Service Manual

FEXP Battery Counterbalanced Forklift Truck

（FE4P60-80N）

WARNING

Do not use the electric truck before reading and understanding these operating instructions

NOTE:

- **Please check the designation of your present type at the last page of this document as well as on the ID-plate.**
- **Keep for future reference**

Version 11/2024

FE4P60-80N- SM-EN

FOREWARD

N series four fulcrum battery counterbalanced forklift truck is a new product developed by our company. The product has the characteristics of small turning radius, beautiful shape, compact structure, small volume, low center of gravity, good stability and superior performance.

This manual is about the correct use of N series four fulcrum battery counterbalanced forklift truck instructions, guide you to safe operation and preventive maintenance, and help the operator to use the electric forklift rationally, so that the electric forklift to maximize the efficiency! Relevant operators and maintenance personnel, be sure to read this manual before use.

As our products continue to be updated and improved, you may have a product that is slightly different from some of the descriptions in this manual. If there is any confusion, please contact to NOBLELIFT sales company or agents.

This manual briefly introduces the technical parameters of our company's counterbalanced forklift, the structure, working principle of each main component, and the requirements and contents of operation and maintenance. Please strictly abide by the instructions and precautions in this manual, careful driving, operation and use, so that forklift in the best working condition for a long time, play the maximum efficiency. When you rent or transfer the forklift, please rent or transfer this manual with the vehicle.

For emphasis, this manual uses the following signs:

1. ⃠ ---- Indicates a potentially hazardous condition that, if not avoided, could result in serious injury to the person, serious damage to the vehicle, or fire.

2. ⚠ ---- Indicates a potentially hazardous condition that, if not avoided, may cause minor injury to human body or partial damage to the vehicle.

3. ☞ ---- General precautions and instructions when using.

⚠ Most of this product is made of recyclable steel, and the waste generated in the process of use, maintenance, cleaning and disassembly must be recycled and disposed of pollution-free in accordance with local regulations. The recycling of these wastes must be done by professionals in designated areas, such as hydraulic oil, batteries and electronic equipment waste, if not properly disposed of, can cause harm to the environment and human health. The product recall service shall be implemented in case of batch problems.

一、Environmental requirements for use of this vehicle：

This vehicle is a special motor vehicle used only in the factory area, warehouse, freight yard and other specific areas specified in the Regulations on Special Equipment Safety Supervision.

1）This product is strictly prohibited for use in potentially explosive environments.

2）Environmental working conditions:

Average environment temperature under continuous operation: 25℃;

The maximum environment temperature in a short period of time (no more than 1h): 40℃;

The minimum environment temperature when using forklift under normal indoor conditions: 5℃;

Altitude: No more than 2000 meters.

If you need to use in high, low temperature and other special environment, need to install special accessories, please contact our relevant personnel.

Vehicle safety monitoring device

The forklift conforms to TSG81-2022 safety monitoring requirements. Driver permission information collector has been installed, through the fingerprint, iris, face features and other biological information or magnetic card and personal identity unique binding media, verify the driver's operation authority, when the collector fails, dismantled or driver information is incorrect, the vehicle can not start.

The forklift is equipped with the seat switch and the mast drop solenoid valve, if the driver is not in the correct operating position, the vehicle cannot walk and the mast cannot move.

Catalog

1 Correct application

1.1 Forklift use precautions

Forklift drivers and management personnel must bear in mind the principle of "safety first", carefully read the use and maintenance instructions, strictly follow the contents and requirements of this manual for safe operation and standardized operation.

1.1 Forklift transport

When loading forklifts in containers or cars, note the following:

1. Brake the parking brake;
2. The mast and the front and back of the counterweight should be fixed with steel wire, and the corresponding positions of the front and rear tires should be padded with wedges;
3. Lift according to the position indicated in the "Lifting sign" of the forklift.

1.2 Forklift storage

1. The mast is lowered to the lowest position;
2. Close the electric lock, place all the joystick in vacant positions, and unplug the power plug;
3. Tighten the hand brake lever;
4. The front and rear tires should be padded with wedges;
5. When the forklift is out of service for a long time, the wheels should be left upright. The battery should be recharged once a month.

1.3 Preparation before use

1. Check whether the instruments are normal;
2. Check whether the tire is damaged;
3. Check the handle and pedal condition;
4. Check whether the battery voltage is within the working range, the specific gravity of the electrolyte and the height of the liquid surface are appropriate;
5. Check whether the connections and plugs of the electrical system are reliable;
6. Check whether hydraulic oil, electrolyte and brake fluid leak out;
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 the test actions of lifting and lowering of the mast, leaning forward and backward, steering and braking;
11. The pollution degree of hydraulic oil is not more than 12.

1.4 Forklift operation

1. Trained and licensed drivers are allowed to drive;
2. The operator should wear shoes, hats, clothing and gloves that can be used for safety protection during operation;
3. In use, attention should be paid to the performance and working state of mechanical, hydraulic, electrical and MOSFET governor;
4. Turn on the power, first turn on the key switch, select the position of the direction switch, turn the steering wheel to see whether the vehicle rotates normally, slowly step on the speed control pedal, and maintain the proper starting acceleration;
5. Pay attention to the voltage of the voltmeter. When the forklift is working, if the voltage of the voltmeter is lower than 20.5V, stop the operation immediately and charge the battery or replace the battery with sufficient power.
6. When carrying, the load should not exceed the specified value, the distance and position of the cargo fork should be appropriate, the whole cargo fork must be inserted under the cargo, so that the goods are evenly distributed on the cargo fork to avoid unbalance load;
7. When the center of gravity of the goods is less than or equal to 500mm from the fork arm, the maximum load is the rated weight. If the center of gravity of the goods is greater than 500mm from the fork arm, the lifting weight should be less than the rated lifting weight;
8. After the cargo fork is loaded, the mast should tilt back to the maximum position, the fork arm should be in contact with the goods, and the cargo fork should be lifted off the ground and then driven around;
9. It is forbidden to stand under the cargo fork, and it is forbidden to stand on the cargo fork;
10. When lifting and lowering the goods, the initial speed should not be too fast;
11. It is not allowed to operate the vehicle and accessories from a position other than the driver's seat;
12. When the mast tilts forward or backward to the limit position or the cargo fork rises to the maximum height, the handle must be quickly returned to the middle position;
13. When the mast is raised, driving or turning is not allowed;
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 ramps, when driving on more than one tenth of the ramp, the uphill should be driven forward, the downhill should be driven backwards, the uphill and downhill should avoid turning, do not load and unload when the forklift is driving downhill;
16. Slow down when turning on wet or smooth roads; When driving on a wharf or temporary auxiliary board, be careful and drive slowly;
17. High-lift forklifts with lifting heights more than 3 meters should pay attention to the falling of the goods above, and take protective measures if necessary;

18. Do not handle unfixed or loosely stacked goods, and be careful to handle larger goods;
19. Avoid emergency braking when the forklift is driving with load;
20. When leaving the forklift, lower the cargo fork to the ground, put the gear handle into neutral, and disconnect the power supply. When parking on the ramp, pull the parking brake device well, and use a wedge to pad the wheel when parking for a long time;
21. The safety valve pressure of the multi way valve and the safety valve pressure of the steering device have been adjusted before the forklift truck leaves the factory, and the user should not adjust it at will in use, so as to avoid the damage of the entire hydraulic system or hydraulic components and the motor burning due to excessive pressure regulation;
22. Forklift trucks with accessories should be operated as loaded forklift trucks when running empty.

1.5 Use of lithium batteries

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

1. Do not operate electric vehicles equipped with lithium batteries at temperatures above 55 °C or below -25 °C
2. In low temperature environment below 0℃, please charge the vehicle immediately after use
3. Do not flush the battery box directly to prevent water into the battery box
4. For non-professionals, do not touch, move, or disassemble the battery pack, high-voltage cables, or other components with high-voltage warning labels
5. If the vehicle is hit by a strong collision during 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 is on fire, quickly leave the vehicle to a safe distance, use a dry powder fire extinguisher for treatment, using water to extinguish the fire or incorrect fire extinguisher may lead to electric shock, according to the characteristics of the battery, the battery capacity attenuation range is 0% ~ 25% within the three package period
7. The charge temperature range is: 0 ~ 40℃. Under low temperature environment below 0℃, high rate charge will cause damage to the battery. Under low temperature environment below 0℃, please charge the vehicle immediately after use.
8. Discharge temperature range: -20 ~ 50 °C, low temperature (-20 ~ 0 °C) discharge capacity compared with normal temperature conditions may be reduced, the battery can be used at 40 ~ 50 °C environment temperature, but the battery temperature is too high, especially the battery in a high temperature environment for a long time, will accelerate the aging of the battery internal materials, shorten the service life of the battery, so it is not recommended to use at this temperature for a long time.
9. If the environment temperature exceeds the charge and discharge temperature range, the battery

performance may be negatively affected or damaged, which may shorten the service life of the battery, please avoid.

1.6 Use of lead-acid batteries

1. When charging the battery for the first time and supplementary charging, strictly comply with the ragulations of the battery manual;
2. When the forklift is working, and the battery voltage is reduced to 41V, or the voltage of any single battery is reduced to below l.7V, or the instrument alarms, the forklift should stop working immediately, and can continue to use after charging or replacing the battery;
3. When charging, check the specific gravity, liquid level height and temperature of the electrolyte at any time;
4. After the forklift is used, the battery must be charged as soon as possible, the storage time shall not exceed 24 hours, and the charging should be prevented from insufficient and overcharging, so as not to damage the battery;
5. The forklift in normal use should be charged once a month in a balanced manner to adjust the proportion between the batteries in the battery group. For detailed charging methods, use and maintenance, please strictly follow the battery and charger instructions

2 General maintenance instructions

2.1 Vehicle parameters

2.1.1 Overall dimensions of the vehicle

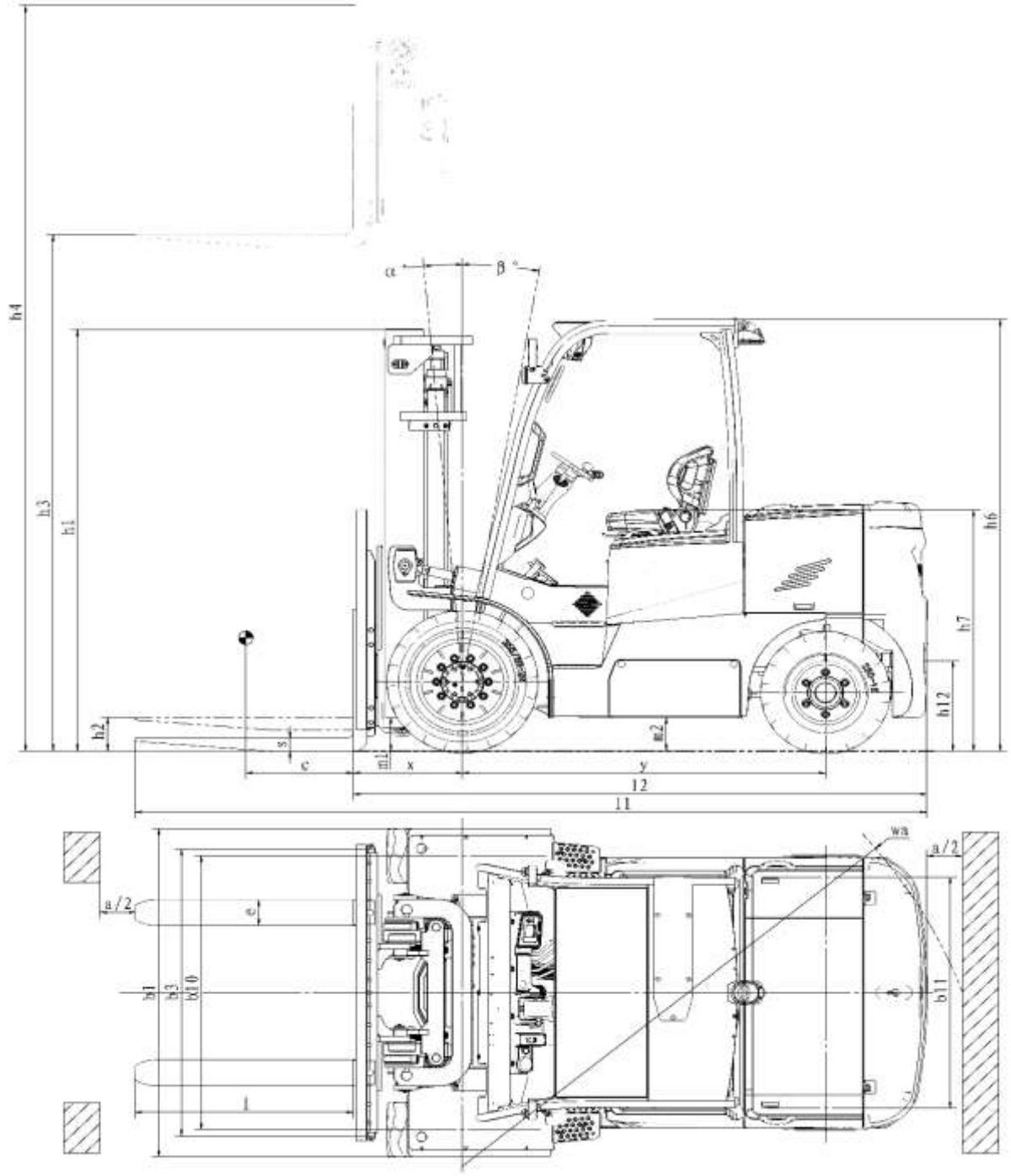


Fig. 2-1 Overall dimensions of the vehicle

2.1.2 Technical performance parameters

Table 2-1 FE4P60N parameter Table

character	1.1	model		FEXP
	1.2	Factory code		FE4P60N
	1.3	Drive mode: electric (battery or power supply), diesel, gasoline, gas, manual		electric
	1.4	Operation mode: manual, walkie, stand-on, sit-on, picking		sit-on
	1.5	Rated load capacity	Q(kg)	6000
	1.6	Load center distance	C(mm)	600
	1.8	front overhang	x(mm)	595
	1.9	wheelbase	y(mm)	2030
weight	2.1	Implicit battery (see 6.5) when dead weight lead-acid (lithium)	kg	9600（8930）
	2.2	Bridge load at full load, front/rear lead-acid (lithium)	kg	13600/2000(13190/1740)
	2.3	Bridge load at no load, front/rear lead-acid (lithium)	kg	4000/5600(3650/5280)
Wheel body	3.1	Tire: solid rubber, super elastomer, air tire, polyurethane tire		solid
	3.2	Front Wheel Size		355/65-15
	3.3	Rear wheel Size		250-15
	3.5	Number of wheels, front/rear wheels (×= drive wheels)		2X/2
	3.6	Front Wheel distance	b10(mm)	1574
	3.7	Rear wheel distance	b11 (mm)	1370
basic size	4.1	Mast/fork tilt Angle, forward/back tilt	α/β(°)	5/10
	4.2	mast retracting height	h1(mm)	2500
	4.3	Free lifting height	h2(mm)	185
	4.4	Lifting height	h3(mm)	3000
	4.5	Height of mast expansion	h4(mm)	4420
	4.7	overhead guard height	h6(mm)	2560
	4.8	Seat height	h7(mm)	1430
	4.12	Height of traction pin	h12(mm)	535
	4.19	Total length	l1(mm)	4407
	4.20	Length of vehicle body (excluding fork)	l2(mm)	3187
	4.21	Total width	b1(mm)	1870
	4.22	Fork size	s/e/l(mm)	60/150/1220
	4.24	Width of fork rack	b3(mm)	1700
	4.31	Ground clearance under the mast	m1(mm)	200
	4.32	Wheelbase center ground clearance	m2(mm)	198

	4.33	Working channel width,1000X1200 pallets (1200 cross-fork placement)	Ast(mm)	4770
	4.34	Working channel width,1200X1200 pallets (1200 placed along the fork)	Ast(mm)	4970
	4.35	Turning radius	Wa(mm)	2980
performance parameter	5.1	Driving speed, full/no load	Km/h	15/15.5
	5.2	Increase speed, full/no load	m/s	340/390
	5.3	Drop speed, full/no load	m/s	370/430
	5.5	Maximum traction, full/no load	Newton	36000
	5.7	Maximum climb, full/no load S_2 5 minutes	%	15
	5.10	Drive brake		hydraulic
motor	6.1	Drive motor power S_2 60 min	KW	35
	6.2	Improving motor power S_3 15%	KW	40
	6.3	Battery type		Lead-acid/lithium
	6.4	Battery voltage (rated capacity) K_5	V/AH	Lead acid 96/720(810/945 optional) Lithium 96/554(618/840 optional)
	6.5	Battery weight Lead acid (lithium)	kg	2310（550）
	6.6	Battery size, length/width/height	mm	1420/610/570
other	8.1	Drive control type		AC
	8.2	accessory working strss	MPa	21
	8.3	accessory oil content	L/min	80
	8.4	Driver's ear noise level according to EN 12 053	decibel	74

character	1.1	model		FEXP
	1.2	Factory code		FE4P70N
	1.3	Drive mode: electric (battery or power supply), diesel, gasoline, gas, manual		electric
	1.4	Operation mode: manual, walkie, stand-on, sit-on, picking		sit-on
	1.5	Rated load capacity	Q(kg)	7000
	1.6	Load center distance	C(mm)	600
	1.8	front overhang	x(mm)	600
	1.9	wheelbase	y(mm)	2030
weight	2.1	Implicit battery (see 6.5) when dead weight lead-acid (lithium)	kg	10300(9400)
	2.2	Bridge load at full load, front/rear lead-acid (lithium)	kg	15200/2100(14550/1850)

	2.3	Bridge load at no load, front/rear lead-acid (lithium))	kg	4000/6300(3400/6000)
Wheel body	3.1	Tire: solid rubber, super elastomer, air tire, polyurethane tire		solid
	3.2	Front Wheel Size		355/65-15
	3.3	Rear wheel Size		250-15
	3.5	Number of wheels, front/rear wheels (×= drive wheels)		2X/2
	3.6	Front Wheel distance	b10(mm)	1574
	3.7	Rear wheel distance	b11(mm)	1370
basic size	4.1	Mast/fork tilt Angle, forward/back tilt	α/β(°)	5/10
	4.2	mast retracting height	h1(mm)	2500
	4.3	Free lifting height	h2(mm)	190
	4.4	Lifting height	h3(mm)	3000
	4.5	Height of mast expansion	h4(mm)	4420
	4.7	overhead guard height	h6(mm)	2560
	4.8	Seat height	h7(mm)	1430
	4.12	Height of traction pin	h12(mm)	535
	4.19	Total length	l1(mm)	4412
	4.20	Length of vehicle body (excluding fork)	l2(mm)	3192
	4.21	Total width	b1(mm)	1870
	4.22	Fork size	s/e/l(mm)	65/150/1220
	4.24	Width of fork rack	b3(mm)	1700
	4.31	Ground clearance under the mast	m1(mm)	200
	4.32	Wheelbase center ground clearance	m2(mm)	198
	4.33	Working channel width,1000X1200 pallets (1200 cross-fork placement)	Ast(mm)	4775
	4.34	Working channel width,1200X1200 pallets (1200 placed along the fork)	Ast(mm)	4975
	4.35	Turning radius	Wa(mm)	2980
performance parameter	5.1	Driving speed, full/no load	km/h	15/15.5
	5.2	Increase speed, full/no load	m/s	320/390
	5.3	Drop speed, full/no load	m/s	380/430
	5.5	Maximum traction, full/no load	Newton	36000
	5.7	Maximum climb, full/no load S_2 5 minutes	%	15
	5.10	Drive brake		hydraulic
Motor	6.1	Drive motor power S_2 60 min	KW	35
	6.2	Improving motor power S_3 15%	KW	40
	6.3	Battery type		Lead-acid/lithium
	6.4	Battery voltage (rated capacity) K_5	V/AH	Lead acid 96/810(945/1035 optional)

				Lithium 96/554(618/840 optional)
	6.5	Battery weight Lead acid (lithium)	kg	2510(550)
	6.6	Battery size, length/width/height	mm	1420/610/570
Other	8.1	Drive control type		AC
	8.2	accessory working strss	MPa	21
	8.3	accessory oil content	L/min	80
	8.4	Driver's ear noise level according to EN 12 053	decibel	74

Table 2-2 FE4P70N

character	1.1	model		FEXP
	1.2	Factory code		FE4P70N
	1.3	Drive mode: electric (battery or power supply), diesel, gasoline, gas, manual		electric
	1.4	Operation mode: manual, walkie, stand-on, sit-on, picking		sit-on
	1.5	Rated load capacity	Q(kg)	7000
	1.6	Load center distance	C(mm)	600
	1.8	front overhang	x(mm)	600
	1.9	wheelbase	y(mm)	2030
weight	2.1	Implicit battery (see 6.5) when dead weight lead-acid (lithium)	kg	10300(9400)
	2.2	Bridge load at full load, front/rear lead-acid (lithium)	kg	15200/2100(14550/1850)
	2.3	Bridge load at no load, front/rear lead-acid (lithium))	kg	4000/6300(3400/6000)
Wheel body	3.1	Tire: solid rubber, super elastomer, air tire, polyurethane tire		solid
	3.2	Front Wheel Size		355/65-15
	3.3	Rear wheel Size		250-15
	3.5	Number of wheels, front/rear wheels (×= drive wheels)		2X/2
	3.6	Front Wheel distance	b10(mm)	1574
	3.7	Rear wheel distance	b11(mm)	1370
basic size	4.1	Mast/fork tilt Angle, forward/back tilt	α/β(°)	5/10
	4.2	mast retracting height	h1(mm)	2500
	4.3	Free lifting height	h2(mm)	190
	4.4	Lifting height	h3(mm)	3000
	4.5	Height of mast expansion	h4(mm)	4420
	4.7	overhead guard heigh	h6(mm)	2560

	4.8	Seat height	h7(mm)	1430
	4.12	Height of traction pin	h12(mm)	535
	4.19	Total length	l1(mm)	4412
	4.20	Length of vehicle body (excluding fork)	l2(mm)	3192
	4.21	Total width	b1(mm)	1870
	4.22	Fork size	s/e/l(mm)	65/150/1220
	4.24	Width of fork rack	b3(mm)	1700
	4.31	Ground clearance under the mast	m1(mm)	200
	4.32	Wheelbase center ground clearance	m2(mm)	198
	4.33	Working channel width,1000X1200 pallets (1200 cross-fork placement)	Ast(mm)	4775
	4.34	Working channel width,1200X1200 pallets (1200 placed along the fork)	Ast(mm)	4975
	4.35	Turning radius	Wa(mm)	2980
performance parameter	5.1	Driving speed, full/no load	km/h	15/15.5
	5.2	Increase speed, full/no load	m/s	320/390
	5.3	Drop speed, full/no load	m/s	380/430
	5.5	Maximum traction, full/no load	Newton	36000
	5.7	Maximum climb, full/no load S_2 5 minutes	%	15
	5.10	Drive brake		hydraulic
Motor	6.1	Drive motor power S_2 60 min	KW	35
	6.2	Improving motor power S_3 15%	KW	40
	6.3	Battery type		Lead-acid/lithium
	6.4	Battery voltage (rated capacity) K_5	V/AH	Lead-acid 96/810(945/1035 optional) Lithium 96/554(618/840 optional)
	6.5	Battery weight Lead acid (lithium)	kg	2510(550)
	6.6	Battery size, length/width/height	mm	1420/610/570
Other	8.1	Drive control type		AC
	8.2	accessory working strss	MPa	21
	8.3	accessory oil content	L/min	80
	8.4	Driver's ear noise level according to EN 12 053	decibel	74

Table 2-3 FE4P80N

character	1.1	model		FEXP
	1.2	Factory code		FE4P80N
	1.3	Drive mode: electric (battery or power supply), diesel, gasoline, gas, manual		electric

	1.4	Operation mode: manual, walkie, stand-on, sit-on, picking		sit-on
	1.5	Rated load capacity	Q(kg)	8000
	1.6	Load center distance	C(mm)	600
	1.8	front overhang	x(mm)	610
	1.9	wheelbase	y(mm)	2030
Weight	2.1	Implicit battery (see 6.5) when dead weight lead-acid (lithium)	kg	11900(11200)
	2.2	Bridge load at full load, front/rear lead-acid (lithium)	kg	17730/2170(17240/1960)
	2.3	Bridge load at no load, front/rear lead-acid (lithium))	kg	4800/7100(4320/6880)
Wheel body	3.1	Tire: solid rubber, super elastomer, air tire, polyurethane tire		solid
	3.2	Front Wheel Size		355/50-20
	3.3	Rear wheel Size		250-15
	3.5	Number of wheels, front/rear wheels (×= drive wheels)		2X/2
	3.6	Front Wheel distance	b10(mm)	1623
	3.7	Rear wheel distance	b11(mm)	1370
basic size	4.1	Mast/fork tilt Angle, forward/back tilt	α/β(°)	5/10
	4.2	mast retracting height	h1(mm)	2500
	4.3	Free lifting height	h2(mm)	200
	4.4	Lifting height	h3(mm)	3000
	4.5	Height of mast expansion	h4(mm)	4420
	4.7	overhead guard heigh	h6(mm)	2560
	4.8	Seat height	h7(mm)	1430
	4.12	Height of traction pin	h12(mm)	535
	4.19	Total length	l1(mm)	4427
	4.20	Length of vehicle body (excluding fork)	l2(mm)	3207
	4.21	Total width	b1(mm)	1945
	4.22	Fork size	s/e/l(mm)	75/150/1220
	4.24	Width of fork rack	b3(mm)	1700
	4.31	Ground clearance under the mast	m1(mm)	200
	4.32	Wheelbase center ground clearance	m2(mm)	198
	4.33	Working channel width,1000X1200 pallets (1200 cross-fork placement)	Ast(mm)	4790
	4.34	Working channel width,1200X1200 pallets (1200 placed along the fork)	Ast(mm)	4990
	4.35	Turning radius	Wa(mm)	2980
performance parameter	5.1	Driving speed, full/no load	km/h	14.5/15.5
	5.2	Increase speed, full/no load	m/s	300/390

	5.3	Drop speed, full/no load	m/s	390/430
	5.5	Maximum traction, full/no load	Newton	36000
	5.7	Maximum climb, full/no load S_2 5 minutes	%	14
	5.10	Drive brake		hydraulic
Motor	6.1	Drive motor power S_2 60 min	KW	35
	6.2	Improving motor power S_3 15%	KW	40
	6.3	Battery type		Lead-acid/lithium
	6.4	Battery voltage (rated capacity) K_5	V/AH	Lead-acid 96/945(1035 optional) Lithium 96/554(618/840 optional)
	6.5	Battery weight Lead acid (lithium)	kg	2820(550)
	6.6	Battery size, length/width/height	mm	1420/610/570
Other	8.1	Drive control type		AC
	8.2	accessory working strss	MPa	21
	8.3	accessory oil content	L/min	80
	8.4	Driver's ear noise level according to EN 12 053	decibel	75

2.2 Description of safety devices and warning labels

2.2.1 Forklift use place and working environment

(1) Ground conditions

The use of forklift truck should be flat and solid road or ground, and good ventilation conditions.

