TITANGREEN
POWERED BY BIGBATTERY

EP18K-Li

USER MANUAL
-
OPERATOR'S GUIDE

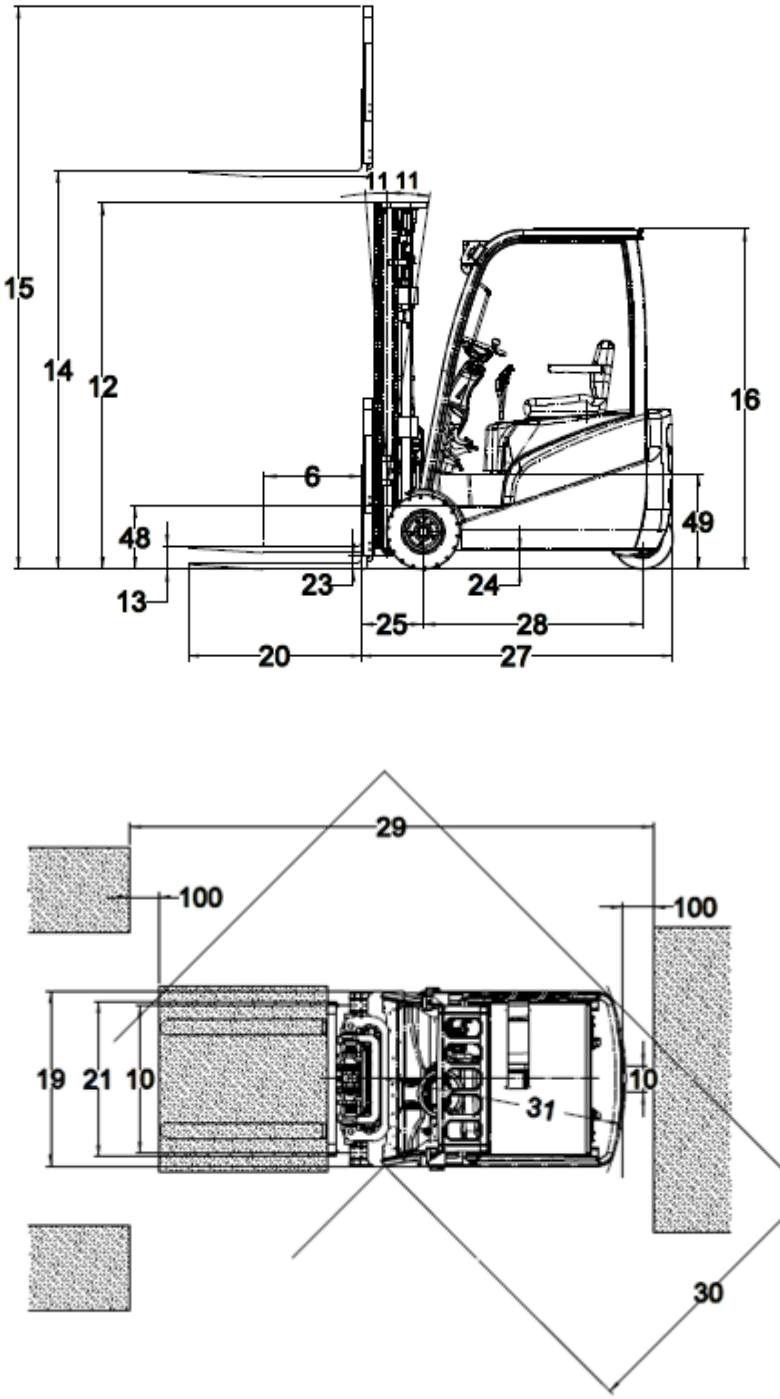
VER 1.0

Table of Contents

1. External view and technical parameter.... 4
2. Safe driving, operation and maintenance of forklift.... 6
   2.1 Transportation,loading,unloading and lifting of forklifts.... 7
   2.1.1 Forklift transportation.... 7
   2.1.2 Forklift loading and unloading.... 7
   2.1.3 Lifting of forklifts.... 7
   2.2 Parking of forklifts.... 8
   2.3 Preparation before use.... 8
   2.4 Precautions for safe operation.... 9
   2.5 Maintenance of lithium battery forklift.... 13
   2.5.1 New forklift maintenance.... 13
   2.5.2 Starting essentials.... 13
   2.5.3 Maintenance Summary.... 13
   2.5.4 Forklift oil and grease.... 15
   2.6 Brief operating instructions.... 16
   2.6.1 Control mechanism and instrument.... 16
   2.6.2 Brief description of operation.... 17
   2.6.3 Maintenance of control system.... 18
   2.6.4 Special reminder.... 19
   2.7 Warning sign.... 19
3. Structure, principle, adjustment and maintenance of lithium battery forklift.... 25
   3.1 drive system.... 25
   3.1.1 Summary.... 25
   3.1.2 Removal of drive system.... 27
   3.1.3 Installation of transmission system.... 28
   3.1.4 Addition of gear oil.... 30
   3.2 braking system.... 31
   3.2.1 Summary.... 31
   3.2.2 Maintenance and adjustment essentials of brake system.... 34
   3.3 steering system.... 35
   3.3.1 Summary.... 35
   3.3.2 Adjustment and maintenance essentials.... 39
4. Electrical system.... 41
   4.1 Summary.... 41
   4.2 Instrument.... 44
   4.2.1 Summary.... 44
   4.2.2 Instrument interface.... 44
   4.2.3 Instrument instructions.... 45
   4.2.4 Instrument working process and instructions.... 47
   4.2.5 Instrument main menu and instructions.... 49
   4.2.6 matters needing attention.... 54
   4.3 Inmotion AC electric control assembly.... 55
   4.3.1 summary.... 55
   4.3.2 Controller structure.... 55
   4.3.3 Controller fault code.... 56
   4.4 AC electron accelerator.... 60
   4.4.1 Appearance and port function.... 60
   4.4.2 Wiring and port diagram.... 61
5. Inmotion three-phase AC motor.... 61

5.1 Summary....61
5.2 Operating environmental conditions....62
5.3 Routine inspection and maintenance of AC motor....62
6. Lithium battery and charger....62
6.1 Use and maintenance of lithium battery....62
6.1.1 Instructions for use of lithium battery....62
6.1.2 Charging steps and precautions of lithium battery....63
6.1.3 Lithium battery storage....65
6.1.4 Treatment of lithium battery....65
6.1.5 Lithium battery safety precautions....65
6.1.6 Lithium battery maintenance....66
6.2 Charger....67
6.2.1 Use of charger and charging method....67
7. Hydraulic system....68
7.1 Summary....68
7.1.1 Oil pump....69
7.1.2 Multiway valve....69
7.1.3 Lifting cylinder....76
7.1.4 Speed limiting valve....79
7.1.5 Tilt cylinder (Fig. 7-17)....80
7.1.6 Hydraulic oil tank....81
7.1.7 Hydraulic system schematic diagram....82
7.2 Maintenance and adjustment of hydraulic system....82
7.2.1 Maintenance of hydraulic oil pump....82
7.2.2 fault diagnosis....86
8.Mast system....87
8.1 Summary....87
8.1.1 Internal and external mast(Fig. 8-1)....88
8.1.2 Fork carriage....89
8.1.3 Fork locating pin....90
8.1.4 Roller position....90
8.2 Maintenance and adjustment of gantry system....90
8.2.1 Lifting cylinder adjustment....90
8.2.2 Height adjustment of fork rack....91
8.2.3 Replace the fork carrier roller....91
8.2.4 Replace the gantry roller (Fig. 8-8)....92

1. External view and technical parameter



Outline drawing of three-wheel lithium battery forklift

Performance parameters of three-wheel lithium battery forklift

GENERAL	1	Manufacturer				TITANGREEN
	2	Model designation				1.8T
	3	Power				Electric
	4	Operation				Sit
	5	Rated capacity			lb(kg)	3968(1800)
	6	Load center			in(mm)	24(610)
DIMENSIONS	7	Tire type- cushion, solid, pneumatic, etc.		Drive/steer		solid/solid
	8	Tire size		Drive/steer	in	18X7-8/15×4.5-8
	9	Wheels - number	X=driven	Drive/steer		2X/2
	10	Tread		Tires Std dr/steer	in(mm)	37.8/7(960/178)
	11	Mast tilt		Std	degrees	3.5F/5B
	12	Mast - lowered height		Std mast	in(mm)	87(2220)
	13	Free lift - top of fork	Std 2 stg limited free lift mast		in(mm)	5(140)
			Opt 2 stg full free lift mast with/without LBR		in(mm)	39/58(990/1475)
	14	Lift height - top of fork	Std 2 stg limited free lift mast		in(mm)	118(3000)
	15	Mast - extended height	Std mast with / without LBR		in(mm)	157/137(3995/3490)
	16	Overhead guard height	Std/drive in rack/opt/opt flat plate		in(mm)	81.4(2070)
	17	Sip to bottom std ohg	Susp at mid-point	Std/susp/swivel	in(mm)	39.4(1000)
	18	Tow pin height	Vertical center of pin		in(mm)	19.9(505)
	19	Overall width	Standard tread		in(mm)	44.4(1130)
	20	Forks	Thickness x width x length		in(mm)	1.6x3.9x42(40×100×1070)
	21	Standard carriage width	Class II		in(mm)	39.7(1008)
	23	Ground clearance	Lowest point	NL/RL	in(mm)	3.3/3.1(85/80)
	24	Ground clearance	Center of truck	NL/RL	in(mm)	4.3/3.9(110/100)
	25	Load distance	Center of wheel to face of forks		in(mm)	15.1(384)
	26	Battery compartment	Height		in(mm)	22(560)
			Width		in(mm)	31.5(800)
			Length		in(mm)	16.5(420)
	27	Length to face of forks	Chassis length		in(mm)	75.9(1927)
	28	Wheelbase			in(mm)	53.5(1360)
	29	Right angle stack			in(mm)	125.9(3197)
	30	Equal aisle	90° Intersecting aisle		in(mm)	73.6(1870)
	31	Outside turning radius			in(mm)	61.4(1560)
WEIGHT	32	Truck weight	Without battery (NL)	NL	lb(kg)	6797(3083)
	33	Axle loading- drive	Static with max. wt. battery	NL/RL	lb(kg)	3284/10141 (1490/4600)
	34	Axle loading- steer	Static with max. wt. battery	NL/RL	lb(kg)	3836/948 (1740/430)
PERFORMANCE	35	Voltage				51.2
	36	Travel speed	Extended shift off	NL/RL	mph(km/h)	9.32/8.39(15/13.5)
	37	Lift speed	Std 3 stg FFL mast	NL/RL	ft/min(m/sec)	83/69(0.42/0.35)
	38	Lower speed	Std 3 stg FFL mast	NL/RL	ft/min(m/sec)	69/79(0.35/0.40)
	39	Gradeability	5 Minute rating	NL/RL	ft/min(m/sec)	24/18
	41	Brake	Method of control	Service/parking	ft/min(m/sec)	Hydraulic/mechanical
			Method of operation	Service/parking	ft/min(m/sec)	Foot/foot
ELECTRIC	42	Battery	Type			lithium-ion
	43	Traction motor	60 Minute rating		hp(kW)	8.8(6.5)
	44	Pump motor	15% Rating		hp(kW)	20(15)
	45	Traction motor	Type/control method			AC/transistor
	46	Pump motor	Type/control method			AC/transistor
	47	Number of speeds	Traction/pump			Infinitely variable / infinitely variable
OTHER	48	Step height			in(mm)	15.2(386)
	49	Floor height	Lowest point		in(mm)	22.8(580)
	50	Attachment relief pressure(mech levers/mini-levers)			psi(bar)	2540/2320(175/160)
	51	Sound level	Measured per ANSI B56.11.5		dB(A)	70

2. Safe driving, operation and maintenance of forklift

Forklift drivers and managers must remember "safety first". Before the first operation, please carefully read the Operation and Maintenance Manual, which will enable you to fully understand our forklift and operate it correctly and safely.

2.1 Transportation,loading,unloading and lifting of forklifts

2.1.1 Forklift transportation

（1）When the forklift is transported by container or truck, the parking brake pedal shall be pressed after the forklift is parked in place

（2）Fix the mast and the balance weight with steel wire and use jacks to prevent the forklift trucks from moving in the container.

（3）Pay attention to the overall length, width, height when loading, unloading and shipping and conforming the regulations is necessary.

（4）If necessary, the working device can be disassembled and transported separately.

2.1.2 Forklift loading and unloading

（1）Use the plate with enough length, width and strength.

（2）Pull the parking brake and use jacks to stop the wheel.

（3）Fasten the plate on the center of the cabin, there must be no grease on the plate.

（4）The left and right height of the plate must be equal to make the loading and unloading smooth.

（5）Don’t change the direction on the plate to prevent the danger.

（6）Reverse the forklift slowly when loading it on the freight car.

2.1.3 Lifting of forklifts

（1）Only the specially trained personnel can sling the truck.

（2）Sling points should always be at the positions specified in sling nameplate.

（3）The slinging cable must be enough to hang the forklift truck.

（4）Disassembled parts of the forklift truck must be slung in the appointed position.

Model	Mast	
	Dimensions(mm)	Weight(kg)
1.8T	2100×1088×393	700

Notice:

Dismantling and slinging the component shall not be performed without the approval of our company. Under special circumstances, the appointed sling position should be used. The balance weight, fork and mast of the forklift truck all have their appointed sling position.The above weights are for reference only and may be adjusted due to different counterweights or technical optimization.

2.2 Parking of forklifts

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

（2）Turn left the key switch and press the emergency stop switch, place all control levers in the empty position, and unplug the power plug.

（3）Tighten the handbrake lever.

（4）Chock the front and rear tires.

（5）When the forklift is out of service for a long time, the wheels should be overhead. Before long-term storage, confirm that the power of the battery system is not less than 50% and not more than 80%, and charge and maintain it every two months. After storage for more than two months, please confirm whether the power battery system has a fault alarm before reuse).

（6）Forklifts shall be stored in a dry and ventilated environment away from heat sources as far as possible after long-term shutdown.

2.3 Preparation before use

（1）Check whether all instruments are normal.

（2）Check tire wear.

（3）Check all handles and pedals.

（4）(Before using the vehicle for the first time, it needs to be charged to 100% before use. After the vehicle is powered on, confirm that there is no battery system alarm message on the instrument panel. Please check the remaining power before use. It is recommended that the SOC be used between 50% and 100%. If the SOC is less than 15%, it is not recommended to continue to use. Please charge as soon as possible.).

(5)Check whether the battery and vehicle power line connectors and signal line connectors are reliable.

（6）Check the hydraulic oil and brake fluid for leakage.

（7）Check the tightness of the main fasteners.

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

（9）Release the parking brake.

（10）Carry out the trial operation of mast lifting, forward and backward tilting, forklift steering and braking.

（11）The contamination degree of hydraulic oil is not greater than Grade 12.

2.4 Precautions for safe operation

（1）Forklift belongs to special equipment. Only drivers who have passed the training and examination and hold the driving license can drive; The maintenance of the forklift should also be carried out by trained and qualified personnel to ensure the normal use of the forklift.

（2）Wear the safety guards, such as clothing, shoes, helmet and gloves while operating the truck.

（3）When the center of gravity of the goods is 600mm from the front wall of the vertical section of the fork, the maximum load is the rated lifting weight, and the load should not exceed the specified value during handling. If the center of gravity of the goods is more than 600mm from the front wall of the vertical section of the fork, the lifting capacity shall be reduced according to the value specified in the load curve, and overloading is strictly prohibited.

（4）Operate your forklift truck on hard ground. Operate on other ground, the lift capacity and travel speed must be decreased. Wipe off the oil and grease from the floor.

（5）Daily maintenance should be done before or after using the truck. Anytime you find that the truck is not functioning normally, operation of the truck should be halted and checked or repaired at once.

（6）When operating one lever, pay attention not to shift another lever. Don’t operate the lever at any position out of the driver’s seat.

（7）Don’t handle unfixed or loose goods. Be careful to handle bulky goods. To prevent the collapse of stacked goods, tighten them. Forbid loading loose or little volume goods without pallets.

（8）Forklifts with accessories specially ordered by users can make their use more extensive. However, the forklift with attachments will reduce the payload and stability of the forklift. Do not use the accessories and special devices for other purposes. Please read the

additional instructions we provide for you and use them strictly according to the requirements. Users are not allowed to modify without permission.

（9）Do not use a fork to pull the embedded object (if necessary, the pulling force shall be calculated first).

（10）When loading goods, the distance between forks shall be adjusted according to the size of the goods, and the weight of the goods shall be equally shared by the two forks, so as to prevent the goods from slipping to one side during eccentric loading or driving; It is prohibited to pick up goods with a single fork.

（11）When carrying large volume goods, the goods block the driver's sight, and the forklift should be driven in reverse.

（12）When loading goods, put the fork to the bottom. After the fork is inserted into the cargo pile, the front wall of the vertical section of the fork should be in contact with the goods, and then the gantry should be tilted back to the limit position, and the fork should be lifted 200 mm - 300 mm from the ground before driving

（13）When lifting or lowering goods, no one is allowed under the lifting frame; It is forbidden to lift people with a fork.

（14）When loading and unloading goods, keep the mast vertical and the truck is in braking state.

（15）Because the forklift truck turns by the rear wheels, the end counterweight may swing widely when turning. Use care in narrow aisles and other workplaces.

（16）During operation, pay attention to the performance and condition of the system of machinery, hydraulic, electric and speed-adjuster etc.

（17）Turn on the power, step on the brake, press the one-button start switch, select the position of the direction switch, turn the steering wheel to see if the vehicle turns normally, and slowly step on the accelerator pedal to maintain the proper starting acceleration.

（18）Pay attention to observe the SOC. When the forklift is working, if the SOC power is lower than 15%, it is recommended to stop the operation as soon as possible, charge the lithium battery or replace the lithium battery with sufficient power. If the SOC power is lower than 10%, the forklift will be forced to operate with reduced power for the protection of the battery. At this time, it is necessary to go to the charger immediately for charging.

（19）The speed of cargo lifting or lowering can be controlled by the number of movements of the operating handle of the multi way directional valve. The initial speed of

cargo lifting or lowering should not be too fast.

（20）Before tilting the mast forward and backward, the forklift shall be braked, and shall tilt slowly when tilting forward to prevent the goods from slipping out suddenly.

（21）Tilt the mast of the high lift forklift truck as backward as possible when operating the truck. Use minimum forward and backward tilt when loading and unloading. It is dangerous to travel or turn when lifting the goods at high levels.

（22） It is noted that the goods will fall down when the forks of the truck with lifting height more than 3m lift, take the protection measures if necessary.

（23）The overhead guard is the main part which is strong enough to meet safety standards, and protect the operator from falling materials. It's very dangerous to dismantle or rebuild the overhead guard, because these conditions could lead to an accident.

（24） The shelf is a safety part. When the goods are stacked high on the fork and the gantry is tilted backward, the goods shall be prevented from sliding backward to avoid personal injury to the driver.

（25） The height of loading and unloading shall be limited to the height of the shelf. If the height of the goods exceeds the shelf, it is easy to cause the goods to slide to the operator, which will lead to serious accidents.

（26）During outdoor operation, the wind has a great impact on the stability of the forklift, so please pay special attention.

（27）When driving on the wharf or temporary planking, be careful and drive slowly.

（28）When carrying goods, do not tilt the mast forward, do not load or unload, and do not brake to prevent the goods from slipping out.

（29）Forklifts should drive into the cargo pile at a low speed, and pay attention to whether there are protruding hard objects near the cargo to avoid puncturing the tires.

（30）When driving, pay attention to pedestrians, obstacles and potholes, and pay attention to the clearance above the forklift.

（31）When the forklift is running, the handle, foot and other parts of the body are not allowed to extend out of the cab, and the vehicle is not allowed to carry people.

（32）Drive carefully on the ramp, and do not turn, drive laterally or diagonally, otherwise the forklift may roll over; When carrying goods on a large ramp, drive forward when going uphill and backward when going downhill; Please use foot brake when going downhill and drive carefully; When driving on the ramp, it is prohibited to slide in neutral gear and use the emergency stop button carefully.

（33）Start, turn, drive, brake and stop carefully, especially when turning on wet or smooth roads.

（34）It is forbidden to suddenly start, accelerate, stop and turn the forklift. Improper operation may cause the forklift to roll over. If this happens, the driver should keep calm and avoid jumping. He should hold the steering wheel with both hands and lean to the opposite direction of the forklift.

（35）Forklifts with attachments shall be operated as loaded forklifts when empty.

（36）During the use of the chain, it should be checked regularly to ensure that there are good lubrication conditions between the chain links, and the tightness of the left and right chains is consistent; If the chain is worn during use, and the change value of the chain pitch exceeds 2% of the standard value, the chain must be replaced to ensure safe loading.

（37）Before the forklift is safely decelerated and stopped, the reverse gear cannot be engaged to ensure the driver's safety.

（38）When the forklift is running with load, emergency braking shall be avoided.

（39）When leaving the vehicle, lower the fork to the ground, place the shift handle in neutral, and disconnect the power supply. When parking on the ramp, pull the parking brake or step down the parking brake. If the parking time is long, chock the wheels.

（40）When the mast is tilted forward or backward to the limit position or the fork is lifted to the maximum height, the handle must quickly return to the middle position.

