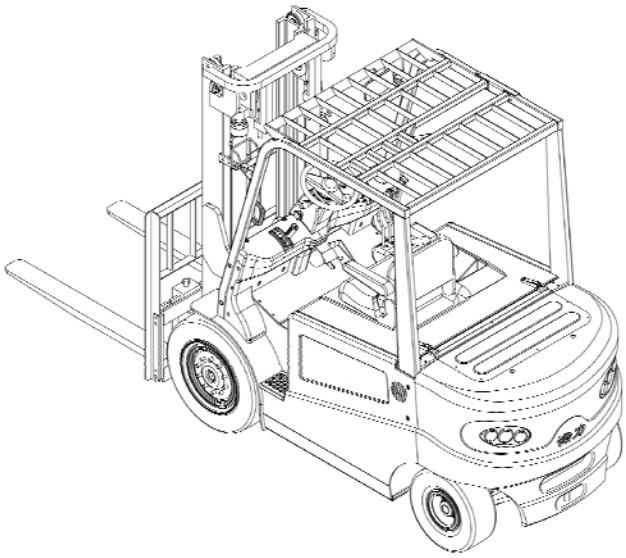
FE4D10-50-SMS-001

Warning

Operators should read and understand this manual and all warning labels on the forklift before using the forklift!

Keep the manual for future reference!



Operation & Maintenance Manual

FE4D40-50 SERIES

Battery Counterbalanced Forklift Truck

ZheJiang Noblelift Equipment Joint Stock Co.,Ltd

Table of Contents

ForeWord

This manual briefly introduces the technical parameters as well as the construction，working principle and the requirements in operation and the maintenance of each main part of the battery counter-balanced forklift of our company. Before operation，please read the manual carefully to ensure safe and efficient load transportation by correct operation and maintenance，and to help the operator to use the battery forklift properly so as to make full use of it. It is hoped that the operator and the facility manager can read the manual carefully before operation. Please perform strictly according to the attention matters in this manual, drive coutiously, operate carefully, use meticulously. Always keep your forklift be in the best situation and make full use of it. When lending or assigning the forklift，please bind this manual with it

To illuminate particularly, the following icons are used in this manual：

1.  ---- Shows that you need to pay attention and have to comply with the rules before operation，if not do so，it may lead to injury on human or damage on equipments or fire.

2.  ---- Shows that you need to pay attention and have to comply with the rules before operation，if not do so，it may lead to damage on equipments or some sort of injury on human.

3.  ---- Attentions and Instruction in Operation.

 The majority of materials consists the equipment can be completely recycled. During working，repairing，maintenance and cleaning，there are waste materials have to be recycled and managed by pollution-free technology under the rules of local government.professional experts must be necessary for dealing with these waste materials（such as hydraulic fluid，old battery andelectronic devices）in specified area，otherwise，the negative effect may harm the environment and human health.

Caution:

1) The Electric Truck can not be used in potentially explosive atmospheres!

2) Declaration of noise emission values according to EN12053:2001+A1:2008

1. The declaration is made in accordance with EN 12053:2001+A1:2008 and EN ISO 4871
2. The declared noise emission for an operating cycle is a combination of the values for the operating conditions "DRIVE", "LIFT" and "IDLE" weighted with proportion factors, together with the time proportion used.
3. During the operation of the industrial truck higher noise values may occur because of the operating mode, environmental influences and additional noise sources

Model	A-weighted emission sound pressure level at the operators' position for each operating condition			emission sound pressure level at the operators' position for an operational cycle
	Lift (Lpa)	Idle (Lpb)	Drive (Lpc)	LpAZ
FE4D40	75.6 dB	0	82.5 dB	76.9 dB
FE4D45	75.8 dB	0	82.7 dB	77.1 dB
FE4D50	76.0 dB	0	82.7 dB	77.1 dB
NOTE: Measurement uncertainties of emission sound pressure level at operator's position: σ R = 2.5dB Measurement uncertainties of noise emission sound pressure level for an operational cycle: KpA = 1.6 σ R = 4.0dB Time proportion factors: a(lift)=0.18, b(idle)=0.58, c(drive)=0.24				

Model	A-weighted emission sound power level for each operating condition			emission sound power level for an operational cycle
	Lift (LWAa)	Idle (LWAb)	Drive (LWAc)	LwAZ
FE4D40	88.9 dB	0	101.1 dB	95.1 dB
FE4D45	89.2 dB	0	101.1 dB	95.1 dB
FE4D50	89.4 dB	0	101.2 dB	95.2 dB
NOTE: Measurement uncertainties of sound power level for each operating condition: σ R = 1.5dB Measurement uncertainties of noise emission sound power level for an operational cycle: KWA = 1.6 σ R = 2.4dB Time proportion factors: a(lift)=0.18, b(idle)=0.58, c(drive)=0.24				

3) The normal-use shake of the forklift conform to the standard EN12059, the actualy shake level is: FE4D40: 1.7m/s^2； FE4D45: 1.8m/s^2； 。 FE4D50: 1.6m/s^2。

4)The normal-use envirenment: elevation less than 2000 meter, the temperature range

-5° C—+40° C, humidity less than 90%. The wind speed is not more than 5m/s.

If you need to use in the freezer for a long time, Or in special environmen， it is needed to install special attachments. Please contact our technical staff.

5)If there are problems with batch products, the products can be returned.

☞ Considering the demand of constantly developing and renewing of the products, manufacturer reserves the right to modify our own products at any moment without notice or incurring in any sanction. It is suggested to get contact with us if users want to know the up-to-date information of the products. All the information reported herein is based on data at the moment of the publication of the manual.

Chapter 1 Precautions of using forklift

Forklift drivers and managers must remember the principle of "safety first", and carefully read this maintenance manual. Operators shall be in strict accordance with this manual to ensure safe and normal operation.

Ⅰ. Forklift transportation

The following shall be noted when transporting forklift by container or trucks:

(1) Apply the parking brake;

(2) Fix the main frame and counterweight with steel wires, and use pads to wedge the corresponding positions at the front and rear tires;

(3) Start lifting from the positions indicated by the "Craning Label" on the forklift.

Ⅱ Storage of the forklift

(1) Reduce the main frame to the lowest position;

(2) Turn off the electric lock, place the lever rod to the "Nertral" position and unplug the power cord;

(3) Tighten the hand brake;

(4) Use pads to wedge the front and rear tires ;

(5) If the forklift is to be left unused for a long time, its wheels should be elevated.

(6)The accumulator should be recharged once a month.

Ⅲ Pre-use preparation

(1) Check if all instruments are normal;

(2) Check the tire pressure;

(3) Check the condition of the levers and pedals;

(4) Check if the accumulator voltage is within the working scope, and if the specific gracity of the electrolyte and the height level of the liquid are appropriate;

(5) Check if the connectors and plug contacts of the electrical system are reliable;

(6) Check for leakage of the hydraulic fluid, electrolyte and brake fluid;

(7) Check the tightness of major fasteners;

(8) Check if the lighting and signal lamps are normal;

(9) Release the parking brake;

(10) Conduct test actions such as lifting and lowering the main frame, tilting forwards and backwards, steering and braking;

(11) Contamination level of hydraulic oil shall not be greater than 12.

Ⅳ. Operation of the forklift

(1) Only trained and licensed drivers can drive the forklift;

(2) Operators shall wear security shoes, hats, clothing and gloves for protection purpose;

(3) Operators should note the performance and working conditions of mechanical, hydraulic, electrical and MOSFET governor;

(4) Power on by switching on the key switch, choose the right position of direction switch, and then rotate the steering wheel to see if the forklift can steer.
If ok, slowly depress the speed pedal and maintain an appropriate speed;

(5) Observe the voltage meter, if the voltage indicated by the voltage meter is below 72V during working, immediately stop operation, and recharge the accumulator or replace with another fully charged accumulator;

(6) Weight of loads handled should not exceed the specified value and fork spacing and location should be appropriate. The fork should be fully inserted below all the goods, which shall be uniformly distributed on the fork. Uneven loading shall be avoided;

(7) If the distance between loads‘ center of gravity and the fork arm is no more than 500mm, the maximum load shall be the rated capacity. If the distance between loads‘ center of gravity and the fork arm is more than 500mm, the maximum load shall be less than the rated capacity;

(8) When carrying loads, the main frame should tit backwards to the maximum extent and the fork arm should be in contact with the goods. Raise the fork to about 200mm away from the ground before driving;

(9) Standing under the fork and on the lifting fork are forbidden;

(10) The initial velocity should not be too fast when lifting and lowering goods;

(11) Never operate the forklift and accessories at places other than the driver's seat;

(12) When the main frame is moving forwards and backwards to the maximum extent, or when the fork is lifted to its maximum height, the operator must rapidly set the lever to the neutral position;

(13) When the main frame is lifting, driving or turning of the forklift is not allowed;

(14) When driving the forklift, drivers should pay attention to pedestrians, road obstacles and potholes, and also note the gap above the forklift;

(15) Drivers should be very careful when driving on ramps. When driving on a ramp with slope gradient more than one-tenth, do move forward for up-hilling and backward for down-hilling.
Never perform steering during up-hilling ad down-hilling process. And avoid loading and unloading when the forklift is down-hilling;

(16) Slow down when steering on wet or slippery road surfaces; be very careful and drive slowly when driving on docks or temporary boards;

(17) For forklifts with lifting height greater than 3 meters, users shall be careful to guard against falling down of the goods overhead and take protective measures if necessary;

(18) Do not carry unfixed or loosely stacked goods and be careful when handling goods with large size;

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

(20) Before leaving the forklift, lower the fork down to the ground, set the lever at neutral position and disconnect power. In case of parking on a ramp,
apply the parking brake. Use wedge pads to fix the wheels if you need to park for a long time;

(21) The safety valve pressures of multiple unit valve and steering device have been tuned up before leaving the factory. During use, users
shall not adjust it, because excessive pressure may cause damage to the entire hydraulic system or its components ,and the motor;

(22) Tire inflation pressure shall be in line with that stipulated on the "Air pressure" plate;

(23) When moving with no load, forklift with accessories shall be operated in a way as if carrying a load.

Ⅴ. Charging of accumulator cells

(1) When charging the accumulator cells for the first time and further charging, users should be in strict compliance with the instructions;

(2) When operating the forklift, if the accumulator voltage decreases to 72V, or that of its single cell drops below l.7V , or the instrument alarms, users shall immediately stop using the forklift and replace the accumulator or recharge it before further use;

(3) Check the specific gravity, liquid level and temperature of the electrolyte from time to time during the charging process;

(4) Forklift must be recharged as soon as possible after use. Never leave the forklift uncharged longer than 24 hours. When charging, pay attention to prevent
insufficient charging and over-charging, so as not to damage the battery;

(5) Users should conduct balanced recharging to the forklift in normal use once a month, so as to adjust the proportion among the accumulator units.

Please refer to the relevant sections of this Mannual for detailed charging and maintenance methods.

Chapter 2 Structure and main parameters of the forklift

Ⅰ. Overall size and performance parameters of the forklift

1. Overall dimensions (as shown in Figure 1-1)

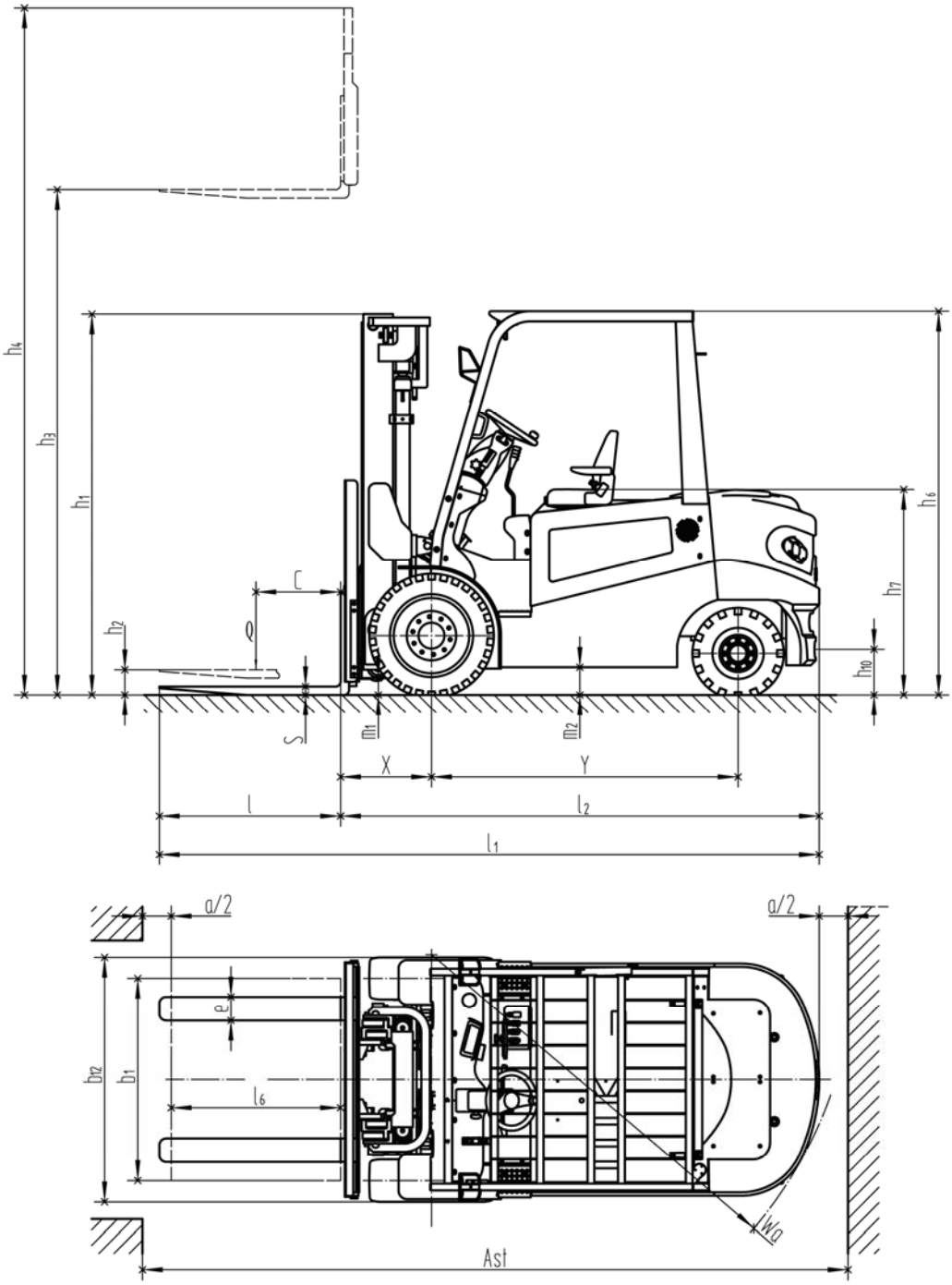


Figure 1-1 Overall dimension

2. Technical parameters （table 1-1）

Model		FE4D40	FE4D45	FE4D50
Drive mode		Electric		
Operation mode		Sit-down		
Rated loading capacity	Q(Kg)	4000	4500	5000
Load centre distance	C(mm)	500		
Front overhang distance	x(mm)	537		
Wheelbase	y(mm)	1810	1810	1810
Weight with accumulator	Kg	6865	7045	7245
Axle load with full load, front/rear	Kg	9478/1160	10290/1255	11095/1150
Axle load with no load, front/rear	Kg	3185/3680	3212/3833	3220/4025
Specification of Front wheel		250-15		
Specification of rear wheel		21×8-9		
Wheel number		2×2		
Front wheelbase	b_{10}(mm)	1200		
Rear wheelbase	b_{11}(mm)	1040		
Tilt angle of main frame, forward/backward	α/β(°)	6/8		
Height of main frame when retracted	h_1(mm)	2260		
Free lifting height	h_2(mm)	150		
Lifting height	h_3(mm)	3000		
Height of main frame when stretched	h_4(mm)	4078		
Height of overhead guard	h_6(mm)	2278		
Seat height	h_7(mm)	1220		
Traction pin height	h_{10}(mm)	270		
Total length	l_1(mm)	3896		
Length of forklift body (Fork surface)	l_2(mm)	2826		
Total width	b_1/b_2(mm)	1450		
Fork dimension	s/e/l(mm)	50/140/1070		
Fork frame width	b_3(mm)	1380		
Distance from wheel base centre to ground	m_1(mm)	150		
Distance from wheel base centre to ground m_2(mm)		165		
Working galery width	Ast(mm)	4240		
Turning radius	Wa(mm)	2500		
Driving speed, full load/no load	KM/h	14/15	14/15	13.5/14.5
Lifting speed, full load/no load	mm/s	320/480	290/440	250/440
Climbing ability, full load/no load S_2 30 minutes %		15/20	15/20	15/20
Drive motor power S_2 60min	KW	11×2		
Lifting motor power S_3 15%	KW	13×2		
Accumulator voltage/capacity K_5	V/Ah	80/720	80/720	80/720
Accumulator weight	kg	1885	1885	1885
Drive control mode		AC		

Ⅱ.Structure, principle and adjustment of the forklift's main components

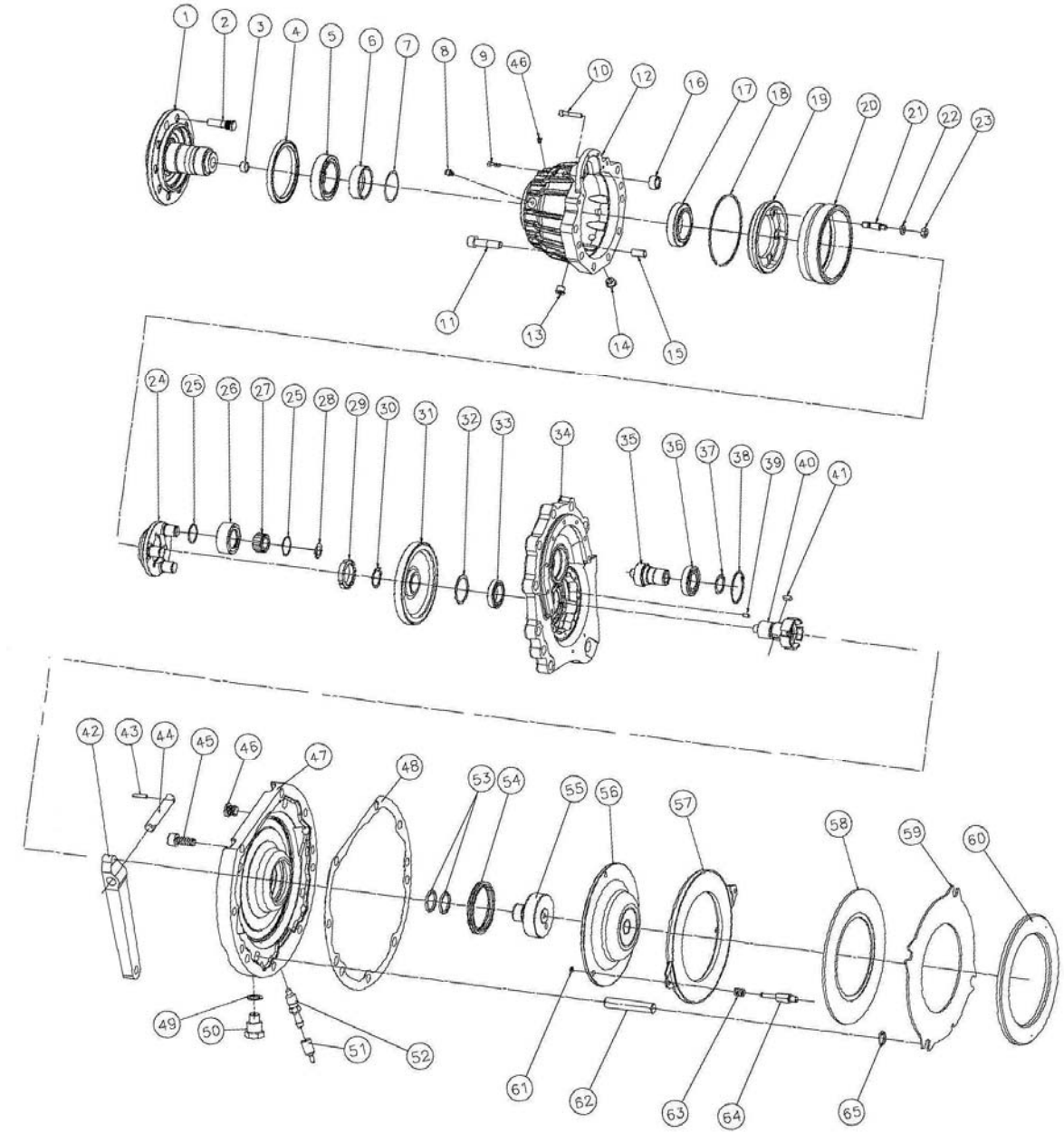
1. Transmission system

1.1 Overview

The transmission system of forklift is composed of two reduction gearbox assembly and two travel motors. Driving gear of decelerator is connected directly with the travel motor, so the driving speed of forklift increases with the increase of motor speed and the driving direction can be changed by changing the direction of motor rotation.

1.2 Reduction gearbox assembly

Located at frame, One end of Transmission is linked with travel motor, the other end installation tire. See figure 2-1



1. Wheel hub	2. Wheel fixing screw	3. Needle cage	4. Shaft seal	5. Taper Roll. Bearing
6. Set-Right Spacer	7. Spacer	8. Breather plug	9. Socket head cap screw	10. Socket head cap screw
11. Socket head cap screw	12. Housing	13. Screw Plug	14. Magnetic Screw Plug	15. Locking pin
16. Needle cage	17. Taper Roll. Bearing	18. Retaining ring	19. Ring-gear carrier disc	20. Ring gear
21. Stud	22. Washer	23. Hexnut	24. Planet carrier	25. Retaining ring
26. Planet gear	27. Roller bearing	28. Retaining ring	29. Locknut	30. Retaining ring
31. Helix gear	32. Retaining ring	33. Ball bearing	34. Cover	35. Helix pinion
36. Ball bearing	37. Retaining ring	38. Retaining ring	39. Locking pin	40. Sun pinion
41. Feather key	42. Lever	43. Elastic pin	44. Pin	45. Socket head cap screw
46. Screw Plug	47. Cover	48. Seal	49. Washer	50. Connection
51. Bleeding valve cap	52. Bleeding valve	53. Basket	54. Basket	55. Piston
56. Elastic disc	57. Disk Pusher	58. Friction disk	59. Steel disk	60. Support disk
61. Retaining ring	62. Locking pin	63. Spring	64. Stud	65. Spring

Figure 2-1 Decelerator

1.2 Care and maintenance

① Before conducting running-in test of the gear box, users shall fill in gear oil (gear oil shall be selected in accordance with the instructions. Please refer to Table 2-1 for the specific requirements). Fill oil into the hole at top of the axle shell until oil is spilled out of the oil level hole in central axle.

② It is necessary to check every 2000 working hours that the stroke of the brake piston is not over 3.5 mm, otherwise it is necessary to replace the brake disk to avoid accidents.

③ Check all the fasteners each 50 working hours . If any looseness is found, tighten it immediately.

④ Check the wheel axle and wheel hub connection each 50 working hours for any oil leakage. Re-apply sealant if any leakage is found.

⑤ Check if the oil level in the gear box meets standards. If the oil level reduces, users should promptly fill up

⑥ Oil in the gear box should be changed every 1000 working hours.

⑦ Annual technical maintenance: Disassemble the drive axle for inspection every year.

⑧ Check and debug requirements during the installation process:

2. Braking system

The Braking system consists of Brake master cylinder and Brakebooster. This system uses the two-fluid structure，and hydraulic oil as a booster medium to push the output rod of the booster, Therefore，the brake fluid of the brake master cylinder can be sent to the brake cylinder through a rigid connection to to achieve braking

When braking system is out of working, Hydraulic oil directly applying to steeing system and make it steering；in addition braking and steering can synchronously working,non-interference in each other. If both of braking and steering are not working, Hydraulic oil directly back to the tank after steering gear, Emergency braking function is necessary in case of Some emergency situations such as engine flameout,This function principle is directly pushing the brake master

cylinder by the rigid connection so that obtain braking,

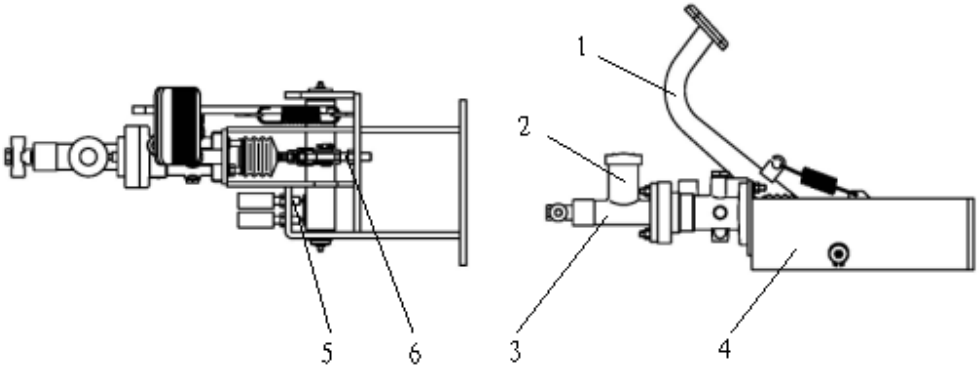
This system has many advantages, for example the boost pressure is low, the energy consumption is more less，good brake sensitivity, There is no hysteresis, Excellent characteristics of the brake booster proportion, Foot operation more convenient and Comfort features

2.1 Overview

The braking system consists of the brake pedal,brake valve, brake master cylinder.

2.2 Brake pedal

The structure of brake pedal is shown in Figure 2-2. The pedal would transfer the pedal force into brake oil pressure through the push rod on the brake master cylinder.

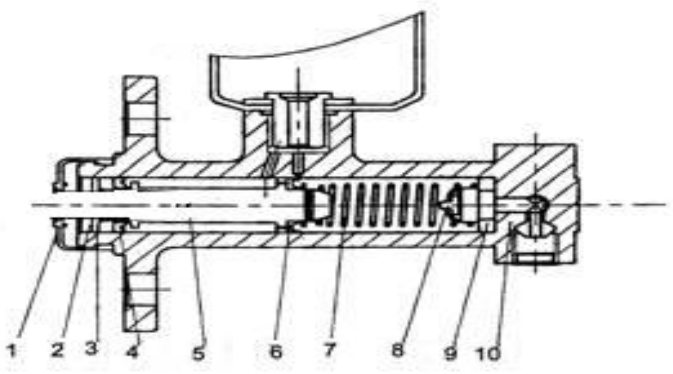


1 Brake pedal	2. Brake oil cup	3. Brake master cylinder
4. Brake support	5. Brake sensor	6. Spacing bolt

Figure 2-2 Brake pedal assembly

2.3 Brake master cylinder (Figure 2-3)

The master cylinder includes a valve seat, a check valve, a return spring, the main cup, piston and auxiliary cup. Stop washer and stop steel wire are used to fix the ends of the cylinder and rubber dust cover is applied to protect its external surface. Master cylinder piston works by depressed the brake pedal to touch the push rod. When the brake pedal is depressed, the push rod will push the piston forward, and the brake fluid in the cylinder will flow back to the storage tank through the oil return hole until the main cup block the oil return hole. When the main cup block the oil return hole, the brake fluid in front cavity of the master cylinder is compressed and the check valve is opened. The fluid will flow to the wheel cylinder through the brake pipelines. Thus, each wheel cylinder piston will protrude and the friction disk of the brake shoe will contact the brake drum to achieve slowing down or braking. At this point, the back cavity of piston will be filled with brake fluid from the oil return hole and the oil inlet. When the brake pedal is released, the piston will be pressed backwards by the return spring, and at the same time the brake fluid in each brake cylinder is also compressed by the return spring of the brake shoe, so that the brake fluid will flow back to the master cylinder (front cavity of the piston) through the check valve. Then the piston will return to its normal position, while the brake fluid in the master cylinder flows back to the storage tank through the oil returning hole. The pressure of the check valve will be adjusted to be in certain proportional of the remaining pressures in the brake pipeline and the brake cylinder, so that the cylinder cup will be correctly placed to prevent oil spilling and to eliminate air resistance that may occur during emergency brake.