The performance of the forklift depends on the ground conditions, the operating speed should be adjusted appropriately, and special care should be taken when driving on ramps or rough roads. Driving on sloping or rough roads will accelerate tire wear and increase noise of forklift trucks.

(2) Working environment

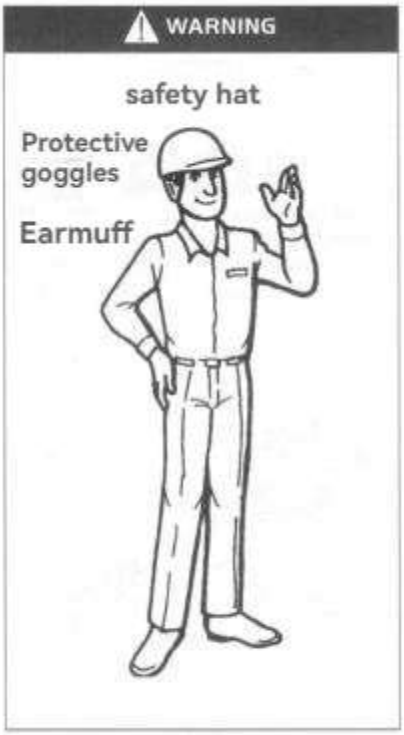
When the forklift is used, the environment temperature should be between 5 ℃ and 40 ℃, and the environment humidity should not exceed 90%.

(3) Weather conditions

In the weather of rain, snow, fog and strong wind, the safety of forklift should be assessed in advance before using it. It is best not to carry out outdoor operations. If necessary, driving and operating should be double careful.

2.2.2 Safety rules

Pass the forklift training and pass the assessment to have a driver's license to operate the forklift!



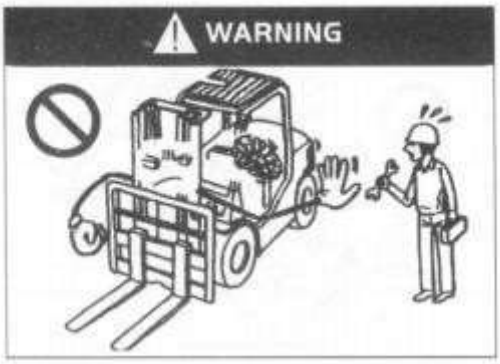
Dress properly before driving, please wear work clothes!

No driving on the highway!

Always be alert: injured, rescue!

Read the forklift manual carefully before driving!

Without permission, it is forbidden to add or remove forklift parts at will!



Turn off engine before maintenance!

Know the traffic rules!

Please check the forklift before use!

Do not move the overhead guard!

Keep the cab clean!

Don't drive an unsafe forklift!

The driver should be in good health!

Make sure your forklift is safe!

Work within the permitted limits!

Don't drive a broken forklift!

Hold the handrail tightly when you get on!

Start the forklift correctly!

Adjust your seat before driving!

Make sure your forklift is in a safe operating condition!

Appropriate fasten your seat belt!

Always pay attention to the height of the forklift working area!

Turn on the lights in gray areas!

Avoid soft or unfinished surfaces
and only run on firm, flat surfaces!

Don’t expose your arms and body outside
the overhead guard while working!

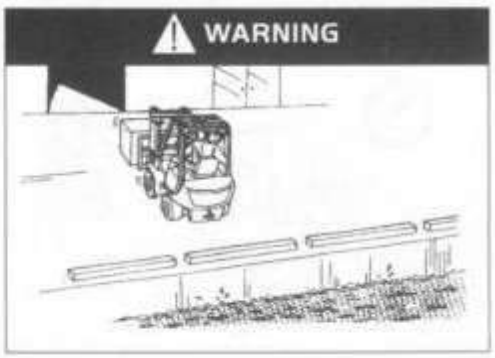
Body under the fence on the vehicle roof!

Avoid unbalance load!

Note that when loading goods,

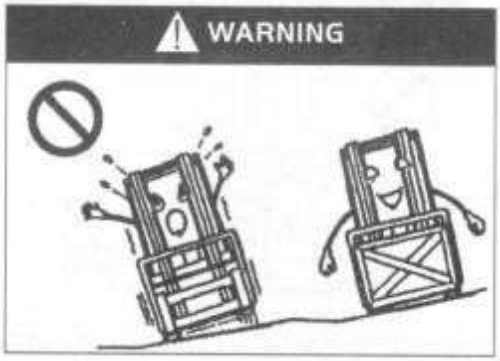
the outstretched fork touches the items in front!

Check the location of the fork dowel pin!

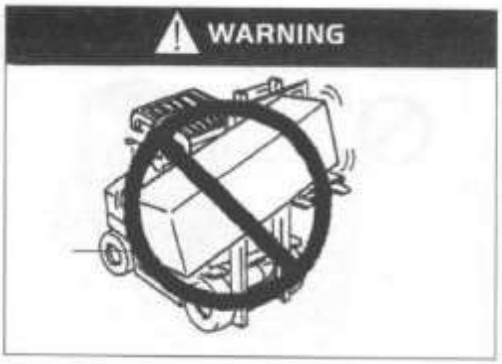


Pay attention to the safety in the work area!

Try not to drive on smooth or slippery ground!



Pay attention to the lateral stability of the forklift when it is unloaded!

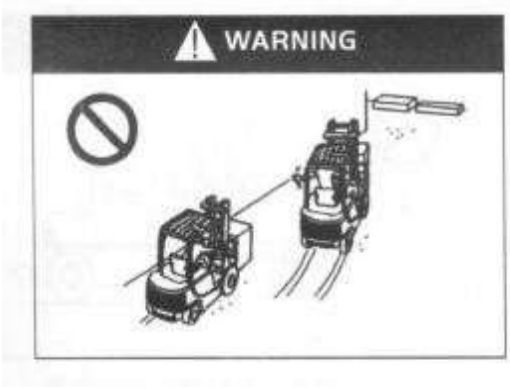


Be especially careful when carrying long or wide loads!

Absolutely not allowed manned!

When turning, if you can't see ahead clearly,
honk your horn and drive slowly!

Use appropriate pallets or sleepers to carry small items!

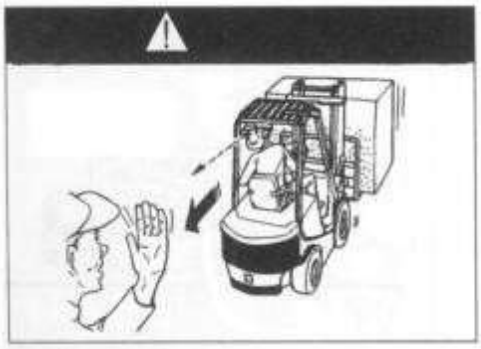


Don't chase each other through driving!

Don't allow anyone to stand on the goods!

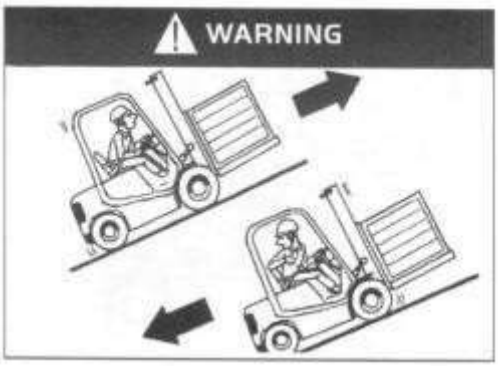
Don't look around while driving!

Don't do stunts with forklifts!



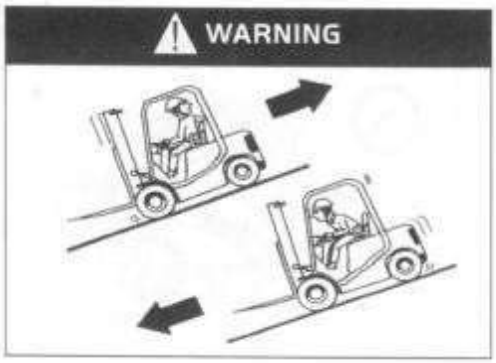
If the loading of cargo is too high and obstructs the view, reverse the driving!

Follow traffic rules and all warnings and signs!
Or someone to guide!



When loading goods, drive uphill and downhill backwards!

Pay attention to the steep slope and the lifting height of the cargo when going uphill!



When no load, uphill backwards driving,

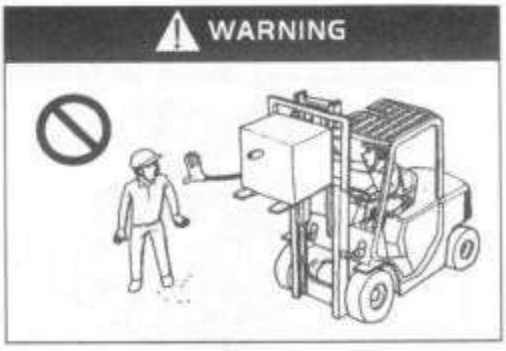
downhill front driving!

Pay attention to brake when starting forklift on slope!

No turning allowed on the slope!

The horn should be sounded when there is someone or something on the road!

Turn should avoid encounter people or goods!



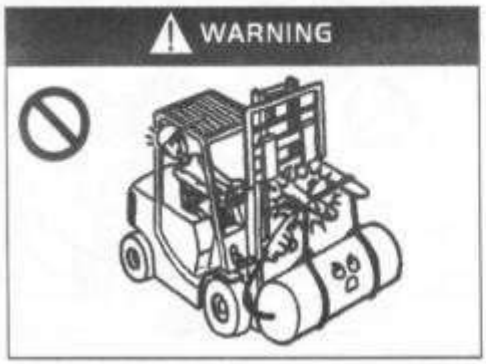
The staff shall not be near the forklift when it is working!

Turning too high speed will cause the center of gravity instability and rollover!

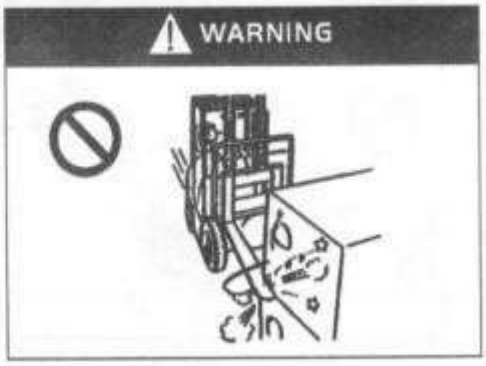
Pay attention to the change of the rated lifting weight of the forklift!

The forklift work area pedestrians stopped!

Forklift driving should always pay attention to the surrounding area.



Please use the cargo fork properly!



Please slow down as much as possible when loading!

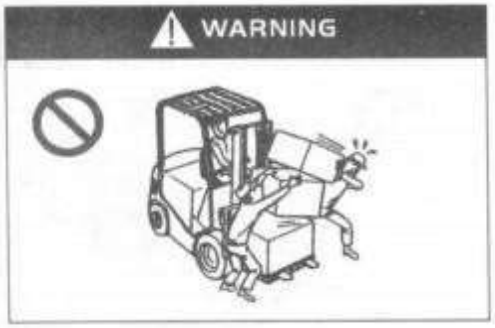
Do not move the forklift when there is someone in front of it!

No one is allowed to walk or stand under a raised fork!

Try not to let the load exceed the load backrest height!

If the goods are difficult to be fixed,

please bundle them before loading!



It is not allowed to transport goods that have not been unloaded from forklifts !

Don't use people to carry the damaged cargo boxes!

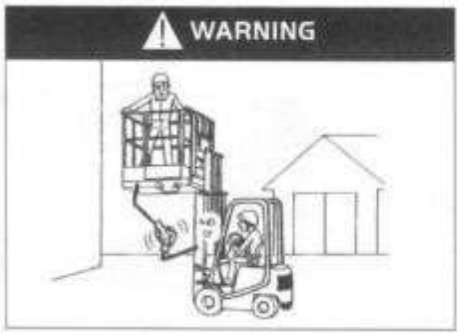
No abuse of forks!

Be careful to load the goods into the car!

Do not carry people at will!

Do not abuse forklifts!

Please do not stretch any part of your body out of the car while driving!



Should drive smoothly do not sudden acceleration and deceleration driving!

Special safety equipment must be used to carry people on high ground!

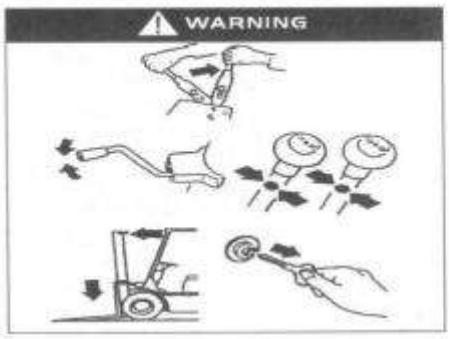
Overload loading is strictly prohibited!

Can't lift when the wind is too strong!

Don’t work in explosive environments!

If the forklift is damaged, it should be placed in the designated area!

The forklift should be parked in the designated area when not in use!



When you are not using a forklift：

- Brake

Forklifts are not allowed on the slope!

- Place the steering bar in the middle position
- Lower fork to ground
- Tilt the mast forward
- Take the key.

2.2.3 Safety issues in upkeep and maintenance

1. Maintenance place

• Adequate equipment and safety protection facilities shall be provided to the service organization at the designated site.

The site shall be on level ground.

The place should be well ventilated.

The site shall have fire extinguishing devices.

2. Precautions before maintenance

• No smoking.

Wear all kinds of protective equipment (protective hats, shoes, glasses, gloves and boots) and appropriate clothing.

Wipe off the oil in time.

When adding lubricating oil, clean the original dirty oil or dust on the joint with a brush or cloth, and then add lubricating oil.

urn off the key switch and unplug the battery, except where necessary.

When maintaining the forklift, the fork should be dropped to the ground.

Clean electrical components with compressed air.

3. Maintenance and upkeep precautions

Be careful not to put your feet under the fork or trip over it.

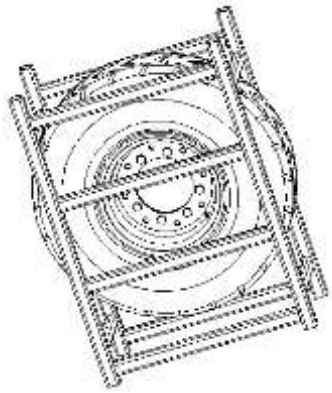
When the fork is raised, a pad or other item should be placed under the inner mast to prevent the fork and mast from falling suddenly.

Carefully open and close the front bottom plate and battery box cover plate to avoid squeezing fingers.

When the work cannot be completed at one time, it should be marked so as to continue the work later.

Use appropriate tools, not temporary substitutes.

Because the hydraulic circuit has a high pressure, do not perform maintenance work before reducing the internal pressure of the oil circuit.



When injured by high voltage, consult a doctor immediately.

Do not use the mast assembly as a ladder.

Do not place your hands, feet and body between the vehicle frame and the mast assembly.

4. Check and replace tires

⚠ • The removal and installation of tires must be carried out by professional personnel.

• High-pressure air should be handled by professionals.

• Wear safety goggles when using compressed air.

• When removing the tire pair, do not loosen the bolts and nuts at the rim connection, because the tire is under high pressure gas, loose bolts, nuts and rims will cause a very dangerous situation.

• To remove the bolts and nuts at the rim joint, the high-pressure gas in the tire must be drained first and carried out in a special tool.

5. Use a jack (when changing tires)

When lifting the forklift with a jack, do not drill your body into the bottom of the forklift.

Before lifting the forklift with the jack, ensure that there is no person and no load on the forklift.

When the forklift wheel is off the ground, the jack should be stopped and the pad should be placed under the forklift to avoid the forklift falling.

Measures should be taken to prevent the forklift from sliding before lifting the forklift with the jack.

6. Waste discharge (electrolytic waste liquid, oil, etc.) requirements

⚠ Scrapped parts (plastic parts, electrical components, etc.) and waste liquid (hydraulic oil, brake fluid, etc.) on the forklift shall be recycled according to the regulations of the local government, and shall not be discharged at will.

2.2.4 Labels

There are many special warning signs on the forklift truck. Please refer to the picture below for the detailed location and content. Please take the time to familiarize with these signs.

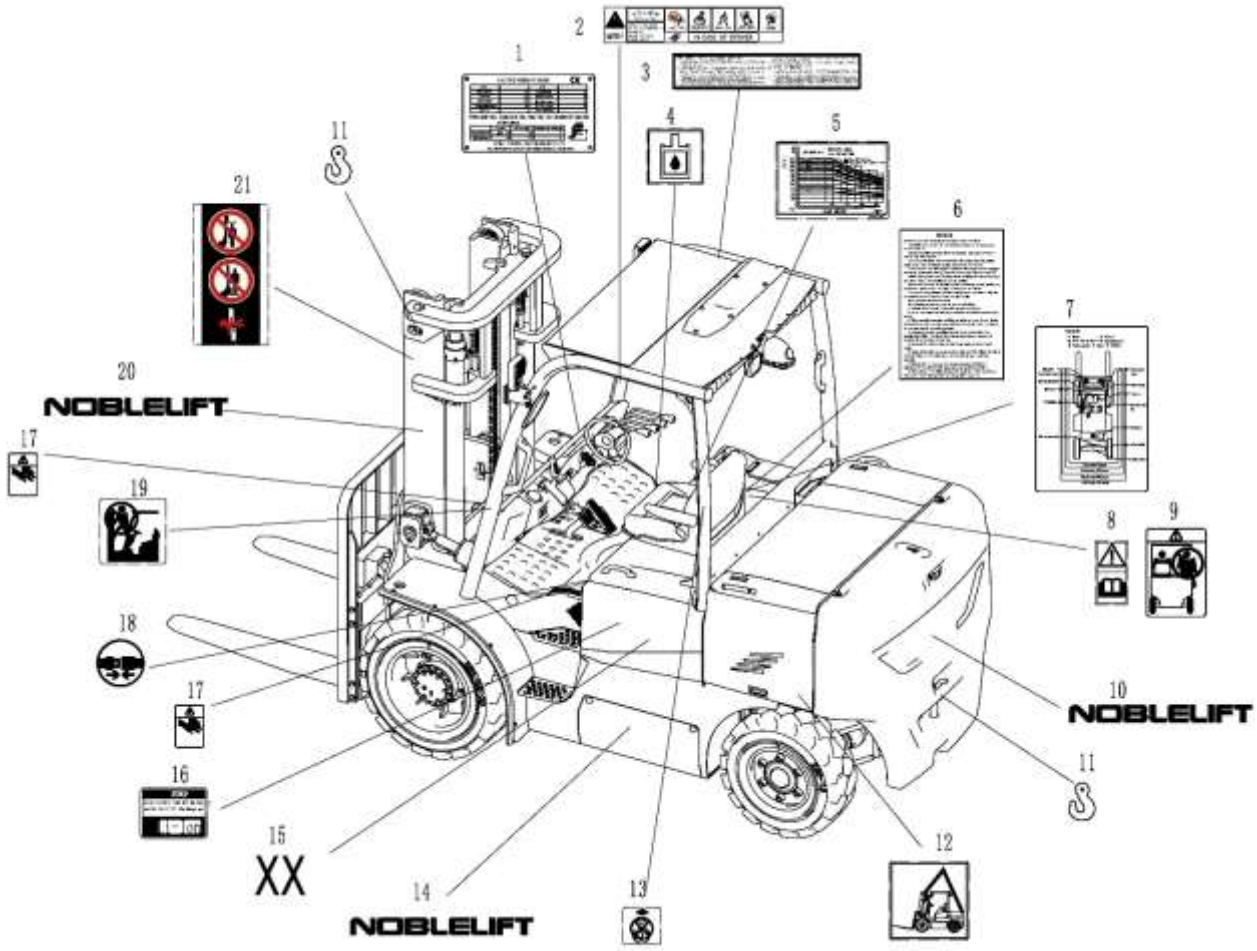


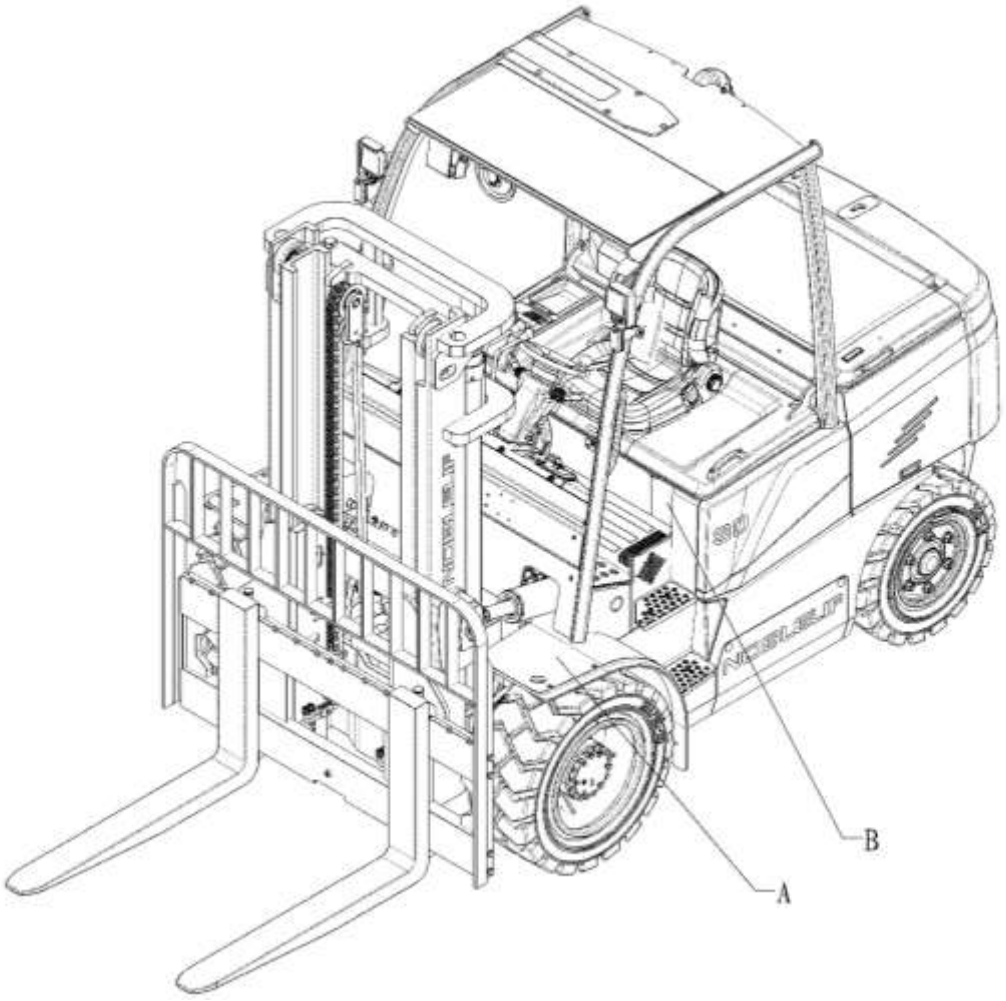
Fig.2-2

1、nameplate	2、operation tip	3、warningsign	4、Hydraulic oil
5、load curve	6、notes for use	7、Lubrication chart	8、reading tips
9、No sitting	10、Company logo - after	11、Lifting point	12、the whole vehicle lifting
13、No lifting	14、Company logo - side	15、Model identification	16、charging logo
17、Squeeze mark	18、safety belt	19、No climbing	20、Company logo - mast
21、No standing			

2.3 Frame number location

The vehicle is equipped with a unique frame number, which is strictly prohibited to be altered or

intentionally damaged. In case of damage, please contact relevant departments or our company in time.



