

SERVICE MANUAL

Starke EcoMaxx Series Rough Terrain Forklifts

ECO-FD30-35RT4

Rev 08-2019



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Foreword

Through reading the original operation instructions carefully, the user can master the technical knowledge necessary for the safe operation of forklifts.

We sincerely recommend that you to read the manual and be sure to the detail in mind including content, It's the only way for the machine were able to reduce the failure and to play the highest security features under such normal operation and proper maintenance. It is strictly prohibited to users to refitting vehicle privately; thus all the consequences of this Company shall not be responsible for. Every driver can do to comply with the safety rules listed in the manual, we believe, is a big help for you under safe operation.

The operating instructions are written for different types of forklift. The operator must pay attention to the implementation of the specific provisions of the corresponding forklift models in operational use and maintenance process

Our Company will research and development for the equipment continually. Therefore, customers should understand that we have this authority to modify the shape, equipment and technology. For this reason, from the operating instructions of the content may not be extended out for any equipment specific properties of those rights.

STATEMENT

Vehicles under the manual are special-purpose vehicles for specific places such as factory, tourist attraction, playground etc. according to « Special Equipment Safety Supervision Regulations» .

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F Periodic servicing

1 Periodic servicing	F 1
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E The structure ,principle ,adjustment and maintenance of forklift

1. Power system

1.1 This series include the model of diesel, the engine is connected with the gearbox, and the power output is transmitted to the front drive axle and the rear steering axle through the front and rear transmission shafts. The engine and gearbox are connected with the frame through the shock pad to reduce vibration.

The main parameter for gasoline machine

	Unit	Parameter
Model		4H50TIC
Manufacturer		HATZ
Model		Four stroke, water cool, straight arrangement
Rated power	Kw	54.9/2600
Rated torque	N.m	240/1600~1900
The number of cylinders		4
cylinder diameter*distance	mm	84×88
Total dischargement	L	1.95
The ratio for compress		17.5:1
The minimum consumption rate for flaming fuel	g/kW-h	≤210
The cooling system		Forced cycled water cooling
The lubrication system		Forced lubrication
Battery voltage	V/Ah	12/120
Lubrication fuel	L	7

1.2 The check and adjustment of the generator

1.2.1 Air filter

- (1) Take down the filter core
- (2) Check the dusts and the damaged conditions of filter core. If dirty, use the low-pressure air to flow from the inside to the outside: if damaged, replace with new one.
- (3) Clean the dusty lid
- (4) Changing time (see table 1.2)

1.2.2 the machine oil filter

1. Diesel machine

- (1) Remove the machine with the wrench and replace with the new filter.
- (2) Drip a little oil to the surrounding of seal ring of the new filter, then install it, then twist two-thirds circles when the seal ring touches the body of machine.
- (3) Changing time (see 1.2)

1.2.3 Water tank and attached water tank

- (1) Check the volume of attached water tank check the volume of attached water tank, if the volume is below “low” scale mark, and then add the antifreeze fluid to the standard volume according to the density of LLC.

The fluid surface should be higher than the “high” scale mark when the generator will be hot and the fluid surface should be at two-thirds scale mark when the generator will be cool.

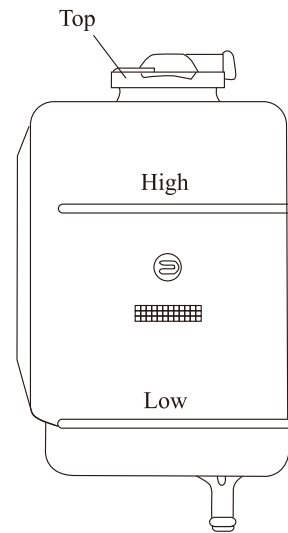


Fig1-1 attached water tank

- (2) Change the antifreeze fluid
 - (a) Wait thirty minutes after turning off the generator
 - (b) Remove the lid of water tank and loose the discharging switch on the water tank
 - (c) Loose the discharging switch of generator and drain the freezing liquid
 - (d) Twist the above two discharging switch
 - (e) Add the antifreeze liquid into the water tank according to the density of the antifreeze liquid and with the adding speed no more than 2l/min
 - (f) Operate generator at the id ling speed after fully adding and check the surface of the attached water tank, if the liquid is lower than the criteria, continue to add until to the standard surface.
 - (g) Screw down the lid of water tank and add antifreeze liquid at any time until the level of the fluid surface is located above the two thirds of the container.

- (3) Adjust tightness of fan belt
- (a) Loose the generator and install the screw
- (b) Adjust the tightness of the belt by moving engine, using finger to press belt with 10 Kg power, press down 10mm at maximum's length.

1.3 The fuel system

The fuel system consists of fuel tank, the fuel filter, the fuel volume indicator and the fuel quantity gauge, which indicates the fuel position.

1.3.1 the fuel tank

The fuel tank is a plug-in fuel tank, which is located on the left side of the frame, and is fixed with six screws, including four on the fuel tank and two on the bottom of the fuel tank. The fuel tank cover plate is located on the upper surface of the fuel tank, and the cover plate is equipped with an oil sensor for measuring the oil quantity.

1.3.2 Fuel volume Sensor

1.3.2 Oil sensor

The oil sensor has a floating element that rises and falls with the liquid level. At the same time, the liquid level is converted to electrical signal and input to the instrument.

1.3.3 Maintenance of fuel system

(1) Water separation of primary filter filter

Replace after 500 hours or 2 years.

(2) The main fuel filter

Replace after 500 hours or 2 years.

(3) The crank box breathing filter

Replace after 500 hours or 2 years.

(4) Oil and oil filter

After 500 hours or 2 years, replace the oil for the first time, after running for 50 hours.

(5) 1200 hours per work, we need to clean the oil filter in the fuel tank once.

(6) Fuel tank

The fuel tank is cleaned once every 2400 hours, and for the gasoline forklift truck, attention should be paid to fire protection when cleaning.

Note:

When changing the oil filter, pour a few drops of fuel around the sealing ring of the new oil filter and install it. When the sealing ring touches the oil filter body, it then screwed into the 2/3 ring.

2. Electric gas system

2.1 Summary

The electric gas system is the single line circuit connecting ground and it consists of the following systems:

(1) Charging system

It consists of the generator, battery, indicating lamp and provides electric source, voltage : DC12V for the electric equipment of the forklift.

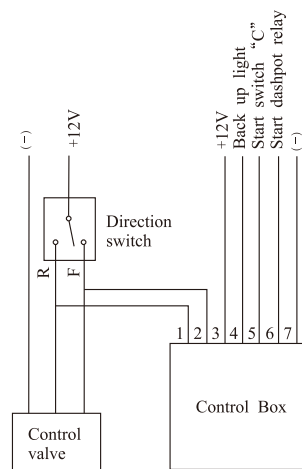
(2) Start system

The start system mainly consists of the preheating installation (only the diesel machine has), start switch, the protective circuit, starter and its function is to start generator.

(3) The transfer and control system for electrohydraulic.

<1>the principle picture of electric gas

<2>the major components



The electro hydraulic control valve

The direction switch

The controlling box

<3> Summary

The electro hydraulic control valve is designed, invented on the basis of the original control switch.

(a) The similarity with the control switch

- Function
- Gearbox connection's size
- The direction and size of the hydraulic fluid connection (input oil mouth, mini-move valve oilmouth, torque-comerter oil-mouth, forward-gear oil-mouth, backward-gear oil-mouth)
- The property parameter of the positioning switch, flowing switch, adjusting switch

(b) Differ from controlling valve The control method of the slide valve is different.

- The machine controls the slide valve of the control valve and the electric magnet valve controls the commutation of the electrohydraulic control valve. The former is the mechanic control and the later is the electric control.

(4) Illumination and signal equipment

Including different kinds of illumination, signal lamp, trumpet and buzzer.

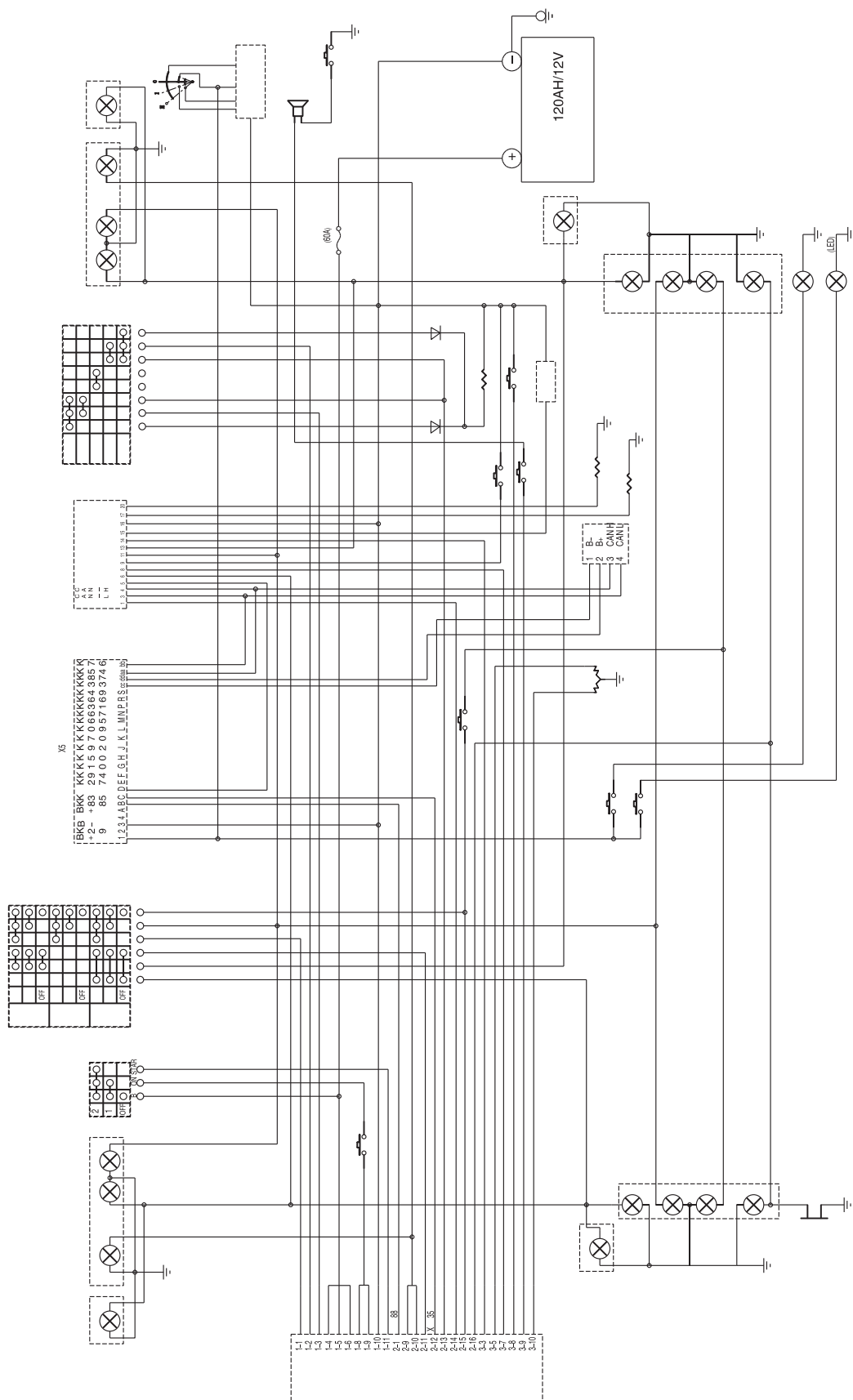
The forward lamp: 55W

The forward combined lamp (transfer/indicating wide): 21W/8W Rear combined lamp (transfer/indicating wide/back the car): 21W(red)/8W(red) 10W (white)

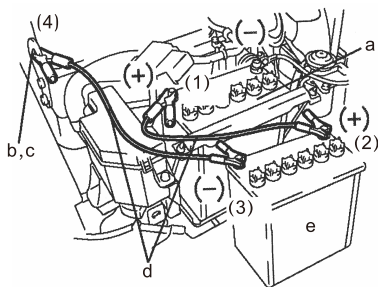
The alarming lamp (Optional part): 21W

(5) Instrument system

Including fuel meter, water temperature meter, oil temperature meter, speed meter, tachometer, hour meter and indicator light. Responsible for monitoring the operation status of forklift.



Electric circuit diagram



- a. Dead-battery vehicle
- b. Engine hanger
- c. To frame
- d. Booster cable
- e. Rescue battery

(12) When the battery is unavailable

when a booster cable is available , it is possible to start the engine by using the battery of another vehicle .