1. Dust cover	2. Stop steel wire	3. Stop washer	4. Auxiliary cup
5. Piston	6. Main cup	7. Spring	8. Check valve
9. Valve seat	10. Pump body		

Figure 2-3 Brake Master Cylinder

2.4 Brakebooster

The structure of Brakebooster is shown in Figure2-4

（1）.Free state：

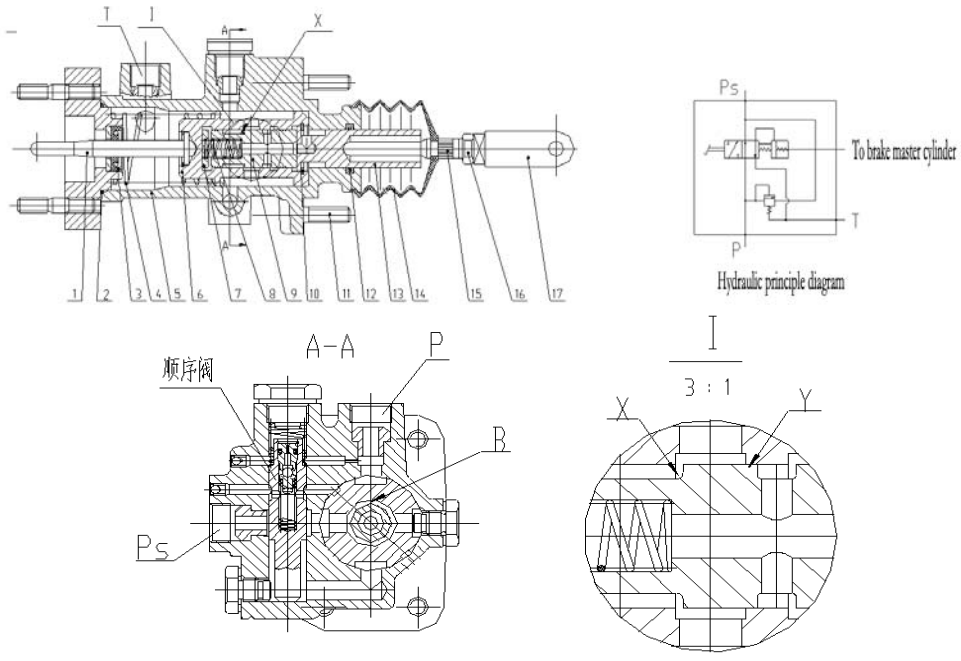
When there is no operation on the input rod 15,the oil get into the valve from the P port,and flow back to the tank through X、 B and Ps port.

（2）.Brake state：

When the brake pedal is depressed, the valve will be open, the from the P port will push brake piston through the push rod. And the brake fluid in the cylinder is compressed and it will flow into the brake cylinder in gearbox through the brake pipelines.The brake disk in the gearbox will contact to achieve slowing down or braking

(3). emergency brake

The forklift reserve the function of manual brake. When the motor or pump is out of working .There is no power hydraulic oil . and you can stop the truck by Depressing the pedal to the end .



1. Push rod	2. O ring 43.7×2.65	3. Seal 8×22×7	4. Spring
5. Valve body	6.Slide	7. Spring bush	8. Spring
9. Valve core	10. Snap ring 24	11. Bolt M8×25	12. Y ring
13. Rod bush	14. Dustproof ring	15.Input rod	16. Nut M16×1.25
17. Connector			

Figure 2-3 Brakebooster

2.5 Control device of parking brake (Figure 2-5)

The regulator located at the cam-type parking brake lever can be used to adjust the braking force.

Braking force adjustment: Turn the regulator clockwise to increase the braking force; turn the regulator counter-clockwise to reduce the braking force.

Pulling force：196N～294N

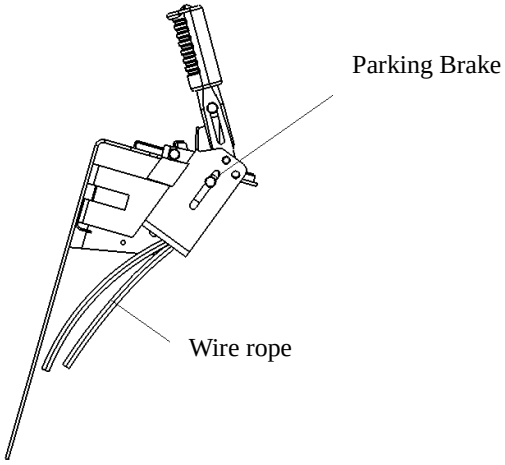


Figure 2-5 Parking bra

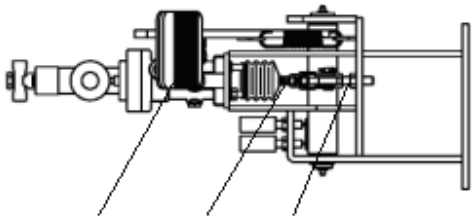
2.6 Adjusting the brake pedal as shown in Figure 2-

(1) Adjusting the Shorten push rod;

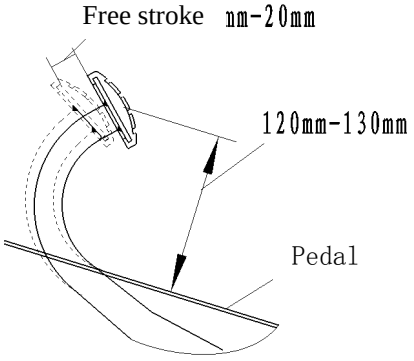
(2) Regulate the pedal spacing bolt and adjust the p ; shown in Figure 2-6 (b);

(3) Adjust the length of the push lever until its fror s with the piston of master cylinder. Then turn back 1-2 circles to guarantee a free travel of the pedal between the 10mm-20mm;

(4) Lock the nuts of push lever and the pedal spacing bolt.



a



b

Figure 2-6

(5) Adjust the brake switch as shown in Figure 2-7

(a) After the height of the brake pedal has been adjusted, release the brake switch and lock the nut;

(b) Disconnect the plug to separate the wires;

(c) Rotate the switch to set the gap A at 1mm;

(d) Make sure the brake light be lit when depressing the brake pedal;

(e) Finally lock the nuts.

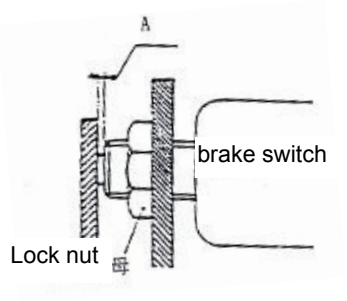


Figure 2-7 Brake light switch

2.7 Troubleshooting and Failure Analysis(Table 2-2)

(Table 2-2)

Problems	Causes analysis	Solutions
Abnormal braking	1.Oil leaks in the brake system	Repair it
	2 The brake shoe clearance is not well-tuned	Adjust the regulator
	3 The brake is over-heated	Check if the brake is slipping
	4 Brake drum and friction disk are not appropriately contacted	Readjust it
	5 There are foreign matters attached to the friction disk.	Repair or replace it
	6 The brake fluid is contaminated	Check the brake fluid
	7 The brake pedal (micro-valve) hasn't been adjusted properly	Adjustment
Noise in the brake	1 The friction surface is hardened or with foreign matters attached on it	Repair or replace it
	2 The baking plate is deformed or the bolts are loosen	Repair or replace it
	3 The brake shoe is deformed or is not installed correctly	Repair or replace it
	4 Worn friction disk	Replace
	5 The wheel bearing is loosened	Repair or replace it
The braking is uneven	1 There are oil stain on the friction disk	Repair or replace it
	2 The brake shoe clearance is not well-tuned	Adjust the regulator
	3 The wheel cylinder fails	Repair or replace it
	4 The return spring of brake shoe is damaged	Replace
	5 The brake drum is deflected	Repair or replace it
The braking is not	1.Oil leaks in the brake system	Repair or replace it
	2 The brake shoe clearance is not well-tuned	Adjust the regulator
	3 Air is mixed within the brake system	Let out the air

enough	4 The brake pedal is not adjusted appropriately	Readjust it

2.8 installation and use

1、During Handling, storage , installation, user should avoid to impact or damage the processig surface.

2、Optional disassembly in a dusty place is not allowed to prevent dirt from enter in

3、It should be checked before use to ensure there is no scratches and Corrosion phenomenon on valve joint surface

4、working oil should be clean, fluid cleanliness level NAS-9

5、Allowable oil temperature: -20 ~ 100 ℃

3. Steering system

3.1 Overview

The steering system (Figure 2-7) mainly consists of the steering wheel, steering shaft, steering gear, steering pump and steering axle. The steering shaft is connected with steering gear through gimbal joints, while the connecting shaft is connected with steering wheel through gimbal joints. The steering column can tilt backwards or forwards to an appropriate position. The steering axle is bolted to the tailstock on the frame rear end, with each steering knuckle at its left and right side. The cylinder piston rod will push the steering knuckle via the connection rod, so that the steering wheel will deflect to achieve steering.

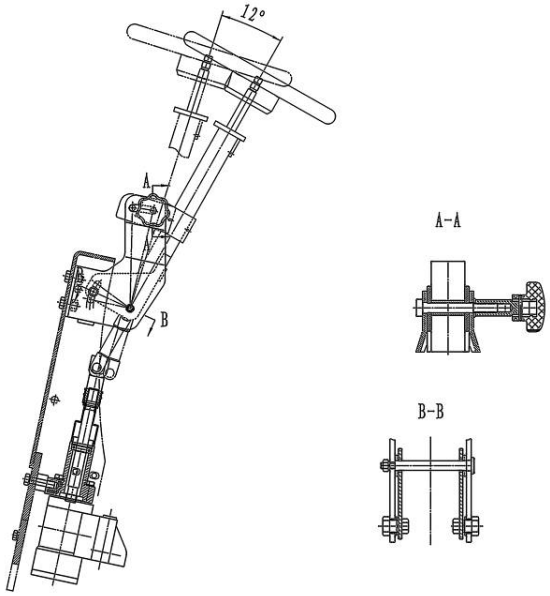


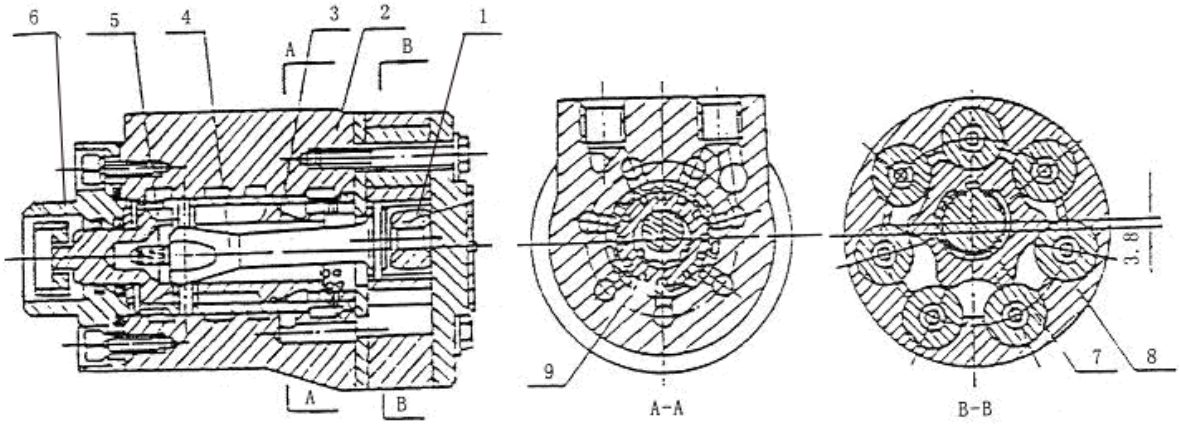
Fig. 2-7 Steering device

3.2 Cycloidal full hydraulic steering gear

The hydraulic steering gear (Figure 2-8) can according to the rotation angle of the steering wheel, transmit the oil from steering pump to the steering cylinder through the oil pipeline. When the pump can not supply oil, the operator can rotate it manually.

The steering gear is composed of a general steering and a combination valve, on which there is a hole serving as the safety valve of the system. Within the valve, there is a two-way overload valve, which could protect the parts from unexpected damage. If accident external shocks cause high pressure within the hydraulic system during the driving process of the forklift. The safety valve and two-way overload valve has been tuned up by the manufacturer and users should not adjust it

without permmision.

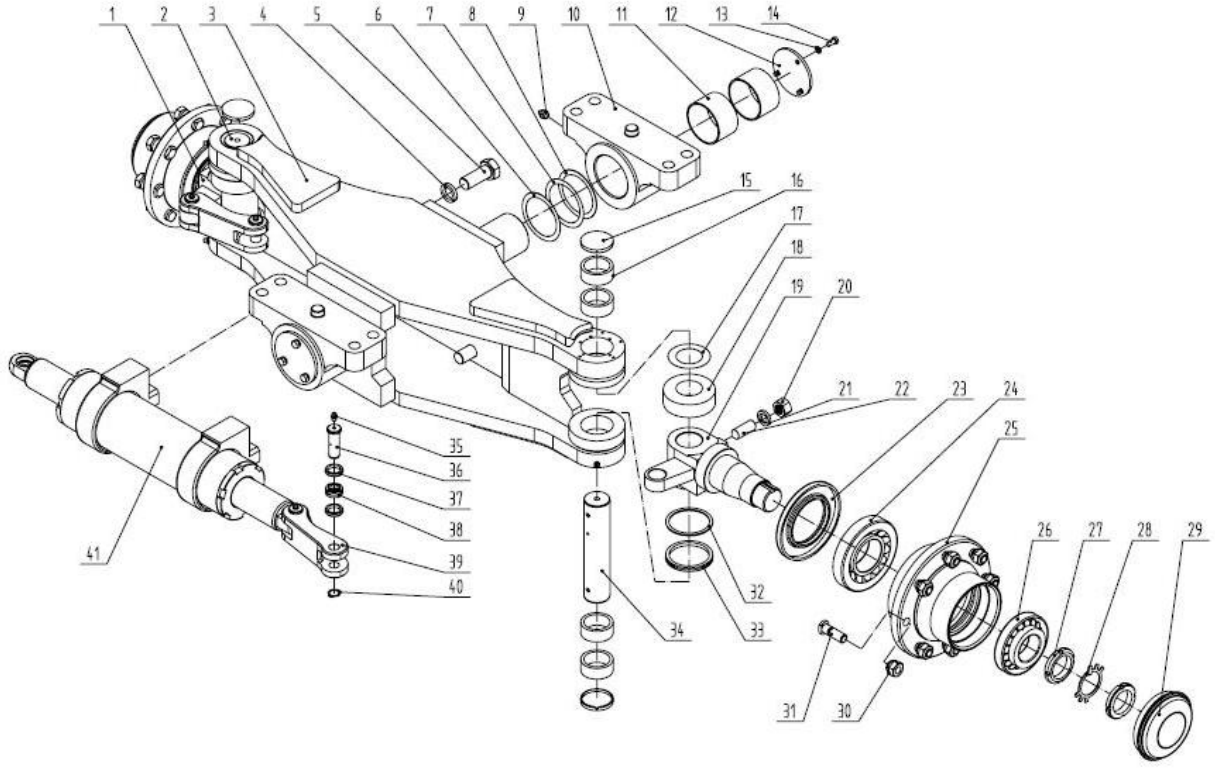


1. Limitation column 4.Couple shaft 7.Rotor
2.Valve body 5.Spring 8.Stator
3. Valve core 6.Connection block 9.Valve sleeve

Figure 2-8 Cycloidal full hydraulic steering gear

3.3 Steering axle

The steering axle push the gear moving through cylinder, so that the steering wheel will deflect to achieve steering. The steering axle is bolted to the tailstock on the frame rear end, with each wheel hub at its left and right side. wheel hub is mounted to the steering knuckle by two tapered roller shaft bearings. The wheel is fixed to the wheel hub by a wheel rim and the rear Oil seal is mounted onto inside of the bearing, so as to keep grease in the wheel hub and steering knuckle cavity.



1. Steering axle body assembly	2. Main pin	3. Steering axle body	4. washer 20
5. Bolt M20×1.5×50	6. Adjustment shim	7. Adjustment shim	8. Adjustment shim
9. Oil Cup ZG1/8	10. support plate	11. Bush	12. Baffle plate
13. Spring washer 6	14. Bolt M6×12	15. cover	16. Needle bearing
17. Adjustment shim	18. Bearing 51208	19. Right knuckle assembly	20. Nut M16
21. Spring washer 16	22. screw M16×45	23. seal130×75×10	24. Bearing
25. Wheel hub	26. Bearing	27. Nut M40×1.5	28. Set-Right Spacer
29. Wheel hub cover	30. Wheel hub Nut	31. Wheel hub Bolt	32. washer
33. seal ring	34. right Main pin	35. Oil Cup M6×1	36. Connecting rod pin
37. Bush	38. joint bearing	39. Connecting rod	40. Retaining ring
41. Steering cylinder			

Figure 2-9 Steering axle

3.4 Technical points on adjustment and maintenance

(1) fill lubricating grease into the wheel hub, internal and external bearings and the inner cavity of the wheel hub cover. And also apply some grease on the oil seal;

(2) Fix the bearing outer ring to the hub and mount the wheel hub to the knuckle;

(3) Put the washer in place and tighten the slotted nut with a torque of 206-235N.m (21-24kgm). Loosen the slotted nut and then tighten it with a torque of 9.8Nm (1kgm);

(4) Tap the wheel hub with a wood hammer and then rotate the wheel hub for 3-4 cycles to ensure that the wheel hub is not loosened;

(5) Tighten the slotted nut to align it to the cotter pin on the knuckle;

(6) And then tap gently on the wheel hub with a wood hammer and turn the wheel by hand for 3-4 cycles to ensure smooth rotation. Then measure the rotation torque of the wheel hub, which

should be 2.94-7.8N. m (0.3-0.8kgm);

(7) If the torque is larger than the specified value, rotate in reverse for 1 / 6 circle to re-measure the torque;

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

3.5 Check the steering system after reinstalling

(1) Turn the steering wheel leftwards and rightwards to the maximum extent to see whether the rotation is uniform and smooth;

(2) Check if the layout of hydraulic piping is correct and if the left and right steering are mounted reversely;

(3) Jack up rear wheels and slowly rotate the steering wheel leftwards and rightwards for several times to remove air in the hydraulic pipelines and oil cylinder.

3.6 Failure analysis (Table 2-3)

(Table 2-3)

Problems	Causes analysis	Solutions
The steering wheel gets stuck	The oil pump is damaged or faulted	Replace
	The rubber hose or fitting is damaged or the pipe is blocked	Replace or clean it
The steering wheel is heavy	The pressure of the safety valve is too low	Adjust the pressure
	There is air in the oil pipeline	Remove the air
	The reset function of steering gear fails. Positioning spring is broken or lacks elasticity	Replace the spring
	The inner leakage of steering cylinder is too large	Check the piston seal
The forklift moves unsteadily or in a snake-like manner	The spring is broken or lose elasticity	Replace
It is noisy when the forklift is working	The oil level in the oil tank is low	Add oil
	The inlet tube or filter is blocked	Replace or clean it
Oil leakage	Guide sleeve seal of the steering cylinder is damaged, or the joint or pipelines are damaged.	Replace

4. Electric system

4.1 Overview

The electrical system mainly includes accumulator cells, traction motor, pump motor, traction motor controller, pump motor controller, combination control switch, instrumentation and lighting devices. Schematic of electrical system See Figure 2-10

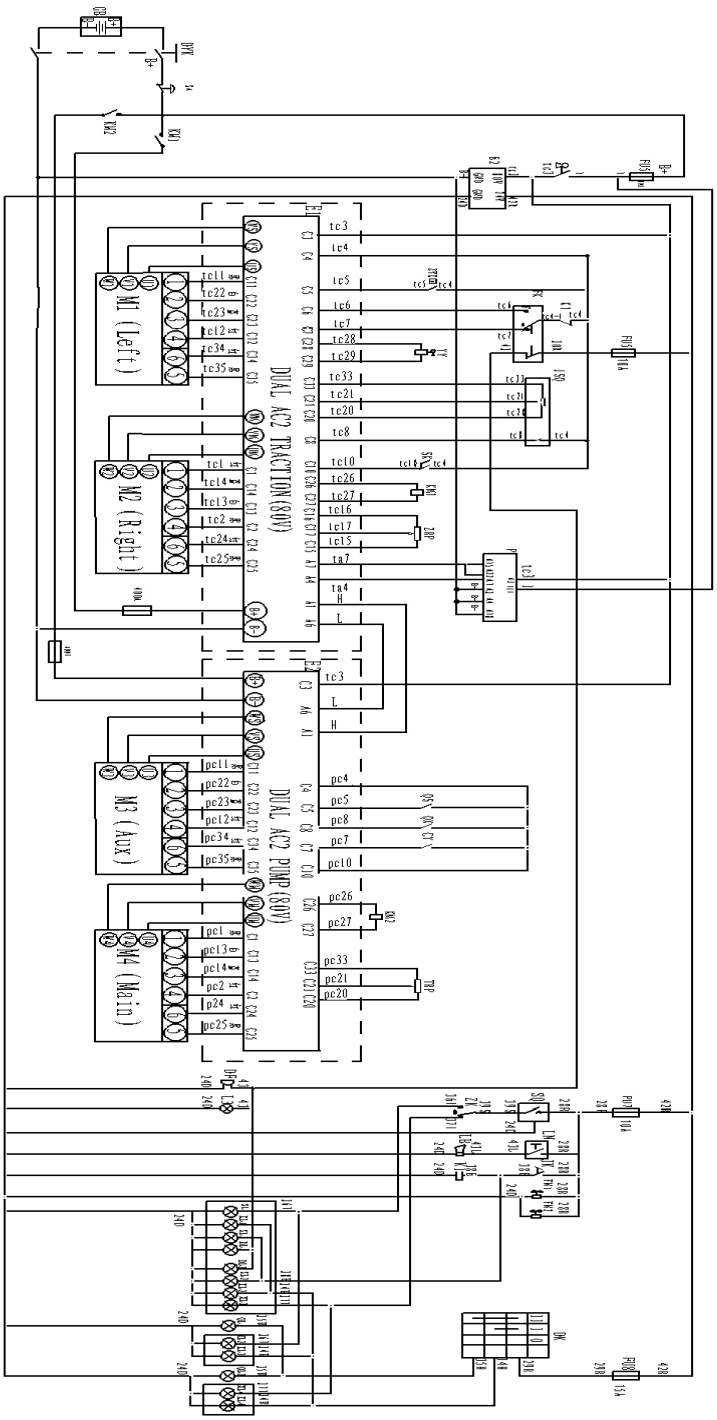


Figure 2-10 Schematic of electrical system

(Table 2-3)

No.	Name	Remarks	No.	Name	Remarks
M1	Traction motor		LB	Horn	
M2	Pump motor		DF	Back-up buzzer	
E1	Traction& Pump controller		DK	Light switch	
FU2	Fuse		LN	Horn switch	
FU1	Fuse		ZK	Steering switch	
KM1	Contactor		JK	Foot brake switch	
DYK	Power connector		FK	Direction switch	
GB	Accumulator		KL3	width lamp	
JSQ	Electric accelerator		XL2	Left steering lamp	
ZYK	Seat switch		QL1	grouped lamp	
SY	Key switch		XL3	Right steering lamp	
SA	Emergency stop switch		KL2	width lamp	
FU4	Fuse		SL2	Braking lamp	
FU6	Fuse		DL2	Reversing lamp	
FU7	Fuse		DL1	Reversing lamp	
FU8	Fuse		SL1	Braking lamp	
P	instrument		KL1	width lamp	
K	Relay		XL1	Left steering lamp	
SK	Hand brake switch		CY	Side shifting switch	
FM1	Fan		QX	Tilt switch	
FM2	Fan		QS	Lifting switch	
SQ	Flasher		KL4	width lamp	
JTF	auxiliary switch		XL4	Right steering lamp	
ZRP	Corner otetiometer		QL2	grouped lamp	
TRP	Lifting potetiometer		HDK	Single level Switch	
S6	Microswitch				

4.2 Electric control assembly

Electric control assembly mainly consists of two DUALAC-2 Power motor controllers and oil pump motor controller as the core component integration , the system is energy-saving and superior in performance and reliable in quality.

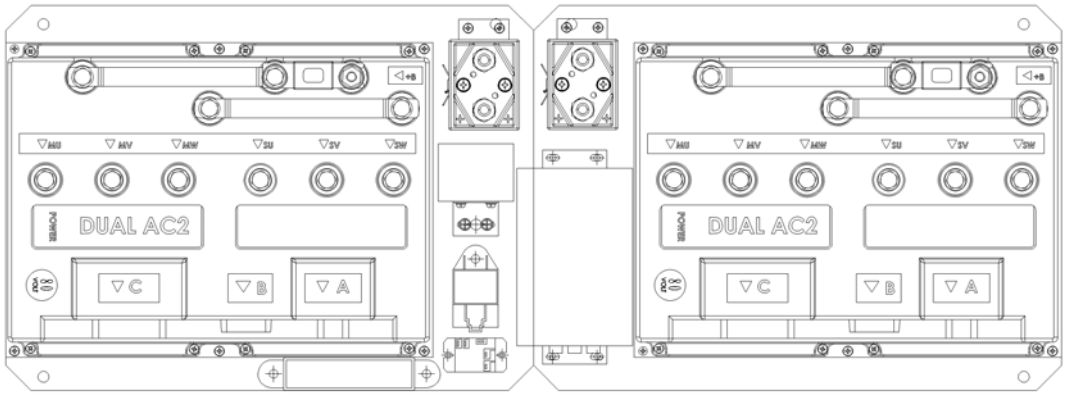


Figure 2-11 Electric control assembly

Basic working principle:

Among MOS Series products of Zapi Company, the DUALAC-2 Power inverter, which is specially designed for 8.0kW-12.0kW motors, has been widely used in electric vehicles, golf carts and multi-purpose utility vehicles for controlling purpose. The lifting force is generated in a way as follows: the AC motor drive pump to generate oil pressure, and then the hydraulic pipes work on the hydraulic cylinders on both sides of the frame to achieve lifting of the fork.

Features of the electric control device:

（1）Overview

The electrical system of FE4D50AC four-wheel AC electric forklift is powered by an 80V battery and traction is enabled by the AC motor. The lifting force is generated in a way as follows: the AC motor drive pump to generate oil pressure, and then the hydraulic pipes work on the hydraulic cylinders on both sides of the frame to achieve lifting of the fork. The lighting system is powered by a 24V voltage.

（2）Characteristics of the Electric System:

The forklift’s AC frequency conversion traction motor, dashboard display, AC drives are all products from the Italian ZAPI Company, the world's leading supplier of electric vehicle systems. The AC frequency conversion motor is efficient, durable and essentially maintenance-free. As it does not contain any commutator seen in DC motors, acceleration is faster (commutator limits acceleration and even limits braking torque during high-speed driving). The controller is one universally used in electric vehicles that communicate via CANopen protocol. With its analog and digital I / O and communication devices, the controller is ideal for managing forklift movements, I / O, for controlling operation and for displaying information. In addition, it can perform discharging and monitoring of the battery group and offers a variety of protection. Dashboard display ECO-SMART can show a variety of data, and can be set at factory or by users. Plus, other functions such as entering of user commands are also avaliable.

（3）Main functions and settings

By properly setting the motor parameters, control parameters and corresponding functional value of the controller, users can acheive safe and efficient performance as well as full operational capabilities of the electric forklift.

1.The crawling speed of electric forklift can be regulated. By setting the crawling speed of the controller, users can operate the electric forklift under low-speed in a long time.

2. Acceleration rate can be regulated. Under different acceleration rate, the "hardness and softness" feel of the accelerator pedal varies. By setting of the acceleration rate, users can meet various accelerating demands in different conditions.

