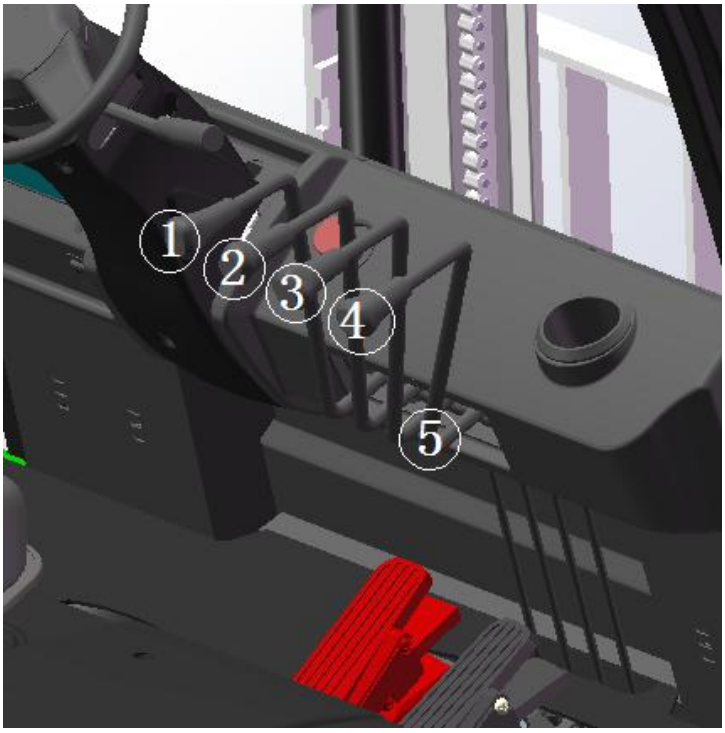
4-4-2 Function

The multiway valve adopts two-piece four-body type, the hydraulic oil from the working oil pump is controlled by the multiway valve stem, and the high pressure oil is distributed to the lifting cylinder or tilting cylinder. There are safety valve and self-locking valve inside the multiway valve. The safety valve is located on the upper side of the inlet of the multiway valve to control the system pressure; the self-locking valve is located on the tilting valve piece, mainly used to prevent the tilting cylinder in the case of no pressure source, due to misoperation of the lever and cause serious consequences. There is a check valve between the oil inlet and the suction port of the lifting valve and between the oil inlet of the lifting valve and the oil inlet of the tilting valve. The main safety valve pressure has been adjusted before the factory, do not allow the user to adjust and disassemble at will.

The priority valve meters the hydraulic fluid to the control valve and steering unit after receiving oil from the main hydraulic pump so that priority is always given to the steering system when steering is required.
The priority valve as shown in the figure is mainly composed of steering safety valve, spring, spool and valve body. Its working principle P port is the steering pump inlet port, CF port is connected to the steering unit inlet port, EF port is connected to the multiway valve inlet port of the working system, LS port is connected to the control port of the steering unit, and T port is the safety valve return port.
When the P port is fed, the hydraulic oil is supplied to the CF port via spool 3 in priority. When the steering gear is not working, the CF port is closed, the pressure of LS port is zero, the right end of the spool is fed, the hydraulic pressure acts on the right end of the spool, overcoming the pre-pressure of the spring 2, so that the spool moves to the left, at this time, the P port is connected with the EF port to realize the functions of lifting, tilting and side shifting.
When the steering works, the CF port is connected with the steering cylinder through the steering, and the gear pump oil enters the steering cylinder first to realize steering.

Multi-way valve operation

The multi-way valves are operated by levers, all mounted on a connecting shaft, which is fixed to the car body by means of a bracket, and the levers operate the slide valves by means of connecting rods.



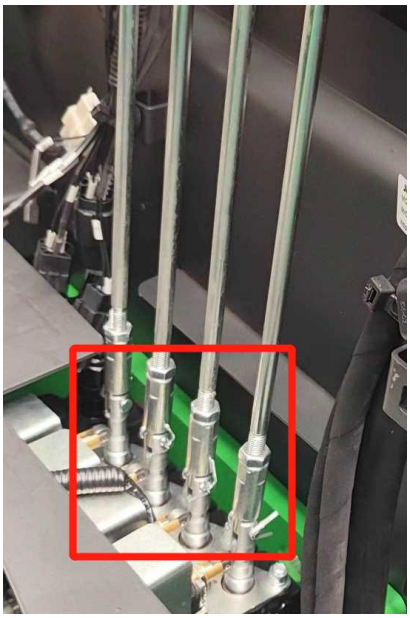
1. Lifting lever
2.Tilt lever
3.Attachment lever ①
4.Attachment lever②
5.Linkage

Safety valve pressure adjustment

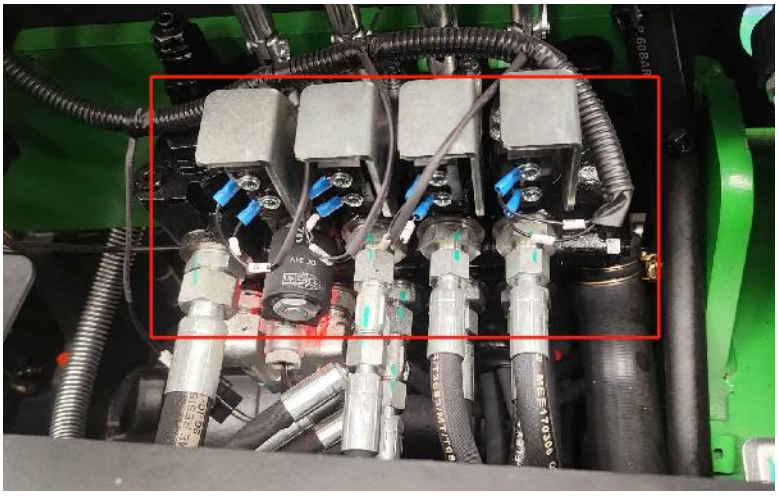
⚠ **Safety valve pressure has been adjusted by the manufacturer, the user may not adjust their own.**

4-4-3 Multi-way valve disassembly and installation

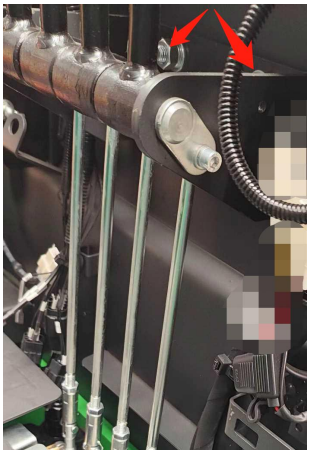
1. Remove the connection between the control lever and the multi way valve



2. Remove the connector and microswitch



3. Remove the fixing bolts and remove them



4-5 Troubleshooting

4-5-1 pump motor

The fault phenomenon	Probable cause
Hydraulic pump motor is not working.	Bad connection or blown fuse. Check the battery connection. Check the key fuse. Check whether the motor of the hydraulic pump may cause the fuse to blow.
	Key switch, seat switch or line contactor is not closed. Close the seat and key switch. Use a multimeter to check the power flow through the seat switch, key switch, line contactor coil and line contactor. The key switch, seat switch and line connector must be turned off for the power steering function to operate.
	Not enough voltage. Recharge or replace batteries. Check if there is one or more defective cell in all cells. Check the specific gravity of each cell. The maximum density difference from the highest cell to the lowest cell shall not exceed 0.020 Sg (specific gravity). Check that the cable terminals fit tightly with the battery terminals and control panel connectors. Check whether the internal wires of the cable are broken.
	Hoisting and drive systems are not operating correctly.
When the battery does not continue to work properly Between.	The batteries mounted on the forklift trucks are too small. Study and question the use of forklifts under their full operating conditions, select and purchase the appropriate battery capacity to know the working hours.
	The battery is not fully charged during battery charging operation. Check that the batteries are evenly charged (charge all the batteries to the same weight). Check the battery charger for defects.
	The battery charge interval is too long or the charging battery cooling time is too short. Reduces battery operation duration. Extend the battery cooling time before charging before putting it into use.
	The battery has one or more defective battery cells, which may result in lower rated capacity and battery capability. Test and find defective cells. Replace defective batteries. The battery units are connected in series. A bad battery results in high power in series with other batteries Resistance. As the battery resistance increases, this reduces the speed of the motor. This can happen when other batteries are almost fully charged.
	Hydraulic systems consume too much battery power because the lifting and tilting devices or hydraulic controls are not correct for the operating cycle. Reduce the hydraulic relief valve setting to the capacity required for the application. Replace with a smaller hydraulic pump (if available). Check for mast restrictions during operation.

	Remove the quick disconnect connection and install the connector with low oil flow resistance. Check defective hydraulic control valves, pilot relief valves. Remove any restrictions in the hydraulic circuit. Check removable hydraulic accessories for limitations. Check sliding parts, bearing wear, hinge bindings, and necessary parts for the correct amount of lubrication.
	Hydraulic pump motor overheating. If the motor temperature reaches 155°C (311°F) Controllers do overheat to warn and reduce performance.
The hydraulic speed of the forklift is very slow	Pump motor control circuit overheating. If the temperature of the power unit reaches 100°C (212°F), the controller will experience overheating warnings and degraded performance.

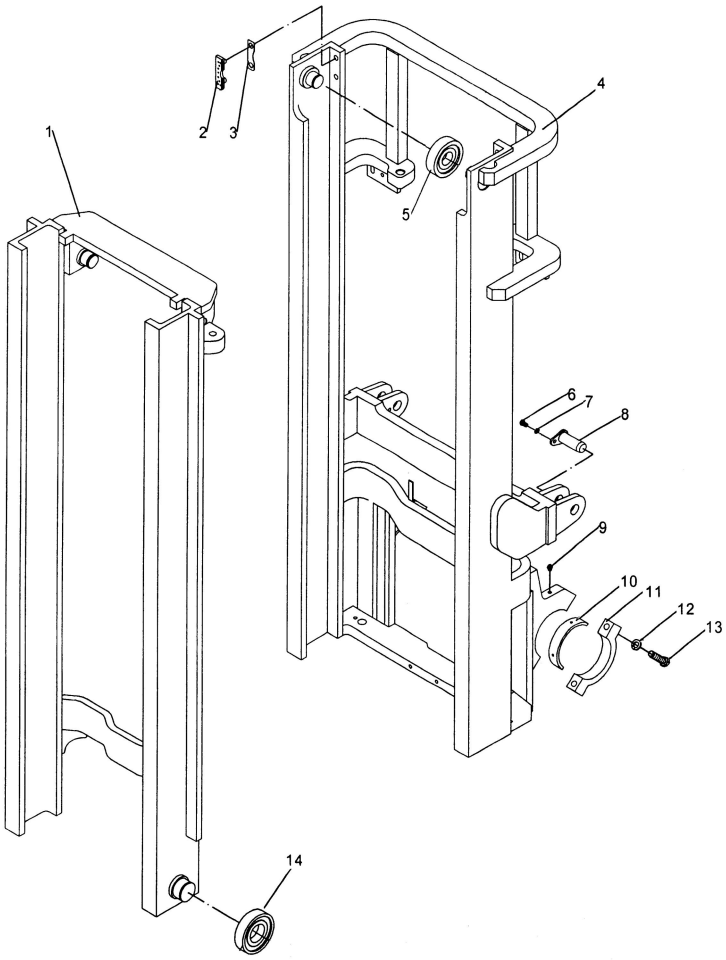
4-5-2 The main hydraulic pump

Fault	Cause	Solution
Less oil discharge	Low oil level in the fuel tank	Refuel to specified level
	Blocked oil pipe or filter	Clean or replace as needed
Low pump pressure	●Damaged liner plate ●Damaged bearing ●Poor sealing ring, bushing seal or retainer ring	Replace
	Overflow valve improperly adjusted	Adjust the relief valve pressure to the specified value with a pressure gauge
	Air in system	●Retighten the suction side oil pipe ●Grease the oil ●Replace oil pump oil seal
Noise during operation	Damaged oil suction pipe or blocked oil filter	Check the tube or repair the oil filter
	Loose air leakage on the oil suction side	Tighten loose places
	Oil viscosity is too high	Change the viscosity oil to match the pump operating temperature
	Air bubbles in the oil	Identify the cause of air bubbles and take action
Oil leakage of pump	Damaged pump oil seal or part seal	Replace
	Damaged pump	Replace

5 .Lifting system

5-1 overview

The middle part of the outer mast is connected with the frame through the tilt cylinder, and can tilt back and forth under the action of the tilt cylinder.