Connect the booster cable following the sequence of the illustration .

Make sure of (+) and (-) terminals of the cable when connecting .

⚠ Caution

- . Connection (1): The (+) terminal of dead battery .
- . Connection (4): Use a frame apart from the battery .
- . Do not directly connect batteries to avoid a danger of explosion .(An inflammable gas generated from batteries may catch fire .)

Note: The maintenance required to bring the energy release
END!

3. Hydraulic transmission device

3.1 overview

The 4WD35 type hydraulic transmission gearbox is a mechanical power device composed of hydraulic torque converter and power shift gearbox with the first three and rear three gear positions. It is used for engineering machinery such as forklift and tractor.

The torque converter used in the 4WD35 type hydraulic transmission gearbox is a single stage two phase three wheel integrated hydraulic torque converter. The hydraulic torque converter makes the hydraulic transmission gearbox automatically adaptable to the output of hydraulic transmission. It can change the output torque and speed accordingly with the change of the external load, and can absorb and eliminate the impact vibration caused by the engine and the external load on the transmission system. The gear shift mode used in the gearbox is the electromagnetic control power shift, with the fretting valve and the buffer valve, which makes the operation simple, convenient and smooth, and reduces the labor intensity of the operator.

The gearbox has a front and rear output port, which enables the vehicle to switch between two wheel drive and four wheel drive through a central toothed clutch.

3.2 Technical Data

ITEM		Technical Data		
Suitable Engine Power kW		36~55		
Suitable Engine Speed r/min		2300~2650		
Suitable Engine Maximum torque N.m		170-280		
Transmission Ratio	Forward I / II / III	I :3.928	II :1.99	III:1
	Revers I / II / III	I :3.928	II :1.99	III:1
The Main Oil Pressure Mpa		1.1~1.3		
torque converter inlet pressure Mpa		0.5~0.9		
Hydraulic torque converter	MODEL	4WD35-00-001		
	Dimension mm	265		
	Working condition of zero speed torque coefficient	3.05 ± 0.15		
	peak efficiency	≥ 0.79		
	Nominal working condition of zero speed pump wheel torque N.m	34 ± 1.5		
	Working condition of the peak efficiency Nominal pump wheel torque N.m	30		
Direction of rotation		Clockwise		
Hydraulic Transmission Oil		6 or 8		
Oil Temperature °C		90~110		
Highest Oil Temperature °C		120 (No longer than 5min)		
Size(L×W×H)mm×mm×mm		714.5×447×697.5		
Net Weight kg		190		

3.3 Operating Principle

3.3.1 Transmission Principle

The working principle diagram of the 4WD35 type hydraulic transmission gearbox is shown in Figure 1.

The hydraulic torque converter is driven by the engine through the elastic connecting plate to drive the pump wheel to rotate, so that the liquid flow flows into the turbine at high speed along its blade direction, and drives the turbine to rotate. The guide wheel makes the torque converter act as a torque converter, and transfers the torque to the input parts of the hydraulic transmission gearbox through spline connection.

When driving backward, when the forward gear is hung, the reversing clutch gear is idling.

The first order of transmission is: 1, 2, 6, 11, 9, 12, 13, 14, 16, and output shaft flange.

The forward second gear transfer sequence is: 1, 2, 6, 11, 9, 10, 15, 14, 16, and output shaft flange.

The three stages of transmission are: 1, 2, 6, 11, 9, 8, 17, 14, 16, and output shaft flange.

After driving, when hang into reverse gears, gear idle running clutch.

The sequence of reversing one gear is: 1, 2, 3, 7, 11, 9, 12, 13, 14, and 16.

The order of reversing second gear is: 1, 2, 3, 7, 11, 9, 10, 15, 14, and 16.

The sequence of reversing three gears is: 1, 2, 3, 7, 11, 9, 12, 13, 14, and 16.

The forward and backward clutch is controlled by electromagnetic power shift operation valve.

Control the clutch closure of the front 20 output shaft through the function switch valve. When the clutch of the 20 front output shaft is closed, it will also output at the same time through parts 18, 19, 21, 22 and front output shaft flange.

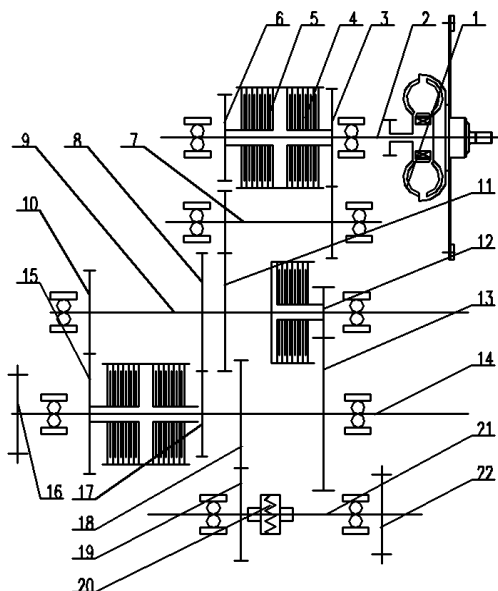


Fig 3-1 4WD35 hydraulic transmission operating principle

- | | | | |
|--------------------------------|-------------------------------|----------------------------|------------------------------|
| 1.Torque converter | 2.Input shaft assembly | 3. Reverse clutch gear | 4.Inner attrition piece |
| 5.Outer attrition piece | 6.Shun clutch gear | 7.Idler gear | 8.Third gear |
| 9.Intermediate shaft assembly | 10.Second gear | 11.Countershaft gear | 12. First gear clutch gear |
| 13.First gear | 14.Rear output shaft assembly | 15.Second gear clutch gear | 16.Rear output flange |
| 17.Three gear clutch gear | 18.Gear | 19.Front output shaft gear | 20.Front output shaft clutch |
| 21.Front output shaft assembly | 22.Front output shaft flange | | |

3.3.2 Oil Line Principle

4WD35 Hydraulic transmission gearbox oil circuit principle diagram as shown in figure 2. The F means Forward, R means Reverse, 1#, 2# and 3# means 1, 2 and 3 gears.

Clutches are controlled by control valves. The fuel pump 3 is an outer meshing gear pump, which is directly driven by the engine through the pump wheel. The oil pump supplies pressure oil to the system. After the torque converter works, the oil enters the radiator on the vehicle, and then enters the gear box to lubricate the friction plate. Bearings and gears.

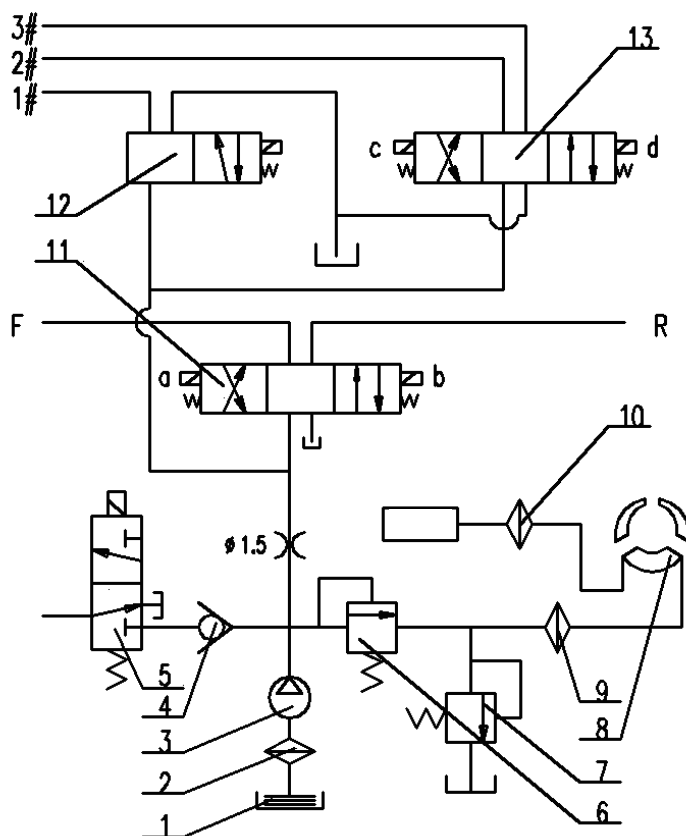


Fig 3-2 4WD35 Hydraulic transmission gearbox oil circuit principle diagram

- | | | | | |
|--|--|--------------------|-----------------|----------------------------|
| 1.Oil tank | 2. Crude filter | 3.Oil Pump | 4.One-way valve | 5.Function switching valve |
| 6.Surge valve | 7.Overflow valve | 8.Torque converter | 9.Fine filter | 10.Cooler |
| 11.Direction solenoid valve | 12. A gear electromagnetic valve gears | | | |
| 13.Two, third gear electromagnetic valve | | | | |

3.3.3 Construction

4WD35 Hydraulic transmission gearbox structure diagram as shown in figure 3.

The power of the engine is input from the torque converter turbine to the input shaft components of the gearbox by the torque converter action. The structure of the gearbox mainly includes the input shaft, the torque converter, the inert gear, the intermediate shaft, the rear axle part, the front output shaft, the control valve, the function switch valve, the oil pump shaft, the oil pump and so on.

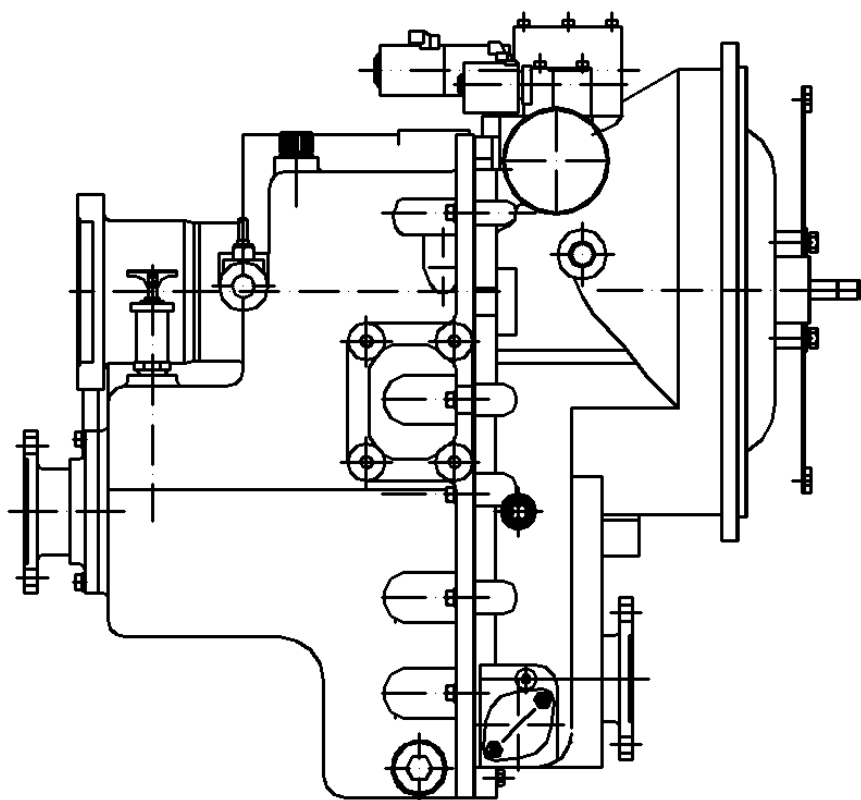


Fig 3-3 4WD35 Structure Chart

3.4 Install、 notes

(1) Before installing the product, please clean surface of the product. To avoid the oil leakage, no demolished or remove of the product.

(2) Preventing hitting collision during install, in case affect the installation and precision.

(3) Central mounting hole to check the engine fly wheel runout is no more than 0.15.5mm, fly wheel runout is no more than 0.1mm; mounting end surface of the flywheel housing runout is no more than 0.2mm, two dowel holes location of the mounting surface is no more than $\phi 0.1\text{mm}$

(4) Forklift control mechanism should ensure manipulate stem and stem stroke jog accurate and reliable positioning. Micro-Valve stem after the operator releases the foot pedal should be reset. When install the micro valve stem, it should be linked with the brake pedal. It must be ensured that the micro valve stem pull-out stroke is equal to or greater than 13 mm and the clutch fluid can be closed to brake the brake pedal. The vehicle shift, turn the micro valve, and then shift.

(5) Working oil should be kept clean, without other impurities, the new gearbox begin first 100 hours of operation, should replace new oil. Then every 500 hours or long-term disabled should be enabled replaced with new oil. Every 250 hours of work in a dirty environment changed to new oil. When replacing new oil, crude oil filter should also be cleaned and replace oil filter.