3. Reverse braking and regenerative braking.When the direction lever is placed reversely

during moving of the forklift, a reverse braking signal will be created, and then the motor drive will order the traction motor to generate a braking torque, so as achieve the purpose of deceleration. Size of the braking force is controlled by the accelerator pedal.Regenerative braking refers to the forklift's braking force generated by the controller when the forklift's speed is relatively higher than the traction motor speed. The force can be transformed into electrical energy and returned to the battery group. In order to reduce the speed of the forklift when moving downwards, users can release the accelerator pedal to a certain extent to achieve regenerative braking, so as to extend the driving distance enabled by a single battery charge.

4.Function of avoiding slipping backwards on a ramp. Electric forklift with AC traction motor could excellently avoid downwards-moving of the forklift on a ramp.

5.The maximum driving speed could be regulated. By setting a reasonable vmaximum speed of the electric forklift, users can avoid overload of traction motor due to excessive speed.

6. As two motor speed change fuction relation:steering angle and steering axle/wheel track The information of steeding angle comes from sensors change, and shaft/wheel track ratio is a constant.It depends on its size, The date dilever to Zapi controller give motor feedback, so that the steering wheel will deflect to achieve steering.

7.Static response off.If the seat switch or key switch is off, the control device will be turned off either. Re-start is enabled only when the directional control lever is placed on the neutral position.If the driver leaves the forklift and then return, he needs to place the directional control lever on the neutral position to re-start the forklift.This feature eliminates accidental occurrence of unsafe operation.A few seconds of latency have been set to the input end of seat switch, so as to realize momentary disconnection of the seat switch in case of turbulence.

8.Function of security protection. If damage occurs to the controller's power components when forklift is running, the controller will disconnect the main contactor in the shortest time; if the controller's temperature is too high, the controller will automatically limit armature current of the motor; if the battery voltage is too low, the controller will stop working to ensure safety.

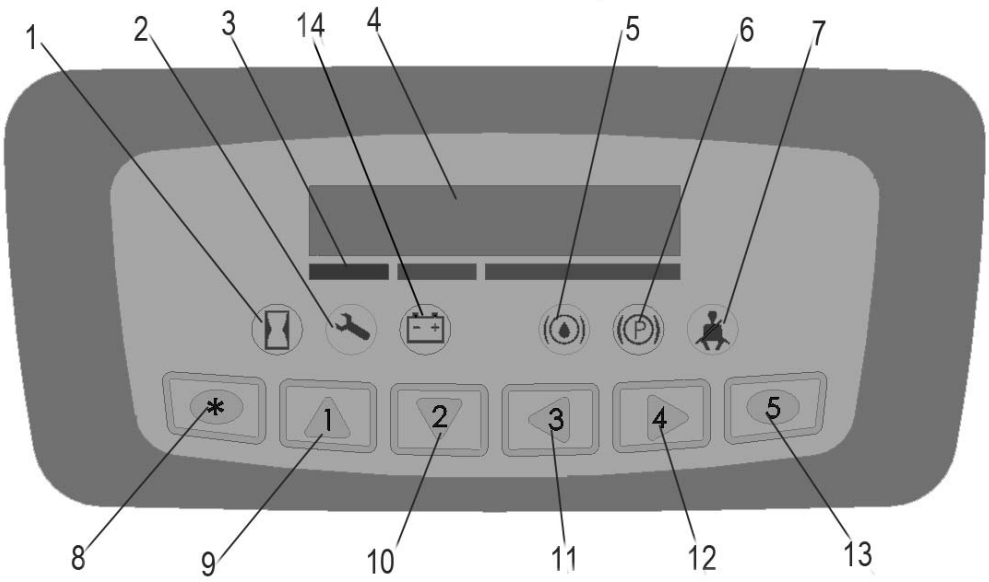
9.Both the traction motor controller and pump motor controller are equipped with a self-diagnostic function. Fault code will show on the meter display and the controller will be automatically disabled to ensure the operating system's security whenever controller fault occurs during its working process.

10.The meter display will show the battery power and its cumulative work hours.

4.3 Combination instrument

The forklift uses new combination instrument that provides auxiliary control function and displays the forklift condition to the driver. It consists of control circuit, cumulative time counter (on LCD), accumulator meter, fault code display and other display circuit. In order to meet the current demands and requirements on electric forklift, the instrument adopts new design on control circuit and display form featuring compact structure, elegant appearance, high automation level and reliable quality, providing drivers with intuitive information of the forklift status.

Smart Display monitor is equipped with six built-in red LCD displays, which could provide basic information of the forklift's operation status to the operator.See the Figure below.



1. Latency light
2 Failure alarm light
3. Battery level mark
4 Display of speed, time and battery level
5 Temperature warning light
6. Indication light of hand braking
7. Indication light of seat
8. Meter function keys
9. Function selection key (up)
10. Function selection key (down)
11. Parameter adjustment key (-)
12. Parameter adjustment key (+)
13. Exist function key
14. Battery indicator

Figure 2-12

4.4 Meter fault code

Table 2-4 Fault code

Status code	Diagnosis of fault status	Status code	Diagnosis of fault status
00	NONE	42	DIR CONT. OPEN
01	CHOPPER RUNNING	43	RIGHT CON CLOSED
02	NO COMMUNICATION	44	RIGHT CONT. OPEN
03	UNKNOWN CHOPPER	45	LEFT CONT CLOSED
04	CONSOLE EEPROM	46	LEFT CONT. OPEN
05	SERIAL ERROR #2	47	MAIN CONT CLOSED
06	SERIAL ERROR #1	48	MAIN CONT. OPEN
07	CHOPPER NOT CONF	49	I=0 EVER
08	WATCHDOG	50	LEFT I=0 EVER
09	FIELD FF FAILURE	51	RIGHT I=0 EVER
10	EEPROM DATA KO	52	PUMP I=0 EVER
11	EEPROM PAR. KO	53	STBY I HIGH
12	EEPROM CONF. KO	54	LEFT STBY I HIGH
13	EEPROM OFFLINE	55	RGT STBY I HIGH
14	LOGIC FAILURE #5	56	PUMP STBY I HIGH
15	LOGIC FAILURE #4	57	HIGH FIELD CUR.
16	LOGIC FAILURE #3	58	NO FIELD CUR.
17	LOGIC FAILURE #2	59	HIGH BRAKING I

18	LOGIC FAILURE #1	60	CAPACITOR CHARGE
19	FORW VMN LOW	61	HIGH TEMPERATURE
20	FORW VMN HIGH	62	TH. PROTECTION
21	FORW VMN LOW	63	THERMIC LEVEL #2
22	BACK VMN LOW	64	PUMP TEMPERATURE
23	BACK VMN HIGH	65	MOTOR TEMPERAT.
24	LEFT VMN LOW	66	BATTERY LOW
25	LEFT VMN HIGH	67	BATTERY LEVEL #2
26	RIGHT VMN LOW	68	BATTERY LEVEL #1
27	RIGHT VMN HIGH	69	CURRENT SENS. KO
28	PUMP VMN LOW	70	POWER FAILURE #3
29	PUMP VMN HIGH	71	HIGH CURRENT
30	VMN LOW	72	POWER FAILURE #2
31	VMN HIGH	73	POWER FAILURE #1
32	VMN NOT OK	74	DRIVER SHORTED
33	NO FULL COND.	75	CONTACTOR DRIVER
34	RGT NO FULL COND	76	COIL SHORTED
35	LFT NO FULL COND	77	COIL INTERRUPTED
36	PU NO FULL COND	78	VACC NOT OK
37	CONTACTOR CLOSED	79	INCORRECT START
38	CONTACTOR OPEN	80	FORW + BACK
39	BRAKE CON CLOSED	81	BAD STEER 0-SET
40	BRAKE CONT. OPEN	82	ENCODER ERROR
41	DIR CONT. CLOSED	83	BAD ENCODER SIGN
84	STEER SENSOR KO	92	DRIVER 1 SIC. KO
85	STEER HAZARD	93	DRIVER 2 SIC. KO
86	PEDAL WIRE KO	94	INPUT ERROR #6
87	PEDAL FAILURE	95	INPUT ERROR #5
88	TRACTION BRUSHES	96	INVERTION
89	PUMP BRUSHES	97	POSITION HANDLE
90	DRIVER 1 KO	98	INPUT ERROR #2
91	DRIVER 2 KO	99	INPUT ERROR #1
241	DATA ACQUISTION (03)	242	PUMP WARNING (03)
244	SLAVE WARNING (03)	245	WRONG SET BAT. (03)
246	SLAVE KO (03)	247	NO CAN MSG N.4 (03)
248	CHECK UP NEEDED (03)	249	THERMIC SENS. KO (03)
250	HANDBRAKE (03)	251	WAITING FOR NODE 4# (03)
253	AUX OUTPUT KO (03)		
241	DATA ACQUISTION (04)	242	PUMP TEMPERATURE (04)
243	PUMP INCOR. START (04)	244	PUMP VACC NOT OK (04)
245	PUMP TH. SENS. KO (04)	246	MASTER KO (04)
247	NO CAN MAS N. 3 (04)	249	THERMIC SENS. KO (04)
250	INPUT MISMATCH (04)	251	WAITING FOR N.3 (04)

5. Accumulator

The shape of accumulator See Figure 2-13

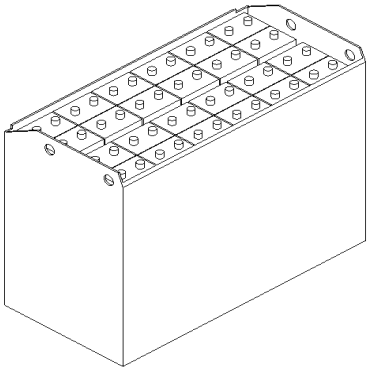


Figure 2-13

5.1 Accumulator safety precautions:

△ Appropriate ventilation measures shall be adopted because hydrogen and oxygen will be generated at the end of the accumulator charging process. If spark occur during the process, explosion may be caused.

△ Harmful acid mist will also be generated during charging. Remove the mist promptly after charging and clean up the accumulator and the charging place promptly.

△ Please wear protective glasses and rubber gloves when charging the accumulator as it contains sulfuric acid. Careless use may cause skin burns and loss of vision. If you splash electrolyte (acid) in your eyes or skin, immediately wash with plenty of water and visit a doctor for treatment. Electrolyte on clothes can be washed off with water.

△ People who are not familiar with the operating method of the accumulator and its dangerousness shall not use the accumulator, so as to avoid harm to personnel caused by the dilute sulfuric acid.

△ Never place any metal objects or tools on the accumulator to eliminate the danger of short-circuit.

△ Unplug the power connector of the accumulator only when power is fully turned off. Hot plugging is strictly prohibited.

△ Before installing the accumulator, please read the instruction manual carefully. After reading, please keep it with you for future reference.

5.2 Accumulator use precautions

Service life of the accumulator is generally 2 to 3 years, or even 4 years if it can be properly used and maintained. In case of the improper use and maintenance, it may suffer early damage in a few months since initial use.

During use of the accumulator, users should regularly check the electrolyte level and the remaining accumulator capacity. Recharge the accumulator if necessary. Accumulator maintenance is relatively simple, but requires patience and meticulousness. Timely supplementing and density control of the electrolyte as well as cleanup of accumulator and polarity terminals can effectively extend the service life of accumulator.

Check if there is water in the accumulator box and drain the water immediately if any.

In addition, the accumulator should not be stored with electrolyte in it. In case of short-term storage of a fully charged accumulator, please charge the it every month during the storage period to compensate for self-discharge of the accumulator, preventing vulcanization of accumulator plate or eliminating minor vulcanization of the accumulator plates. Plus, users shall check the accumulator status frequently during the storage period.

If the accumulator is being used, please conduct a fully discharge together with a fully charge each month. This could help maintain accumulator capacity and avoid plate salvation.

Please keep the external surface of the accumulator clean.

Check the accumulator and the fixing status of wire leads. There should be no looseness.

Check the accumulator case for cracking and damage and then check the pole and lead chuck to see if they are burnt.

Wipe clean dust on the external surface of the accumulator with a cloth. If electrolyte overflows to the surface, please wipe with a cloth or rinse with hot water and wipe it dry with a cloth. Remove dirt and oxides on the post piling and wipe clean the external of lead cable and lead chuck. Unblock and clean up the vent on the filler cap. During the installation process, apply a thin layer of industrial Vaseline on the pole and lead chuck.

Check the accumulator fluid level:

Vertically insert a glass tube with a diameter of 6 ~ 8mm and length of 150mm into the filler until reaching the upper edge of the plate. Then press the upper end of the tube with thumb and clip out the glass tube with the index finger, middle finger and ring finger. The height of the electrolyte within the tube is the height of electrolyte above the plate accumulator surface, which should be 15-25mm. Finally, return the electrolyte to the original single-cell accumulator.

Add electrolyte

If the electrolyte level is too low, distilled water should be promptly added other than tap water, river water or well water, so as to avoid failure of self-discharge caused by impurities. Plus, do not add electrolyte, otherwise the electrolyte concentration will increase, shortening the accumulator life. Note that the electrolyte level can not be too high in order to prevent spill-over of the electrolyte during charging and discharging process that may cause short circuit. After adjusting the electrolyte level, charge the accumulator for 0.5 hours or more to well mix the added distilled water with the original electrolyte. Otherwise, the interal parts of the accumulator tend to be frozen in winter.

Check the electrolyte density

The electrolyte density varies with the different degree of accumulator charging and discharging. Drop of the electrolyte density is an indication of accumulator discharging. To measure the electrolyte density in each cell is a manifestation of the accumulator discharge level.

(1) Measurement method: Remove the liquid filler cap in the single cells in the accumulator, and draw the electrolyte from the liquid filler cap with a density meter, until the float of density meter floats up. When observing the readings, you should raise the density meter to a position that flush with your eye sight, and put the float in the center of the glass tube without touching the tube wall, so as not to affect the accuracy of reading.

If the temperature is below 25 ℃ or higher than 25 ℃, a thermometer should be used to measure the actual temperature of the electrolyte for correcting the value of electrolyte density.

(2) Correction of electrolyte density: errors exist in the density of the electrolyte at different temperatures, so the electrolyte density value shall be corrected accordingly. Electrolyte density at 25 ℃ shall be used as the benchmark. Therefore, if the electrolyte temperature is higher than 25 ℃, you should add 0.0007 to the actual measured value of density for an increase in temperature by 1 ℃; In contrast, if the electrolyte temperature is lower than 25 ℃, subtract the density by 0.0007 when the temperature decrease by 1 ℃; If the temperature difference is large, the density value shall be corrected by the following formula:

Density of electrolyte under standard temperature (25 ℃) can be converted by the following formula:

D25 = Dt + 0.0007(t - 25)

D25 — Electrolyte density when the temperature is 25 ℃

D25 — Measured electrolyte density when the temperature is t ℃

t — The electrolyte temperature when measuring the density

5.3 Charging of the accumulator

(1) Initial charge (generally initial charge has been conducted to the products before leaving the factory, so users could omit this operation)

The quality of initial charge would greatly impact the future performance of accumulator. So initial charge shall be conducted by experienced operators.

Initial charge should be carried out to new accumulators before use.

You should wipe clean the surface of the accumulator and check for damage before the initial charge.

Open the cover on the liquid filler to ensure that the vent is unblocked.

When the charger is under normal working conditions, you could fill sulfuric acid electrolyte with density of 1.26±0.005 (25 ℃) and temperature below 30 ℃ into the accumulator. In this case, liquid level shall be 15 ～ 25mm higher than the protection plate.

Place the accumulator aside for 3 to 4 hours, but ensure the time will never be more than 8 hours. Conduct initial charge only after liquid temperature is reduced to below 35 ℃. If the electrolyte level reduces after standing down, you should add electrolyte to it original level.

Sulfuric acid electrolyte shall be prepared by mixing the accumulator acid and distilled water according to national standard GB4554-84 (never use industrial sulfuric acid and tap water).

During preparation, please slowly fill the concentrated sulfuric acid into the distilled water by trickle and continuously stir with a acid-proof glass rod or with a lead covered wood stick. Filling of distilled water into the sulfuric acid is not allowed, otherwise it will cause boiling and splashing of solution, resulting in burning.

Connect the accumulator with the charger correctly in terms of polarity in a reliable manner, namely, ensure ro connect positive to positive and negative to negative.

For the first phase of initial charge, please use 0.5I5A (60A for D-600 accumulator) until the voltage of a single cell reaches 2.4V. Then we could shift to the second phase of initial charge;

For the second phase of the initial charge, you could use 0.25I5A (30A for D-600 accumulator) for charging;

The temperature of the electrolyte shall not exceed 45 ℃ during charging. Reduce the charge current by half or suspend the charge when the temperature is close to 45 ℃. Continue charging after the electrolyte temperature drops to below 35 ℃. In this case, the charging time shall be extended appropriatly;

Evidence of fully charged: In the second stage of the initial charging, charging voltage will be up to 2.6V and the voltage change shall be less than 0.005V; When electrolyte density is 1.28 ± 0.005 (25 ℃) , if there is no significant change within 2 hours and fine bubbles emerges intensely, the accumulator can be considered fully charged. The charging power is 4 to 5 times of the rated capacity and the charging time is about 70 hours;

In order to accurately control the content of sulfuric acid in the electrolyte, the density of the electrolyte should be checked at the end of the charging process; In case of any discrepancy, please use distilled water or sulfuric acid with density of 1.40 to adjust. Ensure the electrolyte density and height level is adjusted to the specified value within 2 hours since the charging starts;

Wipe clean the accumulator surface and cover the filler cap before putting into use.

2) General Charge

Do not use accumulator that is not fully charged. Users should pay close attention to the discharge level of accumulator during use. If the discharge level exceeds the set value, conduct charge in time. Excessive discharge is strictly forbidden. When the voltage drops o 1.7V / cell, electrolyte density decreases to 1.17, stop discharge timely and conduct charge soon. Never delay charging for a long time. Don’t stop halfway without reason during the charging process.

When conducting general charge, first open the flip cover on the filler cap cover and check whether the electrolyte height meet requirements. If not, please fill distilled water to adjust the liquid level to the required height.

Connect the output of the charger with the accumulator in accordance with the requirements. Connect positive to positive and negative to negative. Pay attention not to connect it reversed.

The charger compatible with the accumulator could automatically regulate the charging current according to the charging capacity and conduct charging until the accumulator is fully charged. (Please refer to the manual of charger for details on observation of the charging state)

In order to keep the accumulator status updated, it is recommended to record each charge and discharge conducted for each accumulator, so as to provide useful basis for determining whether or not the accumulator in the future or not. During the charging process, measure and record the current, total voltage, voltage of each single cell(the cells shall be numbered) , changes in the electrolyte density and temperature (measure with a 0 ~ 100 ℃ mercury thermometer) every 1-2 hour .

If large quantities of even and fine bubbles come into being, voltage of single cell is stabilized at 2.5-2.7V and electrolyte density and terminal voltage stops rising in 2-3 hours, then it can be determined that the accumulator is fully charged. If any cells have no or few bubbles, try to find out the reasons and fix the problem. Then record it in your work log.

Electrolyte temperature shall not exceed 45 ℃ during the charging process. The temperature of the electrolyte during charging shall not exceed 45℃. Suspend charging if the temperature is close to 45 ℃ and continue charging when the electrolyte temperature drops to below 35℃.

When the accumulator charging comes to end, the electrolyte density of the accumulator shall be checked and adjusted. If the electrolyte density fails to meet the requirements, draw some electrolyte from the original cells. If it is less denser than normal, fill concentrated electrolyte with density of 1.40 for adjustment; if it is denser than normal, dilute it by adding distilled water. After adjustment, the difference of electrolyte density of cells should not exceed 0.01 and the liquid level should meet relevant requirements. After adjusting the density, you could continue to charge with small current for 0.5 hours to mix the electrolyte. Then review the electrolyte density and adjust it if necessary. Finally, wipe clean and mount the accumulator for future use.

3）Balanced recharging

Under normal circumstances, although all the accumulator cells run under the same situation, but for some reasons, imbalance in the entire accumulator may occur. In such case, balanced recharging should be conducted to eliminate the charge difference between the accumulator cells, so as to achieve a balanced charging between all cells of the battery. Balanced recharging is simple and users can operate according to the instructions.

Perform balanced recharging to the accumulator once every two or three months during normal use. accumulators that are left unused for a long time should be charged before use.

5.4 Installation and replacement of the accumulator

Perform installation and replacement of batteries in a fixed and reliable manner to avoid tipping; Beating on the polar column and lead chuck with a tool is strictly forbidden; in the handling process, pay attention to avoid strong impact.

6. Hydraulic system

6.1 Overview

The hydraulic system consists of working pump, multiple unit valve, lifting cylinder, tilting cylinder, pipelines and other component parts. See figure 2-14

The hydraulic oil will be supplied by the oil pump directly connected with the motor. The multiple unit valve will assign oil to each cylinder.

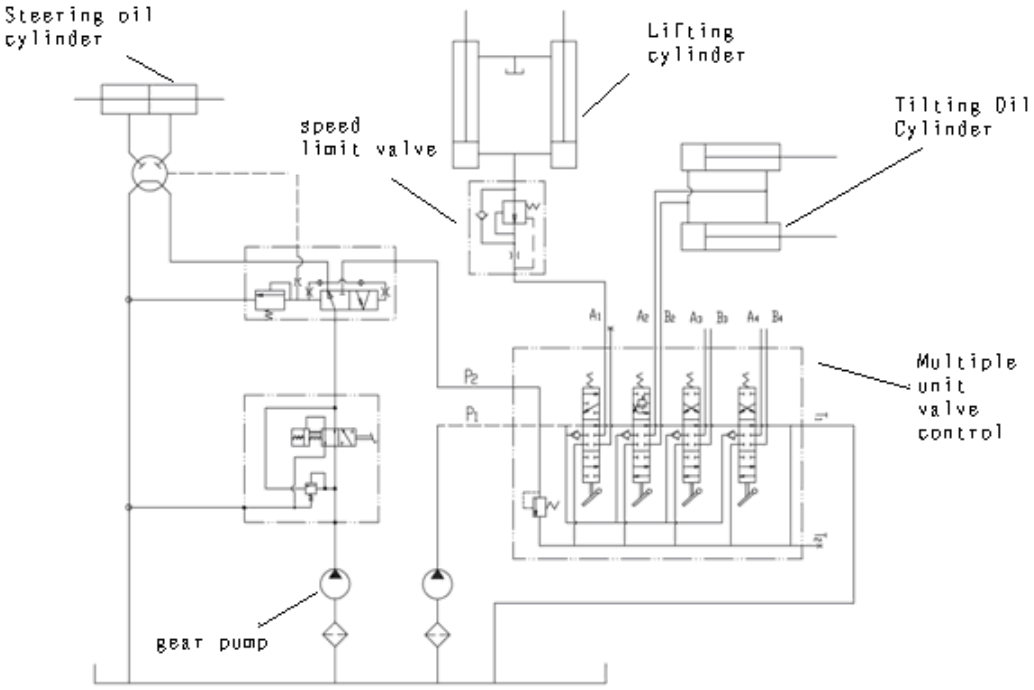


Figure 2-14 Diagram of the hydraulic system

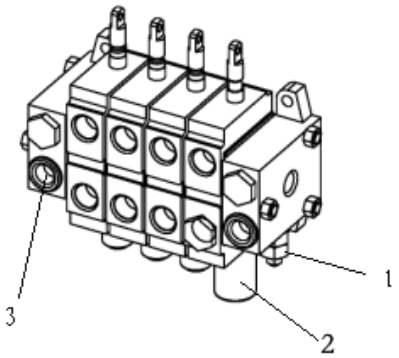
6.2 Oil pump

The oil pump is a gear pump.

6.3 Multiple unit valve

The multiple unit valve includes two four-piece valves. Controlled by the valve rod of the multiple unit valve, the hydraulic oil from the work pump will assign high-pressure oil to the lifting cylinder or tilting cylinder. Safety valve and self-locking valve are installed in the multiple unit valve. Safety valve is located in the upper side of oil inlet in the multiple unit valve to control the system pressure; self-locking valve is located in the tilt valve plate to prevent serious consequences due to misoperation of control lever in case of no pressure source of the tilting cylinder. A check valve is mounted between the oil inlet and the oil abortion hole of the lifting valve plate, as well as between the oil inlet and the oil abortion hole of the lifting valve plate with check valve.

Please see Figure 2-15 for the shape of the multiple unit valve.



1. Safety valve 2. Microswitch bracket 3. Oil returning hole 4. Lifting speed sensor sets

Figure 2-15 Shape of multiple unit valve

（1） Operation of the slide valve (Take tilting slide valve as an example)

(a) Middle position（Figure 2-16）

At this time the high pressure oil discharged from the oil pump will return to the cylinder through the middle position.

(b) Pull in the slide valve (Figure 2-17)

The middle channel is closed at this time, oil from the inlet hole openes the check valve and flow into the cylinder interface B. Oil flows from interface A will flow to the cylinder through the low pressure channel. Then the slide valve can return to the middle position with the help of the return spring.

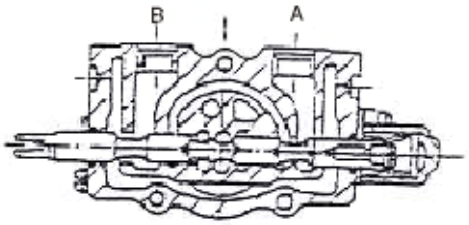


Figure 2-16

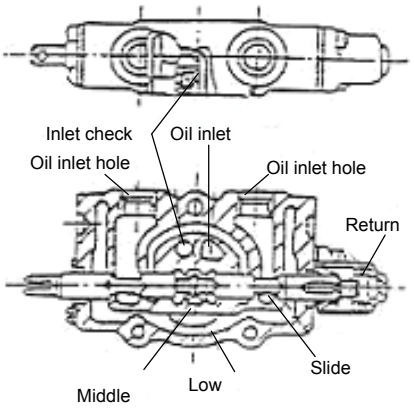


Figure 2-17

(c) Pull out the slide valve (Figure 2-17)

The middle position is closed at this time, oil from the inlet hole openes the check valve and flowes into the cylinder interface A. Oil flows from interface B will flow to the cylinder through the low pressure channel. Then the slide valve can return to the middle position with the help of the return spring.

(2) Action of safety overflow valve (Figure 2-18)

The overflow valve is installed between the "HP" interface of the oil pump and the low-pressure channel "LP". The oil that flows through the lifting valve "C" will acts on the different areas of diameter "A" and "B", so the check valve "K" and overflow lifting valve "D" all land on the valve seat. The preset pressure in the oil pump "HP" channel will act on the spring of pilot valve and the check valve "E" will open. Oil will flow around the valve into the low pressure "LP" side through the open-end hole.

Once the pilot valve "E" is open, the pressure at the inside of valve "C" will decrease and the valve "E" and valve "C" will both land on the valve seat. Liquid flow at back of the flow valve "D" will be off, so the pressure inside is reduced. Pressure on pump "HP" channel side and the inside pressure are different, the valve "D" will open under the pressure difference and the oil will directly flow into the low pressure loop "LP".

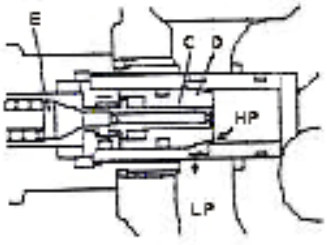


Figure 2-18

(3) Action of the self-locking tilt valve

Self-locking tilt valve is mounted in the tilt cylinder valves. The self-locking valve could prevent sudden fall of the main frame when negative pressure occurs in the cylinder and also eliminate

dangers if the valve rod is titled due to misuse. With this self-locking valve, when forklift motor stops working, the main frame will not tilt forward even if the control lever is shoved. Oil flow direction when valve core is pulled out is the same with that shown in Figure 2-18, at which time the main frame is tilting backwards.