（41）The pressure of the multi way valve and safety valve of the forklift has been adjusted before leaving the factory. Users should not adjust them randomly during use to avoid damage to the entire hydraulic system and hydraulic components due to excessive pressure adjustment.

（42）During the operation of the forklift, additional noise values may be added due to different operations and the impact of the external environment, which may lead to higher or lower noise values.

（43）The driver will feel the vibration of the forklift when operating and driving. The total vibration value of the double arms transmitted by the forklift to the operator shall not exceed 1.3m/s2, but the vibration frequency characteristics of the human body depend on the working conditions (such as road conditions, operation methods, etc.), so the actual vibration frequency characteristics are determined by the site conditions when necessary.

（44）In order to handle super wide goods, users can choose "lengthened fork", but it is worth noting that the bearing capacity of the lengthened fork should work strictly according to

the requirements of the load curve. Within the specified load center, its bearing capacity is the same as that of the standard fork. When the load center moves forward, the load must be lowered; It is strictly forbidden to lift or hit the goods with the fork tip. Pay special attention to safety when driving or turning.

（45）Be familiar with and pay attention to the functions of various signs on the forklift, and timely subsidize if lost.

（46）Forklifts are generally used in an environment below 1000m above sea level, with a temperature of 5°F-104°F (- 15 °C - 40 °C) and a relative humidity of 95%; Use with caution in other harsh environments.

（47）In order to prevent fire, accident or other unpredictable events, fire extinguishers shall be set in advance and operated according to the use requirements of fire extinguishers.

（48）Without the written approval of our company, it is not allowed to modify the forklift or add any working device, otherwise the rated load or safe operation may be affected.

（49）Pay special attention to safety during high maintenance.

2.5 Maintenance of lithium battery forklift

In the process of using the forklift, careful operation, reasonable use, regular inspection and maintenance must be carried out to keep the forklift in good working condition for a long time.

2.5.1 New forklift maintenance

The performance and service life of the forklift are closely related to the maintenance of the new car in the running period. During the running in period, special attention shall be paid to:

The gear oil in the differential or reducer shall be replaced after the first 1000 hours of operation of the new forklift, and all fasteners shall be re-tightened after replacement.

2.5.2 Starting essentials

（1）Oil volume of hydraulic oil: the oil level shall be in the middle of the oil level gauge scale.

（2）Check the pipes, joints, pumps and valves for leaks and damage.

（3）Check the service brake: the idle stroke of the brake pedal shall be 5mm. When the brake is effective, the gap between the front floor and the pedal shall be greater than 20mm.

（4）Check the parking brake function: when the parking brake is fully depressed, it should be stopped on the specified ramp (no load).

（5）Instruments and lighting fixtures: check whether the instruments, lighting, connectors, switches and electrical circuits work normally.

2.5.3 Maintenance Summary

（1）Forklifts need to replace some key safety parts regularly. Please use our pure parts.

（2）The same type of oil must be used when replacing or refueling.

（3）When the forklift is found to be damaged or faulty, stop operating the forklift and inform the qualified maintenance personnel of the forklift's condition in time. Do not operate the forklift until it has been thoroughly overhauled.

（4）The motor, electric control and lithium battery shall be maintained according to the provisions of their instructions.

（5）All connectors shall be checked once a month.

（6）Pay attention to the waterproofing of the forklift and avoid washing with the high-pressure water gun.

（7）The surface of the lithium battery shall be kept clean and dry, and dirt shall be removed frequently.

（8）After normal use, the forklift shall be regularly maintained according to the table below.

No	Item	Maintenance content	Maintenance intervals	Note
1	Steering wheel bearing	Replace grease	1200 hours	
2	Foot brake pin	Add grease	200 hours	
3	Reduction gearbox	Replace gear oil	1000 hours	
4	brake fluid	Add/replace	Anytime/1200 hours	
5	Tilt cylinder pin	Add lubricating grease	400 hours	
6	Hydraulic tank and screen	clean	1000 hours	
7	Hydraulic oil tank and filter	Clean or replace the oil filter	1200 hours	
8	Lifting Chain	replace	3000 hours	Replace at any time in case of damage
9	High pressure rubber hose	replace	3000 hours	
10	Lifting motor switch	Decontamination	200 hours	

Note: During maintenance and inspection, it is not allowed to use the forklift body as a step or the mast and shelf as a ladder. This is very dangerous. Unsafe actions may lead to serious accidents.

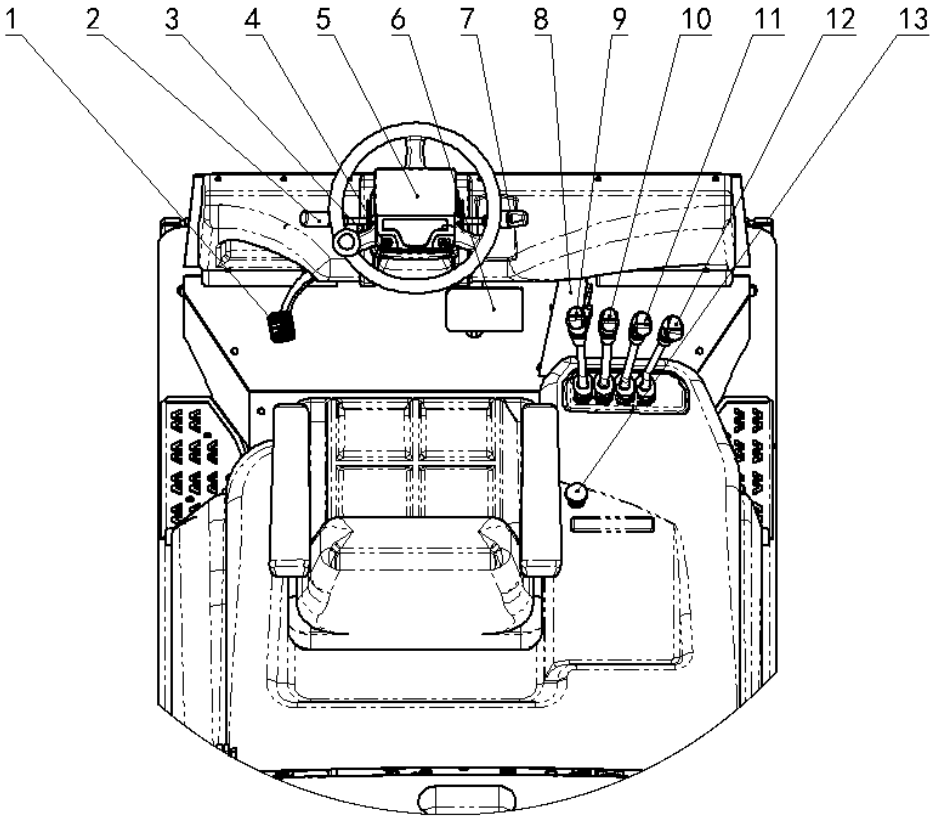
2.5.4 Forklift oil and grease

Name	Brand and code	Qty	Note
Hydraulic oil	ISOVG0	24L	Between the oil dipstick line
gear oil	DONAXTM	0.55 ~ 0.65L(PMP)	To oil level overflow P23
		0.35 ~ 0.4L(ZF)	
Brake fluid	DOT3 Synthetic brake fluid	0.6 L	
grease	JISK2220/2#	appropriate amount	

The filling of oil, grease and brake fluid shall be carried out according to relevant automobile standards. When handling and replacing the above hazardous substances, please handle them according to relevant laws and regulations. Improper treatment will pollute water, soil and atmosphere. This is prohibited by law. When filling various types of oil products, wear safety protection articles, such as safety glasses and thick gloves, to avoid direct contact with the body.

2.6 Brief operating instructions

2.6.1 Control mechanism and instrument



Function and use status of control mechanism

	Name	Function	Usage status
1	Parking brake control	Realize forklift parking brake	Step to the bottom to realize braking function
2	shift knob	Change the driving direction of the forklift	Push forward, reverse backward,median neutral
3	Steering wheel adjusting handle	Adjust the front and rear angle of the steering wheel	
4	Horn button	Switch for controlling horn	The horn sounds when pressed
5	Instrument panel	See the specific introduction of instruments in the electrical system section of this manual	Display vehicle status

6	pedal brake	Brake forklift	Press the brake
7	Centralized light and turn signal switch	Used to operate the two position light control and turn signal switch	Move the combination switch forward to turn left and backward to turn right.
8	Accelerator pedal	Drive vehicle travel	Step down and accelerate The controller outputs the corresponding speed according to the amplitude of the step
9	Lifting cylinder joystick	Operating lifting cylinder	Pull the door frame backward to lift, and vice versa
10	Tilt cylinder joystick	Operating the tilt cylinder	Pull the mast backward to tilt backward and reverse to tilt forward
11	Side Shifter joystick	Operating sideshift cylinder	
12	Accessory joystick	Manipulating accessories	
13	Emergency stop switch	Control electrical system	Press to disconnect the power supply

2.6.2 Brief description of operation

（1）Start: the driver should correctly sit on the driver's seat and fasten the safety belt. Before starting the forklift, the parking brake switch should be placed in the braking position, the shift direction switch should be in the middle position, that is, the N position. Turn the emergency stop switch key to release the emergency stop).

Turn the key switch to the right, and after 1.5 seconds, the instrument panel will light up, the lithium battery will discharge, the forklift self check will be completed and powered on, and the instrument panel indicator and electrical circuit power will be connected.

Push the shift direction switch forward, and the instrument will display the D gear, that is, in the forward gear, release the foot brake pedal, press the accelerator pedal, and the forklift will move forward. Pull the direction switch backward, and the instrument will display the R gear, that is, in the reverse gear. At this time, the reversing light will be on, and the reversing buzzer will sound. If the forklift is equipped with a reversing image, then the instrument will display the reversing image picture).. Note that the instrument will display different fault codes in case of operation sequence error or others.

Light control switch:

The switch has two positions. The switch rotates at different positions, and the lamp lights up as shown below.

Lamp name	Phase 1	Phase 2
headlamps	-----	on
Side marker lamp	on	on

(2) Turn signal: pull the turn signal switch backward, the front small light and rear upper and lower combination light turn signal lights on the right side of the forklift are on, and push the turn signal switch forward, the front small light and rear upper and lower combination light turn signal lights on the left side of the forklift are on, and the corresponding instrument turn indicator lights will also flash at the same time.

（3）Brake signal: When the forklift is braking, step on the brake pedal, and the brake light (red) under the rear combination light will be on.

（4）Reversing signal: When the forklift is reversing, pull the direction switch backward, and the travel motor will reverse, the reversing light (white) on the rear combination light will be on, and the reversing buzzer will beep. If the forklift is equipped with a reversing image, the reversing image on the instrument panel will be on.

（5）The ESH key under the instrument is the switch key of the whole vehicle working mode, and the whole vehicle has three working modes: E, S and H. E is the energy-saving mode, in which the battery life is the longest; S is the standard mode, with moderate power consumption and endurance; H High performance mode, in which the power is strong.

2.6.3 Maintenance of control system

During the use of lithium battery forklift, the control system shall be regularly maintained as follows:;

（1）Check the contact wear of the contactor and whether the contactor moves freely. The contacts shall be checked every three months.

（2）Check the foot pedal or handle the microswitch. Use a multimeter to measure the voltage drop between contacts and ensure that there is no resistance between contacts. The sound of microswitch opening and closing should be clear and crisp. The microswitch shall be inspected every three months.

（3）Check the connecting wires of the main circuit to ensure that the cables of the lithium battery, controller and motor are well insulated and firmly connected.

Cables shall be checked every three months.

（4）Check the spring of the pedal or handle. Ensure that the spring can deform normally and return to its original position. Check every three months.

（5）Check the movement of the contactor. The contact of the contactor should move freely to ensure that the contact is not bonded. Check every three months.

Note:

Please do not open the controller by yourself, otherwise the controller will be damaged and the warranty will be invalid. Keep the controller clean and dry, and regularly check and eliminate the diagnostic history files. It is strictly forbidden to start the electric control for vehicles with incorrect installation.

Regular maintenance should be carried out by trained professionals. If damaged parts need to be replaced, please use the original accessories provided by our company to ensure quality.

If any condition that may cause damage or endanger the safety is found during the inspection, the dealer shall be informed immediately, and the dealer shall decide the operation safety of the vehicle.

2.6.4 Special reminder

（1）As a special vehicle, the lithium battery forklift needs to be operated and maintained by qualified professionals, and attention should be paid to its use characteristics and working environment in order to avoid unnecessary failures of the electrical system (including instruments).

（2）As the vehicle power source, lithium batteries are different from traditional energy sources. Its actual capacity is directly related to the working condition and its own aging condition, and is somewhat different from the rated capacity. According to the general use of lithium batteries, when the power drops to 20% (1 grid), the lithium battery must be charged, which will help to extend the life of the lithium battery.

（3）Using a PC or handheld device to connect with the controller, users can access the powerful software setting interface within certain permission, so as to more intuitively detect and understand the working conditions of the whole vehicle, such as the working current and speed of (AC) drive motors, and improve a series of system parameters such as the working current, speed, service time, fault list, etc. of the motor.

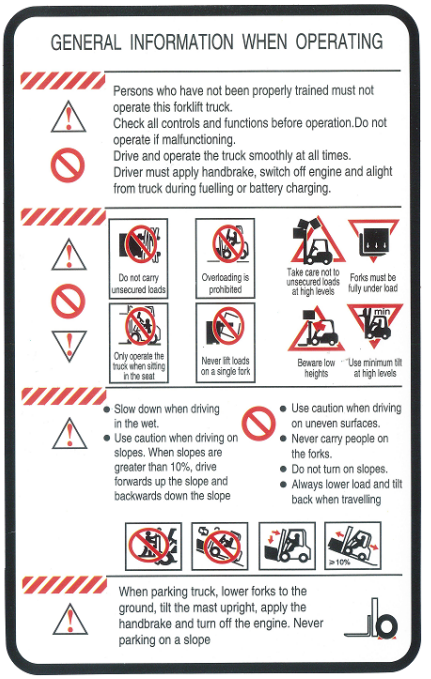
2.7 Warning sign

The warning board affixed to the vehicle is used to explain the use methods and precautions of the vehicle. Please read carefully before driving. This is for your sake as well as for the vehicle. If the warning sign falls off, please re attach it immediately. After repair and maintenance, please check whether the nameplate is complete and the handwriting is clear. If it is lost, please complete it.

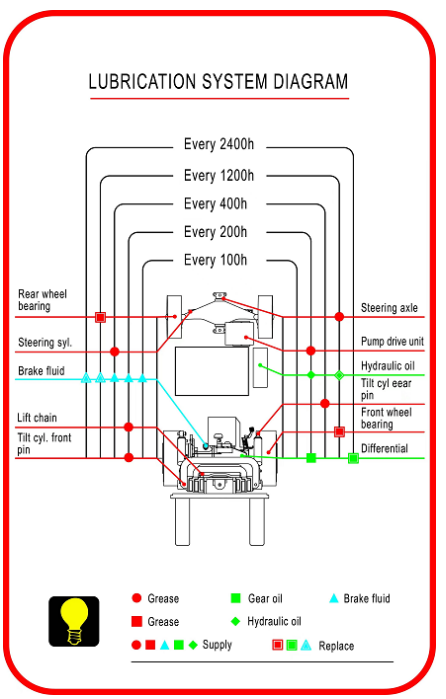
（1）Safety signs

No one is allowed to stand up or down the fork

（2）General information when operating



（3）Lubrication system



（4）Tipping safety sign

（5）Hood clamp label

（6）Tipping safety sign

FOR SAFETY NOTICE FOLLOWING WARNINGS

1 Lateral tipover can occur when unloaded if the combination of speed and sharpness of turn produces an overturning moment which exceeds the stability of the truck.

2 Lateral tipover can occur if overloaded or loaded within capacity and the load is elevated and if turning and/or braking when traveling rearward or if tuming and/or accelerating when traveling forward produces an overturning moment which exceeds the stability of the truck. Rearward tilt and/or off-center positioning of the road and/or uneven ground conditions will further aggravate the above conditions

3 Longitudinal tipover can occur if overloaded or when loaded within capacity and the road is elevated if forward tilt,braking in forward travel, or commencing rearward travel produces an overtuming moment which exceeds the stability of the truck.

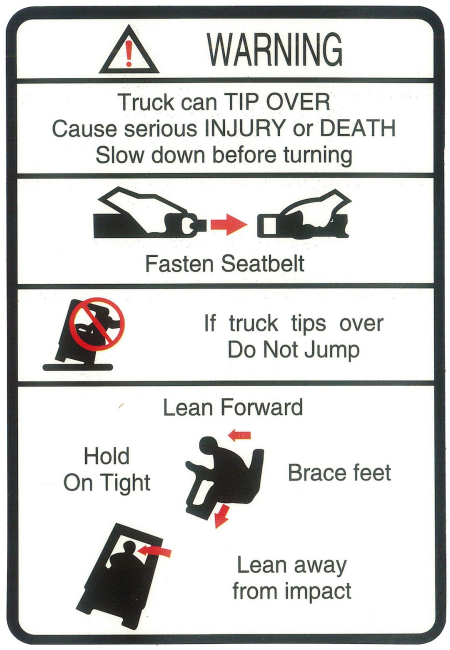
4 Serious injury or death can occur to the operator if he/she is trapped between the truck and the ground.

IN CASE OF TIPOVER

1 The operator should stay with the truck if lateral or longitudinal tipover occurs. The operator should hold on firmly to the steering wheel, brace feet, lean forward and lean away from the point of impact.

2 The operator should stay with the truck if it falls off a loading dock or ramp. There are other situations where the environment of the landing area presents a severe hazard. In those incaidents, it may be prudent for the operator to leave the truck.

(7) Safe driving sticker

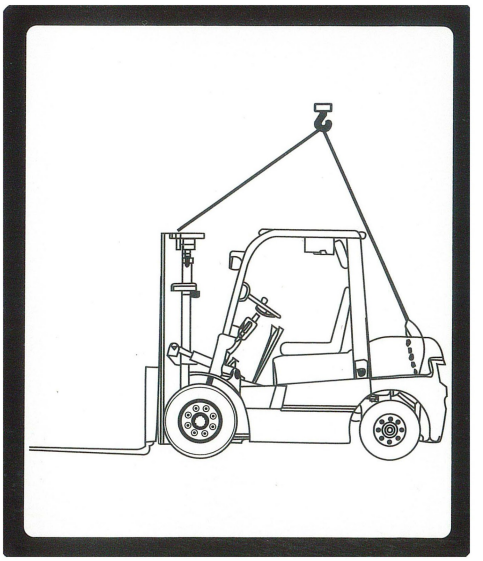


(8) Do not enter the space behind the mast

(9) Lifting point indication

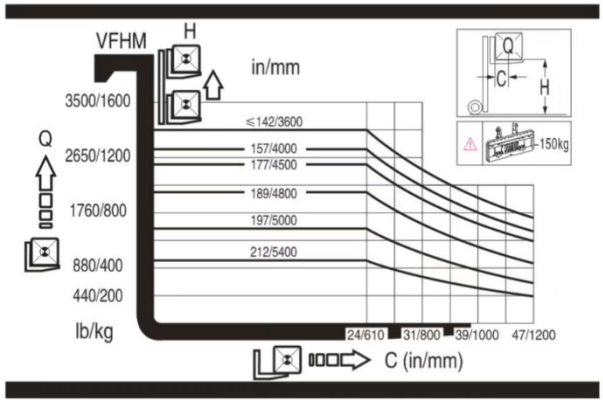
（10）No manned sign

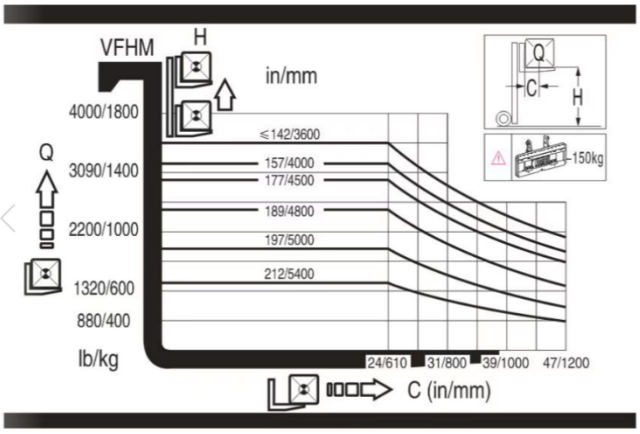
（11）Lifting sign



（12）Pay attention to the warning sign of injured hands

（13） Load curve diagram





3. Structure, principle, adjustment and maintenance of lithium battery forklift

3.1 drive system

3.1.1 Summary

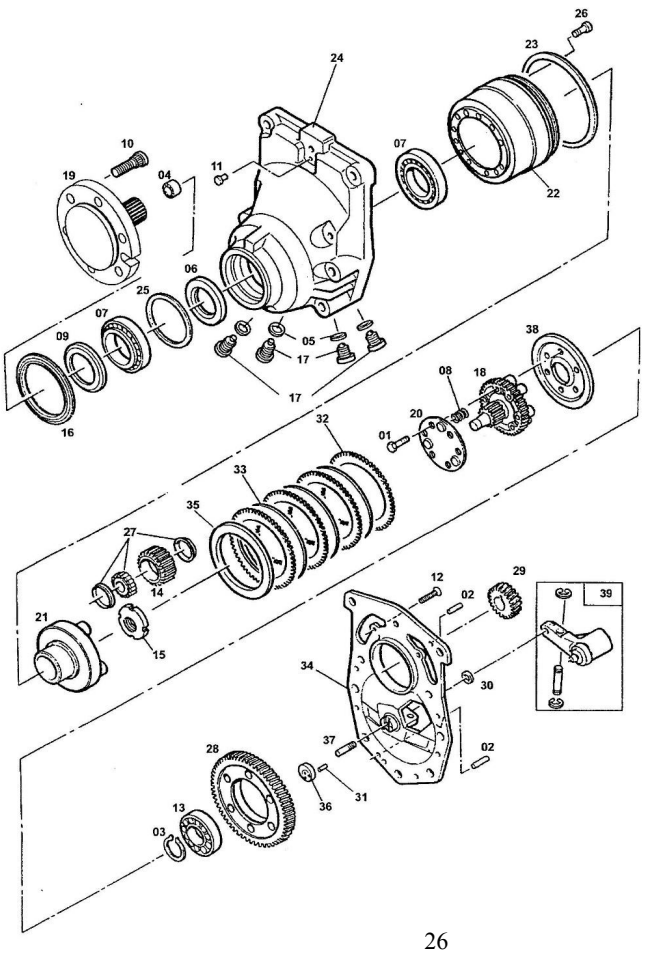
The drive system of the three-wheel forklift truck includes two parts: the traditional transmission system and part of the braking system. The dual-motor drive structure of the front wheel makes the left and right front wheels of the three-wheel forklift independently own the drive axle, gearbox, brake and drive motor, which greatly improves the working efficiency. The reducer and brake are installed together in the drive axle housing and assembled into an integral part, with a compact structure.