(6) Inject working oil, check the oil level after 5 minutes drive. It should be within the prescribed oil-foot range. Filler cap as both a breather cap.

3.5 Fault reason and method

Fault	Reason	Method
Low power and high oil temperature	① No oil	Add oil
	② Pump problem	Change
	③ Seal ring wear	Change
	④ Bearing damage	Change
	⑤ Blockage of oil filter	Change
	⑥ Pipe or joint damage	Change
	⑦ Inching valve not in position	Check and adjust
Leakage Oil	① Seal wear	Change
	② Seal broken	Change
	③ Rubber hardened or deformed	Change
	④ Loosening of bolts and oil leaking in joint	Retighten
	⑤ Joint face scratching	Change
Abnormal noise	① Gear damage	Change
	② Loose or deformation of elastic plate input	Adjust nuts or change new
	③ Wear or damage of bearing	Change
	④ Bolt loosening	Change
	⑤ Spline wear	Change
	⑥ Air leakage caused by air suction	Check and change
	⑦ Lack oil	Add oil
	⑧ Improper adjustment of bearing in wheel hub	Adjust
	⑨ Wear or damage of hub bearings	Change

4. Drive axle

4.1 Summary

4.1.1 Fundamental structure

The drive axle is mainly composed of bridge assembly, main transmission, wheel reducer, brake assembly and so on. The working principle is as shown in Figure 1. The driving torque is input to the main actuator, the driving direction is changed by the active bevel gear and the driven bevel gear which is vertically installed, and the speed is reduced and the torque is transferred, then the power is passed through the differential and half shaft to the edge of the wheel, and the wheel side deceleration mechanism will be further decelerated after the wheel side deceleration mechanism will be transported. The motion and torque are passed to the two drive wheel.

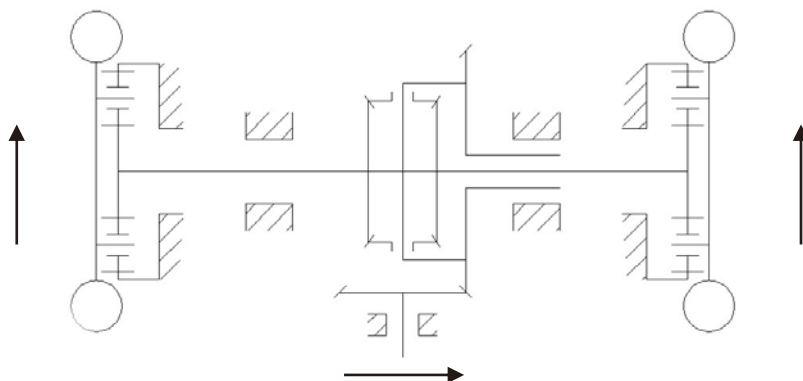


Figure 1 Working principle diagram

4.1.2 The main driver structure

The main driver structure is composed of a pair of spiral bevel gear and differential. The differential is composed of two tapered straight toothed half shaft gears, four cone-shaped straight toothed planetary gears, differential shells, static and dynamic friction discs, etc.

4.1.3 Hub reduction gear

Hub reduction gear which is mainly composed of planetary gear frame, inner gear, planetary gear and solar gear. The inner gear is fixed on the arc support through the spline, and the planetary gear frame is fixed with the hub.

4.1.4 Bridge assembly

The bridge assembly consists of bridge, dynamic and static friction plate and piston.

4.1.5 Main technical performance parameters

	Front axle	Rear axle
Resultant gear ratio	$i=18.6$	$i=13.386$
Tread	$B=1420$ (mm)	$B=1480$ (mm)
Braking torque	$M=15$ (KN · m)	$M=15$ (Kn · m)
Brake oil pressure	$p=5$ (Mpa)	$p=5$ (Mpa)
Bridge load	$W1=8000$ (Kg)	$W1=8000$ (Kg)
Single bridge length	$A=1814.8$ (mm)	$A=1706$ (mm)

4.2 The use of drive axle

4.2.1 Drive bridge installation

The 2.1.1 rim nut is M22 * 1.5, the tightening torque is 563 N.m. A group of rim nuts should be coated with 242 lotion before tightening, and must be carried out in a symmetrical and uniform manner. In normal use, it should be often checked whether the nut is loose, fastened in time, the ball end of the nut should be consistent with the rim of the rim of the rim, and it does contact compaction to make the connection firmly.

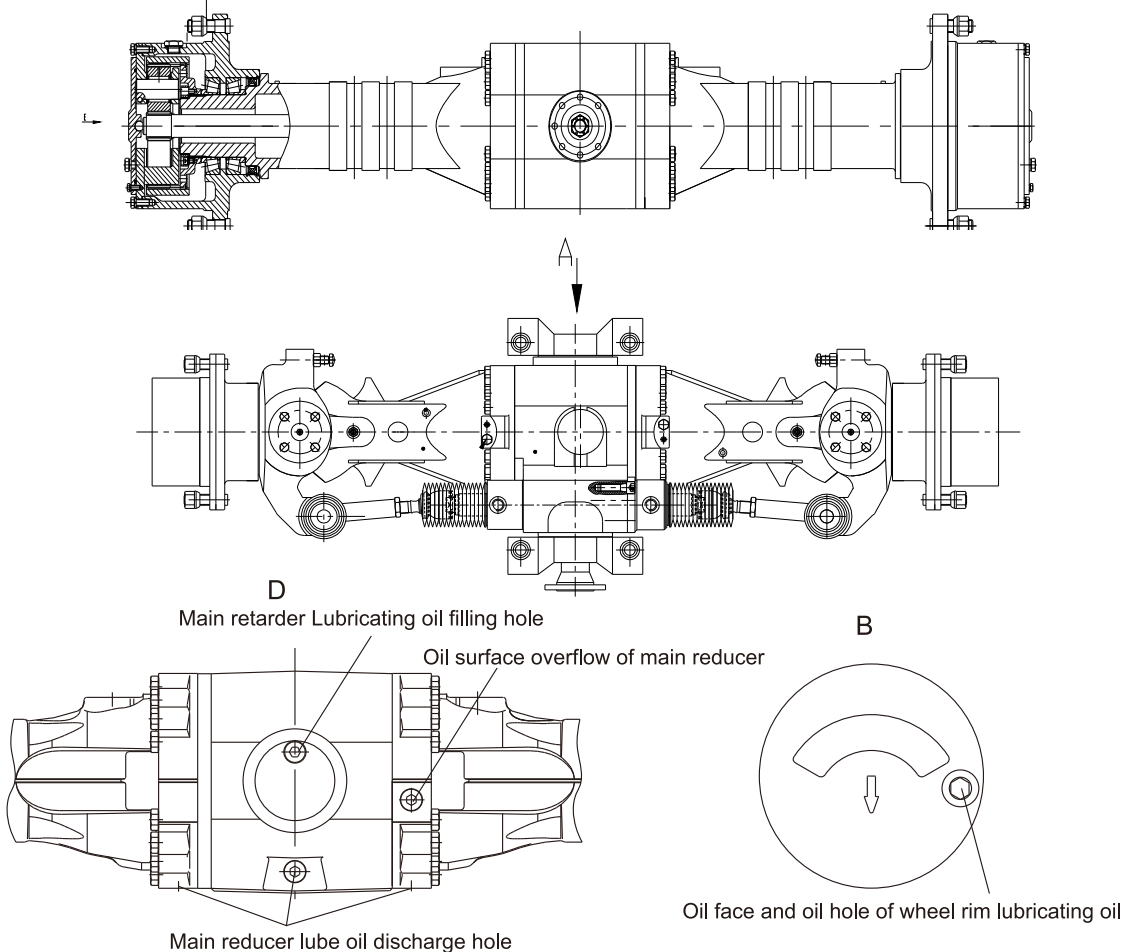
4.2.2 Refueling method of driving bridge

First open the oil face screw on the box, then open the gas hole plug at the left and right hub, and make the refueling holes in the left and right hub, and the oil faces are in the horizontal position.

(1) The wheel refueling is first slowly injected into the gear oil from the hub filling hole. When the oil begins to overflow from the end cover oil face, repeat the process after 10 minutes and repeat the above process in 10 minutes, and refuel for three times.

(2) Slowly pour the gear oil from the oil face of the tank, and stop the oil when the oil starts to overflow from the oil face, as shown below.

Generally use GL-585W/90 heavy load vehicle gear oil, standard code GB12895-92.



DR35.19(Q)、ZR20.13(H)Drive the bridge

4.2.3 Correct way to use wet brakes

The working pressure of the brake is 5MPa. Before the main engine is walking, please adjust the foot brake to make the brakes brake flexible and reliable. When debugging, first tighten the deflation screw (exhaust hole), step on the foot brake plate continuously, until it feels very hard to step forward. At this time, step on the foot brake plate, release the deflation screw (exhaust hole) release, the bubble release can, then tighten the deflation screw and loose the foot brake plate. Repeat the above steps until there is no bubble. The left and right sides of the brakes are operated according to the above requirements.

4.3 Common troubleshooting method

Fault	Reason	Method
Work sometimes has an abnormal sound	①Part friction	Disassemble the repair or replacement parts
	②Bad gear meshing	Reassembly and adjustment
	③Poor lubrication	Improve lubrication
Leaking	①Aging of oil seal burning	Replacement of oil seal
	②Loosening of bolts	Tighten the bolt
	③ Poor lubrication	Improve lubrication
	④High oil surface	Put oil to the specified position
High temperature of bridge body	①Poor lubrication	Improve lubrication
	②Improper assembly of gear and bearing	Adjust according to the requirements of the drawing
Brake locking	①brake piston die	Cleaning the inner cavity and piston of the brake
	②There are problems with braking back oil road	Check the brake back road
	③The dynamic and static friction shaft or stuck	Check the gear if there is debris or bump, and repair

4.4 Tire installed

4.4.1 Front wheels

- (1) Unload the vehicle and place it on level ground .
- (2) Set the parking brake and chock the wheels . Locate the jack-up point on the bottom surface of the frame in the rear of a front tire . Securely insert the jack there .Confirm that the jack is properly positioned .
- (3) Jack up to just prior to the wheels coming up off the ground and loosen the hub nuts .
- (4) Jack up until the wheels come off the ground . then remove the hub nuts and remove the wheels .
- (5) To reinstall the wheels after changing a tire , perform the steps for removing in reverse order . The hub nuts should be tightened evenly and in the sequence shown in the figure .
- (6) After replacing the wheel, check and adjust the tire pressure.

4.4.2 Rear wheels

- (1) Place the vehicle on level ground .
- (2) Set the parking brake and chock the wheels then insert the jack under the weight .

4.4.3 Changing tires

Caution

- . Use proper safety precautions when jacking the vehicle. Never get under the forks or frame .
- . Refer to service data for hub nut tightening torque and tire air pressure .
- . Tire air pressure is very high, so pay attention to rim deformation, cracks, etc. Never exceed proper air pressure .
- . Do not replace any tire without turning on the ignition switch before jacking up the vehicle. Upon completion of the tire replacement, return the ignition switch to the OFF position (SAS models .)

5. Steering system

Type		Real wheel steering
The type of redirector		Arbitral
The number of redirector		BZZ5-E250BC-H1
The turning Cylinder	Model	Double-action piston
	Steering cylinder function area	47.67mm ²
	Distance	210mm
Rated pressure		9mpa
Radius of steering wheel		φ300mm
Specification of tire		10.0/75-15.3-12PR
The air pressure of tire		470kPa

5.1 Summary

The steering system mainly consists of the steering wheel, the steering axle and the steering unit, the steering axle connects with the steering unit by joint and the link connects with the steering wheel by joint. The column can lean to the appropriate position both forward and backward. (Picture5-1)

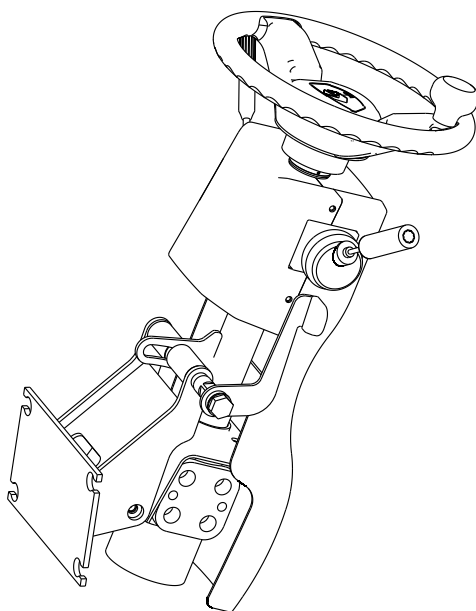


Fig 5-1 Turning control device

5.2 Arbitral

The arbitral (picture 5-2) can transmit the pressure oil from the valve to the steering cylinder by the channel according to the angle measurement. When the generator extinguishes, then the oil pump can not provide oil and can be rotated by manpower.

