

Service Manual

EFG 1,5 H

**Three-wheel Counterbalanced
Electric Forklift Truck**



Original Instruction



Foreword

Thanks for purchasing our Three Wheel Battery Counterbalanced Forklift Truck of Rear-wheel Drive.

Three wheel battery counterbalanced forklift truck is our company's new product. It has the character of small turning radius, beautiful shape, compact structure, small dimensions, low gravity, good stability, rear wheel drive and steering, lifting and turning sharing one pump and excellent performance etc.

This manual simply introduces the structure and principle of the 3 wheel forklift truck as well as some of the common failures. Relevant operator and maintenance personnel must read the manual carefully before operation.

With the continuous updating and improvement of our products, there may be some difference between your product and the description in this manual.

If you have any question, please contact the sales department of DEUTRUCK GmbH Fördertechnik.

The truck type EFG 1,5 H is equipped with electronic controllers of CURTIS, type 1236 and is having a capacity of 1500 kg at the load center of 600mm as a basic capacity.



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1 Drive system

Drive system adopts rear-wheel drive, and is mainly consisted of a 4kw AC traction motor reduction gear box and wheel assembly. The motor is placed on the reduction gear box upright, and the reduction gear box transfers power outputted by motor shaft which has reduced the speed and enlarged the torque to the hub, then the hub rotate to turn the wheels.

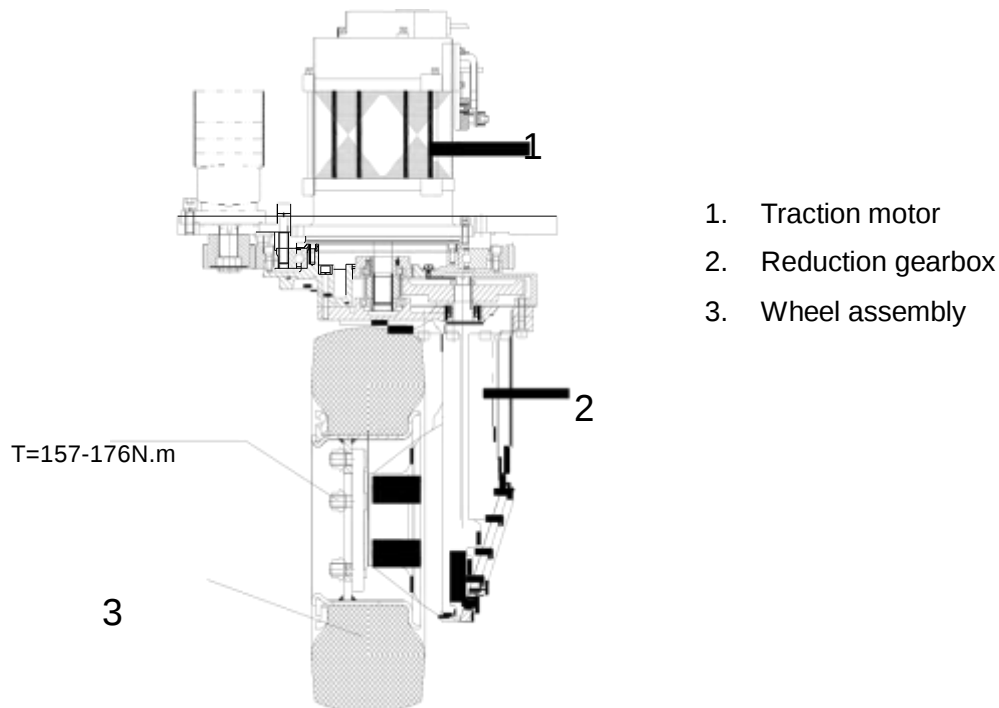


Fig.1-1 Driving system picture

Course of driving system dismount:

1. Parking. Press the power switch, open the storage battery cover, disconnect the connector between storage box and out-linking wire, then pull up the hand brake.

2. Dismount the counterbalance weight. First screw up the four fastening bolts for counterbalance weight, then install two M14 ring bolt in the pre-reserved ring hole, which is used for lifting and dismounting the counterbalance weight;

3. Dismount hydraulic motor. Dismount the hydraulic pipes that connect hydraulic motor entering and exiting the oil hole, screw two M12 fastening bolts in front and back, hold the motor tightly with upright power, then dismount the motor carefully;

4. Dismount the drive motor. Dismount all wires that connect motor and the outside, screw 6

M8 fastening bolts that well-distributed around the motor, slowly vertically lift the motor with lifting device; screw the bolts that fix the right and left cover hood and take off the right and left cover hood.



5. Dismount reduction gear box. Support the back carriage firmly, fix the drive wheels and reduction gear box well, and screw 6 M12 bolts that connect rear carriage shutter and reduction gearbox. Then you can take off the reduction gearbox and the whole drive wheel. When you take off the drive wheel you are able to change or repair the reduction gearbox. Installing order is opposite to the dismount course.



1.1 Reduction gear box

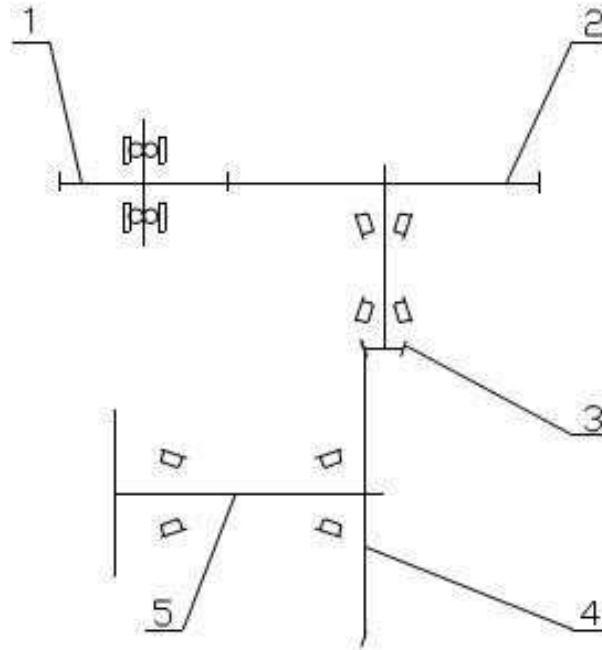
The truck use battery forklift reduction gear box, light and controllable vehicle driving device, which adopts two grades reduce speed gear, namely grade-one cylindrical gear and grade-two spiral bevel gear. This reduction gear box owns traits like small size, light weight, large transmission ratio, small radius of gyration, high efficient and simple structure, which enables turn on site and equip with motor vertically that cause the radius of gyration on the carriage is small. Moreover, this reduction gear box does not need to shift, but realize direction shift (forward or reverse) directly by motor positive inversion, and is easy to use and maintain.

Main technical parameter

Maximum load bearing of the wheel kg	2200
Maximum diameter of the wheel mm	Φ454
Reduction ratio	20.87
Maximum output torque of the wheel when speeding up is allowed Nm	1400
Net weight kg	56
Working oil	GL-5 80W-90 Heavy-loaded vehicle gear oil

Working principle

Simple Fig. of reduction gear box is as Fig.1-2, motor drive gear 1 drives driven gear 2, driven gear 2 drives drive spiral bevel gear 3 to transfer to driven spiral bevel gear 4, then the driven spiral bevel gear 4 drives the output of output flange 5. Power transmission order is that 1, 2, 3, 4, 5 (output flange) drive the wheel output.



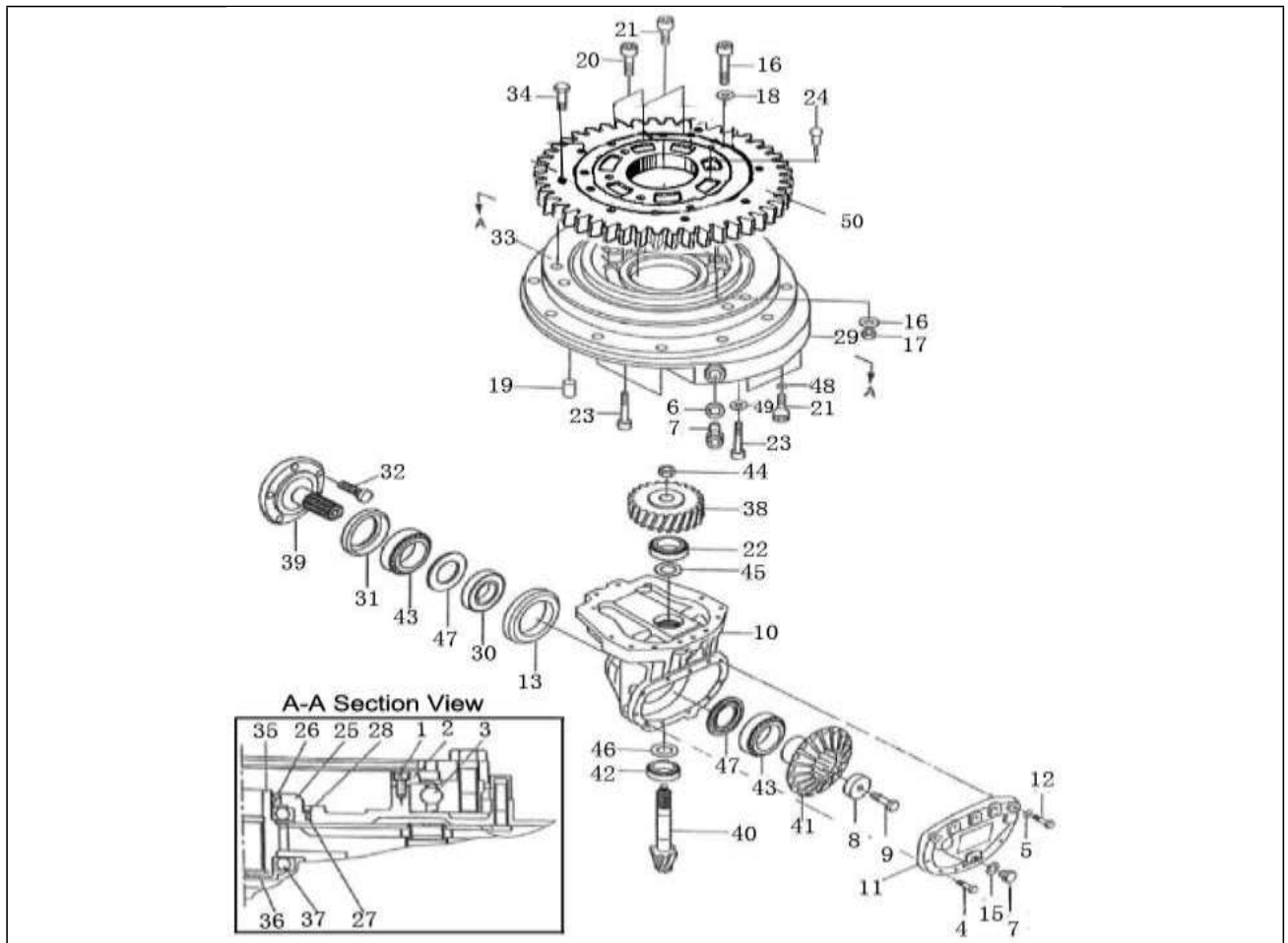
1. Drive gear (pinion gear) 2.Driven gear 3.Drive spiral bevel gear
4. Driven spiral bevel gear 5.Output flange

Fig.1-2 Transmission picture for DBS25 transmission gear box

Structure introduction

(1) Brief introduction of structure

Refer to picture 1-3 for transmission gear box structure, whose principle is listed before, reduction gear box is directly driven by the drive motor through spline joint of drive gear, reducing speed by a couple of cylindrical gears and spiral bevel gears, which, in meeting the transmission ratio condition, guarantees the high-efficient rotate of the reduction gear box and make small radius of gyration.