The walking speed of the forklift increases with the increase of the motor speed; The driving direction is realized by changing the rotation direction of the motor; Steering is the controller that controls the drive motors on the left and right front wheels through the sensor installed on the rear wheels. The left and right drive motors receive different information and output different rotational speeds to realize the steering of the forklift. The front wheel steering of a three-fulcrum forklift is realized by an electric differential. This system eliminates the differential composed of umbrella gear, which not only improves the working efficiency, but also eliminates the noise of umbrella gear transmission.

3.1.1.1 Reduction gearbox

The reduction box is composed of a reduction box, reduction device, brake friction device, reduction box cover, wheel axle, etc. The gearbox housing and gearbox cover are of cast structure. The reducer and brake friction device are installed in the box composed of the gearbox housing and gearbox cover. The power is transmitted to the axle through the gearbox to drive the front wheels to rotate. The whole reducer is fixed on the connecting plate of the frame through 7 bolts. The specific structure is shown in Figure 1-1.

01.Hexagon bolt	14.planet gear	28.helical gear
02.Cylindrical pin	15.Grooved nut	29.pinion
03.Circlip	16.Gamma	30.Shaft seal
04.Needle sleeve	17.Bolt plug	31.Cylindrical pin
05.Sealing gasket	18.Inner circle support	32.Outer brake friction plate
06.Shaft cover	20.Installation disk	33.Inner brake friction plate
07.Tapered roller bearing	21.Planetary support	34.Tank cover
08.Pressure spring	22.Internal gear	35.Pressure washer
09.NIL05 ring	23.FEY ring	36.Support bearing
10.Drive wheel bolt	24.box	37.Thrust round pin
11.Air filter plug	25.Adjusting ring	38.Pressure plate
12.Cylindrical bolt	26.Inner groove bolt	39.Brake lever
13.Grooved ball bearing	27.Cylindrical roller bearing	



3.1.1.2 Front wheel assembly

The front wheel assembly is composed of solid tires and rims. The models of front wheel tyres and rims are as follows:

Solid tires: 18 × 7-8　OD × Width=457 × 170（mm）

Rim: 4.33R

3.1.2 Removal of drive system

Before carefully disassembling the gearbox, remove the front wheel assembly and traveling motor connected to it before repairing and maintaining the parts in the gearbox.

3.1.2.1 Disassembly of wheels (Fig. 1-2)

Before disassembling the device,drain the gear oil in the gearbox, loosen the drive nut and remove the drive wheel. Then unscrew the 7 bolts fixed on the frame and move the gearbox connecting the traveling motor out of the frame.

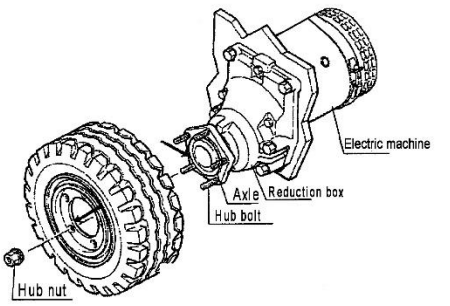


Fig1-2

3.1.2.2 Disassembly of traveling motor (Fig. 1-3)

Remove the three bolts for fixing the traveling motor as shown in the figure:

One M10 × 50 (piece ①) and two M10 × 90 (piece ②).

Note:

·Be careful when removing the motor from the transmission.

·Do not damage the sealing surface of the O-ring installed in the frame when removing the motor.

If only the motor is removed, the open part of the gearbox exposed due to the removal of the motor should be sealed to prevent dust from entering the Gearbox.

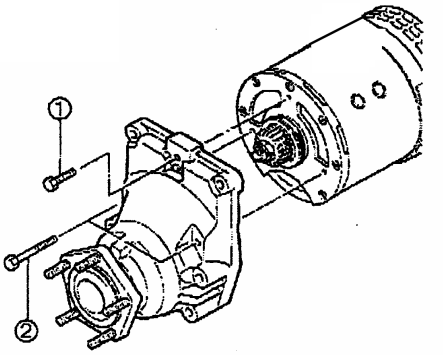


Fig1-3

3.1.2.3 Removal of transmission

Generally, do not disassemble the gearbox. If there is any problem, please contact our dealer.

3.1.3 Installation of transmission system

3.1.3.1 Installation of traveling motor

Before installation, clean and dry the mating surface of the gearbox and motor with detergent (such as loctite706 or alcohol), and check whether the mating surface is damaged. If there is slight damage, please remove it with oil stone.

Note: Because the detergent is corrosive, please wear gloves and goggles when using it. Avoid the detergent splashing on the skin. Do not drink or inhale the volatile gas. In case of drinking detergent by mistake, please see a doctor immediately.

The sealing ring of the shaft connected with the motor is an O-ring, which is installed on the flange of the motor and the housing of the reducer. There is a hole on the motor flange for installing the shaft retaining ring. The shaft of the motor is fixed axially, and the flange of the motor is fixed in the opposite direction. The flange of the motor is connected to the reducer through three M10 screws (see Figure 1-5), and the length of the three screws is 60 and 90 mm respectively. The recommended torque for installation is 50 Nm.

Note: After the reducer is connected with the motor, it can only move axially. The reducer shaft and motor shaft must be perpendicular and orthogonal. To ensure this, it is recommended to lift the gearbox, and then align the spline at the inlet of the gearbox with the shaft of the motor for installation. For the convenience of connection, it is recommended to string pins at the connection holes of the three screws first, and then replace the screws after the reducer is aligned with the motor and installed.

When installing the motor, avoid collision between the motor shaft gear and the transmission gear in the gearbox to avoid noise in the future work.

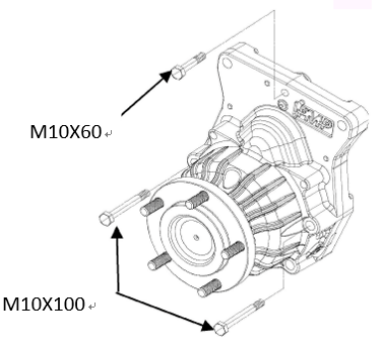


Fig1-4

3.1.3.2 Install the transmission on the frame (Fig. 1-6)

Check whether the connecting plate surface of the frame is flat or damaged, and the flatness of the plane of the transmission installation is not greater than 0.1mm. Fix the transmission to the frame with seven M14 hexagon-head bolts, and the tightening torque is 135 Nm

There is an oil inlet and an oil outlet under the transmission bracket.

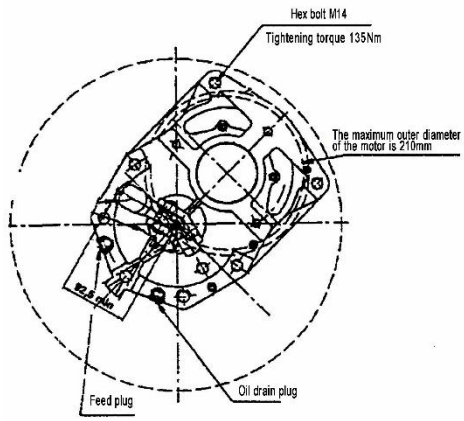


Fig1-6

3.1.3.3 Wheel installation (Fig. 1-7)

The axle on the gearbox can be suitable for the installation of elastic solid tires and semi-solid tires at the same time.

（a）Ensure that the wheel axle surface and the mounting surface of the wheel are clean, and check whether there is any damage.

（b）Align the hole of the rim with the hub bolt on the axle, and push the wheel to make the rim surface of the wheel coincide with the contact surface of the axle.

（c）Install the spring washer, flat washer and nut, and tighten them. The tightening torque is 140 Nm.

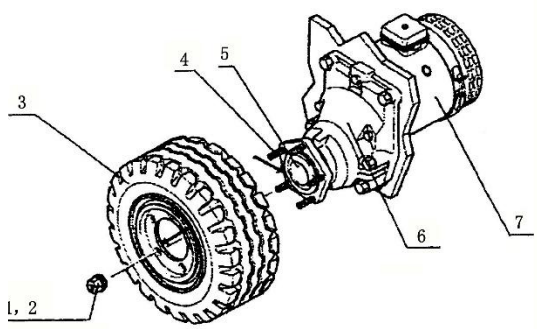


Fig 1-7 Wheel mounting

1.Hub nut 2.Washer 3.Wheel

4.Hub bolt 5.Wheel axle 6.Reduction gearbox

7.Drive motor

3.1.4 Addition of gear oil

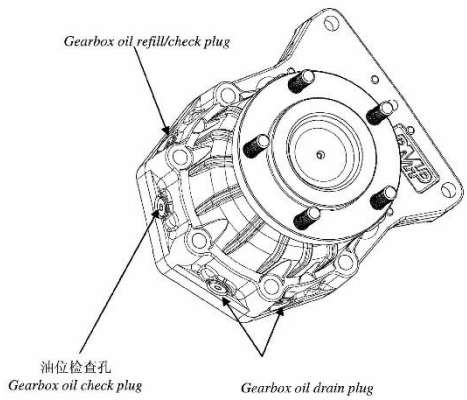
The service cycle of gear oil is 1000 hours/year (whichever comes first), that is, the gear oil needs to be replaced after the forklift works for 1000 hours or one year. Drain the gear oil in the reducer and add the specified gear oil. The specific operation process is as follows:

（a）Unscrew the oil drain plug (part ①) with sealing ring (part ③) to drain the oil; Wipe off the iron powder adsorbed on the oil drain plug (magnetic); Then tighten the oil drain plug again (replace the sealing ring if necessary).

（b）Unscrew the oil filling plug (part ②) with sealing ring (part ④).

(c) Fill the transmission with gear oil.During oil filling, do not let air enter,otherwise bubbles will form in the tank

(d) In any case, the standard volume of gear oil to be added is 0.55-0.65L (PMP) or 0.35-0.40L (ZF), and the volume is guaranteed by the funnel.



(e) Gear oil can be selected from any of the following models:

MOBIL company	ATF2O0、ATF2lO、ATF220
SHELL company	DONAXTM、ATF DEXRON IID- 21666、DONAXTG PLUSD- 22543、DONAXTG D- 21126
ESSO company	TYPESUFFIXA、ATF D-21065、 ATF D- 21611、ATF D- 22079 、 SAE-80W/API GL4/UTTO

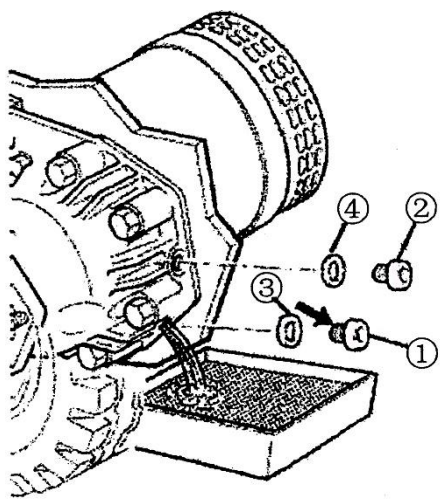


Fig. 1-8.

(f) Tighten the oil filler plug with sealing ring, and the tightening torque is 22Nm, as shown in Fig. 1-8.

3.2. braking system

3.2.1 Summary

The brake system is composed of brake pedal, brake master cylinder and oil-cooled lubricating brake. This oil-bath multi-friction disc brake is installed in the reduction box, which eliminates external pollution, greatly extends the service life of the brake and reduces the use and maintenance costs.

3.2.1.1 brake pedal

The installation mode of brake pedal is suspension type, and the specific structure is shown in Figure 2-1. It is installed on the instrument rack through a bracket. The pedal converts the pedal force acting on the pedal into brake oil pressure through the push rod of the brake master cylinder.

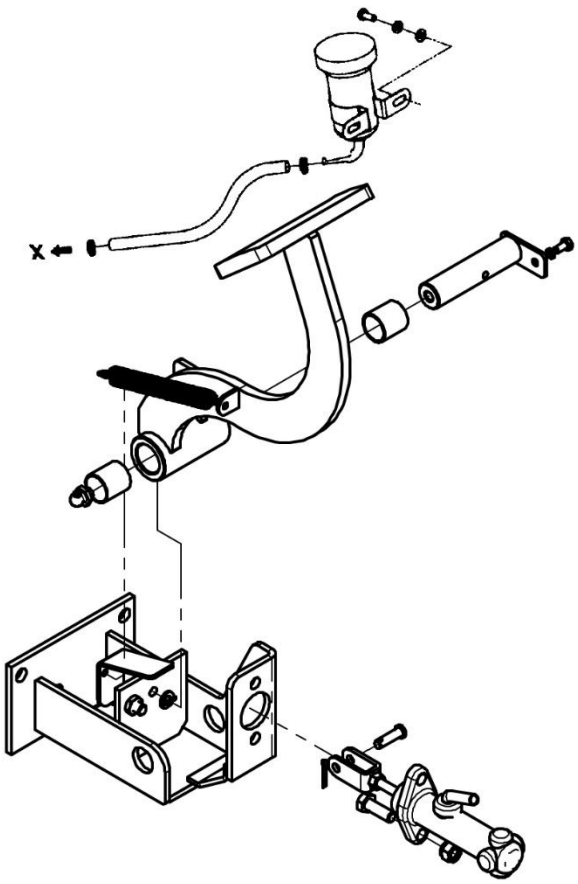


Fig 2-1 brake pedal

3.2.1.2 brake master cylinder

The master cylinder consists of a valve seat, a check valve, a return spring, a leather cup, a piston and an auxiliary leather cup.(see fig 2-2) The end is fixed with a stop washer and a stop steel wire, and the outside is protected by a rubber dust cover. The master cylinder piston acts through a push rod by operating the brake pedal. When the brake pedal is depressed, 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 cup blocks the oil return port. After the main cup pushes past the oil return port, the brake fluid in the front chamber of the master cylinder is compressed and the one-way valve is opened, Thus, it flows to the slave cylinder through the brake pipeline. In this way, each slave cylinder piston extends outward, making the brake shoe friction plate contact the brake drum, so as to achieve the effect of deceleration or braking. At this time, the rear chamber of the piston is supplemented by the brake fluid from the oil return port and the oil inlet port. When the brake pedal is released, the piston is pressed back by the return spring. At the same time, the brake fluid in each brake wheel cylinder is also compressed by the return spring of the brake shoe, so that the brake fluid returns to the master cylinder (piston front chamber) through the check valve. The piston returns to its original position. The brake fluid in the master cylinder flows back to the oil tank through the return port. The pressure of the check valve is adjusted to a certain proportion to the residual pressure in the brake pipeline and the brake wheel cylinder. Make sure that the rubber cup of the scoring pump is correctly installed to prevent oil leakage and eliminate the possible air lock during emergency braking.

1. Connecting rod
2. Push rod
3. Dust cover
4. Circlip
5. Auxiliary leather ring
6. piston
7. Main leather bowl
8. Spring
9. Check valve

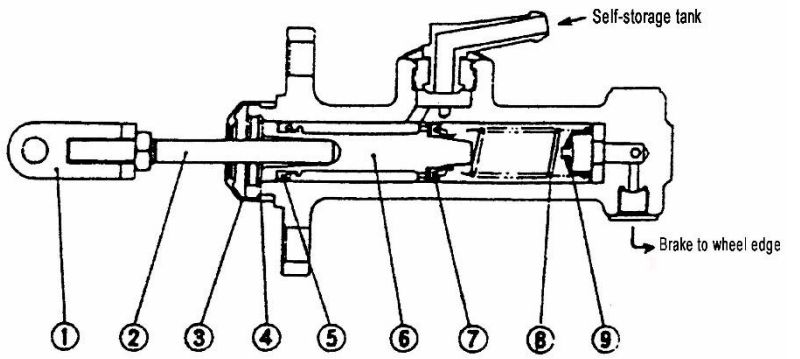


Fig 2-2 Brake master cylinder

3.2.1.3 Connection between brake system and drive unit

There are two mechanical interfaces at the connection between the drive unit and the brake, one for the service brake oil pipe and the other for the bleeding of the service brake system, as shown in Figure 2-3.

a) Connection of service brake

The brake oil pipe interface is connected with the brake oil pipe, and the pre-tightening torque is 12-16Nm.

b)Connection of parking brake

Connect the brake cable joint with the parking brake rod.

3.2.1.4 Exhaust of the brake system

When the brake system is installed and the brake fluid is added, the air mixed in the brake system must be discharged to achieve a good braking effect. The specific steps are as follows:

（a）Loosen the brake exhaust valve so that the brake fluid can just flow out;

（b）Press the brake pedal repeatedly to make the pressure generated by the brake fluid discharge the mixed gas in the brake system;

（c）When the air is exhausted and the plug is sprayed with brake fluid, press the brake pedal and tighten the plug;

（d）Release the pedal and check the brake effect. If the brake effect is not ideal, repeat the exhaust operation until the brake effect meets the requirements.

3.2.1.5 Parking brake operating device (Figure 2-3)

The parking brake device includes the parking brake and brake cable. The parking brake device is lever type, which drives the steel cable to move through the parking brake pedal; Adjust the cable travel position to make the brake pedal in the proper position.

The parking brake control device is shown in Figure 2-3

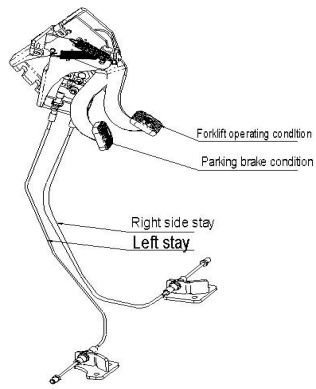


Fig 2-3 Parking brake operating device

3.2.1.6 Brake system operation

After the installation and commissioning of the service brake and parking brake, the normal service brake is achieved by pressing the brake pedal; The parking brake handle is placed on the left side of the instrument rack, and is meshed with the disc brake in the drive unit through the brake cable. The parking brake can be realized by stepping on the parking brake pedal.

3.2.2 Maintenance and adjustment essentials of brake system

3.2.2.1 Inspection and maintenance of brake system

（a）Parking brake performance inspection (daily inspection)

First, check whether the parking brake performance is intact; Then check whether the microswitch works when the parking brake handle is pulled down, that is, whether the circuit is disconnected.

Note: After every 3000 hours of use, it is necessary to ensure that the brake stroke of the brake piston does not exceed 3.8mm, otherwise the brake disc needs to be replaced.

（b）Service brake performance inspection (daily inspection)

Before driving, check the height of the brake fluid in the brake oil tank, and then check whether the brake pedal has a return function, that is, whether the spring works.

（c）Brake fluid leakage inspection

If the brake pedal is depressed and the braking effect is not ideal, then carefully check the assembly and tightening of the service brake system, and mark the oil level on the brake oil tank to check whether there is leakage, so as to eliminate the potential safety hazard.

（d）Brake master cylinder inspection

When the service brake is weak, first check whether there is air mixed in the brake master cylinder. If there is air mixed in the brake system, it can be solved by venting the brake system; Then check whether the cup in the master cylinder is damaged. If the cup is damaged, replace the cup.

（e）Brake cable inspection

When the hand brake is pulled down, the two wheels cannot be completely locked at the same time. At this time, check whether the brake cable is moving normally and whether there is jamming damping. Check whether the clearance of the cable part is appropriate, and whether the angle of the hand brake handle is appropriate. If the angle is not appropriate or the empty stroke of the pull rod is large, adjust the adjusting screw at both ends of the cable.

