Foreword

Counterbalance battery forklift is a new series product researched and developed on the basis of absorbing the advantages of the forklifts at home and abroad combining the company's introduction of advanced foreign technology to satisfy the demand of the market, and it is particularly used for loading and unloading, handling and stacking at stations, ports, freight yards, warehouses and in food, light textile industry, as well as general industrial goods, etc.

Because a wide field hoisting system, fully hydraulic steering mechanism, automatic boosting brake, new stepless speed regulator, open overhead guard and other advanced components are used in the forklift, coupled with good quality motor, battery, MOSFET electric control and a large screen LCD combination instrument, it has superior performance, convenient operation, wide vision, flexible steering, reliable braking, good performance, low noise, no pollution and nice appearance, etc.

This manual briefly introduces the technical parameters of our company's counterbalance battery forklift, the structure, working principle and operation, repair, maintenance and other elements of main components. It can help operators reasonably use the battery forklift, and make the battery forklift to give play to maximum effectiveness. We hope that operators and equipment management personnel read carefully before operating the forklift.

In use, relevant personnel should strictly abide by the provisions of the manual and the matters needing attention, and make careful use of it so that your forklifts can be in the best working state for a long term and give play to greater effectiveness.

Because parts and devices are involved in continuous improvement, relevant content of this manual will also be changed, without prior notice, please users understand. This manual is also used for the forklifts with assembly tools. Four-fulcrum battery forklift has passed the CE certification.

Note: It is strictly prohibited that users privately modify the forklift without permission!

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I. Main technical parameters





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	Model		1	25B-7A	30B-7A	35B-7A
Ra	ted lifting weight	kg	2	2500	3000	3500
Load center moment		mm	3	500	500	500
Lifting height		mm	4	3000	3000	3000
Free lifting height		mm	5	140	165	170
Specification of pallet fork	s×e×1	mm	6	40×122×1070	45×125×1070	50×130×1070
Tilting angle of mast	$F/B(\alpha^{\circ}/\beta^{\circ})$	Deg	7	5/10	5/10	5/10
	Length (not including pallet fork)	mm	8	2286.5	2548	2639
	Width A	mm	9	1285	1285	1365
External dimension	Non- lifting height of mast H1	mm	10	2015	2045	2120
	Lifting height of mast	mm	11	4017	4140	4140
	Height of overhead guard H	mm	12	2152	2152	2138
Turning radius	Minimum R	mm	13	2095	2349	2405
Front overhang G		mm	14	454	476	495
Wheel track	Front Q/rear S	mm	15/16	1058/960	1065/980	1124/1010
Clearance from the ground	Minimum H3	mm	17	95	110	83
	Wheel base F	mm	18	1485	1670	1690
Pallet fork spacing	Min/Max	mm	19	250/1000	250/1060	250/1060
Width of working	1000×1200 horizontal	mm	20	3732	4023	4100
channel, with tray (Ast)*	800×1200 vertical	mm	21	3932	4223	4300
	Running (Full load)	km/h	22	15	15	15
Correct 1	Running (No-load)	km/h	23	16	16	16
Speed	Lifting (Full load)	mm/s	24	280	280	280
	Lifting (No-load)	mm/s	25	440	400	384
Olivet in a set list	Full load	%	26	15	15	15
Climbing gradient	No-load	%	27	15	15	15
Weight	Including battery box	kg	28	4160	4750	5250
Tim	Front ×2		29	23×9-10	23×9-10	23×10-12
1 ire	Rear×2		30	18×7-8	18×7-8	200/50-10
Mada	Drive motor	kw	31	K8.5/J8.5	K11.5/J11.5	K11.5/J11.5
Motor	Lifting motor	kw	32	K11/J11	K15/J15	K15/J15
Dattar	Standard	V/Ah	33	48/600	80/500	80/500
Battery	Optional	V/Ah	34	48/660	80/550	80/550
	Model		35	AC	AC	AC
Controller	Manufacturer		36	ZAPI (ACE2 48V/400+400)	ZAPI(COMBI AC2 80V/400+400)	ZAPI(COMBI AC2 80V/400+400)
W	orking pressure	Мра	37	17.5	17.5	17.5

Note: K=KDS motor, J=Jieheli motor/A standard battery is produced in Zibo and the optional battery is HAWKER. The optional battery has a different battery brand, and the capacity is also different.

II. Forklift structure, principle, adjustment and maintenance

- 1. Battery and installation
- 1.1 Overview

Battery as energy supply center of the whole vehicle has a pivotal role in the normal operation of the whole system, and correct operation has a great impact on the performance and life of the battery pack. Therefore, a very important position is focused on daily use and maintenance of battery, so as to give maximum play to the using performance and life of battery.

1.2 Battery structure

Battery is mainly composed of positive plate, negative plate, clapboard, battery slot cover and electrolyte.

Model	Battery model Specification		Valtaga	Number of	Charger	Plug
Model	Battery model	specification	vonage	monomer	specification	specification
25B-7A	24-6DB600H	600Ah	48V	24	80A/48V	REMA 320
30B-7A	40 50050011	500 A h	90V	40	65 A /2011	DEMA 220
35B-7A	40-3ДБ300П	JUOAII	80 V	40	03A/80V	KEWIA 520

1.3 Standard battery (Zibo) and charger specification

1.4 Storage of battery

(1) The battery not charged but shipped out of factory should be stored in a clean and dry room at a temperature of $(5\sim45^{\circ}\text{C})$, and the storage period of battery from the date of production is two years; if more than two years, the initial charging time of battery should be extended appropriately.

(2) The storage of the battery already charged at the beginning and then shipped out of factory should be consistent with the following:

(a) Stored in a clean and dry room at a temperature $(5 \sim 45 \degree C)$, with regular ventilation;

(b) The dust on the battery cover and the electrolyte dropped on the battery in the process of measurement shall be timely wiped by use of $(5\sim10)\%$ of soda water solution and tap water, to keep the outer surface of battery clean and dry;

(c) Avoiding direct sunlight, away from heat source;

(d) Supplementary charge or equalizing charge the battery with normal charging current phase II every 30 days;

(e) Please note that too long storage time is will affect the whole battery life.

1.5 Use of battery

Daily charging steps of battery:

(1) Where there is a box body or other coverage on the battery box, it must be removed or opened before charging, to ensure that the flammable and explosive gases generated are sent out fully when charging; the coverage can be closed 30 minutes after completion of charging (it can be just used 30 minutes after charging). The charging area should be well ventilated, and a fan should be installed in the indoor charging room.

(2) Push aside the battery power plug, so that the plug is separated from the power plug of vehicle body.

(3) Open the end cover on the battery monomer, and measure the electrolyte density; if the electrolyte density is less than 1.13kg/l (Hawker) or 1.15kg/l (Zibo), the battery has been excessively discharged (the depth of discharging is more than 80%), and users should be reminded to avoid frequent occurrence, thus to shorten the battery life.

(4) Measure the temperature of the electrolyte, and if more than $45 \,^{\circ}\text{C}$, the following steps should be continued after the battery is cooled.

(5) Connect the plug between the battery and charger cable.

(6) If Trak[®]air (air disturbance system) is set, please make sure that the air pipeline has been connected.

(7) If a battery automatic water supply system is provided, connect the water pipe plug.

(8) Open the charger charging switch, and start charging.

(9) After the end of charging, first close the charger power source, and then unplug the battery and charger cable plug and disconnect other supporting auxiliary systems (such as automatic water replenishing device, etc.).

(10) If no battery automatic water supply system is equipped, check the liquid level of the electrolyte after the battery charging has been completed. If the liquid level is lower than the allowable height (below the water plug), distilled water or deionized water in accordance with the standard should be added (1 to 2cm upward at the lowest part of the water plug), but any acid can not be filled.

(11) Adding water must be carried out after charging, because adding water before charging may cause the charging acid to overflow.

(12) Finally, connect the cable plug of the battery and battery cart, and the electric vehicle can be put into use.

1.6 Maintenance of the battery

(1) Daily maintenance

(a) The battery should be immediately recharged after discharging each time;

(b) The volume of each discharging shall not exceed 80% of the total battery capacity;

(c) If there battery acid overflows, it shall be cleaned, in order to avoid the battery leakage.

(2) Weekly maintenance

(a) If the battery is not equipped with an automatic liquid adding system, check the height of the electrolyte after charging. When it is below the allowable level (the height of isolation panel or specified height), a volume of qualified distilled water is added to the designated height. If there is too much electrolyte, it shall be pumped out until reaching the designated height;

(b) Check whether there is ponding water in the battery, and the ponding water must be immediately blotted up if any;

(c) Check whether the fastening nuts of positive and negative electrode lead wire and pole column are loose. Tighten up immediately if loose.

(3) Monthly maintenance

(a) Before the end of charging, check the voltage of all the electrode units and battery, and make records;

(b) After the end of charging, the electrolyte density and temperature per unit of battery should be measured, and relevant records are made. If there is a very big difference with previous measurements, professional personnel should be asked to check.

(4) Annual maintenance

(a) Professional examination on insulation resistance of the forklift and battery is carried out once a year. The specified value of insulation resistance of the battery is 500hm/V. The resistance of the whole battery (voltage up to 20V) is at least 10000hm.

(b) Check the charger according to the instruction manual, to ensure that each function is normal.

1.7 General considerations

(1) The battery should be kept clean and dry, which can avoid crawling electric current.

(2) If there is any fluid in the battery box, it must be immediately sucked out through a straw.

(3) If the battery's inside and outside paint or coating is damaged, it shall be repaired immediately, to protect outer box insulation and from corrosion.

(4) If a battery unit needs to be changed, it should be done by professional personnel.

Phenomenon	Fault feature	Reason	Processing method
Sulfation of polar plate	 The capacity decreases during normal discharging. The decline in proportion is lower than normal. The discharge voltage drops quickly. Bubbles form early when charging. PbSO4 crystal bulky. 	 Inadequate initial charging. In the discharging state, the placement time is too long. Inadequate long-time charging. The electro-hydraulic proportion is high. Liquid level is low, and it is exposed to air above the polar plate. The electrolyte is not pure. Internal short circuit. 	 Over-charging method. Repeated charging method. Water treatment.
Excessive active materials fall off	 Precipitation is found in the electro-hydraulic, and there is a brown material rising from the bottom when charging. The battery capacity decreases. 	 Brown precipitation is caused by too large charging current. White precipitation is caused by excessive discharging. Internal impurities of the battery. Blocks fall off, plate quality problem. The cast is paste, for a high specific gravity or temperature for a long time. 	 Plastic shell battery, replaceable polar plate, and remove the precipitation. Charge with small current and adjust the electro-hydraulic density and liquid level height in later stage.
Internal short	 The charging voltage is low. A small quantity of bubbles at the end of charging, or bubbles form later. The charging temperature rises quickly, and the electro-hydraulic proportion has no change. Less discharge capacity, and quick drop in voltage. 	 Conductive objects fall into. The polar plate is bent, and the baffle is damaged. A lot of sediments. 	 Remove the conductive material. Replace the polar plate. Replace the baffle.
Anti-pole	 The battery capacity declines. Voltage decreases obviously. 	 A problem of assembly. Excessive discharge. Charging is not enough, causing sulphation of polar plate. 	 Replace the battery. Independently charge the anti-pole battery.
Electrolyte in trouble	 Proportion, capacity and voltage are low. Too high proportion. The electrolyte is not pure, mixed with impurities. 	 Add water too much or the polar plate sulphates. Add the electrolyte by mistake. The content of distilled water, and electrolyte impurities is out of the prescribed requirements. 	 Adjust the density or eliminate the sulfuric acid salinization. Take out part of the electrolyte and adjust the density. Change the electrolyte.