1. Bolt	2. Plate	3. Bearing	4. Bolt	5. Gasket
6. Gasket	7. Screw Plug	8. Washer	9. Bolt	10. Shell
11. Cover	12. Bolt	13. Dustproof ring	14. screw plug	15. Gasket
16. Bolt	17. Nut	18. Washer	19. Column pin	20. Bolt
21. Bolt	22. Bearing	23. Bolt	24. Gas cap component	25. Bearing bracket
26. Oil seal	27. O-ring	28. Snap ring	29. Top shell	30. Oil seal
31. Seal ring	32. Screw plug	33. Support ring	34. Screw plug	35. Pinion
36. Plug	37. Bearing	38. Driven gear	39. Output flange	40. Driver spiral bevel gear
41. Bevel gear	42. Bearing	43. Bearing	44. Nut	45. Adjusted pad
46. shim	47. Adjusted Pad	48. Adjusted Pad	49. Combination Gasket	50. Steering gear

FIG.1-3 Structure of reduction gearbox



Dismount and assemble order

Dismount and disassemble the reduction gear box according to the following order:

- ① Dismantle driving wheel (wheels);
- ② Open oil discharging bolt and discharge the oil clean;
- ③ Disassemble swing bearing and top shell articles;
- ④ Disassemble driven cylindrical gear
- ⑤ Open the cover, disassemble driven spiral bevel gear and output flange etc..

Assembling order is opposite to the disassembling order.

Notice to installment and use

(1) Before installing, you should wipe the oil on the surface of the shell. In case that the oil leaks during use, you are not allowed to dismount and disassemble the product.

(2) Prevent the assembling surface and exposed flange from being knocked or damaged, otherwise it may influence the installment and use precision.

(3) Working oil should keep clean, the new machine should change new oil in 50 hours for the first use and every 1000 hours later.

(4) Working oil should in accordance with brand no..

Fault reason and eliminating method

Fault	Probably cause	Method of Fault eliminating
Low efficient transmission and overheat oil temperature	└Lack of oil └Quantity of the oil is ineligible. └Gear or bearing is damaged	Adding oil Replace Replace
Unstable running	└Gear or bearing is damaged	Replace.
Oil leakage	└Wear or damage of oil seal └Leakage from the gasket	Replace Screw bolt or replace

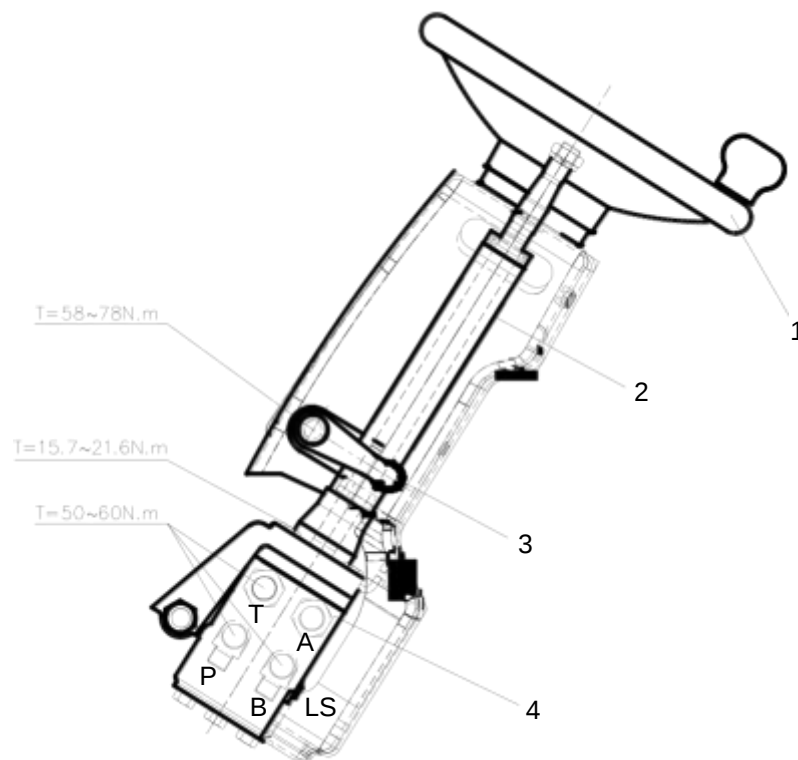
2 Steering system

Steering system is mainly consisted of steering device and hydraulic motor.

2.1 Steering device

It consists of steering wheel, steering pipe device, lock device and hydraulic steering gear etc. You can adjust the steering angle forward and backward according to your need. Refer to fig. 2-1.

Spline joint of steering gear, steering pole and steering wheel should add butter. During assembling, all running part should fill lubrication oil. Under the condition of machine stopping, slightly turn steering wheel with 1kg power, after releasing, steering wheel can turn around 10° automatically. After locking the handle, its position is listed as following figure.



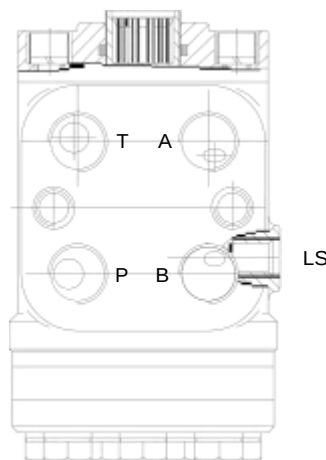
1. Steering wheel assy
2. Steering pipe device
3. lock device
4. Hydraulic steering gear

Fig 2-1 Steering device

2.2 Hydraulic steering gear

Hydraulic steering, composed of servo valve and a pair of cycloid meshing pair, is a cycloid hydraulic steering gear with rotating valve. It is flexible, effort-saving, reliable, owns less fault, simple and compact structure, convenient layout, and achieves manual steering when the engine stopped.

In the hydraulic steering gear, the spools, valve cover and body constitute the servo rotary valve, which controls the oil flow; rotor and stator constitute cycloid meshing pair, plays a part in measuring motor f when the power steering that to ensure the oil quantity flowing into the fuel tank and steering wheel angle is proportional and plays a part as a pump when manual steering; linkage axle plays a part in transferring torque.



Hydraulic steering gear parameter

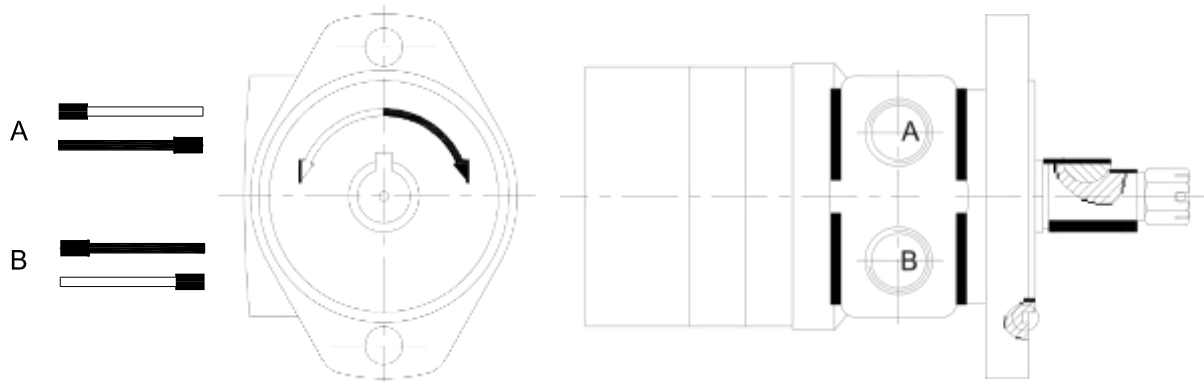
Displacement ml/r	50
Port sealing way	O-ring seal

Notice: Input torque should not be larger than 1.4 Nm.

2.3 Hydraulic motor

Cycloid hydraulic motor is a low speed high torque motor, with large output torque, good starting characteristics, wide speed range, steady speed, low-speed stability, simple overload protection, high efficiency, long service life, small size, light weight, layout flexibility, connecting directly with the work agencies and so on.

By the introduction of hydraulic oil into the hole after the shell, through the bearing plate, valve plate, after side to the working chamber between rotor and stator. With the effect of oil pressure, the rotor was pressed to the low pressure chamber side, and rotate along the stator inner tooth, the rotor rotation including rotation and revolution, through a long spline shaft, transfer to output shaft, meanwhile, transfer to valve plate, rotor and valve plate as synchronous operation by short-spline shaft, so that high pressure oil and low oil constantly alternate to change the input pressure and flow, so that output a different torque and speed. Change the direction of pressure oil imports, which can change the direction of rotation of hydraulic motor



Direction output shaft: When facing motor axle-extension direction.

Port A is high pressure oil, output shaft rotate at clockwise, otherwise rotate counter clockwise.