1.Inner mast	2. Guide plate	3. Adjustment pad	4.Outer mast	5. Outer mast flat roller
6.Tilt cylinder pin	7.Spring washer 10	8.Bolt	9.Oil cup	10.Shaft shank
11.Support cover	12.Spring washer 16	13.Bolts	14.Roller	

5-2 Function

A.Mast tilt

Mast tilt operation is performed by two double acting cylinders.In the case of each cylinder, one end is connected to the chassis of the vehicle and the other end to the side of the Mast.

Tilt forward

Push the tilt lever to move the tilt spool of the multi-way valve to send the hydraulic oil to the opposite chamber of each cylinder rod and extract the oil from the rod chamber.This causes the piston to push forward, tilting the front mast mounted on the cylinder rod on the axis connected to the vehicle.

Tilt backward

Pull the tilt lever to move the tilt spool of the multi-way valve to send the hydraulic oil to the chamber of each cylinder rod and extract the oil from the opposite chamber.This causes the piston to be pushed back, tilting the rear mast mounted on the cylinder rod onto the connecting shaft to the vehicle.

B. Standard Mast lifting

The standard (STD) Mast assembly uses two Mast and two single acting cylinder cylinders to lift the load.

Rollers mounted on the inside and outside of the carriage and Mast respectively facilitate these up / down movements.

Cylinder

After receiving the hydraulic oil from the lift part of the multi way valve, the rod of the standard oil cylinder stretches out to push the internal Mast upward. At the same time, the bracket is also pulled by the lifting chain, which is connected to the external Mast to lift together with the chain.

Lower

If the operator controls the lever to open the outlet port in the poppet of the multiway valve, the oil output from the standard cylinder will begin to flow out by gravity.

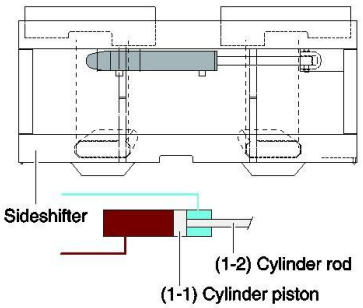
When the oil is drained, the cylinder rod and the attached inner Mast will retract.

When the inner Mast is lowered, the tension of the lifting chain will be relaxed and the bracket will also be lowered.

C.Side shifter

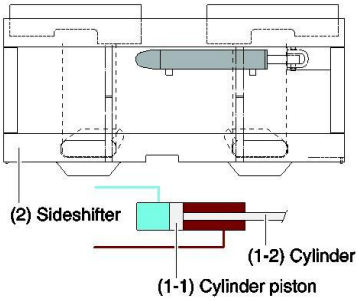
Move to the right

Press down the sideshift rod to move the AUX1 valve element of the multiway valve to send the hydraulic oil to the left chamber of the cylinder piston (1-1) and recover the oil in the right chamber.This causes the piston (1-1) to push forward with the side-shifter (2) mounted on the piston rod (1-2) and also moves the fork attached to it to the right

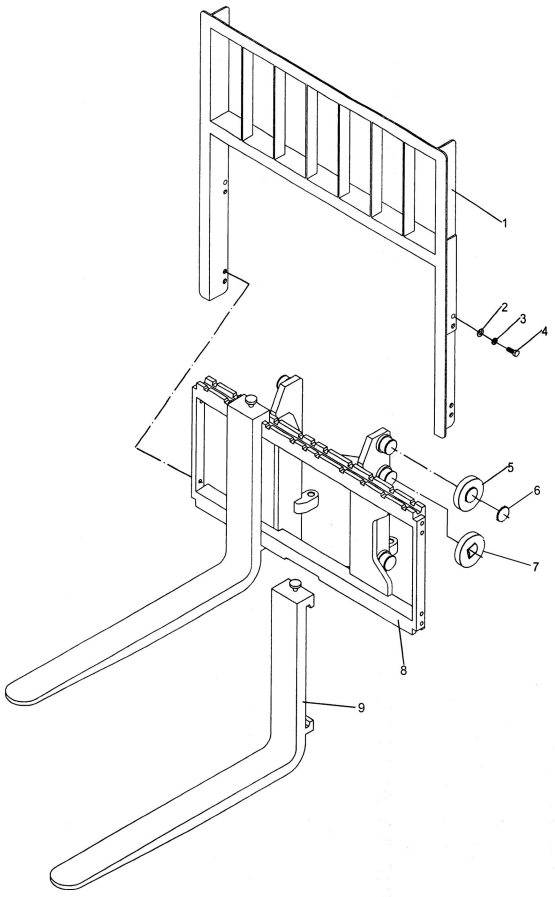


Move to the left

Pull the sideshift lever to move the AUX1 spool of the multi-way valve to send hydraulic oil to the right chamber of the cylinder piston (1-1) and recover the oil in the left chamber.This causes the piston (1-1) to push back together with the Side-shifter (2) mounted on the piston rod (1-2) while moving the fork attached to it to the left.



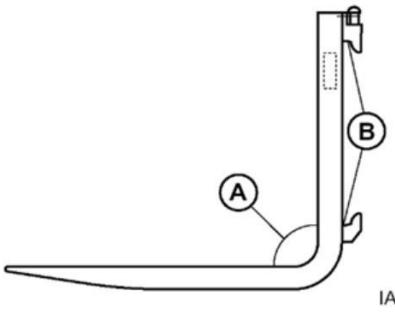
5-3 Fork service



1.Retaining rack	2. Flat washer 14	3.Spring washer 14	4.Bolt	5. Rollers
6.Elastic retaining ring for shaft	7.Composite roller	8.Fork holder	9.Fork assembly	

A. Fork Check

Forks should be inspected at least once every 12 months. If the forklift is made in multiple shifts or heavy duty
For industrial use, it should be checked once every six months.



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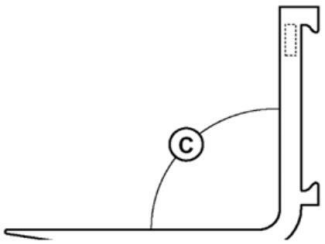
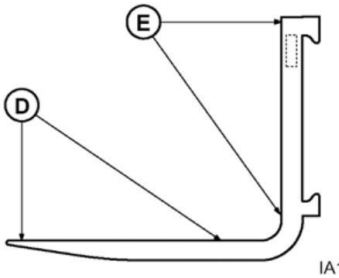
1. Check the forks carefully for cracks. Particular attention should be paid to the heel
(A), all welding areas and mounting brackets (B). Check the hang
The fork on the hook forklift is used on the top and bottom of the fork Hook.
The fork with the crack should be replaced



2. Check the Angle between the upper surface of the fork blade and the front surface of the fork handle.

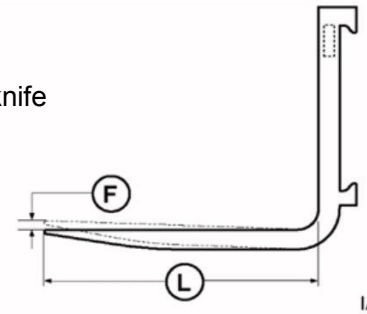
If the Angle (C) exceeds 93 degrees or deviates more than 90 degrees
Forks should be discontinued if the original Angle exceeds 3 degrees, such as some specials
The special application is shown in the fork.



IA1O4094

3. Inspect the upper surface of the blade (D) and the front surface of the shank (E) with a straight edge
The straightness of.

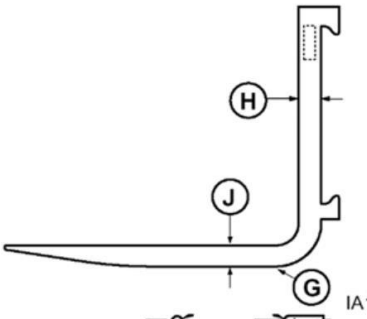
If the deviation in straightness exceeds 0.5% of the blade length and/or the knife
The height of the handle is 5 mm / 1000 mm (0.18 "/ 3"),
The front fork should be discontinued.



IA1O4095

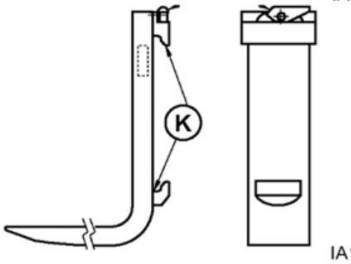
4. When mounting on the fork rack, check the connection
between one fork tip and another height difference.
Differences in the height of the fork tips may result in uneven loads
Support and cause problems entering the load.

The maximum recommended difference in fork tip height (F) is 6.5 mm. for pallet forks
Meter (0.25 in) and fully tapered fork 3 mm (0.125 in)
Inch). The maximum height of the fork tip between two or more forks
Perhaps the difference is 3% of the leaf length (L).



IA1O4096

If the difference in fork tip height exceeds the maximum allowable difference, then
Switch to a fork or two.



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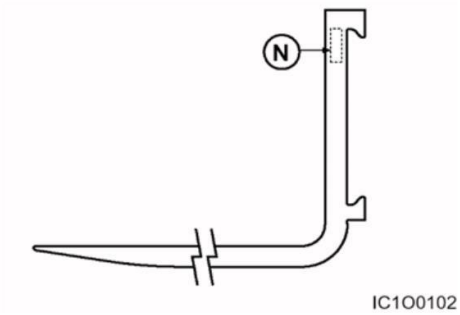
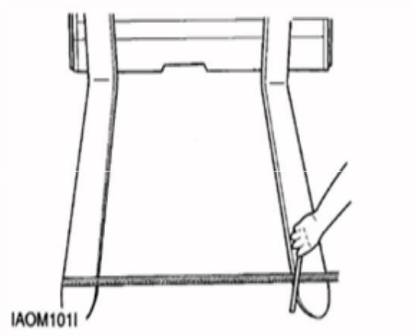


5. Check whether the front fork blade (J) and shank (H) are worn, especially
Notice the following (G). If the thickness is reduced to 90% of the original thickness
Or smaller, the front fork should be replaced.

Fork blade length may also be reduced by wear, especially in
Tapered fork and press plate.
If the blade length no longer fits the expectation
Then the fork will be replaced from the maintenance.



6. Check the fork frame (K) for wear, extrusion and other local deformation.
This can cause excessive lateral swing of the forks. On the hook fork
Large gaps may cause them to fall off the carrier.
Forks showing clear signs of damage should be discontinued.

Check the locator lock and other fork fixtures to make sure they are in place
And it's working.

The hook fork uses the spring pin (M) located in the top hook to engage the notch in the top bracket bar to hold the fork in place.

When adjusting the front fork spacing, prevent the fork from sliding out of the end of the slide frame through the block. These stop blocks are located at both ends of the slide frame and the bottom fork hook
In the path of. In some cases a load backrest extension may be used instead of a stop block.

The shaft mounting fork may be used to either side of the fork using a sleeve or gasket on the shaft. They can also use U-bolts, pins or similar devices,
The fork is engaged through the top structure of the bracket.

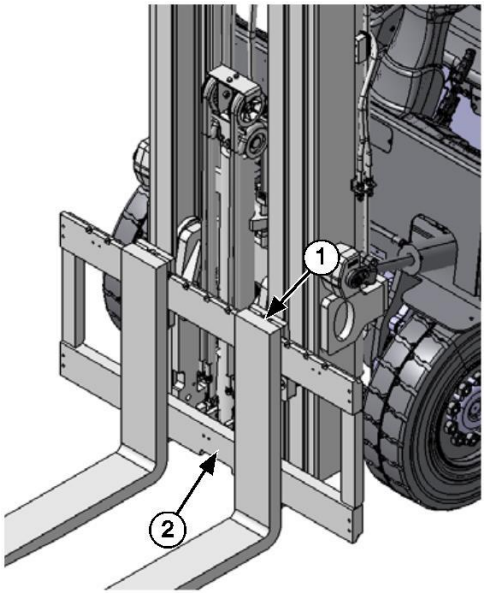
8. Check that the cross (N) is legible. Update the markup as needed to maintain legibility.