(a) When the valve core is inserted (pump is working), oil from the main pump will flow into the tilt cylinder through interface "B", and the oil flowes back from the cylinder will be used to the piston through the role of port A. Oil will return to the cylinder through the holes A and B on the valve core. See Figure 2-19

(b) When the valve core is inserted (pump is not working), there will be no oil that flows into interface "B" of the cylinder, so that the pressure in part P will not increase. Therefore, the piston will not move and oil in the cylinder Interface "A" can not return to the oil cylinder, which won't move. See Figure 2-20

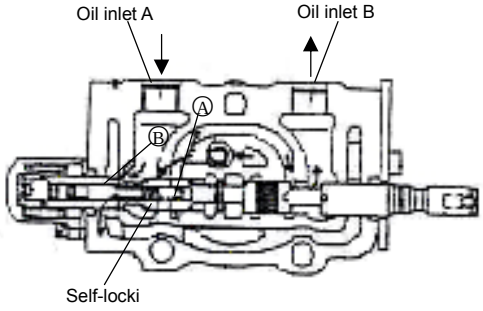


Figure 2-19

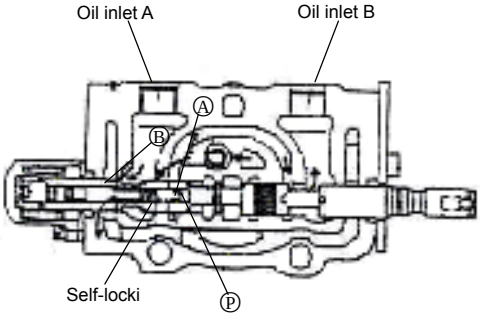
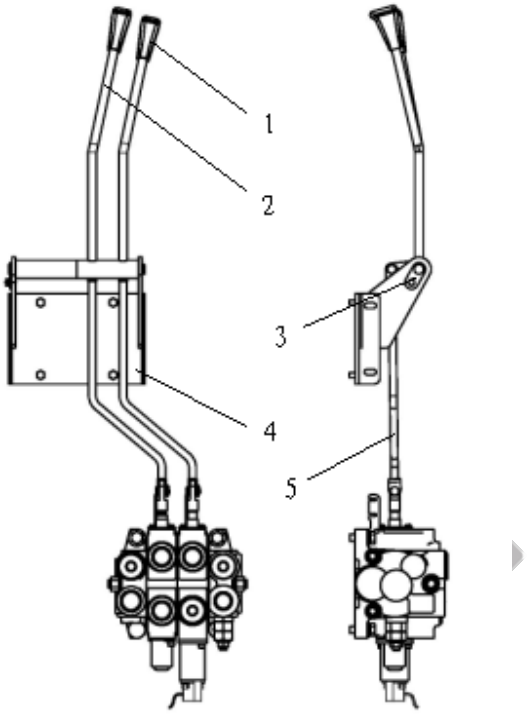


Figure 2-20

(4) Multiple unit valve control Figure 2-21

Multiple unit valve is controlled by the control levers, all of which are installed in a connecting shaft and the shaft is fixed to the forklift body through a bracket.The control lever controls the slide valve through the connecting rod.



1. Lifting control lever 2. Tilting control lever 3. Attachment control lever
4. Bracket t 5. Connecting Rod
(Figure 2-21) Multiple unit valve control

（5）Pressure adjustment of the safety valve

The pre-set pressure of the safety valve: 17.5/18.5MPa;

⚠ **Pressure of the safety valve has been set by the manufacturer and users shall not adjust it wilfully.**

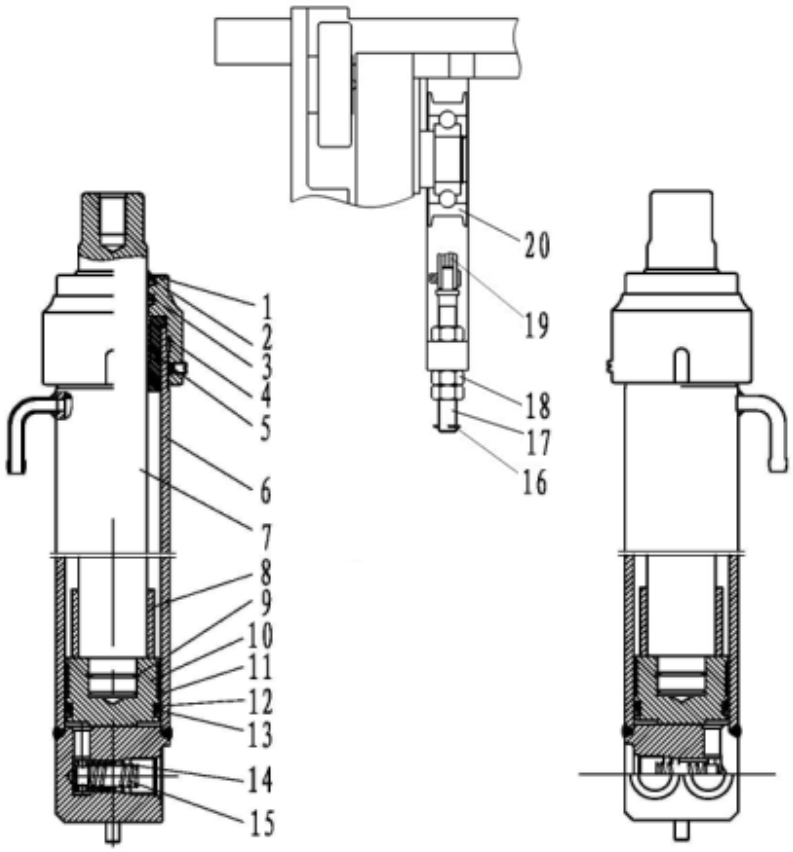
6.4 Lifting cylinder and lifting chain （See figure 2-22）

The lifting cylinder is a single-acting piston cylinder, which consists of the cylinder, piston rod, piston and cylinder head. For the series of forklifts, the two lifting cylinders are installed behind the outer main frame, with the cylinder bottom fixed on the cylinder bearing with a pin and a bolt. And the top of the cylinder (ie the top of the piston rod) is connected with the beam on the outer door frame. The right lifting cylinder is equipped with a governor valve.

Piston is fixed to the piston rod with a elastic steel wire. Oil seal and support ring are mounted to the outer ring of piston.

A shut-off valve is mounted at the bottom of the cylinder, which serves as a protection device if the high pressure pipe suddenly burst in case of lifting of the main frame.

Cylinder head is fitted with steel bearing and oil seal to support the piston rod and to protect the cylinder from dust.



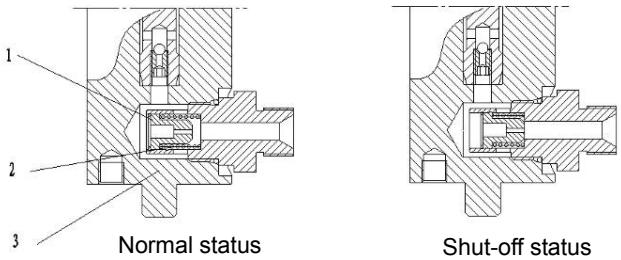
Left lifting cylinder Right lifting cylinder

1.Dust proof ring	2.Shaft seal	3. Steel cover O ring	4. Steel-backed bearing	5. Guide sleeve
6. Left cylinder body	7. Piston rod	8.Adjustment sleeve	9. Stell wire washer for hole	10. Piston
11. Supporting ring for hole	12. Retainer ring	13. Hole seal	14. Buffer valve core	15.spring
16. Cotter pin	17. hain joint	18. Nut	19. Chain	20. Chain wheel

Figure 2-22 Lifting cylinder and chain

6.5 Working status of the shut-off valve

A shut-off valve is mounted at the bottom of the lifting cylinder (see Figure 2-23). When the high pressure hose suddenly bursts, it could avoid sharp decline of the goods. Oil from the lifting cylinder will flow through the shuut-off valve and slide valve. The oil hole around the slide valve will generate pressure difference between the two cavities. If this pressure is less than the spring force, the slide valve does not move. For example, if high pressure hose bursts, forming a large pressure difference, the slide valve will move to block the holes around so that only a small amount of oil will flow through the small hole at the slide valve end to slowly decline the fork.

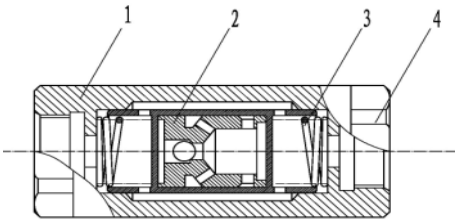


1.Lifting cylinder 2. Pressure spring 3. Valve core

Figure 2-23 Shut-off valve

6.6 Governor valve

The governor valve is installed on the mast to control the decline speed of fork and to ensure safety in case of rupture at high pressure and other unexpected situations.
See Figure 2-58 for the connection method.



1.Lifting cylinder 2. Valve core 3. Pressure spring 4.Screw plug

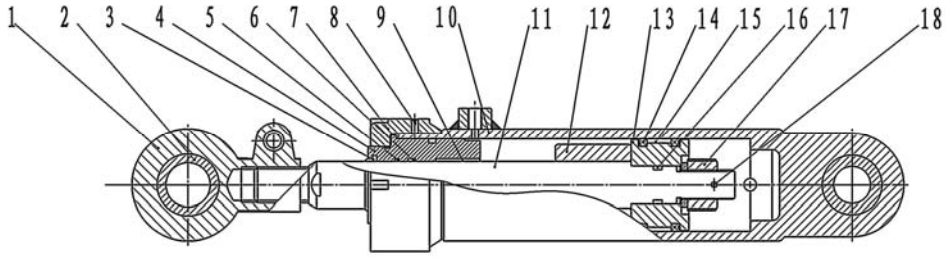
Figure 2-24 Built-in governor valve

6.7 Tilting Oil Cylinder

The tilting oil cylinder is double acting, with its piston rod end connected to the main frame through the earrings. Bottom of the tilting oil cylinder is connected with the frame by pins.
and there is a tilted cylinder at each side of the forklift.

The tilting cylinder is mainly composed by piston, piston rod, cylinder, cylinder bottom, guide sleeve and seals. The piston and piston rod adopt welded structure, with the piston outer surface mounted with a bearing outer ring and two Yx seal rings. In the internal hole of guide sleeve there mounts an axle sleeve, Yx seal ring, retaining ring and dust ring. The shaft sleeve support the piston rod, seals, retaining ring and dust ring that protects from oil spills and dust, all of which are mounted to the cylinder together with the 0-ring. See Figure 2-25

When the tilt sliding valve is pushed forward, the high-pressure oil will flow from the cylinder bottom to push the piston, moving the main frame titling forward. When the slide valve is pulled backwards, the high-pressure oil will flow into from the front end of the cylinder to pull the piston backward, moving the main frame titling backward.

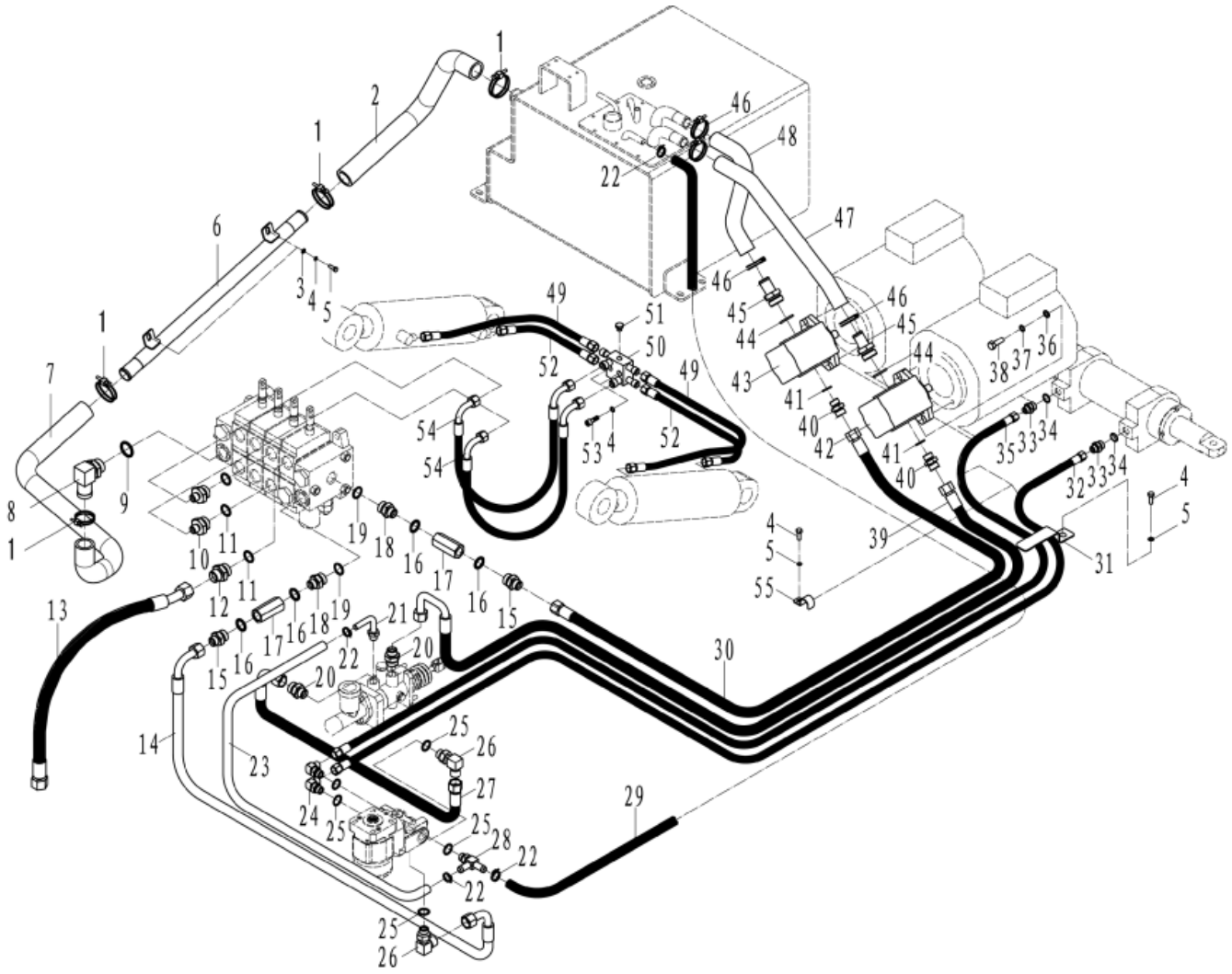


1. Ear ring	2. Bearing	3. Dust proof ring	4. Cylinder head	5. O ring	6.Yseal ring
7. cover	8. screw	9. Guide ring	10. Cylinder barrel	11. Piston rod	12.Y seal ring
13. Piston	14. Y seal ring	15. Guide sleeve	16. O ring	17.Nut	18. Cotter pin

Figure 2-25Tilting oil cylinder

6.8 Hydraulic piping

See Figure 2-61 for the oil pipelines in the hydraulic system



1. Double steel wire clamp	2. Oil return hose II	3. Fat washer 8	4. Spring washer 8
5. Bolt M8×16	6. Oil return transit steel tube	7. Oil return hose I	8. Joint of Oil return hose
9. O ring	10. ilting Oil hose joint	11. O ring	12. Joint of lifting pipe
13. lifting pipe assembly	14. pipe assembly	15. joint 22-22	16. seal washer 22
17. Check valve	18. oil-in joint	19. O ring	20. joint
21. return joint	22. Double steel wire clamp	23. Oil return hose	24. joint 18-16
25. O ring	26. oil-out joint Ⅰ	27. Oil tube for multiple unit valve	28. Oil return joint
29. Oil return hose	30. Oil tube assembly for multiple unit valve	31. pipe clamp	32. Steering oil hose Ⅰ

33. Steering oil cylinder joint	34. O ring	35. Steering oil hose II	36. washer 10
37. Spring washer 8	38. Bolt M10×30	39. pump-brake pipe assembly	40. Oil outlet joint of pump
41. O ring	42. gear pump	43. gear pump	44. O ring
45. Oil suction joint of pump	46. Double steel wire clamp	47. Oil suction hose II	48. Oil suction hose I
49. Tilting Oil hose III	50. Six-way valve joint	51.plug	52. ilting Oil hose II
53. screw M8×30	54. ilting Oil hose I	55.pipe clamp	

Figure 2-61 Hydraulic piping

6.9 Maintenance and adjustment

Maintenance of working oil pump

(1) Disassembling

Clean it thoroughly before disassembling. Removed parts should be placed on a clean paper or cloth. Be careful not to make the parts dirty or damaged.

(a) Place the pump flange at the clamp table.

(b) Remove the connecting bolt 11, rear end cover 5 and pump 1.

(c) Remove the liner plate 6, drive gear 2 and passive gear 3.

(d) Remove the seal ring 7 and retaining ring 8 from the front and back end cover.

Note: If you do not plan to replace the seal ring, do not remove it from the front end.

(2) Check

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

(a) Pump check

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

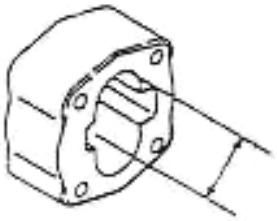


Figure 2-27

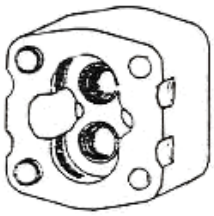


Figure 2-28

(b) Check of liner plate

Check the contact surface of the lining plate and replace it if the surface is damaged or if the lining thickness is less than the specified value. Specified value of the lining thickness: 4.94mm.

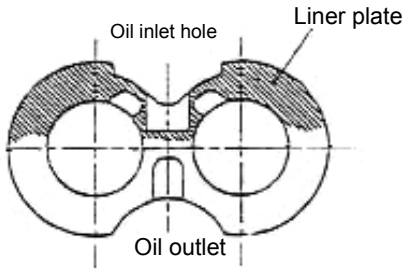


Figure 2-29

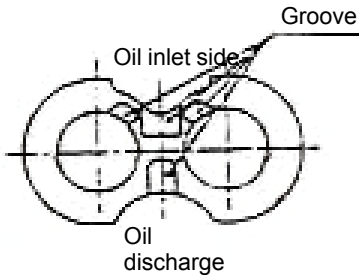


Figure 2-30

(c) Check of the front and rear pump cover

If the inner surface of the bush discolours (turn brown) exceeding the range of 150 °, replace it.

(d) Check of the driving and passive gears

Replace a pair of gears in case of excessive wear. If size of D is less than the specified value, replace in pairs.

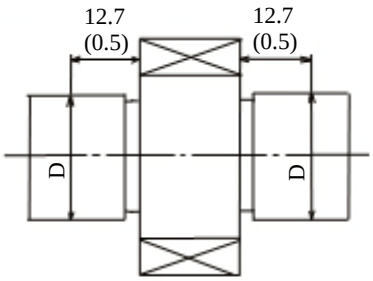


Figure 2-31

(e) If necessary, replace the seal rings, bushing seal, retaining ring, oil seal, spring ring.

(3) Assembly

(a) Mount a new seal ring and a new retainer ring at the front end cover of the pump.

(b) Mount the upper liner plate at the front end cover trench. Be careful not to mis-distinguish the oil abortion hole and the oil discharge hole.

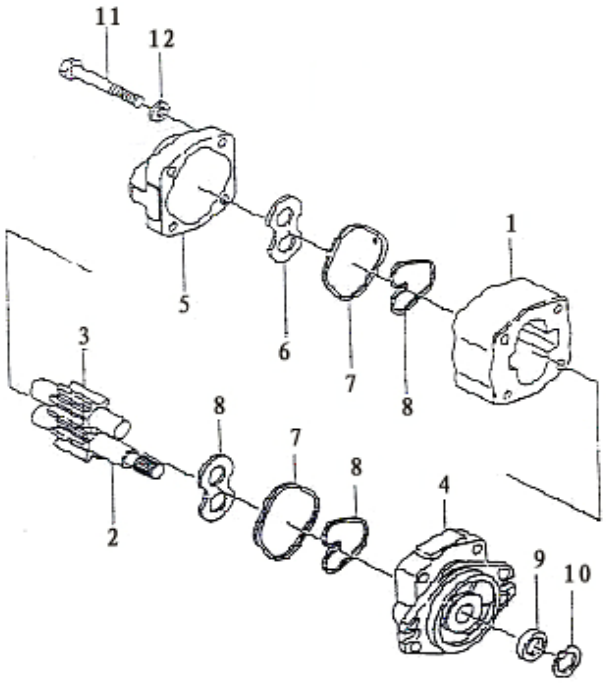
(c) Mount the drive and passive gears on the front end cover.

(d) Mount the liner plate on the gear side to align the groove to the gear points. Be careful not to mis-distinguish oil suction side and oil discharge side.

(e) Mount a new seal ring and a new retainer ring on the groove at the rear-end cover. See Figure 2-65

(f) Mount the rear cover on the pump body and pay attention to distinguish the oil abortion hole and the oil discharge hole.

(g) When all the parts have been installed, tighten the connecting bolts to the specified torque of 9 ~ 10kg.m.



1. Pump body 2. Driving gear 3. Passive gear 4. Front-end cover
5. Rear-end cover 6. Liner plate 7. Seal ring 8. Retainer ring
9. Oil seal 10. Flexible ring 11. Bolt 12. Washer

Figure 2-32 Gear pump

(4) Test run

Conduct running-in of the pump to check if it functions properly. Then perform oil pump testing on the test bench or test by the following steps on the forklift truck:(If oil pump is subject to decomposition and maintenance due to serious wear and jamming caused by the hydraulic oil, the hydraulic oil and filter should be replaced before test-running on the forklift.)

(a) Mount the pump onto the forklift and mount the pressure gauge onto the test hole of the multiple unit valve.

(b) Loosen the adjusting screw of the overflow valve to keep the pump working for 5001000-1000rpm for about 10 minutes. Ensure that the oil pressure is lower than 10kg/cm ².

(c) Increase the pump speed to 1500-2000rpm and keep it running for about 10 minutes.

(d) Set the pump operating speed at 1500-2000rpm. Perform pressure increment of 20-30kg/cm ² and keep it running for 5 minutes after each increase, until the pressure reaches 175kg/cm ². Then keep each oil line working for 5 minutes and replace the oil returning filter.

When increasing the oil pressure, pay attention to the oil temperature, pump surface temperature and the operation sound. If the oil temperature or the pump surface temperature rises excessively, reduce the load to lower the oil temperature before further testing.

(e) After testing, set the overflow pressure at 175kg/cm ² and measure the flow traffic. Determine the flow traffic by measuring lifting speed.

6.10 Failure analysis

If the hydraulic system fails, please find out the causes according to the table below and conduct necessary repairs.

（1）Failure analysis of the multiple unit valve (Table 2-5)

Table 2-5

Fault	Cause	Countermeasures
Pressure of the lifting oil line can't be increased	Jamming of the slide valve	Clean it after disassembling
	Oil hole is blocked	Clean it after disassembling
Vibration Pressure rise is slow	Jamming of the slide valve	Clean it after disassembling
	Inadequate exhaust of air	Full exhaust
Steering oil pressure is greater than the specified value	Jamming of the slide valve	Clean it after disassembling
	Oil hole is blocked	Clean it after disassembling
Less than the required oil volume	Overflow valve is not well adjusted	Adjustment
With noise	Overflow valve is not well adjusted	Adjustment
	Wear of sliding surface	Replace the overflow valve
Leakage (external)	Aging or damage of the O seal ring	Replace the O seal ring
The set pressure is low	The spring is damaged	Replace the spring
	Damage of valve seat surface	Adjust or replace the overflow valve
Leakage (internal)	Damage of valve seat surface	Fix the seat surface
The set pressure is high	Jamming of the valve	Clean it after disassembling

（2）Failure Analysis of the oil pump（Table 2-6）

Table 2-12

Fault	Cause	Countermeasures
Low volume of oil discharge	The oil level in the oil tank is low	Add oil to the specified value
	The tube or filter is blocked	Clean or replace as needed
Low pressure of the pump	●Liner plate damage ●Bearing damage ●Poorly functioned seal ring, bushing seal or retaining ring	Replace
	Overflow valve is not well adjusted	Adjust the pressure of overflow valve to the specified value with a pressure gauge
	There is air within the system	●Re-tighten the side tubing of the oil inlet ●Add oil ●Replace the oil pump seal
With noise when running	The inlet tube is damaged or the filter is blocked	Check the tube or repair oil filter
	Looseness or leakage of the oil inlet	Tighten the loosened parts
	Excessive oil viscosity	Replace the oil with viscosity compatible with the pump operating temperature

	Bubbles in the oil	Find out the cause of bubbles and take measures accordingly
The pump leaks oil	The pump seal or seal ring is damaged	Replace
	Pump is damaged	Replace

7. Lifting system

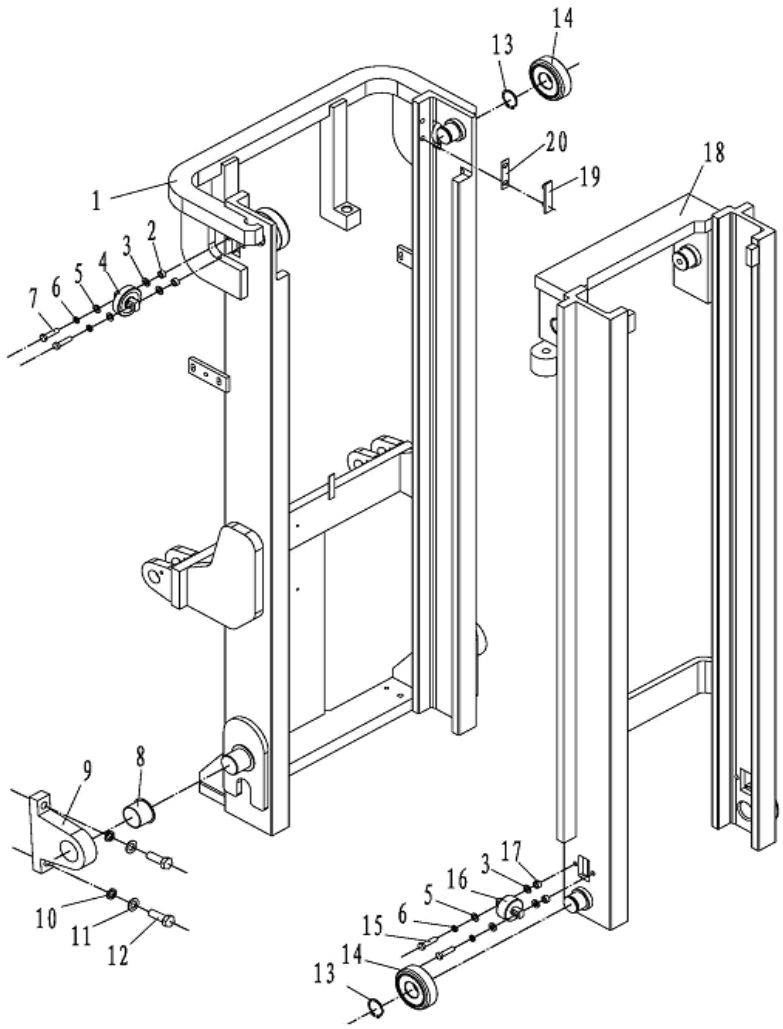
7.1 Overview

Composed by the inner and outer main frames as well as the forklift frame, the lifting system is a roller vertical elevating system with two levels.

7.2 Outer and inner main frames (Figure 2-33)

Inner and outer main frames are welded structures. The bottom of the outer main frame is installed onto the gear box by supporting parts.

The central part of the outer main frame is connected with the frame by the tilting cylinder and can tilt forward and backward under the action of the tilting cylinder.