A B

Fig. 2-3

Frame number：XXXXXXXXX

Frame number location： A or B，(Open the above of the rear panel of the machine cover)

The manufacturer reserves the right to change the product design and specification without prior notice for the requirement of continuous product improvement. If you want to know the latest product parameters, please contact us. All parameters of this manual are subject to the date of publication.

2.4 Disassembly and installation

2.4.1 Attention points

1. Only qualified operators can disassemble or repair the parts of the vehicle.
2. Before starting the disassembly and detection operation, park the vehicle on a flat ground and wedge the wheel, otherwise it will cause the vehicle to move accidentally. At the same time, place the main switch in the off position and disconnect the battery plug.

3. Remove all rings, watches and other metal items from your body before starting the disassembly and inspection operation to avoid accidental short circuits.
4. Please use the correct tools in the disassembly process, if required, please use the marked special tools.
5. Please choose the appropriate lifting device according to the size and weight of the parts to be removed to avoid danger.
6. Be sure to install the sling securely before lifting to avoid slipping. Keep the sling tensioned during lifting.
7. When removing a heavy part from the vehicle, be careful not to lose balance and break it.

2.4.2 Description of lifting point of each disassembled part

1. Lifting instructions of the lifting system Figure 2-20

Maximum weight (excluding accessories) not exceeding 2000kg

Lifting position

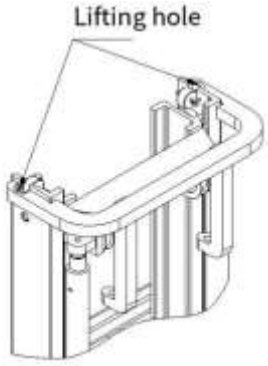


Fig. 2-4

2. Overhead guard lifting instructions Figure 2-21

Maximum weight less than 150 kg

Lifting position

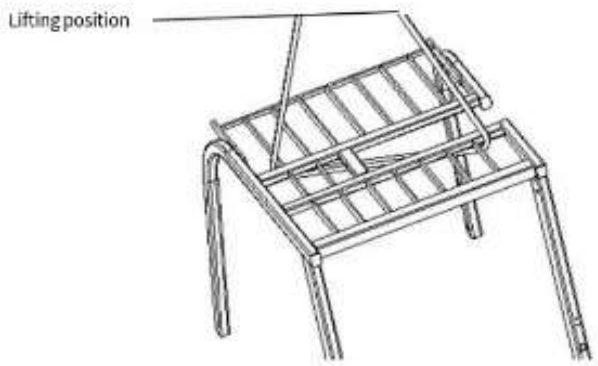


Fig. 2-5

3. Balance weight lifting instructions Figure 2-22

Maximum weight less than 3000 kg

Lifting position

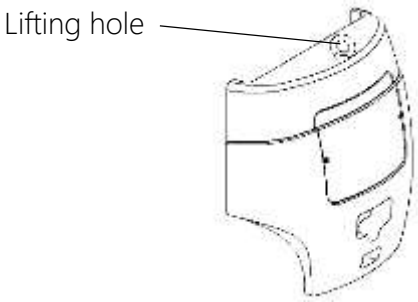


Fig. 2-6

⚠ **The lifting ring on the balance weight is only allowed to lift the balance weight, not the whole vehicle.**

4. Battery box lifting instructions Figure 2-23

Weight see battery nameplate

Lifting position

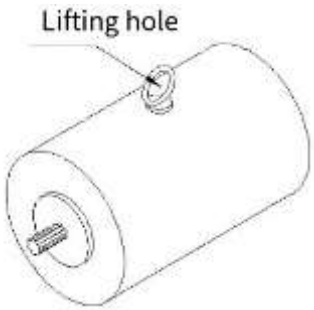


Fig. 2-7

⚠ **The battery has the performance of balance weight at the same time, the user shall not be replaced at will, otherwise it will affect the balance of the whole vehicle and other performance.**

5. Walking motor lifting instructions

Maximum weight less than 200 kg

Lifting position

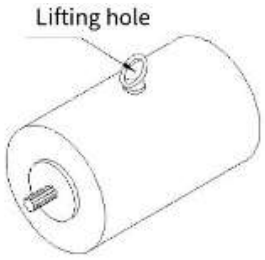


Fig. 2-8

3 Test handling equipment

3.1 Test run

After receiving our new stacker or when retest is required, perform the following steps before operating the vehicle (for the first time):

- Check whether contains all of the parts without damage
- Battery installation and charging
- Perform routine inspection and machine function check

In order to keep your vehicle in good performance, safe use, and economical operation, here are some considerations for proper driving operation.

Operating table introduction

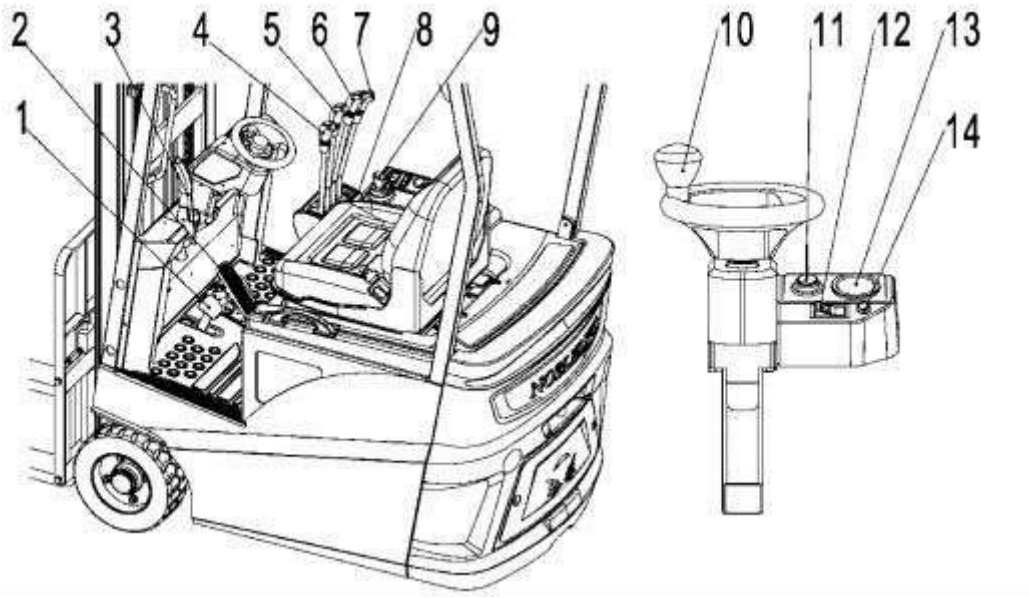


Fig. 2-9

1、Brake pedal
2、Accelerator pedal
3、Parking brake
4、Walking/lifting/horn joystick
5、tilt control lever
6、accessory control lever 1
7、accessory control lever 2
8、Gear switch
9、Emergency switch
10、Steering wheel
11、key switch
12、Turn signal switch
13、Instrument
14、horn button

3.2 Use in a new car

⚠ • The packaging on the new vehicle should be recycled according to the regulations of the local government after disassembly.

• The new car should be tested before use to make sure that all parts of the forklift can work normally (see page 75 1. Inspection before operation).

The service life of your vehicle depends on the use of the new vehicle. Please pay attention to the

following matters during the first 200 hours of operation：

⚠ ·No matter what season, before the operation, the heat engine must be run.

·The maintenance, think to do.

·Do not operate violently, do not use irrationally.

The run-in of the new vehicle

In the initial stage of being put into use, forklifts should operate under low load, especially within 100h, and the following requirements should be met:

— Overdischarge of the new battery during initial use must be prevented. General discharge 20% should be timely charging.

— The prescribed preventive maintenance should be thorough.

— Avoid sharp braking, driving or turning.

— Change oil or lubricate in advance according to regulations.

— Limit load weight to 70 ~ 80% of rated load.

3.3 Relationship between load and forklift stability

In the load curve, the center of the front wheel of the forklift is the fulcrum to maintain the balance between the vehicle body and the load on the fork, and pay attention to the load and the load center to maintain the stability of the vehicle.

Over the load curve, the rear wheel is in danger of being lifted and in a bad situation, the forklift can tip over, leading to a serious accident. Moving the goods closer to the fork tip has the same result as increasing the weight of the goods. In this case, the load capacity should be reduced accordingly.

3.4 Load center and load curve

The center of load is the distance between the front face of the cargo fork and the center of gravity of the cargo. Indicates the relationship between forklift load center and allowable load.

The load curve lable (allowable load) is affixed to the vehicle. If the lable is damaged or lost, it will be replaced with a new product.

If the vehicle is equipped with cargo handling accessories, such as side shifters, buckets or swivel forks, the allowable load is lower than that of the corresponding standard vehicle (without any accessory) for the following reasons:

Reduced load equivalent to the weight of the accessory.

The allowable load is reduced by the same principle because the length of the accessory causes the load center to move forward. The installation of accessories causes the center of load to move forward, which is called "center of load loss".

Do not exceed the allowable load attached to the load curve of the vehicle or equipment.

3.5 Forklift stability

The stability standards of forklifts are specified in IS0 or other standards, however, the stability described in these standards does not apply to all operating states, and the stability of forklifts varies according to the operating state.

Maximum stability is ensured in the following operating states:

1. The ground is flat and hard.
2. Operate under standard no-load or load condition.
3. Standard no-load state: the cargo fork or other bearing accessories are 30cm away from the ground, and the mast is tilting back in place without load.

Standard load state: the cargo fork or other bearing accessories are 30cm off the ground, the allowable load is loaded in the standard load center, and the mast is tilted back into place.

When loading and unloading goods, lean forward and backward as little as possible, unless the load is fixed rest or steel shelves are used, or low lifting height, it is never necessary to lean forward.

3.6 Forklift transportation, loading and unloading

1. Forklift transportation

⚠ ·When transporting by truck, in order to prevent the forklift from moving inside the truck, the wheel should be stopped and the forklift should be completely fixed with ropes.

·When loading, unloading and transporting on the road, pay attention to the full length, full width and full height, and comply with relevant regulations.

2. Forklift loading and unloading

⚠ ·Please use a board with sufficient length, width and strength.

·Effectively apply the truck's parking brake to stop the wheels.

·The board shall be firmly fixed in the center of the carriage, and no grease shall be attached to the board.

·The left and right height of the board should be the same, so that the vehicle can run smoothly when loading and unloading easily.

·To prevent danger, do not change direction or move sideways on the board.

·When loading the forklift onto the truck, in order to make the left and right tires on a board on at the same time, running slowly astern.

3.7 Preparation before driving

1. Check the position of the direction switch handle⑤ and turn the direction switch handle to the

middle position (N).

2. Turn on the key switch

Hold the steering wheel handle ball, then turn on the key switch so that the key switch is at "0N".

⚠ ·Even if the key switch is turned to "0N", it will take about 1 second from the start of the braking circuit to the start.

·Before the key switch is turned to "0N", if the shift lever is placed in the forward "F" or backward "R", the shift lever should be returned to the middle position "N".

·If the accelerator pedal is pressed rapidly, the vehicle may accelerate rapidly. Please pay attention to this.

3. Mast leans backward

Pull the lifting handle back to lift the cargo fork 150-200mm from the ground, and pull the tilting handle back to tilt the mast back.

4. Operate the direction switch handle

The direction switch handle determines the direction of travel (forward - backward). Forward F: Press the direction switch F forward.

Backward R: Press the direction switch R backward.

Release the parking brake pedal and press the brake pedal.

Fully release the parking brake handle downward, grasp the steering wheel with left hand, and gently place right hand on the steering wheel.

3.8 Drive

1. start

Remove foot from the brake pedal and gradually press down on the accelerator pedal,

Then the forklift started to move.

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

⚠ • Do not start and brake suddenly, otherwise it will cause the goods to fall.

2. slow down

Slowly release the accelerator pedal. If necessary, the brake pedal can be pressed. If it is not an emergency brake, release the accelerator pedal and slow down until come to a stop. However, even if the accelerator pedal is released rapidly, it will not cause emergency braking. In case of emergency, press the brake pedal to create an emergency brake.

⚠ • Slow down under the following circumstances:

a. When turning at a road junction;

b. When approaching goods or pallets;

c. When approaching the cargo pile;

d. In narrow passages;

e. When the ground/pavement is not good.

·When driving in reverse, must look behind: directly confirm the safety of the rear, relying only on the rearview mirror to reverse is dangerous.

3. Make turns

Forklifts are different from cars, because forklifts are rear-wheel steering, they should slow down when turning and pay attention to the swing of the rear of the forklift when turning the steering wheel.

⚠ ·In the case of steering, the faster the speed, the smaller the turning radius, the easier the vehicle is to overturn, please be sure to pay attention.

a. Simultaneous operation of driving and lifting (micro-operation)

b. First drive, let goods fork front near the goods 3-5 m.

c. Press the brake pedal completely. (Stop running)

d. Press the accelerator pedal to get the right working speed.

e. Operate the lifting handle to allow the cargo fork to be lifted.

⚠ • The simultaneous operation of driving and lifting (micro-operation) is an operation with high proficiency requirements. It is necessary to correctly understand the shape and center of gravity of the goods, confirm the stability of the vehicle, and carry out the lifting operation of the cargo fork at low speed. At the same time the operation must be very careful.

·Tilt operation while high is very dangerous. Cargo handling on the cargo platform Do not perform any operation other than the entry and exit of the cargo fork.

·In order to reduce the risk of high and high driving, lift operation should be carried out when it is very close to the cargo platform.

3.9 Parking and temporary parking

⚠ Safe stop

·The parking space should be as wide and flat as possible.

·When the unloaded vehicle has to stay on the incline, the mast of the vehicle is tilted down to stop the

wheel and make it unable to move.

- Parking in a safe place or designated place outside the work observation area.
- Use attention signs and signal lights when necessary.
- Should be parked on very hard road, pay attention to prevent sliding and sinking.
- When the fork cannot be dropped due to failure of the vehicle, hang cloth on the fork tip of the fork, and the direction is toward the side where people and vehicles cannot pass

⚠

- Pay close attention to road slippage and collapse.
- Lowering the fork after the vehicle has stopped completely, it is very dangerous to lower the fork while the vehicle is moving.
- Don't jump from the vehicle.
- When getting off, you must face the direction of the vehicle and use the pedal to get off.
- Perform a deceleration operation, press the brake pedal to stop the vehicle, and let the shift lever switch to the mid-range position "N".
- When parking, it should stop in a place that does not hinder other vehicles. Please do the following operations.

a. Pull the parking brake handle back into place to allow the parking brake to operate.

b. Lower the fork to ground.

c. Turn the key switch to 0FF.

d. Pull out the key and keep it.

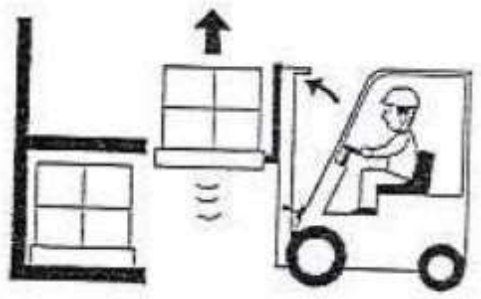
e. Be very careful when getting on and off the vehicle.

f. Park the forklift

☞ • When leaving the forklift, pull the parking brake handle completely and tilt the mast slightly forward. Lower the fork to the ground. When parking the forklift on the ramp, put pads under the wheels.

• When leave the forklift, take away the key

3.10 Stacking

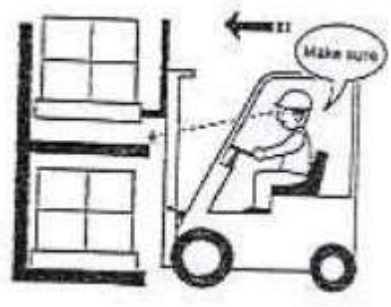


⚠ • Before starting to operate the forklift, check the following items:

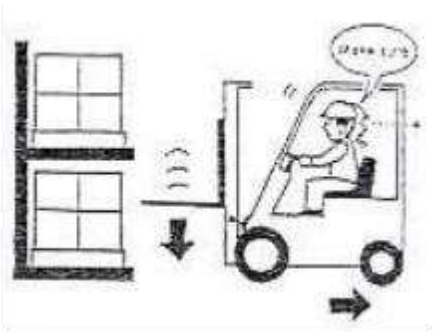
Ensure that there is no falling or damaging cargo in the loading area.

Make sure that no items and cargo piles get in the way of safety. When stacking, the following procedures should be followed:

1. Slow down when approaching the stacking area.
2. Park in front of the stacking area.
3. Check the security around the stacking area.
4. Adjust the position of the forklift so that the forklift is in front of the place where the goods are placed in the stacking area.
5. The mast is perpendicular to the ground and the lifting fork is beyond the height of the pile.
6. Check the stacking position and drive forward, stopping at the appropriate position
7. Make sure that the goods are above the stacking position and slowly lower the fork to ensure that the goods are put away



When the goods are not fully placed on the shelves or brackets：

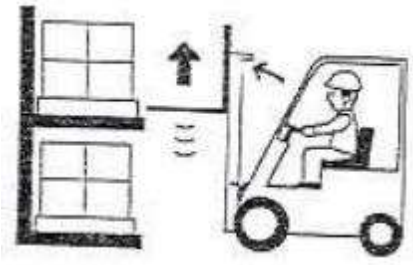


a. Lower the fork until it no longer carries weight.

b. Pull back the forklift 1/4 of the fork length.

c. Lift fork 50-100mm, move the forklift forward and put the goods on the appropriate stacking position.

d. Observe the space at the rear of the forklift and drive the forklift backward to avoid the fork colliding with the pallet or cargo.



e. Make sure the front of the fork is away from the cargo or pallet, and lower the fork for driving. (L50-200mm from the ground)

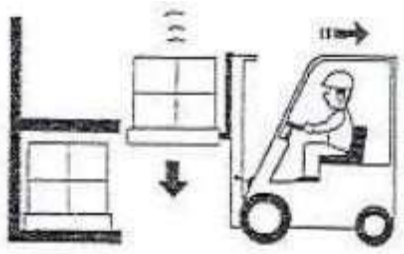
3.11 Unstacking

When unstacking, the following procedures should be followed:

1. Slow down when approaching the goods to be moved.

2. Stop in front of the goods (30cm away from the goods and the fork tips).
3. Adjust the position of the forklift before the load.
4. Make sure the goods are not overloaded.
5. Mast vertical ground.
6. Observe the position of the fork and move the forklift until the fork is fully inserted into the pallet.

☞ • When the fork is difficult to fully insert into the pallet:



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

2. Insert fork completely into pallet.

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

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

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

6. The mast tilts back to ensure the stability of the goods.

7. Transport goods to destination

3. 12 Storage

(1) Before storage

Before the forklift is stored, clean it thoroughly and check it according to the following procedures:

a. Remove oil and grease attached to the vehicle with cloth and water as needed.

b. When cleaning the vehicle body, check the overall condition of the vehicle, especially to check whether the car body is dented or damaged, whether the tire is worn, and whether the pattern is embedded with iron nails or stones.

c. Check for oil leakage.

d. Add grease as needed.

e. Check whether the joint surface of the hub nut and cylinder piston rod is loose, and whether the surface of the piston rod is bruised and stretched.

f. Check whether the mast roller rotates smoothly.

g. Lift the lifting oil cylinder to the top so that the oil fills the cylinder.

As long as the forklift is found to need repair, failure or unsafe factors, the situation should be reported to the management, stop using the forklift until it returns to a safe state.

(2) Daily storage

a. Stop the forklift truck in the designated place and use the wedge to cushion the wheel.

b. Put the shift handle in neutral and pull the parking brake handle.

c. Take off the key and keep it in a safe place.

(3) Long-term storage

On the basis of "daily storage" maintenance, the following maintenance and inspection are performed:

a. Take into account the rainy season, park the vehicle on high and hard ground.

b. Remove batteries from the forklift. Even if the forklift truck is parked indoors, if the place is hot and humid, the battery should be placed in a dry and cool place and charged once a month.

c. Apply anti-rust oil to exposed components such as oil cylinder piston rods and shafts that may rust.

d. Cover parts that are susceptible to moisture.

e. Start the vehicle at least once a week, install the battery, remove the grease on the piston rod and shaft, start the engine and fully preheat it, let the vehicle run slowly before and after, and operate the hydraulic control several times.

f. Avoid parking the forklift on soft surfaces such as asphalt in summer.

(4) Operation of the forklift after long-term storage

a. Remove moisture-proof cover.

b. Remove the anti-rust oil from the exposed parts.

c. Remove foreign matter and water from hydraulic oil tank.

d. After the battery is charged, install the forklift and connect the battery plug.

e. Carefully check before starting.

4 Hazardous energy control

4. 1 Lithium battery usage instructions

Lithium-ion phosphate battery refers to the lithium ion battery with lithium phosphate as the positive electrode material, the main application direction is power battery, this type of battery has the characteristics of small size, light weight, long cycle life, high safety, green pollution-free compared with lead-acid battery, and the cycle life of lithium-ion battery dedicated to forklift can reach 4000 times.

Please strictly follow the instructions on the lithium battery charger to charge the lithium battery. The charging temperature ranges from 0℃ to 40℃. Charging the battery at a low temperature below 0℃ with a high ratio will cause damage to the battery. In a low temperature below 0℃, please charge the vehicle immediately after use.

Discharge temperature range: -25 ~ 50℃, the discharge capacity at low temperature (-25 ~ 0℃) may be reduced compared with normal temperature conditions. 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. Therefore, it is not recommended to use at this temperature for a long time. If the ambient temperature exceeds the charge and discharge temperature range, the battery performance may be negatively affected or damaged, and the service life of the battery may be shortened.

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

Don’t operate electric vehicles equipped with lithium batteries at temperatures above 55 ° C or below -25 °C

In low temperature environment below 0℃, please charge the vehicle immediately after use

Do not flush the battery box directly to prevent water into the battery box

For non-professionals, do not touch, move, or disassemble the battery pack, high-voltage cables, or other components with high-voltage warning labels

Attention：

In order to achieve better use effect and extend battery life, contact the manufacturer every year, and the manufacturer's technical personnel conduct a battery performance test and balanced charging

If the vehicle is hit by a strong collision while driving, stop the vehicle in the safe area and check the battery pack area of the vehicle for damage

When the vehicle or battery pack is on fire, quickly get away from the vehicle to a safe distance, use a dry powder extinguisher to deal with the fire, use water or incorrect extinguisher to extinguish the fire may result in electric shock

Depending on the characteristics of the battery, the battery capacity attenuation range is 0% to 25% during the three-pack period

Don’t immerse or wet the battery pack.