9. Lift the mast and operate the tilt control lever until the top surface of the fork is parallel to the floor. Place two straight bars of the same width as the bracket across the fork.

10. Measure the distance from the bottom of each bottom of the two rods to the floor. For fully tapered and polished (FTP) forks, the forks must be parallel to within 3 mm (.12 in.) and the full length of all other forks must be 6.4 mm (.25 in.).

11. Place a fork (tip one-third) under a clamp that does not move. Then carefully operate the tilt controller until the back of the truck is just lifted off the floor. Perform the same procedure with the second fork. Repeat step 9.

B. Fork removal/installation



1. Completely lower forks.
2. Unlock the latch at position (1).
3. Slide fork into the center groove (2) and remove it.
4. Follow these steps in reverse order to install the front fork.

Note: During the disassembly process, check forks and forks and replace them if they may be damaged.

Any part that is broken or excessively rusted.

5-4 Side shifter service

A. Standard side shifter and cylinder removal/installation

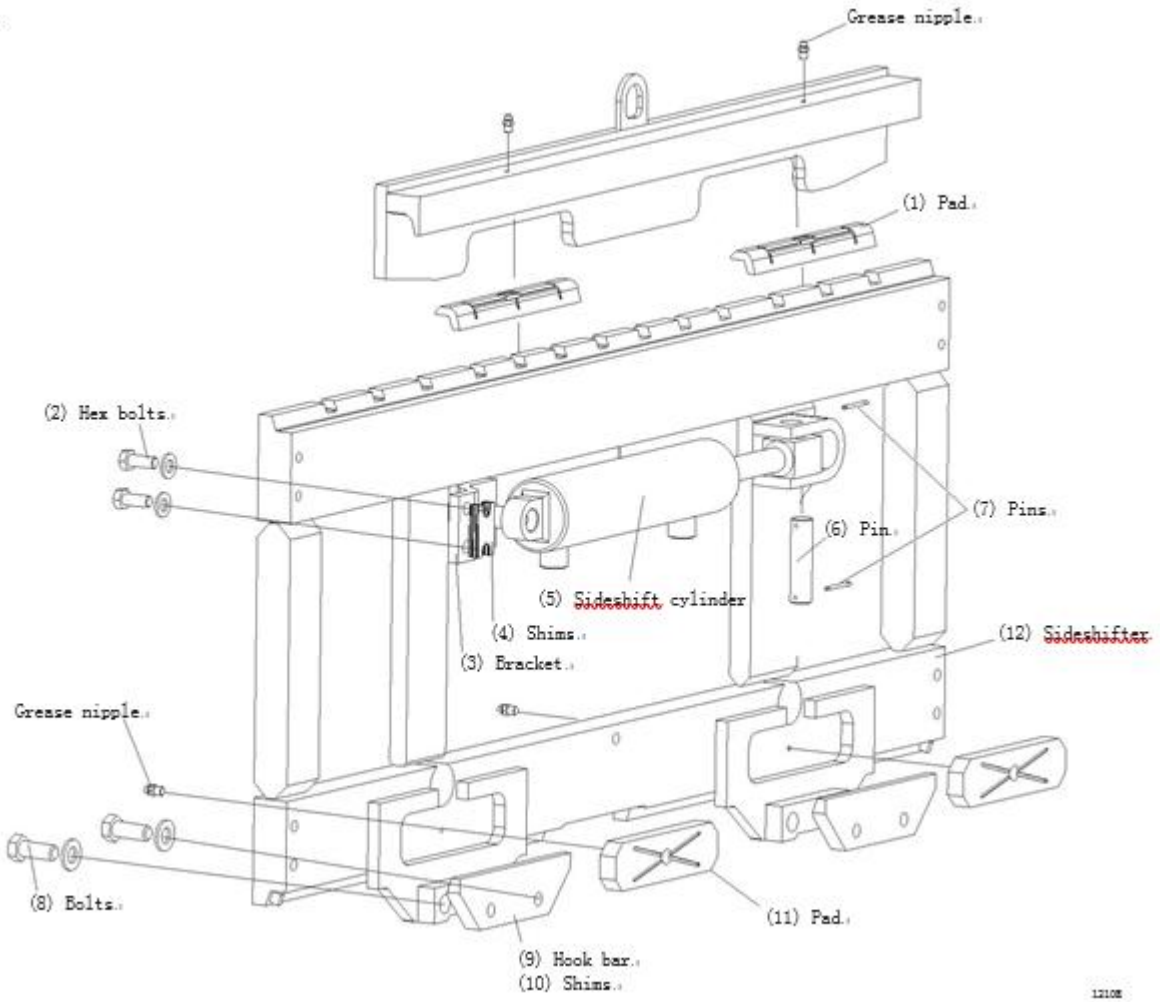


图 5-46

Preliminary steps

1. Lift the bracket and place a block under it.
2. Lower the bracket to the wooden block and then fix the crane on the load backrest.

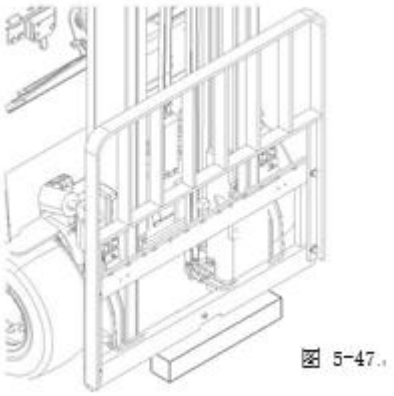


图 5-47

3. Remove the fork(See Section 5-3 B)

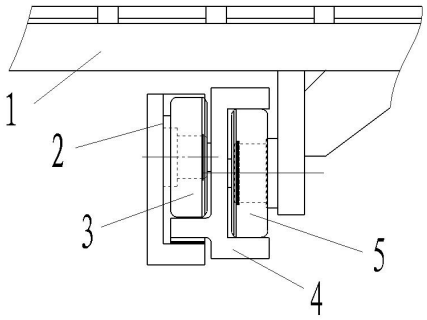
4. Eliminate hydraulic pressure by moving the lever back and forth several times by closing the key Residual pressure in the system

procedure

1. Provide corresponding marks for the hoses and ports of the side moving cylinder as reference for assembly.
2. Disconnect the hose from the side transfer cylinder, then plug and cover the hose and end. Get the pan ready to grab anything from the hose and cylinder
Oil flowing out of ports.
3. Remove the hex bolt and gasket, then remove the gasket. Apply thread glue to hexagon bolts during installation. During installation, adjust the thickness of the gasket so that the clearance between the bracket and the cylinder is a minimum of 1.5 mm (0.06 in).
4. Slide the shifter out of the bracket. When installing, check whether the clearance between the bracket and the side-shifter matches. If this is not the case, the hook bar must be cushioned with gaskets on each side. They can be removed by removing the bolts and gaskets. After installation, lubricate all gaskets by injecting grease through their respective nozzle.
5. After removing the pin, pull out the split pin and remove the side shifting cylinder.
6. Follow the above steps in reverse order to install the side shifter body and side shifter cylinder.

5-5 Rollers

There are two types of rollers: outer frame composite rollers and inner frame and fork frame composite rollers. They are installed on the outer frame, inner frame and fork frame respectively. The compound roller is composed of main roller and measuring roller, the main roller bears the load in the front and rear direction, and the side roller bears the side load, so that the inner frame and fork frame can move freely.



1. fork frame 2. outer mast
3. outer frame compound roller 4. inner mast
5. inner frame and fork frame compound roller

Note: (a) Adjust the side roller clearance to 0.5mm;
(b)Add grease on the surface of the main roller and the contact surface of the mast.

Maintenance, adjustment

Lifting cylinder adjustment is as follows

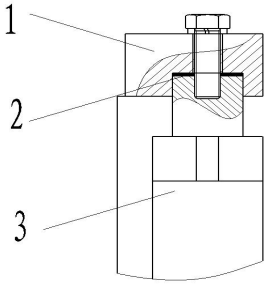
When the lifting cylinder, inner gantry or outer gantry is disassembled and replaced, the lifting cylinder stroke needs to be adjusted again. Adjustment method is as follows:

(1) Put the piston rod head without adjusting pad into the upper beam of the inner gantry.

(2) Slowly rise the mast to the maximum extension of the cylinder, check whether the two cylinders are synchronized.

(3) Add the adjusting pad between the piston rod head of the cylinder and the upper beam of the inner gantry. The thickness of the adjusting pad is 0.2mm and 0.5mm.

(4) Adjust the tension of the chain.



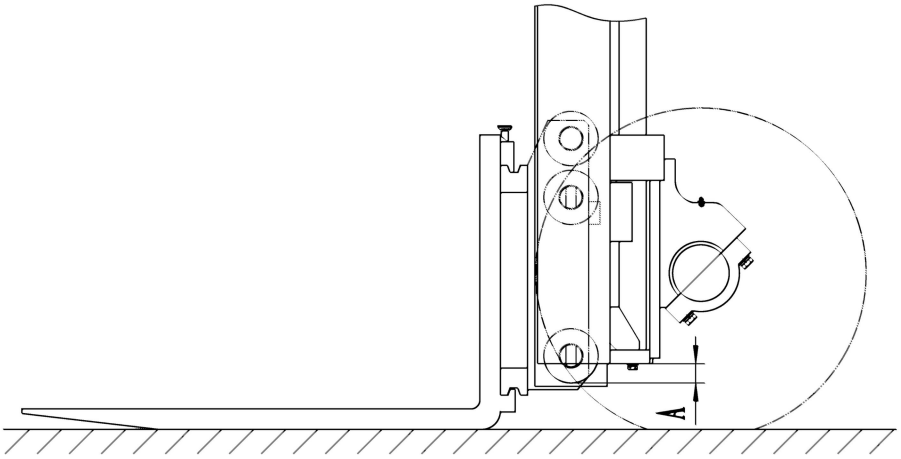
Lifting cylinder adjustment

1.Inner mast upper beam 2.Lifting cylinder adjusting pad 3.Lifting cylinder

Fork rack height adjustment as shown

(1). Stop the car on the horizontal ground and make the mast vertical.

(2). Make the bottom surface of the fork touch the ground, adjust the adjusting nut of the upper end joint of the chain so that the main roller has a certain distance A(A=24～29) from the lower end surface of the inner mast.



(3). Make the forks fall to the ground and tilt back into place. Adjust the upper end joint of the chain and adjust the nut to make the tension of both chains the same.

Replacement of fork frame rollers

(1) Put a pallet on the forks and park the car on the horizontal ground.

(2) Drop the fork and pallet to the ground.

(3) Remove the upper end joint of the chain and remove the chain from the sprocket.

(4) Raise the inner gantry (① in Figure 2-37).

(5) After confirming that the fork frame is detached from the outer gantry, back up the forklift (② in Fig. 2-37).

(6) Replace the main rollers

(a) Remove all spring retainers and remove the main roller with a pulling tool, taking care to keep the adjusting pad.

(b) Make sure the new roller is the same as the one being replaced, put the new roller into the fork frame and snap it in place with the elastic retaining ring.

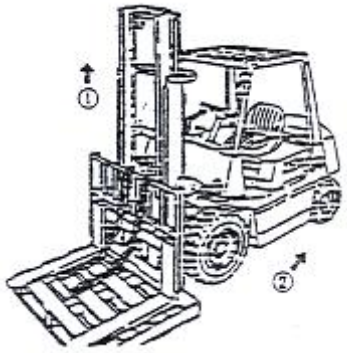


Fig2-37

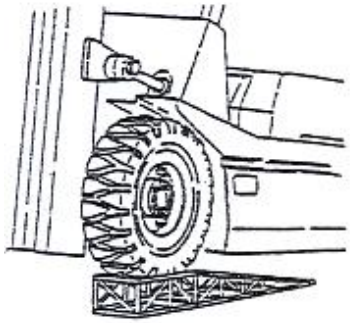


Fig2-38

Replace the mast roller as shown above

(1) Remove the fork frame from the inner mast in the same way as described for replacing the fork frame rollers.

(2) Drive the forklift to level ground and pad the front wheels by 250-300mm.

(3) Pull on the hand brake and pad the rear wheels with wedges.

(4) Remove the lifting cylinder and inner mast fixing bolt. Lift up the inner mast, be careful not to lose the adjusting pad on the piston rod head.