1.8 Common fault and processing methods of battery

Warning

The above is only for reference to the content of the battery, please operate and maintain the battery according to the user manual of battery.

2. Driving motor and drive system

2.1 Overview

HQX25、HQX35 horizontal battery bridge boxes are a mechanical gearbox composed of three-level cylindrical gear and differential gear, respectively applicable to 2.5~3t, 3.5t of battery forklift truck and other industrial vehicles. (HYMX2531000、HYMX3531000 is the product of Zhejiang Xinchang Huaying Transmission Equipment Co.,Ltd.)

HQX25、HQX35 horizontal battery bridge boxes are integrated with drive axle bridge shell and reduction gearbox shell, the drive axle tube has a steel tube structure, and directly bears the frame weight together with the steering axle, the power input device is AC motor, and the motor and bridge box are in parallel arranged. HQX25、HQX35 horizontal battery bridge boxes run forward or backward directly depending on the positive and reverse operation of the motor, without shifting or reversing operation. Parking and driving brakes are a drum brake, with the function of automatic gap compensation. The wheels and reduction gearbox can be directly connected by half shafts, to output the reduction gearbox power. Compared to a vertical battery forklift reducer, it has the features, such as compact forklift structure, short axial dimensions, small volume, and convenient operation and maintenance.

2.2 Gearbox and differential mechanism

Gearbox is arranged between the drive axle and traveling motor; two pairs of cylindrical helical gears of the mechanism reduce the rotating speed from the driving motor output shaft, and increase the torque from the output shaft, and then the torque is transferred to differential mechanism. The gearbox structure is shown in Figure 2-1 and Figure 2-4(Zhongnan), Figure 2-3 and Figure 2-4 is Huaying gearbox.

Differential mechanism is installed on the first half shell via on the bearing seat at both ends, and the front end is bridged with the axle housing. The shell of the differential mechanism is made into a left and right split structure, with two and a half shaft gears and four planetary gears. The differential mechanism structure is shown in Figure 2-3 and Figure 2-4



- 1. 6207 bearing
- 2. 6208 bearing
- 3. Paper pad
- 4. Input shaft
- 5. Left brake assembly
- 6. Gear combination
- 7. Oil seal collar
- 8. Rotary shaft lip seal
- 9. Bearing
- 10. O sealing ring
- 11. Nut
- 12. Bearing
- 13. Gear combination
- 14. Left bridge box component
- 15. Left brake zipper
- 16. Washer
- 17. Bolt

- 18. Round nut
- 19. Brake hub
- 20. Bearing
- 21. Nut
- 22. Bearing
- 23. Oil seal seat
- 24. Rotary shaft lip seal
- 25. Plug screw
- 26. Combined sealing washer
- 27. Bolt
- 28. Sphere nut
- 29. Washer
- 30. Half-shaft paper pad
- 31. Half shaft
- 32. Washer
- 33. Bolt
- 34. Paper pad

- 35. Plug screw
- 36. Differential mechanism assembly
- 37. Intermediate box
- 38. Right bridge cover component
- 39. Right support plate
- 40. Right brake zipper
- 41. Right brake assembly
- 42. Combined sealing washer
- 43. Vent plug
- 44. Ventilation plug
- 45. Washer
- 46. Bolt
- 47. Washer
- 48. Bolt
- 49. Bearing
- 50. O ring

Figure 2-1 Gearbox (2.5-3.5T Zhongnan)



- 1、Bolt M10×45
- 2、Washer 10
- 3、Half axle
- 4、Half axle paper pad
- 5、Nut M60×2
- 6、Washer 60
- 7、Oil seal TC70×95×10
- 8、Bushing
- 9, Tapered roller bearing 32012X
- 10、Hub
- 11、Tapered roller bearing 30214
- 12、Oil seal set
- 13、O-ring 78×3.5
- 14、Oil seal TC100×130×12
- 15、Nut M18×1.5
- 16, Bolt
- 17、Brake drum
- 18、Hexagon bolt

21、The left axle tube

19、Washer 1420、The left brake

- 22, Box 2
- 23、Bolt M16×45
- 24、Washer 16
- 25、Bolt M12×40
- 26、Washer 12
- 27、Positioning pin
- 28、Ball bearing 6207
- 29、Ball bearing 6208
- 30、Gear 3
- 31、Gear 2
- 32、Gear 1
- 33、Tapered roller bearing 32915X
- 34、Bearing 6009
- 35、 Hexagon head choke plug
- 36、Breather plug
- 37、Valve Z1/8
- 38, Washer
- 39、Hexagon head choke plug
- 40、Box 1
- 41、 Tapered roller bearing 32208
- 42、Nut

- 43、Washer
- 44、Ball bearing 6211
- 45、Locking plate 1
- 46、Bolt
- 47、Gear 4
- 48、Left differential case
- 49、Flat shim
- 50、Ball shim
- 51、 Planetary bevel gear
- 52、Shaft bevel gear
- 53、Cross planetary axis
- 54, Right differential case
- 55、Locking plate
- 56、Nut M10
- 57、Box 3
- 58、The right axle case
- 59、O-ring 90×3.1
- 60、The right holder
- 61、The right brake

Figure 2-2 Gearbox (HYMX2531000 2.5/3.0T)



- 1、Bolt M10×45
- 2 Washer 10
- 3、Halfaxle
- 4、Nut M65×2
- 5、Washer 65
- 6、Oil seal TC42×55×9
- 7、Tapered roller bearing 32013X
- 8、Hub
- 9、Tapered roller bearing 30215
- 10、Oil seal TC85×110×12
- 11、Oil seal seat
- 12、Nut M18×1.5
- 13、Bolt
- 14、Brake drum
- 15、Bolt
- 16、Washer 14
- 17、The left brake
- 18, The left axle tube
- 19、Box 2
- 20、Bolt M16×45

- 21、Washer 16
- 22、Bolt M12×40
- 23、Washer 12
- 24、Positioning pin
- 25、Bearing 6207
- 26, Bearing 6208
- 27、Gear 2
- 28、Gear 3
- 29、Gear 3
- 30、Tapered roller bearing 32915X
- 31、Bearing 62/32
- 32、Bearing 6009
- 33、Hexagon head choke plug
- 34、Breather plug
- 35、Valve Z1/8
- 36、Washer
- 37、Box 1
- 38、O-ring 145×3.1
- 39、Tapered roller bearing 32208
- 40、Nut

- 41、Washer
- 42、Ball bearing 6211
- 43、Bolt
- 44、Gear 4
- 45、Left differential case
- 46、Flat shim
- 47、Ball shim
- 48、 Planetary bevel gear
- 49、Shaft bevel gear
- 50、 Cross planetary axis
- 51、Right differential case
- 52、Locking plate 1
- 53、Nut 10
- 54, Box 3
- 55、The right axle casing
- 56、O-ring 90×2.65
- 57、The right holder
- 58、Hexagon head choke plug
- 59、The right brake ass'y

Figure 2-3 Gearbox (HYMX3531000 3.5T)



Gear ring
 Bearing

6. Universal joint pin

7. Left differential mechanism shell

Planetary gear
 Bolt

3. Right differential mechanism shell

4. Washer

5. Half axle gear

8. Lock washer
 9. Nut

10. Thrust washer

Figure 2-4 Differential mechanism (2.5-3.5T Zhongnan)

2.2.3 Matters needing attention to installation and use

2.2.3.1 When installing, the oil seal oil on the surface of this product should be swabbed clean. To avoid damage to the product, please do not arbitrarily decompose or dismantle the product.

2.2.3.2 The mounting surfaces shall be prevented from being hurt by knocking, to ensure the installation precision and normal use.

2.2.3.3 In the assembly process of gear shaft component, tighten the nut, make the starting torque of gear shaft $3.0 \sim 3.5$ N·m, and finally beat and lock the nut tail along the tooth shaft groove.

2.2.3.4 At the time of brake assembly, there is a need to adjust the clearance regulator of the brake to ensure that the value of the radius clearance between the inside diameter of drum brake and friction plate is 0.5~1.0mm. It is strictly forbidden that oil enters into the left and right brakes.

2.2.3.5 When a wheel hub bearing is equipped, there is a need to fill #3 lithium base lubricating grease with the drop point of 170 into the wheel hub, and its quantity is 50%~70% of the inner cavity volume of the wheel hub, about 130ml to 190ml. After the wheel hub is mounted, tighten the round nut and then return by around 1/8 circle, to ensure that the wheel hub can rotate freely. The rotational torque is 10~30N·m.

2.2.3.6 In the normal use process, the oil level height within the bridge box should be at the height position of the oil plug, the oil temperature is $70 \,^{\circ}C \sim 95 \,^{\circ}C$, and the highest temperature does not exceed 110 $^{\circ}C$. The working oil should be kept clean, containing no impurities; the working oil should be replaced after 100 hours of starting to work initially at the normal oil temperature; then, the working oil should be changed every 1000 hours of use or after long-term out of service and before reuse.

2.2.3.7 After unscrewing the screw and draining oil, need to tighten the screw again, and the tightening torque is $45 \sim 60$ N·m.

2.3 Drive axle

Drive axle consists of bridge shell and wheel hub, installed in the front of the frame.

Bridge shell is of integrally cast structure, tires are prized on the wheel hub by the wheel rim with studs and nuts, the wheel hub is supported on the bridge shell by cone roller bearing, power is passed through a differential mechanism to the half shaft, and the wheel hub is driven by the half shaft and the front wheel is driven to turn, while the half shaft only bears the torque passed to the wheel hub. An oil seal is arranged in the wheel hub, to prevent water and dust entering or oil leakage. The drive axle structure is shown in Figure 2-6 and Figure 2-7.

Front wheel tire and rim model and tire pressure are shown in Table 1-1

Forklift tonnage	2.5T	3.0T	3.5T
Wheel tire	23×9-1	0 18PR	23×10-12
Wheel rim	6.50	F-10	8.00G-12
Tire pressure	1030kPa		Solid tire



2.3.1 Installation of wheel hub

- (1) Fill 100cc lubricating grease into the wheel hub, and then install it on the shaft.
- (2) Tighten the adjusting nut using about 1kg.m torque and then set back by 1/2 circle.

(3) Hang the spring balance on the bolt and measure the starting torque of the wheel hub; slowly lock the nut when reaching the specified value.