Don’t put the battery pack into a fire or expose it to a high temperature environment that exceeds the temperature conditions specified in the lithium battery instructions for a long time, otherwise it may cause a fire.

Don’t use or store battery packs near heat sources;

Forbid the battery pack positive and negative short circuit;

Connect the positive and negative electrodes of the battery pack in strict accordance with the label and

instructions. Reverse charging is prohibited；

Do not Pierce the battery pack case with nails or other sharp objects. Do not hammer or step on the battery pack.

Disassembling battery packs and cells in any way is prohibited;

Do not place the battery pack in a microwave oven or pressure vessel;

When electrolyte leaks, avoid skin and eye contact with electrolyte. If exposed, wash the area with plenty of water and seek help from a doctor. It is forbidden for any person or animal to ingest any part of the battery or any substance contained in the battery cell;

Try to protect the battery from mechanical shock, collision and pressure shock, otherwise the battery pack may short circuit, resulting in high temperature and fire;

Don’t use battery packs in extremely hot environments, such as direct sunlight or inside a vehicle on hot days. Otherwise, the battery pack will overheat, which will affect the performance and shorten the service life of the battery pack;

In the process of charging and discharging the battery pack, if there is a peculiar smell or abnormal sound, please stop charging or discharging immediately;

If the above phenomenon occurs, please contact the manufacturer, do not disassemble without permission

1. Battery charging

Select the appropriate charger to charge the battery, and strictly follow the "operation and maintenance instructions" requirements of the charger.

⚠ **Before charging, check the connectors and cables to ensure that they are not damaged.**

Don’t charge under the following conditions:

—-Connector electrode has a damage.

—-The wiring terminals and cables are corroded.

These conditions can lead to sparks, damaged items, fires and explosions.

a. Turn off the key switch and charge

b. When plugging and unplugging the power connector, hold the plug-in or handle instead of holding the cable.

⚠ **Don't unplug the cable.**

• When the cables and power connectors are damaged, you should contact our sales department to replace the damaged cables and power connectors.

Disconnect charging process

⚠ ·**The steps of the disconnected charging process must be strictly operated in accordance with the requirements of the "Operation and Maintenance manual" of the charger used.**

·Do not unplug the charger when charging, otherwise it will produce electrical sparks and cause danger.

2. Replace the battery

When the forklift has been used for a continuous working cycle and the battery power is completely used up, the battery on the original forklift should be replaced with another set of fully charged batteries in time, and the replaced battery should be charged.

⚠ ·When replacing a battery, ensure that the battery matches the forklift. If the battery is not matched with the forklift, the working time of the forklift will be shortened or the forklift will tip over.

• Replace the battery on the platform. Follow these steps to replace the battery:

⚠ • When another forklift is used as a lifting device to replace the battery, appropriate slings (accessories) should be used.

• Lifting batteries should be operated by professionals

a. Open the battery cover.

b. Unplug the battery.

c. Use gas spring or other ways to make sure that lock the battery cover, to avoid falling on the battery cover parts in the human body or body.

d. When lifting the battery out of the forklift, be careful not to damage the steering wheel or other forklift parts.

e. After placing a set of fully charged batteries, the battery plug should be firmly connected.

f. Cover the battery top cover.

⚠ • When covering the top cover of the battery. Be careful not to press your fingers.

·When lifting the battery, care should be taken to avoid the battery box swing and damage the vehicle body.

3. Storage of lithium batteries

Battery pack long-term storage (storage time more than 6 months), the lithium battery needs to be completely powered off, the company recommends storage at not less than 60% of the power, storage environment humidity is not higher than 95%RH.

A full charge, full discharge within the specified time, as required storage.

Table 6-7

Storage environment	Storage environment	Storage time

temperature	relative humidity	
-10～0℃	5%～95%	≤6 months 60%SOC
0～40℃	5%～95%	≤6 months 60%SOC
40～45℃	5%～95%	≤2 months 60%SOC

4.2 Lithium battery recycling and disposal

In order to avoid environmental damage, do not dispose of used machine lubricating oil, battery and filter by yourself. Dispose of such waste products in accordance with local laws or by contacting Noblelift distributors or authorized waste disposal agencies.

Oil and gas, chemicals, batteries, tires and other combustible materials must be stored in a safe location to prevent fire and environmental damage from these materials. Illegal handling of these materials can lead to environmental damage. Please contact Noblelift Sales or a professional waste disposal agency to properly dispose of these materials.

When the battery is replaced by a new battery or the whole forklift is scrapped, the environmental hazard should be considered when handling and recycling the battery. For example, some battery forklifts use lead-acid and lithium batteries.

The materials contained in the batteries are harmful to the environment and humans, so the batteries should be returned or sent to the manufacturer or waste disposal facility for recycling.

5 Hydraulic system

5.1 Overview

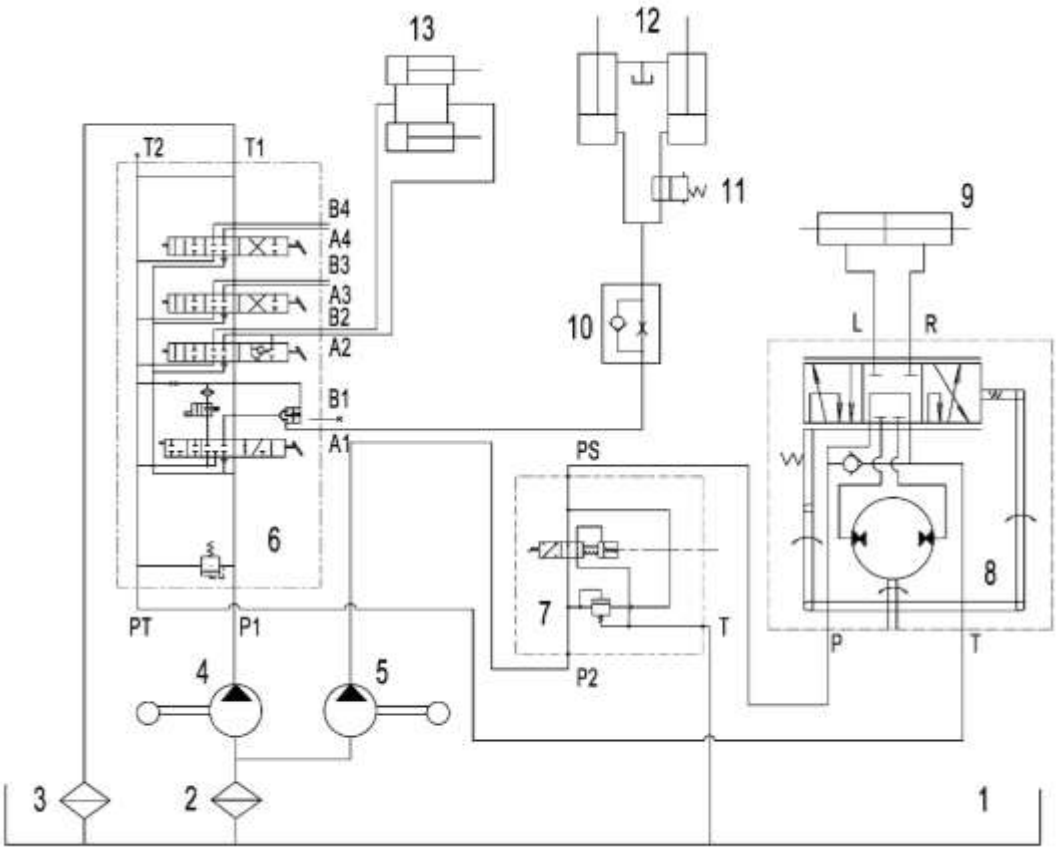


Fig.5-1 Hydraulic system schematic diagram

The hydraulic system is composed of working oil pump, multi-way valve, lifting cylinder, tilt cylinder and pipeline. As shown in the figure, the hydraulic oil is supplied by the oil pump connected with the motor, and then the multi-way valve distributes the oil to each cylinder.

1. Hydraulic oil tank
2. Oil suction filter
3. Oil return filter
4. Working gear pump
5. Steering gear pump
6. Multiway valve
7. Hydraulic booster
8. Steering gear
9. Steering cylinder
10. Speed limiting valve
11. Cut-off valve
12. Lifting cylinder
13. Tilt cylinder

a. Oil pump

The oil pump is hydraulic gear pump.

The hydraulic system is equipped with two hydraulic gear pumps, which provide pressure oil sources for

the mast hydraulic pressure and the steering brake hydraulic pressure. The gear pump for mast work is an external meshing helical gear pump with axial clearance automatic compensation and radial hydraulic balance. Three open structure with "8" shape stop positioning is adopted. DU bushings are installed in the front and back covers of cast iron, and the intermediate is a special aluminum alloy forging. Therefore, it is resistant to impact, has a wide range of oil temperature and speed, and can maintain high performance even in the case of high temperature and low speed. The gear pump for steering brake adopts dual pump structure, asymmetric tooth gear, integral pump body, DU bushing and powder metallurgy plate. It has the characteristics of small pressure pulsation and low noise.

■ Forklift should be used strictly according to the requirements, not overload.

■ Oil requirements: Use L-HM32 or similar viscosity of anti-wear hydraulic oil in summer, or use L-HV32 low temperature hydraulic oil in winter or in cold storage.

■ When starting for the first time, the air in the system should be discharged without load until there is no bubble.

■ The oil should be kept clean, and the fuel tank and pipeline should be fully cleaned before refueling.

■ Regularly check the cleanliness of the oil and whether the oil filter is blocked, and replace it if necessary.

Common troubleshooting methods:

Table 5-1 Common faults

Order	Fault	Possible reaso	Elimination
1	The oil pump does not pump out	Fuel tank oil level is low	Fuel to the specified oil level
		The suction oil pipe or filter is blocked	Clean the oil circuit and fuel tank. If the hydraulic oil is dirty, replace it
2	Oil pump output pressure is low	Bearing wear: retainer, O-ring damage	Fill with calcium based grease
		Safety valve adjustment erro	Use the pressure gauge to increase the pressure
		There is air in the oil pump	Tighten loose joint on suction side
			Fill the tank with hydraulic oil

			Check oil pump seal
			After the air bubbles in the tank disappear, use the oil pump.
3	Oil pump noise	The oil suction side hose is twisted or the filter screen is blocked to produce air cavitation	Adjust or replace hoses and clean filters.
		The air is inhaled from the loose joint on the suction side	Retighten each joint
		Air cavitation is caused by high viscosity of hydraulic oil	Replace with a new hydraulic oil with a viscosity suitable for the oil pump
			Work only when the oil temperature is normal
		There are bubbles in the hydraulic fluid	Check the cause of the bubbles first. Then take action.
4	Oil pump leakage	The oil seal of the oil pump is damaged, the O-ring is damaged or the sliding surface of the oil pump is worn.	Replace faulty parts

b. Multi-way valve

The multi-way valve adopts two-piece four-type, hydraulic oil from the work pump is controlled by the multi-way valve stem, and the high-pressure oil is distributed to the lifting cylinder or the tilt cylinder. The multiway valve has a safety valve and a self-locking valve. The safety valve is located on the upper side of the oil inlet of the multi-way valve to control the system pressure; The self-locking valve is located on the tilt valve plate, which is mainly used to prevent the tilt cylinder from causing serious consequences due to misoperation of the joystick in the absence of pressure source. A check valve is provided between the oil inlet and the oil suction port of the lifting valve plate and between the oil inlet of the lifting valve plate and the oil inlet of the tilting valve plate.

The shape of the multi-way valve is shown.

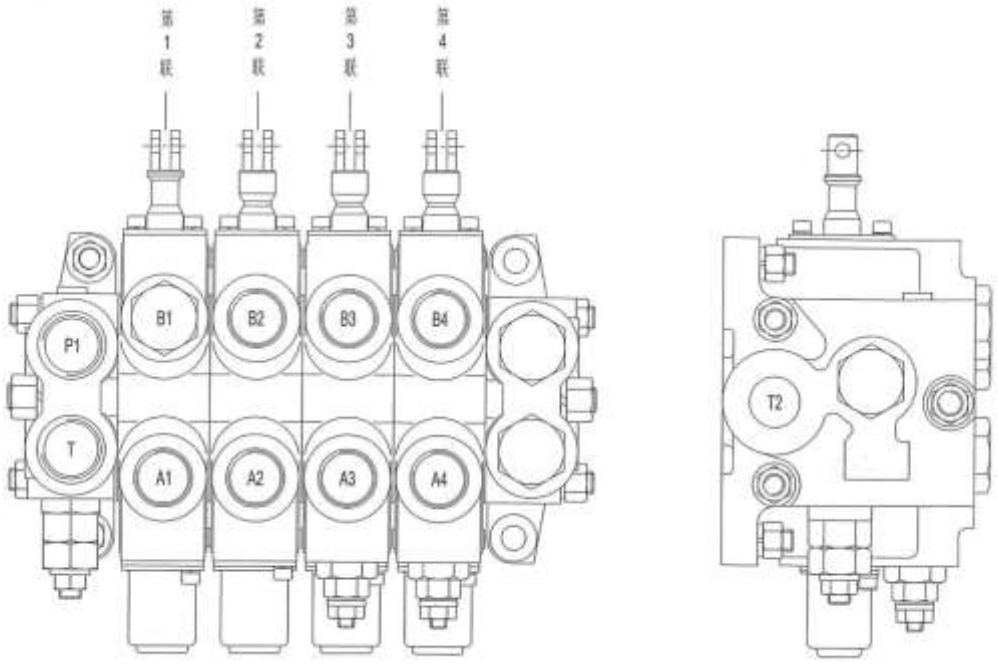


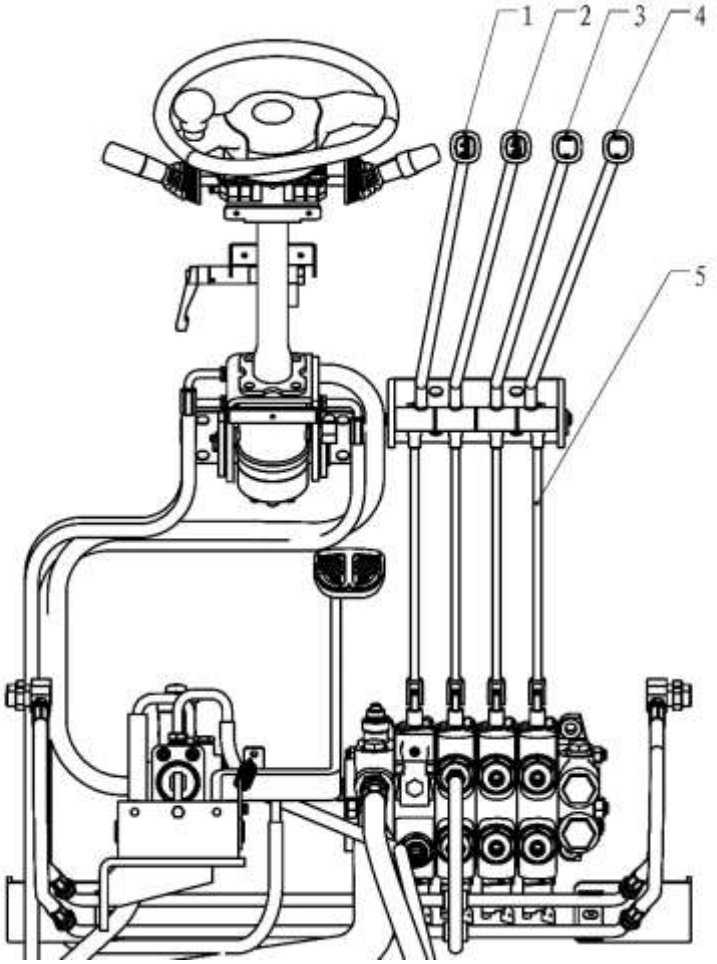
Fig. 5-2 Multi-way valve figure shape

Table 5-2 Mult-iway valve parameter table

Order	Parameter		Parameter
1	Valve stem diameter		20mm
2	Inlet flow		180L/min
3	Allowable back pressure		1.5Mpa
4	Main safety valve sets the pressure		21Mpa
5	Forward tilt back pressure valve	Control pressure	≤2Mpa
6		Internal leakage amount	≤40ml/min
7	Stem control force		≤300N
8	Working oil temperature		-25℃~105℃

Multi-way valve operating mechanism. Shown in figure 5-3

The multi-way valve is operated by a joystick, all the joysticks are mounted on a connecting shaft, which is fixed to the vehicle body through a support, and the joystick operates the slide valve through the connecting rod.



1. Lift joystick 2. Tilt joystick 3. Side shift joystick
4. Accessory joystick 5. Connecting rod

Fig.5-3 Multi-way valve operating mechanism

⚠ Note: The pressure of the safety valve has been set by the manufacturer, and the user shall not adjust it by himself.

Fault analysis

If the hydraulic system faults, find out the cause according to the table below and make the necessary repairs.

Table 5-3 **Common faults and elimination**

Order	Fault	Possible reason	Elimination
1	The safety valve pressure is unstable or cannot be adjusted	The pressure adjusting screw is loose	Fuel to the specified oil level
		Pressure regulating spring screw is deformed or damaged	Change
		The valve core of the safety valve is worn or stuck	Replace or disassemble and reassemble
		Oil pump failure	Maintenance oil pump
2	The lifting motor is closed, the	Tilt back pressure valve wear internal leakage	Replace the stem and back pressure valve

	tilting lever is operated, and the mast is tilted forward.	Tilt back pressure valve spring is broken	Replace the spring
		Tilt valve stem O-ring damaged	Replace the O-ring
		Tilting cylinder seal failed	Maintenance cylinder
3	The mast is unstable when tilted forward	Tilt back pressure valve failure	Replace the tilt back pressure valve
4	When the lift joystick is in the middle position, the cargo fork frame drops obviously	Excessive wear clearance between valve body and stem	Replace stem with required clearance
		Stem position is out of center	Keep the stem position in the middle
		Lifting cylinder seal failed	Maintenance oil cylinder
		Overload valve is worn or stuck with dirt	Replace or clean the overload valve
5	Stem reset failure	The reset spring is damaged or deformed	Replace the spring
		Dirt between valve body and stem	Clean
		Control mechanism stuck	Adjustment
		The reset parts are not coaxial	Reassemble, keep coaxial
6	External leakage	The O-ring is damaged	Change
		Poor sealing of oil port joint	Check the tightness of the joint of the corresponding component
		The valve plate bolt is loose	Clean sealing surface and re-tighten
		Safety valve lock nut loose	Fastening
7	Joystick can't move	Multi-way valve joystick adjustment handle interference	Adjustment

C. Hydraulic steering gear

The hydraulic steering gear belongs to the open-core non-reaction type cycloidal rotary valve type hydraulic steering gear, and the valve body is integrated with an overflow valve, a two-way buffer valve, a two-way oil refill valve and an inlet check valve, making the structure more compact. The steering gear is mainly composed of a rotating valve and a cycloidal pin gear engaging pair. The rotating servo valve is composed of a valve core, a valve sleeve and a valve body to control the direction of the oil flow. The valve core is directly connected with the steering column of the steering wheel. A set of meshing gear is composed

of rotor and stator, namely cycloidal pin gear pair; When rotating the steering, it acts as a metering motor to ensure that the amount of oil in the steering cylinder is proportional to the Angle of the steering wheel; In the manual steering equivalent to manual oil pump; The linkage shaft and the pull pin connecting the rotor and the valve sleeve ensure that the valve sleeve is synchronized with the rotor during the power steering, and play the role of transferring torque during the manual steering. Spring plate: ensure that the operation does not rotate when the valve returns to the center. The check valve between inlet and return oil mouth; During manual steering, the oil in one chamber of the steering cylinder is sucked into the oil inlet through the return port, and then pressed into the other chamber of the cylinder through the cycloidal pin gear pair. In the power steering, ensure that the oil does not flow directly from the P port to the T port.

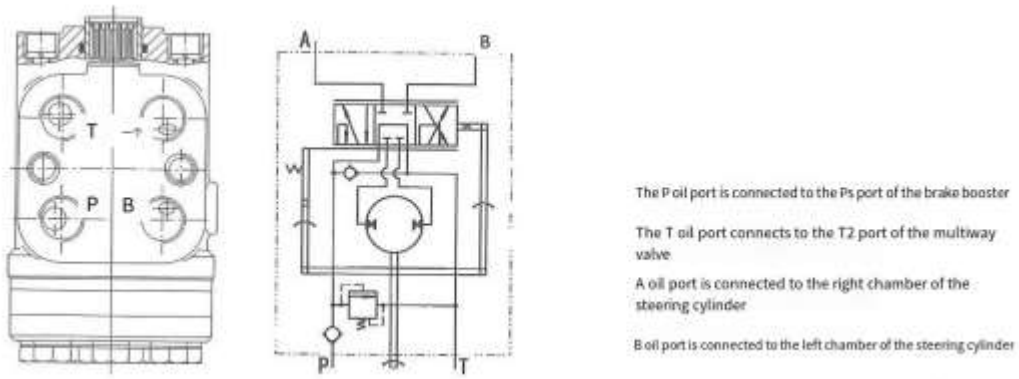


Fig.5-4 Hydraulic steering gear

The hydraulic steering gear has the characteristics of easy operation, reliable operation, less failure, simple and compact structure, convenient installation and arrangement, and can realize manual steering when the machine is shut down. At the same time, it can control the working pressure of the steering system, give cylinder pressure buffer and oil filling protection, and prevent the inversion of the system oil flow direction.

Table 5-4 Hydraulic steering gear parameter table

Order	Feature	Parameter
1	Displacement	250ml/r
2	Rated flow	25L/min
3	Maximum inlet pressure	16Mpa
4	Relief valve set pressure	13Mpa
5	Buffer valve set pressure	19Mpa
6	Continuous back pressure	≤2.5Mpa

7	Oil thread	M20x1.5 O-ring
8	Sealing mode of oil port	Cone angle seal
9	Weight	7kg

Table 5-5 **Common faults and elimination:**

Order	Fault	Possible reason	Elimination
1	Steering gear back cover, stator, isolation pad and valve body leak	The bolt at the binding position between the rear cover stator and the valve body is loose or the combination sealing washer or O-ring on the binding surface is damaged.	Interval and evenly tighten bolts to reach the specified value; Replace the seal ring.
2	Leakage at steering gear journal	The sealing ring at the steering gear journal is too worn or damaged	Replace the seal ring.
3	Slow steering wheel light, fast steering wheel heavy.	The oil pump does not supply enough oil to the steering gear	Check whether the oil pump works normally and the pipeline is smooth.
4	There is foam in the oil and it makes an improper noise. The steering wheel rotates while the cylinder moves and doesn't move	There's air in the steering system	To vent air from system, check to see if the suction tubing leakage or return pipe mouth is already in the liquid level.
5	Turning heavy continues to occur	The tank fluid is below the specified position	Refuel to the prescribed height
		The oil is too viscous	Use specified hydraulic fluids
6	Both fast and slow steering wheels are heavy, and	Check valve between P and T oil circuit in valve body fails	If the steel ball is lost, load the steel ball; If the stolen steel ball is

	steering is stress-free		stuck, it should be cleaned; In both cases, the recovery effectiveness of the sealing tape should be checked.
7	No-load or light load steering Light increase load steering heavy	The relief valve is blocked by dirt or spring failure or the seal ring is damaged	Clean the relief valve (need to check the effectiveness of the seal belt recovery) or replace the spring disc or seal ring.
		The relief valve pressure of the system is lower than the required steering pressure value	Adjust the relief valve pressure to the specified value (but not more than 16Mpa)
8	The steering wheel does not reset itself	Spring plate breaks or produces excessive permanent deformation	Spring plate replacement (do not use alternatives)
9	The steering wheel rotates or automatically swings from side to side	The mutual position of rotor and linkage shaft is wrong	Stop immediately! Align the teeth with the impact point on the linkage shaft with the tooth groove of the rotor spline (the weakest point on the end face).
10	The steering cannot be turned to the limit position	Steering system safety valve pressure is low	Appropriately increase the safety valve pressure (it is best to adjust under the condition of pressure gauge)
11	The steering wheel can be easily turned after the steering has been turned to the limit	Low pressure two-way buffer valve	Appropriately increase the buffer valve pressure

	position		
12	When the power is off, the steering wheel rotates but the cylinder does not move	The radial clearance or axial clearance of the stator is too large	Replace the rotor and stator meshing pairs
		Oil viscosity is low	Change hydraulic oil
13	The pressure of the steering system is not adjusted high or low	Two-way buffer valve failure (steel ball is stuck by dirt or spring failure, seal ring damage)	Clean the two-way buffer valve and replace the spring or seal ring
14	The pressure of the steering system is not adjusted high or low	Spring break	Spring replacement
		The safety valve port is not well sealed, causing the valve assembly to open.	With grinding safety valve core and seat or replacement parts.
		The valve core is stuck due to burrs or oil	Disassemble, inspect, repair.
		The valve core works poorly	Check whether the valve core is got stuck in oil dirt
		The spring is bent or too soft	Spring replacement
		Oil is not clean, the damping valve core hole plug	Replace the clean hydraulic oil and dredge the mud hole.

d. Oil return filter

The selective pipeline filter is installed in the hydraulic oil return pipeline, which is used for the hydraulic system oil return fine filter, filter the metal particles produced by the wear of the hydraulic system components and the rubber impurities of the seals and other pollutants, so that the hydraulic oil flowing back to the tank is kept clean.