(5) Remove the connecting bolt 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 joint.

(6) Put down the inner mast, remove the main roller at the bottom of the inner mast. The main roller at the top of the outer mast will also be exposed from the top of the inner mast.

(7) Replace the main roller.

(a). Remove the upper main roller with a pulling tool without losing the adjustment pad.

(b). Install the new roller together with the adjustment pad removed in step (a).

(8) Lift the inner mast until all rollers are in the mast.

(9) Install the lifting cylinder and fork frame in the reverse order of removal.

5-6 tilting cylinder service

A. Complete disassembly/installation of tilt cylinder

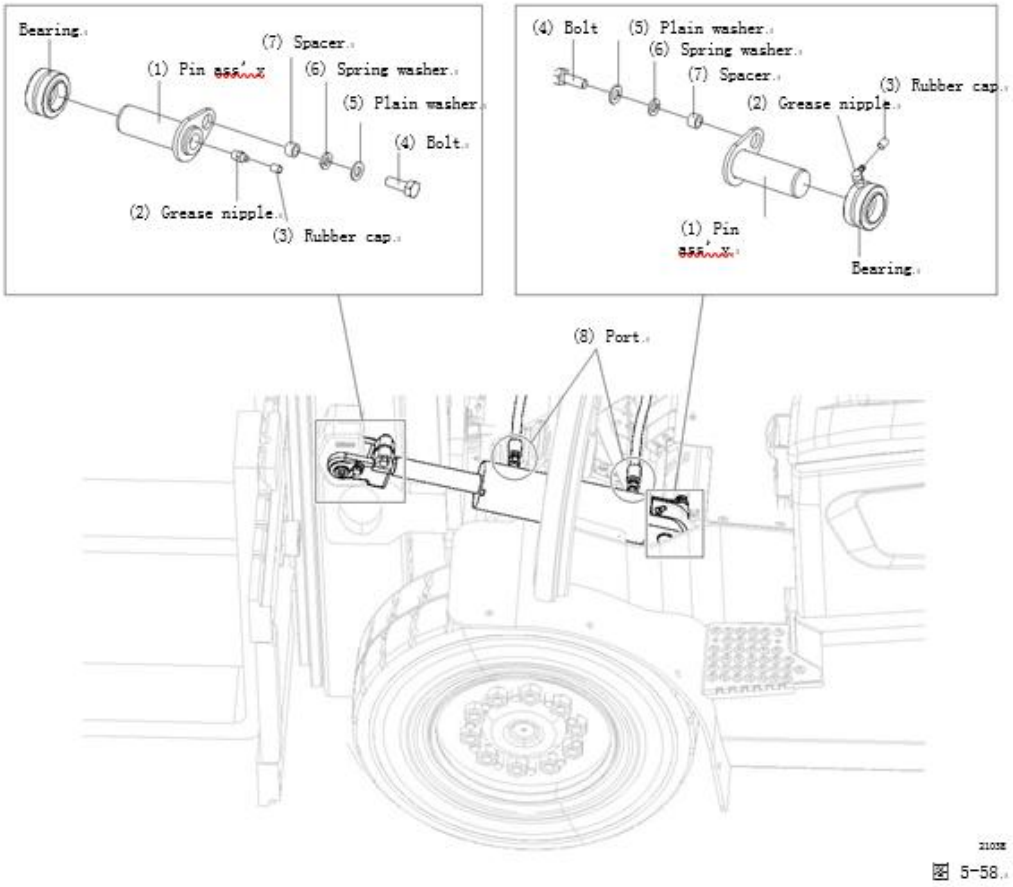


图 5-58

Preliminary Steps

1. Prepare a hoist and tie the straps to the sides above the gantry.
2. Move the lever back and forth several times by turning the key off to remove residual pressure from the hydraulic system
3. Prepare the oil pan.
4. Remove the base plate.

Procedure

1. Mark the hoses and ports (1) as assembly references.

2. Disconnect the hoses from the ports and plug them. Have the oil pan ready to catch any oil that comes out of the hoses and cylinder ports.

3. Remove the bolts (4), washers (5,6) and gaskets (7) from the gantry end of the cylinder.

4. Remove the pin (1) from the gantry end.

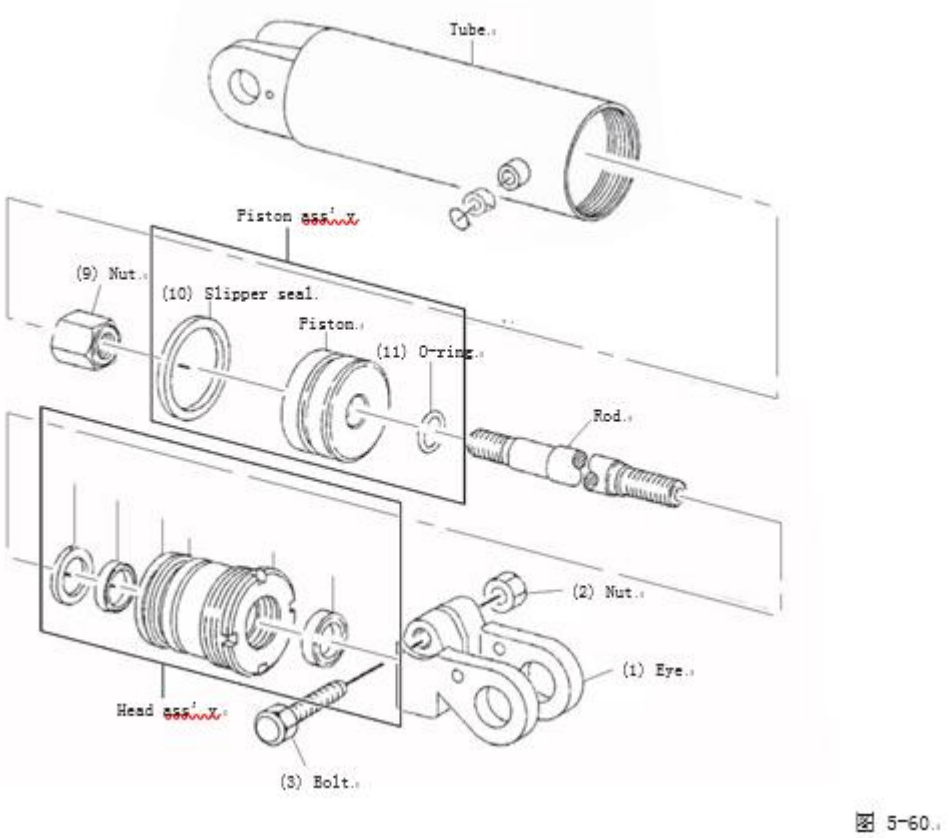
5. Repeat steps 3-4 for the frame end of the cylinder.

6. Remove the tilt cylinder.

7. Install the tilt cylinder by performing the above steps in reverse order.

8. Refill the tank with hydraulic fluid according to the specifications given in sections 1-6 and perform the tilt cylinder alignment procedure provided in section 5-3 A.

B. Tilting cylinder disassembly/assembly



Tools required: claw wrench

1. Place the inclined cylinder in the vise, then remove the rod assembly using a claw wrench.
Mounting torque: 270±30 N·m (200±22 lb·ft)
2. Loosen the nut (2) and bolt (3) and remove the eye (1).
Mounting torque: 95±15 N·m (70±11 lb·ft)
3. Remove the buttocks from the head.
4. Remove sealing ring (4).
Install with lips facing head.
5. Remove the U-shaped cup (5).
6. Remove the O-ring (6).
Install the support ring contact side so bent.

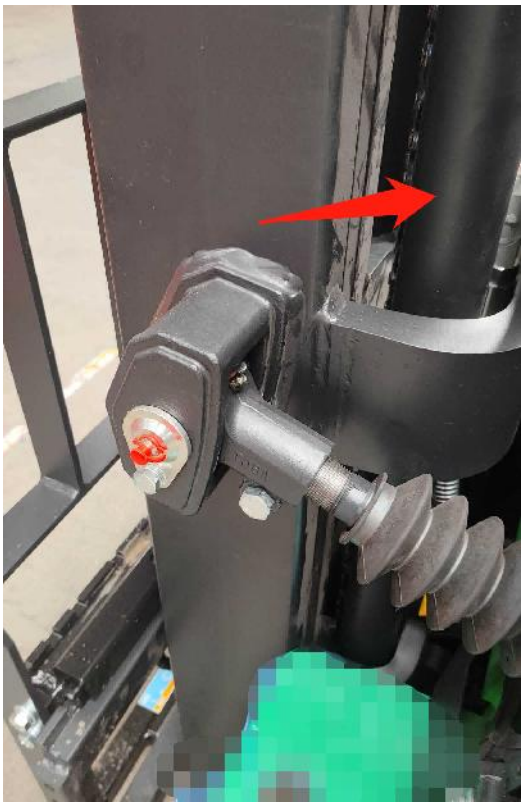
7. Remove the spare ring (7).
8. Remove the dustproof sealing ring (8).
Install with lips facing head.
9. Remove nut (9).
Mounting torque: 402±29 N·m (297±21 lb·ft)
10. Remove piston assembly.
11. Remove the sealing ring of the slippers (10).
12. Remove the O-ring (11).
13. Follow these steps in reverse order to assemble the inclined cylinder.

Note: After the assembly of the tilt cylinder is complete, be sure to reseal the ports with the dust cover and plug.

5-7 Mast side cylinder

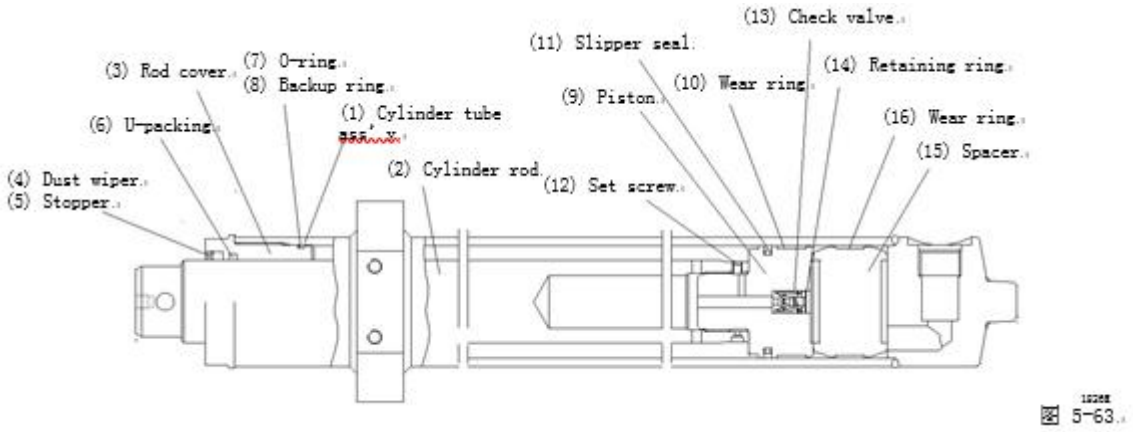
A. Complete disassembly/installation of the main lifting cylinder

1. Remove the chain.
2. Remove the upper and lower fixing bolts of the cylinder as well as the clamp.



3. Remove the lifting oil pipe lifting in mast can take down the cylinder

B. Main lifting cylinder disassembly/assembly



Tools needed: claw wrench

Preliminary Steps

Remove the main lift cylinder.

Procedure

1. Remove the rod cover (10) using a claw wrench.
2. Remove the O-ring (7) and support ring (8) from the outside diameter of the rod cover (3), and remove the dust collector (4), plug (4) and U-seal (6) from the inside. For installation, install the U-shaped gasket (6) so that the lip faces outward. Check the condition of the dust collector (4).
3. Secure the cylinder tube assembly (1) in a vise and remove the cylinder rod (2).
4. Loosen the set screw (12).
5. Unscrew the piston (9)
6. Remove the sliding seal (15) and wear ring (10) from the outside diameter of the piston (9), and remove the stop ring (14) and check valve (13) from the inside.
7. Remove the wear ring (16) and gasket (15).
8. Inspect the condition of the seals and replace any damaged or worn seals.
9. Perform the above steps in reverse order to assemble the master lift cylinder.