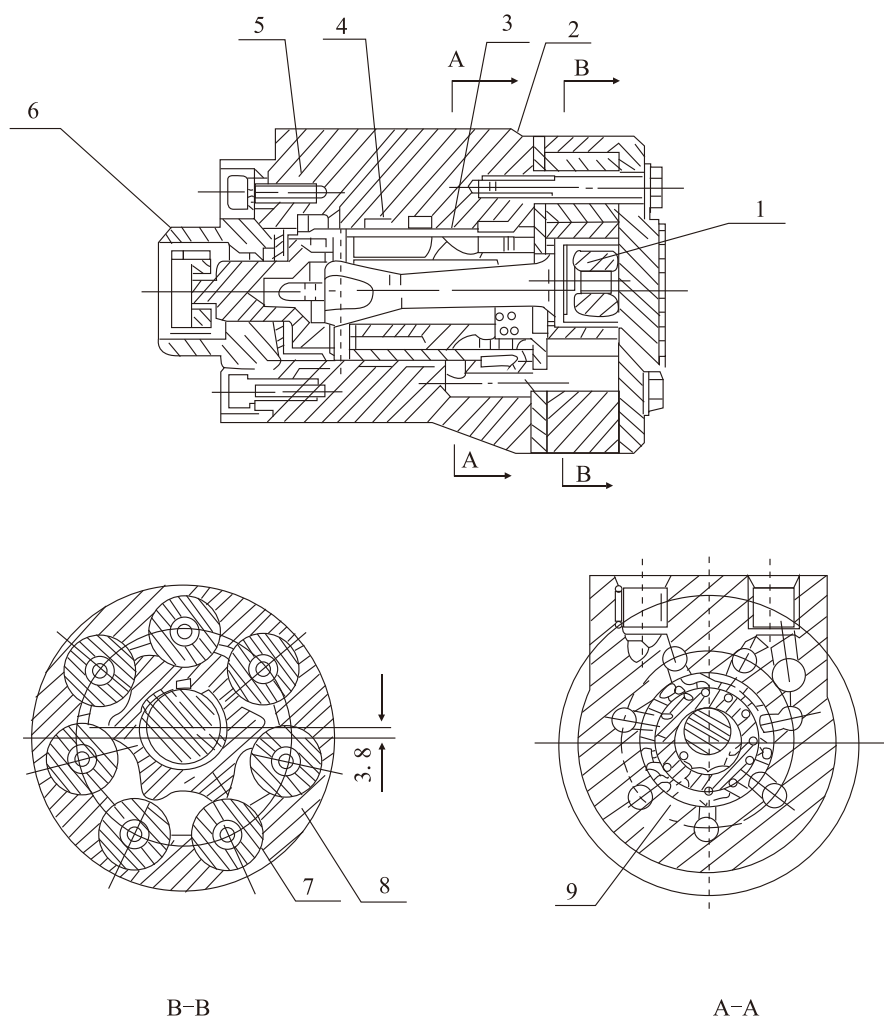


Fig. 5-2 Full hydraulic redirector

- | | | |
|-------------------|----------------------------|----------------|
| 1. limited column | 4. universal driving shaft | 7. rotor |
| 2. valve body | 5. spring plate | 8. stator |
| 3. valve core | 6. connecting piece | 9. valve cover |

5.3 The inspect after reassembling the steering system

(1) Turning the steering hand-wheel right and left. Inspect whether the steering power is smooth.

(2) Inspect whether connection of the hydraulic pipeline is correct by turning the steering hand-wheel right and left.

(3) Lift up the rear wheels and slowly turn the steering hand-wheel right and left several times to exhaust air from the hydraulic pipeline and the steering cylinder.

5.4 Steering system troubleshooting

Malfunction Description	Analyze Malfunction Reasons	Suggestions
Steering Problem	Oil pump damaged or malfunction	Replace
	Flow divider jammed or damaged	Clean or replace
	Hose or connection jammed or damaged	Adjust or clean
Heavy steering	Low pressure in flow divider	Adjust pressure
	Air in the oil way	Exhaust air
	Redirector restoration malfunction, fixed spring break or less elasticity	Replace the spring leaf
	steering cylinder internal leak too much	Check the plunger seal
Forklift Zigzagging or Vibrating	steering flow too much	
	spring break or less elasticity	Adjust the flow divider
Big Noise	Low oil volume in cylinder	Replace
	Sucker or oil filter jammed	Clean or replace
Oil leaking	Steering cylinder seal damaged or pipeline or connection damaged	Replace

6 Braking system

6.1 Summary

The brake system is the four-wheel brake consisting of an accumulator, a master cylinder and a brake pedal mechanism.

6.1.1 Brake pedal

The brake pedal is installed on the floor of the cab. The pedal moves the hydraulic brake valve stem to control the flow and pressure of the brake oil road, and compress the wet brake disc on the front and back of the axle, making the wheel produce the appropriate braking force.

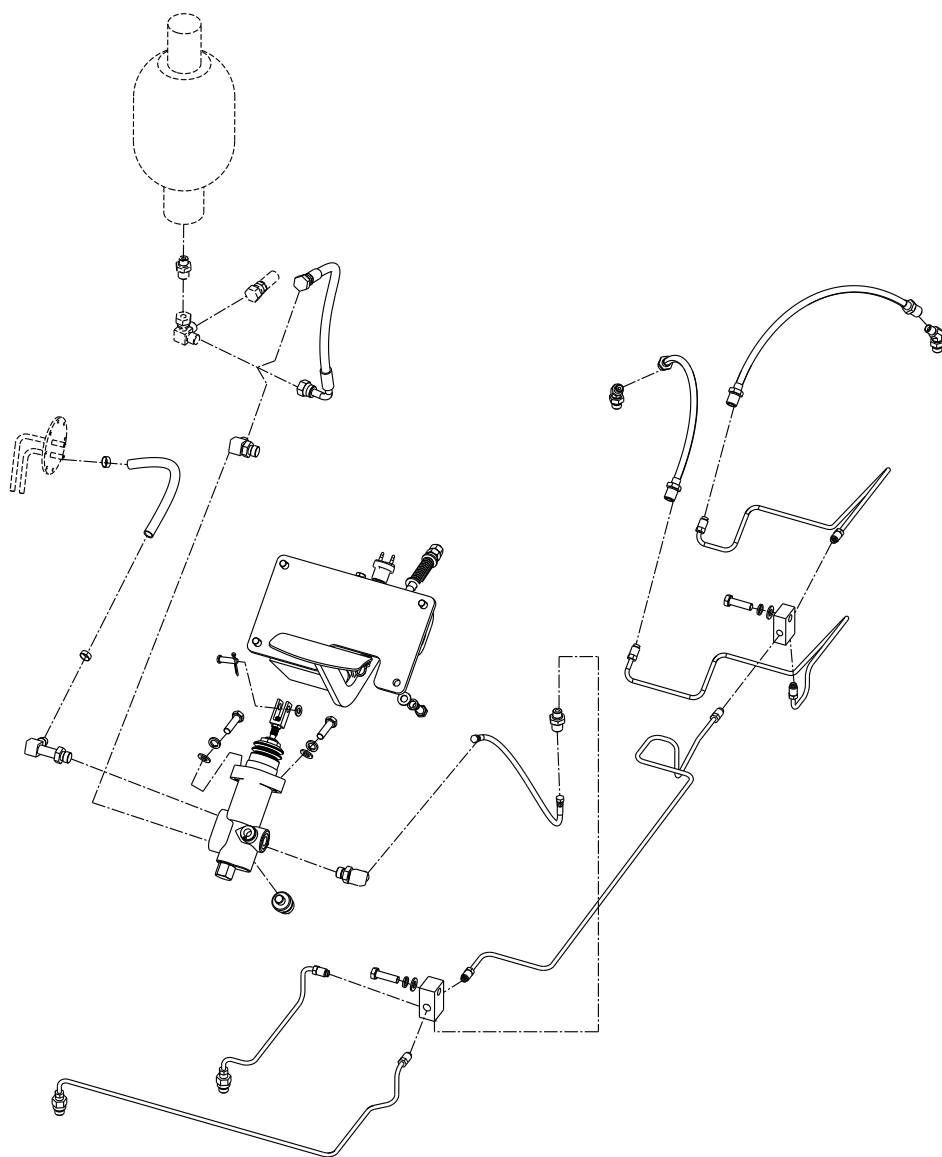


Fig. 6-1 Braking Pedal

6.1.2 Braking main pump

The structure of the brake master cylinder is shown in Figure 6-2. The main pump is composed of piston, spring and push rod.

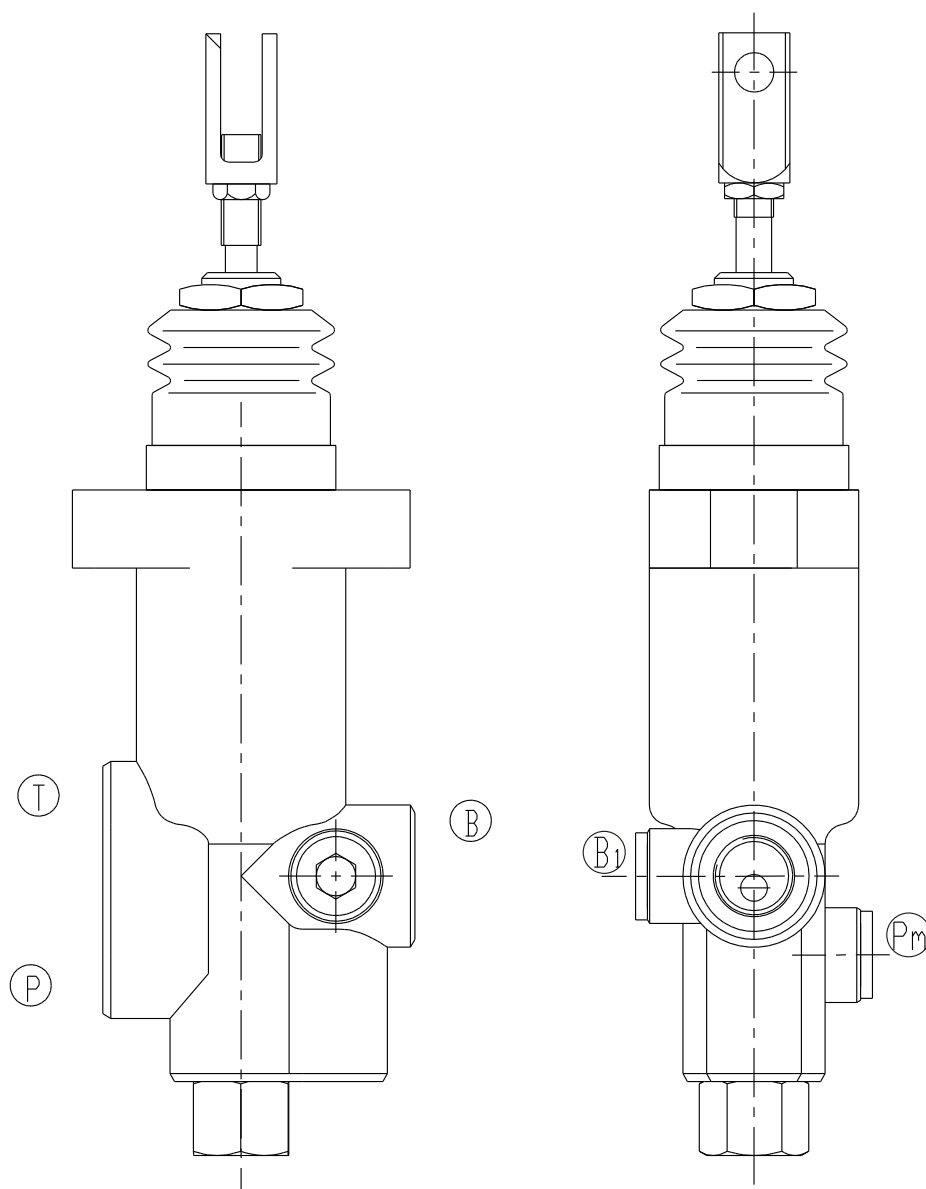


Fig. 6-2 Braking main pump

6.2 Troubleshooting

Problem	Probable Cause	Remedy
Poor braking	<ol style="list-style-type: none"> 1. oil leakage from brake system 2. Maladjustment of brake shoe clearance 3. Brake overheating 4. Poor contact between drum and friction piece 5. Foreign matter adhered on friction piece 6. Foreign matter mixed in brake fluid 7. Maladjustment of brake pedal (inching valve) 	<p>Repair</p> <p>Adjust the adjuster</p> <p>Check for skid</p> <p>Readjust</p> <p>Repair or replace</p> <p>Check brake fluid</p> <p>Adjust</p>
Noisy brake	<ol style="list-style-type: none"> 1. Hardened friction piece surface or foreign matter adhered there 2. Deformed backing plate or loose bolts 3. Deformed shoe or incorrect installation 4. Worn friction piece 5. loose wheel bearing 	<p>Repair or replace</p> <p>Repair or replace</p> <p>Repair or replace</p> <p>Replace</p> <p>Repair or replace</p>
Soft or spongy brake	<ol style="list-style-type: none"> 1. Brake fluid leakage 2. Maladjustment of brake shoe clearance 3. Air mixed in brake system 4. Maladjustment of brake pedal 	<p>Repair</p> <p>Adjust the adjuster</p> <p>Emit the air</p> <p>Readjust</p>