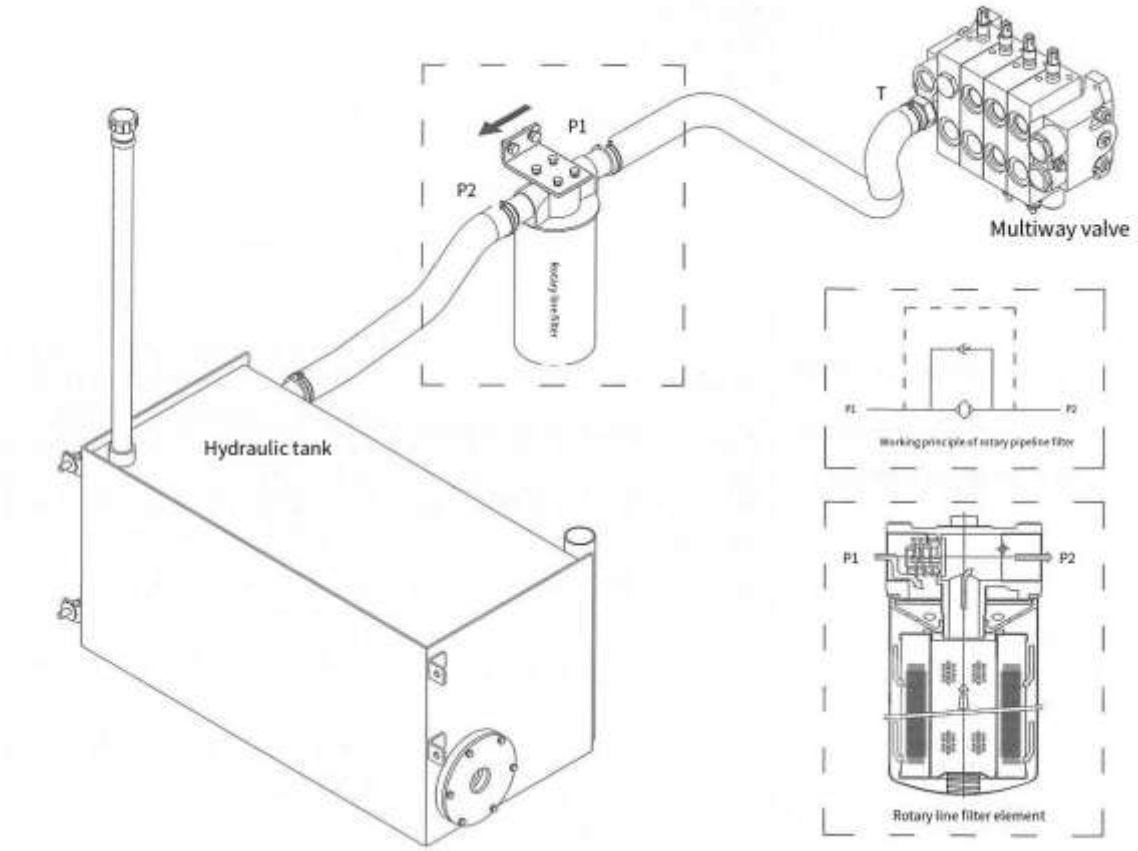


Fig.5-4 Oil return filter

Table 5-6 Parameter table

Order	Feature	Parameter
1	Filter type	SPB-10x10
2	Filter head type	SPH-10
3	Filter element type	SPBX-10x10
4	Maximum working pressure	0.7Mpa
5	Bypass valve opening pressure	0.25Mpa
6	Burst pressure	2.0Mpa
7	Maximum oil return flow	320L/min
8	Filtration accuracy	10um
9	Fitting joint pipe thread	R1 1/4
10	weight	3.0kg

Filter core replacement: the filter head is equipped with a transmitter to detect the use of the filter core.

When the pointer is in the red area, it means that the filter element blockage has been quite serious, the bypass valve of the filter head is open, and the filter does not play a filtering role at this time, and the new filter core must be replaced.

e. Hydraulic pipeline

Hydraulic system Hydraulic pipeline see figure

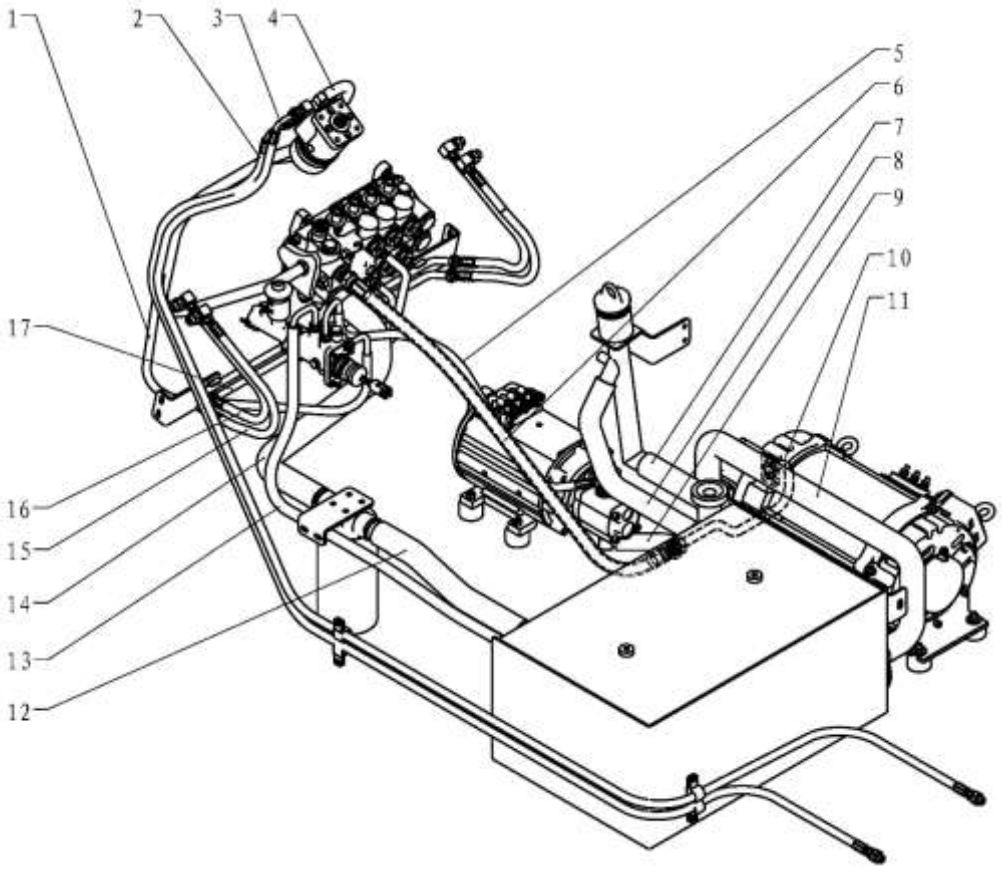


Fig.5-5 Hydraulic pipeline

1. Steering gear inlet oil pipe
2. Steering gear to steering cylinder left cavity tubing
3. Steering gear to steering cylinder right cavity tubing
4. Steering gear return pipe (low pressure)
5. Steering oil pump outlet pipe
6. Working oil pump outlet pipe
7. Refueling rubber pipe (low pressure)
8. Fuel tank vent tube (low pressure)
9. Working oil pump oil transition steel pipe
10. Working oil pump oil transition steel pipe
11. Working Oil pump suction pipe (low pressure)
13. Hydraulic booster oil return (low pressure)
14. Multi-way valve return line (low pressure)
15. Forward tilt oil tubing
16. Rear tilt oil tubing

17. Tilt steel pipe

5.2 Recommended Oils

Name	Number	Capacity (L)	Note
Hydraulic oil	L-HM32	70（FE4P60-80） 80（FE4P60-80）Three-stage mast	Temperature of use≥-5℃
	L-HV32		Temperature of use≥-20℃
Gear oil	85W/90GL-4	8	Temperature of use -15℃~ 49℃
	80W/90GL-4		Temperature of use -25℃~ 49℃
Brake fluid	DOT3/DOT4	0.4	Castrol
Lubricating grease	3#General lithium grease		

Waste materials such as waste oil, waste batteries or other materials must be treated and recycled in accordance with national regulations and if necessary handed over to a recycling company for recycling.

The oil level should not be lower than the minimum amount of oil required to lift the cargo.

Add oil to refueling point if necessary.

5.3 Oil cylinder seal replacement

1. Remove the cylinder head with a crescent wrench

2.Remove piston, then remove retaining ring

4. Remove dustproof seal and shield ring and Y-type seal

	
5. Remove o-seal and shield ring, then repair hose . Installation way is in reverse sequence	

5.4 Common fault analysis of hydraulic motor

Fault	Possible reason
Hydraulic pump motor does not work.	Poor connection or blown fuse. Check the battery connection. Check the key fuse. Check the hydraulic pump motor for possible fuse blowouts.
	The key switch or pump station contactor is not off. Turn off the key switch. Use a multimeter to check the power flow of the pump station contact coil and the pump station contactor. Check the voltage input 🎧 and upper limit of PIN4 in the meter. Switch. The key switch, lift button and pump station connector must be turned off for the power steering function to operate.
	The voltage is not enough. Charge or replace the battery. Check all battery cells for one or more defective battery cells. Check that the cable terminals are tightly aligned with the battery terminals and control panel connectors. Check whether the wires inside the cables are broken.
	Lifting and driving systems are not operating correctly.
	The battery installed on the vehicle is too small.

The battery will not last the full normal operating time.	Research and question the use of the vehicle in its full operating conditions, select and purchase the appropriate battery capacity to understand the operating time.
	The battery is not fully charged during the battery charging operation. Check that the battery is charged evenly (charging makes all batteries the same weight).
	The battery charging interval is too long or the charging battery cooling time is too short. Reduce battery operation duration. Please extend the battery cooling time before charging, and then put into use.
	The battery has one or more defective battery cells, which may cause
	Below the rated capacity and battery capacity. Test and look for defective cells. Replace defective batteries. Battery cells are connected in series, and one bad battery leads to a series connection with other batteries
	Hydraulic pump motor overheating.

5.5 Common fault analysis of hydraulic pump

Fault	Possible reason
Noise in pump	Low oil level.
	Oil is too thick (too viscous).
	The pump inlet line is limited.
	Worn parts in the pump.
	Oil is very dirty.
	Air leaks into the inlet line.
Oil temperature too high	Low oil level.
	Restrictions on the oil passage.
	Safety valve set too low.
	Oil is too thin.
	Exist air leakage in the system.
	Too much wear on the pump.
	The system is operating at too high a pressure. Safety valve set too high. Limits in flow control valves, check valves and oil lines.
Pump shaft seal leaks	The shaft seal is worn.
	Wear inside the pump body.
	Operation of too low oil level in the tank will cause suction on the seals.
	During installation, the seal is cut in the shoulder of

	the pump or keyway.
	The seal lip is dry and hardened by heat.
Pump can’t transfer fluid	The oil content in the tank is low.
	Pump inlet line limited.
	There is a leak in the pump inlet line. Loose bolt. Bay suction line defect.
	The viscosity of the oil is wrong.
	Too much wear on the pump.
	Pump shaft fault.
	The pump bolt does not have the correct torque.

6 Drive/brake system

6.1 Drive axle overview

The drive axle consists of the main reducer assembly (including the differential and parking brake), the wheel side reducer and the housing. The spline sleeve at the input end of the main reducer is connected with the walking motor. The walking speed of the forklift increases with the increase of the motor speed. The change of the driving direction is to change the rotation direction of the motor. The basic structure of the drive axle is shown in Figure 2-3: It is mainly composed of the axle housing assembly, the main transmission device, the half shaft, the wheel side reducer and the left and right shoe brake.

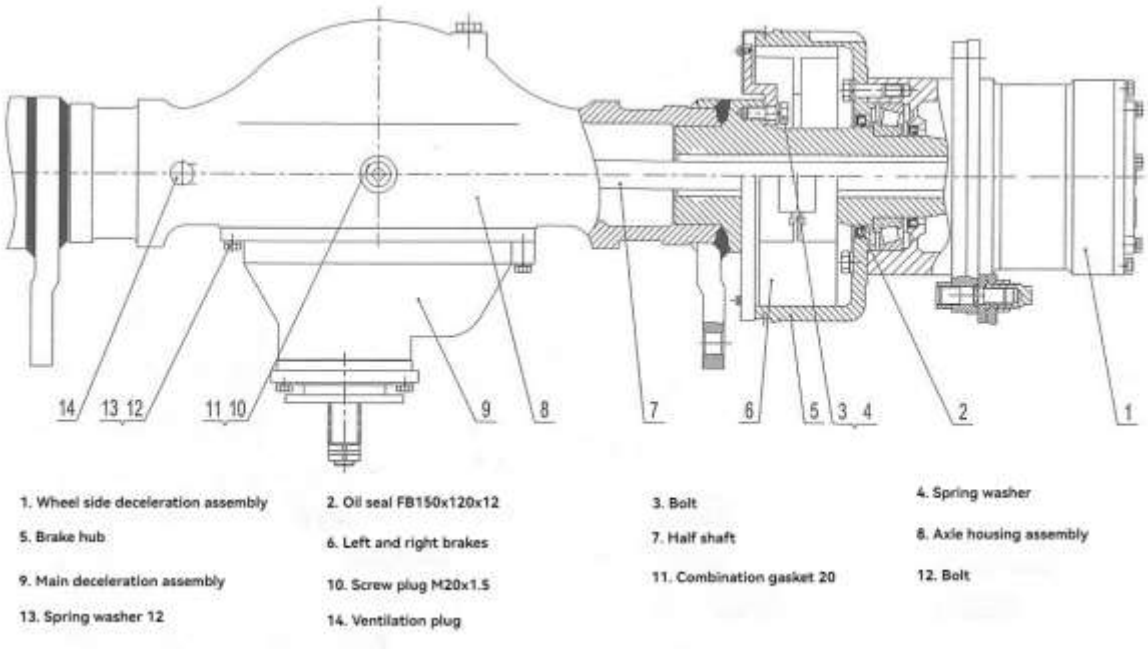


Fig.6-1 Drive axle

The working principle of the drive axle is shown in Figure 6-2: the driving torque is input to the main

drive, and the driving bevel gear and driven bevel gear are installed vertically to change the direction of the power, reduce the speed, and increase the transmitted torque, and then the power is transmitted to the wheel edge through the differential and half shaft, and the movement and torque are transmitted to the left and right driving wheels after the wheel edge reduction mechanism is further decelerated.

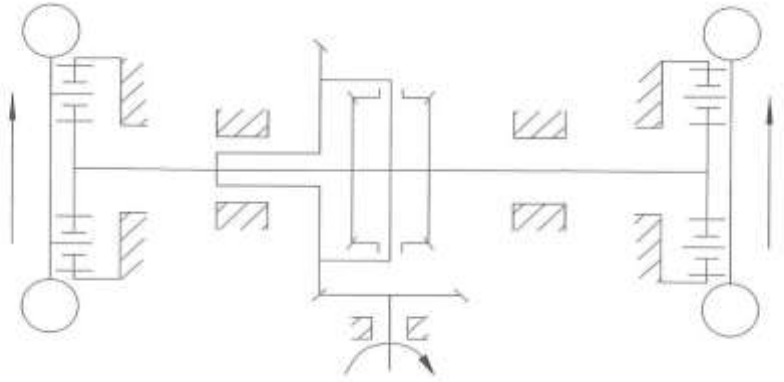


Fig.6-2 Working principle of drive axle

Drive axle main technical parameters

Table 6-1 Drive axle main technical parameters

Overall speed ratio	30.678
Main reduction ratio	5.625
Wheel side speed ratio	5.454
Axle load	185kN
Brake pressure	35kN.m
Braking torque	20.8kN.m
Brake pressure	10Mpa
Weight	580kg

6.2 Common troubleshooting methods

Table 6-2 Drive axle fault analisis

Order	Fault	Possible reason	Elimination
一	Work sometimes has abnormal sounds	1、Parts friction 2、Poor gear meshing 3、Poor lubrication	1、Disassemble and repair or replace parts 2、Reassemble and adjust 3、Improve lubrication

二	Oil leakage	1、Oil seal burning and aging 2、The bolt is loose 3、Poor lubrication 4、The oil level is too high	1、Replace the oil seal 2、Tighten the bolts 3、Improve lubrication 4、Release oil to the specified position
三	Axle housing temperature too high	1、Poor lubrication 2、Improper assembly of gears and bearings	1、Improve lubrication 2、Adjust according to the requirements of the drawing
四	Brake lock	1、Brake pad and brake hub are stuck 2、There is a problem with the brake return oil circuit	1、Adjust the clearance of brake pads 2、Check the brake oil return circuit

6.3 Braking system

The braking system of this vehicle is divided into service braking system and parking braking system. The braking principle diagram is shown in Figure 2-8.

The service braking system realizes the braking of the vehicle through hydraulic power. The system is mainly composed of brake pedal mechanism, hydraulic power brake, brake master pump, brake pipeline and service brake. The hydraulic booster and the brake master cylinder assembly are connected in series to form the booster brake, which makes the foot operation more light and reduces the fatigue strength of the operator. Even in the case of hydraulic power failure, it can still be reliably braking with the help of mechanical braking.

Parking brake system is mainly composed of parking brake pull rod, brake soft axle, shoe type brake and

so on.

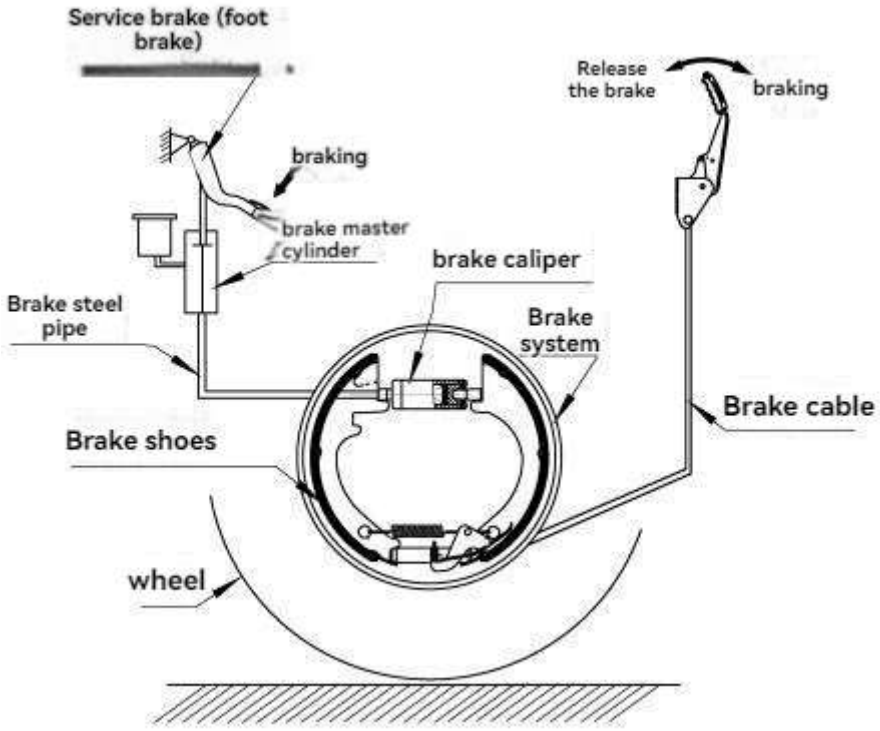


Fig.6-3 Brake schematic figure

1) When driving, when stepping on the foot brake, by pushing the brake fluid in the brake master pump through the brake steel pipe into the brake branch pump, push the brake shoe to realize the service brake, release and cancel the service brake;

2) When parking, when pulling the brake backward, pull off the brake shoe through the brake cable, so as to realize the parking brake, release and cancel the parking brake.

Table 6-3 Parameter table

Brake pedal	Free travel	10-20mm
	Pedal height from front bottom plate	150±5mm
	Step down height	＞60mm
Hydraulic booster	Rated flow	25L/min
	Rated pressure	16Mpa
	Power ratio	4
	Idle stroke	0.6-1.2mm
	Sequence valves adjust pressure	4±0.55Mpa
Brake master pump	Type	Quick-charge type
	Brake piston full travel	28±1mm
	Storage tank capacity	150ml

	Rated working pressure	10Mpa
	Brake fluid	DOT3或DOT4
Service brake	Type	Hydraulic pressurization, internal expansion front wheel mechanical braking
	Brake shoe wear limit (to rivet head)	0.25-0.5mm
	Brake shoe wear limit (to rivet head)	＞0.5mm
Parking control	Type	Mechanical, acting on the parking brake
	Travel	50mm（Control force 250N）

a. Brake pedal

The structure of the brake pedal is shown in Figure 2-3. The pedal converts the stepping force acting on the pedal into the brake oil pressure through the push rod of the brake master pump.

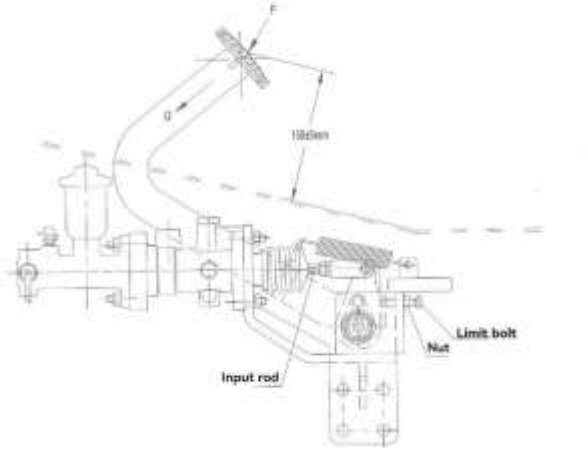


Fig. 6-4 Brake pedal assembly

Brake pedal adjustment:

◎ Adjust the brake pedal limit bolt so that the P point on the pedal pad is 150mm away from the front bottom plate, and tighten the nut;

◎ Integral hydraulic power brake input rod length, make P point in the Q direction of the empty stroke of 1mm-

3mm, and lock the nut;

◎ When the brake pedal is gradually pressed down 10mm-20mm, the brake light switch should be fully switched on, and the brake switch should be disconnected when the foot is released to this state.

b. Hydraulic booster

The hydraulic booster and the steering system share a set of hydraulic oil source, can work separately, if necessary, can be used jointly, and do not interfere with each other.