3.2.2.2 Brake pedal adjustment

（a）Shorten the push rod;

（b）Adjust the stop bolt to make the brake pedal height appropriate;

（c）Step down the brake pedal and lengthen the push rod until the front end of the pushrod contacts the master cylinder piston;

（d）Tighten the push rod lock nut.

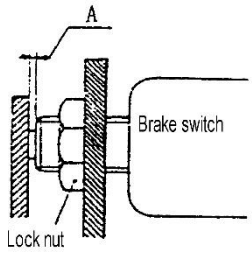


Fig 2-4 Brake switch adjustment

3.2.2.3 Brake switch adjustment (Fig. 2-4)

（a）Loosen the brake lock nut after the brake pedal height is adjusted;

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

（c）Turn the switch to make the clearance A=1mm;

（d）Confirm that the brake light is on when the brake pedal is pressed.

3.3. steering system

3.3.1 Summary

This steering system is a load sensing full hydraulic steering system. It is mainly composed of steering wheel, steering shaft, load sensing steering gear, priority valve, steering motor and steering device. The steering shaft is connected to the load sensing steering gear through the steering knuckle, and the steering column can be tilted back and forth to the appropriate position. See Figure 3-1. The steering device is installed at the rear of the frame, and the steering motor drives the gear to rotate to deflect the steering wheel to realize steering.

Main technical parameters of steering system

model Item	1.8t
Steering system type	Rear wheel power steering
Steering gear type Model	Cycloidal load sensing full hydraulic steering gear BZZ5-E50BF
Rated pressure	7.0MPa
Steering wheel diameter	ϕ310mm
Steering tyre	15*4.5-8
Steering rim	3.00R

3.3.1.1 Steering wheel

The forklift steering wheel is operated in the same way as usual, that is, when the steering wheel rotates to the right, the forklift turns to the right, and when the steering wheel rotates to the left, the forklift turns to the left. The steering wheel is installed at the rear of the forklift, which enables the rear of the forklift to swing outward during steering.

3.3.1.2 Working principle of load sensing full hydraulic steering system (Figure 3-2)

When the steering wheel is turned when there is a steering demand, the LS pipeline transmits the pressure signal from the internal branch orifice of the steering gear to the priority valve, which forces the valve core of the priority valve to balance to ensure the flow required by the CF port. The steering circuit and other working circuits have no influence on each other. The main flow volume shall give priority to the steering circuit, and the pressure and flow of the steering circuit shall be kept first, and the steering shall be reliable; When the steering gear is in the middle position, only a small amount of flow passes through the steering gear, so the system can save energy, and the middle pressure characteristic is not affected by the displacement.

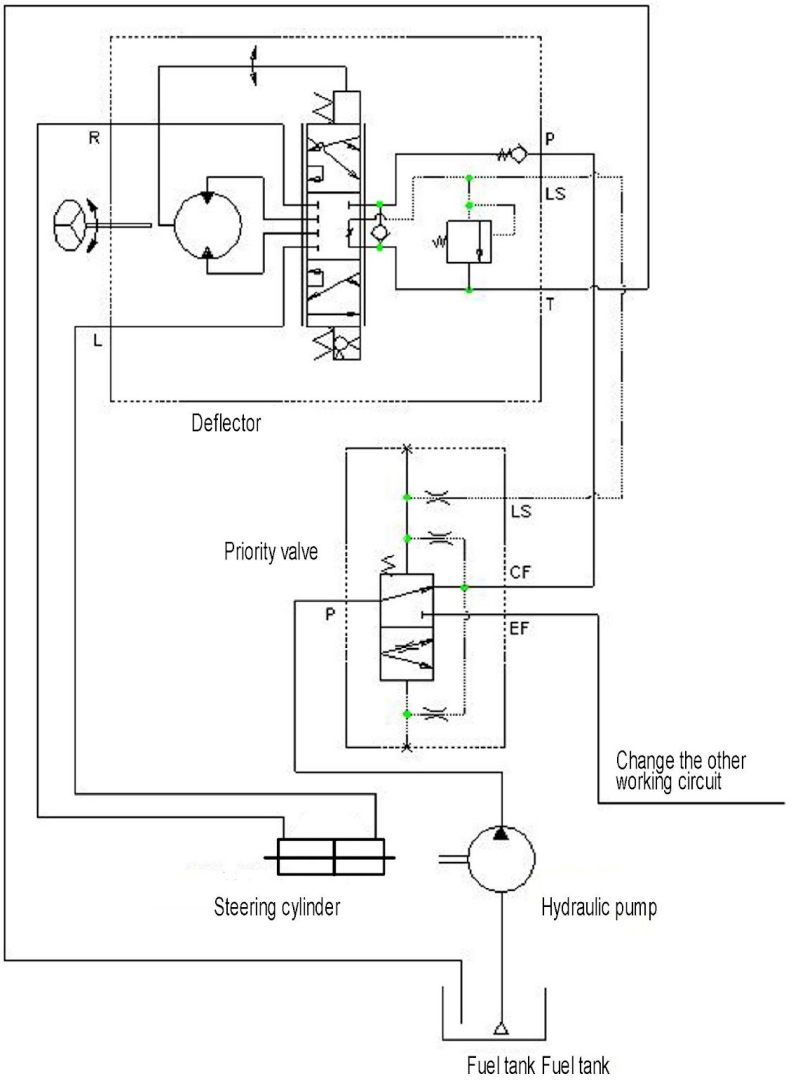


Figure 3-2 Working principle of load sensing steering system

3.3.1.3 Steering device

The steering device (as shown in Figure 3-3) is composed of steering cylinder, steering axle body, steering wheel and other components. The steering cylinder drives the steering axle body to rotate, and the steering wheel rotates with the steering axle body. The wheel is pried onto the rear hub through the rim, and the rear hub is installed on the steering axle body through two tapered roller bearings. An oil seal is installed inside the bearing to keep the grease in the hub and steering wheel shaft cavity.

When the steering wheel is in the middle position, set the steering angle in the electric control to 0 degrees and adjust the resistance value to the middle position.

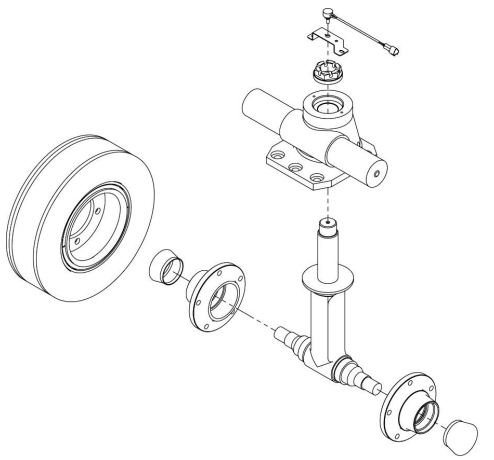


Fig 3-3 Steering device

3.3.2 Adjustment and maintenance essentials.

3.3.2.1 Adjustment of warning load of steering wheel bearing

（a）As shown in Figure 3-5, grease the hub, inner and outer bearings and the inner cavity of the hub cover, and also apply some grease to the oil seal lip;

（b）Fix the outer ring of the bearing on the hub and install the hub on the steering knuckle shaft;

（c）Install the flat washer and tighten the slotted nut with a torque of 206-235N. m (21-24 kg · m). Loosen the slotted nut and then tighten the nut with a torque of 9.8N. m (kg · m);

（d）Gently tap the hub with a wooden hammer and turn the hub for 3-4 turns to ensure that the hub is not loose;

（e）Tighten the slotted nut to align the slot with the cotter pin hole on the steering knuckle;

（f）Then gently tap the hub with a wooden hammer, turn the hub 3-4 times by hand to ensure smooth rotation, and measure the rotation torque of the hub, which is 2.94-7.8N. m (0.3-0.8kg · m);

（g）When the rotational torque is higher than the specified value, it can be returned by 1/6 turn, and then its rotational torque can be measured;

（h）When the specified turning torque is reached, lock the slotted nut with a cotter pin.

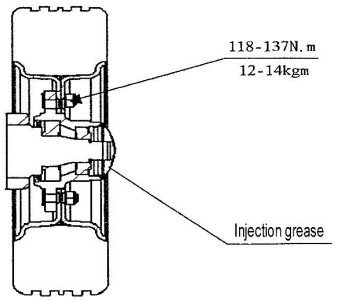


Fig 3-5 Pre-load adjustment

3.3.2.2 Inspection after reassembly of steering system

（a）Turn the steering wheel left and right and open the bottom to check whether the left and right forces are uniform and whether the rotation is stable;

（b）Check whether the oil pressure pipeline is arranged correctly and whether the left and right steering is installed reversely;

（c）Jack up the rear wheel, slowly turn the steering wheel left and right, and repeat several times to remove the air in the hydraulic pipeline and oil cylinder.

3.3.2.3 Steering system fault diagnosis

Problem	Cause analysis	Exclusion method
Steering wheel does rotate	The oil pump is damaged or faulty	Replace
	The rubber hose or connector is damaged, or the pipe is blocked	Replace or clean
Heavy steering wheel	Pressure of safety valve is too low	Adjust pressure
	There is air in the oil circuit	Exhaust air
	Steering gear fails to reset, positioning spring plate is broken or elasticit insufficient	Replace the spring plate
	Excessive internal leakage of steering cylinder	Check the piston seal
The forklift snaked swung	Broken or no spring force	Replace
High working noise	Oil level of oil tank is too low	Add oil
	The suction pipe or oil filter is blocked	Replace or clean
Oil leakage	The steering cylinder guide sleeve seal is damaged or the pipeline or connect damaged	Replace

Attention:

The pump motor of this forklift is controlled and started by the direction switch. Only when the direction switch is placed in the forward or backward position and the accelerator pedal is pressed, can the pump motor start to work.

When exhausting, start the pump motor and turn the steering wheel slightly (if there is any abnormal phenomenon, turn off the power immediately, find out the cause and eliminate the fault). The hand sensing is convenient and flexible, and the steering wheel will also deflect accordingly. In this way, the gas in the system can be exhausted by turning it repeatedly from left to right.

4. Electrical system

4.1 Summary

The electrical system is mainly composed of lithium battery, walking motor, oil pump motor, multi-function integrated electronic control assembly, control switch, instrument and lighting devices.

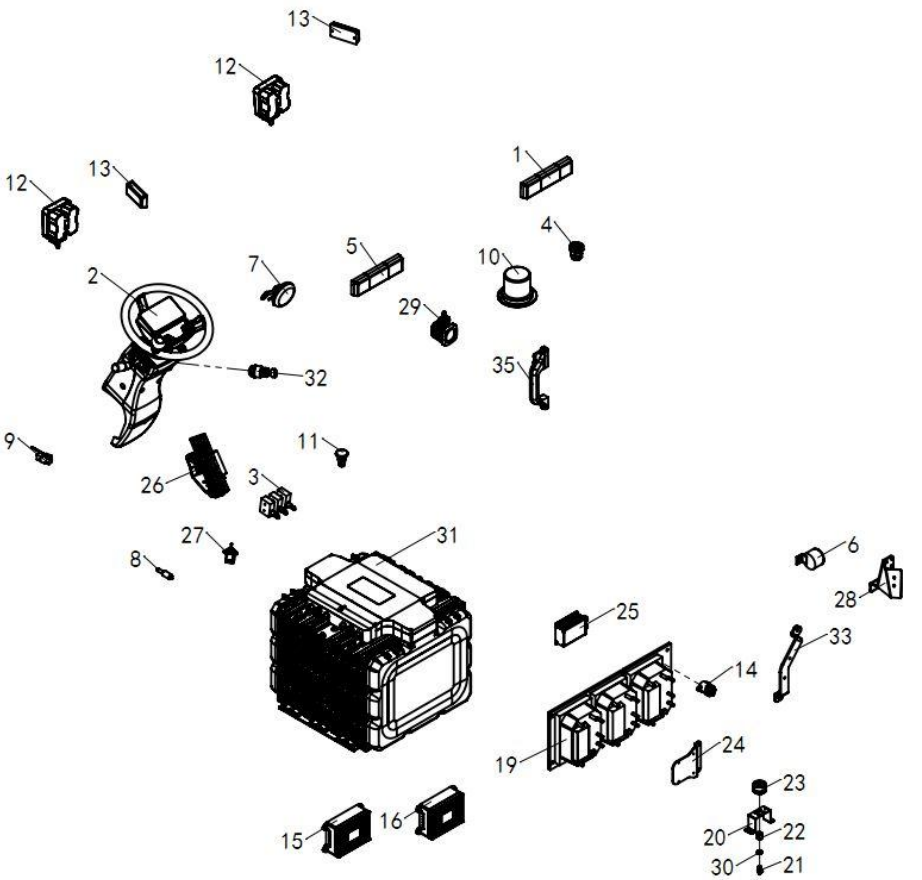


Fig 4-1 Electrical system structure diagram

1	LED three-color tail light (short line)	2	Intelligent instrument assembly
3	microswitch	4	Reverse image camera
5	LED three-color tail light (long line)	6	The reverse buzzer
7	Horn	8	brake light switch
9	Parking brake switch	10	warning light
11	40mm emergency stop switch	12	Working light
13	Turn signal with width indicator	14	contactor
15	Fuse box assembly	16	Control box assembly
17	Vehicle wiring harness	18	cable assembly
19	Controller	20	Angle Potentiometer bracket
21	Installation base of corner point gauge	22	Sensor connection nut
23	DC converter mounting bracket	24	DC converter (48V/300W)
25	accelerator	26	Lifting speed control sensor
27	Power plug fixing plate	28	Blue light warning light
29	Hexagon thin nut M10	30	48V 270-350AH lithium battery
31	key switch	32	Cable tray
33	Inching switch assembly	34	Handle with horn
35	lead wire	36	DC converter mounting bracket

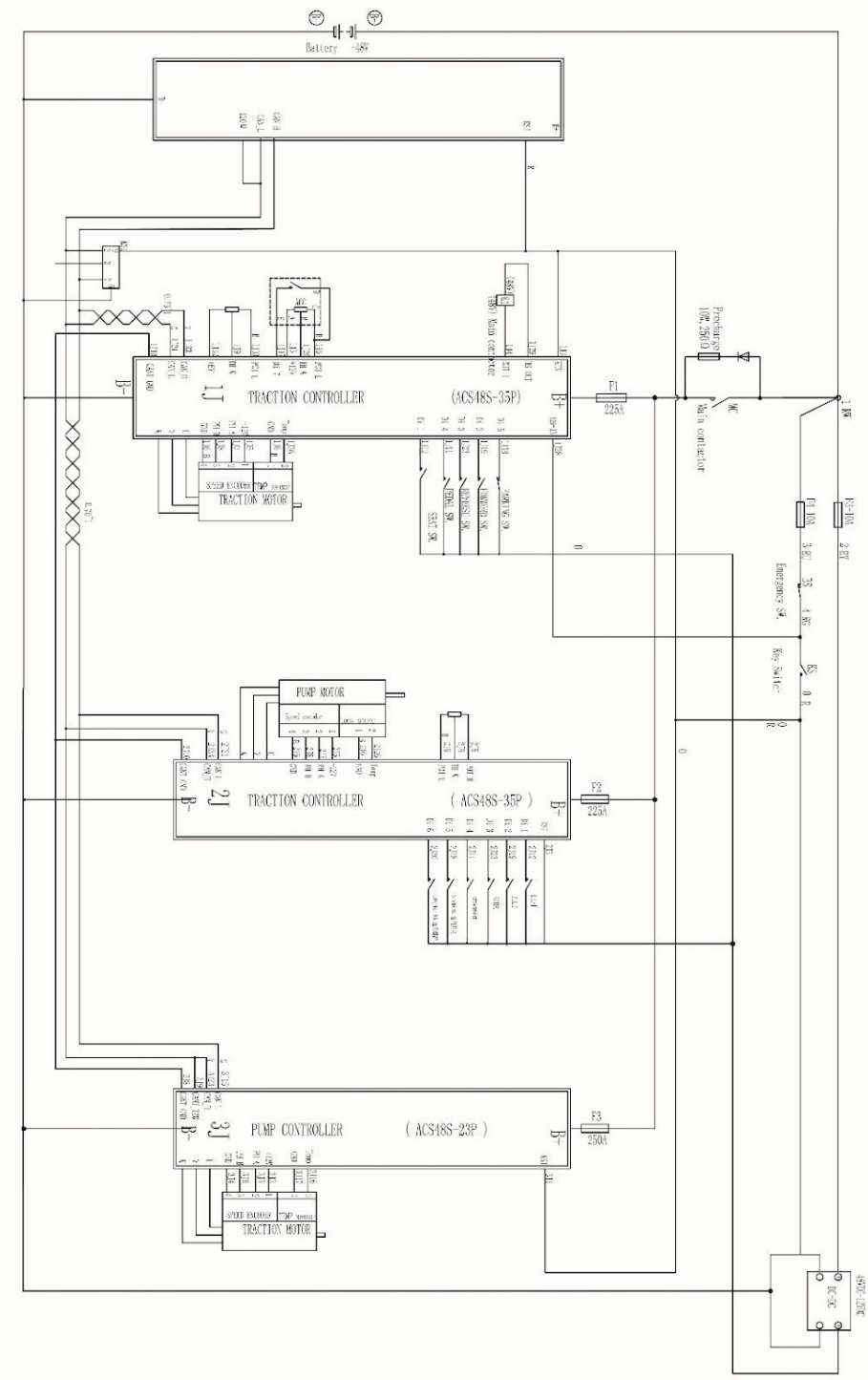


Figure 4-2 Schematic diagram of electrical system

4.2 Instrument

4.2.1 Summary

The AC three-wheel forklift adopts the LCD color screen combination instrument and uses the high-definition LCD display screen for real-time display. The instrument is connected with battery and electric control via CAN line.

4.2.2 Instrument interface

Instrument interface description

DISPLAY TYPE	TECHNICAL DESCRIPTION
WORKING VOLTAGE	+8 ~ +32V
WORKING TEMPERATURE	-22°F-176°F（- 30°C~+80°C）
DEGREE OF PROTECTION	IP65

No	Icon	Icon Description
1		Turn left
2		Turn right
3		Seat indication
4		Parking brake
5	**D**	Forward gear
6	**R**	Reverse gear
7	**N**	neutral gear
8		Width lamp
9		Working light
10		Battery voltage
11		Battery current
12		Vehicle speed display

13		SOC display
14		E/S/H Mode
15		Running time

4.2.3 Instrument instructions

No	Function	Note
1	Logo	
2	Left turn indicator	The green icon flashes when turning left is enabled
3	Seat indicator	Yellow icon when leaving the seat
4	Parking brake indicator icon	Red icon when parking brake
5	Work light icon indicator	Display whether the work light is working
6	Position light indicator	Displays whether the position lights are working
7	Right turn indicator	Green icon flashes when turning right
8	Power battery voltage display	Numerical display
9	Power battery current display	Numerical display
10	Vehicle speed display	Pointer scale display
11	ON-ST gear	Display power on gear ON or start gear ST
12	Vehicle gear	Display N, D, R gear
13	Fault alarm text	When there is no alarm, the display text: it works normally;

		When there is an alarm, the alarm text is displayed. For example: “BMS:XXX” “Travel controller:XXX” “Oil pump controller:XXX”
14	Battery level display	Pointer scale display, red value display when less than 10%
15	Operating mode	Three operating modes E, S and H are displayed, and E mode is the default when power on
16	Running time	Display controller running time

Key definitions are shown in the following table

	Double jump light button
ESH	Three operating modes
	Warning light button
	Reversing camera switch button
	Select button up

	Select button to the left
	Right selection button
	Select button down
	Menu button
	Back button
	confirm button

4.2.4 Instrument working process and instructions

4.2.4.1 One button start function description

（1）Check before power on:

1、The lithium battery discharge plug and the vehicle discharge plug are fully and firmly inserted;

2、The emergency stop button is released;

3、The direction gear is in neutral

4、Adjust the seat, sit on the seat and fasten the safety belt;

（2）Power on in working state

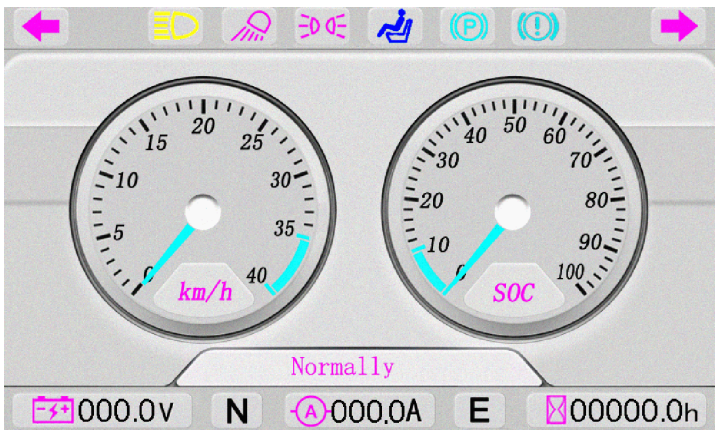
Turn the key switch to the right, and after 1.5 seconds, the instrument panel will light up, the lithium battery will discharge, the vehicle self check will be completed and powered on, and the instrument indicator and electrical circuit power will be connected.