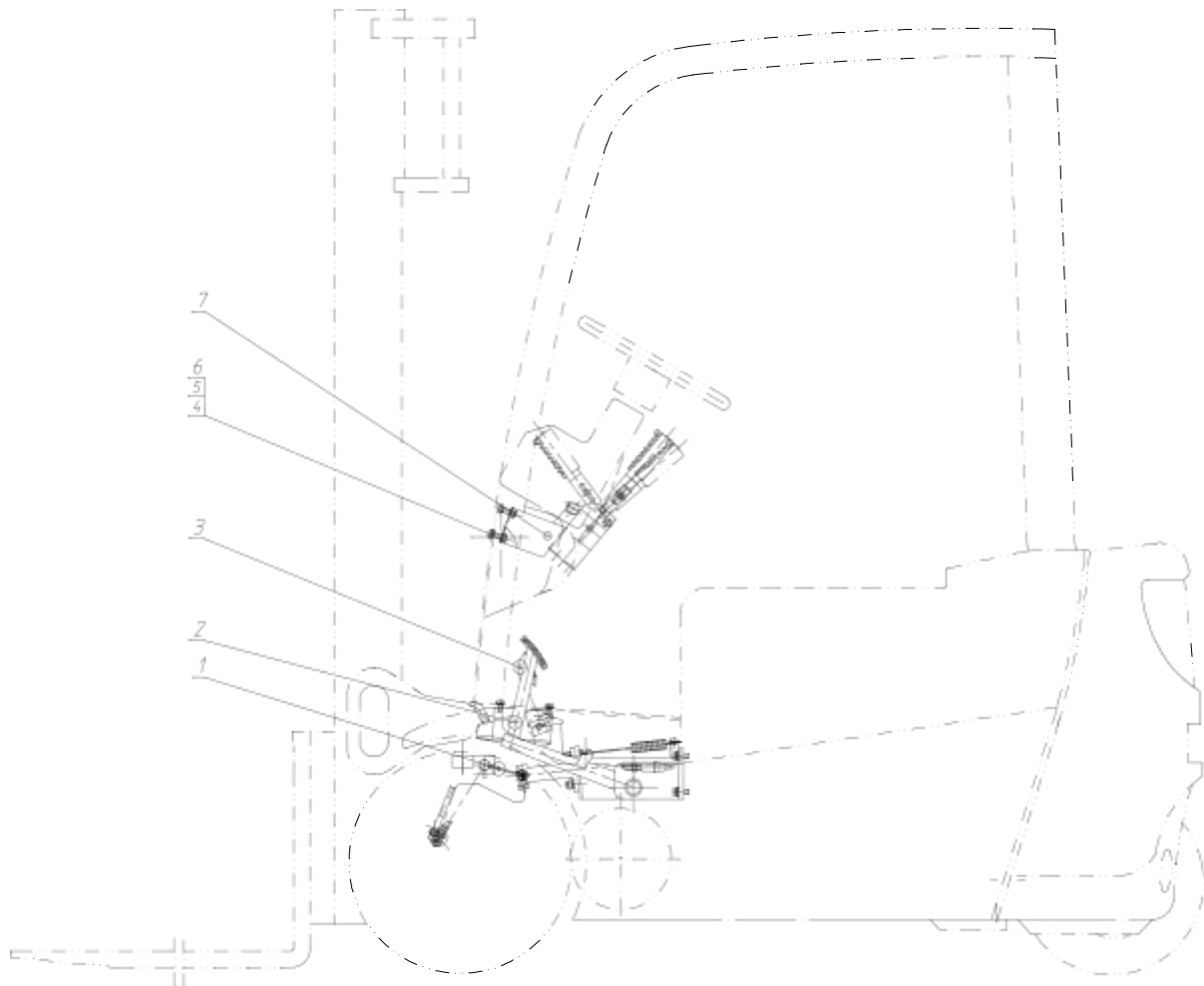
Fig. 2-3 Outside drawing of hydraulic motor

Hydraulic steering gear parameter

Displacement cm^3/rev	101.6
Rated speed rpm	330
Rated torque Nm	165
Rated flow L/min	34

3 Control system

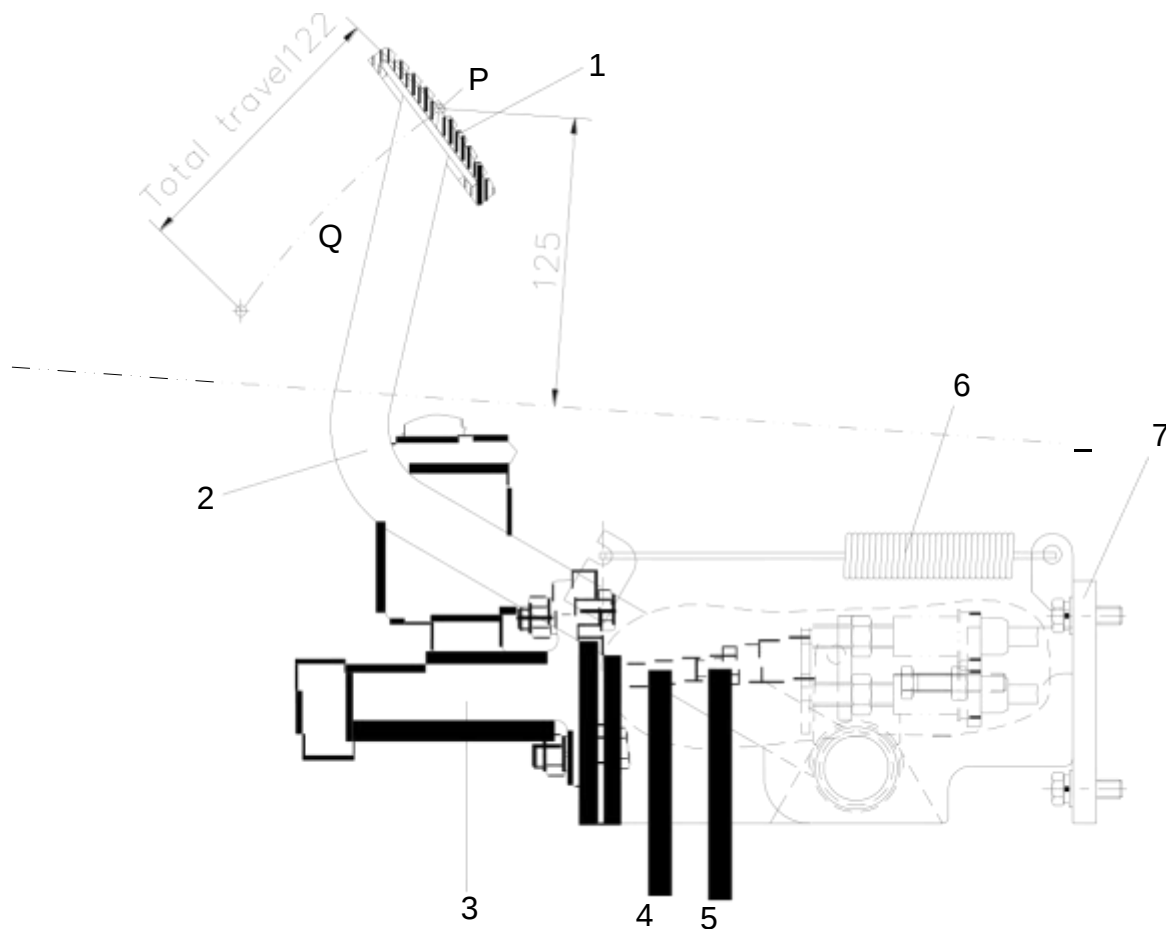
Control system is consisted of brake system and accelerating system. Brake system is double brake of front wheel, including hand brake control and foot brake control ;hand brake is composed of handle and backstay cable; foot brake is composed of brake pedal, brake master pump, pipeline and brake; brake is wet disc brake, avoid maintenance. Accelerating system is composed of accelerate pedal and actiyator etc..



1.Brake pipe assy	2.Brake pedal assy	3.Accelerating control assy	4.Bolt
5.Washer	6.Washer	7.Hand brake	

Fig. 3-1 Control system assy

3.1 Brake pedal



- | | | | |
|--------------|----------------|---------------------------|-------------------|
| 1. Pedal mat | 2. Brake pedal | 3. Brake master pump assy | 4. Handspike assy |
| 5. Nut | 6. Spring | 7. Bracket | |

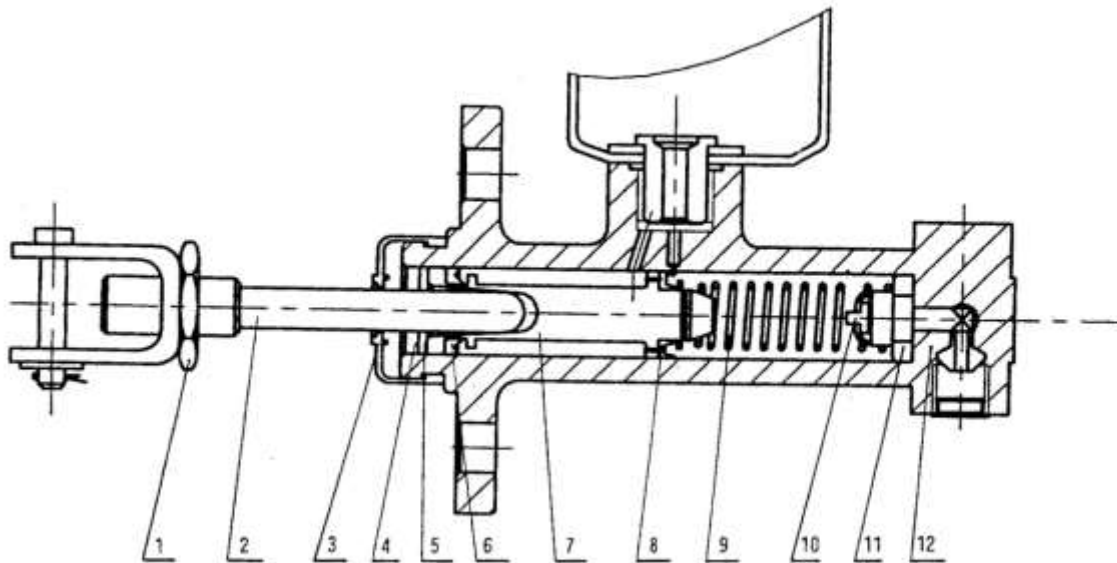
Fig 3-2 Brake pedal assy

Adjustment to the brake pedal:

1. Adjust brake light switch to let the distance between P point of pedal mat and front plate be 125 ± 5 mm, then fasten bolt and nut.
2. Adjust brake mater rod length, make clearance of point P in the Q direction clearance as 1-3mm, then fasten the nut.
3. The brake lamp should be lighted when the brake pedal steps on 10-20mm, when the pedal is released to such condition, brake lamp should disconnect without exception.