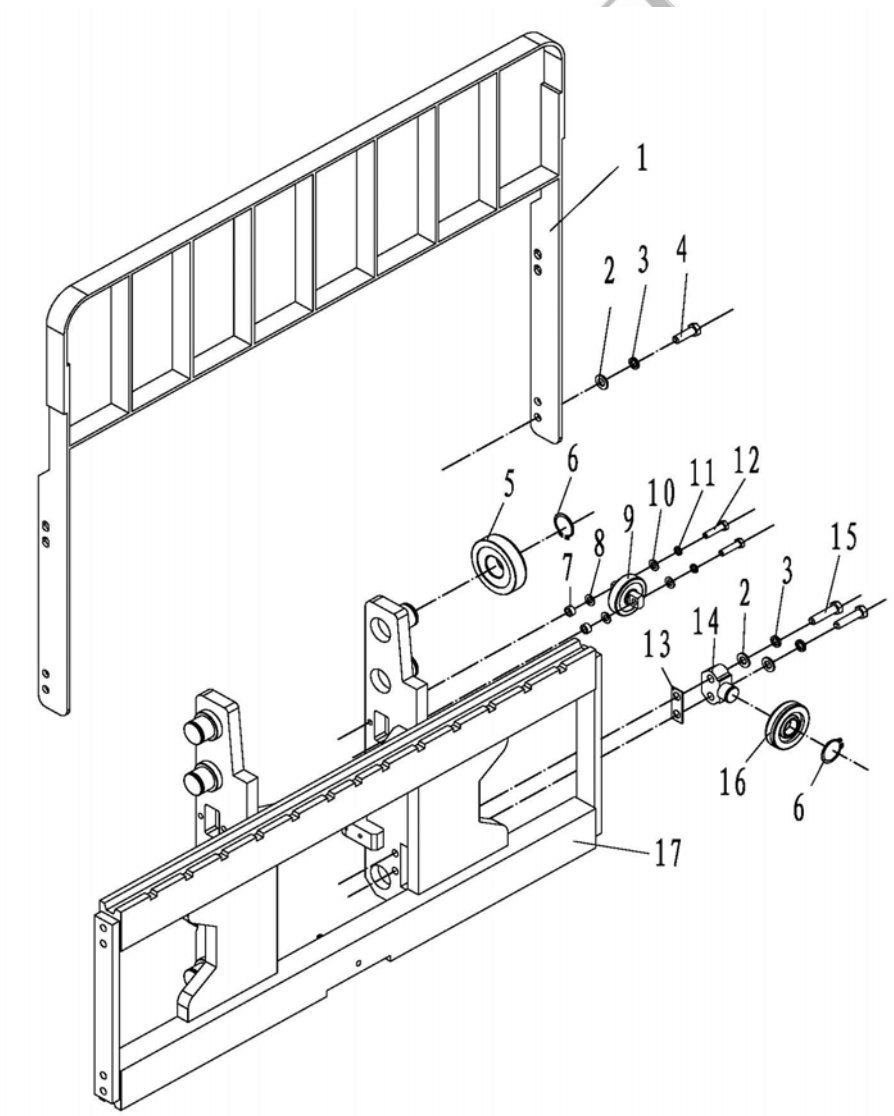


1.outer main frame	2. Adjustment pad Ⅰ	3.Adjustment pad Ⅱ	4.side roller	5.flat washer 12
6.Spring washer 12	7.Bolt M12X40	8.bearing	9.connect base	10.flat washer 20
11.Spring washer 20	12.Bolt M20X80	13.Retaining ring	14.Roller	15. Bolt M12X50
16. side roller	17.Adjustment pad Ⅲ	18. inner main frame	19.steering plate	20. Adjustment pad

Figure 2-33 Inner and outer main frame

7.3 Forklift frame (Figure 2-34)

Forklift frame will roll within the inner main frame through the main roller, which is mounted onto the main roller shaft and fixed by elastic rings. The main roller shaft is welded onto the fork frame and the side roller is integrated into the adjustable composite roller that rolls along the wing plate of the inner main frame. Use two fixed side rollers to roll along the outside of the wing plate in the inner main frame to eliminate rolling gap. The longitudinal load will be born by the main roller. When the fork rises to its highest level, the top roller will be exposed from the main frame top. Lateral load will be born by the side roller.

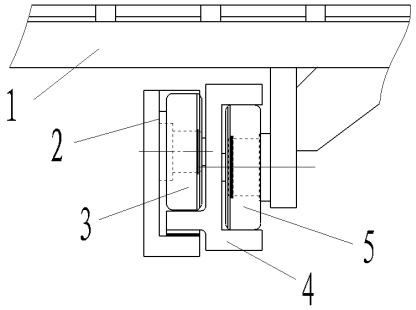


1. Back-rest	2. Flat washer 16	3. Spring washer 16	4. Bolt	5. Roller
6.retaining ring	7. Adjustment pad II	8. Adjustment pad III	9. Roller	10. Flat washer 12
11. Spring washer 12	12. Bolt	13. Adjustment pad	14. Roller axle	15. Bolt
16. Roller	17. Fork frame			

Figure 2-34 Fork frame

7.4 Roller position (Figure 2-35)

There are two types of rollers: outer frame composite roller, composite roller of inner frame and fork frame. The two rollers are installed in the outer door frame, inner door frame and fork rack. Composite roller consists of the main roller () and the side roller, with the former bearing loads from the front and rear sides and the latter bearing loads from the side to achieve free movement of the inner door frame and fork frame.



1. Fork frame 2. Outter main frame 3. Composite roller of outer frame 4. Inner main frame 5. Inner frame and composite roller of fork frame

Figure 2-35 Roller position

Note: (a) adjust the clearance of side rollers at 0.5mm;

(b) Apply lubricant oil onto the main roller surface and the contact surface of main frame.

7.5 Maintenance and adjustment

7.5.1 Regulating the lifting cylinder. See Figure 2-36

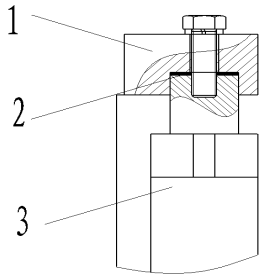
After disassembling or replacing the lifting cylinder, inner main frame or outer main frame, re-adjust the lifting cylinder stroke. Adjustment method is as follows:

(1) Mount the piston rod without adjusting pad onto the beams of inner main frame.

(2) Slowly lift the main frame to its maximum extent of stretching and check the synchronization of two cylinders.

(3) Add the adjustment pad between the piston rod head of the cylinder and the beam on the inner main frame. Thickness of the pad is 0.2mm or 0.5mm.

(4) Adjust the tightness of the chain.



1. Upper beam on the inner main frame 2. Adjustment pad of lifting cylinder 3. Lifting cylinder

Figure 2-36 Regulation of the lifting cylinder

7.5.2 Height adjustment of the fork frame (Figure 2-37)

（1) Park the forklift on level ground and set the main frame vertical.

(2） Lower the fork bottom to make it reach the ground. Then adjust the adjusting nuts on the upper end joint of the chains, so that there will be a certain distance A between main roller and the lower end of the inner main frameA(A=24～29)。

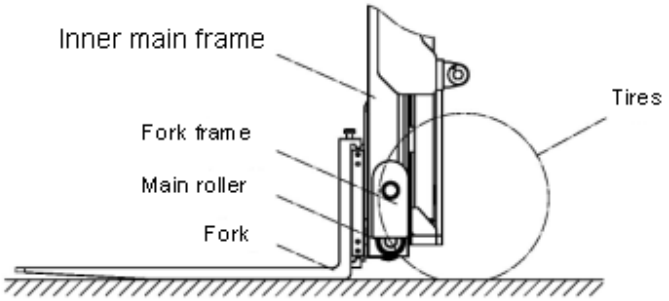


Figure 2-37

（3） Lower the fork to the ground and tilts it backward in place. Adjust the upper end joints of the chain and then regulate the nut to set tightness of the two chains at the same degree.

7.5.3 Change or replace the roller of the fork frame

(1) Place a tray on the forklift and park it on level ground.

(2) Lower the fork and tray down to the ground.

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

（4） Lift the inner main frame (① in Figure 2-38）

（5） Reverse the forklift after confirming that the fork frame has been separated from the outer main frame (② in Figure 2-38).

（6） Replace the main roller

（a） Remove all of spring rings and remove the main roller with drawing tools. Pay attention to the adjustment pad.

（b） Confirm that the new roller is the same with the newly replaced one. Mount the new rollers to the fork frame and fix it with an flexible washer.

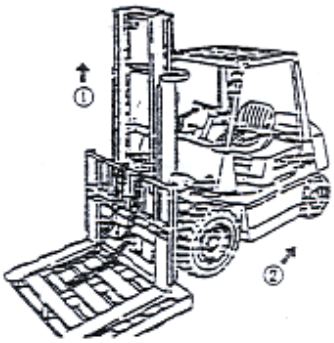


Figure 2-38

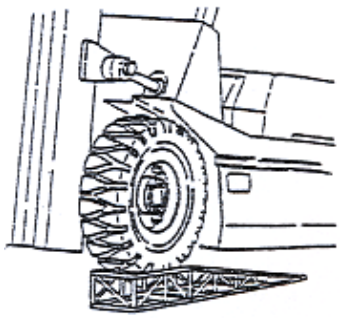


Figure 2-39

7.5.4 Replace the roller of main frame as shown in Figure 2-39

（1） Accoding to the method of replacing fork frame roller as described in 7.5.3, remove the fork frame from the main frame. 7.5.3

(2) Drive the forklift to a level ground and jack up the front wheels for 250-300mm.

(3) Apply the hand brake and put pads under the rear wheels.

(4) Remove the lifting cylinder and the mounting bolts of inner main frame. Lift the inner main frame and be careful not to loose the adjustment pad at head of the piston rod.

(5) Remove the connecting bolts on the lifting cylinder and at the bottom of the outer main frame, and then remove the lifting cylinder and the tubing between the two cylinders without loosening the pipe joints.

(6) Lower the inner main frame and remove the main roller at the bottom of the inner main frame. The main roller at the upper end of the outer main frame will be exposed out of the inner main frame top.

(7) Replace the main roller.

(a) Remove the main roller at the upper end with drawing tools and keep the adjustment pads appropriately.

(b) Install the new roller and the adjustment pads removed at the (a) step.

(8) Lift the inner main frame until all the rollers enter the main frame.

(9) Mount the lifting cylinder and the fork frame in reverse procedures of removing.

7.6 Installation instruction of accessories

⚠ **If you need to install accessories, please contact our sales department and never install by yourselves.**

8 Removal and installation

8.1 Precautions

(1) Only qualified operator can remove or repair the forklift's parts.

2) Before disassembling and detection operations, park the forklift on a flat ground and wedge the wheels, otherwise accidental movement of the forklift may occur. Meanwhile, set the main switch at the off position and disconnect the accumulator plug.

(3) Before disassembling and testing operations, remove all the rings, watches and other metal objects on your body to avoid accidental short circuit.

(4) Please use the right tools for the disassembling process, and use the specified tools if required.

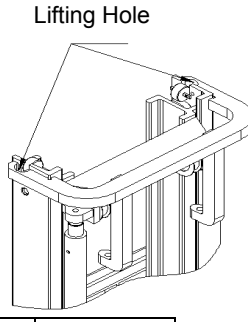
(5) Please choose an appropriate spreader according to the size and weight of the removed parts, so as to avoid danger.

(6) Be sure to mount sling steadily before lifting to prevent falling of the cargo. Please keep the sling tightened during the lifting process.

(7) When removing a heavy part from the forklift, be careful to keep balance and to avoid damage.

8.2 Lifting points of the detached parts

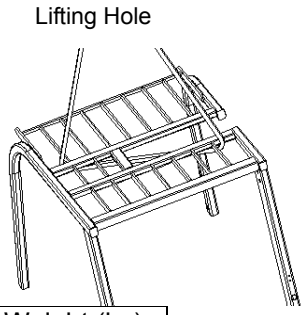
(1) Lifting description of the lifting system as shown in Figure 2-40



Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D40	1607×1430×2260	1262
FE4D45		
FE4D50		

Figure 2-40

(2) Lifting description of the overhead guard as shown in Figure 2-41



Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D40	1650×1304×1513	94
FE4D45		
FE4D50		

Figure 2-41

The lifting ring on the counterbalance can be used to lift the balance weight only. Do not use it for lifting the whole forklift.

(3) Lifting description of the counterbalance as shown in Figure 2-42

Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D45-50	1378×652×1020	1950
FE4D40	1378×652×1020	1750

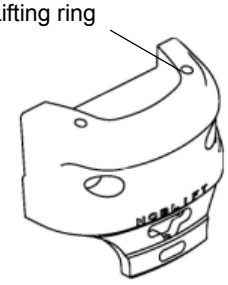


Figure 2-42

(4) Lifting description of the accumulator as shown in Figure 2-43

Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D45-50	1216×818×745	1855

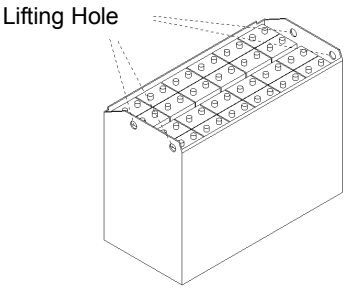


Figure 2-43

The accumulator also functions as a counterbalance, so users shall not arbitrarily change it; otherwise the overall balance and other features may be affected。

(5) Lifting description of the travel motor as shown in Figure 2-44

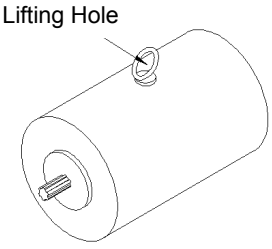


Figure 2-44

Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D40	330×250×φ300	32
FE4D45		
FE4D50		

(6) Lifting description of the working motor as shown in Figure 2-45 .

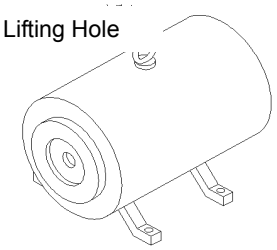


Figure 2-45

Model	Overall Dimension L×W×H (mm)	Weight (kg)
FE4D45-50	330×250× φ300	32

Chapter 3 0peration, use and safety of the forklift

Ⅰ. Driving and operation

In order to ensure good performance, safety operation and economic use of the forklift, we specify the precautions below that should be noted during proper driving operation.

1. The use of a new forklift

⚠ **•All the package materials removed from a new forklift shall be recycled according to local regulations.**

• Test run should be carried out before using a new forklift to see if the forklift parts can work properly (see Ⅰ. Check before operation on page 75).

The service life of your forklift depends on your initial operation. When using it in the first 200 hours, please pay great attention to the following issues:

⚠ **• Heat engine operation shall be conducted before use no matter what season it is.**

• Conduct maintenance in a timely and through manner.

• Never operate it violently or rudely。

2. The relationship between forklift stability and load

In the load curve, the front wheel centre of the forklift is taken as the fulcrum to keep the forklift body and load on the fork balanced. Pay attention to load quantity and load centre when driving to maintain stability of the forklift.

⃠ **·In case the load exceeds the load curve, rear wheels may be lifted and subject to extreme cases, and the forklift may rolling over, causing serious accidents. If goods are stacked at a place close to the sharp tip of fork, the risks above also exist. In this case, decrease the load weight.**

3. Load centre and load curve

Load centre refers to the distance between the front surface of the fork and the cargo's centre of gravity. Load curve label indicating the relationship between the load centre and the allowed loading quantity (allowable load) is attached to the forklift. Replace the plate in case of damage or loss.

⃠ **·If the forklift is equipped with accessories for cargo handling, such as the side shifter, bucket, or rotating fork, the allowable load shall be less than standard forklift (without accessories) for the following reasons:**

1) Reduce loads equal to the weight of the accessories.

2) Since adding of accessory will move the load centre forward, the allowable load will be reduced accordingly.

The installation of accessory will cause load centre shift forward, which is known as

the "loss of load centre."

Do not exceed the allowable load indicated by the load curve attached to the forklift or the accessory.

4. Forklift stability

4. Standard of forklift stability is specified in IS0 or other standards. However, the stability described in these standards does not apply to all the running status and the stability of forklift varies with different operational status.

The maximum stability can be ensured under the following operating status:

1) The ground is flat and solid.

2) Operate under standard no-load or load.

Standard no-load status: fork or carrying accessories are 30cm away from the ground and the main frame can tilt backwards to the specified position without load.

Standard load status: fork or carrying accessories are 30cm away from the ground, allowable load capacity is carried at the standard load centre and the main frame can tilt backwards to the specified position.

·When loading and unloading goods, try to minimize the tilting degree when tilting forwards and backwards. Never tilt forwards unless the load is close to or fixed by steel shelves or the lifting height is low.

5. Transportation and handling of the forklift

(1) Forklift transportation

• When transporting with a truck, stabilize the wheels and fix the forklift with ropes so that the forklift won't slide within the truck.

• During handling and road transportation, the full length, full width and full height of the forklift shall be in compliance with relevant laws and regulations.

(2) Loading and unloading of the forklift

• Use a slab with sufficient length, width and intensity.

• Pull the parking brake in an effective and efficient way to stop the wheels.

• The slab shall be stably fixed to the truck centre and there shall be no oil and grease on the slab.

• The height at the left and right side of the slab shall be the same so that the forklift can move smoothly during loading and unloading process.

• To avoid dangers, please do not change direction or move laterally when driving on a slab.

• Slowly reverse the forklift to achieve simultaneous boarding of the left and right tires when loading the forklift onto a truck.

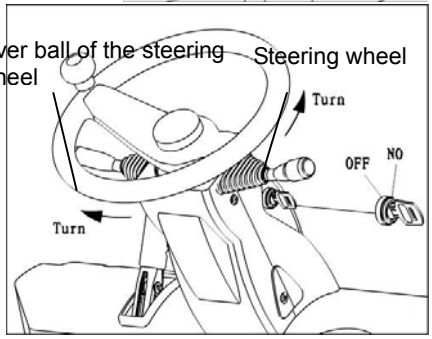
6. Preparation before driving

(1) Check the position of the direction switch lever ⑤

Place the switch lever in the middle position (N).

(2) Turn on the key switch

Seize lever ball of the steering wheel, and then turn the key switch t



• Even if the key switch is turned to the "0N" position, it will take about 1 second for the brake circuit to start off after it starts action.

• If the gear lever is placed at forward "F" or reverse

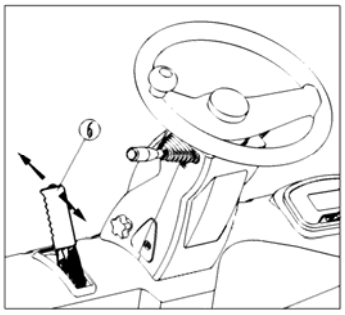
"R" position before turning the key switch to the "0N" position, please shift the lever to the middle position "N".

• If the accelerator pedal is rapidly depressed, it is likely that the forklift will accelerate suddely, be sure to pay attention.

(3) Tilting backward of main frame

Pull back the lever to lift the fork to 150 - 200mm away from the ground and pull back the lever to tilt the main frame backward.

(4) Operation of the direction switch lever ⑤



Use the direction switch lever to decide the driving direction (forward - backward).

Forward F: push the direction switch lever forward.

Backward F: push the direction switch lever backward.

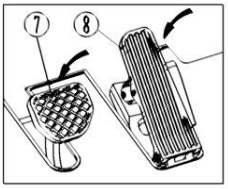
(5) Release the parking brake lever;

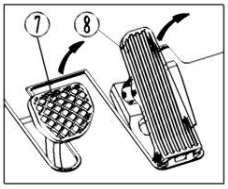
Depress the brake pedal.

Fully release the parking brake lever forward, seize the steering wheel with your left hand and place your right hand gently on the steering wheel.

7. Driving

(1) Starting





Release the brake pedal and gradually depress the accelerator pedal, and the forklift will start moving.

Change in acceleration depends on how much the accelerator pedal has been depressed.

⚠ **·Do not suddenly start or stop, otherwise the goods loaded may fall down.**

(2) Deceleration

Slowly release the foot pedal. Depress the brake pedal if necessary. If it is not for an emergency brake, slowly release the accelerator pedal to decelerate until the forklift stops. But even if the accelerator pedal is released rapidly, emergency brake won't be activated. Under emergency situations, please press the brake pedal to perform emergency braking.

⚠ **• Slow down in the following cases:**

a) When turning at a crossing;

b) When moving close to the goods or tray;

c) When moving close to the goods;

d) When staying in a narrow channel;

e) When the ground / road condition is bad.

• During reversing operation, you must watch the rear side directly and ensure safety through visual confirmation. Relying only on the rear view mirror may cause dangerous.

(3) Turning

Unlike common cars, forklift adopts rear-wheel steering. So operators shall slow down and watch the rear side when turning.

⚠ **• In the case of steering, the faster the forklift moves, the smaller turning radius will be, and more easily the forklift will overturn. Please be quite careful.**

(4) Simultaneous operation of driving and lifting (micro-operation)

a) First drive the forklift until the front end of fork is 3-5m away from the goods.

b) Fully depress the brake pedal. (Travel stop)

c) Depress the accelerator pedal to obtain the right operation speed.

d) Operate the lifting lever to start lifting operation.

⚠ **·Simultaneous operation of driving and lifting (micro-operation) require high level of skills. The operator must correctly understand the form, gravity centre and other features of the goods and ensure stability of the forklift before carrying out low-speed lifting and lowering operations. Be extremely careful when conducting simultaneous operation.**

·Tilting operation involves high risk. Never conduct other operations than extending or retracting of the fork on a cargo platform.

• To eliminate the danger of lifting during driving, conduct lifting only when the forklift is close to the cargo platform.

8. Parking and temporary parking

⚠ **·Park safely**

• The parking place should be spacious and the ground shall be flat.

• If you have to park the forklift without load on a ramp, the main frame side shall be placed down-hilling and fix the wheels to avoid sliding.

• Please park the forklift in a safe place other than the operation site or designated parking places.

• When necessary pay attention to the sign and signal lights.

• Park on solid ground and try to avoid sliding and falling.

• If the fork can be lowered due to failures of the forklift, rap a cloth around the fork tip and adjust it to face the direction where no people and vehicles will pass.

• Pay great attention to road conditions to see if it is slippery or have any collapse.

• Lower the fork after the forklift completely stops. Reducing the fork of the forklift during driving could be quite dangerous.

• Do not jump from the forklift.

• When getting off, you shall face the direction of the forklift and step on the pedal for de-boarding.

• For deceleration, depresses the brake pedal to stop the forklift, and set the gear lever switch to neutral position "N".

• Park the forklift in a place that would not hinder operation of other vehicles according to the following procedures.

a) Pull the parking brake lever to the specified place to activate the parking brake.

b) Lower the fork until it reach the ground.

c) Turn the key switch to the "0FF" position.

d) Remove the key and keep it safe.

e) Be careful when boarding and de-boarding.

f) Park the forklift

☞ **·When leaving the forklift, fully pull the parking brake lever to slightly tilt forward the main frame. Lower your fork to the ground. When parking the forklift on a ramp, place pads**

under the wheels.

• Remove the keys when leaving the forklift.

9. Use of the accumulator

(1) Charging of the accumulator

Choose appropriate charger for charging of the accumulator and operate in strict accordance with the "Maintenance Manual" of the charger.

a) Don't maintain the electrolyte at a too low level.

⚠ **• Maintain the electrolyte at the required level, otherwise the accumulator may be overheated or burned.**

• When the electrolyte level is low, the accumulator life will be shortened.

b) Add distilled water

c) Overcharge is not allowed

d) Charging should be carried out in a well ventilated place

⚠ **• Charging should be carried out in a well ventilated and moisture proof place.**

b) Open the accumulator cover.

⚠ **• Hydrogen will be generated during the charging process. Open the accumulator cover during charging.**

f) Check the connecting terminal, cables and connectors.

⚠ **• Users should check the connectors and cable lines for damage before charging.**

·Never conduct charging in case of the following conditions:

- The connector electrode is damaged.

- Connection terminals and cable lines are corroded.

These conditions can result in sparks, burning, fire or explosion。

g) Conduct charging after the key switch is turned off

h) Check the specific gravity

Measure the specific gravity of electrolyte in all the single-cell accumulator before charging to identify abnormality of the accumulator. Understanding the specific gravity before charging could help eliminate the possibility of accidents.

i) When connecting and disconnecting the power connector, hold the plug or handle instead of holding the cable.

⚠ **• Do not pull out the cable.**

• If the cable and power connectors are damaged, please contact our sales department and replace the damaged cables and power connectors.

j) Disconnecting the charging

⚠ **·Disconnect the charging in strict accordance with steps required by the "Maintenance Manual" of the charger.**

• Do not pull out the charger plug during charging, or else danger may be caused by sparks.

(2) Replace the accumulator

If the accumulator on the forklift completely runs out of power, another fully charged accumulator should be timely used to replace the original one. Then recharge the original accumulator.

⚠ **·Before replacing the accumulator, ensure the new accumulator match the forklift. If a accumulator doesn't match with the forklift used, working hours of the forklift will shorten or may cause rolling of the forklift.**

·Replacement of the accumulator should be carried out on a platform 。

Follow these steps to replace the accumulator:

⚠ **• When using another forklift to lift the accumulator to be replaced, appropriate spreader (accessory) should be used.**

• Only experienced operators could lift the accumulator.

a) Disconnect the accumulator plug.

b) Open the accumulator top cover.

Take advantage of gas spring or other means to ensure that the accumulator top cover is locked, because its faliing may cause physical injury or damage to the forklift.

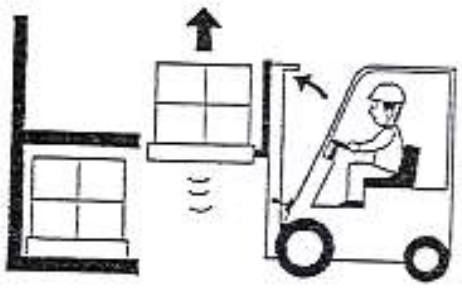
c) When lifting the accumulator out of the forklift, be careful not to damage the steering wheel or other forklift parts.

d) After a group of fully charged accumulator is well placed, securely connect the accumulator plug.

e) Cap the accumulator cover.

⚠ **·When fitting on the accumulator cover, be careful not to hurt your fingers.**

• Be careful to keep it stable when lifting the accumulator, so as not to cause collision damage to the forklift body.



10. Stacking

⚠ **• Check the following items prior to operation of forklift:**

a) Ensure the goods in the loading area will not fall and be damaged.

b) Ensure that no obstruction for the goods or cargo in the way .

Conduct stacking according to the following procedures:

(1) Slow down when driving close to the stacking area.

(2) Park before the stacking area.

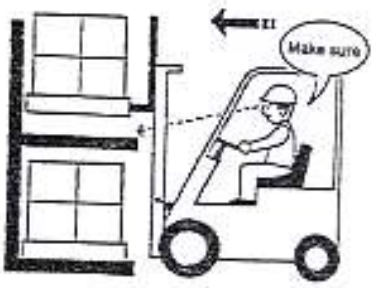
(3) Check the safety status around the stack area.

(4) Adjust the forklift position to place it in front of the stacking area.

(5) The main frame shall be perpendicular to the ground and the lifting fork shall be higher than the stacking height.

(6) Check the stacking position and driving forward to park in the right place.

(7) Ensure that the goods is right above the stacking position, and slowly lower the fork to put the goods in place.



☞ **·When the goods are not fully placed on the shelf or bracket：**

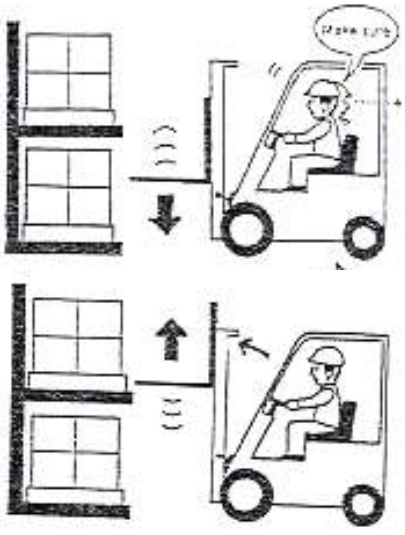
a) Lower the fork until it no longer carry any weight.

b) Reverse the forklift for 1 / 4 of the fork length.

c) Lift the fork for 50-100mm, move the forklift forward and stack the goods in the right position.

(8) Observe the rear space of the forklift and reverse the forklift to avoid collision of the fork with the pallet or cargo.