Starting torque: 5-15kg.m

4) Mount the lock and lock nut, and lock the locking plate.



Figure 2-6 Fill lubricating grease



2.3.2 Brake

Brake is of two-way brake power type, and is installed on both sides of the drive axle.

Brake is composed of 2 groups of brake shoes, brake cylinders and regulators.

One end of the brake shoe contacts with the fixed pin, and the other end contacts with the adjusting device. Apply the return spring and compression spring rod to press the parking brake.

In addition, a parking brake mechanism and automatic adjusting device are also assembled on the brake. The brake structure is shown in Figure 2-9 and Figure 2-10.



- 1. Brake bottom plate assembly
- 2. Clearance adjusting sleeve
- 3. Friction plate assembly
- 4. Resilient pad
- 5. Hand brake lever
- 6. Return spring
- 7. Gasket
- 8. Ejector rod
- 9. Tension spring
- 10. Hand brake push rod
- 11. Compression spring
- 12. Adjusting lever
- 13. Pressure spring seat
- 14. Spring

- 15. Pressure spring cover
- 16. Spring
- 17. Pressure spring seat
- 18. Pressure spring pull rod
- 19. Fulcrum post
- 20. Gasket
- 21. Rubber plug
- 22. Brake steel wire assembly (left)
- 23. Brake steel wire assembly (right)
- 24. Washer
- 25. Brake cylinder
- 26. Brake cylinder shield
- 27. Brake cylinder piston top rod
- 28. Piston

Figure 2-9 Brake (2.5-3.0T)

- 29. Pump leather cup
- 30. Brake cylinder spring
- 31. Brake cylinder oil plug
- 32. Brake cylinder bleeder screw
- 33. Pump bleeder screw shield
- 34. Dust cover
- 35. Rivet
- 36. Backing plate
- 37. Fulcrum post
- 38. Clearance adjusting bolt
- 39. Washer
- 40. Clearance adjusting lever



- 1、Bolt M8×25
- 2、Washer 8
- 3、Glue plugging
- 4、Pull rod
- 5、Left brake baseboard

9、Pressure spring seat

- 6、Pin
- 7、Pull rod
- Brake shoe hand friction disc assembly
- 10、Compression spring11、Tension spring12、Left pawl
- 13、Left torsion spring
- 14、Left gap regulator assembly
- 15, Spring tension device
- 16、Left return spring (rear)
- 17、Guide block
 - 18、Left return spring (front)

- 19、Guide plate
- 20、Left brake shoe hand
- friction disc assembly
- 21、 Breke subpump assembly
- 22、Pin
- 23、Push rod
- 24、Washer
- 25、Washer
- 26、Spring
- 27、Brake cable assembly
- Figure 2-10 Brake (3.5T)
- 2.3.3 Matters needing attention to installation and use

2.3.3.1 When installing, the oil seal oil on the surface of this product should be scrubed clean. To avoid damage to the product, please do not arbitrarily decompose or dismantle the product.

2.3.3.2 The mounting surfaces shall be prevented from being hurt by knocking, to ensure the installation precision and normal use.

2.3.3.3 The working oil should be kept clean, containing no impurities; the working oil should be replaced after 100 hours of starting to work initially at the normal oil temperature; then, the working oil

should be changed every 1000 hours of use or after long-term out of service and before reuse.

(1) Action of the brake

The brake cylinder applies the same force onto the primary brake shoe and secondary brake shoe to press the drum brake, until the upper end of the secondary brake shoe presses against the fixed pin, and the brake shoe moves to the rotating direction of the drum brake.

After the fixed pin is pressed against, the friction between the friction plate and drum brake increases, and the pressure on the secondary brake shoe from the primary brake shoe is much larger than the brake cylinder pressure, resulting in a large braking force.

The action of the brake when backing is opposite to the forward direction.



Figure 2-11 Forward action



Figure 2-12 Backing action

(2) Parking brake

Parking brake device is assembled in the wheel brake, and is composed of pull rod and push rod. Pull rod is installed on the side of primary brake shoe with pin, and the movement of the pull rod is passed through the push rod to the secondary brake shoe.



Figure 2-13 Parking brake device

(3) Clearance auto-adjusting mechanism

Clearance auto-adjusting mechanism can enable to maintain the proper clearance between the friction plate and drum brake.

Clearance auto-adjusting mechanism works only when driving in reverse.



Figure 2-14

▲ Action of clearance auto-adjusting mechanism

Operate the brake when the forklift backs away, and the secondary brake shoe and the primary brake shoe contact and rotate together, so that the pull rod turns to the right around point A, as shown in Figure 2-18, when the point B is raised; after the brake is released, the pull rod turns to the left under the action of spring force, and the point B declines. When the clearance between the friction plate and brake hub becomes large, the vertical distance where the point B turns is increased, a tooth of the regulator is dialed, the adjustment lever becomes long (see Figure 2-15), and the clearance narrows accordingly. The adjusting range of the clearance is shown in the following table:

Model	2.5T-3.0T	3.5T
Clearance	0.40~0.45mm	0.25~0.40mm



As shown in Figure 2-15 Clearance auto-adjusting mechanism

2.3.4 Disassembly and adjustment points of the brake

This section describes the decomposition and assembly of the brake, and adjustment method 3T brake pedal in the removal condition of the wheel and wheel hub. This section applies to brake, and although the adjusting structures of other models are different, the maintenance methods are basically the same.

(I) Decomposition of the brake

(1) Dismantle the support pin, adjustment lever, adjusting device and spring of secondary brake shoe.



Figure 2-16

(2) Dismantle the shoe return spring.



Figure 2-17

(3) Dismantle the fixed spring on the primary brake shoe.



Figure 2-18

(4) Dismantle the primary brake shoe and secondary brake shoe. Dismantle the regulator and regulator spring at the same time.



Figure 2-19

(5) Dismantle the brake pipe from the brake cylinder, then dismantle the mounting bolt of the brake cylinder, and dismantle the brake cylinder from the brake bottom plate.



Figure 2-20

(6) Dismantle the E-shaped baffle ring on the brake bottom plate for fixing brake cable. Then, dismantle the bolt for installing the brake bottom plate, and remove the brake bottom plate from the drive axle.



Figure 2-21

(7) Dismantle the brake cylinder: dismantle the dust ring. Press the piston on one side and hold up the piston on the other side, and then press the piston with finger



Figure 2-22

(II) Brake inspection

Parts inspection, repair or replacement of damaged parts

 Check whether there is rust on the inner surface of the pump body and around the piston And then determine the clearance between the piston and the pump body. Standard size: 0.03~0.10mm
 Limit size: 0.15mm

Limit size: 0.15mm



Figure 2-23

- (2) Visually check whether the piston cup is damaged and deformed, and replace if abnormal.
- (3) Measure the free length of the brake cylinder spring, and replace it if more than the reference.
- (4) Measure the thickness of the friction plate, and replace if more than the wear limit.



Figure 2-24

(5) Visually check the inner surface of the drum brake, and grind and correct; replace if over the correction limit if it is damaged or unevenly worn.

Model Type	2.5-3.0T	3.5T
Standard value	310mm	314mm
Limit value	312mm	316mm



Figure 2-25

(III) Brake assembly

(1) Brush brake fluid onto the cup and piston of the brake cylinder, and assemble the spring, piston cup, piston and dust ring in order.

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

(3) Install the backing baseplate on the drive axle.

(4) As shown in Figure 2-26, coat heat-resistant lubricating grease everywhere, and keep careful not to apply onto the friction plate.



Figure 2-26

(5) Clamp the parking brake cable with E-shaped baffle ring.

(6) Install the brake shoe with a fixed spring.

(7) Install the compression spring onto the hand brake push rod, and then mount the push rod onto the brake shoe.



Figure 2-27

(8) Install the brake shoe guide plate onto the fulcrum post, and then install the brake shoe return spring. At first, install the main shoe, and then install the secondary shoes.

(9) Install the regulator, regulator spring, ejector rod and ejector rod return spring.

Pay attention to the following points:

(a) Direction of regulator thread and its mounting direction;

(b) Direction of regulator spring (do not allow the regulator teeth to contact the spring);

(c) Direction of ejector rod return spring (the spring hook on the fulcrum post should be fixed on the relative side of the ejector rod);

(d) The lower end of the adjusting lever must contact the regulator teeth.



Figure 2-28

(10) Connect the brake oil pipe to the pump.

(11) Measure the inner diameter of the drum brake and outer diameter of the brake shoe, regulate the speed controller to make the difference between the inner diameter of the drum brake and the outer diameter of brake shoe friction plate is 1mm.



Figure 2-29

(IV) Operation test of brake clearance regulator

(1) First of all, make the diameter of the brake shoe close to the designated installation size, pull the adjusting lever with a hand to rotate the regulator, and when the hand is released, the adjusting lever returns to its normal position and the regulator gear does not turn.

Note: even when loosening the hand, the regulator gear returns with the adjusting lever, and the regulator can still work normally after being loaded.

(2) If the regulator can act as above when pulling the adjusting lever, the following inspections shall be done:

(a) Mount the adjusting lever, ejector rod, ejector rod spring and compression spring seat firmly;

(b) Check whether the ejector rod return spring and regulator spring are damaged, then check the rotation of the regulator gear and whether the meshing part is excessively worn or damaged. Check whether the lever contacts with the gear. Replace the damaged parts.



Figure 2-30

2.4 Driving motor

2.4.1 Specification of driving motor

Item Model	Model of driving motor	Rated power kw	Rated voltage V
25D 7A	YDQ8.5-4-9200 (KDS)	0.5	DC49
23 D- /A	AHT8.5-4030B (JIEHELI)	0.5	DC48
30B-7A	YDQ11.5-4-9200 (KDS)	11.5	DC%0
35B-7A	AHT11.5-4030C(JIEHELI)	11.5	DC80

2.4.2 Environmental conditions for use

The motor should be able to run normally in the following environment:

- (1) No more than 1200m above sea level;
- (2) Change range of ambient air temperature: $-25 \degree C \sim +40 \degree C$;
- (3) Relative humidity up to 100%.

- 3. Lifting motor and installation
- 3.1 Model and specification of lifting motor

Item Model	Model of lifting motor	Rated power kw	Rated voltage V
25D 7A	YDB11-4-9200 (KDS)	11	DC48
23 D- /A	AST11-4010BK (JIEHELI)	11	DC40
30B-7A	YDB15-4-9200 (KDS)	15	DC80
35B-7A	AST15-4010CK (JIEHELI)	15	DC80

4 Electrical systems

4.1 Overview

Electrical system mainly includes motor controller, instrument and auxiliary electrical equipment (switches, lamps and lanterns, audible device, etc.). According to different forms of the motor and its controller, it is also classified into two models, AC and DC separate excitation, of which Italian ZAPI controller is used for the AC model.