3.2 Brake - master cylinder

The master cylinder contains a valve seat, check valve, return spring, primary cup, piston and secondary cup, which are kept in place with stop washer and stop wire. The exterior of the cylinder is protected from dust by means of a rubber dust cover. The piston is actuated through the push rod by operation of the brake pedal. First, as the brake pedal, the push rod pushes the piston forwards. The brake fluid in the cylinder flows back to the reserve tank through the return port until the primary cup blocks up the return port. After the primary cup passes the return port, the brake fluid in the cylinder is pressurized and opens the check valve, flowing through the brake lines to the wheel cylinder. Thus, each wheel cylinder piston is forced outwards. This brings the brake shoes into contact with the wheel drum and slows or stops the lift truck. Meanwhile, the cavity caused behind the piston is filled with brake fluid led through the return port and inlet port to lubricate the piston. When the brake pedal is released, the piston is forced back by the return spring. At the same time, the brake fluid in each wheel cylinder is pressurized by the force of the brake shoe return spring, thus returning into the master through the check valve. With the piston in its original position, the fluid in the cylinder flows into the reserve tank through the return port. The brake fluid in the brake lines and wheel cylinders has a residual pressure proportioned to the set pressure of the check valve, which makes each wheel cylinder piston cup securely seated to prevent oil leakage and eliminates of vapor lock developing when the lift truck is sharply broken.

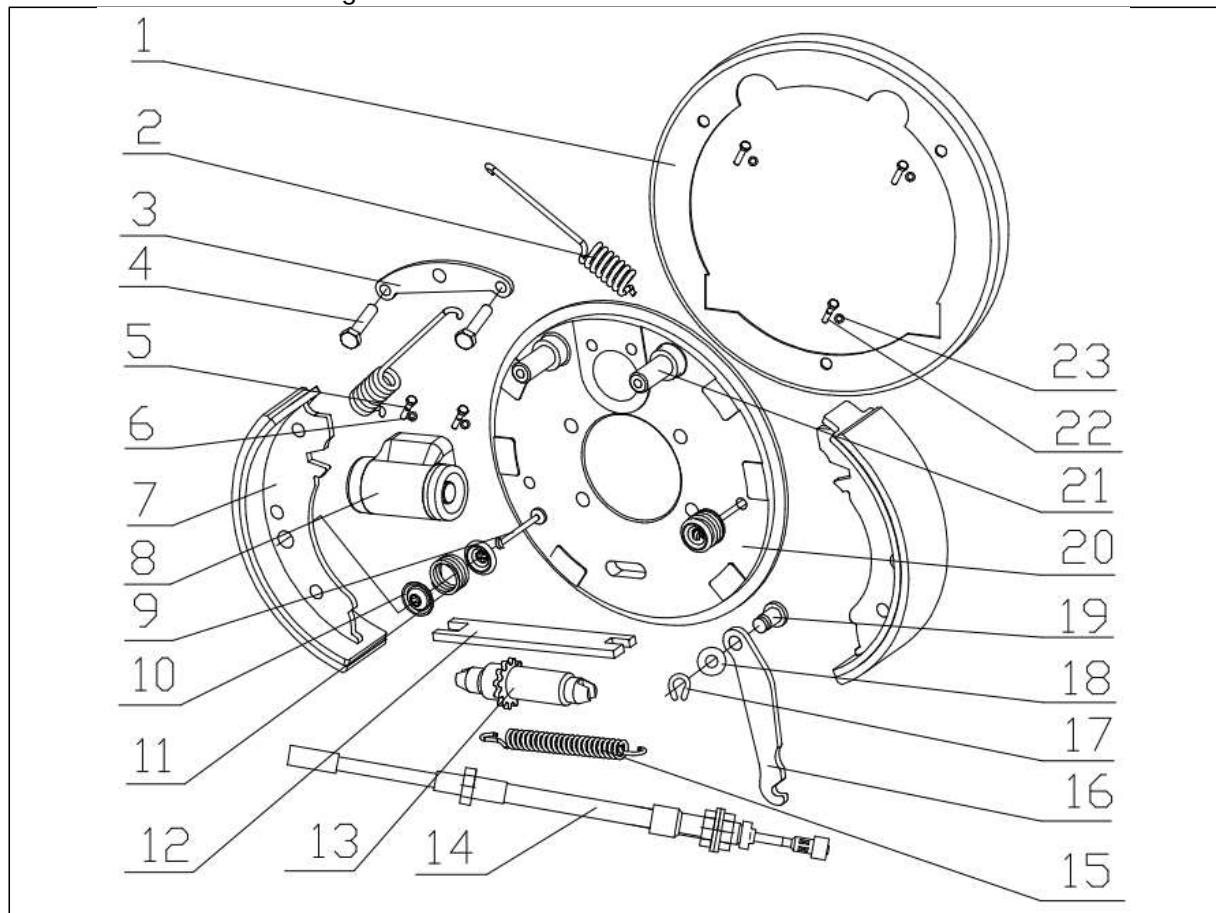


- | | | | |
|---------------|-----------------|---------------|------------------|
| 1.Lock nut | 2.Rod | 3.Dust cover | 4.Stop wire |
| 5.Stop washer | 6.Secondary cup | 7.Piston | 8.Primary cup |
| 9.Spring | 10.Check valve | 11.Valve seat | 12.Cylinder body |

Fig. 3-3 Brake - master cylinder

3.3 Brake

Brake structure is as fig. 3-4



1. Dust guard	2. Pull-off spring	3. Connecting plate	4. Screw
5. Bolt	6. Washer	7. Brake shoe	8. Brake cylinder assy
9. Lever	10. Spring seat	11. Spring	12. Lever parking
13. Adjuster	14. Parking brake cable	15. Pull-off spring	16. Lever parking
17. Clamp spring	18. Washer	19. Pin	20. Bottom plate
21. Pin	22. Screw	23. Washer	



Way to change brake block

- (1) Park the truck on the concrete road.
- (2) Start the motor, and lift the forks about 100mm.
- (3) Stuff a block at the back of rear wheel to avoid the truck's moving backwards.
- (4) Release the nut about 2-3 rings respectively.
- (5) The mast should tilt to the end and place block at every side of the bottom of the outer mast.



Warning

Never let the block touch the tyre.

- (6) Tilt the mast forwards until the tyres leave the ground.



Notice:

- **Disassy the wheel nut after the front wheel rising from the ground.**

- (7) Add chock to the bottom of front carriage to support the truck.
- (8) Engine stops.
- (9) Dismantle wheel nut and wheel. Dismantle half axis, lock nut and lock piece.
- (10) Dismantle hub and drum brake.
- (11) Replace new brake block.
- (12) Re-install hub and drum brake, lock nut and lock piece. Adjust gap of bearing.
- (13) Adjust the gap between block and drum brake and the method is: rotate the wheel in reverse direction and step the brake pedal for several times.
- (14) Taking out the filling block: taking out each filling block in the opposite sequence that when being inserted..
- (15) Confirm there is no person or obstacle, drive backwards at the speed of 2-3Km/h and step the brake pedal for 2-3 times.

3.4 Hand brake device

The hand brake device adopts a hand-pulling soft brake wire device. It makes use of auto-assist pressure linings type brake shared with foot brake. During the whole operation of the handle, article 1(device installing bracket) and article 2 (bolt head) should not be meddled. Only when parking truck, you are able to use the hand brake.

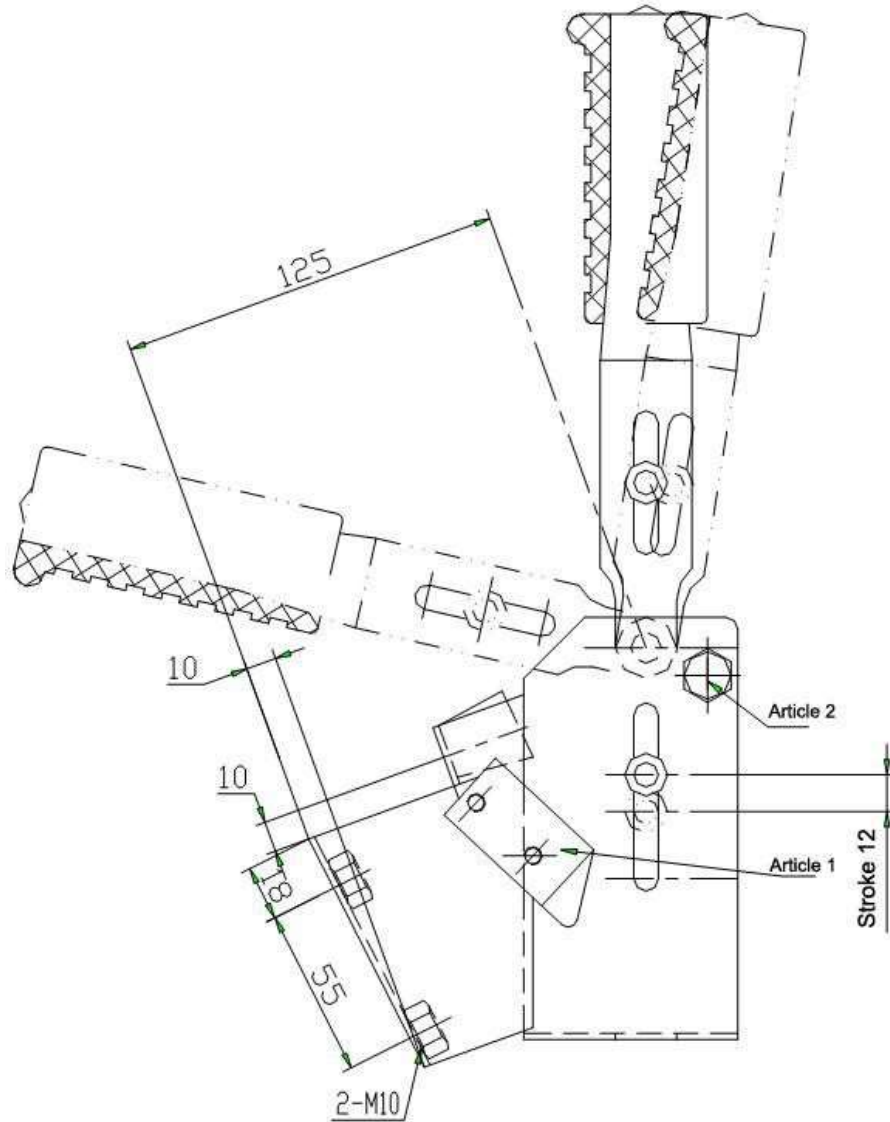


Fig. 3-5 Hand brake

3.5 Fault and adjustment of brake system

Condition	Probable cause	Corrective action
Insufficient brake force	Oil leakage in brake lines. Air in brake lines. Improper functioning of master cylinder Clogged oil lines.	Correct and replenish Bleed air Correct or replace Clean
Brake dragging	No free stroke of brake pedal. Faulty piston cup. Weak or broken return springs. Clogged master cylinder return port. Clogged oil lines.	Adjust Replace Replace Clean Clean