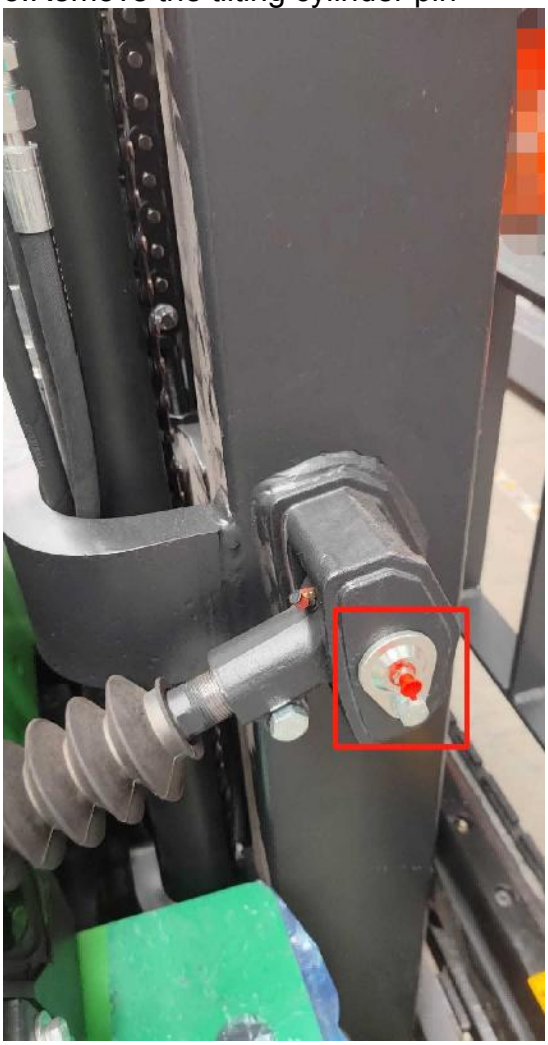
NOTE: After completing cylinder assembly, make sure to reseal the ports using the dust caps.

5-8 Mast assembly disassembly

1.Lift mast with crane in the specified lifting point

2.Remove the lifting oil pipe

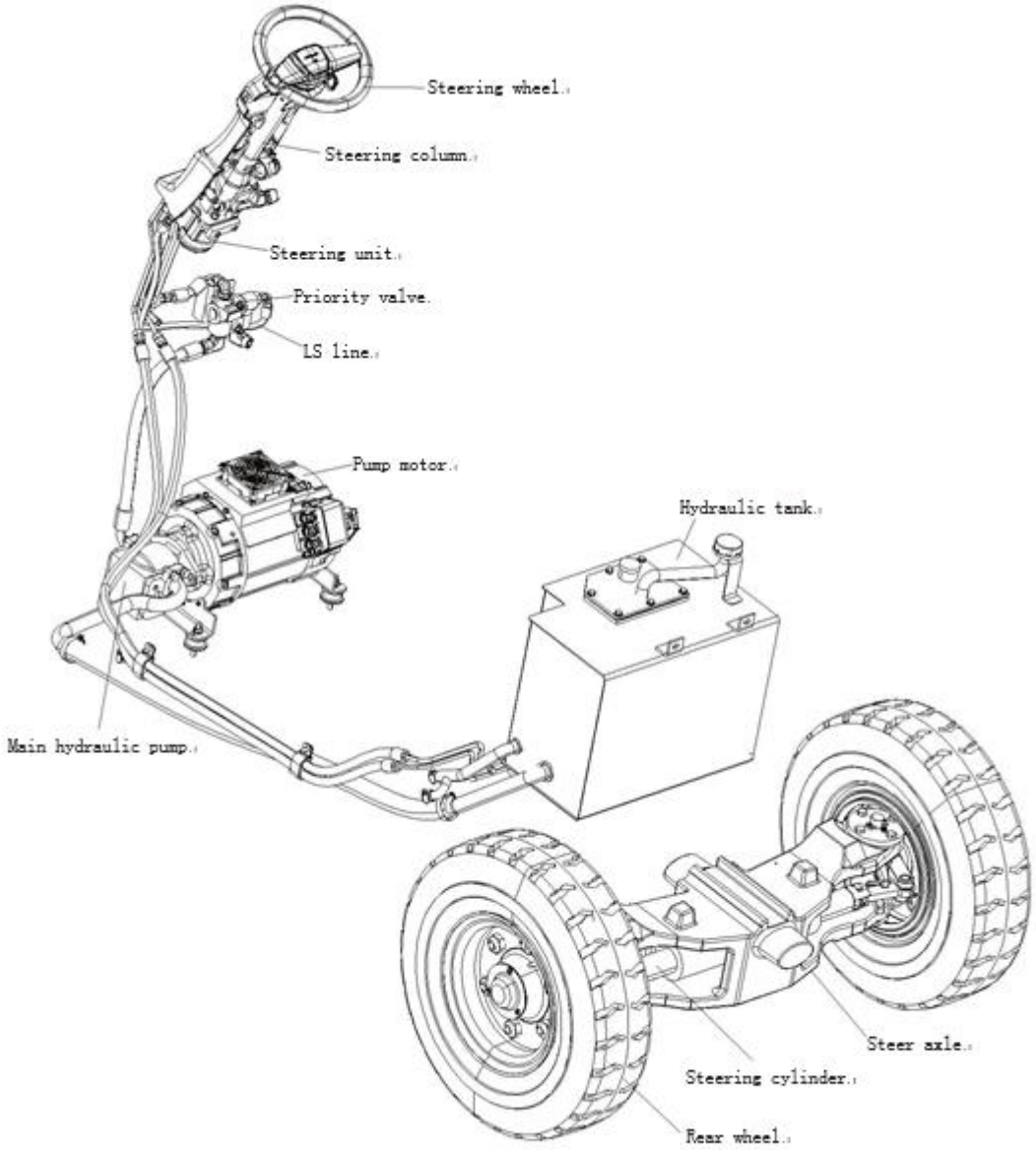
3.Remove the tilting cylinder pin



4. Remove the mast fixed tile to remove the mast

6 Steering system

6-1 overview



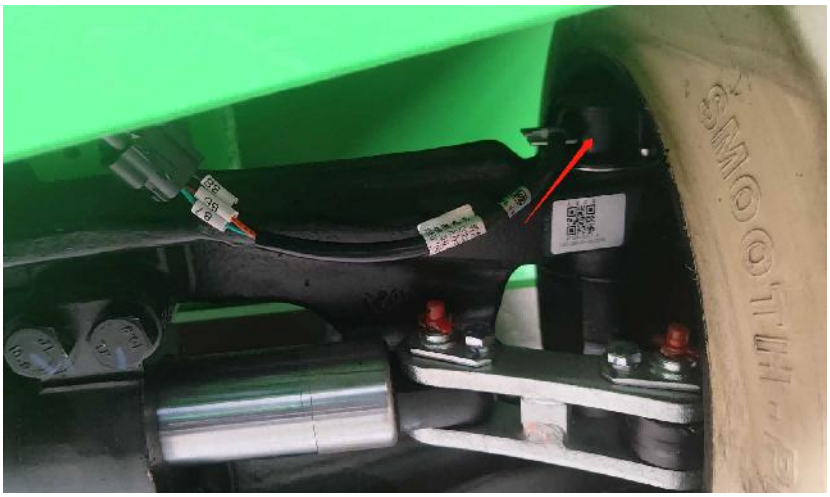
6-1

The steering system is a group of devices that turn the vehicle to the left or to the right. In this model, the steering system is hydraulically operated and consists of a control group and an actuator group that:

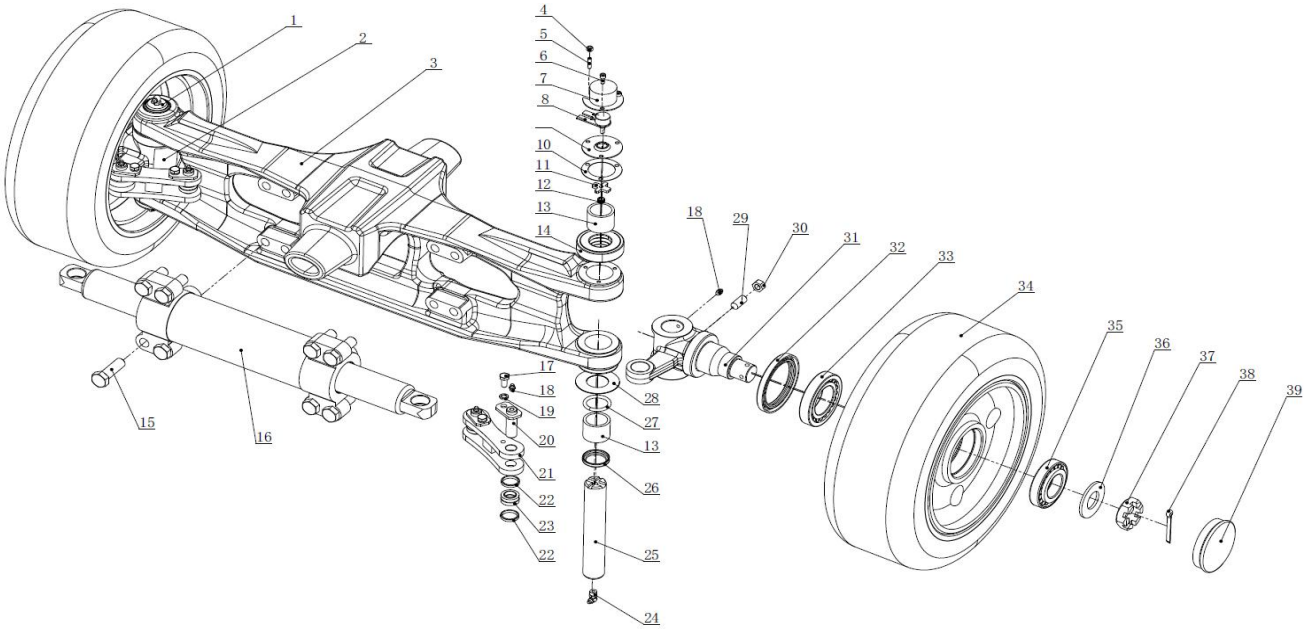
1. The control group determines the speed and direction of steering and supplies hydraulic fluid to the operator group accordingly. This group includes the steering wheel and steering gear.
2. The operating group converts the hydraulic power transmitted from the control section into mechanical power via hydraulic fluid to steer the rear wheels. This group includes the steering cylinder, the steering shaft and the two rear wheel assemblies. Unlike automobiles, forklifts use the rear wheels as steering wheels because their priority is not in driving speed but in ensuring wider steering angles in tight places.