4.2 Characteristics of AC electric control





Figure 4-1 Controller outline and characteristics (AC motor controller)

A set of ACE2 motor controller produced by ZAPI is adopted for the AC controller of such series vehicles, with motor speed and temperature feedback microprocessor control, regenerative braking and CAN BUS communication interface. It can be very convenient to control the vehicle's traction and oil pump precisely. The motor controller can also be adjusted online through a hand-held unit or truck-mounted instrument (authorized) according to different working environments and type of driven load, in order to achieve the perfect using efficiency and performance. At the same time, the controller also has a complete fault self-diagnosis function, and can give the fault codes of common faults, convenient for maintenance personnel to judge and analyze the failure parts, clear the fault in the shortest possible time, and thus to reduce the loss of work delay caused by the vehicle fault.



TIEW	INTME	WTI T	TIMENT	
T TTM	NIMME	TTEM	NAME	TFM
27	Brake SW	14	Fuse box	1
28	Horn but ton	15	Combination SW	2
29	Fan	16	Side light	3
30	Battery	17	Head light	4
31	Fuse	18	Turn light	5
32	Emergency stop SW	19	Brake light	9
33	Key SW	20	Reverse light	7
34	DC convertor	21	Buzzer	8
35	Seat SW	22	Reverse work light	6
	Direction SW	23	Diode	10
	Lift POT	24	Horn	11
	Acclelrator	25	Flasher	12
	Hand brake SW	26	Turn signal SW	13
	35 34 33 33 33 33 33 33 33 33 33 32 33 29 28 28 27 27	Hand brake SW Acclelrator Lift POT Direction SW Seat SW SW Seat SW SW SW SW SW SW SW SW SW SW SW SW SW S	26 Hand brake SW 25 Acclelrator 24 Lift POT 23 Direction SW 35 Seat SW 35 21 Dc onvertor 34 20 Key SW 33 21 Dc onvertor 34 20 Key SW 33 19 Emergency stop SW 32 18 Fuse 31 17 Bat terry 30 16 Fan 29 15 Horn button 28 14 Brake SW 27	Turn signal SW 26 Hand brake SW Flasher 25 Acclelrator Horm 24 Lift POT Diode 23 Direction SW 35 Reverse work light 22 Seat SW 35 Buzzer 21 DC convertor 34 Reverse light 20 Key SW 33 Brake light 19 Energency stop SW 32 Turn light 17 Battery 30 Head light 16 Fane 31 Head light 16 Fane 32 Turn light 16 Fase 32 Head light 16 Fase 30 Side light 16 Fase 31 Head light 17 Battery 29 Side light 16 Fan 20 Side light 16 Fan 28 Head light 16 Fan 28 Fuse box 14 Brake SW 27



Reversewidthlight main contactor Alarm lamp display fuse NAME ITEM 33 35 3432 31 multi-way valve switch handbrake switch travel motor pump motor controller NAME 26 TEM 30 29 28 27 switch accelerate F/R switch lift pot. DC-DC seat NAME ITEM 25 24 23 22 21 S. stop key switch emergency battery NAME fuse fan ITEM t igh 20 19 11 16 SWI lamp brake switch horn switch cornering flash horn NAME 15 14 ITEM 77 13 Ξ lanp back lamp lamp buzzer brake diode work] NAME ITEM 10 و σ \sim cornering lamp lamp switch width lamp head lamp fuse box NAME പ ITEM ~ ~1 4

3T, 3.5 T Figure 4-2 Electrical system diagram (ZAPI Electric Control)



Figure 4-3 Display(ZAPI)

SMART DISPLAY display device is a kind of intelligent dashboard connected to vehicle system through CAN bus. The intelligent instrument provides the diagnosis and settings of the vehicle system. Diagnosis and settings include: intelligent display itself, traction controller, lifting controller, and valve controller. The intelligent display menu enters into the SMART instrument menu by six operation buttons on the touch keyboard. SMART display has six built-in red light emitting diodes, which can provide operators with some summary information about vehicles. Liquid crystal display can also provide fault code, for instance the following drawing shows the failure with error code "60" at the system node "5" and the failure with error code "66" at the system node "2". The vehicle usually stops when the "ALARM" failure occurs, and the level of "WARNING" failure will be lower, when the vehicle sometimes stops and sometimes the output power is reduced.

ALARM 60	WARNING 66
ON NODE 5	ON NODE 2

There is a liquid crystal display on the right place in the middle of the header, used to display electric quantity and speed.

Three symbols tell the operators to act based on the following:



Hourglass symbol (A) the hour meter is working when the symbol flashes.

_			
ſ			
	÷	-	

Battery symbol (B) the battery power shown is insufficient when the light on the symbol is on.



Adjustable wrench symbol (C) when the symbol flashes, the maintenance requirements or specified warning are set by program. In this case the relevant codes will be displayed.

Warning

When there is a fault code to appear, please immediately stop operating, until the fault is eliminated. When the electric quantity shown is less than "20", please stop operating, and recharge in time.

4.3 Common fault code of AC electric control

CODE OF	COMMON	TRACTION	FAULT
CODLOI	COMMON	INACTION	TAULI

Code	Fault name	Description	Conditions for removing the fault
13	EEPROM KO	EEPROM error	The controller will use initial parameters.
	LOCIO		Hardware failure generated by current
17	LOGIC	Logic card fault #3, overload protection	protection caused by the logic card. The
	FAILURE#3	of hardware circuit	logic card needs to be replaced.
		Logic card fault #3, U, V and W voltage feedback circuit error	Hardware failure of phase voltage
18	LOGIC FAILURE#2		feedback caused by logic card. The logic
			card needs to be replaced.
		LOGIC FAILURE #1, logic card fault #1,	The under voltage/over-voltage
			protection fault signal is triggered and
			generated by interrupt, and there are two
			reasons:
19	LOGIC FAILURE#1		1. Under voltage/overvoltage situation
		over voluge of under voluge detected	does exist.
			2. Hardware failure of overvoltage
			protection caused by logic card. The
			logic card needs to be replaced.
			This alarm takes place. It is possibly
			caused by the reasons below:
		Low VMN high VMN	1. Motor connection or motor circuit
	VMN LOW/	Motor power output error: power	error; check whether the motor's
30/31		component or MOS tube driving circuit or motor failure	three-phase connection is correct and
	VMN HIGH		the vehicle's power matches with the
			motor power.
			2. If inverter power failure, there is a need
			to replace the controller.
			Before the main contactor is driven,
			check whether the controller's main
	CONTACTOR CLOSED		contactor contact is adhesive. The
			controller will drive the main circuit
37		Main contactor's contact is adhesive	within a short time, trying to release the
37		Wall contactor's contact is adhesive	surplus electricity of the capacitor. If it is
			not released, there will be a mistake.
			Suggest checking whether the contactor
			contact has a phenomenon of mechanical
			adhesion.
38	CONTACTOR OPEN		Main contactor coil has been driven by
		Main contactor can not suck or contactor is bad	logic card, but the contactor is not closed.
			There are two possible reasons below:
			1. The coil is disconnected or not well
			connected.
			2. The contactor contact can not work
			normally.
52	OTDV LUCU	High static electric current, and current	The signal output from current sensor and
53	21BA LHIGH	sensor feedback circuit voltage fault	detected by micro control system is

			beyond the allowed scope of not running
			current. It is possibly caused by the
			reasons below:
			1. Current sensor fault.
			2. Logic card failure: replace the logic
			card at first, and if the failure remains,
			replace the power unit.
			Possibly caused by the reasons below:
			1. The charging resistor is open circuit.
	CAPACITOR		2. The charging circuit malfunctions.
(0)		Capacitor pre-charging failure	3. There is something wrong with the
60	CHARGE		power part.
			4. Before the main contactor is closed,
			check whether the contact output has
			leakage phenomenon.
			Possibly caused by the reasons below:
			1. The charging resistor is open circuit.
			2. The charging circuit malfunctions.
(0)	CAPACITOR		3. There is something wrong with the
60	CHARGE	Capacitor pre-charging failure	power part.
			4. Before the main contactor is closed,
			check whether the contact output has
			leakage phenomenon.
			The controller temperature is high; if the
(2)	TH DROTECTION	Over termenter and stice	actual temperature of the controller is not
02	TH. PROTECTION	Over temperature protection	high, the internal temperature sensor fails,
			Replace the controller.
			Possibly caused by the reasons below:
			1. High motor temperature.
65	MOTOR	High motor temperature	2. If the actual temperature of the motor
05	TEMPERATURE	righ motor temperature	is not high, first check the circuit and
			motor temperature sensor. If normal,
			there is a need to replace the controller.
66	BATTERY LOW	Low power failure	Charge the battery.
			When the electric lock is closed, the
			microprocessor tests whether the main
			contactor driver is shorted circuit; if so, it
74	DRIVER SHORTER	Main contactor coil driver is shorted circuit	will alarm. First, check whether the
			external circuit is shorted circuit; or
			whether the impedance between C26 and
			- BATT (between negative electrode of
			main contactor and negative electrode of
			battery) is lower. If external reason can't
			be found, the controller will be replaced.
	CONTACTOP	Main contactor coil driver circuit is	After the completion of initial diagnosis,
75	DRIVER	disconnected (it can't provide the correct	close the main contactor by the traction
		drive voltage)	controller, and check the drain voltage of