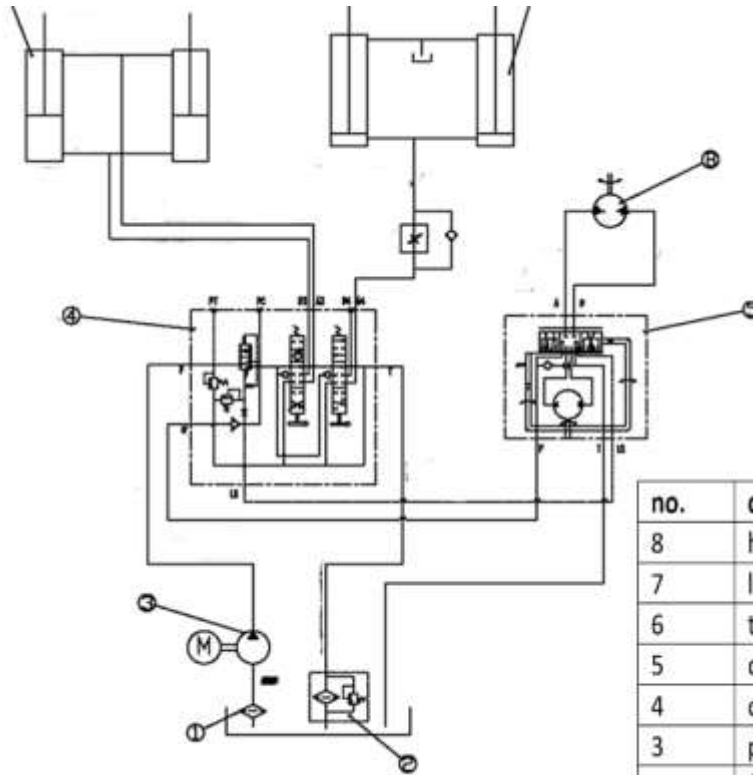


4. Hydraulic system

High-pressure oil outputted through the gear pump divide into two oil line: one line reaches hydraulic steering gear, and preferentially guarantees the operation of steering system; the other reaches hand control valve, control cylinders or tilting cylinder.

The function of pressure-gradient control valve can preferentially distribute oil to the hydraulic steering gear, whatever the loaded pressure and however the steering wheel speed, it can offer sufficient oil, and the rest part can supply to lifting cylinder and tilting cylinder, therefore, it conquers the bad effect on steering arising from over or insufficient oil supplying.

Lifting and tilting slide valve is in the neutral position, and the pressure-gradient control valve does not supply oil. Pulling lifting slide valve, high-pressure oil flow into the lifting cylinder that push the lifting of piston rod; when pushing the lifting slide valve, the bottom of the lifting cylinder piston connects with the low voltage, low down the piston rod by the self-weight and cargo weight. At this time, the descent speed of oil that flows from the lifting cylinder is controlled by one-way governor valve, and pressure-gradient control valve does not offer oil; when operating tilting slide valve, high-pressure oil flows into the tilting cylinder, and the other side is connected with low pressure, which realizes tilting backwards and forwards.



no.	component	measurement data
8	hydraulic Motor	300 cc/rev -- 1000 rpm
7	lifting cylinder	Ø 65 mm bore -- Ø 35 mm rod
6	tilting cylinder	Ø 40 mm bore – Ø 25 mm rod
5	drill tool	14 MPA pressure – 800 cc/rev
4	control valve	30 MPA working– 14 MPA relief – 1,5MPa allowable
3	pump	30.6 MPA rated – 27,6MPa peak
2	filter	70l/min -- 30µ
1	filter	100 µm

Hydraulic diagram

4.1 Gear pump

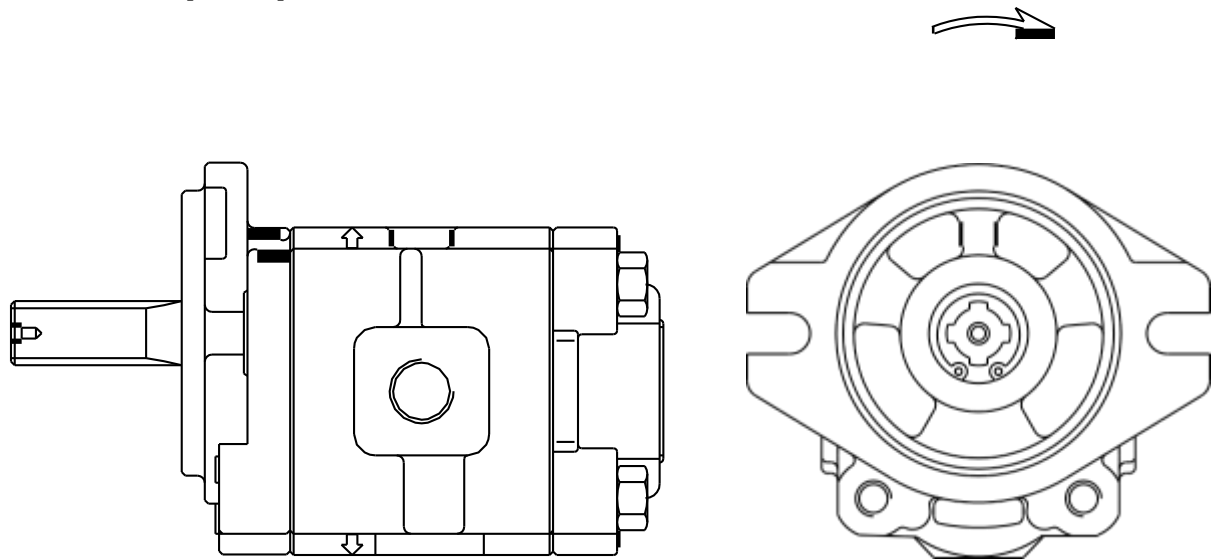


Fig. 4-1 Outline drawing of gear pump

Gear pump parameter

Oil used		Hydraulic oil L-HM32 and relevant oil
Working temperature		-15~90℃
Noise index in the working pressure		≤70db
Performance parameter	Nominal displacement ml/r	16
	Rated pressure MPa	20.6
	Max. pressure MPa	22.6
	Min. rotating speed r/min	500
	Rated rotating speed r/min	2000
	Max. rotating speed r/min	3000
Volumetric efficiency		The efficiency in the rotating speed is more than 80%; The efficiency in the rated rotating speed is more than 93%



Gear pump fault and adjustment:

Fault	Probable cause	Corrective action
No oil pumps from the pump	Low oil level	Fill to the specified oil level
	Blocking of oil suction pipe or strainer	Clean oil pipe and oil tank. If hydraulic oil is dirty, please change it.
Low oil pressure of oil pump output	Bearing worn; retainer, O-ring damage	Change the bad spare parts
	Adjustment failure of relieve valve	Rise pressure with pressure gage
	Air in the oil pump	•Screw the loose connector of the intake side •Fill hydraulic oil to the oil tank •check pump oil seal •Use the pump after bubble vanishing
Noise of oil pump	Distortion of soft tube of the oil absorbing side or cavitation arising from the strainer blocking	Adjust or replace soft tube and clean the strainer
	Suck the air from the loose connector at the intake side.	Re-screw each connector
	Cavity caused by the high viscosity of hydraulic oil	•Replace new hydraulic oil, whose viscosity suits pump running speed •Work only when the oil temperature is normal
	Bubble in the hydraulic oil	Check the reason for the bubble and take measures
Oil leakage of the pump	Damage of oil seal of the pump, damage of O-ring or wear of the pump sliding surface.	Change the bad spare parts

4.2 Control valve

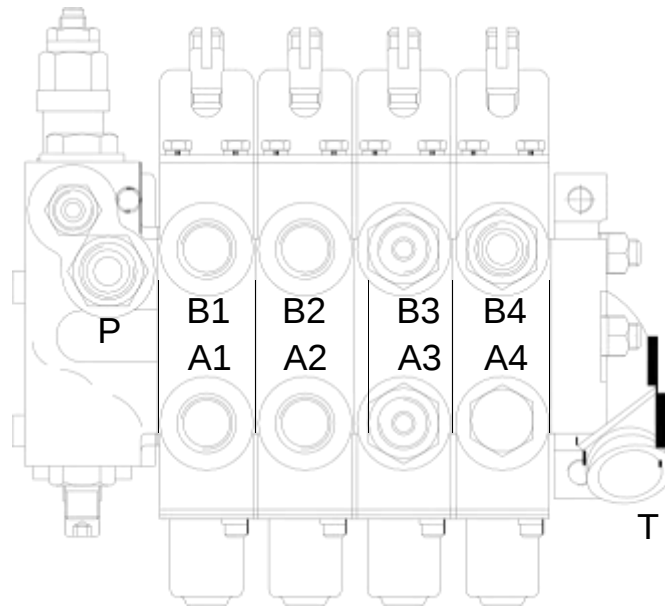
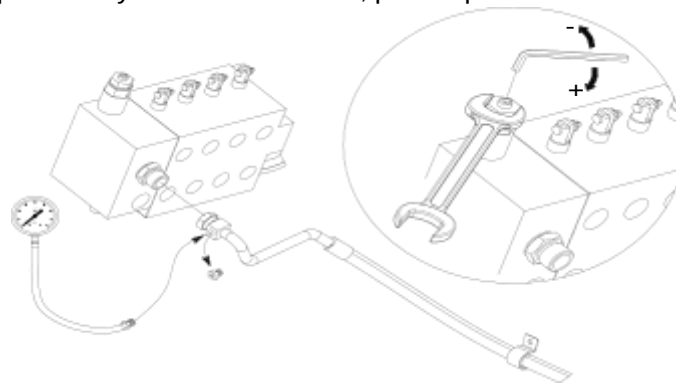


Fig. 4-2 Control valve assy

Main relief valve pressure adjustment

The main relieve valve has been adjusted before leaving the factory, , it is not allowed to adjust at will in general condition. Adjusting way is as follows:

- (1) Park the truck on solid and smooth road, place in neutral, pull up the hand brake handle, tilt the mast backwards to the end, and drop the fork to the ground. The engine stops.
- (2) Open front soleplate, release the pressure mouth bolt of oil inlet pipeline in the multi-way valve, and put in clean place. If hydraulic oil outflows, please protect the environment.