6-2 Steering axle

6-2-1 Appearance and specifications



Corner Potentiometer Location



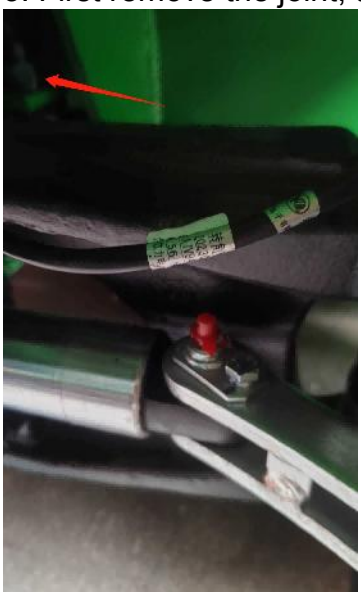
A	253616011001	Steering Axle(Solid Tire)
A	253616012001	Steering axle(environmental tire)
1	253698526001	Main pin A73J4-32111
2	253698526002	Left steering knuckle assembly AE774-32021
3	253698526003	Steering axle body assembly A7V94-10202
4	253698526004	Nut M5-B4133-00005B
5	253698526005	Hexagon socket set screws with flat end B9997-05020B
6	253698526006	Hexagon socket cheese head screws M5x12-B8030-05012B
7	253698526007	Protection cover A7V94-32121
8	253698526008	Corner positioner A7V94-10203
9	253698526009	Main pin upper cover A7V94-32131B
10	253698526010	Sealing gasket A7V94-10200
11	253698526011	Cross D-plate A7V94-10201B
12	253698526012	Screw M10x8-B8330-10008
13	253698526013	Needle roller bearing Φ32×Φ40×32-Z-943/32
14	253698526014	Single direction thrust ball bearing Z-198908P
15	253698526015	Hexagonal bolt M16×50-293686
16	253698526016	Steering cylinder assembly A7V94-30201
17	253698526017	Bolt M8X16-B0330-08016B
18	253698526018	Straight-through oil nozzle M6-Q700B06
19	253698526019	Spring pad 8-B5050-00008B
20	253698526020	Connecting rod pin 25RC4180000B
21	253698526021	Connecting rod AE774-32011B
22	253698526022	Bushing H24C4-12003
23	253698526023	Radial spherical plain bearing Z-GE16ES
24	253698526024	90°bend neck type slide grease nipple Q701B90
25	253698526025	Main pin/right A7T74-33011
26	253698526026	Iron shell oil seal 23654-32081
27	253698526027	O-ring 23654-32161
28	253698526028	Steering knuckle adjusting pad 22214-30321
29	253698526029	Hexagon socket set screw with tapered end M12×30-B8050-12030B
30	253698526030	Type 1 hexagonal nut M12-B4133-00012B
31	253698526031	Right steering knuckle assembly AE774-32031
32	253698526032	U-shaped seal 75x100x10-DZ6301-07523
33	253698526033	Tapered roller bearing Z-30210
34	253698526034	Solid tire assembly (no tread) AE774-40331
34	253698526035	Tire 16x6x10.5(no tread pattern)Z3230-60030
35	253698526036	Tapered roller bearing Z-30208
36	253698526037	Washerφ31Xφ62X4-G27Z4-30711
37	253698526038	Slotted nut M30X2-A21B4-32311
38	253698526039	Pin 6.3x50-B3010-6P350
39	253698526040	Hub cap A24K4-32061

6-2-2 Steering Axle Disassembly and Assembly Method

1. Lift the vehicle at the counterweight lifting point to let the rear wheels vacate

2. Remove the tire

3. First remove the joint, then remove the fixing bolt, you can remove the steering axle



6-2-3 Steering Gear Disassembly and Assembly

1. Open the housing to remove the oil pipe

2. Remove the fixing bolts to take off

6-3 Troubleshooting

problem	Peobable cause
It takes too much force to turn the steering wheel	The priority valve (if equipped) releases the pressure oil at a low setting
	The oil pressure of the pump is low and the pump is worn.
	The steering cover is too tight
	The steering column is not aligned with the steering gear.
	Priority valve spool is held in one position.
	The steering gear does not need lubrication.
	The liquid level in the hydraulic supply tank is low.
The steering wheel did not return to the center position correctly.	The steering gear cover is too tight.
	The steering column is not aligned correctly.
	The spool in the steering gear is limited.
	The priority valve check valve allows lifting and tilting hydraulic oil to affect the hydraulic circuit.
The pump leaks oil.	Loose hose connection.
	Poor shaft seal
The oil pressure is low.	The oil level is low
	The priority valve (if equipped) relief valve spring is weak.
	The relief valve (priority valve) will not move from the open position.
	Oil leakage inside or outside the system.
	The pump is broken.
The pump makes noise when the steering wheel is turned, and Can't move smoothly	Air in the steering hydraulic circuit.
	The pump is too worn.
	The oil pipe connection on the inlet side of the pump is loose.
	The viscosity of the oil is wrong.
	The oil level in the hydraulic tank is very low.
	The oil level in the tank is very low.
	There is air in the steering system.
	Incorrect pump operation.
	Dirt in the steering system
	Incorrect steering gear operation.
	Limit of steering shaft connecting rod.
	The steering cylinder has worn parts.
The oil temperature is too high.	The viscosity of the oil is wrong.
	Air is mixed with oil.
	The relief valve is set too high (priority valve).
	There are restrictions in the return line.

7.Battery Charger

Concise operation guide for high frequency intelligent charger of industrial battery

General Edition

7-1. Precautions for safe operation

Foreword

Thank you for using this product. Please read this manual carefully before installation and use, and carefully check whether the product packaging and accessories are complete according to the packing list.

In order to ensure the safety of the operator and the normal operation of the charger, please strictly abide by the installation procedures, operating procedures and safety

tips specified in this operation guide to ensure the normal operation of the equipment.

Note: If the product is damaged due to failure to operate in accordance with the prescribed procedures, the company will not be responsible for product maintenance and additional losses caused by it.

Please be sure to keep this operation guide properly so that it is convenient for installation, use and maintenance, and the operator can use and refer to it at any time.

cPrecautions

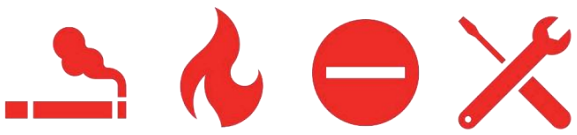
♦This charger is specially designed for battery charging, please do not use it for other purposes.
♦The battery must match the voltage and current of the charger before the charger can run.

Electrical Safety

♦This charger must be connected to the power supply system specified in the "Product Specifications".

♦Must use the supplied accessories, in order to ensure safe use, please do not replace the accessories without permission.

♦If you find that the cables, connectors or other accessories are damaged, you must stop using the charger immediately and contact the technical service center for repair or replacement.



Operating environment safety

♦ Smoke, water, flame and corrosive gas shall be prevented from entering the charger.

♦ If a small amount of liquid intrudes, please turn off the charger immediately and hand it over to the designated professional technicians for maintenance.

♦ The protection grade of this charger is IP20, which means that it has only basic dust-proof and no water-proof functions.

♦ The working environment of the charger is: - 20 ℃ ~ 40 ℃.

♦ The storage temperature of the charger is: - 40 ℃ ~ 70 ℃.

♦ Working and storage relative humidity: 0% ~ 95% (no condensation).

7-2 Installation guide

7-2-1 AC input wiring mode

The AC input wiring mode of our factory charger is as follows:

Specifications	Wiring mode
3KW series	Single phase three wire system
6KW series and more	Three phase four wire system
	Three phase five wire system

♦ The charger is equipped with industrial plug and socket accessories. The plug has been pre installed by our company. You need to install the socket accessories yourself.

♦ Please have the professional electrician with electrician certificate complete the socket wiring installation.

Single phase three wire socket	Three phase four wire socket	Three phase five wire socket	Y-type terminal block	
			phase	color
			L1	brown
			L2	black
			L3	grey
			N	blue
			G / PE	Yellow green

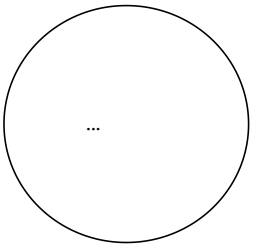
7-2-2 DC output wiring mode

The charger you purchased may be the following DC output connectors:


(Anderson)


(DIN)


(National standard gun)



(others)

No matter what kind of DC output connector you choose, be sure to connect the charger correctly according to the identification on the connector.

7-2-3 note:

Before use, please carefully check whether the AC input end and DC output end are connected in place without looseness.

7-3 Quick setup

♦ The charger is equipped with a circuit breaker, which is located at the side or rear of the casing. You may see the following models:

(1P: 3KW series)

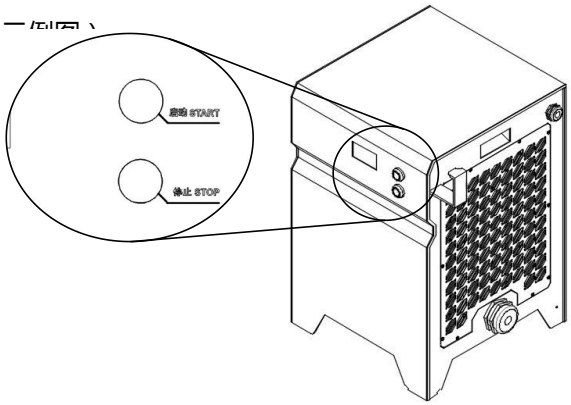
(2P: 6KW series)

(4P: 9~30KW series)

Check that the AC input terminal is connected, and the DC output terminal is connected with the battery, turn the circuit breaker up to the on position, and power on the charger.

♦ After power on, the charger system automatically starts self inspection, the system detection is normal, and the front panel display screen prompts "ready".

♦ Press the "start" button on the front panel to start charging (the following is 18kw Series)



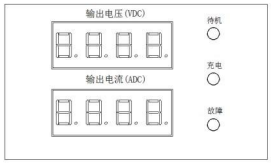
(Example: 18kw series)

♦ Press the "stop" button on the front panel, and the charger stops charging.

♦ When the charger is not in use, please turn the circuit breaker down to the "off" position.

7-4 Charger display and simple troubleshooting

♦ According to the different models you buy, the charger is equipped with an LCD or LED nixie tube display, which can display the charging status



(LCD display) (LED display)

Status display:	Status description:
Self checking (LCD)	Check whether the battery is faulty, whether charging is allowed, and whether the charger itself is faulty
Ready (LCD)	The external environment is normal and can be charged
Battery charger (LCD)	Charging
Battery full (LCD)	Charging complete
Shutdown... (LCD)	Power off, and the main switch can be turned off at this time
Grid anomaly (LCD)	The input voltage of the charger is higher or lower than the input voltage range
Please connect the battery (LCD)	The output line is not connected to the battery or the hardware is poorly connected
Battery disconnect / mode error : (LCD)	Charger charging mode selection error
Error E01	The charger output voltage is higher than the predetermined

	value
Error E02	The charger output current is higher than the predetermined value
Error E03	Communication failure of charger
Error E04	Charger temperature above set value
Error E09	Charger temperature acquisition signal is abnormal
Error EB1	Battery voltage too high
Error EB2	Excessive battery current
Error EB3	The communication between the charger and the power management fails, and the charger cannot detect the BMS message
Error EB4	Battery temperature too high
No charging (LCD)	The battery is not allowed to be charged
Note: some of the above fault codes need to be sent with BMS for display. If the battery has no BMS, some fault codes will not be displayed.	

♦ If you cannot solve the charger fault by yourself, please contact the technical service center for assistance.

8. CURTIS Handheld programmer

8-1 Operation Cautions

The prompt function of the programmer is designed for the convenience of vehicle inspection and maintenance, Adjustments to the controller parameters are not allowed without the approval of the vehicle manufacturer,so as to avoid vehicle and personal safety accidents.

After modifying the parameters, the handheld unit will automatically save the parameter settings, and the only thing you need to do is just close the key switch and restart.

CURTIS handheld programmer can be connected when the controller is powered on or off.

8-2 Process of Vehicle Fault Reading

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

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

8-3 Vehicle Signal Detection

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

Check for the Monitor based on the CURTIS handheld menu list

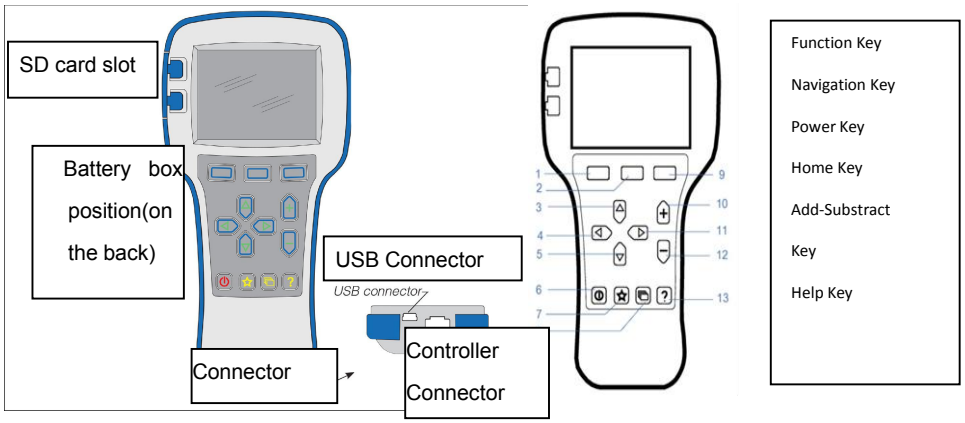
Please open the corresponding detection menu sub item according to the need, run the vehicle, and observe the change of handheld value.