(9) After confirming that the front end of fork left the goods or the pallet, lower the fork to facilitate moving. (l50-200mm away from the ground)



11. Un-stacking

Conduct un-stacking according to the following procedures:

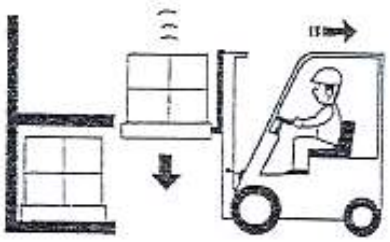
(1) Slow down when close to the goods to be handled.

(2) Park in front of the goods (distance between the goods and fork tip is 30cm).
(3) Adjust forklift position in front of the goods.
(4) Ensure to avoid overloading.
(5) The main frame shall be perpendicular to the ground.
(6) Observe the fork position and move forward the forklift until the fork is fully inserted into the pallet.

☞ **·When the fork can't be fully inserted into the pallet:**

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

b) Fully insert the fork into the pallet.



(7) After inserting the fork into the pallet, lift the pallet (for 50-100mm)
(8) Observe the space around and drive the forklift backwards until the goods have been lowered.
(9) Reduce the goods to 150-200mm away from the ground.
(10) Tilt the main frame backward to ensure stability of the goods.
(11) Handle the goods to the destination

12. Storage
(1) Before storage
Prior to storage, thoroughly clean the forklift and conduct inspection according to the following procedure:
a) If needed, clean oil and grease attached to the forklift body with a cloth and water.
b) When cleaning the forklift body, check the overall condition of the forklift. In particular, check if there are dents or damage on the forklift body and if the tires are worn out or embedded with nails or stones.

c) Check for oil leakage.
d) Add lubrication grease if necessary.
e) Check if the wheel hub nuts and joints of the cylinder piston rod is loose, and if the rod surface have bumps or pull marks.
f) Check if rollers of the main frame could rotate smoothly.
g) Raise the lifting cylinder to the highest level to make the cylinder full of oil.

⃠ **·If you found that the forklift is in need of repair, or it fails or is unsafe, report to the management staff and stop using it until it returns to safe state.**

(2)Daily storage
a) Park the forklift in designated areas and use wedge pads to fix the wheels.
b) Place the shift lever in neutral position and pull the parking brake lever.
c) Remove the key and keep in a safe place.
(3) Long-term storage
Conduct the following maintenance and inspection based on "daily storage" maintenance:
a) Park the forklift on a high and solid ground to protect it from flood in rain seasons.
b) Remove the accumulator from the forklift. In humid environment, store the accumulator in a dry and cool place and charge it monthly even if the forklift is parked indoor.
c) Apply rust-proof oil on exposed parts such as cylinder piston rod and shafts that may get rusty.
d) Cover parts from moisure
e) Start the forklift at least once a week. Mount the accumulator, remove the oil and grease

on the piston rod and the axis, start the engine and fully warm up, slowly drive the forklift forwards and backwards, and manipulate hydraulic controller for several times.

f) Don't park the forklift on soft ground such as those paved with asphalt in summer.

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

a) Remove the moisture-proof covering.

b) Remove anti-rust oil on the exposed parts.

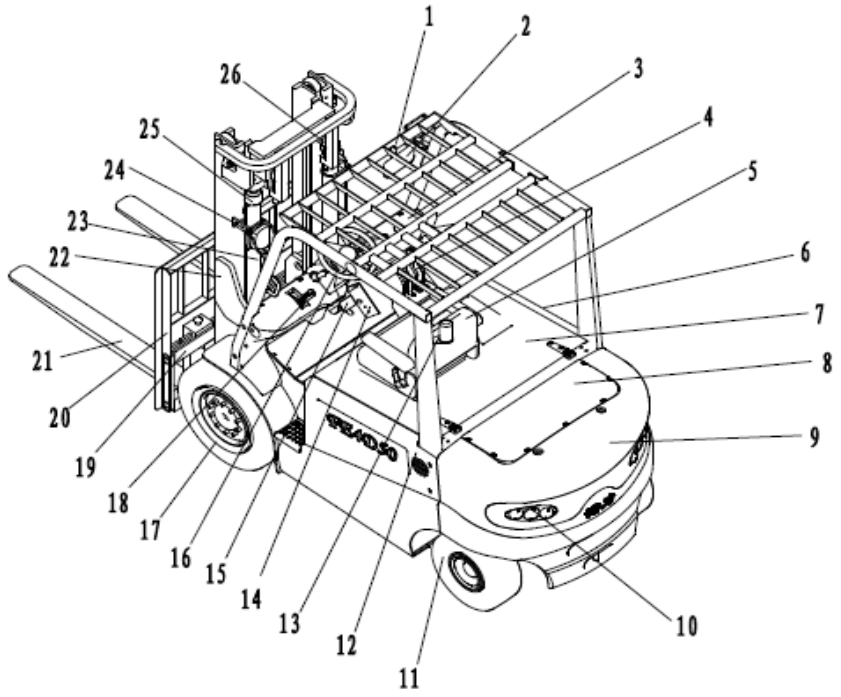
c) Remove foreign bodies and water in the hydraulic tank.

d) Mount the charged accumulator onto the forklift and connect the accumulator plugs.

e) Conduct pre-start check carefully .

Ⅱ. Operation device and use method

1. Diagram on forklift parts and operation device (see below)



1. Overhead guard	2. Rear view	3. instrument	4. Multiple unit valve lever	5. Seat
6. Right guard plate	7. Accumulator case cover	8. Controller cover plate	9. Counterweight	10. Rear grouped lamps
11. Rear tires	12. Left guard plate	13. Warning lamp	14. Accelerator pedal	15. Foot brake pedal
16. Steering wheel	17. Front tires	18. Hand brake	19. Fork frame	20. Back-rest
21. Fork	22. Main frame	23. Front grouped lamps	24. Front headlight	25. Lifting cylinder
26. Chain assembly				

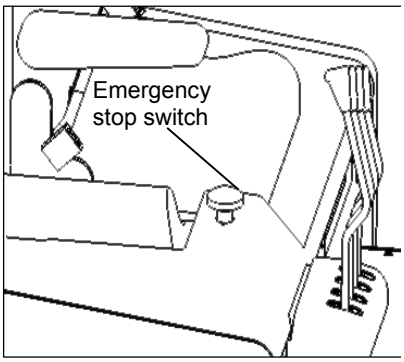
2. Combination instrument

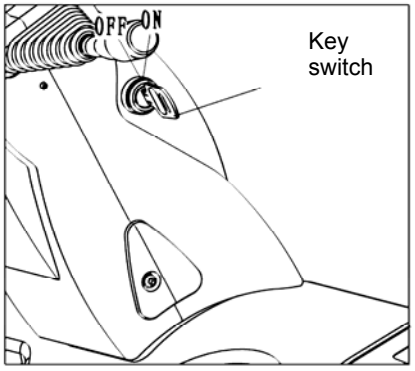
See4.3 Combination instrument (Page 22),

3. Switch parts

(1) Emergency stop switch

In the event of an emergency, press the red mushroom-shaped button to cut off power of the forklift, disabling the walking, turning and lifting operation of the forklift. Rotate the button as indicated by the arrow above the button to restore operation.





(2) Key switch

Key switch can be turned on or off for power control

0FF : The switch is off at this position and keys can be inserted and pulled out.

0N: The switch can be connected and the forklift will start if you rotate forward from the OFF position.

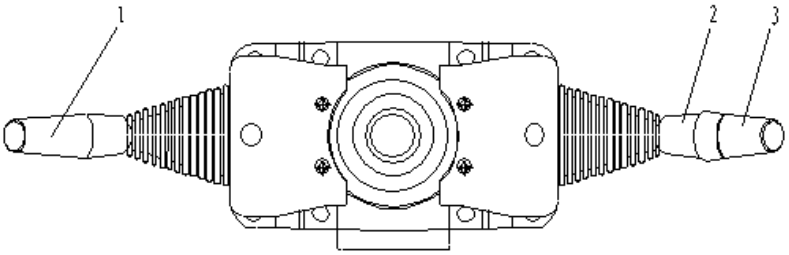
⚠ **• Do not step on the accelerator pedal when turning on the key switch.**

• When you leave the forklift, take out the keys to protect it from being misused.

• After parking the forklift or when recharging, take out the keys to protect it from being misused.

(3) Combination switch

Combination switch is combined by the direction switch, steering lamp switch as well as the switchs of small and big lamps.



1-Direction switch 2 – Steering lamp switch 3 - Switch of small and big lamps

Direction switch controls the direction the forklift and would convey the signal to the instrument for display. Push the lever to move forwards and pull back it to move backwards. The middle position is the neutral position. When the lever is pulled back for reverse purpose, the reversing lamp and warning lamp will light up and the reversing buzzer sounds.

Steering lamp switch will specify the turning direction. When the switch lever is turned to the steering position, the turning lamp flashes.

Push forward	The left steering lamp blinks
Middle	Neutral position
Pull backwards	The right steering lamp blinks

The switch of small and big lamp controls the lighting and extinguishing of the lamps. The switch has two gears: the small lamp lights up when rotating to the first gear and the small and big lamps light up together when rotating to the second gear.

Gear / Lamp	OFF	First gear	Second gear
Width lamp	×	○	○
Tail lamp	×	○	○
Headlamp	×	×	○

○:lights ON ×:lights OFF

(4)Rear headlight switch

Rear lamp switch is a single gear switch that controls the lighting and extinguishing of the rear lamp. Pull the switch to light the lamp and push it to distinguish the lamp.

4. Control parts

(1) steering wheel ① and lever ball② of the steering wheel

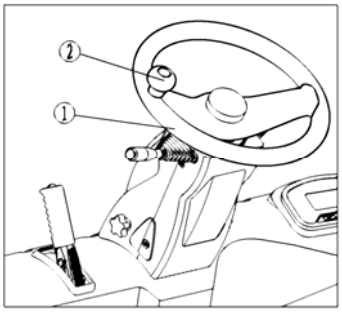
The steering wheel can be operated in usual way, namely, when rotating the steering wheel rightwards, the forklift will turn right; Vice versa. Steering wheel is mounted at the rear side of the forklift, enabling the forklift rear part to swing out during turning.

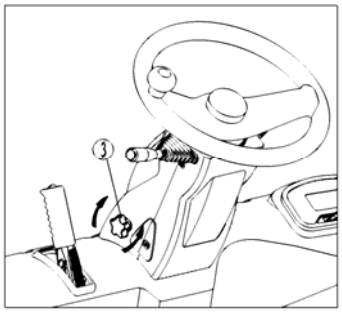
During turning, grasp the lever ball of steering wheel with your left hand while place the right hand on control lever of the multiple unit valve or steering wheel.

Hydraulic steering system and tilt device of the steering wheel are standard equipments on the forklift.

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

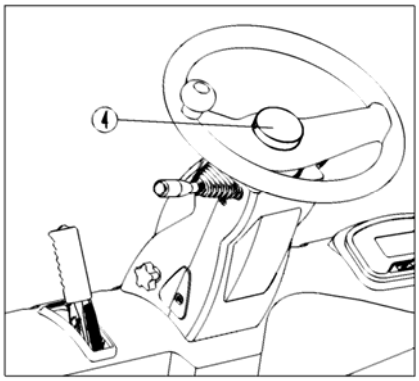
• After adjusting the tilt steering wheel, lock steering column with star-shaped lever③ .





(2) Horn button ④

Press the rubber cover in the centre of the steering wheel to make a buzzing sound. The horn can sound even when the key switch is closed.



(3) Direction switch lever ⑤

Indicating the direction of travel.

Moving forward (F): push forward the lever and depress the accelerator pedal.

Moving backward (B): pull back the lever and depress the accelerator pedal.

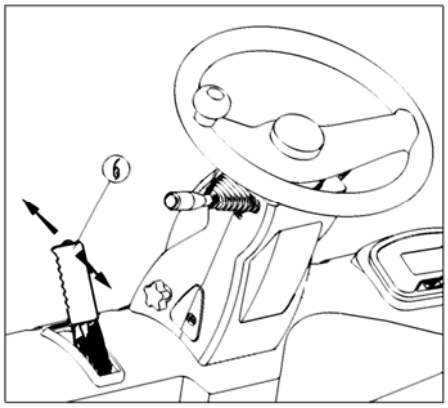
When parking the forklift, place the direction switch lever in the neutral position (N).

(4) Parking brake lever ⑥

To prevent moving of the forklift, fully pull back parking brake lever when parking the forklift.

Push forward the parking brake lever to its maximum level before driving.

⚠ **• When operating the parking brake lever, depress the brake pedal.**



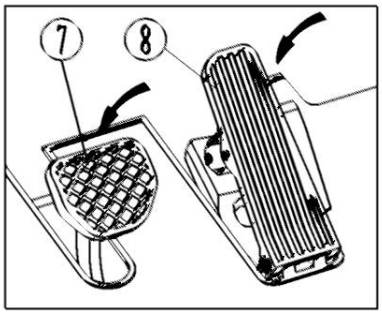
(5) brake pedal ⑦ and accelerator pedal ⑧

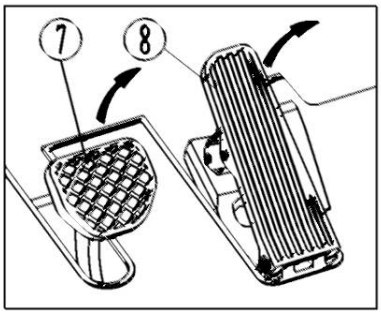
⚠ **• Do not slam on the accelerator pedal, otherwise the forklift will suddenly start or accelerate.**

•Before depressing brake pedal, make sure to remove the foot from the accelerator pedal.

From left to right, respectively, the brake pedal⑦ and accelerator pedal⑧.

Depresses the accelerator pedal slowly and the speed of forklift depends on how much the accelerating pedal has been depressed.



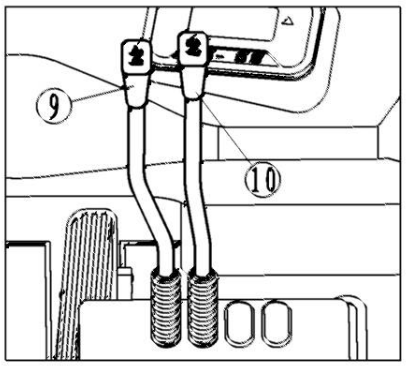


(6) Lifting lever ⑨

Pull back the fork lever to lift the fork and push forward the fork lever to lower the fork. Lifting and lowering speed can be controlled by the tilting angle of the lever . The greater the angle is, the greater the speed will be.

⚠ • If you push or pull the lever when turning on the key switch, the fork will not lift.

• Do not suddenly reduce the fork or suddenly stop lowering the fork.



(7) Tilt lever ⑩

The main frame will tilt backward when pulling the tilt lever backward and tilt forward when push the lever forward. Speed of titling forward and backward can be controlled by the tilting angle of the lever . The greater the angle is, the greater the speed will be.

⚠ • If you push or pull the lever when turning on the key switch, the fork will not tilt.

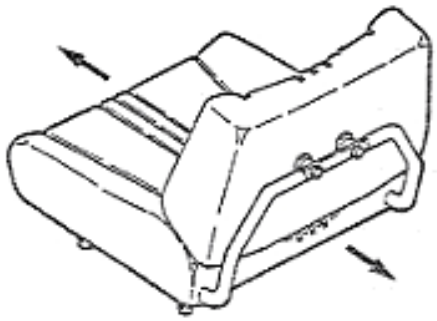
5. Forklift body

(1) Seat

By adjusting the lever , the operator can tune the seat position for greater comfort.

Pull the lever upwards to activate the adjustment function. After completing adjustment, try to move the seat back and forth gently to confirm if the seat has been locked.

Adjustment range of seat position is within 120mm. When driving on dry concrete ground, the seat will exert a vertical acceleration on the driver at the speed of 2.130m/s-2.237m/s and the integrated acceleration is 2.252m/s-2.356m/s.



(2) Overhead guard

·Overhead guard is a import component that prevent falling of objects overhead and protect the operator's safety. The size of a opening in overhead guard is more than 150mm. If the cargo size is less than 150×150mm, additional protective measures must be adopted to prevent accident falling of the cargo. Unsteady installation, removal or transformation before use are all dangerous actions that may lead to major accidents.

(3) Back-rest

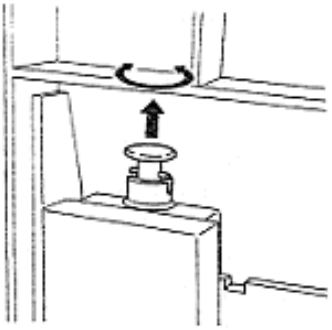
·Back-rest is an import security component that prevents falling down of cargo on the fork to the operator. Unsteady installation, removal or transformation before use are all dangerous actions.

(4) Traction Pin

Traction pin is only applicable to the following occasions:

• When the forklift can not move (such as tires sank into a side ditch, etc.);

• When the forklift is to be loaded or unloaded from a truck.



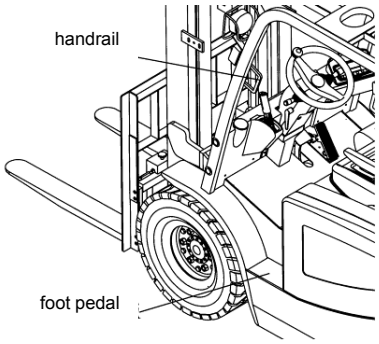
• Never use it for towing or towed operation.

(5) Locating pin of the fork

The locating pin can lock the fork in a certain position. To adjust the fork spacing, pull up the location pin and turn it for l/4 cycle. Then, adjust the fork to the required position. Fork spacing should be adjusted based on the goods to be loaded.

·Based on the principle that gravity center of goods shall be consistent that of the fork, operators shall adjust the spacing until the spacing to left side and to the right side are the same. After adjusting, fix the fork with the location pin to make it immovable.

·When adjusting the fork spacing, lean your body against the back-rest. Stand still and push the fork with your feet. Never adjust spacing by hands.



(6) Foot pedal and handrail

The foot pedal is located at left side of the forklift and the handrail is on the left front strut of the overhead guard. Use the pedal and handrail when on-boarding and de-boarding the forklift to ensure safety.

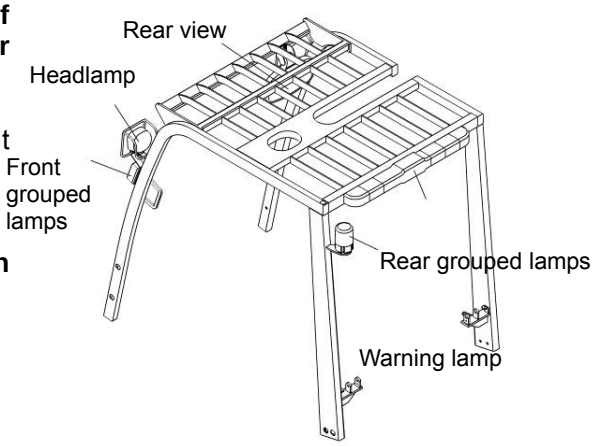
(7) Lighting

The front of the forklift is equipped with front headlights and front combination lights (steering lamp, parking light, width light). The rear of the forklift is equipped with combination lamps which include taillight, steer lamp, brake light, parking light, reverse light and flasher.

• Check the working conditions of lights, if the lamps are burned, damaged or dirty, replace or repaired immediately.

(8) Rear view

Rear view is installed at the right side of the front beam on the overhead guard.



• Keep rear view surface clean.

• The rear view can be adjusted to a position allowing complete rear view.

(9) Accumulator plug

Accumulator plug is used to connect or disconnect the accumulator and forklift's electrical components. Generally connection operation is more common。

⚠ **• If you have to touch the internal electrical components, disconnect the accumulator plug first to prevent danger.**

• Voltage still exist in the main circuit even if the key switch at the "0FF" position. If you want to cut off the main power, please pull the plug.

• If the accumulator plug is disconnected during driving process, steering will be disabled. So never unplug the accumulator unless circumstance requires.

Ⅲ. About safety

Ensure safety is your business and responsibility. This section describes the basic safety regulations and warnings during use of the forklift, but also applicable to forklifts with special specifications and with the main frame and accessories.

1. Site and working environment of the forklift

(1) Ground conditions

The forklift should used on solid ground in well-ventilated environment.

Forklift performance depends on the road condition. Running speed should be adjusted to an appropriate level. Be especially careful when driving on ramps or rough roads. When driving on ramps or rough roads, the forklift will speed up, increasing tire wear and the noise.

(2) Working environment

Ambient temperature for use of the forklift should be within -20 °C ~ 40 °C and the ambient humidity shall be less than 80%.

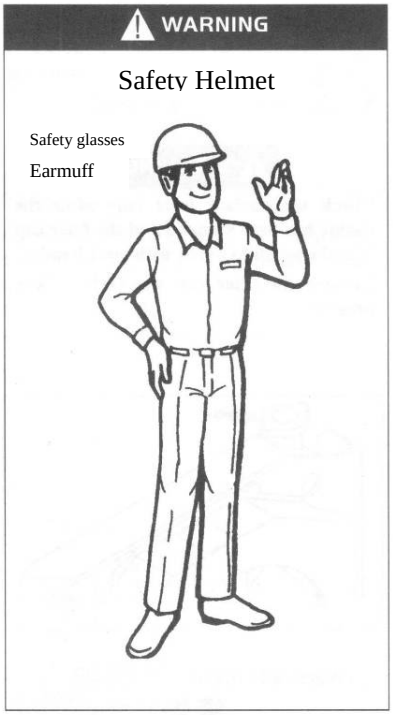
(3) Weather conditions

In days of fog, rain, snow and strong winds, pre-assess the safety of using the forklift. It's better not to use it for outdoor operations. If it is must be done, be extremely cautious during driving and operation.

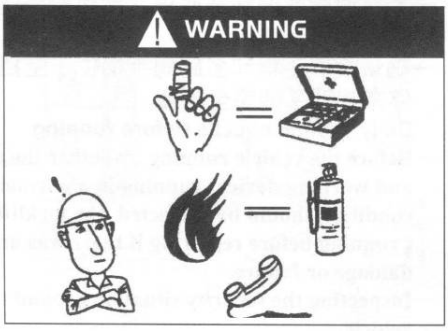
2. Safety rules

Only trained personnel who owns a driving license of forklift could operate it!

Driving on highways are prohibited!



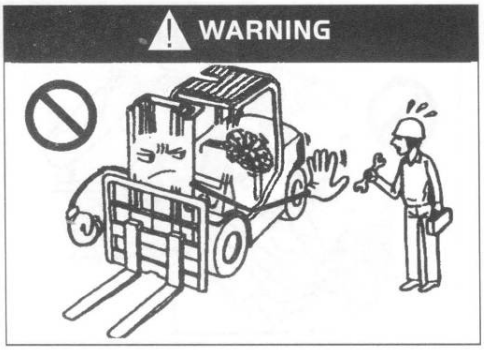
Drivers shall wear working clothes before driving!



Alert: seek medical aid in case of injuries!

Don’t change forklift parts without permission!

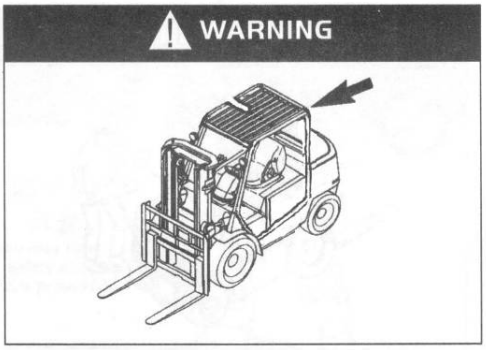
Please read the instructions before operating the forklift!



Turn off the engine before maintenance!

Understand the traffic rules!

Check the forklift before use!



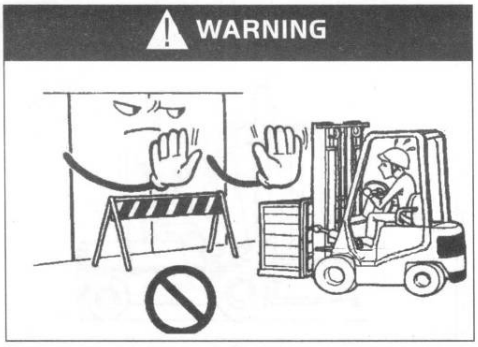
Do not move the overhead guard!

keep the cab clean!

Do not drive an unsafe forklift!

The driver should be healthy!

Make sure that your forklift is safe!



Work within the permitted scope!

Do not drive damaged forklift!

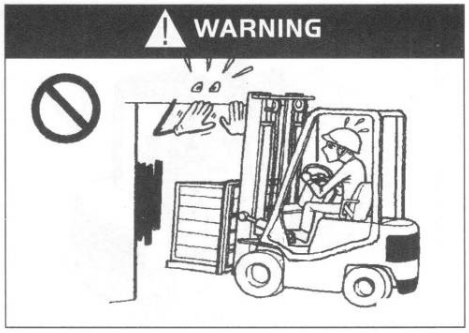
Hold the handrail during on-boarding

Start the forklift in a correct way!

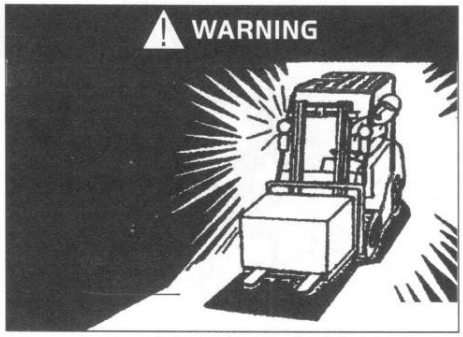
Adjust the seat before driving!

Make sure that your forklift is under safe working condition

Appropriately fasten the seat belt!



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

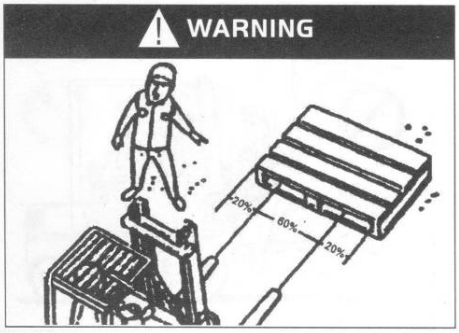


Turn on the lights in dark areas!

Do not expose your arm and body outside the overhead guard!

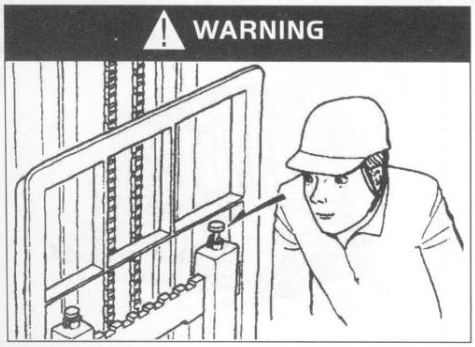
Avoid driving on soft or unprepared ground. Keep the body under the overhead guard!

Drive on flat and solid surface!

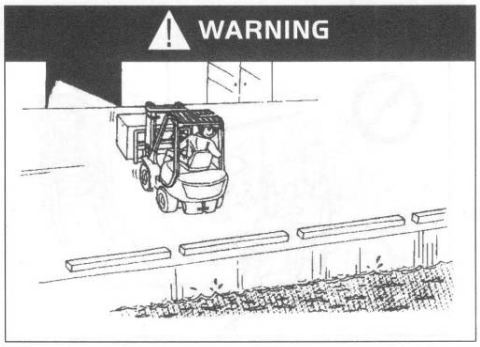


Avoid eccentric loading!

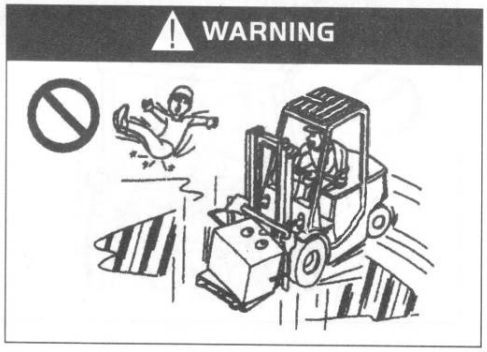
Pay attention to keep the projecting fork clear from goods ahead!