7 Hydraulic system

		3T	3.5T
Engine Type		4H50TIC	
Main Pump	Type	Gear pump	
	Displacement	40mL/r	
Multiport Valve	Type	Double sliding Valve with Overflow Valve, flow divider and tilt self-lock valve	
	Adjustable pressure	17.5MPa	
	Pressure divided	7MPa	
	Max. flow divided	14L/min	
Lifting Cylinder	Type	Single-acting Piston	
	Cylinder diameter	56mm	63mm
	Stroke	1495mm(When lifting height 3M)	
Tilt Cylinder	Type	Double-acting piston	
	Cylinder diameter	80mm	
	Stroke	131mm	
Brake pump	Brake pressure	5.5MPa	
	Max. brake system flow	10L/min	
Accumulator	Accumulator volume	1.6L	
	Precharge pressure	5.5MPa	
	Maximum pressure	20MPa	
Oil tank Capacity		65L	

7.1 General description

The hydraulic system consists of the main oil pump, the priority multiple valve, the steering gear, the tilting solenoid valve, the tilting cylinder, the hydraulic lock, the hand pump, the hydraulic brake valve, the fluid filling valve, the accumulator, the lift cylinder, the inclined cylinder and the pipeline. The oil supply tank is on the right side of the car body.

7.2 Main pump

The main oil pump is the gear pump, it is driven by the gearbox power outlet, and the tank oil is transmitted through the main pump to the filling valve.

The main pump consists of body of pump, a pair of gear, scale board and check ring. Use the bearing of pressure balance and the unique lubrication method to minimize the gap of the gear. The pressure balance method is to make the scale board press towards the side of gear because of the oil discharging between the scale board and pump.

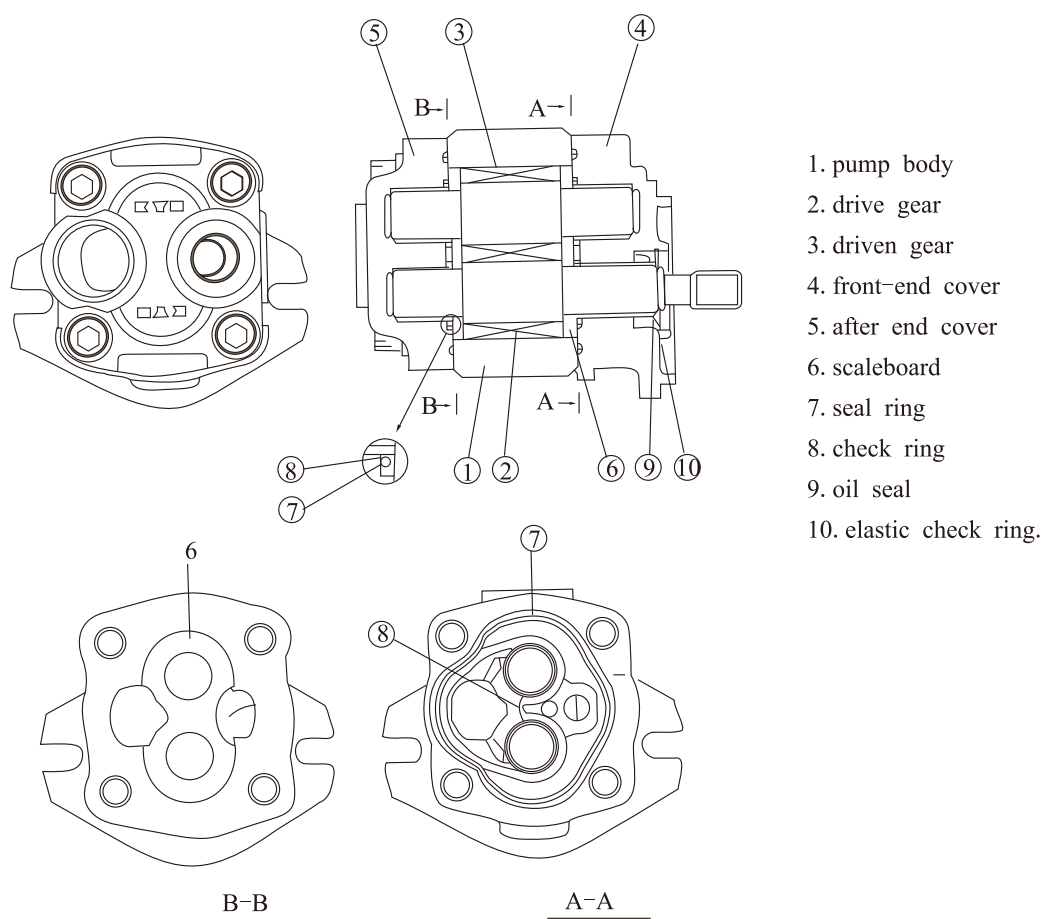


Fig. 7-1 Main Pump

7.3 Control valve

The control valve (2 spools type) consists of four-valve housing, two spools. On relief valve, the four-valve housing is assembled together with three bolts and nuts. The tilt spool valve contains a tilt lock valve.

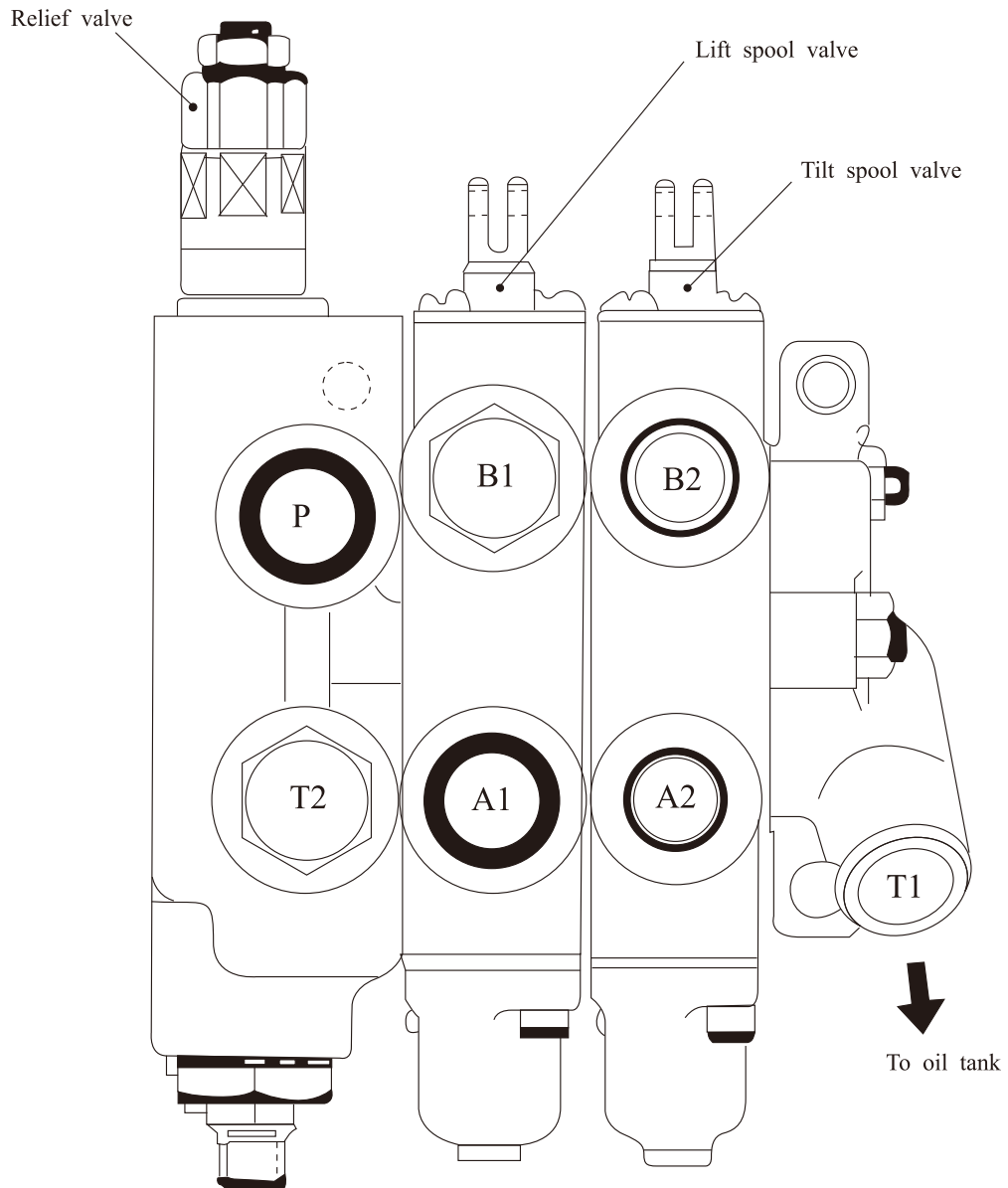


Fig. 7-2 Control valve

7.3.1 Slide valve operation

(take the tilt slide valve for example)

(A) : Neutral position

The high-pressure oil from lift pump returns to the oil tank through the mid-passage

(B) : Pushing-in of spool

In this time, the spool is pushed in to close the mid-passage. This causes the oil from the main oil inlet to push up the inlet check valve and to flow into the port “B” . The return oil from the port “A” flows through the low-pressure passage to the tank and the spool is restored to its neutral position by return spring.

(C) Drawing-out of slide valve

With the mid-passage closed, the oil from the main oil-inlet pushes up the check valve and flows into the port “A” the return oil from the port “B” . flows through the low-pressure passage to the tank, the spool can be restored to its neutral position by return spring

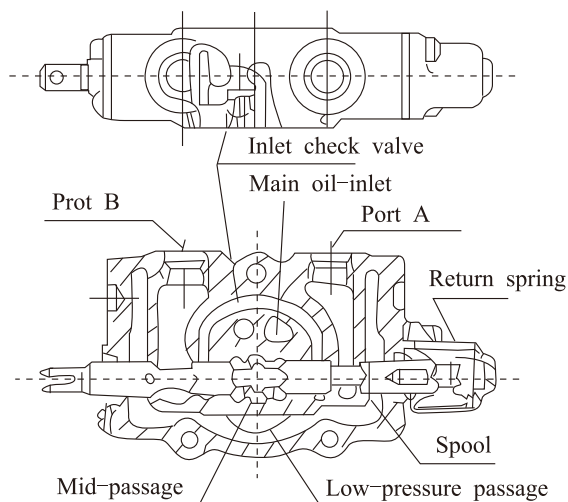


Fig. 7-3

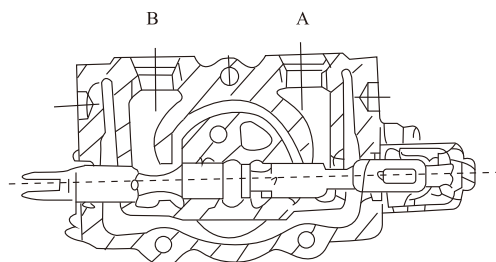


Fig. 7-4

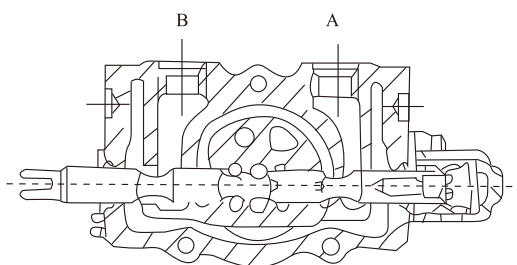


Fig. 7-5

7.3.2 Main safe overflow valve and the flow-dividing safe valve (picture 7-6)

The main safe overflow valve is composed of the main valve A and the conducting valve B, when the selector valve reverses the direction, Q cavity is connected with the high-pressure oil of the working structure (such as the lifting cylinder, the leaning cylinder), the pressure oil acts on the conducting valve B through the fixed theittling orifice D, E, when the systematic pressure is bigger than the adjusting pressure, then the conducting B opens and makes the pressure of cavity F fall, the whole valve core of main valve A moves towards right and makes the pressure oil cross through the low-pressure channel G, make the cavity Q saturate so as to ensure the stability of systematic pressure, the adjustment of screw can be used to adjust the stable pressure of the system.