- (3) Connect the pressure gauge. Notice: a. Specification of gauge should be larger than 20Mpa. b. taper thread at pressure mouth matches: Rc1/8R1/8; c. tightening torque is 20-22N•m.
- (4) Start the engine, place the mast in vertical, and the fork is 300mm from the ground.
- (5) Read out the indication in the pressure gauge, and judge is the main safety valve of multi-way valve is in normal scope.
1.5t:15MPa,
- (6) If the pressure is not in the normal scope, please release the main safety valve lock nut, and adjust adjusting bolt.
If the indication is smaller than the normal scope, inner hexagon spanner the adjusting bolt in clockwise (+) to increase main safety valve pressure.
If the indication is larger than normal scope, inner hexagon spanner the adjusting bolt in counterclockwise (-) to decrease main safety valve pressure.
- (7) Stable the pressure in normal scope for 30's.
- (8) Release pressure gauge, install the bolt, and the tightening torque is 20-22N•m. Drop the mast to the ground and tilt backward to end.
- (9) Retighten the tightening nut, and fix it on the front soleplate.


Control valve fault and adjustment:

Fault	Probable cause	Corrective action
Pressure of relief valve is not steady or cannot be adjusted.	Loose of pressure-adjust screw.	Readjusted and retighten.
	Distorted or damaged pressure-adjust spring.	Replace.
	Worn or blocked relief valve core.	Replace or clean for new assembling.
	Pump abated.	Examine and repair pump.
Fork tilt forward when control lever is used while engine is off.	Worn or damaged tilt lock valve.	Replace valve core and tilt lock valve as an assembly.
	Broken tilting lock spring.	Replace spring.
	Damaged tilt valve plunger O-ring.	Replace O-ring.
Mast is unstable when tilting forward.	Malfunctioning tilt relief valve.	Replace tilt relief valve assembly.
Fork carriage descends apparently when the lifting lever is in neutral	Valve body and spool valve is worn and clearance between them is too great.	Replace spool valve with specified clearance.
	Spool valve is not in centre.	Keep the lever be in the neutral
	Cylinder seal abated.	Examine and repair cylinder.
	Taper valve is worn or blocked by dirt.	Replace or clean taper valve.
Spool valve is not return neutral position.	Damaged or distorted reposition-spring.	Replace spring.
	Dirt exists between valve body and spool valve.	Clean.
	Blocked control device.	Adjusted.
	Not coaxial parts at reposition	Reinstall, be coaxial
Leakage	Damaged O-ring.	Replace.
	Faulty seal of joint.	Check and retighten. of the relevant part
	Loose seal plate.	Clean seal plate and retighten blots.
	Loose of lock-nut of relief valve and connect-nut between plate and plate.	Tighten.
Control valve can not move back and forward	Back and forward adjust handle intervene	adjust

4.3 Governor valve

Governor valve is installed at the entrance of lifting cylinder, and is used to keep oil smooth when the lifting cylinder piston lifts, which guarantees the lifting speed; restrict the oil return quantity when the lifting cylinder piston descends, thus restrict the descend speed of the lifting cylinder piston.

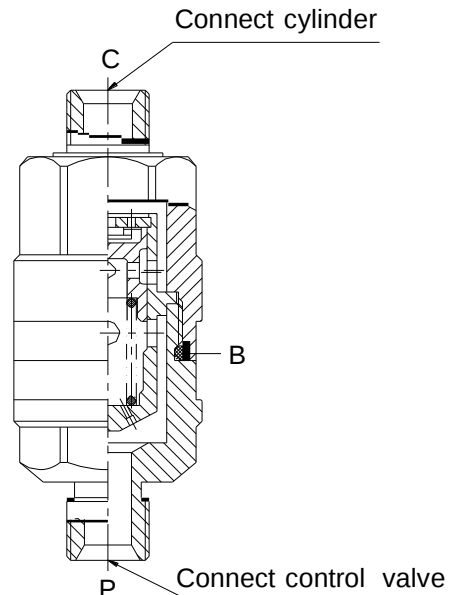


Fig 4-3 Outside drawing of governor valve

Main parameter of relief valve:

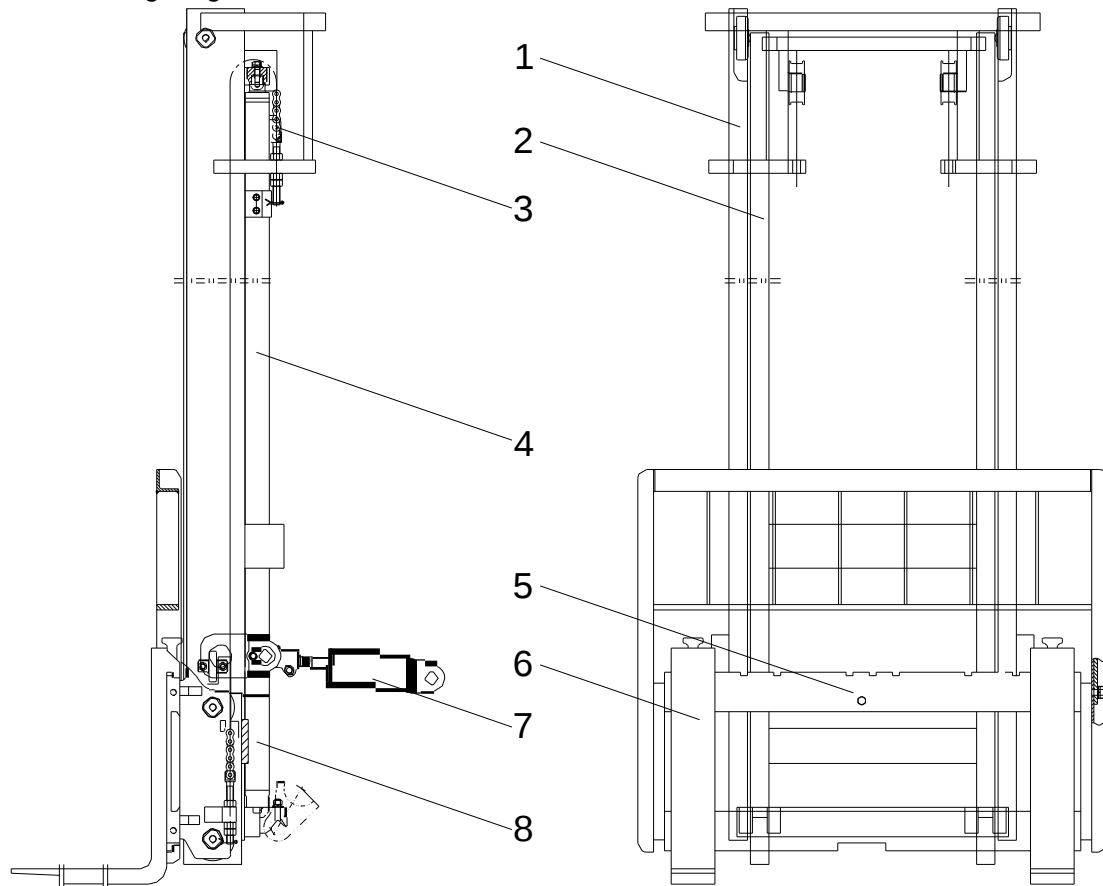
- (1) Hydraulic oil: L-HM32 or in relevant;
- (2) Test oil temperature: $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$; Working oil temperature: $-40^{\circ}\text{C} \sim 100^{\circ}\text{C}$;
- (3) When the input flow is 58 l/min, pressure loss (P→C) should not exceed 0.55MPa;
- (4) Nominal pressure: 20MPa; pressure durability: 29.4MPa/ min;
- (5) When the part B is damaged, C→P pipe line is not cut, when controlling differential pressure 11Mpa, C→P controlling speed is 7~20 l/min;
- (6) Structure chart, main size, control characteristic curve and pressure loss characteristic curve should meet the map requirement.

5.Mast

The basic type mast is 3 meters 2 stages mast. The lifting system is composed of inner and outer mast, chain, fork carriage, roller and etc.

The forks are set at the fork shaft of the fork carriage, the carriage equips with roller and side roller, and the bottom of inner mast also equips with lifting roller and side roller.

Hydraulic oil from the control valve enter the lifting cylinder through governor valve, push the lifting of piston and piston pole, which drives lifting of inner mast, meanwhile, one end of the chain installed on the chain wheel of the inner mast stick to the outer mast, and the other end connects the fork carriage. Fork carriage and forks lift with the lifting of inner mast, which reaches the purpose of lifting cargos.



1.Outer mast

2.Inner mast

3.Chain assembly

4.Left lifting cylinder

5.Fork carriage assembly

6.Fork assembly

7.Tilting cylinder

8.Right lifting cylinder

Fig. 5-1 Mast



Common faults and troubleshooting

Situation	Probable cause	Corrective action
The fork carriage and the mast do tilt by themselves.	1. Tilt cylinder and ring used excessively.	Replace piston ring or tilt cylinder.
	2. The hydraulic control valve spring is out of function.	Replace the unit.
The fork carriage moves up and down too slowly.	1. Caused by piston jamming or bent piston rod.	Clean.
	2. Too much dirt is accumulated in the cylinder	
The fork carriage lifting unsmooth.	1. Carriage bracket assembly out of adjustment.	Adjust clearance with thrust metal and carriage side roller.
	2. Insufficient clearance between inner and outer mast or rollers and mast.	Adjust clearance with rollers
	3. Dirt or foreign material do block the movement.	Remove foreign materials.
	4. Unsufficient lubrication .	Apply grease on contact surfaces on sliding parts.
	5. Deflection of inner mast and bent of carriage bracket	Repair or replace
Forks are lifted unevenly	1. Lift chain is out of adjustment.	Adjust the chain to the same tension
Lift roller does not rotate	1. Unsufficient grease or dirt accumulated in lift rollers.	Clean and lubricate lift rollers.
	2. Improperly adjusted lift roller.	Adjust.
Excessive mast noise	1. Insufficient lubrication. 2. Rollers are not properly mounted. When lifting the mast the upper rollers are fastened too strongly.	Lubricate. Adjust roller, side roller, adjust shim.
Insufficient lift power or blocked lift movements.	1. Excessive wear occurs between the oil pump body, causing too much clearance	Replace the wear parts or the oil pump.
	2. The piston of the lift mast is used or is used or is leaking inside the cylinder.	Replace the O-ring.
	3. Springs in the control valve and relief valve are inoperative or leaking.	Replace new springs.
	4. Excessive wear occurs in the hydraulic control valve and leads to excessive leaks.	Replace.
	5. Oil leaks occurring in the hydraulic control valve sections.	Dismantle for regrinding the seal surfaces and reassemble the valve.
	6. Leakage occurring in the hydraulic pipe.	Inspect the seals and tighten the nuts.
	7. The hydraulic oil temperature is too high. Oil viscosity is too low and the flow is insufficient.	Change hydraulic oil, find out the reason for high oil temperature and eliminate the fault.
	8. The load lifted is beyond the designed capacity.	Do observe the lifting capacity limit.