4.2.5 Instrument main menu and instructions

（1）Turn the key switch to the right to power on the instrument panel, the buzzer inside the instrument will make a sound of "drop", and the instrument will display the startup interface. The instrument power on interface displays for 2 seconds, completes hardware

initialization, and automatically displays the main working interface. The main interface displays various parameters of the current machine, such as high and low beam lamps, left and right turn signals, position lights, seat indicators, foot brake indicators, power battery voltage, power battery current, battery SOC, driving speed, gear indicator, working mode, time indicator, etc.

Startup interface



main interface

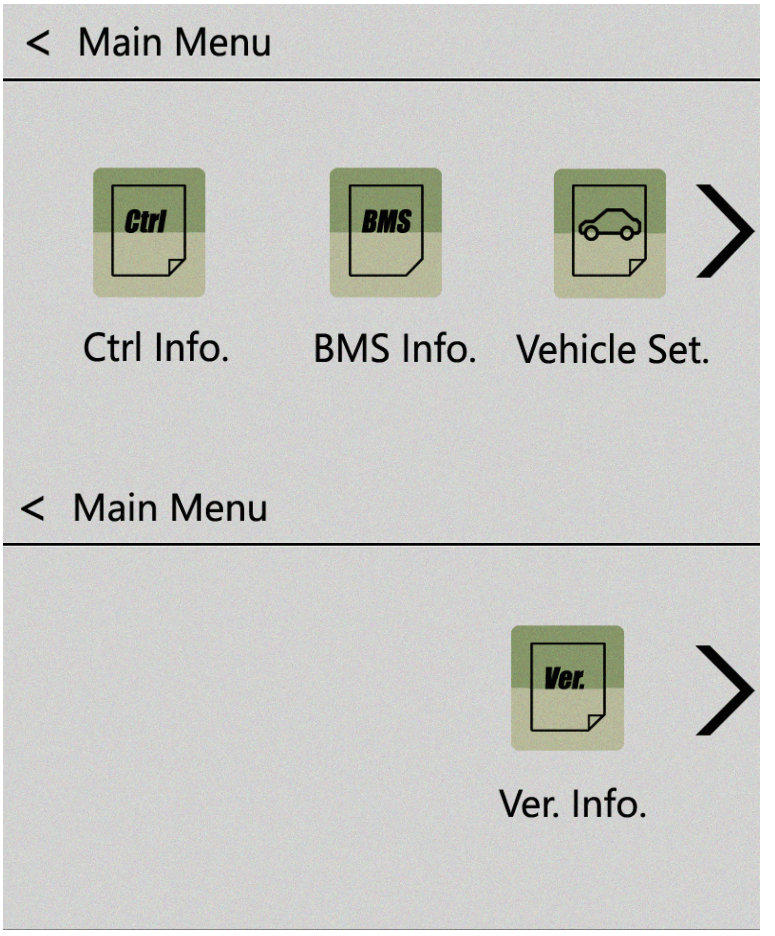
（2）When the steering switch is turned forward or backward, the left and right steering marker lamps will flash. When the headlight is turned on, the light indicator lamp will be on.

（3）Brake display

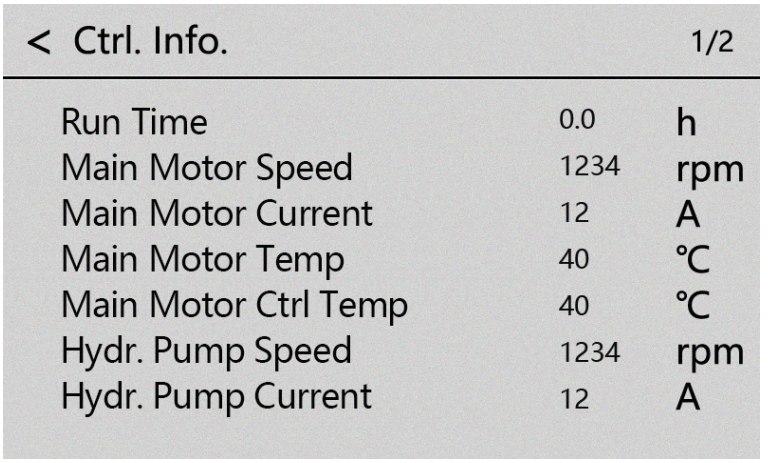
When the parking brake is used, the graphic [P] light is on; When the parking brake is released, the marker lamp goes out.

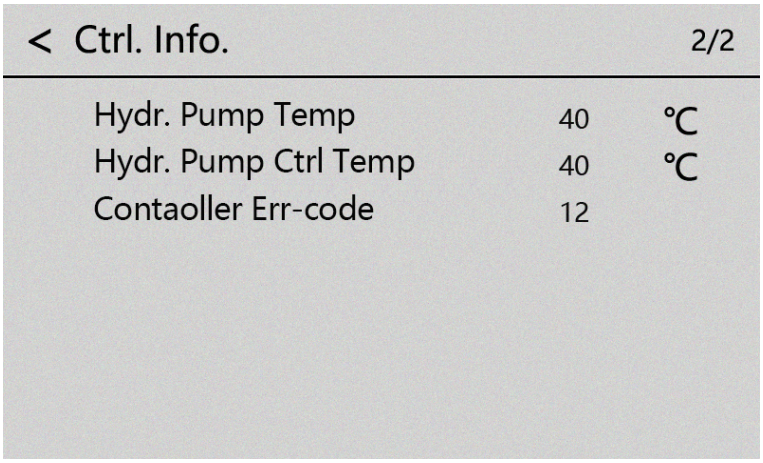
4.2.5.1 Parameter Description

（1）Press the menu key on the main interface to enter the main menu, including controller parameters, BMS information parameters, vehicle setting parameters and version information parameters, as shown in the following figure:



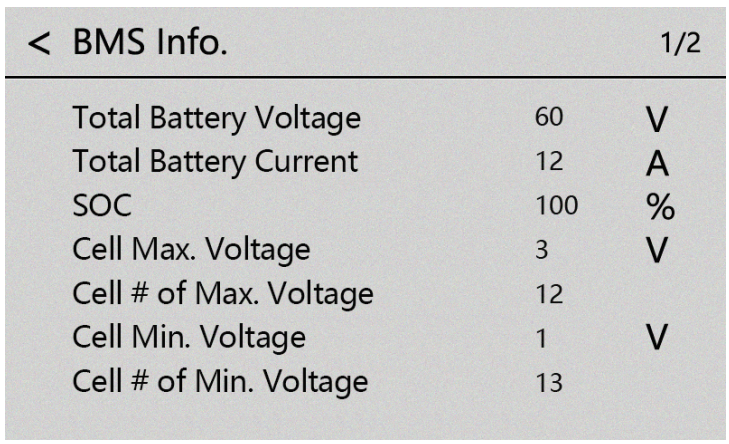
（2）Enter the control parameters in the main menu, as shown below:

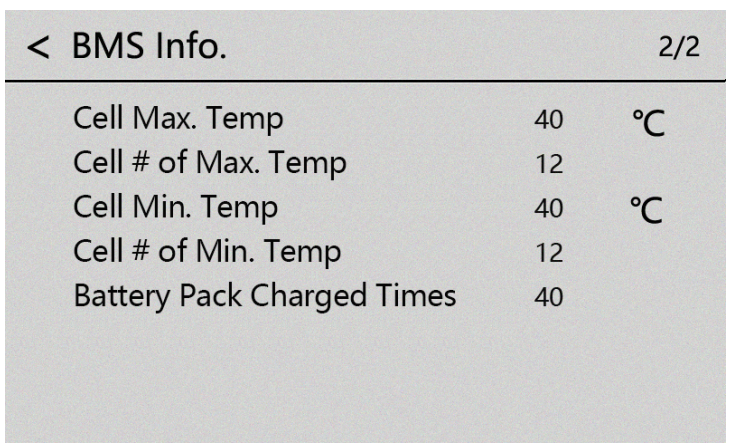




The specific values of 10 parameters including running time, traveling motor speed, traveling motor current, traveling motor temperature, traveling controller temperature, oil pump motor speed, oil pump motor current, oil pump motor temperature, oil pump motor controller temperature and controller fault code are displayed.

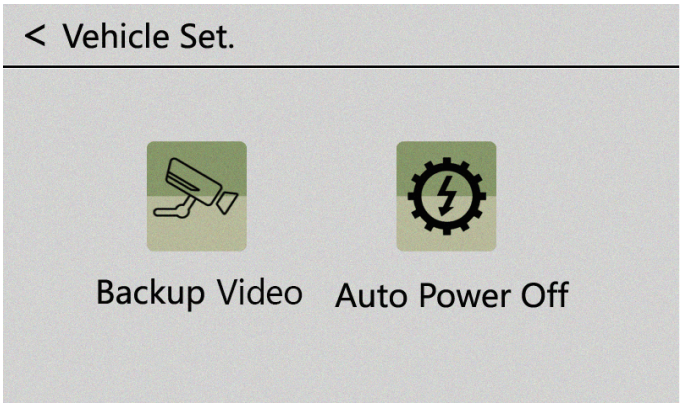
（3）Enter BMS parameters in the main menu, as shown below:

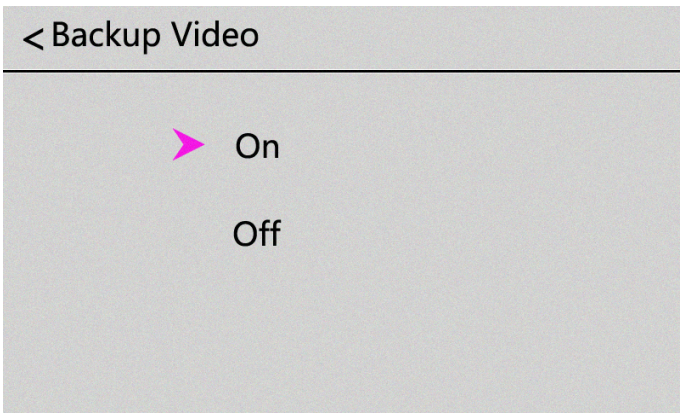


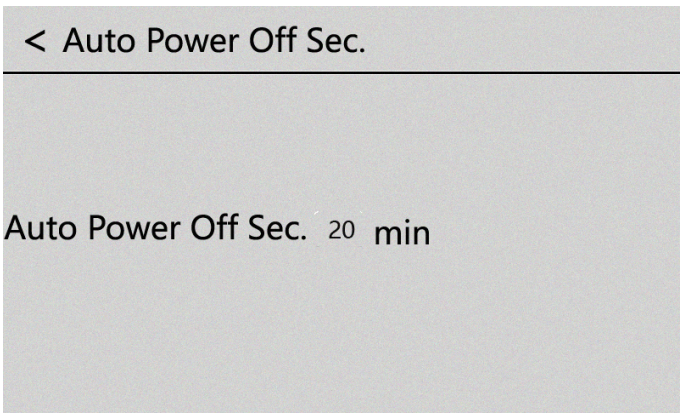


Display the specific values of 12 parameters, including total battery voltage, total battery current, SOC, cell max. voltage, cell # of max. voltage, cell min. voltage, cell # of min. voltage, cell max. temp, cell # of max. temp, cell min. temp, cell # of min. temp and battery pack charged times.

（4） Enter vehicle settings in the main menu, as shown below:

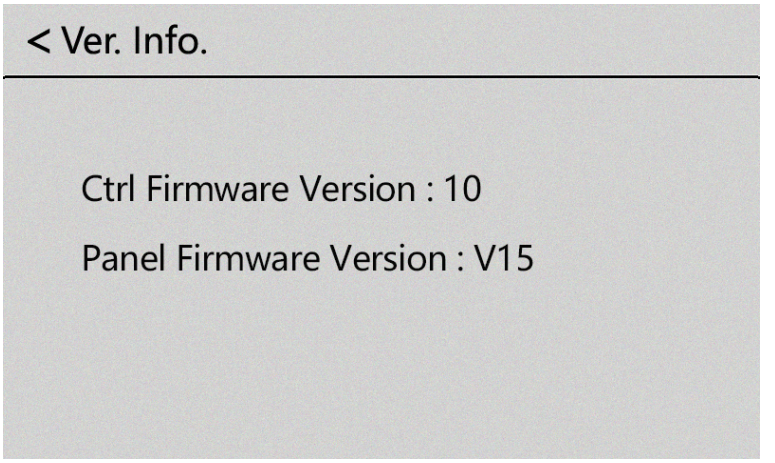






Two parameters are displayed: reversing image and automatic power-off. The reversing image switch can be set in the reversing image option, and the automatic power-off time can be set in the automatic power-off time option.

（5）Enter version information in vehicle main menu, as shown below:



Display control box software version and instrument software version parameters.

4.2.6 matters needing attention

（1）It is forbidden to use high-pressure water guns to wash instruments when users wash vehicles.

（2）Do not plug or unplug the plug of the instrument and harness frequently to avoid loose contact.

（3）Do not strike or scratch the instrument.

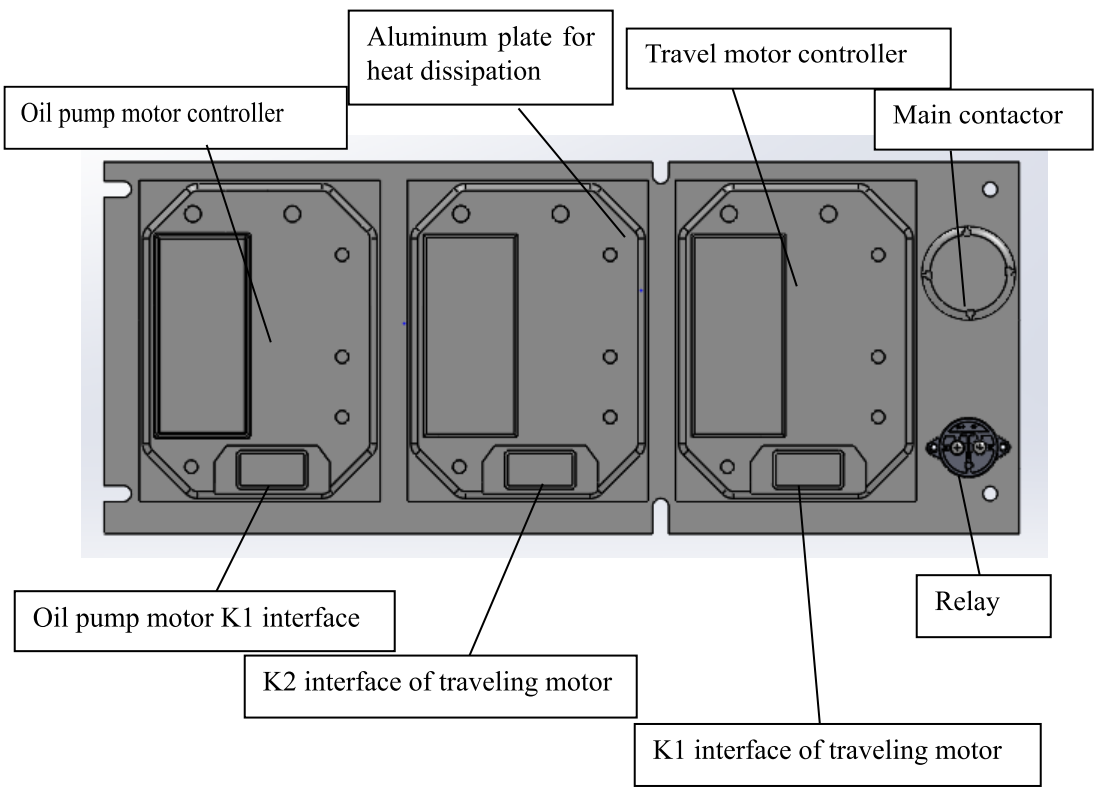
（4）If the instrument does not work normally, please contact our company for maintenance.

4.3 Inmotion AC electric control assembly

4.3.1 summary

The three-fulcrum AC control assembly is composed of two travel controllers, an oil pump controller, a main contactor, a control aluminum plate, etc.

4.3.2 Controller structure



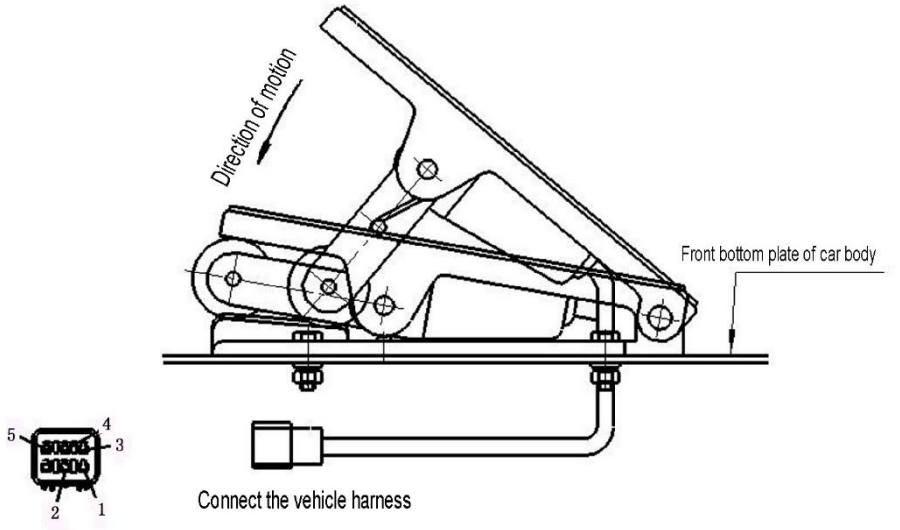
4.3.3 Controller fault code

20	ERROR Accelerator pedal switch activated during startup
21	ERROR Direction switch activated during startup
22	ERROR Simultaneous activation of front and rear direction switches
23	ERRORAccelerator pedal analog value out of range
24	ERROR Accelerator pedal analog fault
31	ERROR Driver CAN communication failure
32	ERRORLow battery voltage
34	ERROR CPU internal error
36	ERROR Tilt switch activated during startup
37	ERROR Activate the sideshift switch during startup
38	ERROR Activation of accessory switch during startup
39	ERROR Activate the lifting switch during startup
40	ERROR The lifting analog value is out of range
43	ERROR Angle analog value out of range
44	WARNING Traction drive speed protection
45	WARNING Traction drive encoder error
51	ERROR Short circuit from traction driver
52	ERROR Low DC bus voltage from traction driver
54	ERROR Overcurrent from traction drive
55	ERROR High DC bus voltage from traction driver
56	ERROR High DC bus voltage from traction driver (hardware monitoring)
57	ERROR Pump driver pre charging timeout
58	ERROR High temperature from traction motor
59	ERROR High temperature from traction drive
60	ERROR Temperature sensor error from traction drive
61	ERROR Fault in speed control of traction motor
63	ERROR Slave traction motor temperature sensor error
64	ERROR Fault at the output port of the traction drive
65	WARNING Overcurrent or short circuit from traction driver
67	ERROR Speed sensor fault from traction drive
81	WARNING Low temperature of traction drive
82	WARNING High temperature of traction drive
83	ERROR Traction driver temperature sensor error
84	WARNING Low temperature of traction motor
85	WARNING High temperature of traction motor
86	ERROR Traction motor temperature sensor error
87	ERROR Traction motor speed sensor error
88	WARNING High DC bus voltage of traction drive
89	WARNING Low DC bus voltage of traction driver
90	WARNING The default value of the traction drive is loaded
91	WARNING Traction drive energy limiting mode
97	ERROR Traction driver output port error

98	WARNING Traction driver overcurrent or short circuit
101	ERROR Short circuit of traction motor driver
102	ERROR High temperature of traction drive
103	ERROR High temperature of traction motor
104	ERROR Traction drive overcurrent
105	ERROR Traction driver pre charging timeout
110	ERROR Low DC bus voltage of traction driver
111	ERROR High DC bus voltage of traction drive
112	ERROR High DC bus voltage of traction drive (hardware monitoring)
114	ERROR Internal power supply failure
121	WARNING Pump driver temperature low
122	WARNING Pump driver temperature high
123	ERROR Pump driver temperature sensor error
124	WARNING Low pump motor temperature
125	WARNING High pump motor temperature
126	ERROR Pump motor temperature sensor failure
127	ERROR Pump driver speed sensor failure
128	WARNING Pump driver DC bus voltage high
129	WARNING Pump driver DC bus voltage low
130	WARNING The default value of the pump driver is loaded
132	WARNING Pump driver energy limit
137	ERROR Pump driver output port failure
138	WARNING Pump driver overcurrent or short circuit
141	ERROR Pump driver short circuit
142	ERROR Pump driver temperature high
143	ERROR High pump motor temperature
144	ERROR Pump driver current calibration error
145	ERROR Pump driver pre charging timeout
150	ERROR Pump driver DC bus voltage low
151	ERROR Pump driver DC bus voltage high
152	ERROR High DC bus voltage of pump driver (hardware monitoring)
153	ERROR Internal error in pump driver
154	ERROR Pump driver speed control failure

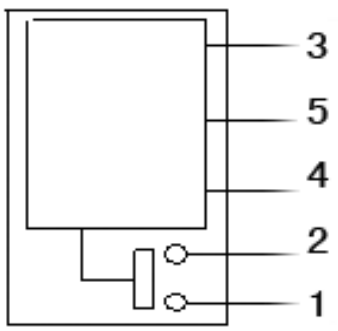
4.4 AC electron accelerator

4.4.1 Appearance and port function



4.4.2 Wiring and port diagram

Port number	Port definition	Linear color
1	Switch output 1	yellow
2	Switch output 2	blue
3	Power supply positive input（12V+）	red
4	Power negative input（12V-）	black
5	Acceleration signal output	green



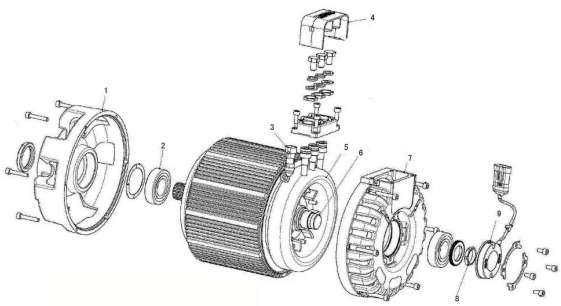
Acceleration signal: linear change from 0.38V to 0.42V to 3.9V to 4.1V

Switch signal: non-polar normally open contact, capacity: 2A/100V

5. Inmotion three-phase AC motor

5.1 Summary

The whole power system of the three-wheel AC lithium battery forklift truck consists of two 6.5KW AC three-phase walking motors and one 12KW three-phase AC lifting motor. It has the functions of speed sensing and temperature sensing. The whole motor has the characteristics of simple structure, reliable performance and maintenance-free. Three-phase AC motor is generally composed of a stator, rotor, speed encoder, temperature sensor and other accessories.