8-4 Contents of CURTIS Handheld Menu

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

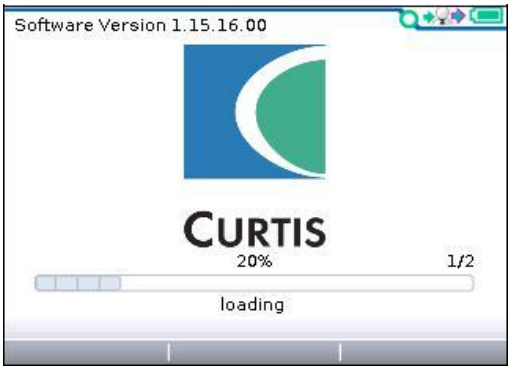
Warning：The control system will affect the performance of vehicle's acceleration, deceleration, hydraulic system and brakes. Hazardous conditions may occur if the vehicle control system is incorrectly programmed or beyond safety limit. Only the vehicle manufacturer or authorized service agent may program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

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

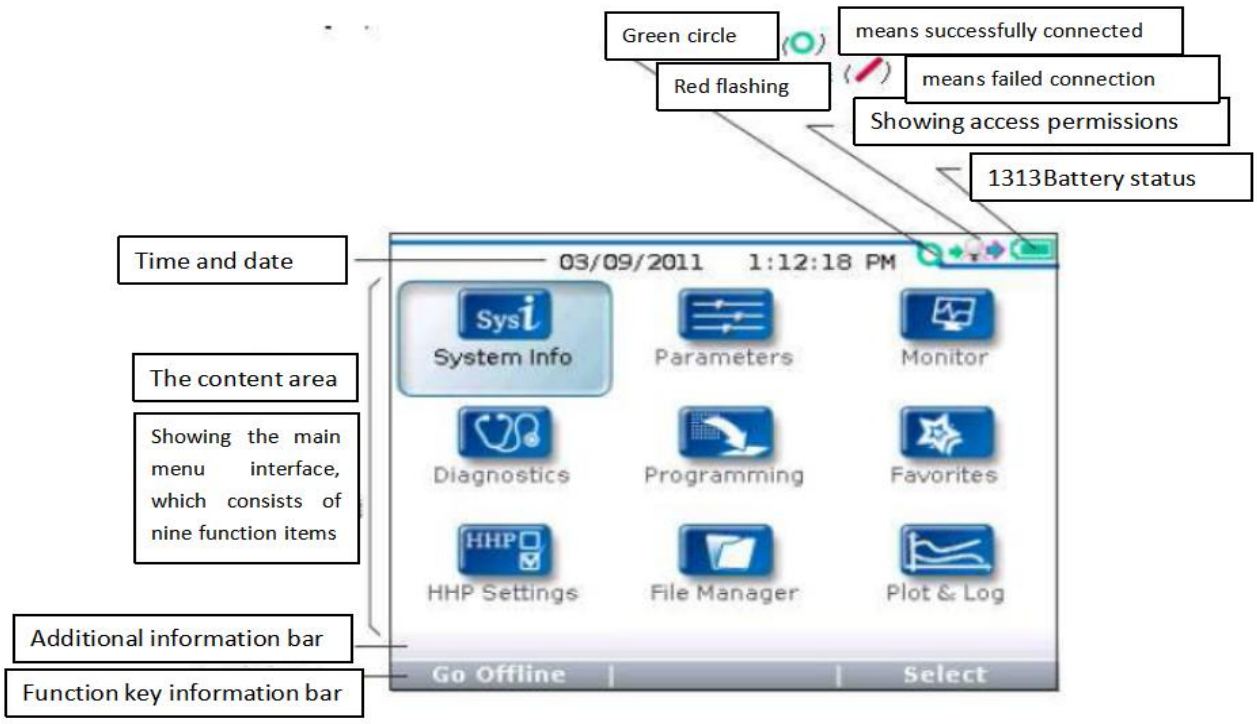


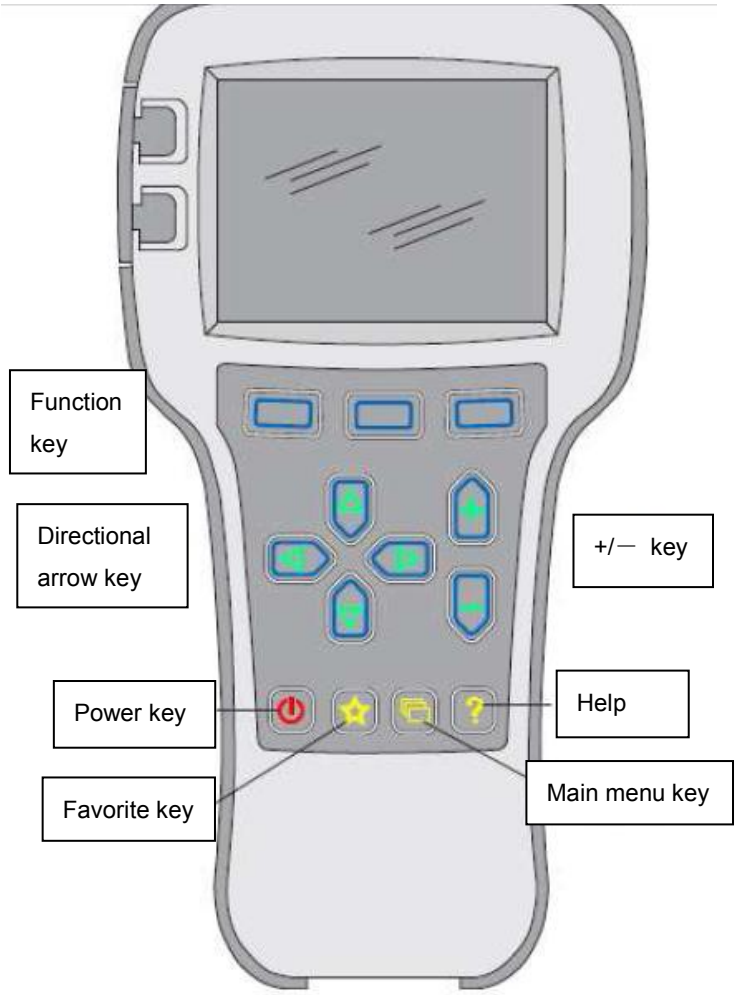
1. Power the programmer

The handheld programmer can be connected to the controller by inserting its connection wire into the programming port of the controller, and will automatically power on and display the control information on the programmer after connecting to the controller.



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





Function keys

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

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

+ / - Button

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

Power switch

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

2. Menu structure

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

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

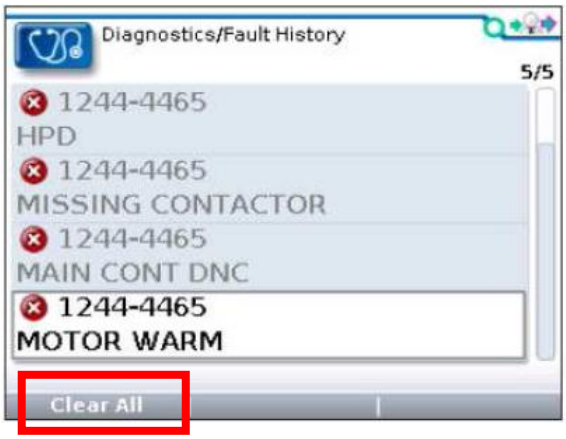
All nine submenu names are shown in bold on the main menu and below the icons. When you enter the stepped menu, the name of the submenu or the path you are in are displayed at the top of the screen.

Nine main menus

3. Fault diagnosis menu

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

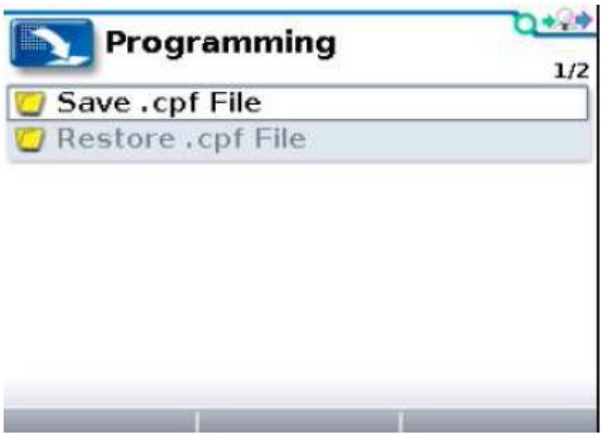
Note: the fault caused by a temporary event captured in the circuit is not a real system fault in some cases. and you can determine if the fault really exists by restarting the system and observing the automatic fault indication. In the history failure folder, the failures listed are all failures encountered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



"Clear All" is used to Clear the history failure folders. A function key will be highlighted separately if there is a history failure in the history failure folder, and will be grayed out if there is

4.Programming edit menu

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



Save.cpf File

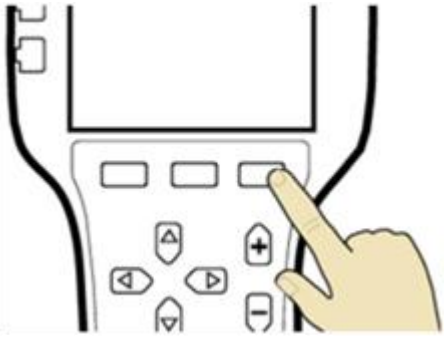
Use the save. cpf file function in the programming menu to back up the currently set parameters. You can save as many. cpf files as you need, and you need to name each. cpf file with a different name.Restore.cpf File

Restore.cpf File

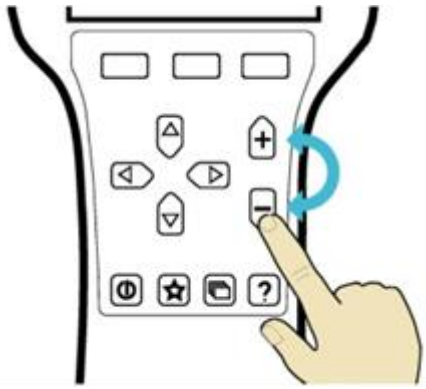
You can select the. cpf file saved earlier to replace the. cpf file of the current controller. When the whole data recovery process is completed, a dialog

5.Parameter Setting

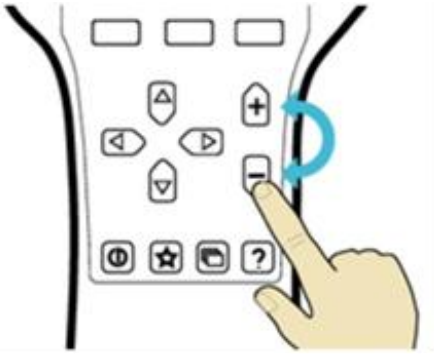
Select "Parameters" from the main page and press "Select" to enter the parameter setting page, in which you can adjust or modify the parameters of the controller.



Parameters can be adjusted or modified in two ways: one is in the parameter list page as shown in the figure below;



The other is through the parameter edit page as shown below



9.Solutions for fault codes

A.Fault level

One of the functions of the instrument panel is to display the faults that occur in the vehicle.