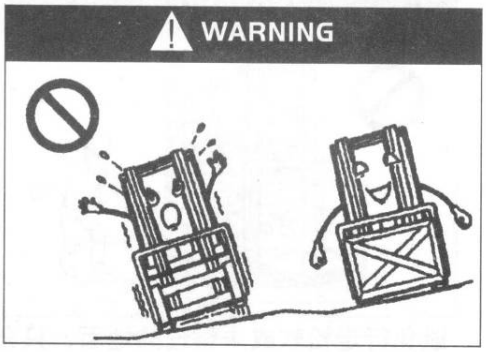
Check the position of the location pin!



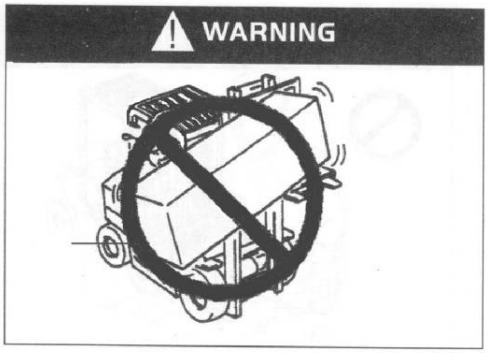
Check the safety of working areas!



Don’t drive on smooth or slippery ground!



Ensure the lateral driving stability when the forklift is running without load!

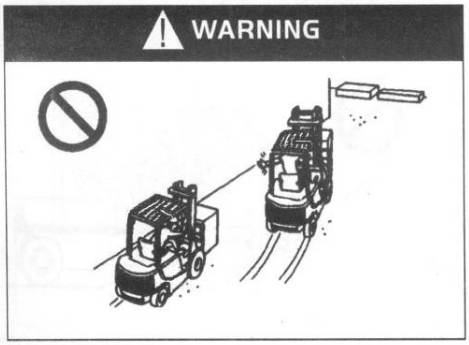


Be especially careful when handling goods with relatively large length or width!

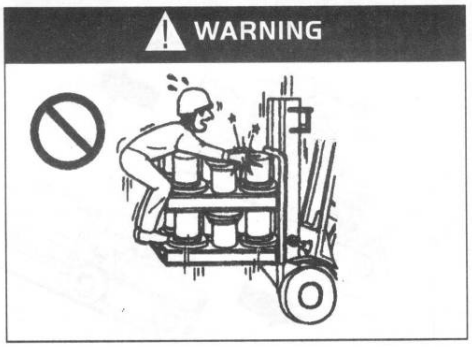
Carrying passengers is absolutely prohibited!

During turning, please slow down and blow horns if you can't see the roads clearly!

Use the appropriate pallets or sleeper when handling small objects!

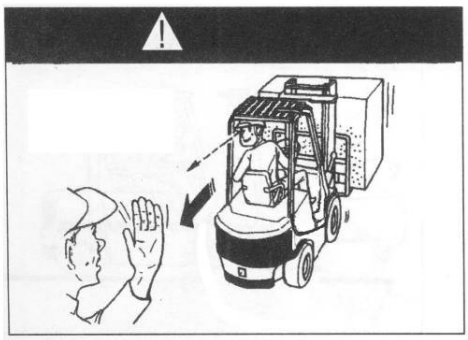


Do not chase each other driving across the road!



No one shall stand on the goods!

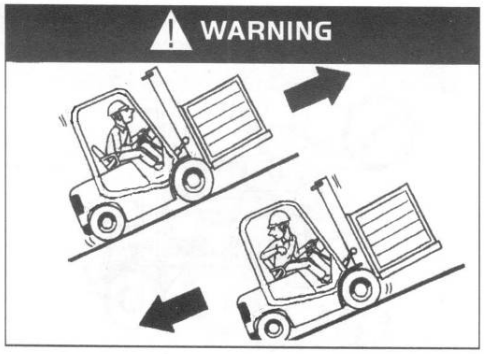
Looking around is not allowed while driving!



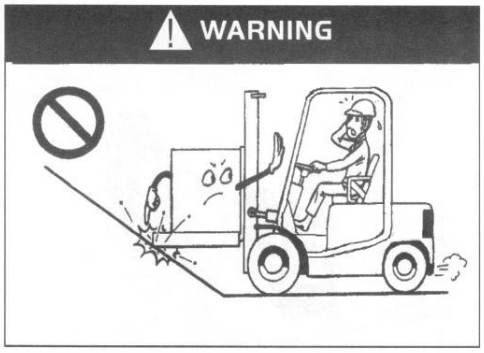
Do not do stunt with the forklift!

If the loaded cargo is too high and blocks your eyesight, drive reversely.
or under the guidance of other people!

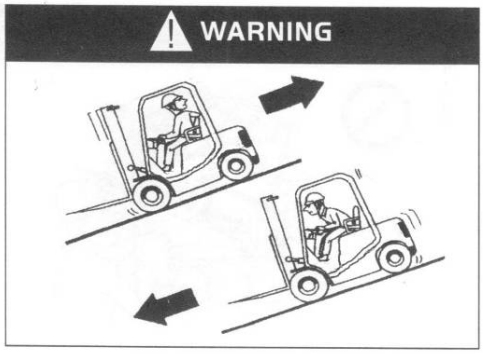
Obey the traffic rules and all warnings and signs!



When carrying load, move uphill facing the ramp and move down-hilling by driving in reverse!



During up-hilling process, pay attention to steep ramp and the lifting height of the goods!



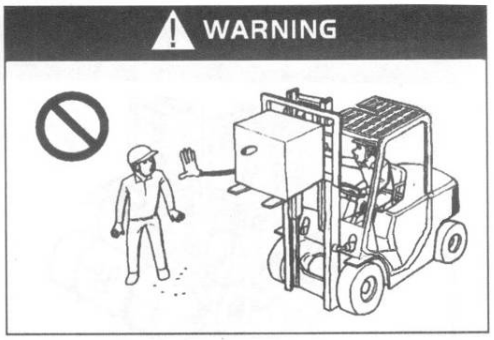
When carrying no load, move uphill by driving in reverse the ramp and move downhill facing the ramp!

Perform braking when starting on the ramp!

Turning on the slope is not allowed!

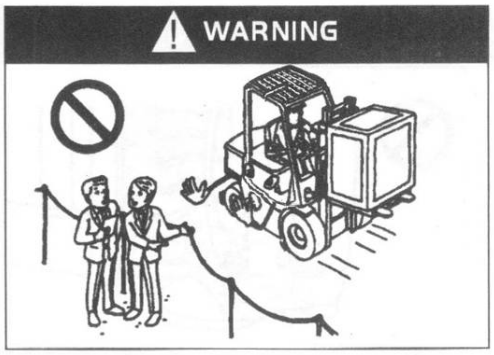
Blow the horn when there are people walking ahead!

Avoid collision with people or objects during turning!



Keep clear of other persons during working of the forklift!

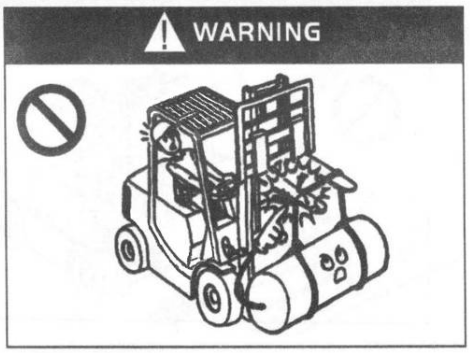
High speed during turning will cause workingoverturning due to unstable centre of gravity!



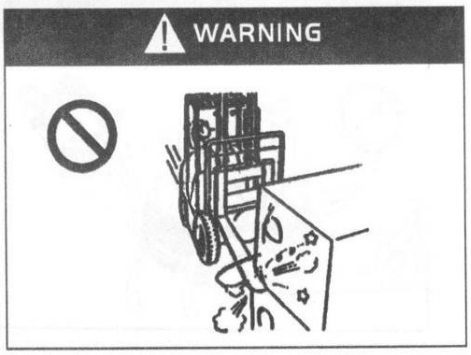
Pedestrians are forbidden within area of the forklift!

Changes in the rated capacity of the forklift should be noted!

Always pay attention to the areas around when driving the forklift!



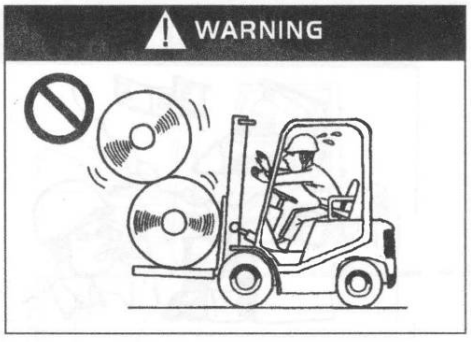
Please use the fork for loading!



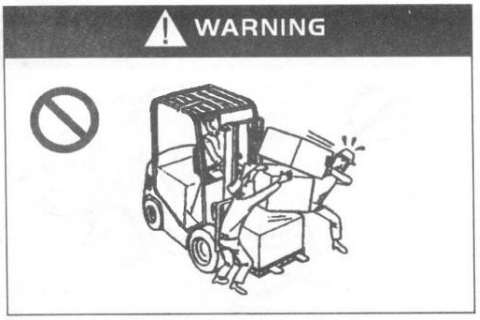
Slow down when loading!

Please do not move the forklift when there are people standing in front of it!

No one shall walk or stand below the elevated fork!

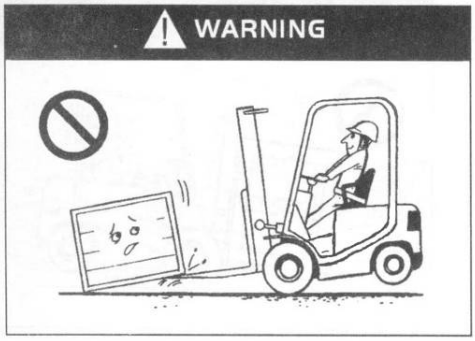


Never load cargo with a height higher than the back-rest!

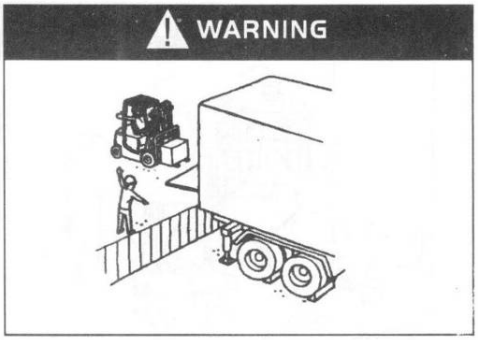


For goods difficult to fixed, bundle them before loading!

Goods have not been loaded from the forklift shall not be handled!



Do not carry damaged goods cases by your shoulders!



Abuse of the fork is not allowed!

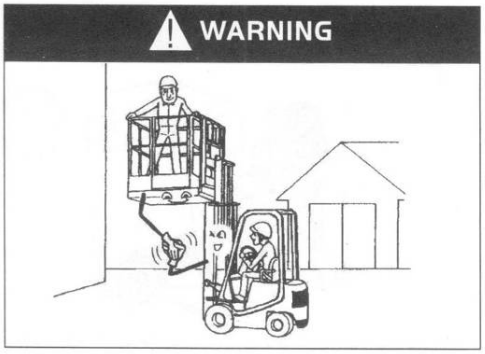
Be careful when loading the goods onto cars!

Never carry people!

Do not abuse the forklift!

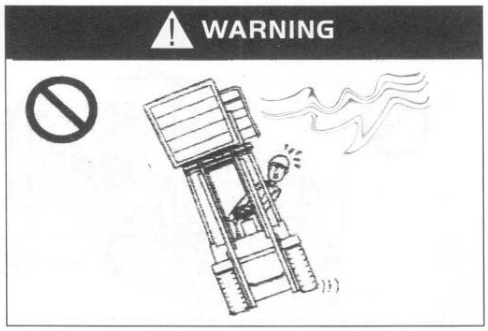
Do not stretch any part of the body out of the forklift!

Drive smoothly. Sudden acceleration and slow down is not allowed!



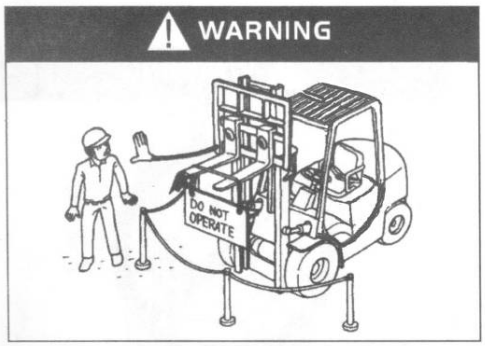
Special safety equipment shall be used when carry out manned operation

Do not overload!

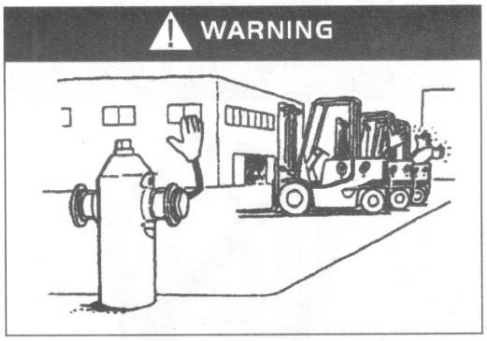


Lifting is not allowed when it is too windy!

Operating in an explosive environment is not allowed!

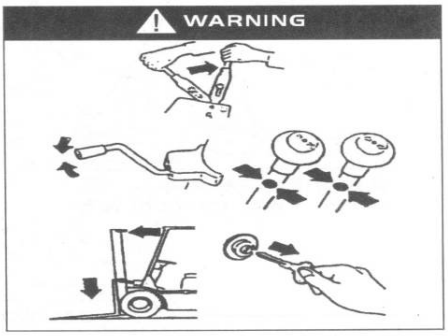


Damaged forklifts need to be placed in designated areas!



When not in use, the forklift shall be parked in designated areas!

It is prohibited to park the forklift on a slope!



When you do not use the forklift:

—Brake

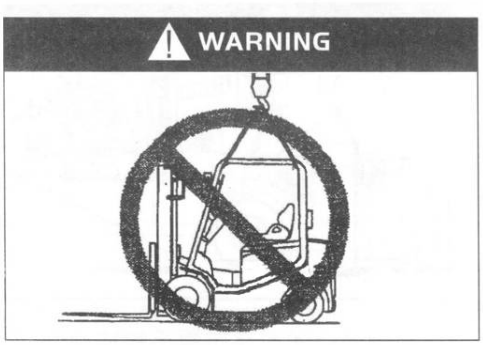
- Place the direction lever at the netural position

—Lower the fork to the ground.

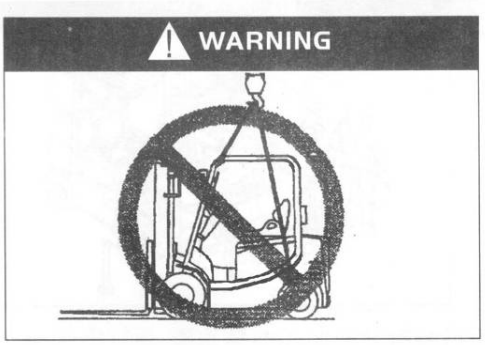
— Tilt the main frame forward

— Remove the key

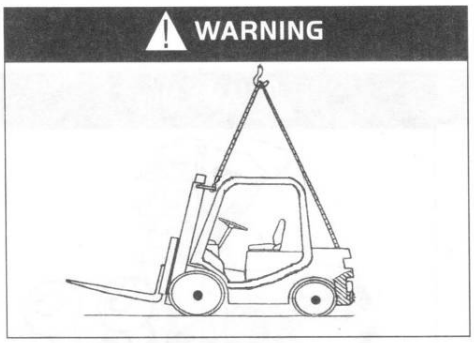
3. Transportation of the forklift



Lifting from the forklift top is prohibited!



Lifting from the forklift frame is prohibited!



Lift the forklift correctly when handling goods!

Lift the forklift

·Fasten the steel wire to the holes at the two ends of the outer frame beam and to the counterweight hook, and then hoist the fork by using the lifting equipment. And the steel wire connected to counterweight shall pass through overhead guard notch and shall not exert force on the overhead guard.

• When lifting the forklift, be sure the steel wire is not twisted around the overhead guard.

• The steel wire and lifting devices shall be firm enough to support the forklift safely, because the forklift is extremely heavy.

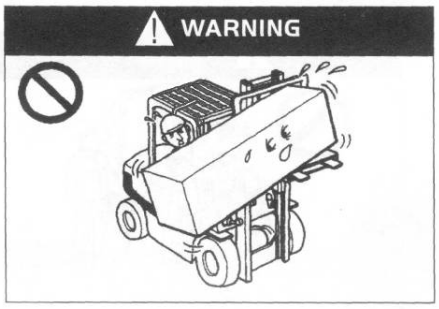
• Do not use the cab frame (overhead guard) to lift the forklift.

• When lifting the forklift, do not stay underneath the forklift.

4. How to avoid rollover and protect yourself

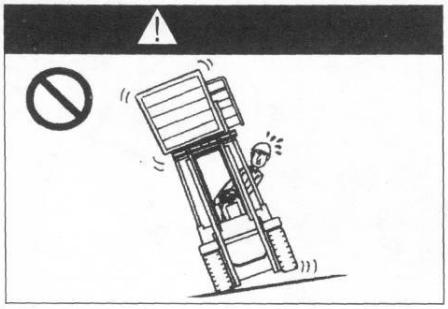
To avoid tipping, tilting forward to lift the load is forbidden!

Tilted loading of the goods is prohibited!

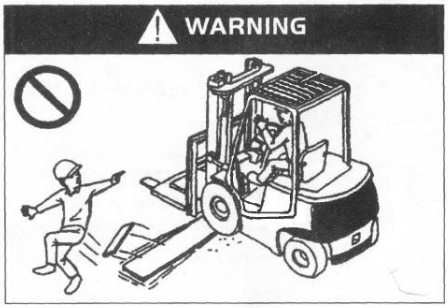


Eccentric loading of the goods is prohibited!

Avoid driving on slippery surface!



Do not load or unload if the forklift is not on a level ground!

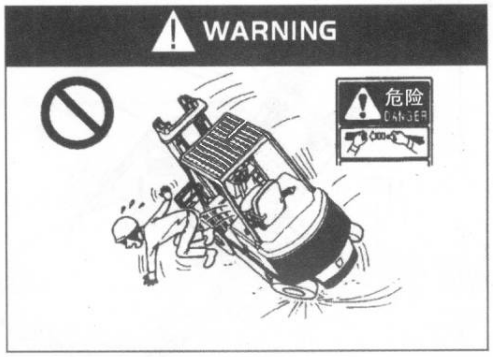


Do not drive over trenches, other obstacles that cause tipping!

During driving, the distance between fork and the ground shall be within 150mm to 200mm!

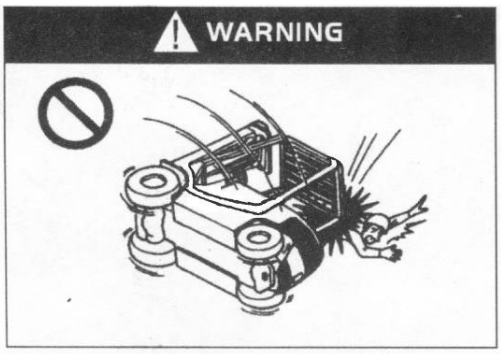
Avoid fast and wide turning no matter carrying load or not!

When the empty fork is lifting, please turn



Be sure to fasten your seat belts!

within a narrow range to avoid tipping!



In the event of forklift tipping, please do not jump!

Please wear a helmet while driving!

⚠ **In case of tipping, it is safer when you stayed in the forklift with seat belt than jumping out of the forklift. If the forklift begins to tip:**

1. Step on the brake pedal and clench the steering wheel tightly.
2. Do not jump.
3. Bend your body to the opposite direction of tipping.
4. Tilt your body forward。

5. Safety issues during maintenance and protection

(1) Maintenance location

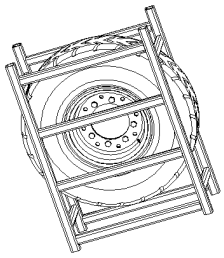
⚠ **• The premise should be designated places that can provide enough equipment and security facilities to the service organization.**
• The site should be level ground.
• The site should be well ventilated.
• The site should have fire-fighting equipment.

2) Precautions before maintenance

⚠ **• No smoking.**
• Wear all kinds of protective equipments (helmets, shoes, glasses, gloves and boots) and appropriate clothing.
• Timely and wipe out overflowed oil.
• Use a brush or cloth or clean dust or dirty oil before adding lubrication oil.
• Turn off the key switch and pull out the accumulator plug except for some certain cases.
• Lower the fork to the ground before carrying out maintenance of forklift.
• Use compressed air to clean electrical components.

(3) Precautions on care and maintenance

⚠ **• Take care not to put feet below the fork and not to be tripped by the fork.**
• When upgrading the fork, use pads or other things as cushion below the main frame to avoid sudden drop of the fork and main frame.
• Take care to open and close the front chassis and accumulator cover plate, so as not to pinch fingers.
• When your job can't be completed within a day, make a mark to continue work next time.
• Use right tools and never use makeshift tools.
• Because of the high pressure of hydraulic circuit, never carry out maintenance work before the internal pressure of oil circuit is reduced.



• When injured by high-voltage electricity, immediately seek medical treatment.

• Do not use the main frame assembly as a ladder.

• Do not put your hands, feet and body between the forklift frame and the main frame assembly.

(4) Inspection and replacement of tires

⚠ **• Removal and installation of tires must be operated by professionals.**

• Handling of high-pressure air shall be done by professionals

• Wear a goggle when using compressed air.

• During disassembling of tires, do not loose bolts and nuts at rim connection. As there is high-pressure gas within the tires, looseness of bolts, nuts and rims could cause danger.

• Before removing bolts and nuts at the rim connection, you must first exhaust the high pressure gas within the tires with special tools.

(5) Use of jack (replace the tires)

⚠ **• When jacking up the forklift, do not keep any part of your body below the forklift.**

• When jacking up the forklift, ensure that there are no one and no load in the forklift.

• When the forklift wheels are lifted off the ground, stop use the jack and place pads below the forklift to protect it from falling down.

• Take measures to prevent the forklift from sliding before jacking up the forklift.

(6) Requirements on waste discharge (electrolyte liquid, oil, etc.)

⚠ **·Waste parts on the forklift (plastic parts, electrical components, etc.) and waste liquid (hydraulic oil, brake fluid, etc.) should be recycled according to the local regulations rather than discharged**。

6. Safety during accumulator use

(1) No smoking

⚠ **·The accumulator can produce hydrogen. Spark will generate in case of short-circuit and lit cigarette near the accumulator may cause explosion and fire.**

(2) Prevent electric shock

⚠ **• The accumulator has high voltage, so when you perform installation and maintenance, do not touch the accumulator conductor, which can cause serious burns.**

(3) Correct connection

⚠ **• When the accumulator is charging, ensure the positive and negative poles are not reversed, otherwise heat, fire, smoke or explosion may be caused.**

(4) Never place metal objects on the accumulator

⚠ **• Avoid reversed installing of the positive and negative bolts or tools, which may lead to short-circuit occurs, causing injury and explosion.**

(5) Avoid excessive discharge

⚠ **· Do not keep using the forklift until it can not move, otherwise the accumulator life will be**

shortened. If the accumulator capacity alarm indicator flashes continuously, it means that the accumulator needs to be recharged.

(6) Keep clean

⚠ **• Keep cleanness of accumulator surface**

·Do not use a dry cloth or chemical fiber cloth to clean the accumulator surface. Do not use polyethylene film to cover the battery.

• Static electricity can cause an explosion.

• Clean the uncovered parts at the top of the accumulator with a damp cloth.

(7) Wear protective clothing

⚠ **• During maintenance of the battery, you should wear goggles, rubber gloves and rubber boots.**

(8) Accumulator electrolyte could be harmful

⚠ **• Accumulator electrolyte is made of dilute sulphuric acid. Be careful when handling.**

• When the electrolyte adheres to skin and clothing or touch your eyes, it will result in vision loss or serious burning.

(9) Emergency treatment

⚠ **When an accident occurs, perform following emergency treatment and contact a doctor immediately.**

• spilled on skin: rinse with water for 10-15 minutes.

• spilled in eyes: rinse with water for 10-15 minutes.

• contamination in large area: use soda (sodium bicarbonate) or clean with water.

• Ingestion: Drink plenty of water or milk.

• spilled on clothing: immediately take off the clothes.

(10) Put on the accumulator top cover

⚠ **• Put on accumulator top cover tightly to prevent electrolyte leakage.**

• Do not add too much electrolyte, otherwise the electrolyte will overflow and cause current leakage.

(11) Waterproof

⚠ **• The accumulator can not be wet by rain or sea water, otherwise the accumulator will be damaged, causing fire.**

(12) Abnormality of accumulator

⚠ **When the following problems occur to the battery, please contact our sales department:**

• Accumulator stinks.

• The electrolyte gets dirty.

• The electrolyte temperature gets higher.
• The electrolyte volumes reduce quicker than normal .

(13) Prohibiting disassembling

• Do not drain the electrolyte from the battery
• Do not disassemble the battery.
• Do not repair the battery.

(14) Storage

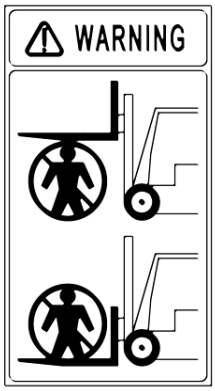
• When the accumulator is to be unused for a long time, it should be stored in well-ventilated places with low possibility of fire.

(15) Disposal of waste battery

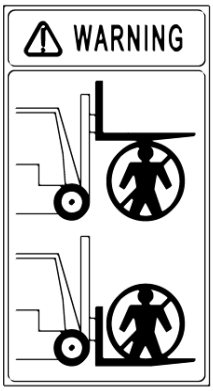
• Contact our sales department for disposal of waste battery.

7. Lables

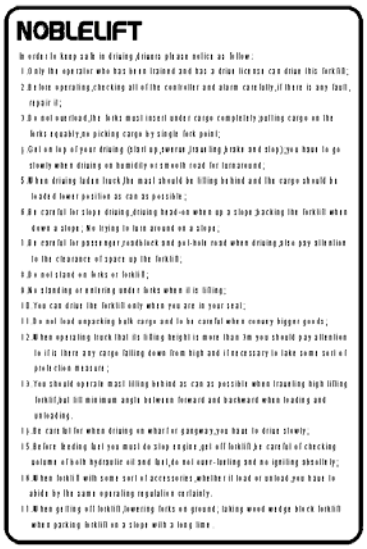
Labels posted on the forklift are used to illustrate the use and precautions of it. They are for the benefits of both you and the forklift. Immediately re-paste the labels if they fall off.