1. Front end cover	4. Terminal protection box	7. Rear end cover
2. Bearing	5. stator	8. Sensing gear
3. Temperature sensor	6. rotor	9. speed sensor

5.2 Operating environmental conditions

(1) The altitude does not exceed 1200 meters.
(2) The ambient air temperature changes from - 25 °C to+40 °C.
(3) The relative humidity is 100%.

5.3 Routine inspection and maintenance of AC motor

(1) The motor should always be kept clean, and no water drops, oil stains or dust are allowed to fall into the motor.

(2) Frequently check the bearing for heat and oil leakage.

(3) The load current of the motor shall not exceed the rated value of the motor.

(4) If the motor is found to have friction noise, squeal or other noises during operation, it should be stopped immediately and checked. Only after troubleshooting can it continue to operate.

6. Lithium battery and charger

6.1 Use and maintenance of lithium battery

The correct use and daily maintenance of lithium batteries have a great impact on the performance and service life of lithium batteries. Therefore, the user must carry out maintenance in accordance with the provisions of this manual and the actual situation, make a good charge record of the lithium battery forklift, and carefully fill in the record card. This card can be copied as the basis for daily spot check records. See the attached table at the back of the book for the lithium battery forklift charging record card.

6.1.1 Instructions for use of lithium battery

（1）Before using a new lithium battery, clean the surface and check for damage.

（2）The lithium battery installed on the forklift is also used as a counterweight. When it is lower than the minimum weight, it will affect the lifting capacity of the forklift. When a lithium battery is installed on the forklift, it must be limited by a lithium battery anti-stripping plate to prevent it from falling out when the vehicle is overturned. After replacing the lithium battery, the lithium battery anti-stripping plate must be installed in its original position.

（3）During the use of the lithium battery, it should be charged in time in strict accordance with the instructions of the instrument, and try to avoid over-discharge (that is, the voltage drop of the single lithium battery is below 2.8V), because the over-discharge of the lithium battery will seriously affect the service life and performance of the lithium battery. When the SOC of the lithium battery of the vehicle drops below 15% and is greater than 10%, the instrument buzzer will beep for 1s and stop for 5s, and the charging indicator yellow icon will light up. At this time, the user needs to finish the current work as soon as possible and drive to the charging place for charging; When the SOC drops to less than 10% and more than 5%, the buzzer will beep for 1s and stop for 1s, and the red icon of the charging indicator will light up. At this time, the user needs to immediately drive to the charging place to charge; When the SOC drops to 5%, the buzzer will ring long and the red icon of the charging indicator will light up. The user should immediately drive the car to the charging place for charging; When $0<SOC \leq 10\%$, the traveling motor and oil pump motor will operate at reduced power, and will automatically resume normal power operation when the charging $SOC \geq 15\%$.

（4）Warning: When the SOC is less than 15%, if the battery is not charged in time, long-term storage may cause irreversible damage to the battery.

6.1.2 Charging steps and precautions of lithium battery

Charging procedure:

Step 1: Charging preparation

1. Park the forklift in the charging area and turn off the vehicle key switch
2. Confirm that the battery button switch is open
3. Check the battery charging interface for foreign matters
4. Confirm the status of the charger and check the charger plug for foreign matters

Step 2: Start charging

1. Connect the charger interface with the battery system charging connector correctly
2. Observe the charging connection and display status of the charger display
3. Wait for charging confirmation for about 15 seconds, charging current is normal, and charging begins

Step 3: End of charging

1. Press the charger stop button
2. After confirming that the charging current in the charger is 0A, correctly unplug the charger charging plug
3. Close the protective cover of the battery charging port or the forklift seat, and place the charger charging connector in a standard manner

Charging precautions:

1. Turn off the vehicle key and charge it,
2. Please choose a safe environment for charging (avoid liquid, fire source, etc.),
3. Necessary safety fire extinguishing devices shall be equipped around the charging equipment so that emergency fire extinguishing can be carried out in extreme cases,
4. Before charging, it is necessary to confirm that there is no dust, water and other foreign matter in the charging gun and charging socket. If there are any foreign matters, it is necessary to clean them before charging, otherwise it will lead to poor contact between the charging gun and charging socket, resulting in heat and even fire,
5. Do not modify or disassemble the charging port and charging equipment, which may cause charging failure and cause fire,
6. After charging, do not disconnect the charging equipment with wet hands or standing

in water, which may cause electric shock and personal injury,

7. If it is necessary to end the charging process, please press the stop button first, and disconnect the charging plug only when the current drops to 0A, otherwise the cut-off with load will cause relay damage and plug-in terminal burn,

8. When the battery power is lower than 15%, it should be recharged in time. Overdischarge of the battery is strictly prohibited (20 charging is recommended),

9. The battery should be charged in time after use and fully charged every two months. Especially in low temperature environment, please charge and fully charge the battery immediately after use,

10. Do not pull or twist the charging cable,

11. Do not subject the charging device to impact,

12. Do not use the charging device in an environment with temperature higher than 55 °C,

13. It is forbidden to plug and unplug the charging plug-in directly when the charging device has current output, which may cause electric arc, property damage and personal injury,

14. Do not place the charging device near the heater or other heat sources,

15. Note that the matters not mentioned above are mainly safety.

6.1.3 Lithium battery storage

（1）According to the characteristics of the battery, the lithium-ion battery pack shall meet the environmental conditions of its storage during storage and transportation to maximize the protection of the battery,

（2）During the storage and transportation of lithium-ion batteries, proper protection shall be provided to maintain the SOC level of about 50% to ensure that there will be no short circuit and liquid will not enter the tank, so that the battery pack will be immersed in liquid (such as water, oil, etc.).

（3）Check the battery total voltage, single string voltage, quantitative relationship between single string and total voltage, and differential pressure level once every two months. Timely maintenance and handling problems found.

（4）In the process of loading and unloading, the battery should be handled with care and placed in order to prevent rolling and heavy pressure. The storage battery shall not be stored upside down, and mechanical impact or heavy pressure shall be avoided. It is strictly prohibited to expose the battery to the sun and rain.

（5）A special storage area must be set up in the warehouse. It is forbidden to store other inflammable and explosive materials in the area. The battery shall be at least 2m away from the heat source;

6.1.4 Treatment of lithium battery

When disposing of waste lithium batteries, please properly dispose of them according to relevant laws and regulations.

6.1.5 Lithium battery safety precautions

（1）Keep the battery or battery pack away from dangerous goods or materials, such as corrosive chemicals, dangerous mechanical equipment, high temperature environment, etc

（2）Improper use of this series of products may cause smoke, such as external short circuit, overcharge, high ambient temperature, etc. In case of smoke, please cut off the power supply in time, use carbon dioxide or dry powder fire extinguisher for treatment, and bury with sand or soil. During the whole process, the crowd must be evacuated and the alarm must be given in time (if necessary)

（3）It is forbidden to disassemble, extrude, puncture, lay or bake the battery at high temperature to avoid excessive vibration, external force impact, high drop, etc. This operation may cause personal injury or property loss;

（4）It is forbidden to directly short circuit the positive and negative poles of the battery, and avoid any metal or other conductive objects other than the battery pole pressing bolts and the conductive belt from contacting the positive and negative poles of the battery. This operation may cause personal injury or property loss

（5）It is forbidden to expose or store the battery in an environment above 50 °C for a long time. It is forbidden to try to heat or put the battery into fire. This operation may cause personal injury or property damage

（6）It is forbidden to charge the battery without installing a reasonable charging protection device (lithium ion battery protection circuit board, battery management system, etc.) or using charging equipment not approved by the company (charger, DC power supply, etc.). This operation may cause personal injury or property loss

（7）It is forbidden to use this series of products in series or parallel with other models or types of batteries, which may cause personal injury or property damage; It is prohibited to

conduct series or parallel operation on the complete power supply system containing lithium-ion battery protection circuit board or battery management system. This operation may cause personal injury or property damage. If necessary, please contact the relevant technical department of the company to obtain correct technical support

（8）Non-professional personnel shall not dismantle or modify the battery without authorization. The charging and discharging shall not exceed the maximum current specified in the technical parameters. Charging in direct sunlight is not allowed. This operation may cause personal injury or property loss

（9）It is forbidden to disassemble and maintain the battery pack without the presence of our after-sales technical personnel.

6.1.6 Lithium battery maintenance

Preparation before maintenance operation

1. The site shall be spacious, flat, safe and equipped with charging equipment

2. Adjust the battery power to ensure that the battery SOC is between 25% - 40%

3. Stop the vehicle stably, turn off the power supply, check all electrical equipment in the vehicle, and ensure that it is closed

Maintenance content

1. Check the appearance of the outer box: check the outer box of the battery system for sundries, obvious deformation, corrosion and other abnormalities

2. Charging port: under power-off condition, check whether there are sundries, rust and other abnormalities in the interface

3. Connector: check whether the connector is loose, damaged and other abnormal conditions when the power is off

4. Parameter detection: before charging and discharging, check the battery voltage, temperature and other status displayed on the display to ensure that all values are within the normal range

To ensure personal safety, professional personnel must wear insulating shoes, insulating gloves, goggles and other protective equipment before performing regular inspection. Non-professional personnel are not allowed to disassemble or repair without authorization.

If any abnormality is found, please contact our after-sales service department for handling. It is strictly forbidden to operate without permission

6.2 Charger

The charger is composed of a three-phase rectifier, DC/DC conversion, monitoring board, auxiliary power supply, input/output detection and protection circuit. The charger adopts full bridge phase-shifting technology and is specially designed for lithium battery charging power conversion. The CAN bus of the charger communicates with the battery BMS to track and adjust the charging parameters in real time, so that the charger can always work in an efficient and reliable charging state, improving the charging efficiency and saving power. Its LCD display can intuitively understand the real-time charging state and fault information.

6.2.1 Use of charger and charging method

When the warning of low lithium battery voltage is displayed on the LCD after the forklift operation is stopped or during the operation, please charge in time according to the following tips:

（a）Stop the forklift at the designated position, press the one-button start button to turn off the power supply of the whole vehicle, and open the charging compartment door cover. When the lithium battery needs to be replaced, the lithium battery can be lifted out of the forklift as required.

（b）Confirm the input power voltage and frequency of the charger, and select the charger matching the lithium battery to be charged.

（c）Remove the charging gun, and connect the straight gun cable with the lithium battery charging socket correctly.

（d）Turn on the air switch, the charger will display the current system version, the current lithium battery voltage, and the maximum charging current, and the charger will enter the automatic detection state.

（e）After the detection process is completed, the charger enters the formal charging process, and the LCD screen of the charger displays the real-time charging voltage and current.

（f）When the "Full" indicator is on, the lithium battery is full.

（h）After charging, close the air switch and disconnect the lithium battery cable plug from the charger.

7. Hydraulic system

7.1 Summary

The hydraulic system is composed of a working oil pump, multi-way valve, lifting cylinder, tilt cylinder, pipeline and other components.

The hydraulic oil is directly supplied by the oil pump connected with the motor, and the multi-way valve distributes the hydraulic oil to each cylinder.

Forklift type Item		1.8t
Main pump	Type	Gear type
	Name	DSG05A20F1H9-L224C
	displacement	20ml/rev
	Drive mode	Motor connection
Multiway valve	Type	Plunger type
	Name	CDB3.1-F15DEXF-D-04
	Adjusting pressure	16MPa
Lifting cylinder	Type	Single-acting piston type with shut-off valve
	Inner diameter of cylinder	Φ45mm
	Piston rod outer diameter	Φ36mm
	trip	1495mm（Lifting height 3000mm）
Tilt cylinder	Type	Double-acting piston type

	Inner diameter of cylinder	Φ63mm
	Piston rod outer diameter	Φ36mm
	trip	85mm
Hydraulic oil tank	capacity	24L

7.1.1 Oil pump

The oil pump is a gear pump with the model of DSG05A20F1H9-L224C.

The lifting oil pump is driven by the lifting motor, and the oil is distributed to the steering gear through the multi-way valve.

7.1.2 Multiway valve

The multi-way valve adopts the two-piece four-body type. The hydraulic oil from the working oil pump is controlled by the valve rod of the multi-way valve to distribute the high-pressure oil to the lifting cylinder or tilt cylinder. There are safety valves and self-locking valves inside the multi-way valve. The safety valve is set on the upper side of the oil inlet of the multi-way valve to control the system pressure; The self-locking valve is set on the tilt valve plate, which is mainly used to prevent the tilt cylinder from causing serious consequences due to mis-action of the control lever without pressure source. A check valve is installed between the oil inlet and the oil inlet of the lifting valve plate and between the oil inlet of the lifting valve plate and the oil inlet of the tilt valve plate.

The outline of the multi-way valve is shown in Figure 7-1.

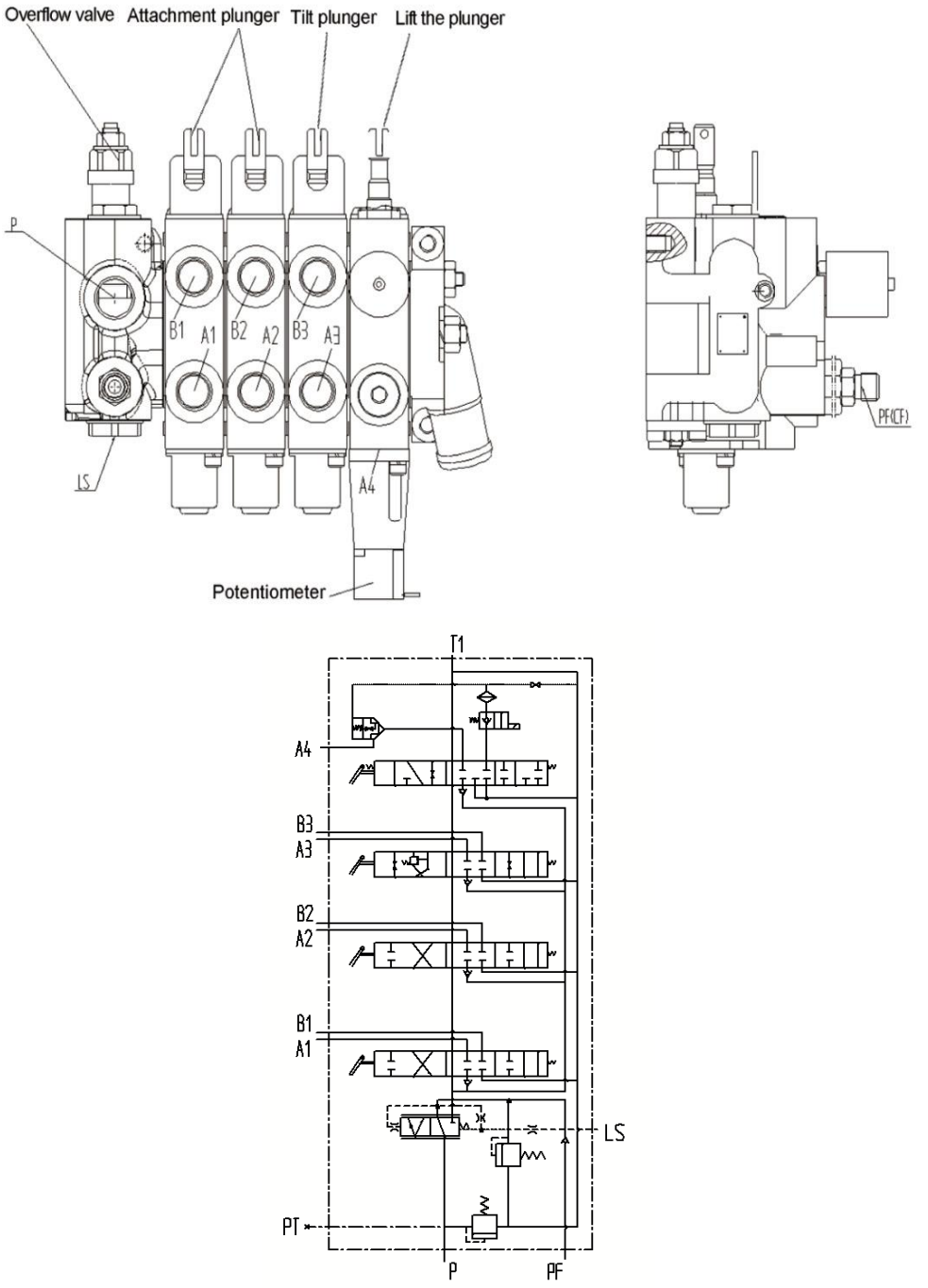


Figure 7-1 Outline Drawing of Multi way Valve

（1）Operation of the spool valve (take the tilt spool valve as an example)

（a）Neutral position (Figure 7-2)

At this time, the high-pressure oil discharged from the oil pump returns to the oil tank through the neutral position.

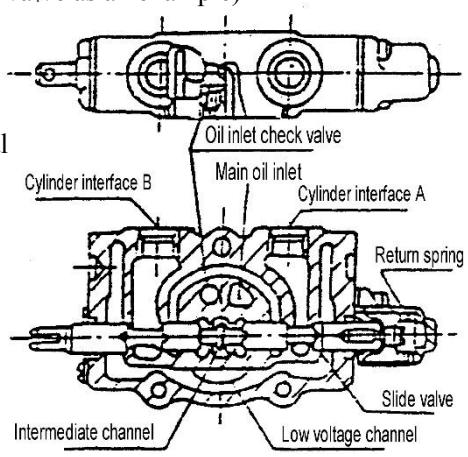


Fig 7-2

（b）Push in the spool valve (Fig. 7-3)

At this time, close the middle passage. The oil from the oil inlet opens the check valve and flows to the oil cylinder interface B. The oil from the oil cylinder interface A flows to the oil tank through the low pressure passage. With the help of the return spring, the spool valve can be returned to the neutral position.

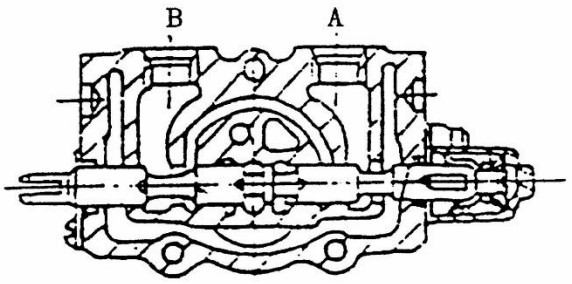


Fig 7-3

（c）Pull out the spool valve (Fig. 7-4)

At this time, the neutral position is closed. The oil from the oil inlet opens the check valve and flows to the oil cylinder port A. The oil from the oil cylinder port B flows to the oil tank through the low pressure channel. With the help of the return spring, The spool valve can be returned to the neutral position.

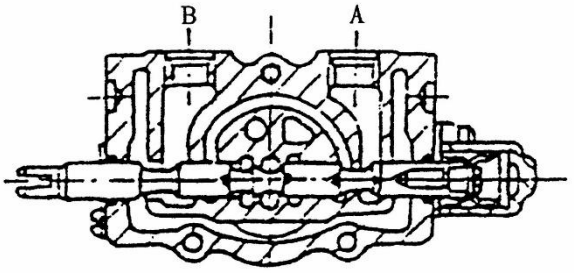


Fig 7-4

（2） Action of safety overflow valve

An overflow valve is installed between the "HP" interface of the oil pump and the "LP" low pressure passage. The oil passing through poppet "C" acts on the areas with different diameters "A" and "B", so that the check valve "K" and overflow poppet "D" both fall on the valve seat. As shown in Figure 7-5

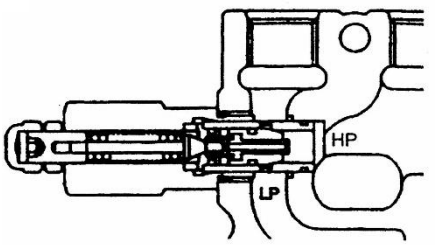


Fig 7-5

The pressure set at the middle note of the oil pump "HP" channel acts on the spring of the pilot valve, and the check valve "E" will open. The oil flows from the through hole around the valve into the low pressure "LP" side. See Figure 7-6.