			drive MOS tube. If the drain voltage of
			MOS tube is not low, the driver can't be
			closed, and fault signal is produced.
			Replace the controller.
			Test in standby mode. When alarming,
			the accelerator voltage is above 1V more
			than the minimum voltage set through the
78	VCC NOT OV	Accelerator signal failure	PROGRAM VACC function. Possible
78	VCC NOT OK		reasons are below:
			1. Accelerator setting error
			2. There is something wrong with the
			accelerator.
			Possible reasons are below:
			1. The forward, backward or accelerator
			allows the switch to be damaged.
79	INCORRECT	Startup sequence error	2. Wrong operating sequence.
	START		3. If no problem by checking, but error
			still exists, the logic card needs to be
			replaced.
			Possible reasons are below:
			1 The line or switch fails
80	FORWARD+	Forward and backward two requests	2 Check whether there is problem and if
00	BACKWARD	occur at the same time	the error still exists the logic card
			needs to be replaced
			First check the encoder connection and if
87	ENCODER ERROR	Encoder error	there is something wrong with the line
02	LIVCODER ERROR		there is a need to replace the encoder
			Possible reasons are below:
			1 Check whether the instrument is in
			treachle
217	CANBUS KO DISP	Instrument communication disconnected	trouble.
			2. Check whether the CAN
			communication line connected to the
			instrument and the controller falls out.
218	TORQUE PROFILE	Torque parameter error	Check the controller parameters, and if no
			problem, replace the controller.
220	PROG VACC NOT OK	Accelerator signal failure	Test in standby mode. When alarming,
			the accelerator voltage is above 1V more
			than the minimum voltage set through the
			PROGRAM VACC function. Possible
			reasons are below:
			1. Accelerator setting error
			2. Accelerator fault
			3. Controller fault
			Test in standby mode. When alarming,
220	PROG VACC NOT OK	Accelerator signal failure	the accelerator voltage is above 1V more
			than the minimum voltage set through the
			PROGRAM VACC function. Possible
			reasons are below:
-----	----------------	---	--
			1. Accelerator setting error
			2. Accelerator fault
			3. Controller fault
221	SEAT MISMATCH"	Seat switch signal input error	Check the seat switch
			Check the connection between the
	WAITING FOR		controllers, and check whether the inside
222	NOOD	Waiting for the node response	parameters of the controller are correct; if
			no problem, replace the controller.
223	WATCHDOG #1	The controller's internal communication	Replace the controller.
		14115	Check whether there is any connection
		Auxiliary coil short circuit (A18 port	with A18 port and check the wiring in
224	AUX COIL SHORT	short aircuit)	the absence of connection replace the
		short circuit)	
			Tast in standbarmada When alamina
			Test in standby mode. when alarming,
			the accelerator voltage is above 1 v more
			than the minimum voltage set through the
226	VACC OUT RANGE	Accelerator signal failure	PROGRAM VACC function. Possible
		C C	reasons are below:
			1. Accelerator setting error
			2. Accelerator fault
			3. Controller fault
227	WATCHDOG #2	The controller's internal communication fails	Replace the controller
			The fault is alarmed if after the person
			leaves the seat for a certain period of
228	TILLER OPEN	Safety direction switch disconnected	time, and it can be removed when
			reclosing the electric lock or closing the
			foot brake switch.
			If the controller's internal logic circuit
229	SAFETY INPUT	Safety switch input failure	fails, replace the controller.
230	MC COIL SHORT	Main contactor coil short circuit	Replace the contactor
	COIL SHORT HW	Internal main contactor and auxiliary	·r ·····
231	КО	hardware of the controller short circuit	Replace the controller
	-		1. Check whether the key switch contacts
			are in good condition
			2 Check the key switch peripherals (DC -
222	VEV OFE SHOPT	Detect an instantaneous low level on the	DC horn etc.)
232	KET OFF SHOKT	key switch when the motor is switched on	2 Chack whather the motor has looked
			ond the voltage will be lowered do
			when starting we
	DOWED MOS	The MOS take inside the controll	when starting up.
233	FUWER MUS	the WOS tube inside the controller is	Replace the controller.
	SHUKI	shorted circuit	
			1. Cneck whether the hand brake wiring
235	HANDBRAKE	Hand brake failure	is correct, and whether the contacts are
			in good condition.

			2. Check whether the hand brake wiring
			has voltage input.
236	CURRENT GAIN	Current sensor fault	Replace the controller.
227		The controller's internal data conversion	Restart the vehicle, and if it has been
237	ANALOG INPUT	fails	repeated, replace the controller.
			1. Poor contact of motor phase line.
220	WRONG 0	Mater sinerit for 14	2. Motor's internal short circuit.
238	VOLTAGE	Motor circuit fault	3. Motor and shell short circuit.
			4. Controller fault
239	SAFETY OUTPUT	Internal damage to safety output switch	Replace the controller.
240	HARDWARE FAULT	The controller's internal hardware fails	Replace the controller.
241	FLASH		The software fails or the internal chip of
241	CHECKSUM	Software boot self-checking fault	the controller is damaged.
2.42	ENCODER		Check whether the encoder line drops
242	LOCKED	The encoder is locked	out, and the contact is good.
			Possibly caused by the reasons below:
			1. High motor temperature.
242	SENS MOT TEMP	High motor temperature	2. If the actual temperature of the motor
243	КО	High motor temperature	is not high, first check the circuit and
			motor temperature sensor. If normal,
			there is a need to replace the controller.
244	SOFTWARE	Internal testing of controller activers	Set the parameter DEBUG
244	ERROR	Internal testing of controller software	CANMESSAGE to OFF.
245	WRONG RAM	The controller's internal storage fails	Try to restart and if it has been repeated,
243	MEMORY	The controller's internal storage fails	replace the controller.
			Check whether there is any connection
246	ALLY DRIV ODEN	Auxiliary driver open circuit (A18 port	with A18 port, and check the wiring; in
240	AUX DRIV.OFEN	open)	the absence of connection, replace the
			controller
248	NO CAN MSG	Without CAN communication	Traction and oil pump instrument without
240	NO CAN MSO		CAN communication signals
	CHECKID		Reset the controller's internal
249	NEEDED	Remind of maintenance period	maintenance time; or close the function
	NEEDED		directly.
250	THERMIC	Temperature sensor fault (inside the	Replace the controller
	SENS.KO	controller)	
251	WRONG SET BAT	The set battery fails, and the voltage on the key end is 20% different from normal voltage	When closing the electric lock, the controller will detect the battery voltage and compare with the set value of the parameter "SET BATTERY'. If the actual value is higher than the set value or lower
			by 20%, an error may be produced.

5. Steering device and installation

5.1 Overview

Steering device and installation is mainly composed of steering wheel, steering hub column, connecting shaft and hub column bracket. The upper universal joint of the steering device is connected to the steering wheel through the steering hub column, the lower part is connected to the steering through the connecting shaft, and the steering hub column can be tilted to the appropriate location toward the front and back, as shown in Figure 5-1



Figure 5-1 Steering device

5.1.1 Inspection after re-installation of steering system

(1) Turn the steering wheel toward the left and right to check whether the left and right force is uniform and whether the rotation is smooth;

(2) Check whether the hydraulic piping layout is correct, and whether the left and right steering is installed reversely;

(3) Top up the rear wheels, slowly turn the steering wheel toward the left and right, repeat for several times, and remove the air in the hydraulic piping and cylinder.

5.1.2 Steering system fault diagnosis

Problem	Reason analysis	Elimination method
Fail to turn the steering	Oil pump is damaged or malfunctions	Replace
wheel	Hose or joint damaged or blocked	Replace or clean
	The safety valve pressure is too low	Adjust the pressure
The steering wheel feels	There is air in oil pipe	Remove the air
	Steering reset fails, and the positioning spring	Penlace the spring
ncavy	is broken or lacks of elasticity	Replace the spring
	Gas leakage in the steering cylinder is too big	Check the piston sealing
Forklift crawls or swings	The spring is broken or has no elasticity	Replace
Loud working noise	Low oil level in the fuel tank	Refuel

	The suction pipe or oil filter is clogged	Clean or replace
	The guide sleeve sealing of the steering	
Oil leakage	cylinder is damaged or the pipeline or joint is	Replace
	damaged	

6. Steering axle and installation

6.1 Overview of steering axle

Steering axle is made in the form of welded structure with box cross section, and it consists of steering bridge, steering cylinder, connecting rod, knuckle and wheel hub and other components. Steering trapezoid has a slider-crank mechanism, the oil cylinder piston rod drives the knuckle to steer through the connecting rod, and thus the steering wheel offsets, so as to achieve steering.

Steering axle structure is shown in Figure 6-1 and Figure 6-2. Figure 6-3.

The model of steering axle tire, rim and tire pressure refer to the table below:

Forklift tonnage	2.5T	3.0T	3.5T
Model number	Z02A1-20000 Z03A2-2		20000
Tyre	18×7-8 14PR		200/50-10
Wheel rim	4.33R-8 4.33R-8		6.50F
Tire pressure	970kpa		Solid tire



Figure 6-2 Steering axle (2.5T)



1. Round pin	14. Wheel hub	27. Connecting rod pin
2. Spring washer 14	15. Wheel hub nut	28. Straight-through grease nipple M6
3. Bolt M14×45	16. Tapered roller bearing 30207	29. Steering cylinder assembly
4. 90°neck-bent grease nipple Z1/8	17. Washer	30. Single direction thrust ball bearing
5. Main pin	18. Slotted nut M30×2	31. Left knuckle assembly
6. Oil seal	19. Wheel hub cover	32. Bushing
7. Needle bearing	20. Nut M12	33. Adjustable pad
8. Steering axle assembly	21. Hexagon socket set screw with cone point M30×30	34. O ring
9. Bolt M12×35	22. Cotter pin 6.3×50	35. Flat washer 14
10. Nut M12	23. Right knuckle assembly	36. Bushing
11 01 1	24. Centripetal knuckle bearing	
11. Oil seal	GE16ES	
12. Tapered roller bearing 32209	25. Connecting rod	
13. Wheel hub bolt	26. Retaining ring for shaft	

Figure 6-3 Steering axle (3.0/3.5T)

(1) Knuckle

Knuckle is installed between the upper and lower ends of the steering axle by use of steering king pin, tapered bearings, dust cover and "O" ring, the upper end of the king pin is fixed on the axle with a stopper, the lower end of the king pin is fixed on the axle with a split pin, and the bearing is supported by the cone bearing pressing on the axle (as shown in Figure 6-4)



- 1. Thrust bearing
- 2. Knuckle
- 3. Fixed pin

6. Needle bearing Figure 6-4 Knuckle

(2) Steering cylinder

Steering cylinder is a double-acting piston cylinder, both ends of the piston rod are connected through connecting rod to the knuckle, and the pressure oil from the hydraulic orbitrol enables the piston rod through the steering cylinder to rotate toward the left and right, so as to realize left and right turning. The piston sealer is a combined sealing of support ring and O ring, Yx circle axial seal is arranged between the cylinder head and piston rod, and the oil cylinder through the cylinder heads on both sides is fixed on the steering axle. (As shown in Figure 6-5)





(3) Wheel hub

Wheel hub is installed on the knuckle with two conical roller bearings, wheels are pried onto the wheel hub by rim, an oil seal is arranged inside the bearing, the lubricating grease is kept in the wheel hub and knuckle cavity, and the tightness of the bearing is adjusted with a nut.

6.2 Adjustment and maintenance points

6.2.1 Adjustment of pre-load on the steering wheel bearing

(1) As shown in Figure 6-6, lubricating grease is filled into the inner cavity of the wheel hub, internal and external bearing and wheel hub cover, and at the same time, some lubricating grease should also be applied to the oil seal lip;



Figure 6-5 Adjustment of pre-load

(2) Fix the bearing outer ring onto the wheel hub, and load the wheel hub onto the knuckle;

(3) Mount the flat washer and screw down the slotted nut, with the torque of $206\sim235$ N.m ($21\sim24$ kgm), loosen the slotted nut back, and then screw the nut, with the torque of 9.8N.m (1kgm);

(4) Tap the wheel hub with a wooden hammer, and rotate the wheel hub for $3\sim4$ circles, to ensure that the wheel hub is not loose;

(5) Tighten the slotted nut to make the slot align the split pin hole in the knuckle;

(6) Tap the wheel hub with a wooden hammer, turn the wheel hub by hand for $3\sim4$ circles, in order to ensure smooth rotation, and determine the rotational torque of the wheel hub and the value is $2.94\sim7.8$ N.m ($0.3\sim0.8$ kgm);

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

(8) After its rotational torque is reached, lock the slotted nut with a split pin.