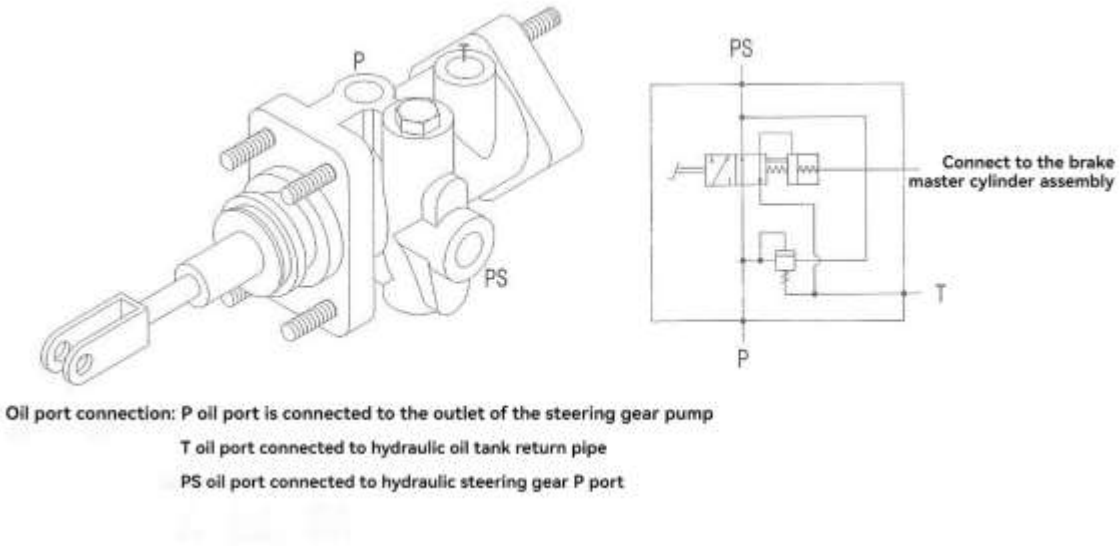


Fig.6-5 Hydraulic booster structure figure

Troubleshooting method of hydraulic booster：

Table 6-4 Fault table

Order	Fault	Possible reason	Elimination
1	Brake can not work effectively	Oil leakage in oil circuit	Repair, refueling
		Oil pump failure	Repair, refueling
		Foreign objects in the slide valve	Clean or replace
		Foreign objects in the pressure reducing valve	Clean or replace
		sealing ring is worn and leaking oil	replace
2	Brake too hard	Slide valve fails	replace
3	Brake stuck	Foreign objects in the slide valve	Clean or replace
		Output rod absorbs impurities	Clean or replace

c. Brake master pump

The master pump includes a seat, a check valve, a return spring, and a main skin bowl, piston and auxiliary skin bowl. The end is fixed with a stop washer and stop wire, and the exterior is protected by a rubber dust cover. The piston of the master pump is operated by the brake pedal through the push rod. When the brake pedal is stepped down, 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 skin bowl blocks the oil return hole. After the main skin bowl is pushed through the oil return port, the brake fluid in the front chamber of the main pump is compressed and the check valve is opened, thus flowing through the brake line to the branch pump. In this way, each branch pump piston extends out, so that the brake shoe friction plate and the brake drum contact, to achieve the effect of slowing down or braking. At this time, the rear chamber of the piston is replenished with brake fluid from the return and intake ports. When the brake pedal is released, the piston is pressed by the return spring, and the brake fluid in each brake pump is also compressed by the brake shoe return spring, so that the brake fluid returns to the main pump (piston front chamber) through the check valve, the piston returns to the original position, and the brake fluid in the main pump flows back to the oil storage tank through the oil return port. The pressure of the check valve is adjusted to a certain proportion of the remaining pressure in the brake line and brake sub-pump, so that the branch pump skin bowl is correctly placed to prevent oil leakage and eliminate the possible air blockage during emergency braking.

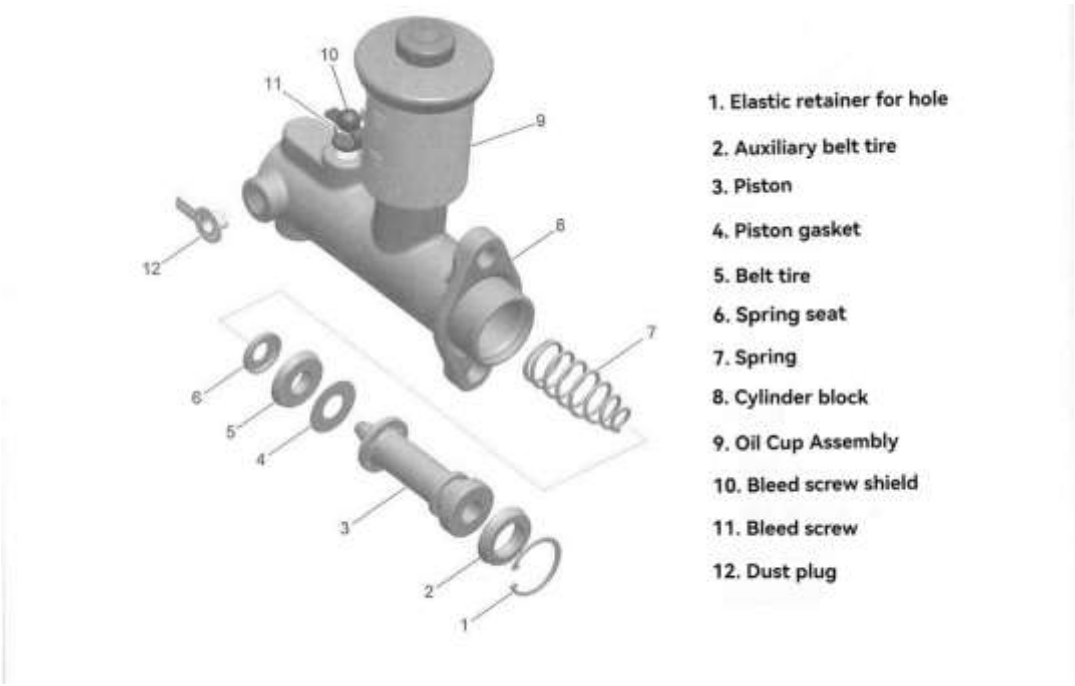
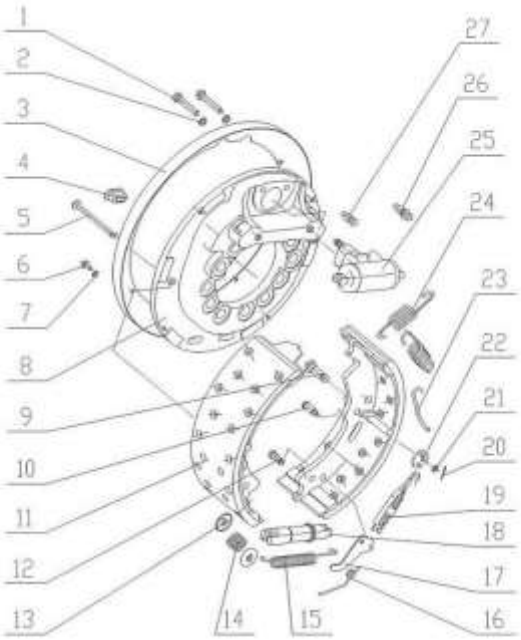


Fig.6-6 Brake master pump

The brake master pump brake is a double shoe brake, which is installed on both sides of the drive axle. The brake is composed of two sets of brake shoes, brake pump and regulator. One end of the brake shoe is in contact with the fixing pin and the other end is in contact with the regulating device. The parking brake part is pressed by the return spring and the compression spring rod. In addition, a parking brake mechanism and an automatic adjustment device are also assembled on the brake. As shown in the figure



1. Bolt M8 × 45	2. Spring washer 8	3. Cover shell	4 rubber plugs
5. Compression spring pull rod	6. Bolt M6 × 10	7. Spring washer 6	8. Brake base plate
9. Pin	10. Pin	11. Brake shoe friction pad assembly	12. Pin
13. Compression spring seat	14. Spring F	15. Spring B	16. Spring C
17. Paws	18. Left/right adjuster assembly	19. Spring riveting device	20. Cotter pin
21 gaskets	22 rocker arm	23. Left/right upper pull rod	24. Spring E
25. Brake sub-pump assembly	26. Pin	27. Pin	

Fig.6-6 Service brake

d. Parking brake control device

The parking brake system adopts a hand-pulled soft-shaft mechanism, which acts on the brake of the input shaft of the main reducer of the drive axle. Use the parking brake system only when the forklift is stopped. If the driving forklift truck is found that the service brake system is out of order, it can also use the parking brake to stop the vehicle. The parking brake handle is ratchet type and the braking force can be adjusted by a regulator located at the end of the brake handle.

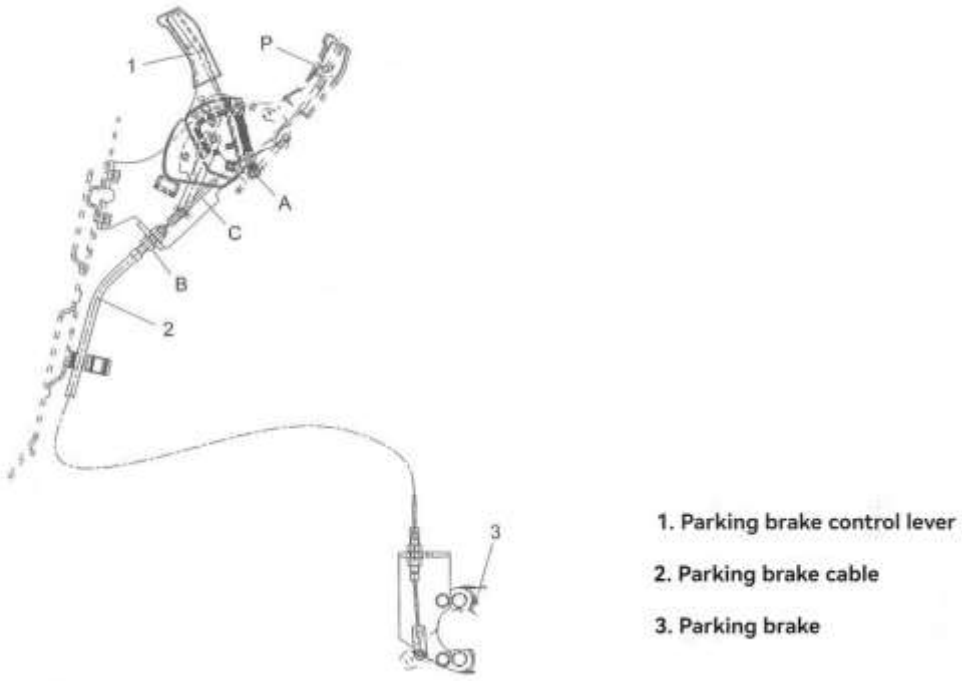


Fig. 6-7 Parking driving control

Fig.6-8 Parking control handle

Parking brake control handle adjustment:

When the free travel of the parking brake control handle is too large, it should be adjusted. First relax the parking brake lever forward to the limit position, adjust the nut of the brake pull wire with an open wrench, tighten it clockwise and loosen it counterclockwise. Handle operating force control range: 100N ~ 300N.

6.4 Common troubleshooting methods

Table 6-5 Fault analysis table

Fault	Cause analysis			
Poor braking	1 Brake system leaking oil			
	2 Brake shoe clearance is not adjusted properly			
	3 Brake Overheating			
	4 Poor contact between brake drum and friction plate			
	5 Impurities are attached to the friction plate			
	6 Impurities are attached to the friction plate			
	7 Impurities are attached to the friction plate			
Brake noise	1 The surface of the friction plate is hardened or impurities are attached to it			
	2 The bottom plate is deformed or the bolt is loose			
	3 Brake shoe deformation or incorrect installation			
	4 Friction plate wear			
	5 Wheel bearing loose			
Brake uneven	1 There is oil stain on the surface of the friction plate			
	2 Brake shoe clearance is not adjusted properly			
	3 Branch pump failure			
	4 Brake shoe return spring damaged			
	5 Brake drum deflection			
Lack of braking	1 Brake system leaking oil			
	2 Brake shoe clearance is not adjusted properly			
	3 There is air mixed in the braking system			
	4 The brake pedal is not adjusted correctly			

e. Maintenance

Level 1 technical maintenance (about 50 hours of work)

- If the new vehicle run-in, replace the gear oil. (Note: When replacing gear oil, first no-load, allow heating, after the oil, and then wash with kerosene. Then refuel to the designated position.) Add 6L

to the main reducer and 1.2L to each wheel reducer. Gear oil selection GL-4 85W/90 heavy duty vehicle gear oil.

- Check the movement of each transmission member without abnormal sound.
- Check that the external fasteners of the wheel reducer, main reducer and brake are loose and tightened.
- Check shoe wear in brake and remove possible air.
- Check the leakage of oil in all parts, timely maintenance and elimination. All seals, once removed, shall not be reused.

Adjustment of wheel hub bearing clearance: tighten the inner nut until the hub brake drum can only turn slightly. Then reverse the inner lock nut 1/8 circle, at this time the hub brake drum should be able to rotate freely, no stuck phenomenon, and no obvious axial clearance and deviation phenomenon, and then assemble the lock washer, and finally lock with the outer lock nut.

Level 2 technical maintenance (about 1200 hours of work)

- Check and adjust the clearance of bearings and spiral bevel gears according to the requirements of "Adjustment method of main reducer and wheel edge reducer".
- Replace gear oil as required by season or overhaul.
- Check and clean oil, dirt and dust, especially keep the vent plug on the axle housing unblocked.
- Check the shoe wear in the brake.

Check and tighten external fasteners. If it is loose, apply Loctite 242 anti-loose adhesive and tighten it again. (Note: wheel nuts can not be coated with relaxation glue)

Level 3 technical maintenance (about 2400 hours of work)

- Disassemble and inspect wheel edge reducer, main reducer and brake, repair and replace damaged parts. During assembly, the parts originally coated with sealant should be cleaned with solvent, and after drying, SD-314 silicone should be applied. All fastener bolts should also be cleaned, dried, coated with Loctite 242 anti-loosening glue, and then tightened, tightening torque to meet the requirements of Table 1.
- Adjust the main reducer and wheel edge reducer mechanism.

6.5 Common fault analysis of drive motor

Problem	Possible reason
Drive motor does not work	Switch not off (battery connector, key switch, proximity switch) : Turn off the switch. If it still does not work, use a voltmeter to test the power supply to the control panel and the current of each switch.

	The signal is bad. Blown fuse: Check the battery connection. Check the battery connector connection. Check fuses, drives and logic. Replace the fuse if it is blown. Check the drive motor and control panel for possible fuse blowouts. Some of the reasons are: Working under excessive load, the current limit is too high
	Low battery voltage: Check the battery terminal voltage. If it is too low, charge the battery. Check all cells for one or more defective cells.
	Control operation is incorrect
Drive motor does not work	The encoder is faulty.
Traction does not operate during normal operation	The brake is defective, resulting in excessive resistance. The heat increases, causing the motor to stop. Check the brake adjustment.
	There is too much heat in the control panel for the following reasons: Heavy traction load: reduce duty cycle load. Thermal sensor failure: These can cause the drive motor to malfunction, The control handle is faulty or the drive fuse is open
Traction will not last throughout the normal working period	Vehicles have batteries that are too small
	If the battery is not fully charged during battery charging, check whether the battery is charged Check whether the battery charger is faulty.
	The interval between battery replacement is too long or the cooling time of battery replacement is too short.
	A battery has one or more defective cells that cause the rated capacity and capability of the battery to be lower than normal
	The drive system is consuming too much battery power due to a drive system failure. Check the brake adjustment. Check wheel bearings, axles and other mechanical parts for correction to eliminate faults.

	Change to a tire with less friction
	After a work shift, the vehicle is working beyond its designed capacity without available power
The positive (+) or negative (-) electrode of the battery is in direct contact with the vehicle 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 applies a voltage to the forklift frame: Clean the battery with baking soda and an aqueous solution.
	Battery or control panel wiring in contact with the vehicle frame: Perform continuity tests and move wire contacts. Remove wires in sequence until the fault is cleared. The fault will disconnect at the end of the wire
	Wet motor
The vehicle did not reach the maximum speed	If the battery is not fully charged or the battery is poorly charged: charge the battery. Check the battery. If necessary, replace the battery.
	Failure in the drive motor, control handle or drivetrain: Check the vehicle speed in both directions. If the controller needs to be adjusted, follow the corresponding section of the manual programmer to do so. If the drive motor fails, test the motor components
Slow acceleration	Drive control overheating, temperature sensing switch on. Note: If the temperature is 145° C (293° F), the thermal switch will issue a warning.

7 Electrical system

7.1 Overview

FE4P60-80N electric forklift truck's electrical system is powered by a 96V lead-acid/lithium battery pack, and traction power is provided by an AC asynchronous motor. The lifting power of goods is driven by AC motor oil pump to produce oil pressure, and then by hydraulic pipeline through the hydraulic cylinder on both sides of the mast to achieve the lifting, tilt and side movement of fork. The acousto-optic system uses lead acid/lithium battery 96V to 24V voltage supply.

7.2 Control power system

AC controller, this type of controller sets high safety, reliability, flexibility, easy operation in one, through advanced control software to ensure that the motor in different modes, can run smoothly, including full speed and high torque state regenerative braking, zero speed and torque control, proprietary input/output ports and software, it ensures the economy and high efficiency of the control of electromagnetic braking and hydraulic system. The selected AC variable frequency motor is efficient, durable and essentially maintenance-free.

The control system is mainly Curtis system and Inmotion system.

Fig.7-1 Curtis controller

Fig.7-2 Inmotion controller

7.3 Main functions and Settings

By correctly setting the various motor technical parameters and control technical parameters and functional values of the controller, the safe and efficient working performance and complete operating functions of the electric forklift can be achieved.

1、 The crawling speed of electric forklift can be adjusted. Through the crawling speed setting function of the controller, the electric forklift can run for a long time at low speed.

2、 The acceleration rate can be adjusted. The acceleration rate is the "soft and hard" feeling of the accelerator pedal when operating the electric forklift. By setting the acceleration rate, the forklift can meet the requirements of acceleration operation under different working conditions.

3、Plug braking and regenerative braking. In the vehicle driving, when the direction bar is reversed, the reverse braking signal is generated, which controls the traction motor through the motor driver to give a

braking torque to achieve the purpose of vehicle deceleration. Braking force is controlled by the accelerator pedal. Regenerative braking is generated by the control of the controller under the condition that the speed of the vehicle is relatively higher than the speed of the traction motor. The energy of the vehicle braking can be converted into electric energy and returned to the battery. In particular, when the electric forklift is sliding down the slope on the ramp, in order to properly reduce the speed of the vehicle sliding down the slope, the regenerative braking can be realized by properly lifting the accelerator pedal board to extend the driving distance of the battery on a single charge.

4、Slope anti-sliding function. The electric forklift with AC traction motor has the excellent function of not sliding on ramps.

5、The maximum driving speed can be adjusted. Reasonable adjustment of the maximum speed of the electric forklift can prevent the traction motor from being overloaded due to high speed.

6、Static recovery off. If the seat switch or key switch is disconnected, the control device is turned off and the directional control lever must be brought back to the middle neutral to restart. If the driver leaves the vehicle and returns at any time, the direction control lever needs to be pulled back to the middle neutral before restarting. This function prevents unexpected unsafe operations from occurring. A time delay of several seconds is provided at the input end of the seat switch to allow an instantaneous disconnection of the seat switch in the event of turbulence.

7、Safety protection function. If the power element of the controller is damaged during the operation of the vehicle, the controller will disconnect the main contactor in the shortest time; When the controller temperature rise is too high, the controller will automatically limit the armature current of the motor; When the battery voltage is too low, the controller stops working to ensure safety.

8、Traction motor controller and steering motor controller have self-diagnosis function. In the working process of the controller, once there is a failure, the fault code will be displayed on the display instrument, and the controller will automatically stop working to ensure the safety of the operating system.

9、The display instrument will display the battery power and the accumulated working hours. When the performance parameters of the electric forklift are very different, the performance of the electric forklift may be reduced, the efficiency is low, and even the truck cannot work normally.