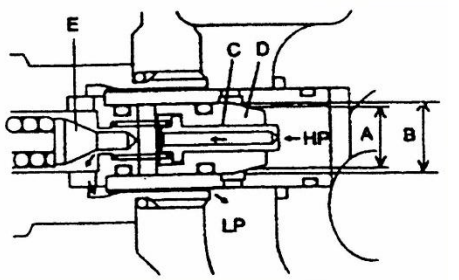


Fig 7-6

As soon as the pilot valve "E" is opened, the pressure inside the valve "C" will drop, and both the valve "E" and the valve "C" will fall on the valve seat. The fluid flow to the rear of valve "D" will be closed, so the pressure of the inner side section will be reduced. See Figure 7-7.

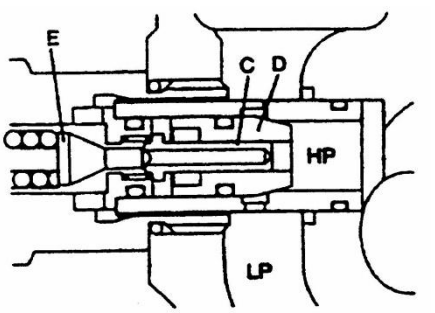


Fig 7-7

The pressure at the "HP" passage side and inside of the the oil pump is not balanced. Under the pressure difference the valve "D" opens and the oil flows directly into the low pressure circuit "LP". See Figure 7-8.

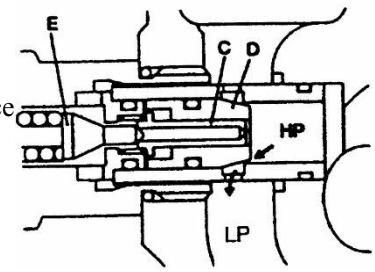


Fig 7-8

（3）Action of tilt self-locking valve

A tilt self-locking valve is installed in the valve plate of the tilt cylinder. When negative pressure is generated in the oil cylinder, prevent the gantry from suddenly falling down, and at the same time, prevent danger from misoperation of the tilt valve rod. With this self-locking valve, when the forklift motor stops working, even if the control lever is pushed hard, the gantry cannot tilt forward.

When the valve core is pulled out, the flow direction of oil is the same as that in Figure 7-10, and the gantry is in a backward tilt state.

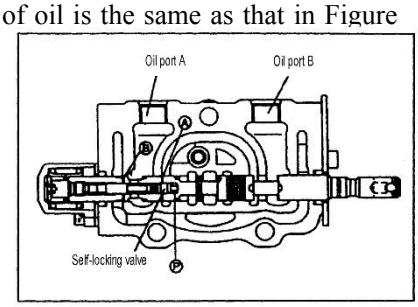


Fig 7-9

The following describes the status of the valve core when it is pushed in (Fig. 7-9).

a）When the valve core is pushed in (the pump works)

The oil from the main pump flows to the tilt cylinder through the port "B", and the oil returned from the the cylinder acts on the piston through the port. The oil returns to the tank through the upper and lower passages of the valve element.

（b）When the valve core is pushed in (the pump does not work)

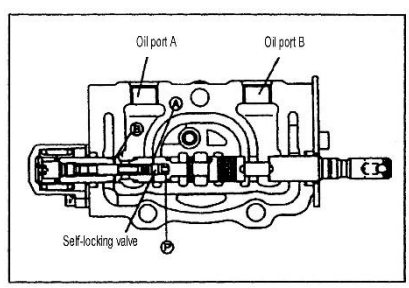


Fig 7-10

When the oil pump is not working, push the valve core, and no oil enters the oil cylinder interface "B", so that the pressure will not rise. Therefore, the piston does not move, the oil in the "A" interface of the oil cylinder cannot return to the oil tank, and the oil cylinder does not move.

（4）Multiway valve operation

The multi-way valve is operated by a joystick, all of which are installed on a connecting shaft. The shaft is fixed on the instrument panel through a bracket, and the joystick operates the spool valve through a connecting rod.

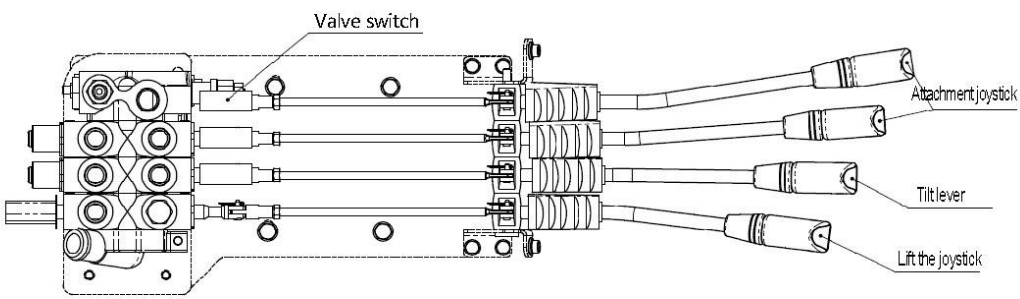
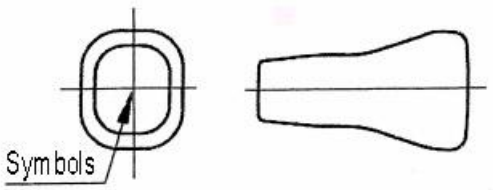


Fig. 7-11 Multiway valve operation



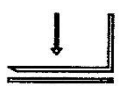
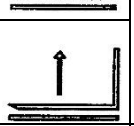
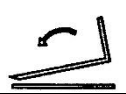
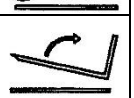
No	Symbol	name
1		Lift
		
2		Tilt
		

Figure 7-12 Joystick Identification

According to the arrow direction shown in Figure 7-12, push and pull the lifting handle forward and backward, and the gantry will rise and fall respectively. Push and pull the tilt handle forward and backward, and the gantry will tilt forward and backward respectively.

（5）Multiway valve pressure adjustment

The pressure of the multi-way valve has been set before leaving the factory, and the user shall not adjust it at will, otherwise it will easily bring danger to the system and vehicle safety; If the oil pressure is inconsistent with the specified value (see the table below) , the professional personnel shall adjust it according to the test method specified in the standard according to the following steps:

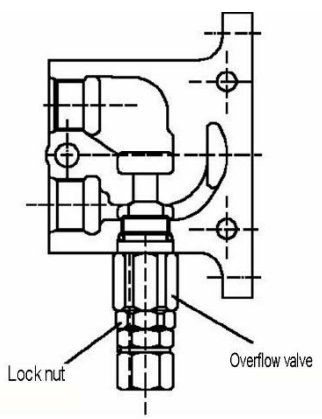


Fig 7-13 Multiway valve pressure adjustment

(a) Unscrew the measuring hole plug at the inlet of the multi-way valve and install an oil pressure gauge that can measure 20MPa.

(b) Operate the tilt handle to measure the pressure at the end of the cylinder stroke.

(c) When the oil pressure is different from the specified value, loosen the locknut of the overflow valve, and turn the adjusting screw left and right to adjust it to the specified value. When the pressure is high (screw out), it rotates to the left, and when the pressure is low (screw in), it rotates to the right.

(d) Tighten the nuts after adjustment.

Forklift type	1.8t
Pressure regulating value of safety valve	16MPa
Steering gear pressure setting	7MPa

7.1.3 Lifting cylinder

The lifting cylinder is a single-acting piston type, composed of cylinder block, piston rod, piston, cylinder head, etc. The bottom of the lifting cylinder is fixed on the support of the lifting cylinder of the outer portal frame with pins and bolts, and the top of the cylinder (i.e. the top of the piston rod) is connected with the upper beam of the outer portal frame.

The piston is fixed on the piston rod with elastic steel wire, and the outer ring of the piston is equipped with an oil seal and backup ring.

A shut-off valve is installed at the bottom of the cylinder. If the gantry is raised and the high-pressure pipe breaks suddenly, it can play a safety protection role.

Steel back bearing and oil seal are installed on the cylinder head to support the piston rod and prevent dust from entering.

1. Upper crossbeam
2. Adjusting pad
3. Dust ring
4. Oil seal
5. Guide sleeve
6. O-ring
7. Cylinder head
8. Steel back bearing
9. Cylinder block
10. piston rod
11. piston
12. Piston Seal
13. oil seal
14. Seat ring
15. Circlip
16. Shut off valve
17. Spring lock ring
18. cotter pin
19. Lock nut
20. Adjusting nut
21. End joint
22. chain
23. Sprocket

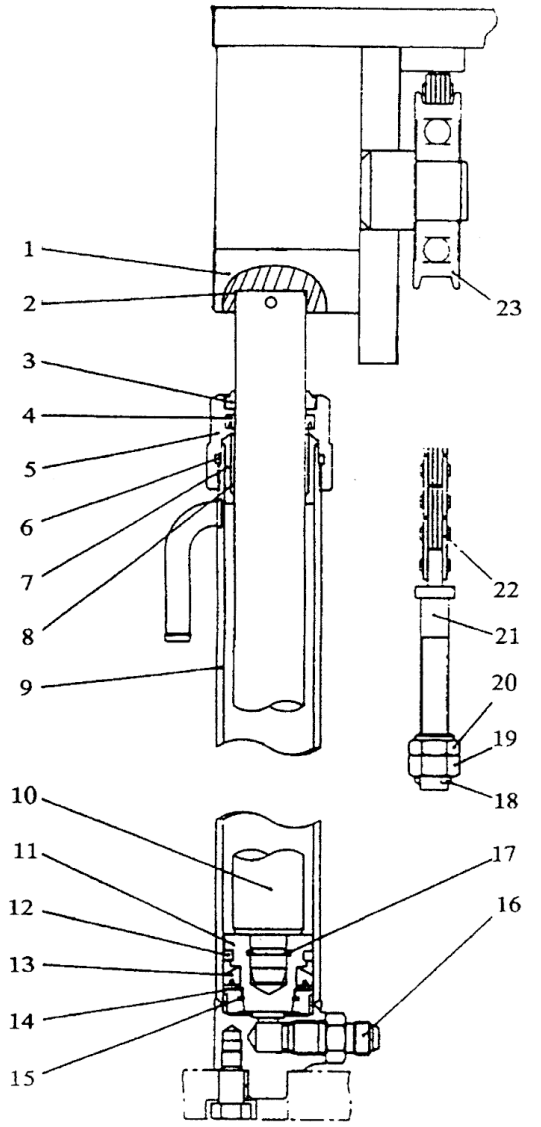


Fig. 7-14 Lifting cylinder

There are all shutoff valves at the bottom of the lifting cylinder (see Figure 7-15). When the high-pressure rubber hose breaks suddenly, it can prevent the goods from falling sharply. The oil from the lifting cylinder passes through the cutoff valve spool valve, and the oil hole around the spool valve causes a pressure difference between the two chambers. When the pressure difference is less than the spring force, the spool valve does not act, such as the high pressure rubber hose breaks, forming a large pressure difference, which makes the spool valve move to block the oil hole around it, and only allows a small amount of oil to flow through the small hole at the end of the spool valve, so that the fork slowly drops.

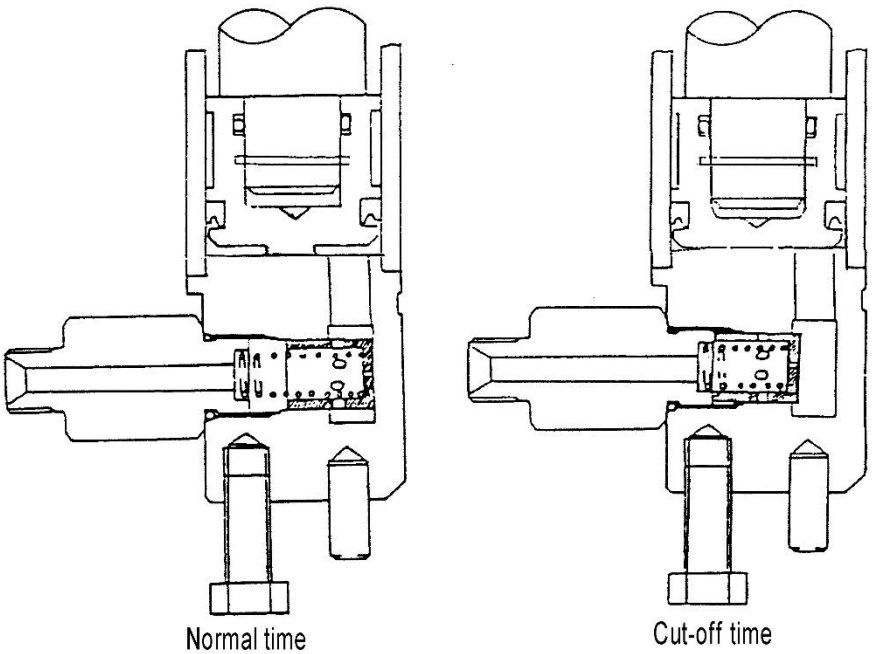
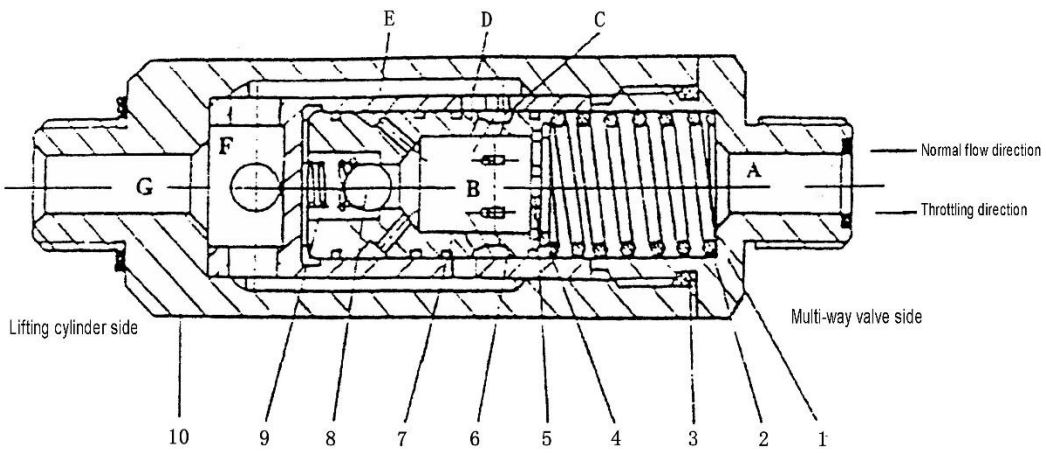


Fig. 7-15 Operation of shut-off valve

7.1.4 Speed limiting valve

The speed limiting valve (i.e. throttle valve) is installed in the oil circuit of the lifting cylinder to limit the lowering speed of the fork under heavy load. Its structure is shown in Figure 7-16. When the spool valve of the multi-way valve is in the "lifting" position, the

high-pressure oil from the multi-way valve flows into the lifting cylinder through cavities A, B, C, D, E, F and G without throttling; When the spool valve of the multi-way valve is in the "down" position, the oil from the lifting cylinder passes through the cavity G, and the oil holes F, E, D, C, B, and A pass through the entire valve. At this time, a pressure difference is generated between the cavity A and the cavity B. When the pressure difference exceeds the spring force of the spring (part 8), the valve core 7 moves to the right, causing the oil flow to decrease due to the decrease of the D and C holes, which also reduces the flow through the orifice.



1.	Connector	3.	O-ring	5.	Throttle plate	7.	spool	9.	Spring
2.	Spring	4.	Retaining ring	6.	Valve sleeve	8.	ball valve	10.	valve body

Figure 7-16 Speed limit valve

7.1.5 Tilt cylinder (Fig. 7-17)

The tilt cylinder is double-acting and installed on both sides of the gantry. Its piston rod end is connected with the gantry. The bottom of the tilt cylinder is connected with the frame with a pin.

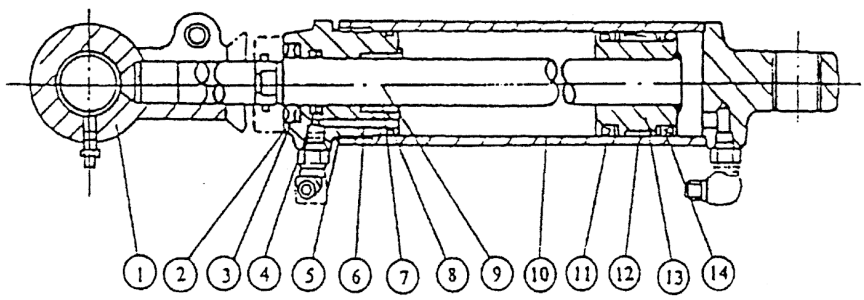
The tilt cylinder assembly is mainly composed of piston, piston rod, cylinder block,

cylinder bottom, guide sleeve and seals. The piston and piston rod are welded. The outer edge of the piston is equipped with a support ring and two Yx sealing rings. The inner hole of the guide sleeve is equipped with a shaft sleeve and Yx sealing rings, retaining rings and dust rings. This shaft sleeve supports the piston rod. The sealing ring, retaining ring and dust ring can prevent oil leakage and dust, and they are screwed onto the cylinder block together with the O-ring.

When the tilt slide valve is pushed forward, the high-pressure oil enters from the bottom of the cylinder, thus pushing the piston forward to tilt the gantry forward by 3.5 °. When the slide valve is pulled backward, the high-pressure oil enters from the front of the cylinder, and pushes the piston backward until the gantry tilts backward by 7 °.

7.1.6 Hydraulic oil tank

Oil suction filter is installed in the oil tank and oil return filter is installed in the oil return pipe. To ensure the supply of clean oil.



1.	Earrings	4.	Yx seal	7.	Bearing	10.	Cylinder block	13.	piston
2.	Dust ring	5.	O-ring	8.	O-ring	11.	Yx seal	14.	Yx seal
3.	Retaining ring	6.	Guide sleeve	9.	piston rod	12.	Backup ring		

Figure 7-17 Tilt Cylinder

7.1.7 Hydraulic system schematic diagram

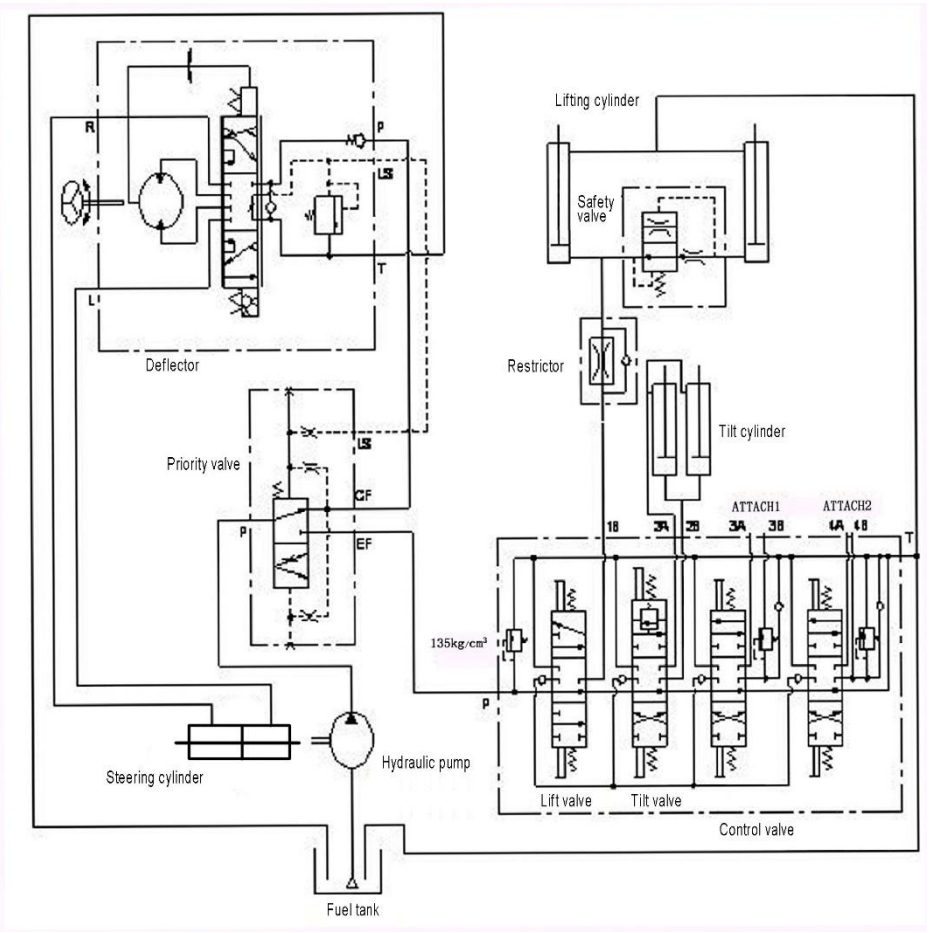


Fig 7-18

7.2 Maintenance and adjustment of hydraulic system

7.2.1 Maintenance of hydraulic oil pump

1．decompose

Clean thoroughly before disassembly. Put the removed parts on clean paper or cloth, and be careful not to contaminate or damage the parts.