The structure of flow-dividing valve is simple and is vertically overflowing and uses the principle of balancing the liquid pressure with the spring force directly to acquire the stable pressure value of steering system. When operating the steering wheel, the oil cavity M is connected with the high-pressure oil way, when the systematic pressure is bigger than the spring pressure, the valve core A moves right-ward, the pressure oil flows to the low-pressure oil way through the cavity T, then makes the cavity M unload to ensure the stability of the pressure of steering system and adjusting the screw K can adjust the stable pressure value of the system.

L valve is the smooth slide valve, through the continuous change of the flowing capacity and the pressure, it makes the slide valve L moves leftward or rightward to change the opening of R, S, to ensure the flowing capacity to the cavity Q and the hydraulic steering machine from the output PS balance automatically and flow divide stably and proportionally. A is the fixed theittling orifice.

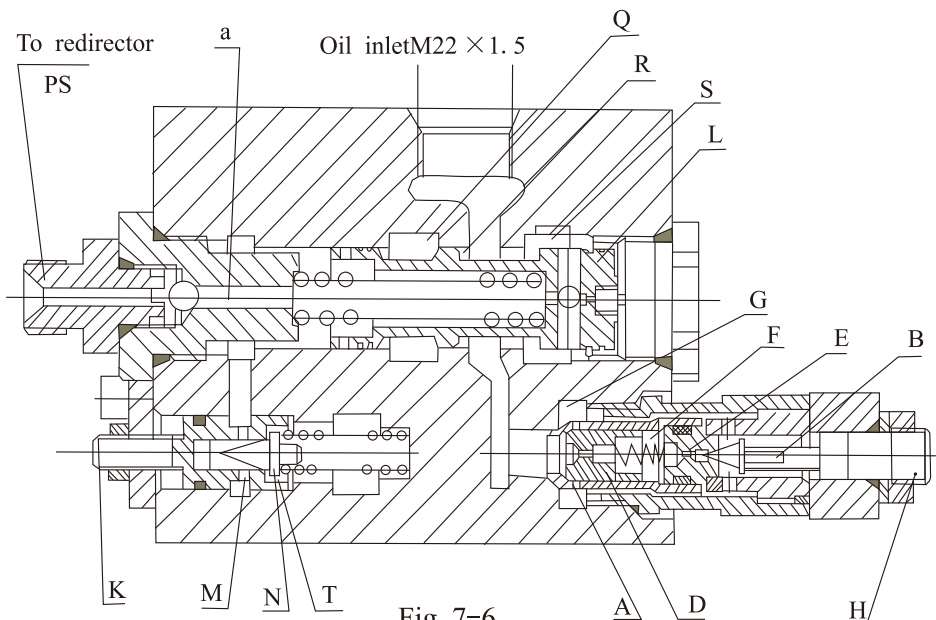


Fig. 7-6

7.3.3 Action of tilt-lock valve

Title slide valve housing contains a tilt-lock valve, the tilt lock valve is intended to prevent vibrations of the mast resulting from the negative pressure in the tilt cylinder and also to avoid danger incurred from mishandling of the slide valve. When the lift motor isn't running. The mast will not be tilted forward by pushing the tilt lever.

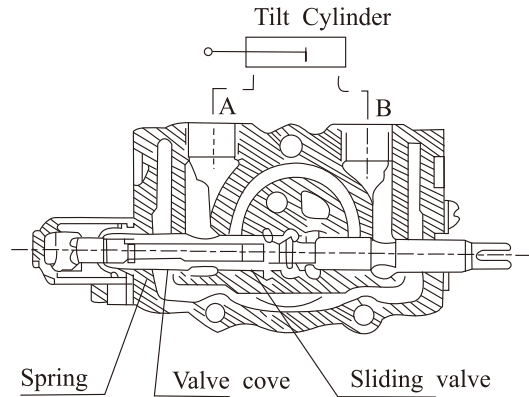


Fig. 7-7

The interface A, B of the valve should be connected with the front and back cavity of the tilt cylinder piston, when pulling out the slide valve, the high-pressure oil (P) enters the interface A, the oil of the back cavity returns to the oil tank (T) through "B", at this time, the bracket is in the backward leaning position.

When pushing in the tilt slide valve, the high-pressure oil enters the interface B, with the help of the high-pressure oil to move the self-locking valve of the spool valve, the point A connects with the low-pressure, when the generator extinguishes or stops operating there isn't high-pressure oil to move the self-locking valve of the slide valve, so the interface "A" can not be connected with the low pressure, the bracket will not lean forward and the leaning cylinder can not form the negative pressure.

7.4 Liquid filling valve and accumulator

The high pressure oil from the main oil pump arrives at the filling valve and distributies the stable flow to the brake system by the fluid filling valve, filling the accumulator and supplying the brake fluid to the brake when the engine is running.

7.5 Hydraulic Oil Circuit

From the high pressure oil out of the main oil pump to the liquid filling valve, the fluid filling valve divides the oil into three parts, one supplies the brake system oil and fills the accumulator of the brake system, and the other supply the cab tilting system. When the cab tilting operation is needed, the hydraulic system provides the tilting power; the remaining oil is much more liquid. In the road valve.

The oil of multi-channel valve is divided into two parts. One part divides the high pressure oil into the working cylinder such as the lifting cylinder or the inclined cylinder, and the other part is divided into the steering system with constant flow to control the steering cylinder. When the multi-channel valve stem is in neutral position, the high pressure oil will return to the tank from the passage.

When the lifting slide valve is pulled, the high-pressure oil moves through the throttle valve to drive the lifting piston rod to raise the door frame. When the lifting slide valve is pushed, the lower part of the lifting cylinder is connected with the low pressure area, and the portal frame descends depending on the self weight and the weight of the goods. At this time, the hydraulic oil flowing out of the lifting cylinder is controlled by the throttle valve. When the slide valve is operated, the high pressure oil flows into the side of the inclined cylinder, the other side is connected with the low pressure area, and the door frame is inclined to the front and back under the action of the oil pressure.

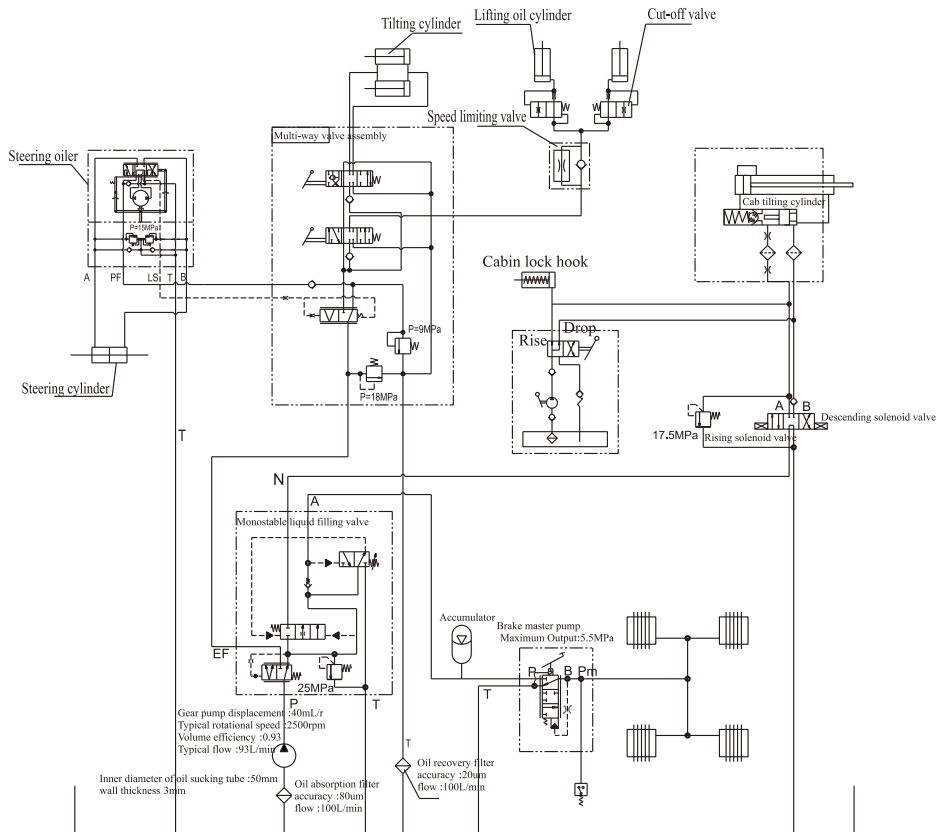


Fig. 7-8 Hydraulic System oil way

7.6 Operation of the multi-control valve

The control valve is operated with the valve levers. All valve levers are assembled together with a shaft and the shaft with multi-way valve by installing installed on the frame. The valve levers operate the control valve with the joins.