7. Hand brake control

7.1 Overview

Hand brake control is mainly composed of hand brake assembly and anchor clamp. (As shown in Figure 7-1).

7.2 Parking brake control device

The parking brake handle is cam type, and can be used to adjust the braking force of the regulator on the end of brake handle.

Adjustment of the braking force:

Turn the regulator clockwise, and the braking force rises; rotate the regulator counterclockwise,

and the braking force decreases.

Pull: 200~300N

Note: as for 1~3.5T forklift, turn the screw in the regulator to adjust.



Figure 7-1 Hand brake control

- 8. Foot brake control
- 8.1 Overview

The foot brake control is composed of foot brake assembly, left and right brake oil pipe and brake fluid tank.

8.2 Foot brake pedal

The foot brake pedal structure is shown in Figure 8-1, and it is installed on the gearbox or frame through brackets.

The pedal converts the stepping force acting on the pedal into brake oil pressure through the push rod of the brake master pump.



Figure 8-1 Foot brake control

8.2.1 Adjustment of foot brake pedal

(1) Shorten the push rod;

(2) Adjust the locking bolt, and adjust the pedal height as shown in Figure 8-2;

(3) Step down the brake pedal, and lengthen the push rod, until the front end of the push rod contacts the master pump piston;





Figure 8-2

Figure 8-3

- (4) Tighten the lock nut of the push rod.
- ▲ Adjustment of brake switch
 - (a) After the height of the brake pedal is adjusted, loosen the brake switch locking nut;
 - (b) Remove the plug to separate wires;
 - (c) Turn the switch, to keep the clearance A=1mm;
 - (d) Confirm that the brake light should be when the brake pedal is stepped down.

8.3 Brake master pump

Master pump includes a valve seat, a one-way valve, a return spring, and cup, piston and auxiliary cup. The ends are fixed with a lock washer and locking steel wire, its outer part is protected through the rubber dust cover, and the master pump piston works by virtue of the push rod by means of operating the brake pedal; when stepping down the brake pedal, the push rod pushes the piston forward, and the brake fluid in the pump body flows back to the storage tank through the return oil outlet, until the main cup blocks back the return oil hole; after the main cup pushes through the oil return outlet, the brake fluid in the front cavity of the master pump is compressed and the one-way valve is opened, and flows through the brake pipe into each pump; in this way, each pump piston protrudes outward to make the brake shoe friction plate and drum brake contact, to achieve the effect of deceleration or braking, and at this point, the piston rear cavity is added by the brake fluid from the return oil outlet and inlet. When loosening the brake pedal, the piston is pressed by the return spring, and at the same time, the brake fluid in each brake cylinder is also compressed by the brake shoe return spring, so that the brake fluid through the one-way valve returns to the master pump (piston front cavity), and the piston comes back in situ; the brake fluid in the master pump flows through the oil return outlet back to the fuel tank, and the one-way valve pressure is adjusted to a certain proportion with the residual stress in the brake pipeline and brake cylinder, so that the pump leather cup is mounted correctly in case of oil leakage, so as to eliminate the phenomenon of gas resistance possible when braking under emergency. Figure 8-4 shows the brake master pump structure.



8.4 Fault diagnosis

Problem	Reason analysis	Elimination method
	1. The brake system leaks oil	Repair
	2. The brake shoe clearance is not adjusted	Adjust the regulator
ike	3. The brake is overheating	Check whether to skid
d bra	4. The drum brake and friction plate are in poor contact	Re-adjust
Ba	5. Impurities are attached to the friction plate	Repair or replace
	6. Impurities are mixed in the brake fluid	Check the brake fluid
	7. The brake pedal (micro valve) is improperly adjusted	Adjust
ke	1. The friction plate surface is hardened or impurities	Repair or replace
e bra	are attached to it	Repair or replace
n the	2. The base plate is deformed or bolt is loose	Repair or replace
ing i	3. The brake shoe is deformed or its installation is not	Replace
exist	correct	Repair
oise (4. The friction plate is worn	
й	5. Wheel bearing becomes loose	
50	1. The friction surface has oil pollution	Repair or replace
aking	2. The brake clearance is not adjusted	Adjust the regulator
n bra	3. The pump fails	Repair or replace
Jeve	4. The brake shoe return spring is damaged	Replace
Ŋ	5. Drum brake is skewed	Repair or replace
g	1. The brake system leaks oil	Repair or replace
raki	2. The brake clearance is not adjusted	Adjust the regulator
or b	3. The brake system is mixed with air	Deflate
Pc	4. The brake pedal is not correctly adjusted	Re-adjust

9. Hydraulic oil tank and installation

9.1 Overview

Hydraulic oil tank and installation is mainly composed of fuel tank, fuel tank cover, magnet, filter element, breathing apparatus, fuel tank cover, oil drain plug, sealing gasket, etc.

9.2 Hydraulic oil tank

2.5-3.5T Hydraulic oil tank is arranged behind the battery. The fuel tank is equipped with oil absorption oil filter, and a return oil filter is mounted in the oil return pipe, to ensure the supply of clean oil.

10. Hydraulic system

10.1 Overview

Hydraulic system consists of oil pump, multiway valve, orbitrol, oil pipe, connectors and other components. Hydraulic oil is supplied by the oil pump directly connected with the motor. Multiway valve assigns oil to each cylinder through oil pipe. Figure 10-1 shows the hydraulic principle diagram



Figure 10-1 Hydraulic diagram

10.2 Gear pump

Gear pump is driven by lifting motor to supply oil to the multiway valve. The gear pump structure is shown in Figure 10-2.

10.2.1 Maintenance of gear pump

(1) Decomposition

Before decomposition, it should be thoroughly cleaned, the dismantled parts should be put on the clean paper or cloth, and it should be careful not to stain or damage the parts.



- 1. Pump body
- 2. Drive gear
- 3. Driven gear
- 4. Front end cover

5. Rear end cover

Figure 10-2

- 6. Liner plate
- 7. Seal ring
 8. Baffle ring

Elastic collar
 Bolt
 Washer

9. Oil seal

- (a) Clamp the pump flange onto the pliers.
- (b) Dismantle the connecting bolt 11, pump cover 5 and pump box 1.
- (c) Dismantle the liner plate 6, drive gear 2 and driven gear 3.
- (d) Dismantle the seal ring 7 and baffle ring 8 off the front and rear end cover.
- Note: if the seal ring is not replaced, do not dismantle it from the front end.
- (2) Inspection

Check the decomposed parts, and clean with gasoline (except for the rubber parts).



Figure 10-3

(a) Inspection of pump body

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

(b) Inspection of liner plate

Check the contact surface of liner plate, and if the surface is damaged or the plate thickness is less than the specified value, replace the liner plate.

The specified value of the thickness of liner plate: 4.94mm.



Figure 10-4

(c) Front and rear pump cover

Replace if the inner surface bushing changes in color (brown) more than $150\,^\circ\!\mathrm{C}$.

(d) Check the driving gear and driven gear from the front and back side. If excessive wear, change a pair, and if the size D is less than the specified value, change a pair.



Figure 10-5

(e) According to the need, replace the seal ring, liner seal, retaining ring, oil seal, and spring collar.



(3) Assembly

(a) Install a new seal ring and a new retaining ring onto the pump front end cover.





(b) Mount a liner plate on the front end cover groove, and keep careful not to make a mistake about the oil suction inlet and oil discharge outlet.



Figure 10-8

(c) Install the driving/driven gear on the front end cover.

(d) Mount a liner plate on the gear side to make the groove align the gear point. Be careful not to make a mistake about the oil suction side and oil discharge outlet.

(e) Install a new seal ring and a new retainer ring on the back cover groove. See the figure

(f) Mount the back cover onto the pump body, and pay attention not to make a mistake about the oil suction inlet and oil discharge outlet.

(g) After all are installed, tighten the connecting bolt to the specified torque 9~10kg.m.

(4) Test run

Test run aims to run in the oil pump, check whether the movement is normal and the best test the oil pump on the test bench, but it also can be tested on the forklift following these steps below:

(If the oil pump is seriously worn or jammed because of the hydraulic oil, leading to breakdown maintenance, the hydraulic oil and filter should be replaced before test run on the forklift.)

(a) Load the oil pump onto the forklift, and install a pressure gauge on the pressure testing port of the multi-way valve.

(b) Loosen the adjusting screw of the overflow valve, and make the pump run at $500 \sim 1000$ rpm for 10 minutes, to ensure the oil pressure lower than 10 kg/cm².

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

(d) Keep the running speed of the pump 1500~2000rpm, increase the pressure 20 to 30kg/cm² every time, and run for 5 minutes, until it reaches 175kg/cm². Then, each oil pipe works for 5 minutes, and change the oil return filter.

When increasing the oil pressure, pay attention to detecting the oil temperature, pump surface temperature, and running sound; if the oil temperature or pump surface temperature rises excessively, reduce the load to decrease the oil temperature, and then continue to test.

Fault	Reason	Repair method	
Small oil discharge Fuel tank has low oil level		Refuel to the specified amount	
amount	Oil pipe or filter clogged	Clean or replace as required	
	Liner plate damaged		
	Bearing damaged	Replace	
	Bad seal ring and liner seal or		
Low nump	retaining ring		
pressure	Improper overflow valve	Use a pressure gauge to adjust the overflow	
pressure	adjustment	valve to the specified value	
		Retighten the oil pipe on the oil suction side	
	There is air in the system	Refuel	
		Replace the oil pump oil seal	
	Oil suction pipe damaged or oil	Check the pipe or maintain the ail filter	
	filter clogged	Check the pipe of maintain the on filter	
	The oil suction side is loose	Tighten the loose part	
Noise while	and leaks air		
running	Oil viscosity is too high	Change the oil which viscosity is appropriate to	
	On viscosity is too nigh	the pump operation temperature	
	Pubbles in ail	Find out the cause of the bubbles and take	
	Bubbles III oli	measures	
	Pump oil seal or seal ring	Penlace	
Pump oil leakage	damaged	керіасе	
	Pump damaged	Replace	

(e) After testing, measure the flow rate when the overflow pressure is 175kg/cm^2 . Oil amount is measured by lifting speed.

10.3 Multiway valve

10.2.2 Fault diagnosis

Multiway valve is two-piece four-body type; the hydraulic oil from the working oil pump is controlled by the multiway valve stem, and the high pressure oil is distributed to the lifting cylinder or tilting cylinder. There are a safety valve and self-locking valve within the multiway valve. The safety valve is located above the multiway valve oil inlet and can control the system pressure; the self-locking valve is located on the tilting valve block, and is mainly used to prevent serious consequences caused by misoperation of the joysticks under the condition of no pressure source for the tilting cylinder. A one-way valve is separately equipped between the oil inlet and the lifting valve oil suction mouth and between the lifting valve oil inlet and the tilting valve oil inlet.

The outline of multiway valve is shown below.



Figure 10-9

- (1) Operation of the slide valve (take oblique slide valve as an example)
 - (a) Neutral position (Figure 10-10)

At this time, the high pressure oil discharged from the oil pump flows back to the fuel tank through the neutral position.