6 Electrical system

6.1 CURTIS Code table for motor controller fault

There are red and yellow shining LED light on the shell of controller, and different flashing means different fault condition. Listed as follows:

Display condition	Meaning
No lights are on.	The controller does not have power. The battery is out of power or the wire has defection.
Yellow light is flashing	The controller works normally
Both yellow and red light are on	The controller is updating software
Both yellow and red light are flashing	The control has problems.

CURTIS Code table for traction controller fault

EFG 1,5 H

Displayed code	Displayed fault code	Possible reason
1, 2	Controller Overcurrent	1.Short circuit of outer connector U, V or W; 2.Mistake of motor parameter adjustment; 3.Controller fault
1, 3	Current Sensor Fault	1.short between U, V, W phase and truck body.(stator short) 2.Controller fault.
1, 4	Precharge Failed	1.The outside load of capacitance group(B+ terminal) prevent capacitance recharging 2.See 1311 battery check menu: capacitance voltage.
1, 5	Controller Severe Undertemp	1.Controller work in extreme condition, lower than -40°C. 2.See 1311 controller menu: temperature.
1, 6	Controller Severe Overtemp	1.Controller work in extreme condition, higher than +95°C. 2.Over loading; 3.Fix controller incorrectly; 4.See 1311 controller menu: temperature.
1, 7	Severe Undervoltage	1.Adjust battery menu parameter incorrectly; 2.Over loading; 3.Internal impedance of battery is too high. 4.Disconnect battery when driving; 5.See 1311 battery check menu: capacitance voltage. 6. B+ fuse melt or main contactor unclosed.
1, 8	Severe Overvoltage	1. Adjust battery menu parameter incorrectly; 2.The resistance is too high when battery produce rating regenerate current; 3.Disconnect battery when regenerate brake; 4.See 1311 battery check menu: capacitance voltage.



Displayed code	Displayed fault code	Possible reason
2, 1	Controller Undertemp Cutback	1.Controller does not work at this temperature , lower than -25°C; 2.Controller work in extreme condition; 3.See 1311 controller menu: temperature.
2, 2	Controller Overtemp Cutback	1.Controller does not work at this temperature , higher than 85°C。 2.Controller work in extreme condition;; 3.Over loading; 4.Incorrectly fix of controller ; 5.See 311 controller menu: temperature.
2, 3	Undervoltage Cutback	1.Normal condition, fault means need recharging, the controller performance is limited at this voltage, 2.Adjust battery menu parameter incorrectly; 3.Check whether there is any other load running out of battery or not; 4.Internal impedance of battery is too high. 5.Disconnect battery when driving. 6.See 1311 battery check menu: capacitance voltage. 7.B+ fuse melt or main contactor unclosed.
2, 4	Overvoltage Cutback	1.Operate normally. Fault shows regenerate current increase battery voltage when regenerate brake. The controller performance is limited at this voltage, 2.Adjust battery menu parameter incorrectly; 3.Internal impedance of battery is too high.。 4.Disconnect battery when regenerate brake;。 5.See 1311 battery check menu: capacitance voltage.
2, 5	+5V Supply Failure	1.Outside load resistance connected with +5v terminal(pin26) is too low; 2.See 1311 input watch menu: current of 5V and Ext.
2, 6	Digital Out 6 Overcurrent	1.Outside load resistance connected with digital output terminal 6(pin19) is too low;
2, 7	Digital Out 7 Overcurrent	1.Outside load resistance connected with digital output terminal 7(pin20) is too low;
2, 8	Motor Temp Hot Cutback	1.Motor temperature $\geq$ seted cut off temperature , motor temperature>145°C 2.Adjust temperature control parameter of motor incorrectly; 3.See 1311 motor check menu: temperature and motor input:Analog2; 4.If does not use electric heating adjuster, temperature compensate and cut should be OFF.
2, 9	Motor Temp Sensor Fault	1.Connect motor electric heating incorrectly; 2.If does not use electric heating adjuster, temperature compensate and cut should be OFF. 3.See 1311 motor check menu: temperature and motor input:Analog2;
3, 1	Coil 1 Driver Open/Short	1.Drive load open or short; 2.Pin connector dirt; 3.Wiring harness damaged or connect wiring incorrectly.



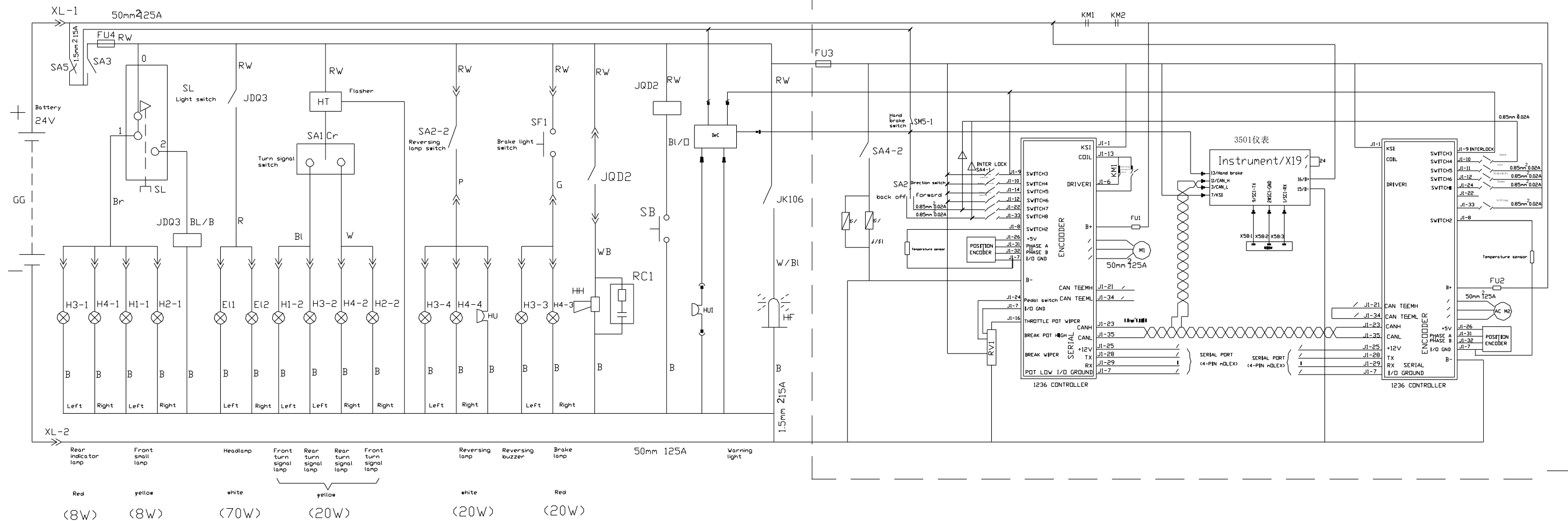
Displayed code	Displayed fault code	Possible reason
3, 2	Coil2 Driver Open/Short	1. Drive load open or short; 2. Pin connector dirt; 3. Wiring harness damaged or connect wiring incorrectly.
3, 2	EM Brake Open/Short	1. Drive load open or short; 2. Pin connector dirt; 3. Wiring harness damaged or connect wiring incorrectly.
3, 3	Coil3 Driver Open/Short	1. Drive load open or short; 2. Pin connector dirt; 3. Wiring harness damaged or connect wiring incorrectly.
3, 4	Coil4 Driver Open/Short	1. Drive load open or short; 2. Pin connector dirt; 3. Wiring harness damaged or connect wiring incorrectly.
3, 5	PD Open/Short	1. Drive load open or short; 2. Pin connector dirt; 3. Wiring harness damaged or connect wiring incorrectly.
3, 6	Encoder Fault	1. Motor coder fault; 2. Wiring harness damaged or connect wiring incorrectly; 3. See 1311 motor watch menu: motor RPM
3, 7	Motor Open	1. The U、V、W wiring of motor open; 2. Wiring harness damaged or connect wiring incorrectly.
3, 8	Main Contactor Welded	1. Main contactor pin cement; 2. The U phase of motor disconnect or open ; 3. There is current which an alternative voltage affords for capacitor group (B+).
3, 9	Main Contactor Did Not Close	1. Main contactor unclosed; 2. Main contactor pin oxidation; 3. Outside load at capacitor group(B+) prevent capacitor recharging; 4. B+ fuse melt.
4, 1	Throttle Wiper High	1. The input voltage of accelerator is too high; 2. See 1311 input watch menu: accelerator voltage.
4, 2	Throttle Wiper Low	1. The input voltage of accelerator is too low; 2. See 1311 input watch menu: accelerator voltage.
4, 3	Brake Wiper High	1. The input voltage of brake is too high; 2. See 1311 input watch menu: brake voltage.
4, 4	Brake Wiper Low	1. The input voltage of brake is too low; 2. See 1311 input watch menu: brake voltage.
4, 5	Pot Low Overcurrent	1. The resistance of potentiometer connected with low terminal is too low; 2. See 1311 input check menu: low terminal.
4, 6	EEPROM Failure	1. Fail to write in EEPROM .EEPROM may be written by VCL, CAN bus, adjusting parameter of 1311 or loading new software, above all may cause fault.
Displayed code	Displayed fault code	Possible reason
4, 7	HPD/Sequencing Fault	1. The sequence of electric door ,interlock , direction and accelerator input is incorrect; 2. The wiring harness or transition switch of electric door, interlock , direction and accelerator input damage.



		3. See 1311 input watch menu.
4, 7	Emer Rev HPD	1. Emergency reverse operating terminates, but the accelerator, back and forward input , interlock switch do not revert to empty shift.
4, 9	Parameter Change Fault	1. Because some parameter setting of 1311 is changed, then this fault appears, it can be eliminated by restarting electric door switch. For example, if user change accelerator type, it may cause fault, it can be eliminated by restarting electric door switch.
6, 8	VCL Runtime Error	1. VCL code run time error; 2. See 1311 controller watch menu: VCL error module and VCL error. This fault may be compared to error code which is defined in run time VCL module ID and system information file.
6, 9	External Supply Out of Range	1.The current of outside load which 5V and 12V input produce is too high or too low, 2.The outside maximum and minimum input of fault check menu parameter is adjusted incorrect, 3. See 1311 input check menu: outside input current.
7, 1	OS General	1. Inner controller fault.
7, 2	PDO Timeout	1.The communicate receiving time of CAN PDO exceeds the overtime cycle of PDO.
7, 3	Stall Detect	1.Motor stop; 2.Motor coder fault; 3.Wiring harness damaged or connection incorrectly; 4.Coder power provide appears matter; 5.See 1311 motor watch menu: motor RPM.
8, 7	Motor Characterization Fault	1. Motor performance description of motor description step is wrong.
8, 8	Encoder Characterization Fault	1. Coder performance description of coder description step is wrong. 2.Motor coder pulse frequency is not a standard value (32, 48, 64, 80ppr)
8, 9	Motor Type Fault	1. Motor type parameter exceeds range.
9, 2	EM Brake Failed to Set	1.Truck remain run when sending out brake signal; 2. EM brake cannot grip the rotary motor.
9, 3	Limited OperatingStrategy (LOS)	1. No matter coder fault (code 36) or stop check fault (code 73) appear, as a result, limited operation control mode is activated. 2. Motor coder fault. 3.Wiring harness damaged or connection incorrect; 4. Truck stall.
9, 4	Emer Rev Timeout	1. Emergency reverse is activated, but emergency reverse has stopped work, because emergency reverse time has exceeded required time. 2. Emergency reverse signal cement.