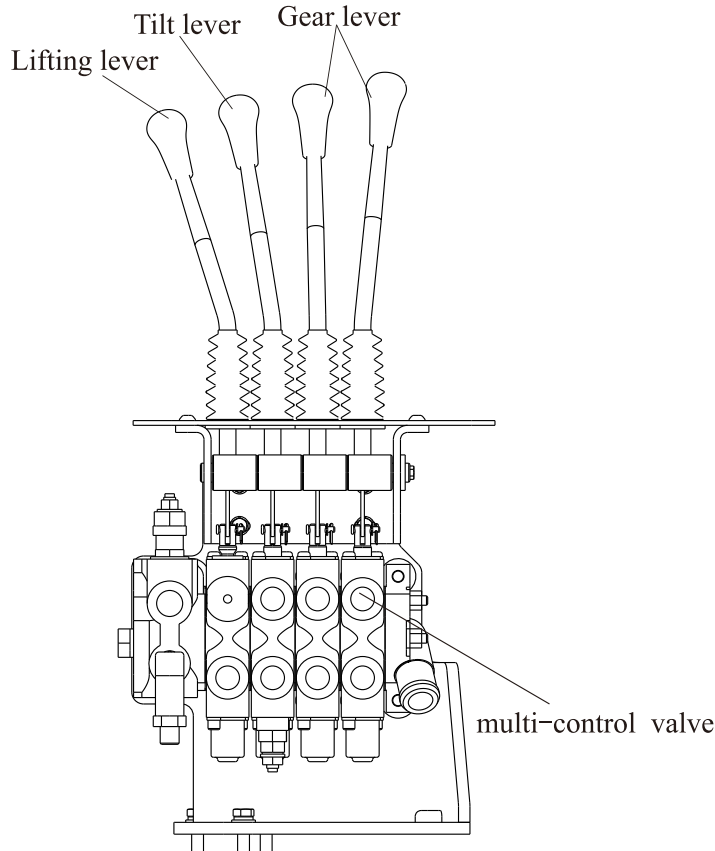


Fig. 7-9 Operation of the multi-control valve

7.7 Lifting cylinder

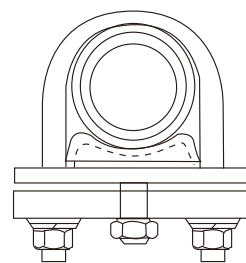
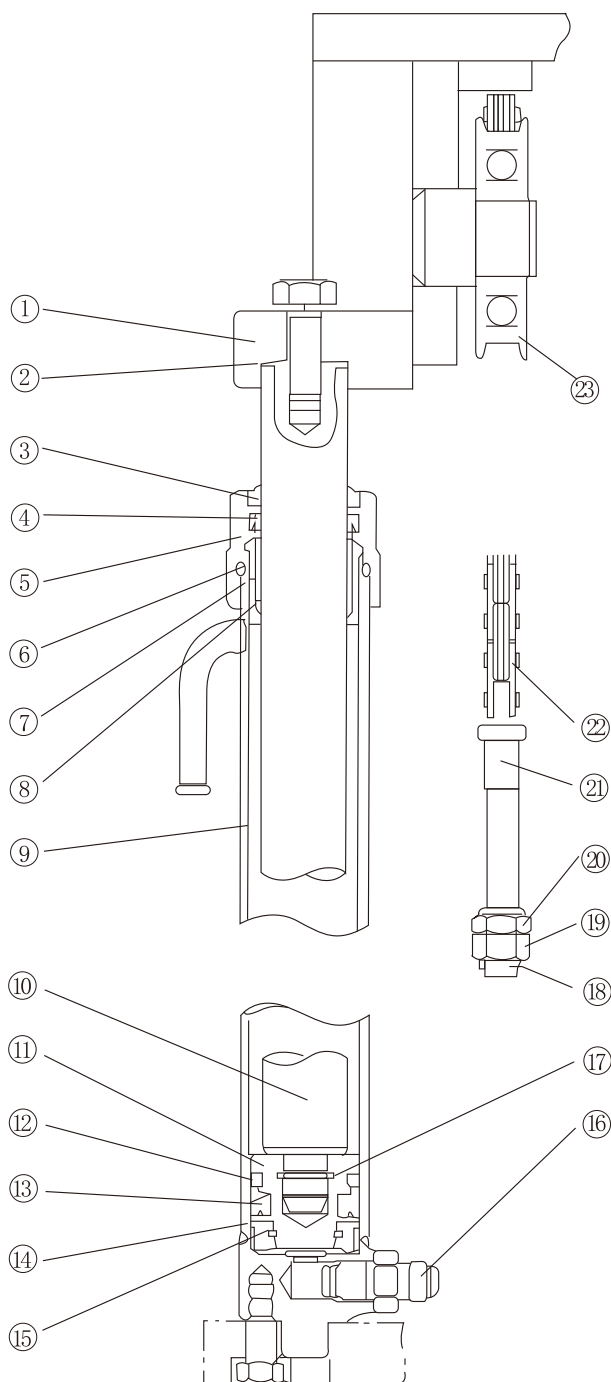
The two single acting type lift cylinder is composed of cylinder body, piston, piston rod, cylinder cap, cylinder base, and oil seals

The bottom of the lifting cylinder is fixed on the lifting cylinder of outside bracket by pin and bolt; the top of cylinder (the top of piston rod) is connected with beam on the outside bracket.

The piston is fixed on the piston rod by the elastic spring; the outer ring of piston installs the oil seal and back-up ring.

There is a cut-off valve at the bottom of lifting cylinder (see the picture 7-10) when the high-pressure pipe cracks suddenly, the goods can be avoided to fall sharply.

The cylinder end installs bearing and oil seal to support the piston and avoid the entry of dust.



Cylinder support

1. upper separator
2. spacer
3. dustproof cover
4. oil seal
5. guide sleeve
6. "O" ring
7. cylinder end
8. steel bearing
9. cylinder body
10. piston rod
11. piston
12. piston oil seal
13. oil seal
14. seat ring
15. elastic check ring
16. dump valve
17. elastic lock ring
18. cotter pin
19. locking nut
20. adjusting nut
21. End Connector
22. chain
23. chain wheel

Fig. 7-10 Lifting Cylinder

There is a cut-off valve that operates when the high-pressure hose bursts for any reason to prevent the load from dropping down abruptly at the bottom of the lift cylinder. The oil from the lift cylinder flows through small holes under the circumference of the cut-off valve spool and produces a pressure difference between two chambers. As the pressure difference as a result of passing the holes is smaller than the spring force so that the cut-off valve spool won't move. If the high-pressure hose bursts. The pressure difference will be big enough to overcome the spring force, causing the spool to move until the holes on the circumference on the spool are blocked up and allowing only a small amount of oil to flow through the holes at the spool end to let the forks descend slowly.

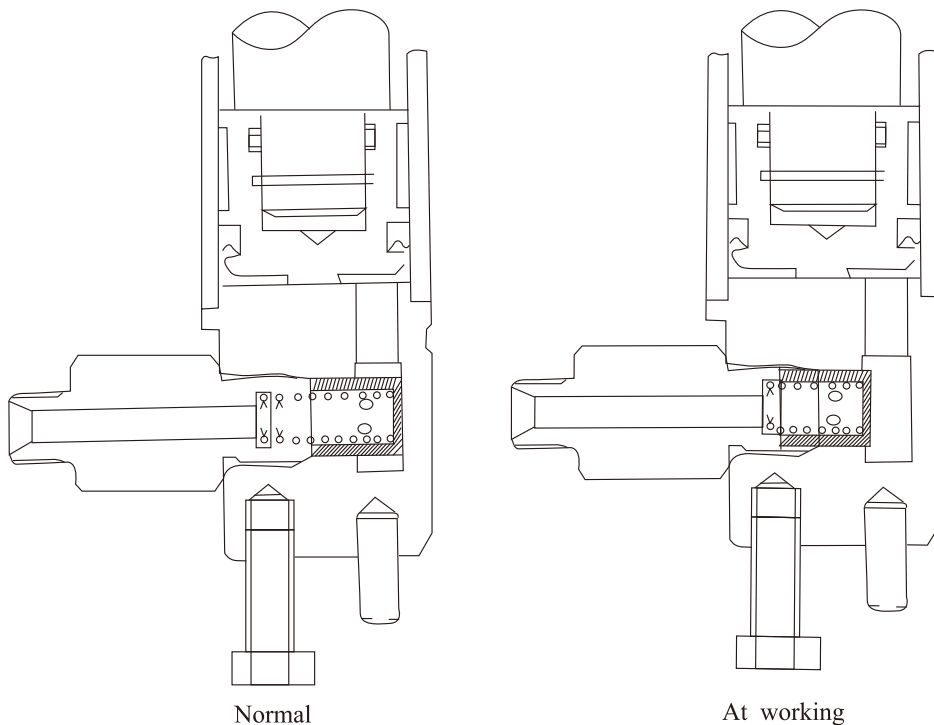


Fig. 9-11

7.8 Flow Regulator Valve

The flow regulator valve, located in the lift cylinder circuit to limit the descending speed of loaded forks, has the construction as shown in fig. When the lift spool is placed in the “lift” position, the oil from the control valve flows through the oil chambers A and B, oil holes C, D, E and F, and the chamber G to the lift cylinder without any regulation. When the lift spool is placed in the “down” position, the oil flows in the reverse direction. When the oil passes the orifice plate and a pressure difference generates between the chambers A and B, the pressure difference overcomes the force of the spring and moves the valve core right, thus the oil flow being decreased by narrowing of the hold D and C, and reduces the oil flow passing through the orifice plate.

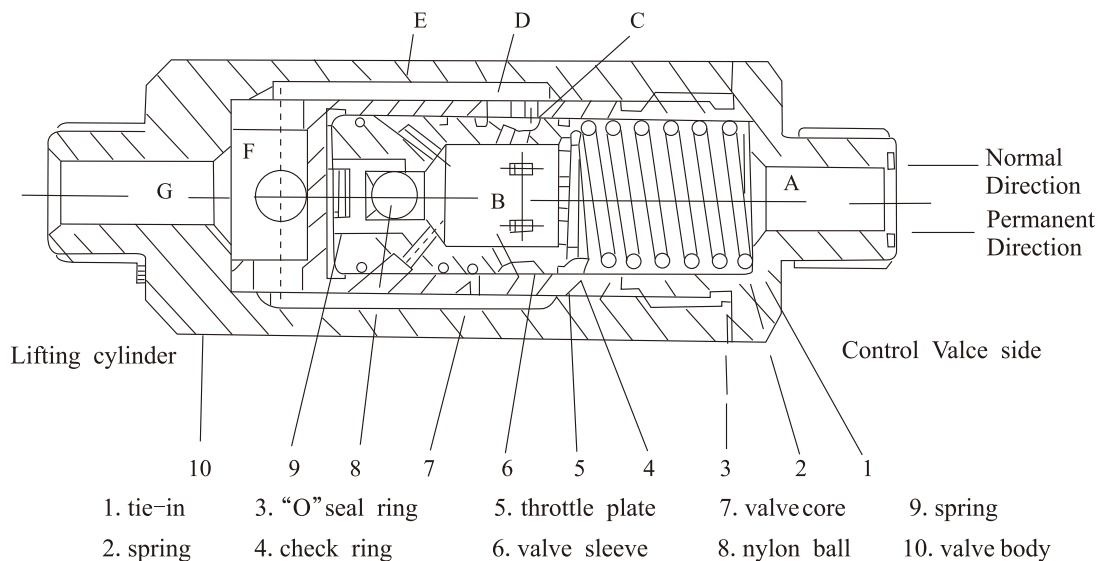


Fig. 7-12 Flow regulator valve

7.9 Tilt Cylinder

The tilt cylinder is of double-acting type. Each truck has two tilt cylinders that are installed on each side of the frame with pin while their piston rod ends are connected with the outer mast.

The tilt cylinder consists primarily of piston, piston rod, cylinder body, cylinder base, guider sleeve and seals. The piston, welded to the piston rod, is fitted with two Yx-ring, and one wear ring on its circumference. A bushing press-fitted to the inner side of the guide sleeve supports the piston rod. The guide sleeve is with dust seal, nap ring, Yx-ring and O-ring to prevent oil leakage and keep dust off. Fitted with them, the guide sleeve is screwed into the cylinder body.

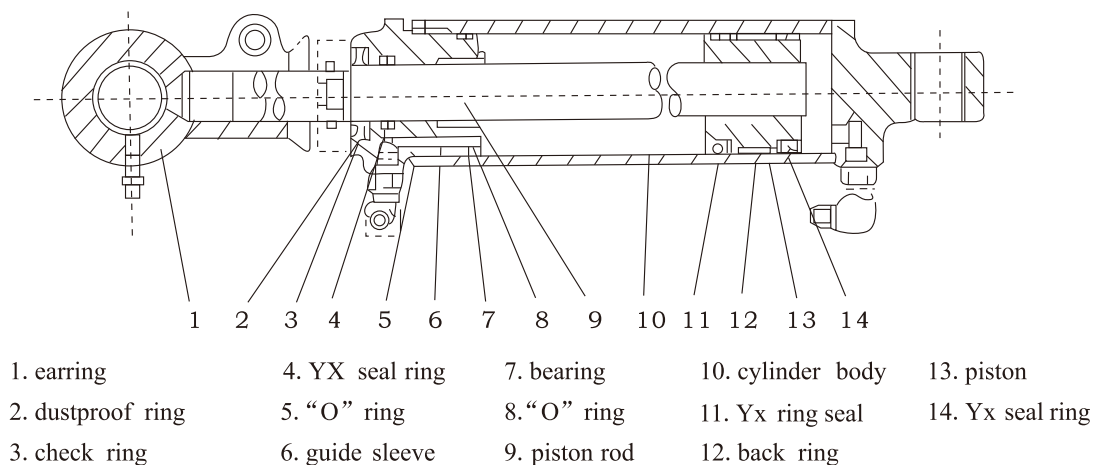


Fig. 7-13 Tilt cylinder

When the tilt lever is pushed forward, the high-pressure oil enters the cylinder body from the cylinder tail, moving the piston forward and causing the mast assembly tilting forward to 6 degrees. When the tilt lever is pulled backward, high-pressure oil enters the cylinder body from the guide sleeve and moves the piston backward, tilting the mast assembly backward to 12 degrees.

7.10 Cab tilting system

When the engine works, the valve can provide high pressure oil to the cab tilting system. By pressing the "tilting switch" in the driving room, the valve can be controlled by the solenoid valve to inject the hydraulic oil into the tilting cylinder to turn the cab up or down. At the same time, the tilting system is equipped with a hand pump. When the vehicle is unable to start the engine because of the failure of the vehicle, the vehicle can be turned up and down by the use of the hand pump for the tilting oil cylinder by using the hand pump, which is convenient for the vehicle to be overhauled in the condition of failure.

7.11 The hydraulic oil tank

The hydraulic oil tank is a plug-in fuel tank, which is located on the right side of the frame. The oil tank is equipped with oil suction and oil return filter to filter foreign matter.