Figure 10-10

(b) Push the slide valve (Figure 10-11)

Close the middle channel at this time, and the oil from the oil inlet opens the one-way valve and flow to the cylinder interface B, while the oil from the cylinder interface A flows by virtue of low pressure channel to the fuel tank; the slide valve can go back to the neutral position with the aid of the return spring.



Figure 10-11

(c) Pull the slide valve (Figure 10-12)

Close the neutral position at this time, and the oil from the oil inlet opens the one-way valve, and flows to the cylinder interface. A, while the oil from the cylinder interface B flows by virtue of low pressure channel to the fuel tank; the slide valve can go back to the neutral position with the aid of the return spring.



Figure 10-12

(2) Action of safety overflow valve

An overflow valve is mounted between the oil pump "HP" interface and low-pressure pathway "LP". The one-way valve "K" and the overflow lift valve "D" are arranged on the valve seat on the area with "A" and "B" different diameter through the oil effect of lift valve "C", as shown in Figure 10 to 13.



Figure 10-13

The set pressure in the oil pump "HP" pathway acts on the guide valve spring, and then the one-way valve "E" will be opened. Oil flows through around the valve into the low pressure "LP" side from hole, as shown in Figure 10-14.



As shown in Figure 10-14

Upon the guide valve "E" is opened, the pressure inside the valve "C" drops, and both the valve "E" and the valve "C" fall on the seat. The liquid flow at the back of the valve "D" will be closed, and therefore, the internal pressure is reduced, as shown in Figure 10 -15.



Figure 10-15

Oil pump "HP" channel and internal pressure is imbalanced, and under the action of pressure difference the valve "D" is open and oil flows directly into the low pressure loop "LP", as shown in Figure 10-16.



Figure 10-16

(3) Action of tilting self-locking valve

Tilting cylinder valve is equipped with a tilting self-locking valve. When there is negative pressure inside the oil cylinder, the mast is prevented from suddenly falling, and at the same time, there will be danger in case of misoperation on the tilting valve stem. Where the self-locking valve is adopted, when the forklift motor stops working, even if the joystick is thrust, the mast can't tilt forward.

When pulling out the valve core, the oil flows in the same direction as Figure 10-12, and the portal is in the backward state at this time. The status in which the valve core is pushed is explained in the following.

(a) When pushing the valve core (the pump works)

The oil from the main pump flows through the interface "B" to the tilting cylinder, the oil returned from the oil cylinder flows through the oil outlet A into the piston, and the oil returns to the fuel tank through the low oil way of the holes A and B in the valve core.





(b) When pushing the valve core (the pump does not work)

When the oil pump does not work, push the valve core, and there is no oil flowing into the oil cylinder interface B" and thus P pressure will not rise. So, the piston does not move, the oil of the oil cylinder interface "A" can not return to the fuel tank and the oil cylinder does not move.



Figure 10-18

(4) Manipulation of multiway valve



Figure 10-19 Manipulation of multiway valve

Multiway valve is manipulated by joystick, and all the joysticks are installed on a connecting shaft; the shaft is fixed on the dashboard through a bracket, and the slide valve is operated through the connecting rod by the joystick.



As shown in Figure 10-20, push forward and pull backward the lifting handle, and the mast moves up and down respectively; push forward and pull backward the tilting handle, and the mast tilts forward and backward, respectively.

(5) Pressure adjustment of multiway valve

	2.5T	3-3.5T
Pressure		
adjustment value	17.5Mpa	17.5Mpa
of safety valve		
Pressure		
adjustment of	12Mpa	12Mpa
orbitrol		

Adjustment method for pressure of safety valve (Figure 10-21)

Safety valve pressure shall not be adjusted freely, and if it is essential to adjust, please follow the steps below.

(a) Unscrew the measuring hole plug at the inlet of the multiway valve, and mount an oil pressure gauge which can measure 20MPa.

(b) Operate the tilting control handle, and measure the pressure when the oil cylinder stroke reaches the bottom.

(c) If the hydraulic pressure is not the same as the specified value, loosen the lock nut of the overflow valve, turn the adjustment screw toward the left and right, and adjust to the specified value. Turn to the left if the pressure is high, and turn to the right if the pressure is low.

(d) Adjust and then tighten the nut.



Figure 10-21

10.3.1 Fault diagnosis

Fault	Reason	Repair method
Lifting oil pipe pressure is	Slide valve is blocked	Cleaning after disassembly
not high	Oil hole is jammed	Cleaning after disassembly
Vibration	Slide valve is blocked	Cleaning after disassembly
Pressure rise is slow	Venting is not sufficient	Fully vent
Steering oil pipe pressure is	Slide valve is blocked	Cleaning after disassembly
greater than the specified value	Oil hole is jammed	Cleaning after disassembly
Not up to the specified oil amount	Improper overflow valve adjustment	Adjust
There is notice	Improper overflow valve adjustment	Adjust
There is noise	Sliding surface is worn	Replace the overflow valve
Oil leakage (external)	O seal ring is aged or damaged	Replace O seal ring
	Spring damaged	Replace the spring
The set pressure is low	Valve seat surface	Adjust or replace the
	damaged	overflow valve
Oil leakage (internal)	Valve seat surface damaged	Correct the valve seat face
The set pressure is high	The valve is blocked	Cleaning after disassembly

10.4 Full hydraulic orbitrol

Full hydraulic orbitrol (10 to 22) can deliver the pressure oil from the steering oil pump to the steering cylinder measurably through pipeline according to the size of turning angle of the steering wheel. When the oil pump can't supply oil, manual steering can be used.

The orbitrol is a new-generation integrated hydraulic orbitrol which has all combination valve functions, containing safety valve, overload valve, oil supplementary valve, inlet check valve and manual check valve. The safety valve pressure has been adjusted before out of the factory, and users may not arbitrarily adjust the safety valve pressure; if it is essential to adjust, the main engine plant must agree, or else the consequences shall be borne by the users.



Figure 10-22

10.5 Speed limit valve

The speed limit valve controls the falling speed of pallet fork and plays a security role under the accidental condition of high pressure fracture. The working condition of the speed limit valve is shown in Figure 10-23. The return oil of lifting cylinder flows into the valve cavity G, and returns to the multiway valve through FEDCB and A.

When a large amount of oil flows through the valve core hole C, the pressure difference generated by the valve core enables the valve core to move toward the right.

The channel between the holes D and C becomes narrow, and thus, the amount of return oil is reduced and the pallet fork slows down.

If the pallet fork is planned to be lifted, the high pressure oil from the multiway valve flows through ABCDEF and G into the lifting cylinder.



10.6 Hydraulic pipeline

The hydraulic oil pipeline of 1.5-3.5T hydraulic system is shown below



Figure 10-24 Hydraulic pipe line

11. Working device

11.1 Overview

The working device is mainly composed of inner mast, outer mast, fork carriage, lifting cylinder, tilting cylinder, etc.

11.2 Inner and outer mast (Figure 11-1)

Inner and outer mast belongs to welding parts. The bottom of the outer mast is mounted on the drive axle with support.

The central part of the outer mast is connected together with the frame through the tilting cylinder, and can tilt toward the front and back under the action of the tilting cylinder.

Inner and outer mast channel steel is C, a main roller and side rollers are installed on the upper part of the mast, and a composite roller is installed at the bottom of the inner mast.

Maintenance of the composite roller of inner and outer mast belongs to high maintenance, and thus safety should be paid attention to.



Figure 11-1

11.3 Fork carriage

Fork carriage consists of carriage, block shelves and pallet fork. The fork carriage rolls inside the inner mast through a composite roller, the composite roller is directly welded on the carriage, and the rolling gap is adjusted by horizontal roller inside the composite roller.



Figure 11-2

11.3.1 Height adjustment of fork carriage

(1) Park the forklift on a level surface and make the mast vertical.

(2) Make the pallet fork bottom contact with the ground, and adjust the adjusting nut on the upper end joint of the chain so that there is a distance A between the composite roller and the inner mast.

Type of forklift	A (mm)	
2.5T	24-29	
3-3.5T	19~24	





(3) Make the pallet fork fall to the ground and tilt backward in place. Adjust the upper end joint of the chain, and adjust the nut to make the degree of tension of two chains the same.



Figure 11-4

11.4 Rolle position (Figure 11-5)

Roller is classified into composite roller and side roller, which are respectively installed on the outer mast, interior mast and fork carriage; the composite roller bears the front, rear and lateral load, and the side roller mainly bears the lateral load, so as to make the interior mast and fork carriage move freely.



Figure 11-5

Note: (a) Adjust the side clearance of the composite roller to 0.5 mm.

(b) Coat the composite roller surface and mast contact face with butter.

11.4.1 Replace fork carriage

(1) If loading a tray with pallet fork and park it on a level ground surface.

(2) Make the pallet fork and tray fall to the ground.

(3) Remove the upper end joint of the chain, and take down the chain from the sprocket.

(4) Lift the interior mast (1 in Figure 11-6)

(5) Confirm that the fork carriage has been off the outer mast, and return the pallet fork (2 in Figure 11-6)



Figure 11-6

11.5 Lifting cylinder

Lifting cylinder belongs to single acting piston type, and is composed of cylinder block, piston rod, piston, and cylinder head and so on. Two lifting cylinders in this series of forklift are installed behind the outer mast, the bottom is fixed with pin and bolt on the lifting cylinder bearing of the outer mast, and the top of the cylinder (that is, the top of piston rod) is connected to the outer mast beam.

The piston is fixed onto the piston rod with elastic steel wire, and the piston outer ring is equipped with oil seal and support ring.

An explosion-proof value is arranged at the bottom of the cylinder; when the mast rises, if the high pressure pipe bursts, the value can ensure the safety. A steel-backed bearing and oil seal are installed on the cylinder head, used to support the piston rod and prevent dirt entering.

The lifting cylinder is shown in Figure 11-7 and Figure 11-8.



- 5. O ring
- 6. explosion-proof valve
- 7. Hoop
- 8. Rubber sleeve
- 9. Hoop seat
- 10. Washer
- 11. Nut
- 12. Bolt
- 13. Nut

- 18. Back-up ring for hole
- 19. Piston
- 20. Spacer bush
- 21. Piston rod
- 22. Bushing
- 23. O ring
- 24. Steel-backed bearing
- 25. Nylon cushion
- 26. Bolt

Figure 11-8 Lifting cylinder (2.5-3.5T)

- 27. Cylinder head
- 31. Bolt
- 32. Baffle ring
- 33. Chain wheel
- 34. Chain
- 35. Cotter pin
- 36. Nut
- 37. Nut

Working condition of explosion-proof valve

An explosion-proof is positioned at the bottom of the lifting cylinder valve, as shown in Figure 11-9; when the high pressure hose bursts, it is used to prevent the cargo falling sharply. The oil from the lifting cylinder generates pressure difference between two cavities around the slide valve by cutting off the slide valve, and when the pressure difference is less than the spring force at this time, the slide valve does not act; if the high pressure hose bursts, a very big pressure difference will form, so that the slide valve is moved to block the oil holes around, but only a small amount of oil flows through the holes in the end of the slide valve, until the pallet fork declines slowly.