B. Troubleshooting measures for fault codes

（Curtis F4/6-A）Error Code List

Display	FLASH CODE	Explanation	Cause
Controller Over Current	1.2	Controller Over current	1. External short of phase U, V, or W motor connections. 2. Motor parameters are mistuned. 3. Controller defective.
Current Sensor Fault	1.3	Current Sensor Fault	1) Leakage to vehicle frame from phase U, V, or W (short in motor stator) 2) Controller defective
Precharge Failed	1.4	Precharge Failed	An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging
Controller Severe Undertemp	1.5	Controller Severe Undertemp	Controller is operating in an extreme environment
Controller Severe Overtemp	1.6	Controller Severe Overtemp	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller.
Severe Undervoltage	1.7	Severe Undervoltage	1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted.
Severe Overvoltage	1.8	Severe Overvoltage	1) Battery menu parameters are misadjusted 2) Battery resistance too high for given regen current 3) Battery disconnected while regen braking

Speed Limit Supervision	1.9	Speed Limit Supervision	1. Motor speed detected that exceeds the limit set by the Max Speed Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu.
Travel Control Supervision	1.10	Travel Control Supervision	1. The vehicle stop state, the detected motor frequency and/or phase current exceed the limit control supervision parameters specified for travel. 2. Improper travel control monitors parameters. 3. See Programmer » Application Settings » Trip Control Supervision menu.
Controller Overtemp Cutback	2.2	Controller Overtemp Cutback	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling.
Undervoltage Cutback	2.3	Undervoltage Cutback	1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system-drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close.
Overvoltage Cutback	2.4	Overvoltage Cutback	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking.
Ext 5V Supply Failure	2.5	Ext 5V Supply Failure	1. External load impedance on the +5V supply is too low.
Ext 12V Supply Failure	2.6	Ext 12V Supply Failure	Fault Type(s): 1 = 12V Supply's voltage is out-of-range 2 = 12V Supply's current is out-of-range

Motor Temp Hot Cutback	2.8	Motor Temp Hot Cutback	1. Motor temperature is at or above the programmed Temperature Hot setting—resulting in a reduction of controller drive current. 2. The motor temperature and sensor control parameters are misadjusted. 3. If the motor does not use temperature sensor, the programming parameters "Tempcompensation" and "Temp cutback" must be set to "OFF".
Motor Temp Sensor	2.9	Motor Temp Sensor	1. Motor thermistor is not connected properly. 2. If the motor does not use temperature sensor The programming parameter "MotorTemp Sensor Enable" must be set to "OFF"
MAIN DRIVER	3.1	Main Driver Open/Short	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.
EM Brake Driver	3.2	EM Brake Coil Open/Short	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring.
Lower Driver Fault	3.5	Proportional drive open/short	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring
Encoder Fault	3.6	Encoder Fault	1. Loss of supervision. 2. Pulse of overcurrent tripping loss. 3. Speed signal pulse loss. 4 . Automatic characterization 5 . Encoder power supply (voltage) fault.
Motor Open	3.7	Motor Open	1. Motor phase is open or lost. 2. Bad crimps or faulty wiring.
Main Contactor Welded	3.8	Main Contactor Welded	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal).

Main Contactor Did Not Close	3.9	Main Contactor Did Not Close	1. Main contactor did not close. 2. Main contactor tips are oxidized,burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse.
Motor Setup Needed	3.10	Motor Setup Needed	Motor setup is required. Please refer to fault type. Bit1: The current regulator needs to be configured. Bit2: The slip gain test needs to be run. Bit3: The base speed test needs to be run. Bit4: The automated test needs to be run (full motor commissioning).
Throttle Wiper Low	4.2	Throttle Input	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Inputs » Configure.
Pot2 Wiper Low	4.4	Brake Input	*Triggered by the respective fault diagnostic associated with the brake input source (assigned analogX input).
EEPROM Failure	4.6	NV Memory Failure	1. Failure to read or write to nonvolatile (NV) memory. 2. Internal controller fault.
HPD/Sequencing Fault	4.7	HPD Sequencing	1. Incorrect sequence in application of Keyswitch, Interlock, Direction,or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Hardware Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Hardware Inputs » Throttle Command.
Emer Rev HPD	4.7	EMER Rev HPD	Emergency Reverse operation has concluded, but the throttle, forward and reverse, and interlock inputs have not been returned to neutral.

Parameter Change Fault	4.9	Parameter Change	While the Interlock was On, a safetybased parameter was changed. Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter menu listings.
EMR Switch Redundancy	4.10	EMR Switch Redundancy	1. Either or both Emergency Reverse input switches are inoperative,resulting in an invalid state. NO……NC……State On……Off……valid Off……On……valid On……On……invalid Off……Off……invalid 2. Ingress of dirt or moisture in switch(es).
VCL Tra HPD Fault	5.1	Travel HPD fault	1. Forward switch/reverse receive signal when power on 2. The gas pedal is in the signal state when the power is on
Pump HPD Fault	5.1	Oil pump HPD failure	When the power is on, lifting, tilting, side shifting, and genera receive signals
Tra PDO Timeout	5.2	Travel PDO timeout	1.CAN wiring error 2.Inconsistent baud rate 3.Abnormal bus resistance
VCL_Lower_SRO_Fault	5.3	Lowering operation sequence fault	Active drop switch signal at power-up
Pump PDO Timeout	5.7	Oil pump controller PDO timeout	1.CAN wiring error 2.Inconsistent baud rate 3.Abnormal bus resistance
BMS PDO Timeout	5.8	BMS PDO timeout	1.3401 Instrument/controller battery type setting error 2.CAN wiring error 3.Inconsistent baud rate 4.Abnormal bus resistance
Seat Belt Alarm	5.9	Safety belt alarm	Not wearing seat belt when the speed is higher than 4km/h

Wrong 3401 Model	6.2/6.3/6.4/6.5	3401 model error	1.CAN bus abnormality 2.Instrument model or software error
Steer Sensor Pot Fault	6.6	Turning angle sensor failure	1. Corner potentiometer reset 2. Corner potentiometer failure
VCL Run Time Error	6.8	VCL Run Time Error	VCL Run Time Error detected.
PDO Timeout	7.2	PDO Timeout	The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter.
Stall Detected	7.3	Stall Detected	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder.
Supervisor Fault	7.7	Supervision	1. Data mismatch found during audit 2. Monitor the internal damage of microprocessor 3. The switch input is allowed to exceed 100ms in the upper and lower range
Supervision Input Check	7.9	Supervision Input Check	Internal controller fault.
PDO Mapping Error	8.2	PDO Mapping Error	1. The PDO Map has too many data bytes assigned or has objects mapped that are not compatible. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.
Internal Hardware	8.3	Internal Hardware	Internal controller fault detected.
Driver 1 Fault	A1	Drive 1 failure (drop solenoid)	1. Disconnected or shorted lowering solenoid valve. 2. Dirty connector (T13 or T2) pins on controller or contactor coil. 3. Poorly crimped or incorrectly wired connectors. 4. Drive overcurrent by drive 1 overcurrent parameter.
Driver 5 Fault	A5	Drive 5 failure (contactor)	1. Contactor load disconnection or short circuit. 2. Dirty connector pins or contactor coil on controller. 3. Poorly crimped or miswired connectors.

			4. Drive overcurrent by drive 5 overcurrent parameter.

Inmotion Programmer Fault Code Table		
Code	Explanation	Solution
20	Incorrect start Accelerator pedal switch active before key on	Release pedal switch
21	Incorrect start Forward switch or reverse switch active before key on	Turn off the direction switch
22	Forward switch and reverse switch active at the same time	Direction switch fault
23	Throttle analog value out of range	Throttle fault or analog need to be calibrated
24	Throttle analog fault	
31	Traction controller CAN communication fault	Check CAN wire of controller and display
32	Battery voltage low	Need charge
34	CPU fault	Reset key
36	ERROR Incorrect start Tilt switch active before key on	Reset tilt switch
37	ERROR Incorrect start Side switch active before key on	Reset side switch
38	ERROR Incorrect start Attachment switch active before key on	Reset attachment switch
39	ERROR ERROR Lift switch activated at startup	Reset lift switch
40	ERROR	Lift analog fault or need to be calibrated

	Lift analog value out of range	
43	ERROR Steer analog value out of range	Steer analog fault or need to be calibrated
44	WARNING Traction controller speed protection	Vehicle speed is too high alarm
45	WARNING Traction controller encoder fault	1.Traction controller encoder fault 2.Traction motor speed sensor connection wire is open
81	WARNING Traction controller temperature is low	Traction controller temperature is low alarm
82	WARNING Traction controller temperature is high	Traction controller temperature is high alarm
83	ERROR Traction controller temperature sensor fault	Traction controller temperature sensor fault
84	WARNING Traction motor temperature is low	1.Traction motor temperature is low 2.Traction motor temperature sensor is fault
85	WARNING Traction motor temperature is high	1.Traction motor temperature is high 2.Traction motor temperature sensor is fault

86	ERROR Traction motor temperature sensor fault	1.Traction motor temperature sensor is fault 2.Traction motor temperature sensor connection wire is open
87	ERROR Traction motor encoder fault	1.Traction motor encoder fault 2.Traction motor speed sensor connection wire is open
88	WARNING DC bus voltage of traction controller is high	1.DC bus voltage high 2. The ramp is too steep
89	WARNING DC bus voltage of traction controller is low	Need to charge or check power wiring
90	WARNING The default value of the traction controller is updated	Reset key
91	WARNING Traction drive limit	Battery low vehicle speed limit
97	ERROR Open drain of traction output open or short	Check the wire of open drain of traction output open or short
98	WARNING Traction controller over current or short	Check power wiring
101	ERROR	1.Check power wiring

	Traction controller short	2.Controller enable before contactor pull
102	ERROR Traction controller temperature is high cut back	Traction controller temperature is high need cool
103	ERROR Traction motor temperature is high cut back	1.Traction motor temperature is high need cool 2.Traction motor temperature sensor fault
104	ERROR Traction controller over current	1.Vehicle overload or Mechanical clamping 2.Traction motor speed sensor fault
105	ERROR Traction controller precharge failed	Replace the pre charge resistance
110	ERROR DC bus voltage of traction controller is low cut back	Battery need charge
111	ERROR DC bus voltage of traction controller is high cut back	DC bus voltage of traction controller is high cut back
112	ERROR () DC bus voltage of traction controller is high cut back(Hardware monitoring)	DC bus voltage of traction controller is high cut back(Hardware monitoring)
114	ERROR Internal power supply error	Traction motor temperature sensor or speed sensor connection wire is open
121	WARNING	Pump controller temperature is low alarm

	Pump controller temperature is low	
122	WARNING Pump controller temperature is high	Pump controller temperature is high
123	ERROR Pump controller temperature sensor fault	Pump controller temperature sensor fault
124	WARNING Pump motor temperature is low	1.Pump motor temperature is low 2.Pump motor temperature sensor fault
125	WARNING Pump motor temperature is high	1.Pump motor temperature is high 2.Pump motor temperature sensor fault
126	ERROR Pump motor temperature sensor fault	1.Pump motor temperature sensor fault 2.Pump motor temperature sensor connection wire is open
127	ERROR Pump controller encoder fault	1.Pump motor speed sensor fault 2.Pump motor speed sensor connection wire is open
128	WARNING DC bus voltage of pump controller is high	DC bus voltage of pump controller is high
129	WARNING	Check power wiring

	DC bus voltage of pump controller is low	
130	WARNING The default value of the pump controller is updated	Reset key
132	WARNING Pump drive limit	Battery voltage low need charge
137	ERROR Open drain of pump output open or short	Check the wire of open drain of pump output open or short
138	WARNING Pump controller over current or short	Check power wiring
141	ERROR Pump controller short	
142	ERROR Pump controller temperature is high cut back	
143	ERROR Pump motor temperature is high cutback	Pump motor temperature is high alarm
144	ERROR Pump controller current calibration error	Reset key
145	ERROR Pump controller pre charge failed	Replace the pre charge resistance
147	BMS BMS Cell voltage too high	
148	BMS BMS first fault	
149	BMS BMS second fault	
150	ERROR DC bus voltage of pump controller is low cut back	Low battery power
151	ERROR	

	DC bus voltage of pump controller is high cut back	High battery voltage
152	ERROR () DC bus voltage of pump controller is high cut back (Hardware monitoring)	High battery voltage
153	ERROR Pump controller CPU fault	Reset key
154	ERROR Pump controller speed control fault	Pump controller speed control fault
155	BMS CAN bus Off	BMS CAN
156	BMS BMS temperature protection	
157	BMS BMS over temperature protection	BMS over temperature protection
158	BMS BMS Monomer Overdischarge	Lithium Battery Low Battery Monomer Overdischarge
159	BMS BMS over voltage protection	BMS over voltage protection
163	BMS BMS over current	BMS over current
164	Charge protection	Charge protection
165	Seat switch off after a period of time, the direction of the request to reset	Reset direction switch
168	BMS BMS indicates Limit Current alarm	BMS indicates Limit Current alarm
169	BMS BMS indicates cutoff Current alarm	BMS indicates cutoff Current alarm
170	BMS BMS indicates brake Current alarm	BMS indicates brake Current alarm
171	BMS CAN BMS CAN Error	BMS CAN BMS CAN Error
	HPG CONTROLLER DRIVER SHORTED	Pump contactor drive coil short circuit (HPG DC pump control failure)
79	INCORRECT START HPG CONTROLLER INCORRECT START	(HPG) Operation sequence failure (HPG DC pump control failure)
161	CAN DISPLAY CAN FAULT	CANCAN CHECK DISPLAY AND CONTROLLER CAN CONNECTION