7.4 Electrical schematic diagram

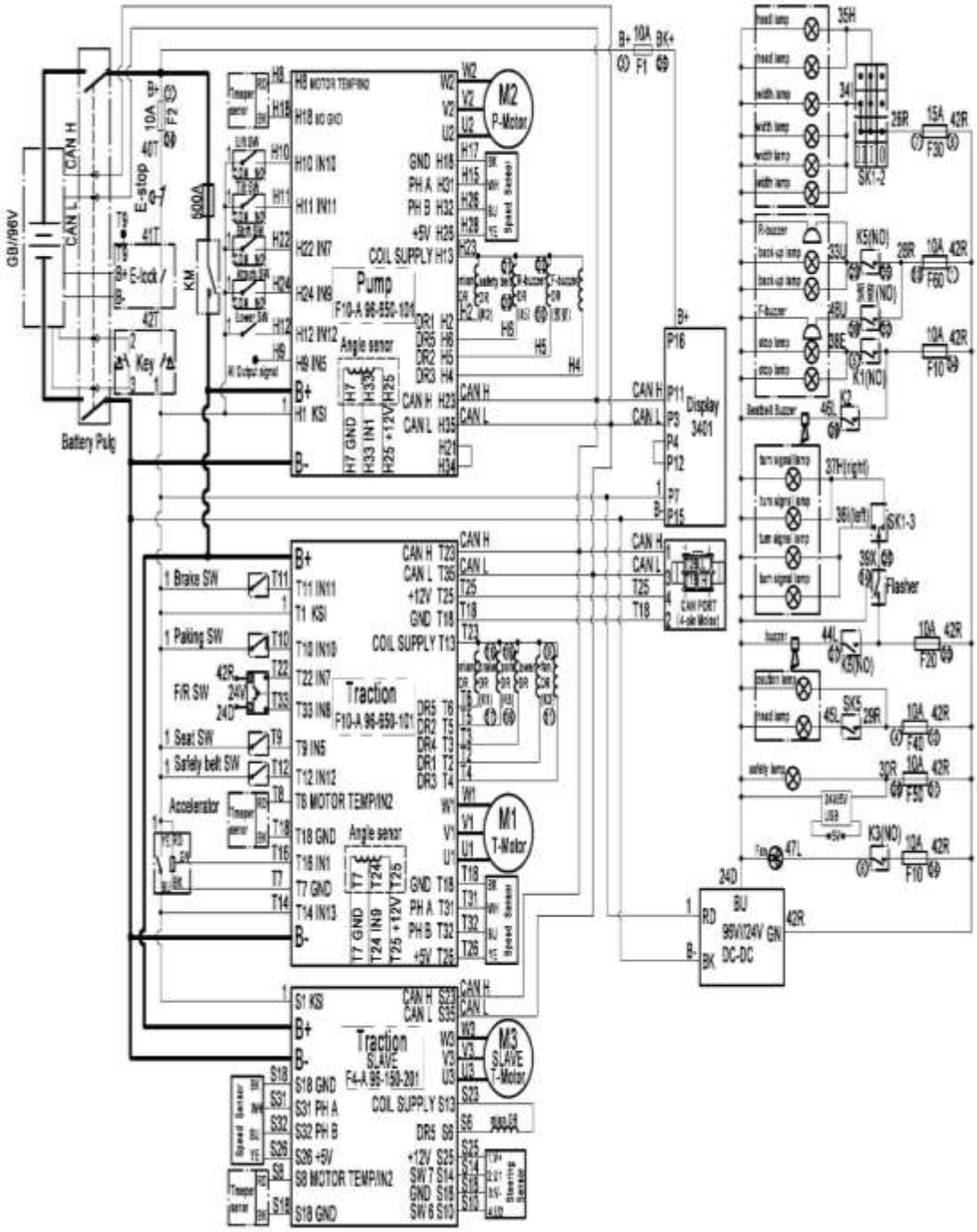


Fig.7-3 Electrical schematic diagram—Curtis system

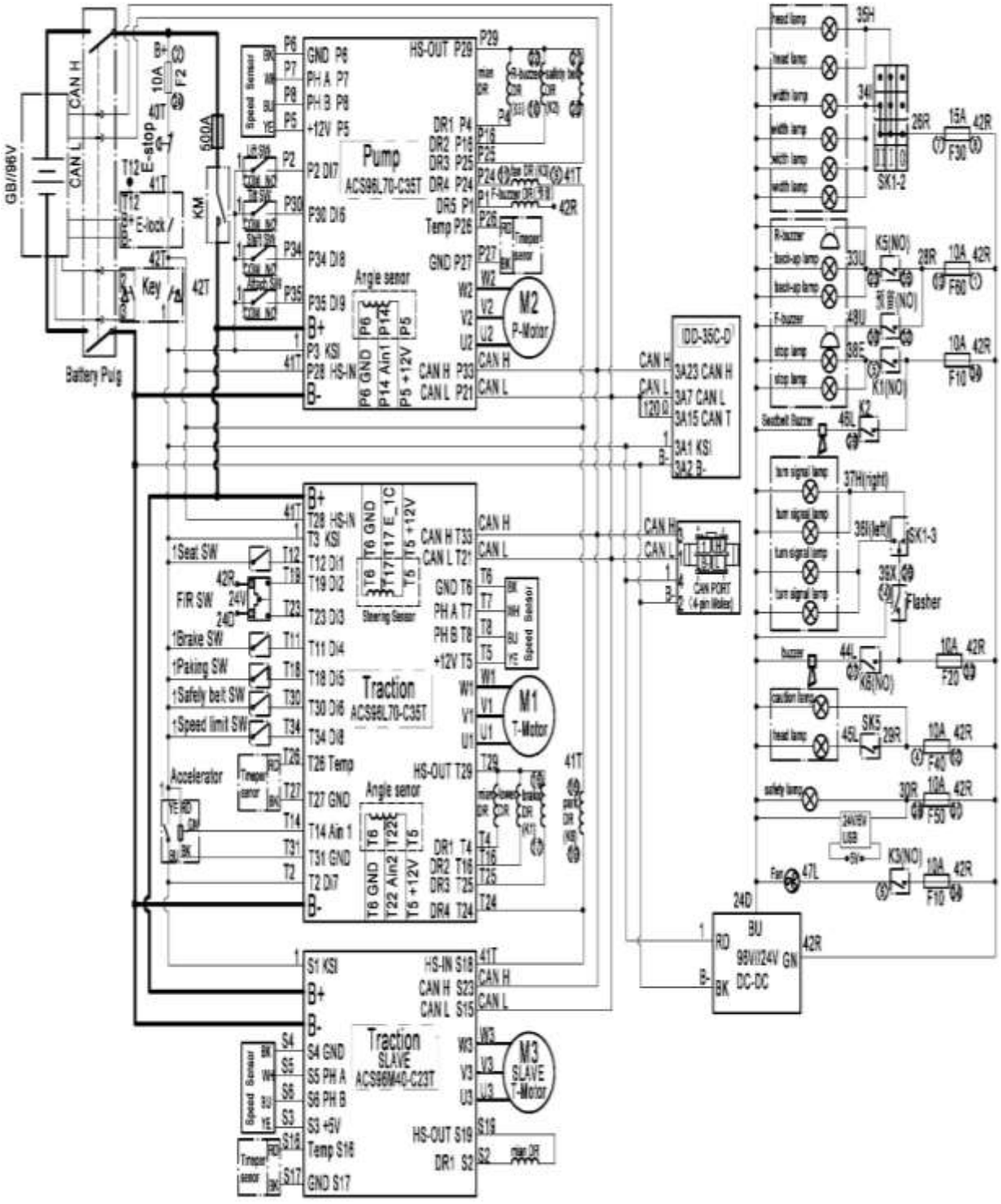
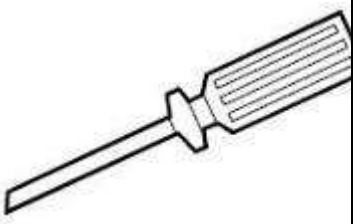
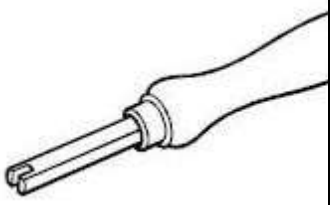
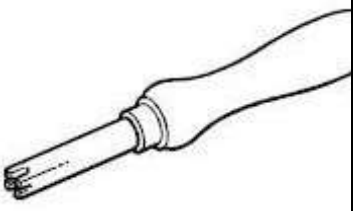
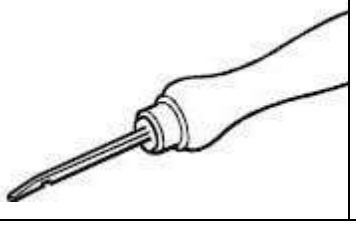


Fig.7-4 Electrical schematic diagram—Inmotion system

7.5 Replacement tool for electrical plug-in

	Picture	Applicaton
		Take off pin
		Mounting pin
		Loose lock
		Two hole lock
		Four hole lock
		Take off pin

7.6 Electronic control element

AC controller, this type of controller sets high safety, reliability, flexibility, easy operation in one, through advanced control software to ensure that the motor in different modes, can run smoothly, including full speed and high torque state regenerative braking, zero speed and torque control, proprietary input/output ports and software, it ensures the economy and high efficiency of the control of electromagnetic braking and hydraulic system. The selected AC variable frequency motor is efficient, durable and essentially maintenance-free.

The control system is mainly Curtis system and Inmotion system.

1、Emergence button

Fig.7-5 Emergence button

Function: The emergency switch is used to cut off the current in the electrical system in an emergency, thus stopping the operation of the vehicle. When the key is pressed, all the DC and AC circuits are disconnected except the horn circuit.

When the emergency switch is turned on, the positive battery is disconnected from the key switch, thus cutting off all load power supplied through the key switch. Therefore, all DC loads except the horn will be cut off.

7.7 Removal of lights

1: Turn off the vehicle, cut off the power supply, and disconnect all the wiring harnesses of the lights.

2: Loosen the bolt that hold the light

3: Replace it

7.8 Replacement of reversing lights

1: Turn off the vehicle, cut off the power supply, and disconnect all the wiring harnesses of the reversing lights.

2: Loosen the bolt that holds the brake light and remove the brake light.

Fig. 7-6 Reversing lights

3: Replace it

7.9 Instrument interface function display

（Curtis System）

Fig.7-7 Instrument display function

（Curtis System）

Table 7-1 Instrument display function（Curtis System）

1	Parking	13	Steering Angle
2	Seats	14	Instrument Menu
3	Braking	15	Instrument Menu
4	Prompt lock	16	Instrument Menu
5	Fault Identifier	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	Working hours	21	Turtle mode
10	Driving speed	22	Cancel /-
11	Speed mode	23	Confirm /+
12	Fault code	24	None

（Inmotion System）

Fig.7-8 Instrument display function

（Inmotion System）

Table 7-2 Instrument display function（Inmotion System）

1	Turtle speed prompt	13	Battery Power
2	Fault prompt	14	Driving speed
3	Power alarm	15	Steering Angle
4	Prompt lock	16	Forward/backward
5	Seat promot	17	Speed mode
6	Parking promot	18	Working hours
7	Cancel		
8	Confirm		
9	Turtle button		
10	High performance button		
11	Regular performance button		
12	Economic performanc button		

7.10 Controller fault code table

Table 7-3 Fault code table (Curtis System)

Original code	Instrument code	Fault explanation	Fault reason
Controller Over current	1.2	Controller Over current	1、motor external U, V or W connection short circuit 2、motor parameters do not match 3、The controller is faulty
Current Sensor Fault	1.3	Current Sensor Fault	1、 motor U, V, W on the vehicle body circuit, resulting in leakage 2、 The controller is faulty
Precharge Failed	1.4	Precharge Failed	1、 the positive end of the capacitor is connected to the external load, so that the capacitor can not be charged normally
Controller Severe Undertemp	1.5	Controller Severe Undertemp	1、 the controller working environment is too harsh
Controller Severe Overtemp	1.6	Controller Severe Overtemp	1. the controller working environment is too harsh 2. Vehicle overload 3. Controller installation error
Severe Undervoltage	1.7	Severe Undervoltage	1. Battery parameter setting error 2. Power consumption of non-controller system 3. battery impedance is too large 4. The battery connection is disconnected 5. Fuse is disconnected, or main contactor is not connected
Severe Overvoltage	1.8	Severe Overvoltage	1. Battery parameters are incorrectly set 2. The battery impedance is too high 3. The battery connection is disconnected during regenerative braking
Speed Limit Supervision	1.9	Speed Limit Supervision	1. The detected motor Speed exceeds the limit monitoring parameter set by Max Speed. 2. MaxSpeed improperly adjusts monitoring parameters. 3. see: Programmer » Application Settings » Maximum Speed Monitor menu
Travel Control Supervision	1.10	Travel Control Supervision	1. the vehicle stop status, detected motor frequency and/or phase current exceed the limit control monitoring parameters specified in the travel.

			2. Improper monitoring parameters for travel control. 3. See: Programmer » Application Settings » Trip Control Monitor menu.
Controller Overtemp Cutback	2.2	Controller Overtemp Cutback	1. The controller working environment is harsh 2. Vehicle overload 3. The controller is incorrectly installed
Undervoltage Cutback	2.3	Undervoltage Cutback	1. Low battery power 2. Battery parameter setting error 3. Non-controller system runs out of power 4. The battery impedance is too large 5. The battery connection is disconnected 6. The fuse is disconnected or the main contactor is disconnected
Overvoltage Cutback	2.4	Overvoltage Cutback	1. The regenerative braking current causes the battery voltage to rise during the regenerative braking process 2. Battery parameters are incorrectly set 3. The battery impedance is too large 4. Regenerative braking
Ext 5V Supply Failure	2.5	Ext 5V Supply Failure	1. The external load impedance is too low
Ext 12V Supply Failure	2.6	Ext 12V Supply Failure	Fault type: External load impedance +12V power supply is too low. 1. 12 V power supply voltage out of range 2. 12 V power supply current out of range
Motor Temp Hot Cutback	2.8	Motor Temp Hot Cutback	1. The motor temperature reaches or exceeds the alarm temperature set by the program, resulting in reduced current output 2. The motor temperature parameter is set incorrectly 3. If the motor does not use a temperature sensor.The programming parameters "Tempcompensation" and "Temp cutback" must be set to "OFF".
Motor Temp Sensor	2.9	Motor Temp Sensor	1. The motor temperature sensor is incorrectly connected 2. If the motor does not use a temperature sensor. Programming parameter "MotorTemp Sensor

			Enable must be set to "OFF"
MAIN DRIVER	3.1	MAIN DRIVER	1. Connect the load open circuit or short circuit 2. Connection pins are stained 3. Wrong wiring
EM Brake Driver	3.2	EM Brake Driver	1. Connect the load open circuit or short circuit 2. Connection pins are stained 3. Incorrect cables are connected
Lower Driver	3.5	Lower Driver	1. Connect the load open circuit or short circuit 2. Connection pins are stained 3. Incorrect cables are connected
Encoder Fault	3.6	Encoder Fault	1. Loss of supervision. 2. Pulse of overcurrent trip loss. 3. Speed signal pulse loss. 4. Automatic representation 5. Encoder power supply (voltage) failure.
Motor Open	3.7	Motor Open	1. The motor lacks phase or breaks phase 2. Poor crimping or incorrect cable connection
Main Contactor Welded	3.8	Main Contactor Welded	1. Main contactor contact welding 2. Motor U or V phase disconnected or missing phase 3. The circuit connected to the B+ terminal charges the capacitor
Main Contactor Did Not Close	3.9	Main Contactor Did Not Close	1. The main contactor is not closed 2. Main contactor contact oxidation, Melted, Or the connection is unstable 3. The capacitor is charged by an external device 4. The fuse is disconnected
Motor Setup Needed	3.10	Motor Setup Needed	Motor setup is required. Please refer to the fault type.1: The current regulator needs to be configured. 2: Need to run slip gain test. 3: Basic speed test needs to be run. 4: Automated testing needs to be run (full motor commissioning).

Throttle Wiper Low	4.2	Throttle Wiper Low	1. Throttle voltage exceeds analog low or analog high Analog input parameters are defined for throttle input. 2. See Programmer » Controller Settings » Input » Analog 1 type. 3. See Programmer » Controller Settings » Input » Configuration.
Pot2 Wiper Low	4.4	Pot2 Wiper Low	The diagnosis of related brake input source is triggered by the corresponding fault (distribution simulation X input).
EEPROM Failure	4.6	EEPROM Failure	1. Non-volatile (NV) memory cannot be read or written. 2. The internal controller is faulty.
HPD/Sequencing Fault	4.7	HPD/Sequencing Fault	1. The sequence is incorrect. Key switch interlock direction or throttle. 2. Incorrect cables are connected. Pressure welding or switch KSI interlock direction or throttle. 3. The water input switch in the above number causes an invalid (true) on/off state. 4. Verify the input switch status. See Programmer » System Monitor menu » Input » Switch status. 5. Verify the throttle. See Programmer » System Monitor Menu » Input » Throttle Command
Emer Rev HPD	4.7	Emer Rev HPD	1. The emergency reverse operation is complete. But the accelerator forward and the reverse input and interlock have not been reset
Parameter Change Fault	4.9	Parameter Change Fault	1. To ensure the safety of the vehicle. Changes to some specific parameters must take effect after the key switch is restarted.
EMR Switch Redundancy	4.10	EMR Switch Redundancy	1. The emergency astern input switch does not work. Causes an invalid state. Switch NC State On Off Valid Off On Valid On On Invalid

			Off Off Invalid 2.Dirt moisture to enter in the switch.
VCL Tra HPD Fault	5.1	VCL Tra HPD Fault	1. A forward switch or backward signal is displayed during power-on 2. The accelerator is in signal state when it is powered on
Pump HPD Fault	5.1	Pump HPD Fault	When powered on, lift, tilt, side shift, accessories have signals
Tra PDO Timeout	5.2	Tra PDO Timeout	1.CAN connection error 2. Baud rate is not uniform 3. Abnormal bus resistance
VCL_Lower_SRO_Fault	5.3	VCL_Lower_SRO_Fault	The drop switch signal is valid when powered on
Pump PDO Timeout	5.7	Pump PDO Timeout	1.CAN connection error 2. Baud rate is not uniform 3. Abnormal bus resistance
BMS PDO Timeout	5.8	BMS PDO Timeout	1.3401/ Controller Battery Type is incorrectly set 2.CAN cables are incorrectly connected 3. Baud rate is not uniform 4. Abnormal bus resistance
Seat Belt Alarm	5.9	Seat Belt Alarm	Do not wear a seat belt at a speed higher than 4km/h
Wrong 3401 Model	6.2/6.3/6.4/6.5	Wrong 3401 Model	1.CAN bus is abnormal 2. Instrument model or software error
Steer Sensor Pot Fault	6.6	Steer Sensor Pot Fault	1. Reset the Steer Sensor 2. Steer Sensor fault
VCL Run Time Error	6.8	VCL Run Time Error	1. VCL code timed out the operation time
PDO Timeout	7.2	PDO Timeout	1. The time for receiving CAN PDO messages exceeds the PDO time limit
Stall Detected	7.3	Stall Detected	1. Motor rotation 2. Motor encoder failure 3. Incorrect wiring 4. Input motor encoder power failure
Supervisor Fault	7.7	Supervisor Fault	1. Data mismatch was found during the inspection. 2. Inspect the internal damage of the microprocessor 3. The switch input is allowed to exceed 100ms in the upper and lower ranges.

Supervision Input Check	7.9	Supervision Input Check	Internal controller failure.
PDO Mapping Error	8.2	PDO Mapping Error	1. PDO Map data is overallocated or incompatible with byte maps with objects. 2. Adjust PDO Settings. See Programs » Application Settings »CAN Interface »PDO Settings.
Internal Hardware	8.3	Internal Hardware	Internal controller failure detected
Driver 1 Fault	A1	Driver 1 Fault (Drop solenoid valve)	1. The drop solenoid valve is open or short circuit.2. The connector (T13 or T2) on the controller has a dirty pin or contactor coil. 3. The connector is improperly crimped or connected. 4. Driver overcurrent, driver 1 overcurrent parameters.
Driver 5 Fault	A5	Driver 5 Fault （contactor）	1. The contactor load is broken or short-circuited. 2. The connector pin on the controller is dirty or the contactor coil is dirty. 3. The connector is improperly crimped or connected. 4. Driver overcurrent,driver 5 overcurrent parameters.

Table 7-4 Fault code table（Inmotion System）

Fault code	Fault explanation	Solution
20	The accelerator pedal switch activates when power-on starts	1. Release the accelerator pedal 2. Replace the accelerator
21/22	The direction switch is activated when the power is on	1. Turn the direction switch to neutral position 2. Internal short circuit occurs in the water inlet of the combined switch to drain the water 3. Combination switch internal short circuit, need to change
23	Accelerator pedal analog value is out of range	1. The accelerator pedal is faulty
24	Accelerator pedal analog fault	
25	Faulty seat belt operation sequence	1. Operate safety belt properties correctly

31	Traction driver CAN communication failure	1. Please check the CAN line (C21 and C23) 2. Check whether the resistance between the CAN line (C21 and C23) is 120Ω or 60ohm resistance 3. The controller is faulty
32	Battery low voltage	1. Timely charging is required 2. The battery voltage is too low (combined with the measurement of dynamic voltage drop)
34	CPU internal error	1. Restart the key switch. If the key switch does not work, the controller is faulty
36	The tilt switch is activated during power-on startup	1. Readjust the position of the tilt switch
37	The sideshift switch is activated during power-on startup	1. Readjust the position of the sideshift switch
38	The accessory switch is activated during power-on startup	1. Readjust the position of the accessory switch
39	The lifting switch is activated during power-on startup	1. Readjust the position of the lifting switch
40	Lift analog value out of range	1. Lifting sensor is damaged or multi-way valve is stuck inside
43	Steer analog value is out of range	1. The Steer potentiometer is damaged or needs to be re-calibrated
44	Traction driver speed protection	High vehicle speed alarm
45	Traction driver encoder error	1. Traction motor speed sensor failure 2. The traction motor speed sensor connection line is disconnected
81	Traction driver temperature is low	Alarm of too low temperature of controller
82	WARNING Traction driver temperature is high	Alarm of too high temperature of controller
83	Traction driver temperature	Controller temperature sensor is faulty
84	Traction motor temperature is low	1. The temperature of the traction motor is too low 2. Thermistor fault of traction motor
85	Traction motor temperature is high	1. The temperature of the traction motor is too high 2. Thermistor fault of traction motor
86	Traction motor temperature sensor error	1. Thermistor fault of traction motor 2. The traction motor temperature sensor connection line is disconnected

87	Traction motor speed sensor error	1. Speed sensor fault of traction motor 2. The traction motor speed sensor connection line is disconnected
88	The traction driver has a high DC bus voltage	1. High battery voltage 2. The ramp is too steep regenerative braking is too strong
89	The traction driver has a low DC bus voltage	1. The battery voltage is too low 2. Check the connection cables between the motor and the controller B+, B-, U, V, and W
90	Traction driver default values are loaded	Refresh the program after the protection, restart the key
91	Traction driver limited power	1. Timely charging is required 2. the battery voltage is too low (combined with the measurement of dynamic voltage drop)
97	Traction driver outlet error	1. Check whether the contactor wiring harness has short circuit and open circuit (such as the main contactor, reversing relay, etc.)
98	Traction driver overcurrent or short circuit	1. Check the connection cables between the motor and the controller B+, B-, U, V, and W
101	Traction motor driver short circuit	1. Check whether the motor U, V, W is connected to the motor housing for short circuit (the motor line needs to be disconnected)
102	Traction driver temperature is high	The traction driver overheats and needs to be cooled
103	Traction motor temperature is high	1. traction motor temperature is too high, need to cool 2. traction motor temperature sensor fault
104	Traction driver overcurrent	1. Whether the mechanical brake is stuck 2, motor encoder failure (walking jitter, long-term operation will be serious heat)
105	Traction driver precharge timeout	Replace the precharge resistor (gold resistor replacement)
110	Traction driver DC bus low voltage	1. The battery voltage is too low 2. Check the connection cables between the motor and the controller B+, B-, U, V, and W
111	Traction driver DC bus high voltage	High battery voltage
112	Traction driver DC bus high voltage	High battery voltage
114	Internal power supply failure	Check motor encoder and temperature sensor wiring harness for short circuit or misconnection
121	Pump driver temperature is low	The controller temperature is too low
122	Pump driver temperature is high	The controller temperature is too high

123	Pump driver temperature sensor error	The temperature sensor of the controller is faulty
124	Pump motor temperature is low	1、The temperature sensor of the controller is faulty 2、The temperature sensor of the controller is faulty
125	Pump motor temperature is high	1、The temperature of oil pump motor is too high 2、Thermistor fault of oil pump motor
126	Pump motor temperature sensor is faulty	1、Thermistor fault of oil pump motor 2、Oil pump motor temperature sensor connection line
127	Pump drive speed sensor is faulty	1、The speed sensor of oil pump motor is faulty 2、Wiring harness fault, oil pump motor speed sensor connection line broken
128	Pump driver DC bus voltage is high	High battery voltage
129	Pump driver DC bus voltage is low	1、Battery voltage is too low 2、Check the connection cables between the motor and the controller B+, B-, U, V, and W
130	Pump driver default values are loaded	Refresh the program after the protection, restart the key
132	Pump drive limited power	1、Timely charging is required 2、、Battery voltage is too low（combined with the measurement of dynamic voltage drop）
137	Pump driver outlet failure	1、Check the outlet harness for short circuit and open circuit
138	Pump driver overcurrent or short circuit	1、Check the power harness
141	Pump driver short circuit	
142	Pump driver temperature is high	
143	Pump motor temperature is high	1、Pump motor temperature is too high alarm
144	Pump driver current calibration error	1、Restart
145	ERROR Pump driver precharge timed out	1、Replace the pre-charging resistor (gold resistor replacement)
148	BMS Level 1 failure	1、Scan the QR code on the lithium battery box to troubleshoar, and limit the speed and lift of the vehicle
149	BMS Level 2 failure	1、Scan the QR code on the lithium battery box for troubleshooting, and the vehicle does not work
150	Pump driver DC bus voltage is low	1、Timely charging is required 2、The battery voltage is too low (combined with the measurement of dynamic voltage drop)
151	Pump driver DC bus voltage is high	High battery voltage

152	Pump driver DC bus voltage high (hardware monitoring)	High battery voltage
153	Drive speed control failure	Restart the key switch, no effect is the controller fault
154	Driver speed control failure	Controller fault
155	BMS CAN bus Off	BMS CAN communication fault
171	BMS CAN fault	BMS CAN communication error
79	Sequential fault	Operation sequence fault (HPG DC pump control fault)
161	Instrument CAN communication failure	Check the connection between the instrument CAN and the electric control CAN line

7.11 Maintenance of the circuit system

(1) Check the wear condition on the contact; Replace contacts when they are worn. Contactor contacts should be checked once every 3 months.

(2) Check the pedal or handle micro-switch; Measure the voltage drop at both ends of the microswitch, there should be no resistance when the microswitch is opened and closed, and there should be a crisp sound when it is released. Check every 3 months.

(3) Check the main circuit: battery - controller - motor connection cable. Make sure cables are well insulated and circuit connections are tight. Check every 3 months.

(4) Check the mechanical movement of the pedal. See whether the spring can be deformed normally, and whether the potentiometer spring can be stretched to the maximum level or set level. Check every 3 months.

(5) Check the mechanical movement of the contactor; Should be free of movement and non-adhesion, the mechanical action of the contactor should be checked every 3 months.

8 Lifting system

8.1 Overview

The lifting system is two-stage roller type vertical lifting and shrinking, which is composed of inner and outer mast and fork frame.

8.2 Inner and outer mast

The inner and outer mast are welded parts. The middle part of the outer mast is mounted on the frame with a self-lubricating joint bearing.

The middle bottom of the outer mast is connected with the frame through the tilting cylinder, and can tilt forward and backward under the action of the tilting cylinder.