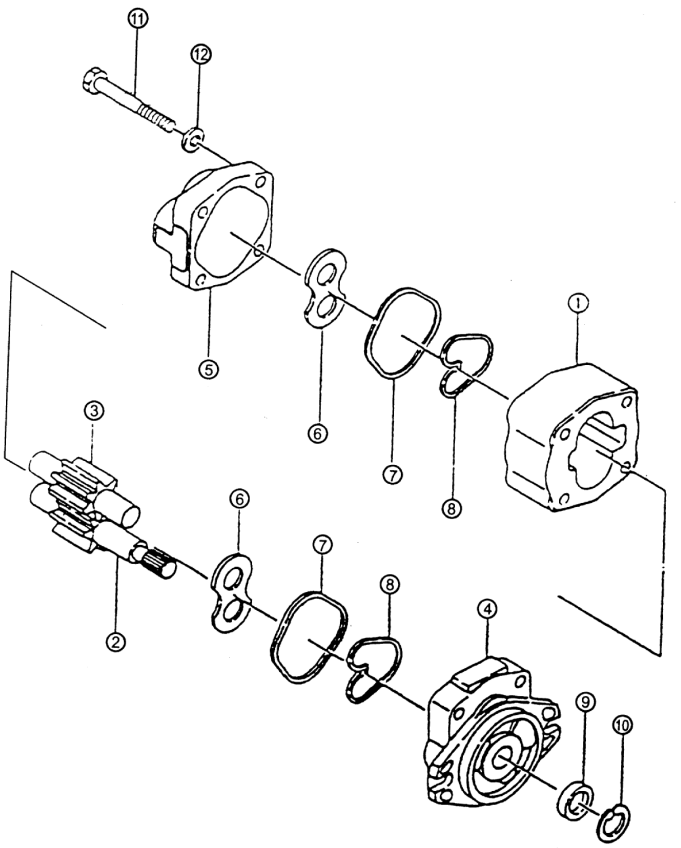
（a）Clamp the flange of the pump on the tong platform.

（b）Remove the connecting bolts, rear end cover ⑤ and pump body ①. (See Figure 7-9)

（c）Remove the lining plate ⑥, drive gear ② and driven gear ③.

（d）Remove the sealing ring ⑦ and retaining ring ⑧ from the front and rear end covers.

Note: If the seal ring is not replaced, do not remove it from the front end cover.



1.Pump body
2.Drive gear
3.Driven gear
4.Front end cover
5.Rear end cover
6.Liner plate
7.seal ring
8.Retaining ring
9.oil seal
10.Circlip
11.Bolt
12.Washer

Fig. 7-19 Hydraulic oil pump

2．inspect

Check the disassembled parts and clean them with gasoline (except rubber parts).

（a）Pump body inspection (Fig. 7-20)

If the contact length between the pump body cavity and the gear is greater than 1/2 of the circumference, replace the pump body.

（b）Lining plate inspection (Fig. 7-21)

Check the contact surface of the lining plate. If the surface is damaged or the thickness of the lining plate is less than the specified value, replace the lining plate.

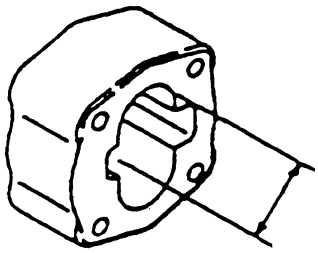


Fig 7-20

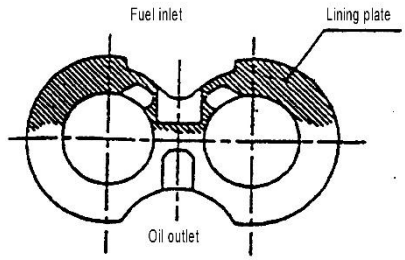


Fig 7-21

（c）Front and rear pump covers (Fig. 7-22)

If the discoloration (brown) of the inner surface bushing exceeds 150 °, replace it.

（d）Check the drive and drive gears from the front and rear. If it is excessively worn, replace a pair. (Figure 7-23)

（e）Replace the seal ring, bushing seal, retainer ring, oil seal and spring retainer as required.

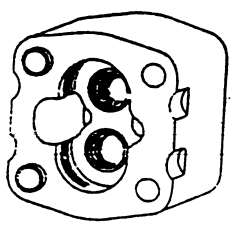


Fig 7-22

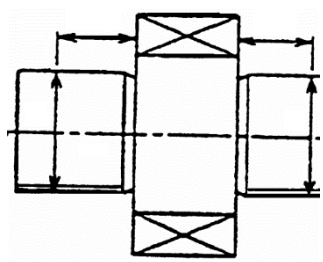


Fig7-23

3．assembly

（a）Install a new seal ring and a new retaining ring on the front cover of the pump.

（b）Install the lining plate on the groove of the front end cover, and be careful not to mix the oil suction port with the oil discharge port.

（c）Install the drive and driven gears on the front end cover.

（d）Install the lining plate on the gear side to align the groove with the gear point. Be careful not to mix the oil suction port side with the oil discharge port side. (Figure 7-24)

（e）Install a new sealing ring and a new retaining ring on the groove of the rear cover. (Fig. 7-25)

（f) Install the rear cover on the pump body, and pay attention to the oil suction port and oil discharge port.

（g) After all are installed, tighten the connecting bolts to the specified torque of 9-10kg. m.

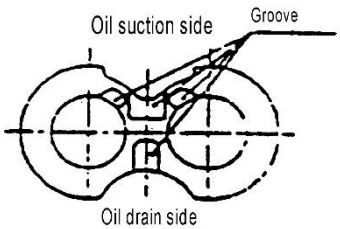


Fig 7-24 Lining plate

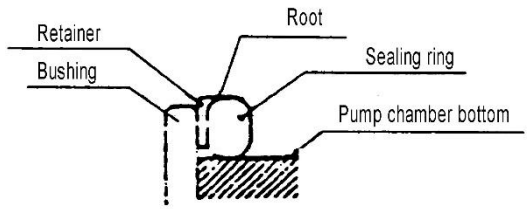


Fig. 7-25 Bushing Seal

Note: Due to different oil pump suppliers, the maintenance data of the above oil pump parts may be different.

4．Test run

Run in the oil pump to check whether it operates normally. It is better to test the oil pump on the test bench, but it can also be tested on the forklift according to the following steps:

Note: If the oil pump is disassembled for maintenance due to severe wear or seizure of the pump due to the hydraulic oil, the hydraulic oil and filter shall be replaced before the test run on the forklift.

（a）Install the pump on the forklift, and install a pressure gauge on the pressure detection port of the multi way valve.

（b）Loosen the adjusting screw of the overflow valve, make the pump run at 500-1000 rpm for about 10 minutes, and ensure that the oil pressure is lower than 10 Kg/cm2.

（c）Increase the pump speed to 1500-2000rpm and operate for about 10min.

(d) Keep the running speed of the pump at 1500-2000 rpm, increase the pressure by 20-30 Kg/cm2 each time, and run for 5 minutes until the required working pressure is reached. Then operate each oil circuit for 5 minutes and replace the return oil filter.

When increasing the oil pressure, pay attention to the temperature of the oil, the temperature of the pump surface, and the sound of operation. If the oil temperature or pump surface temperature rises excessively, reduce the load to reduce the oil temperature, and then continue the test.

（e）After the test, make the overflow pressure at the required working pressure and measure the flow. The oil quantity is measured by the lifting speed.

7.2.2 fault diagnosis

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

1. Multiway valve

Fault	Reason	Repair method
The pressure of lifting oil circuit is not high	Spool valve stuck	Cleaning after disassembly
	Plugged oil hole	Cleaning after disassembly
shock Slow pressure rise	Spool valve stuck	Cleaning after disassembly
	Insufficient exhaust	Fully exhaust
Steering oil circuit pressure is greater than the specified value	Spool valve stuck	Cleaning after disassembly
	Plugged oil hole	Cleaning after disassembly
The specified oil quantity is not reached	Improper adjustment of overflow valve	adjustment
Noisy	Improper adjustment of overflow valve	adjustment
	Wear of sliding surface	Replace the relief valve
Oil leakage (external)	O-ring is aged or damaged	Replace O-ring
Low set pressure	Broken spring	Replace the spring
	Valve seat surface is damaged	Adjust or replace the relief valve
Oil leakage (internal)	Damaged valve seat surface	Correct valve seat surface
High set pressure	Valve stuck	Cleaning after disassembly

2．Oil pump

Fault	Reason	Repair method
Less oil discharge	Low oil level of oil tank	Add oil to the specified amount
	Oil pipe or oil filter blocked	Clean or replace as required
Low pump pressure	Damaged lining plate and support Poor seal ring, bushing seal or retainer ring	replace
	Improper adjustment of relief valve	Use a pressure gauge to adjust the pressure of the relief valve to the specified value
	Air in the system	1 Retighten the oil suction measuring pipe and add oil ; 2 Replace oil pump oil seal
Noise during operation	The oil suction pipe is damaged or the oil filter is blocked	Check the pipe or repair the oil filter
	Loose air leakage at oil suction side	Fastening looseness
	Oil viscosity is too high	Replace the viscosity oil corresponding to the operating temperature of the pump
	Bubbles in oil	Find out the causes of bubbles and take measures
Pump leaks oil	Pump oil seal or seal ring damaged	replace
	Pump damage	replace

8. Mast system

8.1 Summary

The mast system is a two-stage roller-type vertical lifting and shrinking system, which is composed of internal and external gantry and fork frame. The fork is fixed in the groove of the upper crossbeam of the fork frame with a lock pin. The fork spacing can be adjusted left and right by hand. The fork and fork frame adopt international standards for general use and interchangeability. The working device is mainly used to complete the operations such as forking, loading and unloading, lifting and stacking of goods.

Type	Roller type, "J" shaped inner mast, "C" shaped outer mast with free lifting and two-stage telescopic gantry
Main roller	Φ111.3
Side roller	Φ40
Chain wheel	Φ40×Φ95×Φ113

Lifting chain	LH1223，2×3 combination
Upper roller of outer mast	Φ91.5
Fork mast lifting system	Hydraulic
Mast tilting device	Hydraulic
Fork spacing adjustment device	Manual

8.1.1 Internal and external mast(Fig. 8-1)

The internal and external door frames are weldments. The bottom of the outer gantry is mounted on the drive axle with a support.

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

The channel steel of the outer portal frame is C-type, and the main roller and side roller are installed on the upper part.

The channel steel of the inner portal frame is J-shaped, and the main roller and side roller are installed at the bottom.

The maintenance of the main roller and side roller on the inner and outer gantries belongs to the high-level maintenance, and attention should be paid to safety.

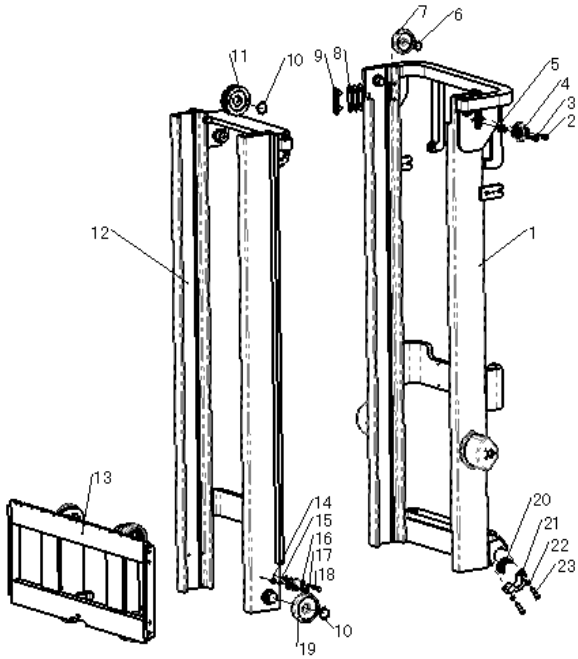
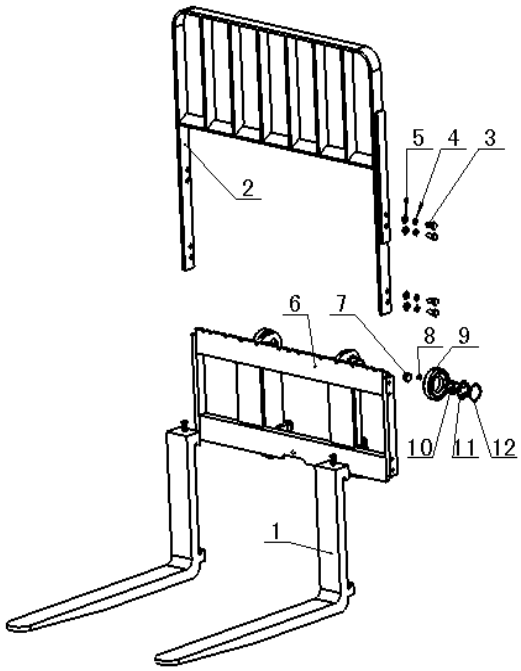


Figure 8-1 Internal and external gantry

1.	External mast	7.	Mast bearing	13.	Carriage	19	Roll pulley
2.	Bolt	8.	Adjusting shim	14.	Adjusting washer	20	bearing bush
3.	Washer	9.	Mast guide plate	15.	Washer	21	Bearing cover
4.	Lateral roller bearing	10.	Retaining ring	16.	Side roller	22	Washer
5.	Washer	11.	Roller bearing	17.	Washer	23	Bolt
6.	Retaining ring	12.	Inner mast	18.	Bolt		

8.1.2 Fork carriage

The fork carrier rolls in the inner gantry through the main roller, which is installed on the main roller shaft and clamped with an elastic retainer ring, and the main roller shaft is welded on the fork carrier. The side rollers are fixed on the fork frame by bolts and roll along the outside of the inner door frame flange, which can be adjusted by adjusting pads. To prevent rolling clearance, use 2 fixed side rollers to roll along the outer side of the inner gantry flange. The longitudinal load is borne by the main roller. When the fork is lifted to the top, the upper roller is exposed from the top of the gantry. The lateral load is supported by the side roller.



1. Fork rack
2. Block shelf
3. Bolt
4. Spring washer
5. Side bearing
6. Bush
7. Bolt
8. Spring washer
9. Main roller
10. shim
11. Retaining ring
12 Retaining ring

Figure 8-2 Fork rack

8.1.3 Fork locating pin

The fork locating pin locks the fork in a certain position. To adjust the fork spacing, pull up the fork positioning pin and turn it for 1/4 turn. The fork spacing adjustment depends on the goods to be loaded and unloaded.

8.1.4 Roller position

There are two types of rollers: main roller and side roller. They are installed on the outer gantry, inner gantry and fork rack respectively. The main roller bears the load in the front and rear directions, and the side roller bears the side load, so that the inner gantry and fork frame can move freely.

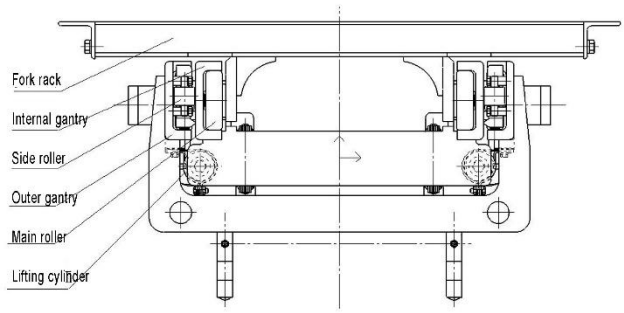


Fig 8-3 Roller position

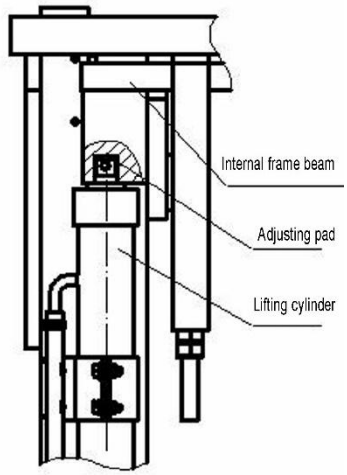
Note: (a) Adjust the side roller clearance to 0.5mm;

(b) Apply grease on the surface of the main roller and the contact surface of the gantry.

8.2 Maintenance and adjustment of gantry system

8.2.1 Lifting cylinder adjustment

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



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

(2) Slowly raise the mast to the maximum lift of the oil cylinder and check whether the two oil cylinders are synchronized.

Fig 8-4

(3) Add an adjusting pad between the piston rod head of the stop cylinder and the upper cross beam of the inner gantry (Fig. 8-4). The thickness of the adjusting pad is 0.2mm~0.5mm.

（4) Adjust the tension of the chain.

The adjustment of the lifting cylinder belongs to high level maintenance, and attention should be paid to safety.

8.2.2 Height adjustment of fork rack

（1）Park the vehicle on the horizontal ground and make the gantry vertical, as shown in Figure 8-5.

（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 there is a distance A: 20-34mm between the main roller and the fork frame.

（3）Make the fork fall to the ground and tilt back in place, adjust the upper end joint of the chain, and adjust the nut to make the tension of the two chains the same. (Figure 8-6)

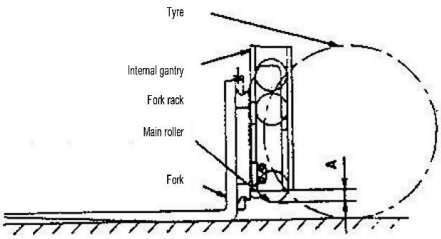


Fig 8-5

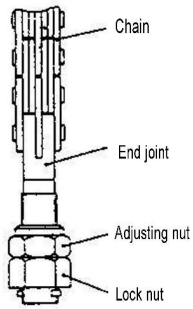


Fig 8-6

8.2.3 Replace the fork carrier roller

（1）Put a pallet on the fork and park the car on the level ground. (Figure 8-7)

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

(3) Remove the upper end joint of the chain and remove the chain from the sprocket. (Figure 8-6)

(4)Lift the inner gantry (in Figure 8-7).

(5) After confirming that the fork carrier has been separat forklift (Figure 8-7)

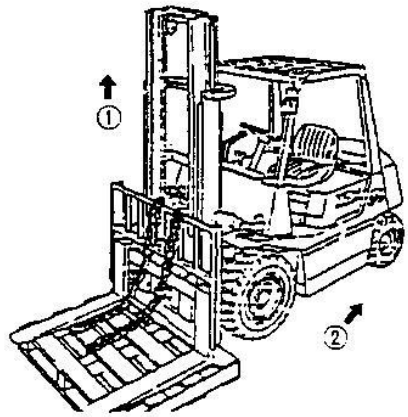


Fig 8-7

（6）Replace the main roller

·Remove all spring washers, remove the main roller with a puller, and keep the adjusting pad。

·Confirm that the new roller is the same as the replaced roller, install the new roller into the fork frame and clamp it with the circlip.

8.2.4 Replace the gantry roller (Fig. 8-8)

(1) Remove the fork carrier from the inner gantry in the same way as described in 8.2.3 Replacing the fork carrier roller.

(2) Drive the forklift to the level ground and pad the front wheel 250~300mm.

(3)Pull on the hand brake and block the rear wheel with wedges.

（4） Remove the fixing bolts of the lifting cylinder and the inner gantry. Lift the inner mast, and be careful not to lose the adjusting pad of the piston head.

(5) Remove the connecting bolts between the lifting cylinder and the bottom of the outer mast, remove the oil pipe between the lifting cylinder and the two cylinders, and do not loosen the oil pipe joint.

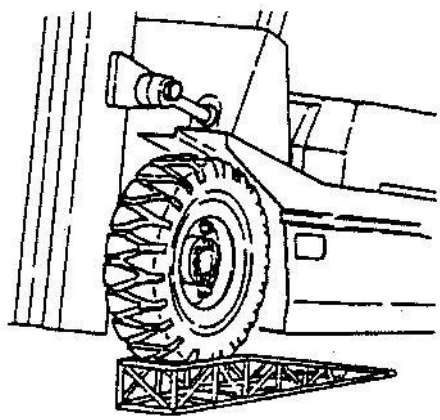


Fig 8-8

(6) Lower the inner gantry and remove the main roller at the bottom of the inner gantry. The main roller on the upper part of the outer mast will also be exposed from the top of the inner mast.

（7) Replace the main roller

·Use the puller to remove the upper main roller without losing the adjusting pad.

·Install the new roller and the newly removed adjusting pad together.

(8) Lift the inner gantry until all rollers enter the gantry.

(9) Install the lifting cylinder and fork rack in the reverse order of disassembly.

Attached table:

Lithium battery forklift charging record card

Forklift model: Serial number: Date of purchase:

Lithium battery model: Lithium battery No.: Date of first use:

Date	Electrolyte level (normal/low)	Specific gravity of electrolyte (g/cm3) (before/after charging)	Charging time(h) (Start/End)	Voltage (V)	Charge quantity(Ah)	Amount of distilled water added (ml)
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Specific gravity of electrolyte St: it must be charged when the specific gravity of electrolyte is lower than 1.160g/cm3
S25=St+0.0007 (t-25) S25 - specific gravity at 25 °C St - specific gravity at t °C (measured value) t - liquid temperature (measured value)
Termination voltage: about 52V
Charged power: 130% - 150% of lithium battery quota
Liquid level height: 15-20 mm higher than the guard

Exceptions:

Note: Please copy and carefully fill in the form, which will be the basis for lithium battery maintenance

Record