Figure 11-9

11.5.1 Adjustment of lifting cylinder

When removing or replacing the lifting cylinder, inner or outer mast, the lifting cylinder stroke needs to be re-adjusted. The adjustment method is as follows:

(1) The piston rod head without adjustable pad is loaded into the beam of the inner mast.



Figure 11-10

(2) Raise the mast to the cylinder's maximum stroke slowly, and check whether the two cylinders keep synchronized.

(3) In the process of movement, stop the adjustable pad between the head of the cylinder piston rod and the beam of the inner mast. The thickness of the adjustable pad is 0.2mm and 0.5mm.

(4) Adjust the degree of tension of chain.

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

Note: when the forklift is not in use for a long time, lift the cylinder within no more than 10 days to the top for 2 or 3 times, for lubrication and maintenance.

11.6 Tilting cylinder

Tilting cylinder is a double-acting cylinder, its piston rod end is connected with the mast through the earrings, the tilting cylinder bottom is connected to the frame with pin, and there is a tilting cylinder on each side of the forklift.

Tilting cylinder is mainly composed of a piston, piston rod, cylinder block, cylinder bottom, guide sleeve and seal; the piston and piston rod are of welding structure, the outer ring of the piston is equipped with a support ring and two Yx seal rings, and the inner hole in the guide sleeve is equipped with a shaft sleeve and also with Yx seal ring, baffle ring and dust ring; the shaft sleeve supports the piston rod, seal ring, baffle ring and dust ring, which can prevent oil leakage and dust, and it is screwed onto the cylinder body with the O ring, as shown in Figure 10-35, Figure 10-36 and Figure 10-37.

When the inclined slide valve is pushed forward, high pressure oil enters from the oil cylinder bottom, so as to push the piston forward to make the mast forward; when the slide valve is pulled back, high pressure oil enters from the front end of the cylinder body, to push the piston to move backward, so as to make the mast tilt backward.



- 1. Nut M12×1.5
- 2. Washer 12
- 3. Oil cup M10×1
- 4. Earnings
- 5. Joint bearing GE30ES
- 6. Cartridge stop for hole D47
- 7. Bolt M12×1.5×40
- 8. Dust ring d32×52×8/11
- 9. Cartridge stop for hole D52
- 10. Block piece

- Baffle ring
 Shaft seal φ32×φ48×10
- 13. Steel-backed bearing ϕ 32× ϕ 36×25
- 14. Guide sleeve
- 15. Baffle ring D70×ф61.5×1.5
- 16. O ring 70×5.7
- 17. Piston rod
- 18. O ring 38×3.5
- 19. Adjusting sleeve I
- 20. Hole seal D70×60×6

Figure 11-12 Tilting cylinder (2.5T)

- Baffle ring D70×φ60×2.5
 Back-up ring for hole
- D70×16×2.5
- 23. Piston
- 24. Cotter pin 5×40
- 25. Slot nut M22×1.5 22 thick
- 26. Adjusting sleeve II
- 27. Cylinder block
- 28. Axis pin
- 29. Washer 10
- 30. Bolt M10×20



- 1. Nut M14×1.5
- 2. Washer 14
- 3. Oil cup M10×1
- 4. Earnings
- 5. Joint bearing GE30ES
- 6. Cartridge stop for hole D47
- 7. Bolt M14×1.5×40
- 8. Dust ring $d35 \times 43 \times 5/6$
- 9. Baffle ring ϕ 45× ϕ 35×3
- 10. Shaft seal $35 \times 45 \times 6$

- 11. Steel-backed bearing $\phi 35 \times \phi 39 \times 35$
- 12. Guide sleeve 80
- 13. Baffle ring $\phi 80 \times \phi 71.5 \times 1.5$
- 14. O ring 80×5.7
- 15. Piston rod
- 16. O ring 41×3.5
- 17. Adjusting sleeve I
- 18. Hole seal D80×70×6
- 19. Baffle ring $\phi 80 \times \phi 70 \times 2.5$
- 20. Back-up ring for hole D80×16×2.5

Figure 11-13 Tilting cylinder (3.0-3.5T)

- 21. Piston80
- 22. Cotter pin 5×45
- 23. Slot nut 27×2×27
- 24. Adjusting sleeve II
- 25. Cylinder block
- 26. Axis pin
- 27. Washer 10
- 28. Bolt M10×20

11.7 Installation of mast (as shown in Figure 11-14)

(1) Install the part 6 tilting cylinder sleeve onto the part 7 frame tilting cylinder support;

(2) Pass the part 8 tilting cylinder axis pin (frame) through the tilting cylinder and its bearing mounting hole;

(3) Tighten the fasteners of the part 9 tilting cylinder axis pin (bolt, spring washer);

(4) Cover the 3 mast brackets onto the mast installation place of the part 10 drive axle, adjust the left and right clearance, then cover the part 2 support lid correspondingly, and tighten the part 1 support lid fasteners (bolt, spring washer and flat mat) (one on the left and right);

(5). Install the part 6 tilting cylinder sleeve onto the mast tilting cylinder support of the mast 4;

(6). Pass the part 5 tilting cylinder axis pin (portal) through the tilting cylinder and its bearing mounting hole, and tighten the fasteners (bolt, spring washer and flat mat);

(7). Connect the part 11 multiway valve - speed limit valve hose;

(8). Cover the part 12 oil return pipe on the mast tee joint, and fix the oil return pipe with the part 13 oil return pipe clamp tightly, so the mast is installed well.



Note: when installing a mast, the safety of lifting the mast should be ensured and the installation personnel must accept relevant training.

1. Support lid fasteners	2. Support lid	3. Mast bracket
(Bolt, spring washer and flat mat)		
4. Mast tilting cylinder support	 5. Tilting cylinder axis pin (portal) 	6. Tilting cylinder
7. Mast tilting cylinder support	 8. Tilting cylinder axis pin (frame) 	
9. Tilting cylinder axis pin fasteners (Bolt, spring washer)	10. Mast installation place of drive axle	
11. Multiway valve—speed limit valve hose	12. Oil return pipe	13. Oil return pipe clamp

11.8 Disassembly of mast (as shown in Figure 11-14)

(1) Disassemble the part 11 multiway valve—speed limit valve hose;

(2) Disassemble the part 13 oil return pipe clamp;

(3) Disassemble the part 12 oil return pipe;

(4) Disassemble the fasteners (Bolt, spring washer and flat mat) on the part 5 tilting cylinder axis pin (portal), and disassemble the part 5 tilting cylinder axis pin (portal);

(5) Unscrew and disassemble the part 1 support lid fasteners (Bolt, spring washer and flat mat), and disassemble the part 2 support lid (one on the left and right) at the same time;

(6) Lift the mast, and its disassembly is finished.

Note: when disassembling the mast, the safety of lifting the mast should be ensured and the installation personnel must accept relevant training.

III. List of wearing parts

1. Part of wearing parts

S/N	Name	Qty.	Installation position	
1	Driving wheel	2	Drive axle	
2	Steering wheel	2	Steering axle	
3	Paper pad	1	Drive axle	
4	Half shaft pad	2	Drive axle	
5	Piston	1	Lifting cylinder (standard)	
6	Piston	1	Tilting cylinder	
7	Instrument left cover plate	1	Instrument stand	
8	Instrument right cover plate	1	Instrument stand	
9	Various kinds of hoses		Hydraulic system/portal piping system	
10	Chain	2	Mast	

2. Oil seal

S/N	Standard	Model/Specification	Qty.	Installation position
1	GB/T9877.1-1988	B100×130×12	2	Drive axle
2	GB/T9877.1-1988	B100×125×12	1	Drive axle
3	GB/T9877.1-1988	B70×100×10	2	Drive axle
4	GB/T9877.1-1988	B70×95×10	1	Drive axle
5	GB/T9877.1-1988	B50×70×12	1	Gearbox
6	GB/T9877.1-1988	B55×72×8	1	Gearbox
7	NOK	Shaft coal $40 \times 50 \times 6$	2	2.5 T lifting cylinder
		Shart Sear 40^30^0		(standard)
8	NOK	Shaft seal 15×55×6	2	3.0/3.5T lifting cylinder
		Shalt Seal 45^55^0		(standard)
9	LBH	Dust ring $40 \times 48 \times 5/6$ 5	2	2.5T lifting cylinder
		Dust mig 40^48^5/0.5		(standard)
10	LBH	Dust ring $45 \times 53 \times 5/6$ 5	2	3.0/3.5T lifting cylinder
		Dust mig +3^33^3/0.3		(standard)
11	NOV	Hole coal $50 \times 40 \times 2$	2	2.5T lifting cylinder
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11	NOK	NOK Hole seal 50×40×5 2		(standard)
12	NOK	Hole seal 56×45×7	2	3.0/3.5T lifting cylinder
				(standard)
13	LBH	Dust ring 32×52×8/11	1	2.5T tilting cylinder
14	LBH	Dust ring 35×43×5/6	1	3.0/3.5T tilting cylinder
15	NOK	Shaft seal 32×48×10	1	2.5T tilting cylinder
16	NOK	Shaft seal 35×45×6	1	3.0/3.5T tilting cylinder
17	NOK	Hole seal D70×60×6	2	2.5T tilting cylinder
18	NOK	Hole seal D80×70×6	2	3.0/3.5T tilting cylinder

3. O sealing ring

S/N	Standard	Specification	Qty.	Installation position
1	GB3452.1-1992	71×3.55G	2	2-3.5T Drive axle
2	GB1235-76	35×3.1G	2	Gearbox
3	GB1235-76	75×3.1	2	Gearbox
4	GB1235-76	60×3.1	2	2.5T lifting cylinder (standard)
5	GB1235-76	68×3.1	2	3.0T lifting cylinder (standard)
6	GB1235-76	75×3.1	2	3.5T lifting cylinder (standard)
7	GB1235-76	70×5.7	1	2.5T tilting cylinder
8	GB1235-76	38×3.5	1	2.5T tilting cylinder
9	GB1235-76	80×5.7	1	3.0/3.5T tilting cylinder
10	GB1235-76	41×3.5	1	3.0/3.5T tilting cylinder
11	GB1235-76	18×2.4	2	Hydraulic system
12	GB1235-76	35×3.5	1	Hydraulic system
13	GB1235-76	22×2.4	13	Hydraulic system

4. Combined seal ring

S/N	Standard	Specification	Qty.	Installation position
1	JB/T 982-1977	20	1	Drive axle
2	JB/T 982-1977	18	2	Hinged bolt

5. Part of the electrical components

S/N	Standard	Model/Specification	Qty.	Remark
1	Fuse box	BX2081	1	
2	Micro switch	RZ-15GQ22-B3	1	Hand braking
3	Micro switch	Z-15GW22-B	1	multiway valve