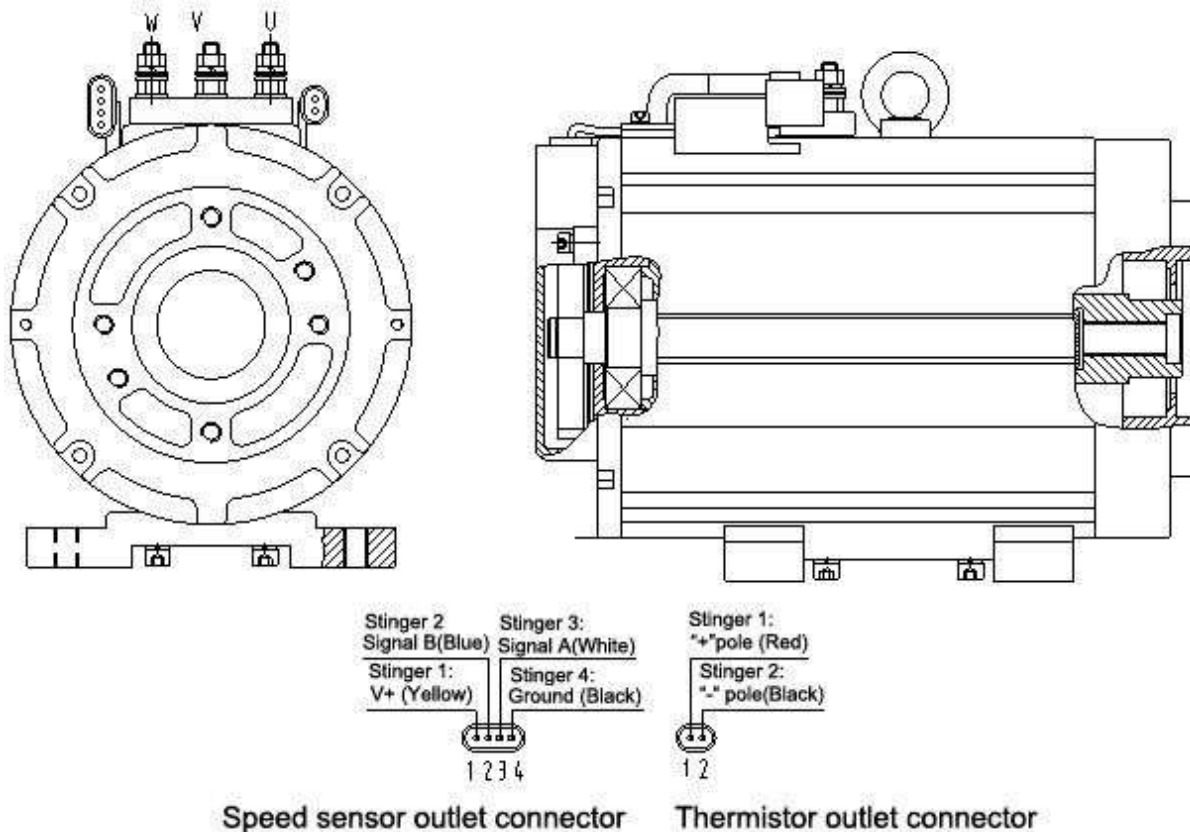


6.4 The electrical system schematic diagram



EFG 1,5 H Electrical system principle diagram

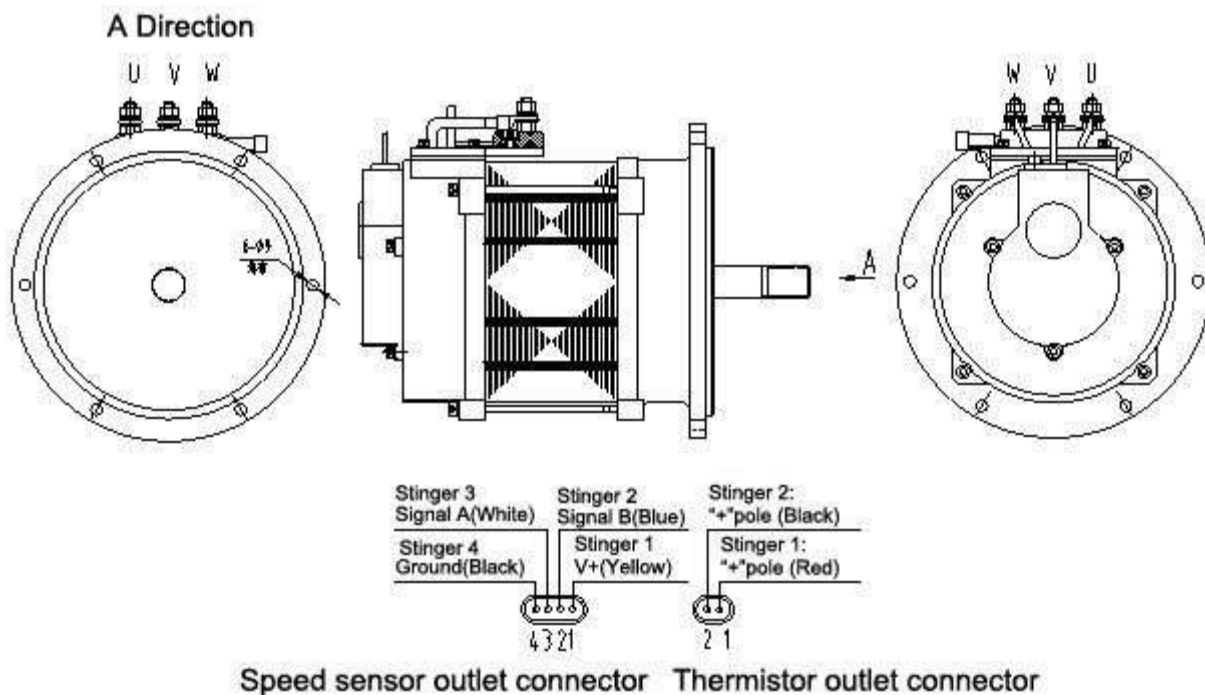
6.5 Pump motor



Use and maintenance

- (1) You should keep the surface and surrounding clean during the motor is running, and the inner of the motor should not have foreign objects.
- (2) Motor is forbidden to start or run without load.
- (3) Motor is forbidden to run overload for long periods.
- (4) If there occurs to peculiar noise or vibration during the motor running, please stop the truck for check.
- (5) When you are checking and maintaining, in order to avoid accident, power must be cut.
- (6) Normal working temperature of the bearing should not exceed 95°C and the sound should be slight and even. Once you find that the temperature is too high or there contains some noise, the bearing may be damaged or intruded by some foreign objects, thus you should disassemble it for clean and check. After cleaning, you do not find any damage, but there is still "ZhaZha" noise, you should replace new bearing. After installing bearing, fill lubricating grease that covers about 2/3 oil chamber of the bearing cover, and change new lithium base lubricating grease after working 2000-2500 hours, meanwhile, you must keep away the intruding from dirt and humidity.
- (7) This motor equips with temperature sensor, and the warning temperature is 135°C, when the motor temperature is over 135°C, the instrument will give you the warning, then you must stop using the vehicle and re-use it when the motor cools down. It is necessary to check whether the brake and transmission system of the truck is normal or jamming condition.
- (8) This motor does not have commutator or brush, is maintenance free. But you should clean the dust on the surface and check whether the wiring is OK.

6.6 AC traction motor



Main technical parameter

Rated capacity	kW	4
Rotate speed	r/min	3170
AC Output	V	16
Current	A	200
Frequency	Hz	110.7
Phase		3

Technical requirement

Per rotate of the sensor outputs 64 square waveform pulse signal, when the motor rotates clockwise (watching from drive end), signal A advances signal B 90°. Thermistor is KTY84-150. Watching from the drive end, when the end terminal letter sequence is the same with power phase sequence, the motor rotates anticlockwise. Output end of the sensor and thermistor adopt AMP connector.



7 Related safety instructions

The model by CE certification which according to the following instruction and standard:

The results meet the requirements of Directive 2006/42/EC of the European Parliament and of the council on the approximation of the laws of the Member States relating to machinery, 2000/14/EC of the European Parliament and of the council on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors, EN ISO 3691-1:2015, ISO/TS 3691-7:2011, EN 16307-1:2013+A1:2015, EN12053:2001+A1:2008, EN1175-1:1998+A1:2010, EN13059:2002+A1:2008 and their harmonious standards.

- Main safety factor will be according with DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL and EN ISO 3691-1:2015, ISO/TS 3691-7:2011, EN 16307-1:2013+A1:2015, EN1175-1:1998+A1:2010 standard.
- The design and manufacture of electrical element comply with the low voltage standard 2006/95/EC.
- Noise will be according with EN12053:2001+A1:2008 and with 2000/14/EC amended by 2005/88/EC.
Sound pressure level at the operator's position is 69 dB(A), sound power level is 86 dB(A).
The measurement uncertainty is 1.5 dB(A).
- Vibration parameters are measured according to standards of ISO5349-2:2001, EN13059:2002+A1:2008, ISO2631-1:1997, and the result meets the requirement of 2002/44/EC.
The whole body vibration of the seat is 0.54m/s^2
- Electromagnetism compatibility is measured according to standard of EN12895:2015, and meets 2014/30/EU.

KONFORMITÄTSCERTIFIKAT / CONFORMITY CERTIFICATE
CERTIFICAT DE CONFORMITE

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We, Deutruck GmbH, declare under our sole responsibility that the specified machine Type/Serial number/Year of construction is in conformity with the following directives: Machinery Directive 2006/42/CE, Electromagnetic Compatibility Directive 2004/108/CE, Low voltage Directive 2006/95/CE. Technical file controlled by: Director Engineering.

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Maintenance Record

Date	Maintenance Content	Maintenance Manual



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