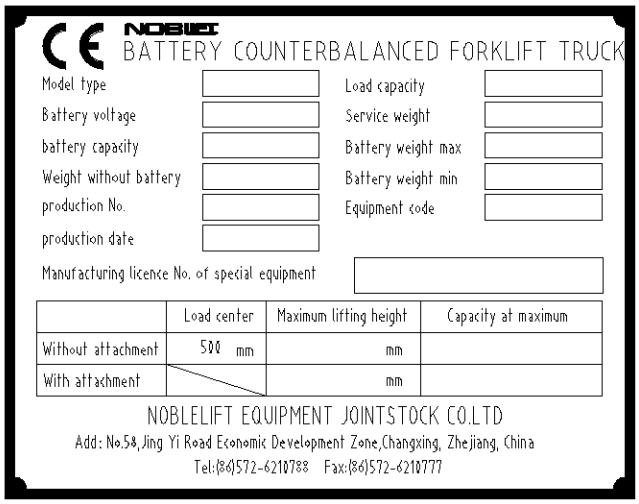
Left ssfety logo



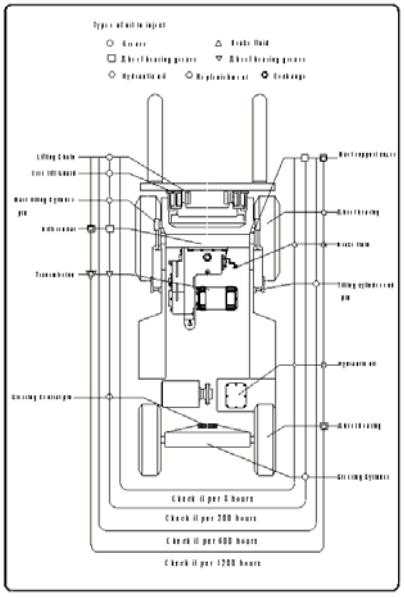
Right safety logo



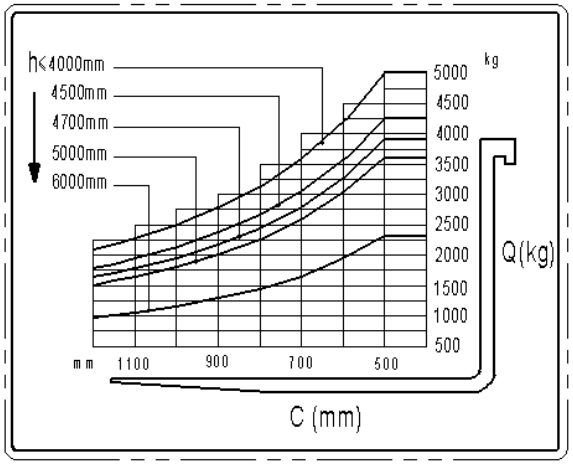
Opertaing instruction



Forklift nameplate



Lubrication chart

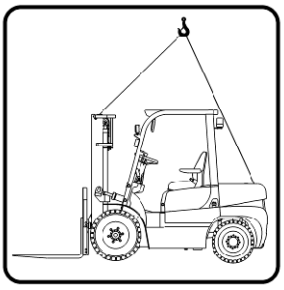


Load curve mark

Hydraulic oil plate

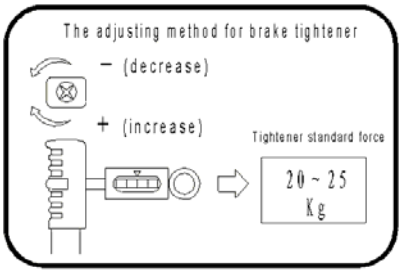
Craning mark

No lifting mark

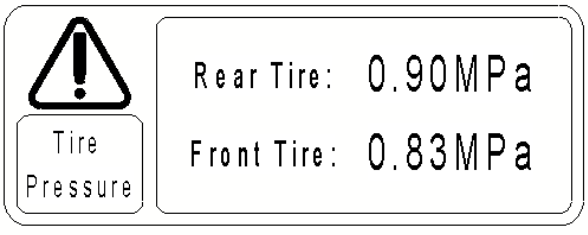


Craning of entire vehicle

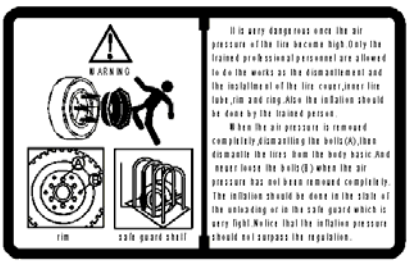
No climbing mark



Hand brake mark



Air pressure plate



Tire dismouting logo

Watch Your Hand warning

Chapter IV Periodic inspection and maintenance

Conduct a comprehensive inspection of forklift to avoid failure and to extend its service life. Service hours indicated in the Maintenance Procedures is based on the assumption that the forklift works 8 hours a day and works 200 hours a month. In order to ensure safe operation, maintain the forklift regularly according to the maintenance procedures.

Routine maintenance and repair work shall be carried out by the forklift driver and other inspection and maintenance work shall be done by professional maintenance personnel.

Ⅰ. Check before operation

In order to ensure safe operation and to keep the forklift in good condition, please undertake the statutory duty to conduct a comprehensive inspection of the forklift before operation. If any problems are found, please contact the sales department of our company.

⚠ • A small fault will cause a major accident. Don't operate or move the forklift before the completion of repair and inspection work.

• Conduct checking the forklift on a platform.

• Before checking the electrical system of the forklift, turn the key switch off and unplug the accumulator before check.

• Improper handling of waste oil (such as dumping into water pipes, soil, or burning them) will cause pollution to the water, soil and air, thus are strictly prohibited.

1. Check points and contents

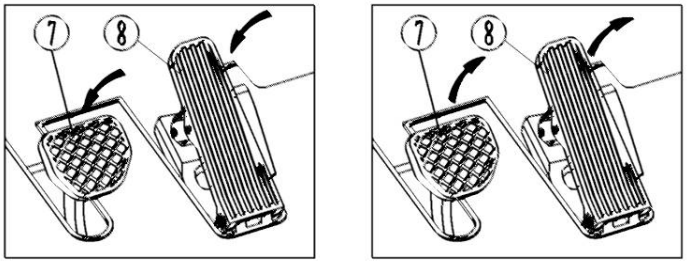
	No.	Check points	Check contents
Braking system	1	Brake pedal	Travel distance and braking force of the foot brake pedal
	2	Brake oil	Quantity and cleanliness
	3	Parking brake	Travel distance and braking force of the parking brake lever
Steering system	4	Manipulation of steering wheel	Tightness, rotation, forward and backward movement
	5	Manipulation of hydraulic steering	The operation of all components
Hydraulic system and main frame	6	Features	Function, cracks and lubrication status
	7	Pipeline	If the oil pipeline leaks
	8	Hydraulic Oil	Appropriate oil volume
	9	Lifting chain	Tightness of the left and right chains should be the same
Wheels	10	Tires	Pressure size and if there is any damage or abnormality
	11	Rim nut	Firmly tighten it
Accumulator	12	Charging	Check the display status of accumulator capacity, the specific gravity and firm connection of the plugs
Lights, horn and switches	13	Headlights, tail lamps, reversing lamp, steering lamps, horn and emergency power off switch	Switch on and off the lamps to see if they can light up. Press the horn button to see if the horn could sound and check if the emergency power off switch is normal.
Inspection and displaying lamps	14	Features	When the key switch is turned on, it should display "normal test state"

Others	15	Overhead guard, backrest	If the bolts and nuts are tightened
	16	Nameplate and labels	Completeness
	16	Other parts	If there is abnormality

2. Check the procedure

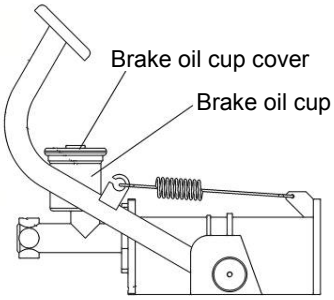
(1) Check the foot brake pedal ⑦

Check the braking status. Ensure that if the brake pedal is fully depressed, the travel distance of the brake pedal
should be more than 50mm, and the braking distance of no-load forklift shall be about 2.5m.



(2) Check brake fluid

⚠ **• Open the oil cup cover and check the quantity of brake oil and other conditions.**



(3) Check the parking brake lever

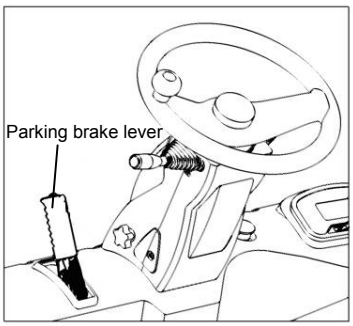
Push forward the parking brake lever and check the following items:

• If the pull distance is appropriate.

• Degree of braking force.

• If the parts are injured .

If the operator find the manipulation force of the lever(standard force is 17-22kg) approprate. Operators can adjust the screw at the top of the lever.

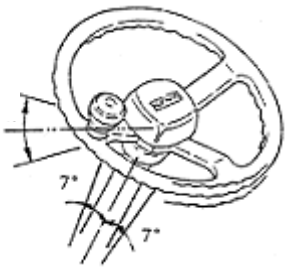


(4) Check the rotation of the steering wheel

Gently rotate the steering wheel clockwise and counterclockwise to check if rebound occurs.

The suitable travel length for rebound
shall be 50-100mm. The travel length of steering wheel when moving forwards and backwards are about 7°.If the actual travel length falls within the scope, rotation of the steering wheel can be deemed as Normal.

Rebound stroke
50—100mm

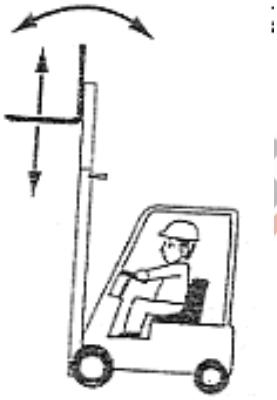


(5) Check the power steering feature

Rotate the steering wheel clockwise and counter-clockwise, and check the working condition of the power steering.

(6) Check the hydraulic system and the function of main frame

Check if the operations of lifting, tilting forward and ackward are normal and smooth.

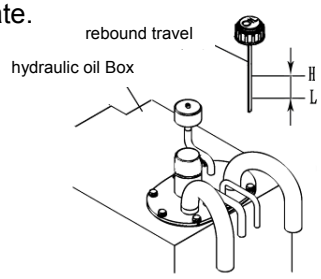


(7) Check the oil pipe

Check the lifting cylinder, tilting cylinder and all the piping for oil leakage.

(8) Check hydraulic oil

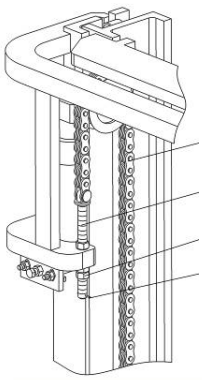
Lower the fork to the ground and check the oil level of hydraulic oil with a gauge. If the oil level is within the range of H to L, the hydraulic oil volume is appropriate.



Model	H≤4m	H>4m
FE4D40	52 L	62 L
FE4D45	52 L	62 L
FE4D50	52 L	62 L

(9) Check the lifting chain

Lift the fork to 200-300mm away from the ground and ensure that the tightness of left and right chains are the same. Check whether the finger lever is in the neutral position. Adjust the chain joints in case of difference in tightness.



⚠ **• Double-nut should be tightened after this adjustment, .**

(10) Check the tires (inflated tires)

Unplug the gas nozzle cap and measure the tire pressure with a tire barometer. After checking the pressure, make sure no gas leakage will occur before fitting the cap of gas nozzle.

Check the tires (solid tire)

Check tires and the side surfaces for damage or cracking, and then check the wheel rim and the lock ring for deformation or damage.

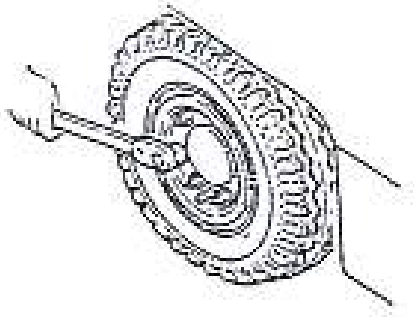
(11) Check the rim nuts

⚠**·Looseness of rim nuts could be very dangerous as it may lead to falling off of wheels and overturning of the forklift. Check all the rim nuts for looseness. Make sure they have been tightened to the specified torque to avoid danger.**

Tightening torque of the rim nuts:

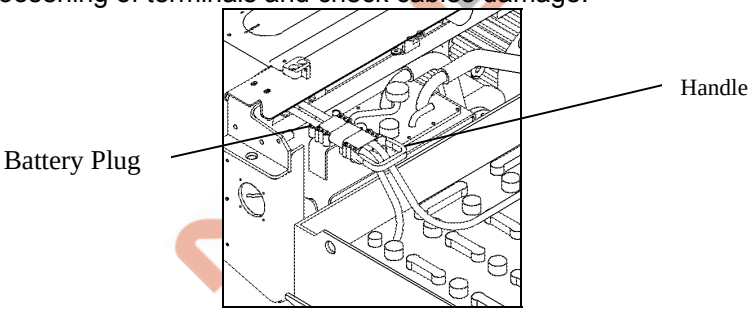
Front wheel：250-15　363-490N．m

Rear wheel：21×8-9　157-176N．m



(12) Check the charging status

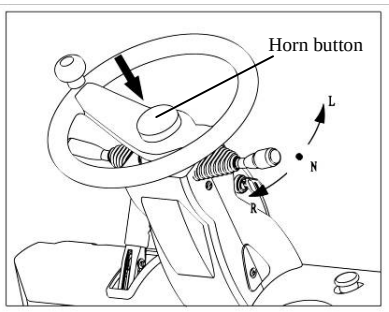
Measure the specific gravity of the battery. If the specific gravity of the accumulator is 1.275 to 1.285 when the accumulator is switched to 30 ℃, indicating that the accumulator is fully charged. Check for loosening of terminals and check cables damage.



(13) Check the front headlight, steering lamp and the horn

Check if these lamps could light up normally and if the horn can sounds normally (checking by pressing the horn button).

Check the emergency stop switch.

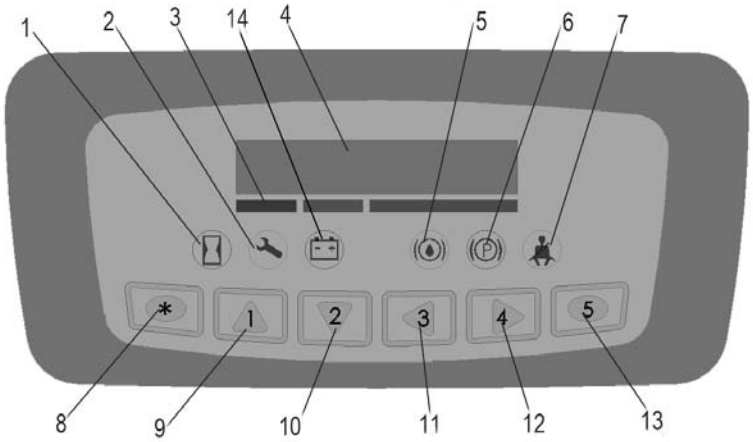


L	Left steering lamp lights up
N	Neutral position
R	Right steering lamp lights up

(14) Check instrument panel

Under normal circumstances, the instrument panel will displays as below within a few

seconds after turning on the key switch.



1.Indicationon of locking
2.Indicationon of hand braking
3.Fault code of traction control
4.Speed mode
5.Fault code of pump controller
6.Indication of oil filtering (disabled)
7.Indication on maintenance time
8.Fault indication
9.Indication of turning right
10.Buttons for mode switch and parameter adjustment
11. Capacity indicator of the accumulator
12.Timing indicator
13. Operation menu button
14.Indication of turning left

15) Check the overhead guard and backrest
Check the bolts or nuts for looseness.
16) Check the integrity of the labels
17) Others
Check for abnormalities on other components.

⚠ **• In addition to checking of the lights and operating conditions, turn off key switch and unplug the accumulator before check the electric system.**

Ⅱ.Checking after operations

After work, remove dirt from the forklift and check the following items:
(1) Inspect all parts and components for damage or leakages.
(2) Check for deformation, distortion, damage or breakage.
(3) Add grease if necessary.
(4) Lift the fork to the maximum height for several times after operations are finished. (After you do not lift the fork to its maximum height in daily work, this allows the oil flow through the cylinder to prevent rusting.))
(5) Replace abnormal components that cause failures during work.

⚠ **• A small fault will cause a major accident. Do not operate or move the forklift before completion of repair and inspection.**

Ⅲ.Clean the forklift

⚠ **• Park the forklift at the specified location.**
• Pull the parking brake lever.
• Press the emergency stop switch.
• Turn off the key switch and remove the key.
• Disconnect the accumulator plug.

1. Clean the forklift surface

Do not use flammable liquids to clean the forklift and take safety measures to prevent short circuits.

·Use water and soluble detergent to clean the forklift.

• Carefully clean the oil filler and the periphery of the lubricating port.

Please conduct lubrication timely if you clean the forklift frequently.

2. Clean the chain

Do not use chemical detergents, acids and other corrosive liquids to clean the chain.

• Place a container under the main frame.

• Use gasoline and other petrochemical derivatives to clean the chain.

• Do not use any additives when cleaning with a steam nozzle.

• Wipe the chain pin and water on chain surface immediately after cleaning.

3. Clean the electric system

Do not use water to clean the pump control and the connectors, so as to avoid damage to the electrical system.

Use non-metallic brush or low-power dryer to clean the electric system according to the manufacturer's instructions. Do not move the protective cover.

4. After cleaning

• Thoroughly wipe off water stains on the forklift (compressed air could be used.)

• Start the forklift according to the procedures.

If moisture penetrates into the motor, you should first remove the moisture to prevent short circuits.

Moisture will reduce brake performance, so you shall conduct braking to dry the brake.

Ⅳ. Regular maintenance

• Regular inspection and maintenance of the forklift shall be conducted to keep it in good performance status.

•Use spare parts made by Noblelift Machinery.

•Do not use different types of oil when replacing or refilling oil .

• The oil and accumulator being replaced shall be disposed according to local environmental protection laws and regulations rather than being dumped and abandoned.

• Develop comprehensive maintenance and repair program.

• Keep detailed record of each maintenance and repair.

• Forklift repairing without training is prohibited.

•No smoking.

· Turn off the key switch and disconnect the accumulator plug before maintenance. (Except for conducting some of the troubleshooting checks)

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

• Never stretch your hands, feet or any part of the body into the place between the main frame and instrument rack.

• The charged capacitor within the controller may cause electrical injury even if the key switch is off. Be careful when contacting the controller.

1. Regular maintenance schedule √ - Inspection, calibration, adjustment × - Replacement

(1) Accumulator

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Accumulator	Electrolyte levels	measure by sight		√	√	√	√
	Specific gravity of electrolyte	Hydrometer		√	√	√	√
	Accumulator power		√	√	√	√	√
	Looseness of terminals		√	√	√	√	√
	Looseness of the connection lines		√	√	√	√	√
	Cleanness of accumulator surface		√	√	√	√	√
	If there is any tool placed on accumulator surface		√	√	√	√	√
	If the ventilation cover is tight and if the ventilation is uncovered			√	√	√	√
	Keep away from fireworks		√	√	√	√	√

（2）Controller

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Controller	Check wear status of contacts					√	√
	Check if the mechanical movement of the contactors is good					√	√
	Check if the operation of micro switch pedal is normal					√	√
	Check the connection between the motor, accumulator and the power units					√	√
	Check if the						For the

	troubleshooting system of controller is normal						first 2 years

(3) Motor

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Motor	Remove foreign body on the motor shell				√	√	√
	Replace or clean the bearing						√
	Check for wear of carbon brushes and commutator. Also check if the spring force is normal				√	√	√
	Check if the wiring is correct and reliable				√	√	√
	Clean up the groove on changeover plate and add carbon powder on the changeover					√	√

（4）Transmission system

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Gearbox and wheel reduction mechanism	If any noise		√	√	√	√	√
	Check for leakage		√	√	√	√	√
	Replace the oil						×
	Check the working status of brake		√	√	√	√	√
	Check the gear operation					√	√
	Check looseness of the bolts at the connection with the main frame				√	√	√
	Check the tightening torque of wheel hub bolt	Torque Wrench	√	√	√	√	√

(5) Wheels (front and rear)

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Tires	Wear, cracks or damage		√	√	√	√	√
	nails, stones or other foreign body on the tire				√	√	√
	Damage of wheel rim		√	√	√	√	√

（6）Steering system

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Steering Wheel	Check the clearance		√	√	√	√	√
	Check the axial looseness		√	√	√	√	√
	Check the radial looseness		√	√	√	√	√
	Check the operating status		√	√	√	√	√
Steering gear and Vavle block	Check for looseness of the mounting bolts				√	√	√
	Check the leakage on contact surface of valve block and steering gear		√	√	√	√	√
	Check the sealing condition of the interface connectors		√	√	√	√	√
Rear axle	Check for looseness of the mounting bolts on rear axle				√	√	√
	Check bending, deformation, cracking and damage				√	√	√
	Check or replace the lubrication on axle supporting bearing					√	√
	Check or replace the lubrication on bearing of the steering wheel hub					√	√
	Check the operating conditions of		√	√	√	√	√

	steering cylinder						
	Check for leakage of the steering cylinder		√	√	√	√	√
	Check the meshing of gear and rack					√	√
	Sensor wiring and working status					√	√

（7）Braking system

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Brake pedal	Free travel	Graduated scale	√	√	√	√	√
	Pedal travel		√	√	√	√	√
	Operating conditions		√	√	√	√	√
	If there is air within the brake lines		√	√	√	√	√
Manipulation of parking brake	If the brake control is safe and reliable and with enough travel		√	√	√	√	√
	control performance		√	√	√	√	√
Rod, cable and etc	control performance				√	√	√
	Looseness of the connection				√	√	√
	Wear of the joints with gearbox					√	√
Pipelines	Damage, leakage, rupture				√	√	√
	Connection, clamping parts and looseness status				√	√	√
Braking Master cylinder and Wheel Cylinders	Leakage		√	√	√	√	√
	Check the oil level and replace oil		√	√	√		×
	Action of master cylinder and wheel cylinders					√	√
	Leakage and damage of master cylinder and wheel cylinders					√	√
	Check wear and damage of master cylinder, wheel cylinder piston cups and check valve. Replace if						×

	necessary.						

（8）Hydraulic system

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Hydraulic cylinder	Oil volume check and replacement of oil		√	√	√	√	×
	Clean the oil absorption filter						√
	Exclude foreign body						√
The control valve rod	Looseness of the connection		√	√	√	√	√
	Operating conditions		√	√	√	√	√
Multiple unit vavle	Oil leakage		√	√	√	√	√
	Operating conditions of the safety valve and self-locking tilt valve				√	√	√
	Measure the pressure of the safety valve	Oil pressure gauge					√
Pipe line joints	Leakage, looseness, crack, deformation and damage				√	√	√
	Replace the tube						× 1 to 2 years
Hydraulic Pump Cylinders	Oil leaks or noise of hydraulic pump		√	√	√	√	√
	Wear of the driving gear of hydraulic pump				√	√	√

（9）Lifting system

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Chain sprocket	Check the tightness of the chain and see if there is any deformation, damage and corrosion		√	√	√	√	√
	Lubricate the chain				√	√	√
	Riveting pin and its looseness				√	√	√
	Deformation and damage of chain wheel				√	√	√
	If the sprocket of bearings are loose				√	√	√
Accessories	Check if it is in normal state				√	√	√
Lifting cylinder and tilt cylinder	Looseness, deformation, damage of piston rod, threaded rod and their connection parts		√	√	√	√	√
	Operating conditions		√	√	√	√	√
	Leakage		√	√	√	√	√
	Wear and damage of pins and steel backed bearing				√	√	√
Fork	Damage, deformation and wear of the fork				√	√	√
	Damage, wear of the location pin					√	√

	Cracking and wear on the welding parts at the root of the fork				√	√	√
Main Frame Fork frame	Crack or damage on the inner main frame, outer main frame and welded parts on the beam				√	√	√
	Bad welding, cracking, damage on the welded parts between tilt cylinder bracket and the main frame				√	√	√
	Bad welding, cracking or damage of the inner and outer main frame				√	√	√
	Bad welding, cracking or damage of the fork frame				√	√	√
	Looseness of rollers				√	√	√
	Wear and damage of the support bearing of the main frame						√
	Looseness of bolts on the main frame bearing cap	Test hammer			√ (Only for the first time)		√
	Looseness of bolts on the piston rod head of the lifting cylinder and the plate bending bolts	Test hammer			√ (Only for the first time)		√
	Cracking and damage of roller, roller axle and welding parts				√	√	√

(10) Others

Maintenance Item	Maintenance content	Tools	Per day (8 hours)	per week (50 hours)	per month (200 hours)	Every 3 months (600 hours)	Every 6 months (1200 hours)
Overhead guard and backrest	are firmly installed	Test hammer	√	√	√	√	√
	Check the deformation, cracking and damage		√	√	√	√	√
Steering lamp	Working and installation status		√	√	√	√	√
Horn	Working and installation status		√	√	√	√	√
Lamps and light bulbs	Working and installation status		√	√	√	√	√
Back-up buzzer	Working and installation status		√	√	√	√	√
Instrument	Working status of instrument		√	√	√	√	√
Wiring	Damage and loosening of harness			√	√	√	√
	Loosening of circuit connection				√	√	√

2. Replace critical safety components periodically

If injury or damage of some parts is difficult to find through regular maintenance, users shall conduct periodic replacement of parts given in the following table to further improve security.

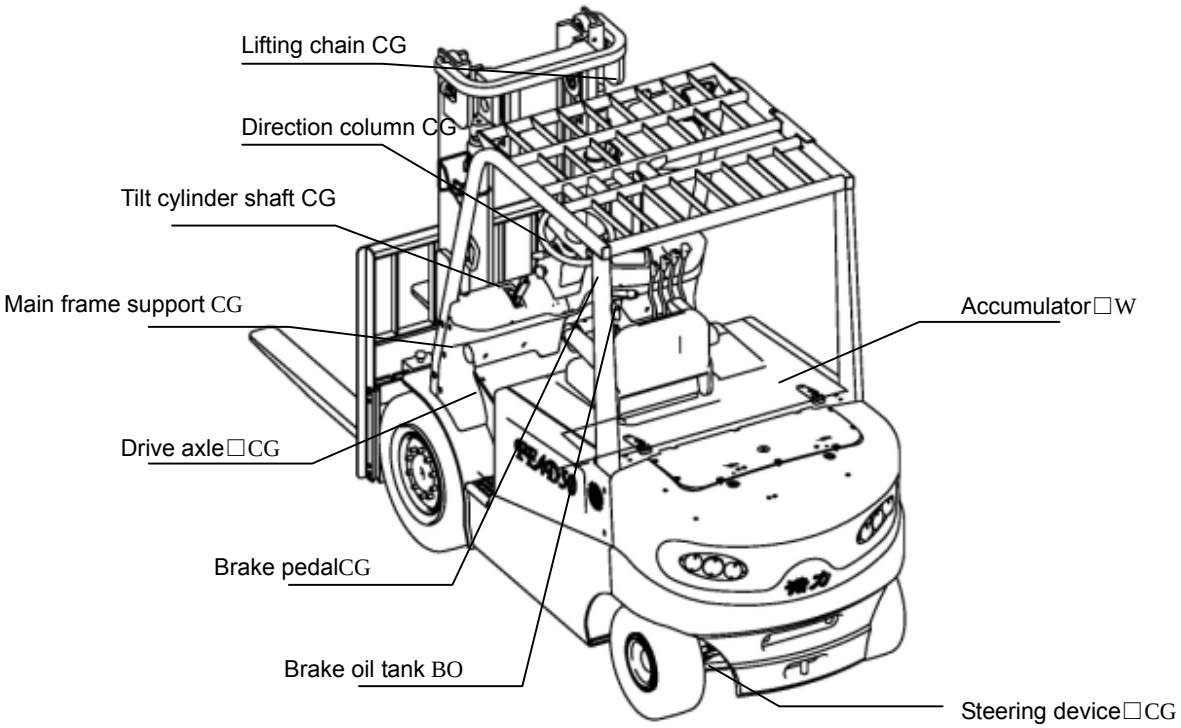
If these parts are abnormal before the due replacement time, replace them immediately.

Name of key safety components	Service life (years)
Brake hose or tube	I～2
Hydraulic hose for the lifting system	I～2
Lifting chain	2～4
High pressure hose and tube for the hydraulic system	2
Oil cup of the brake fluid	2～4
Brake master cylinder cover and dust proof cover	1
Internal seals and rubber parts of the hydraulic system	2

Ⅴ. Lubricating parts and recommended oil

1. Lubricating parts

○：Replacement　　FO: Hydraulic oil
○：adding　　GO: Gear oil
○：Check and adjustment　　CG: Lubricant grease
BO: Brake oil　　W: Distilled water



2. Recommended oil

Name	Nameplate, code	Volume (liters))	Remarks
Hydraulic Oil	L-HM32	52L(H≤3000mm) 62L(H>3000mm)	Winter
	L-HM46		Summer
Gear oil	AFT DEXRON Ⅱ	1.4~1.6	Single
Hydraulic fluid	Caltex DOT3	0.3	
Industrial Vaseline	2#		accumulator electrode column
Lubricant grease	Universal lithium grease for automobiles		

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