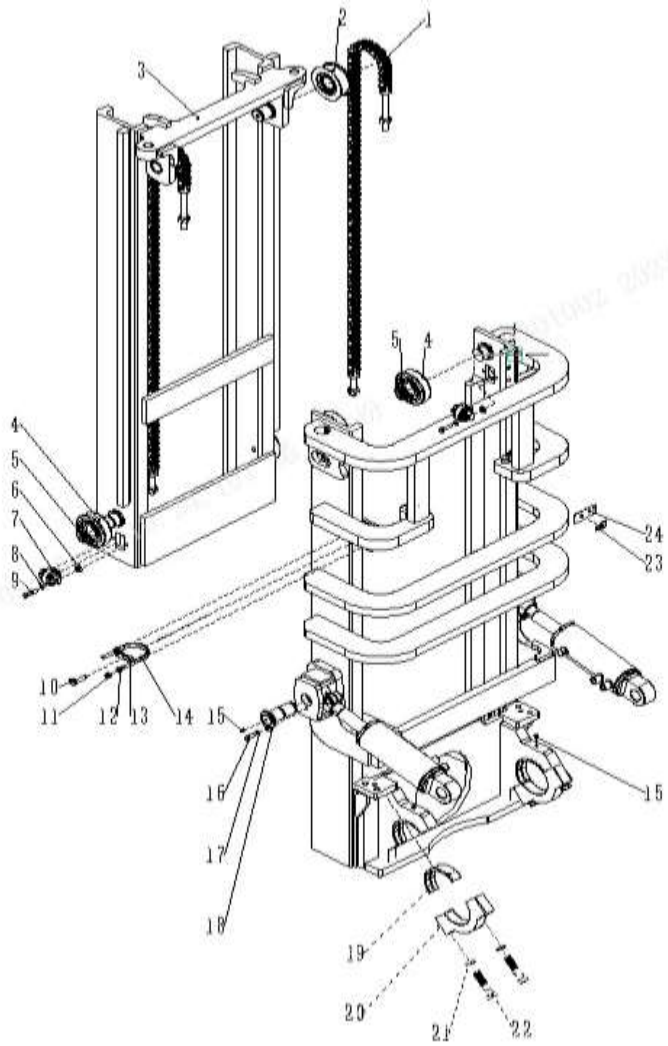


Fig.8-1 inner and outer mast

1.Lifting chain2044	2.Sprocket bearing	3. Inner mast welding	4.Main roller 152	5. Elastic retaining ring for shaft 22
6.Bushing	7.Side roller Φ72	8.Spring washer12	9. Bolt 12	10. Bolt16
11.Flat washer12	12.Nut 12	13.Collar	14.Hoop seat	15.Oil cup10

16.Bolt12	17.Spring washer12	18.With trunnion Φ50	19.Bearing bush	20.Support cover
21.Spring washer24	22.Bolt24	23.Pipe clamp bottom plate	24.Bottom Plate	

8-2 Mast

Mast dismantling

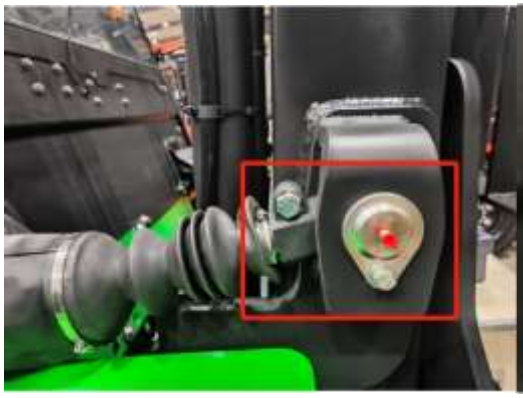


Fig. 8-3

Fig. 8-4

Figure 1，Figure 2，two disassembly can lift the mast away.

8.3 Fork frame

The fork frame is rolled through the main roller inside the mast, the main roller is mounted on the main roller shaft and jammed with an elastic stop ring, the main roller shaft is welded to the fork frame, and the side roller rolling along the inner mast is bolted to the fork frame through 4 side rollers and adjusted with adjusting washer. When the fork reaches the top, a pair of side rollers run out of the inner mast track, in order to prevent the fork beam (fork support plate or upper beam) from shaking, two more limiting rollers are installed under the fork, and the limiting roller rolls along the inner mast wing plate, which can be adjusted. The longitudinal load is beared by the main roller, which is exposed from the top of the mast when the fork is raised to the top. Lateral loads are supported by side rollers.

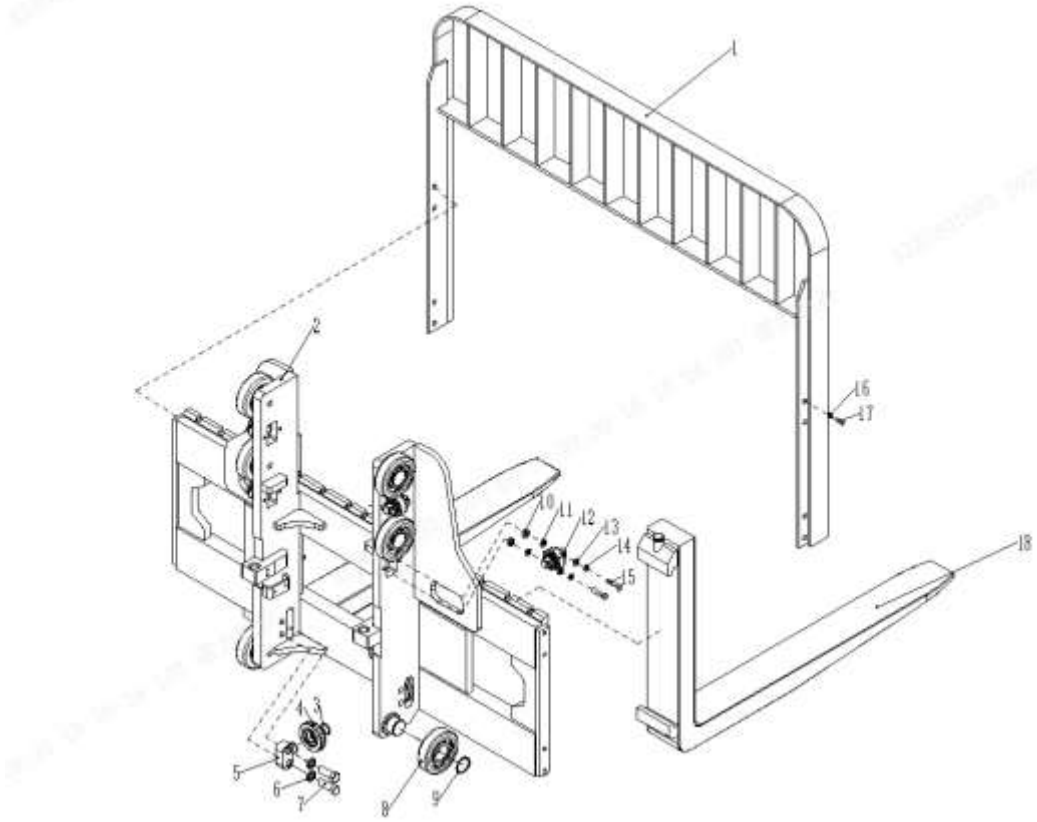


Fig.8-5 fork frame

1.Load backrest	2.fork frame	3. Elastic retaining ring for shaft 35	4. Main roller 102	5.Side axle head 35
6.Flat washer 22	7.bolt 22	8. Main roller 152.5	9. Elastic retaining ring for shaft 55	10.bushing
11.Flat washer 12	12.washer22	13.Side roller Φ 72	14. Spring washer 12	15.bolt 12
16. Spring washer 14	17.bolt 14	18.fork		

8.4 Roller position

There are two kinds of rollers: the outer frame compound roller and the inner frame and the fork frame compound roller. Install on outer mast, inner mast and fork frame respectively. The compound roller is composed of a main roller and a side 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 mast and the fork frame can move freely.

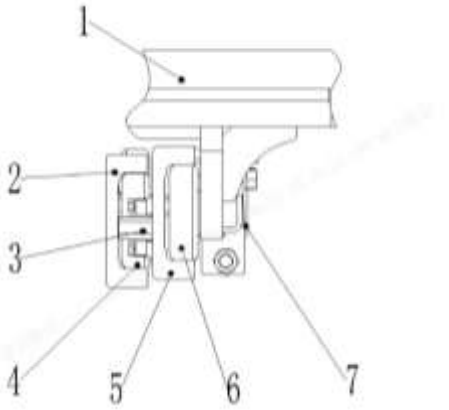


Fig.8-6 roller position

1.fork frame 2. outer mast 3. Outer mast side roller 4.inner mast main roller 5. inner mast 6.Fork frame main roller 7. fork frame

Note: (a) Adjust the side roller clearance to 0.5m;

(b) Butter the main roller surface and the mast contact surface.

8.5 Replace the door frame roller

8.5.1 Lifting cylinder adjustment

When the lifting cylinder, inner mast or outer mast is removed and replaced, the lifting cylinder travel needs to be adjusted again. The adjustment method is as follows:

（1） Insert the head of the piston rod into the beam of the inner mast without an adjustment pad.

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

（3） Add an adjustment pad between the piston rod head of the cylinder and the beam on the inner mast. Adjust pad thickness 0.2mm and 0.5mm.

（4） Adjust the tension of the chain.

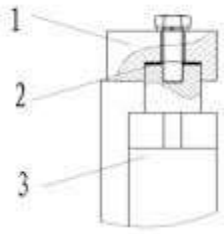


Fig.8-7 lifting cylinder adjustment

1、inner door mast beam 2、lifting cylinder adjustment pad 3、lifting cylinder

8.5.2 Fork frame height adjustment

(1) Park the vehicle on the level ground and make the mast vertical.

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

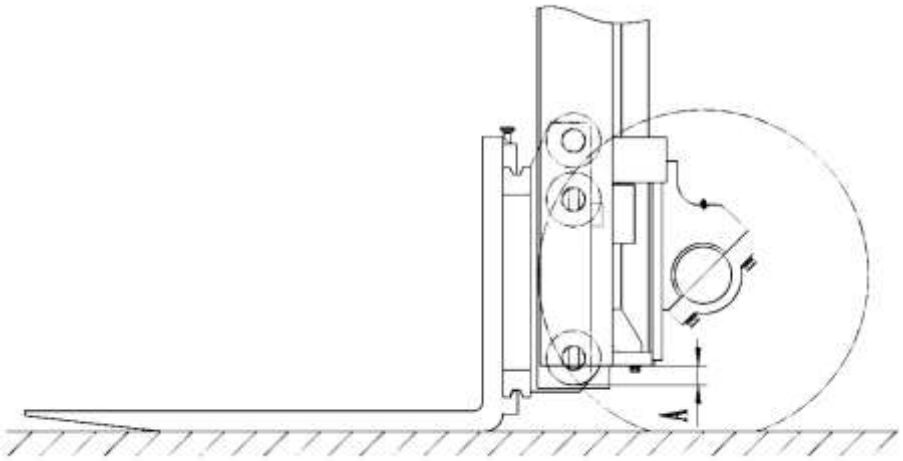


Fig.8-8 fork frame adjustment

(3) Make the fork land and tilt back into place. Adjust the upper end joint of the chain and adjust the nut so that the two chains are equally tensioned.

8.5.3 Replace the fork frame roller

1. Put a pallet on the fork and park the vehicle on level ground.
2. Drop the fork and pallet to the floor.
3. Remove the upper end connector of the chain and remove the chain from the sprocket wheel.
4. Lift the inner mast(① in Figure 2-18).
5. After confirming that the fork is detached from the outer mast, reverse the forklift (② in Figure 2-18).
6. Replace the main roller

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

（b） Make sure that the new roller is the same as the replaced roller, install the new roller into the fork frame and clamp it with the elastic retaining ring.

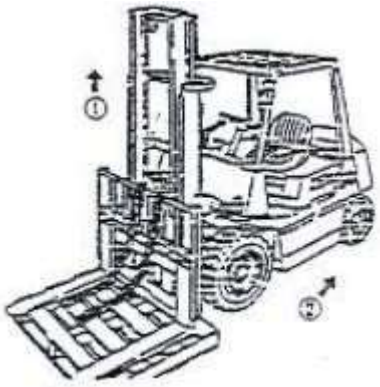


Fig. 8-9

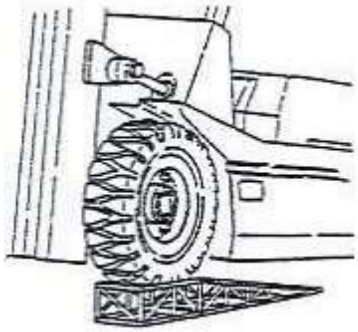


Fig. 8-10

8.5.4 Replace the mast roller

1. Remove the fork frame from the inner mast in the same way as described in 7.2.3 for replacing the fork frame roller.
2. Drive the forklift to the level ground, and pad the front wheel up 250-300mm.
3. Pull the hand braking and pad the rear wheel with a wedge.
4. Remove the lifting cylinder and the fixing bolts of the inner mast. Lift the inner mast, taking care 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, and do not loosen the oil pipe joint.
6. Lower the inner mast and remove the main roller at the bottom of the inner mast. The main roller of the outer mast will also be exposed from the top of the inner mast.
7. Replace the main roller.
8. Remove the upper main roller with the drawing tool, do not lose the adjustment pad.
9. Install the new roller with the adjustment pad removed in step (a).
10. Lift the inner mast until all rollers enter the mast.
11. Install the lifting cylinder and fork frame according to the steps opposite to disassembly

8.6 Accessories installation instructions

△If users need to install accessories, please contact our sales department, do not install by themselves.

9 Steering system

9.1 Overview

The steering system (Figure 9-1) is mainly composed of steering wheel, steering shaft, steering gear, steering oil pump and steering axle. The steering shaft is connected with the steering gear through the cardan joint, and the connecting shaft is connected with the steering wheel through the cardan joint. The steering column can be tilted to the appropriate position through the handle (A). The steering axle is installed on the tail frame at the rear of the frame, and there is a steering joint on the left and right respectively. The steering joint is driven by the steering cylinder piston rod through the connecting rod to deflect the steering wheel and realize steering.

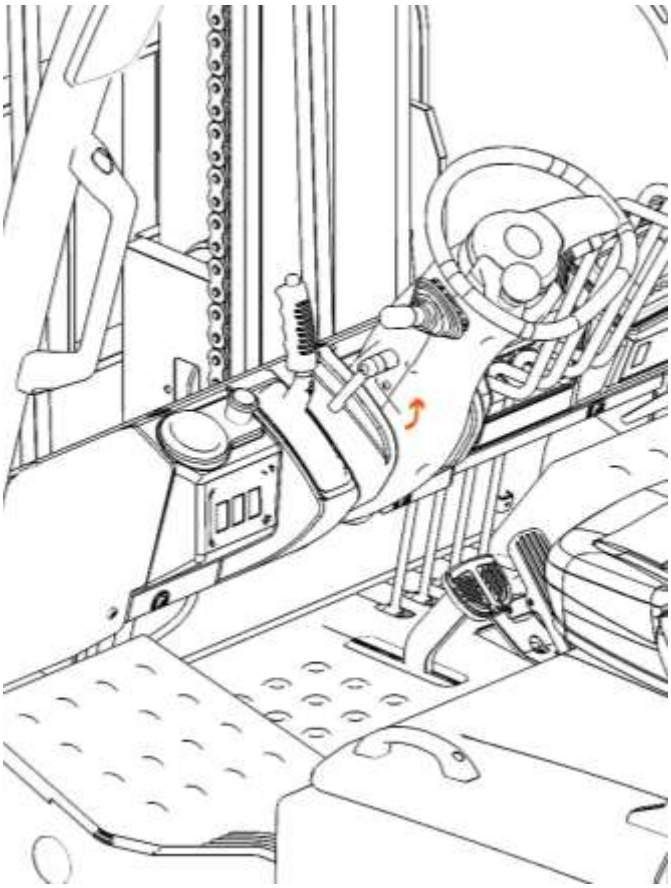


Fig.9-1 steering system

9.2 Steering axle

The steering axle is a box-shaped cross-section welded structure (Figure 6-9), which is composed of steering axle body, steering cylinder, connecting rod, steering joint and steering wheel and other parts. The steering ladder adopts the crank slider mechanism, and the oil cylinder piston rod drives the steering joint through the connecting rod to make the steering wheel offset, so as to realize the steering. The steering axle is bolted to the tail frame at the

back of the frame by the front and rear pins through the fixed plate, that is, the shock absorber pad, so that the bridge can swing around the pin shaft, there is a steering joint on the left and right of the steering axle, the rear hub is mounted on the steering joint shaft with two tapered roller bearings, the wheel is fixed on the hub through the rim, and the bearing is equipped with an oil seal to keep the grease in the hub and the steering joint cavity.

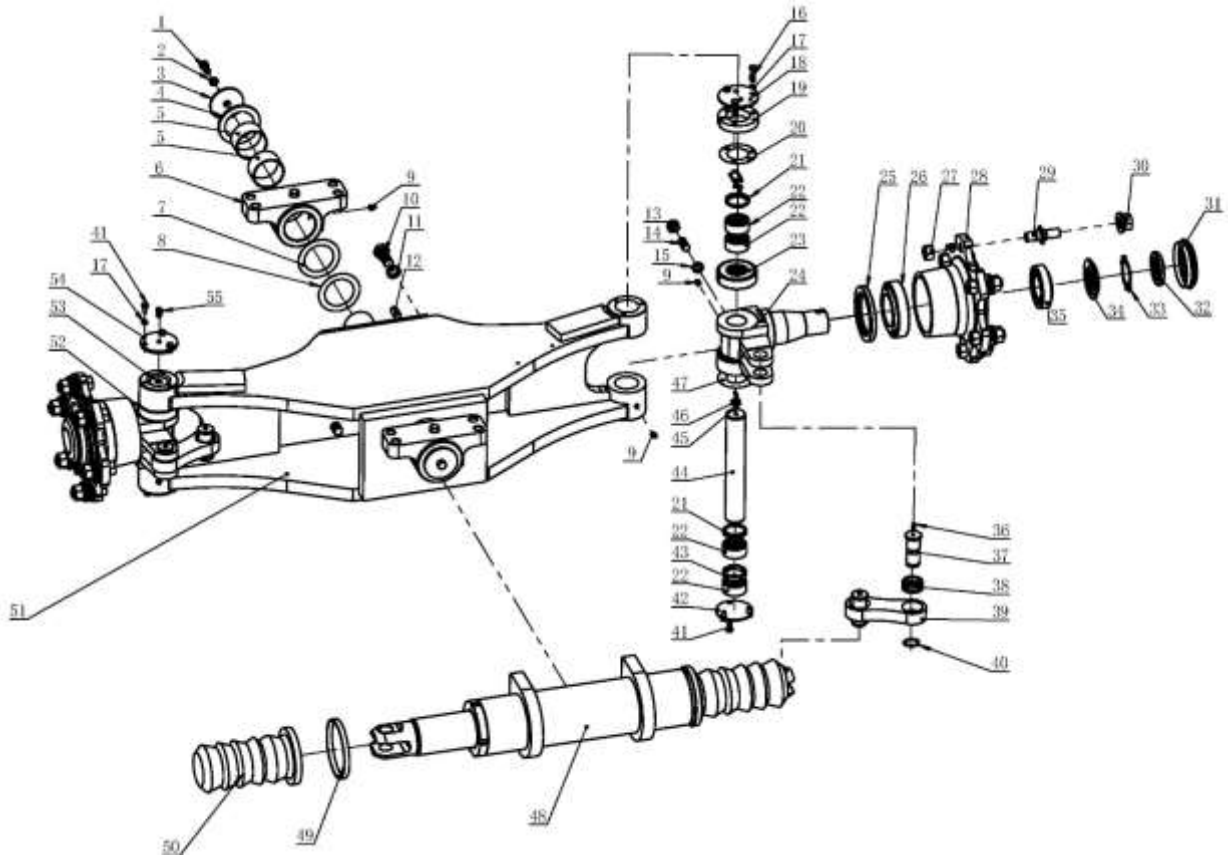


Fig.9-2 steering axle

1. BoltM12x1.25x25
2. Spring pad12
3. Shaft end baffle
4. Adjust pad φ71x φ100x6
5. Sliding bearing φ70x φ75x40 φ70x φ75x40
6. Rear axle supports
7. Adjust pad φ71x φ100x1
8. Adjust pad φ71x φ100x0.5
9. Straight-through grease nozzle Z1/8
10. Bolt M20x1.5x50
11. Spring pad 20
12. Pin B16x32
13. Hex nut M16
14. Set screw M16X45
15. Spring pad 16
16. Bolt M8x35
17. Spring pad 8
18. Top protection cover
19. Protective cover side wall
20. Sealing gasket
21. Oil seal Φ45X Φ55X8
22. Needle roller bearing Φ45X Φ55X24
23. Thrust ball bearing shaft 198911P
24. Right steering joint assembly
25. U-type seal ring B95x130x12D
26. Tapered roller bearings 32215
27. Nut M20×1.5
28. Wheel hub
29. Wheel hub bolts
30. Hub nuts
31. Hub caps
32. Nut M55x2
33. Stop washer 55
34. Enlarge round nut
35. Tapered roller bearings 32211
36. Straight through oil nozzleM6
37. Connecting rod pins
38. Joint bearingGE30ES
39. Connecting rod
40. Elastic retaining ring for shaft 30
41. Bolt M8X16
42. Main pin lower cover
43. Spacer sleeve
44. Steering joint main pin
45. Screw M8X8
46. Turning angle potentiometer
47. Adjust pad
48. Steering bridge assembly

49. Hose clamp/130-150	50. Sheath	51. Steering axle assembly	52. Left steering joint
53. Steering joint main pin	54. Main pin end cover (top)	55. 90° curved neck grease nozzle	

The hub is mounted on the steering joint with two tapered roller bearings, the wheel is pry to the hub through the rim, the bearing is equipped with an oil seal inside, so that the grease is kept in the hub and the steering joint cavity, and the bearing tightness is adjusted with nuts.

9.3 Steering cylinder

The steering cylinder is a double-acting piston cylinder, and the two ends of the piston rod are connected to the steering joint through the connecting rod. The pressure oil from the full hydraulic steering gear moves the piston rod left and right through the steering cylinder, so as to realize the left and right steering. The piston seal is sealed by the combination of the support ring and the O-ring, the Yx ring axial seal is used between the cylinder head and the piston rod, and the cylinder is fixed on the steering axle through the cylinder head on both sides.

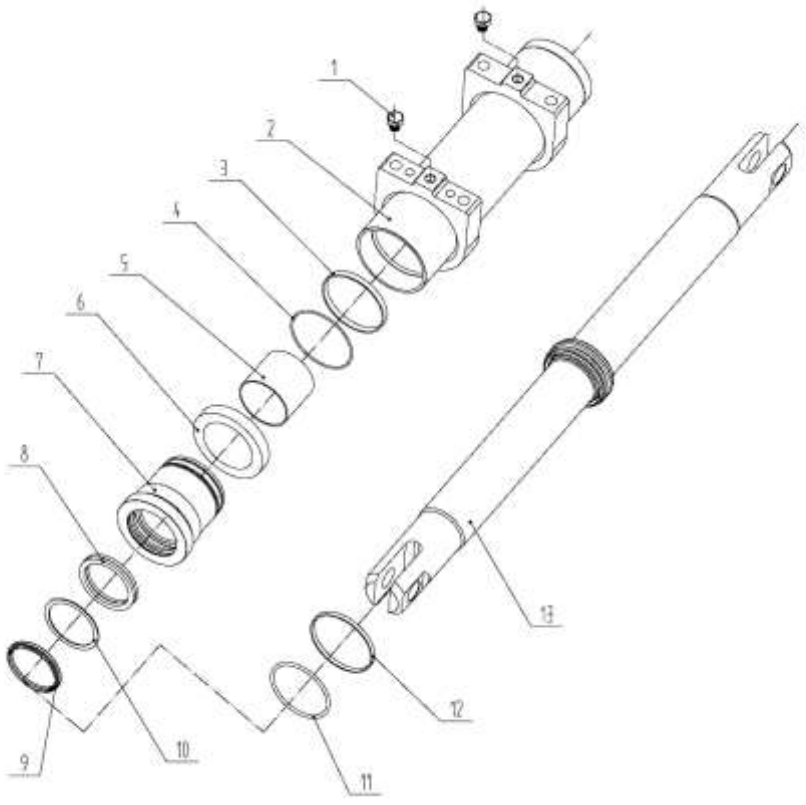


Fig. 9-3 steering cylinder

1. Cover M16x1.5	2. Cylinder body	3. Guide sleeve support ring
4. O-ring 109.4x3.1	5. Steel back bearing 85x90x80	6. Spacer sleeve
7. Guide sleeve	8. Shaft seal ring 85x100x9	9. Dust ring 85x97.2x7.1

10. Retaining ring 85x100x3
11. O-ring 110x5.7
12. Support ring
13. Piston rod assembly

9.4 Troubleshooting methods

Table 9-1 Fault analysis table

order	Fault feature	Possible reasons	exclude
1	Unstable driving	Wheel nut loose	Fastening
		Hub bearing exceeds adjustment range	adjust
		Incorrect installation of axle end adjustment gasket	adjust
		Hydraulic system failure	See section (Hydraulic Systems)
2	noise	Insufficient lubrication	Add calcium base grease
		Bolts and nuts are loose	Fastening
		Incorrect installation of axle end adjustment gasket	adjust
		Joint bearings at both ends of the connecting rod are damaged	change