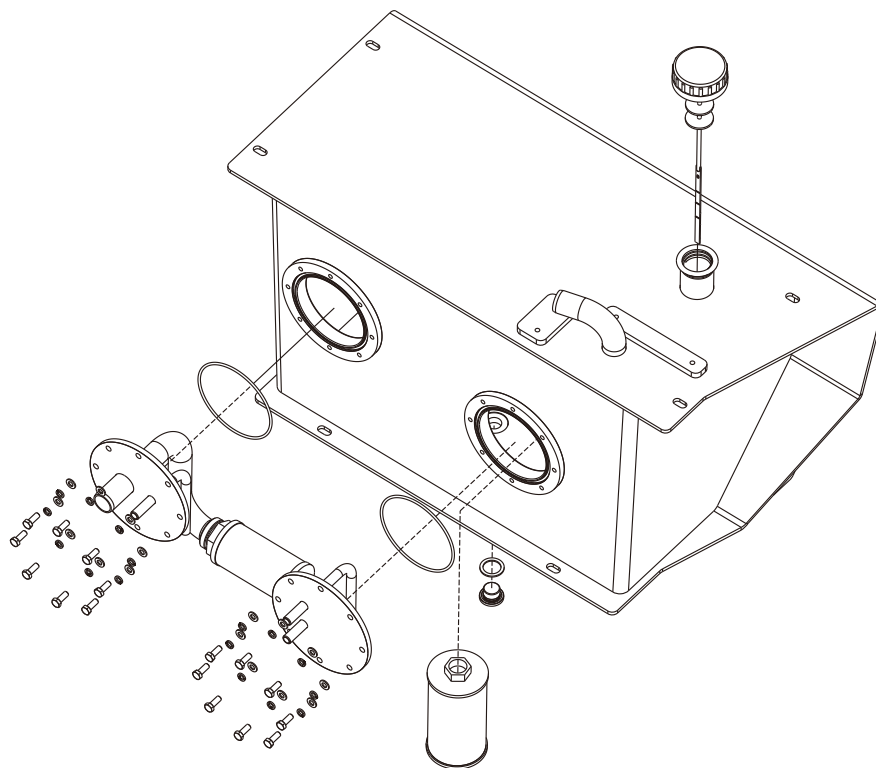


Fig. 7-14 Hydraulic oil tank

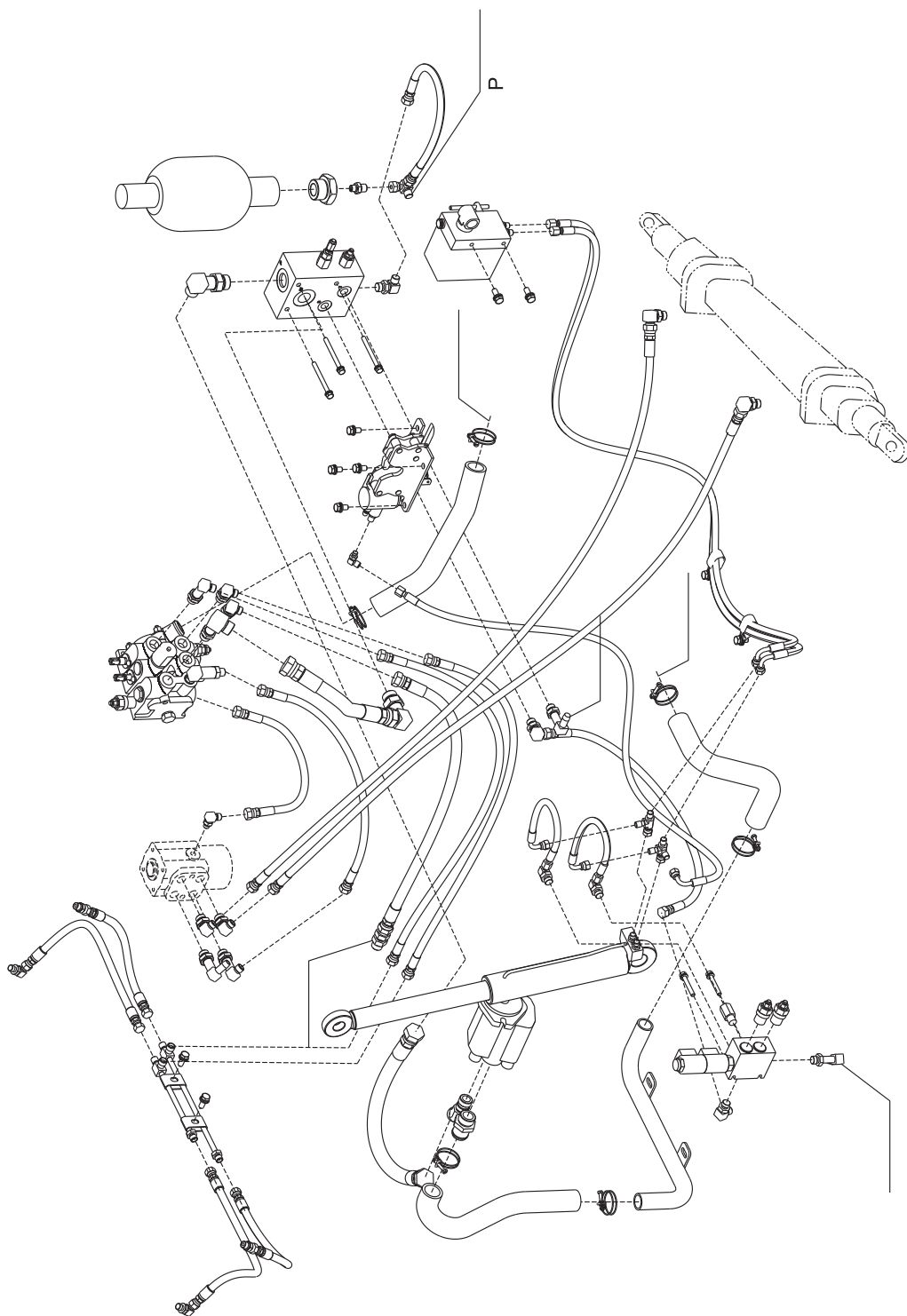


Fig. 7-15 Hydraulic Pipeline

7.12 Maintenance of Main oil Pump

(1) Disassembly

Before disassembling the pump, put the removed parts on the paper or cloth. Don't damage the parts.

(A): Hold the pump cleaned in a vice by lightly clamping the flange section.

(B): Remove bolts 11, pump cover 5, and pump body 1.

(C): Remove bushing 6—drive gears 2, driven gear 3.

(D): Remove the seal ring and packing ring from front cover or rear cover.

Note: Don't remove the seal ring and packing ring from the front cover or rear cover, if the seal ring and packing ring needn't be replaced.

(2) Inspection

Check the disassembled parts and wash them with engine oil, (Don't wash the rubber items with engine oil.)

(A): Body inspection

When the scraping trace becomes longer than $1/2$ long of the inner periphery, replace the pump body.

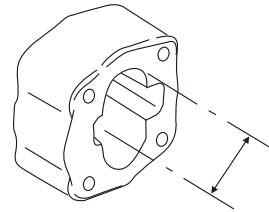


Fig. 7-16

(B): Scale board inspection

When surface of scale board is damaged or the thickness is less than the standard value, replace it.

The standard thickness: 4.94mm

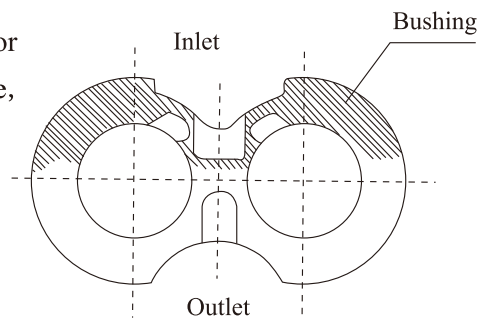


Fig. 7-17

(C) The front and rear pump cover

If the lining of inner surface changes color (the brown) and surpasses the range of 150 then change them.

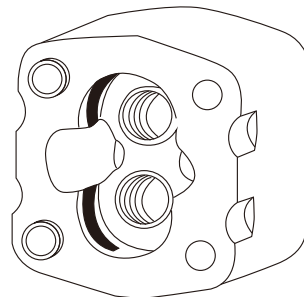


Fig. 7-18

(D) Check the drive gear and driven gear from the front and rear. If the abrasion is excessive, change a pair of new one. If the size D is smaller than the standard value, change several pairs.

$D=20.961\text{mm}$

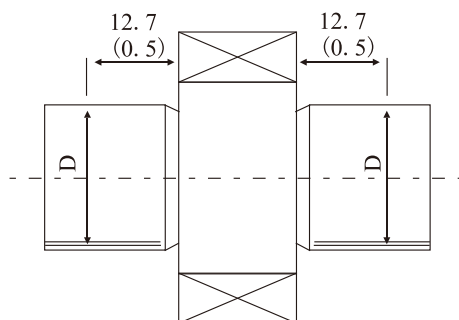


Fig. 7-19

(E) Change seal ring, the seal component of lining, the check ring, the oil seal and the spring check ring according to the condition.

(3) Assemble

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

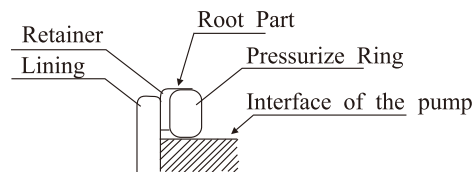


Fig. 7-20 Lining seal cap

(B) Install the scale board at the furrow of front cover; don't mistake the sucking inlet for the oil outlet.

(C) Install the driven gear on the front cover.

(D) Install the scale board on the side of gear to make the furrow aim at the gear point. Don't mistake the side of oil inlet for the side of oil outlet.

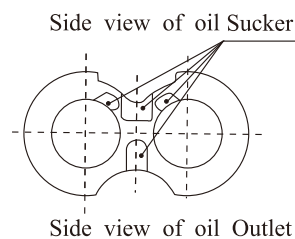
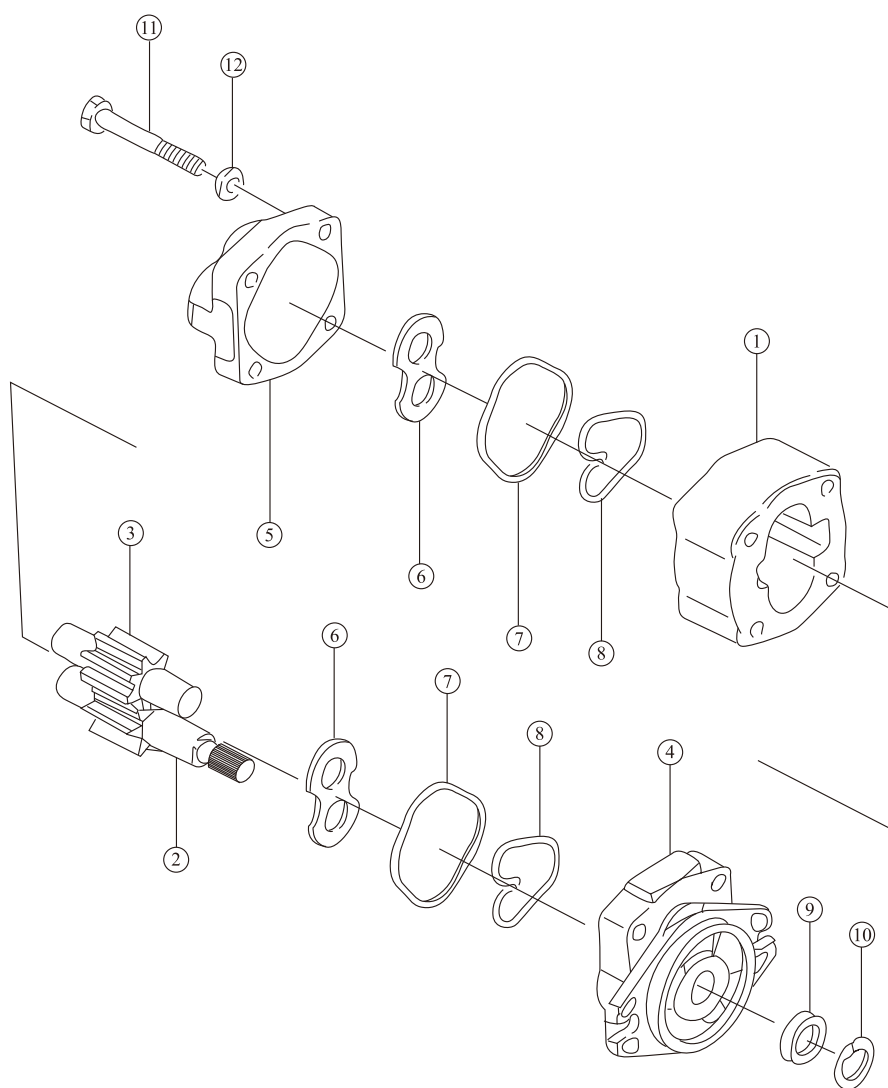


Fig. 7-21 Scale board

(E) Install a new seal ring and check ring at the furrow of rear cover.

(F) Install the rear covers on the pump; don't mistake the oil inlet for oil outlet.

(G) After completing the assembly, twist the connecting bolt to the standard torque 9-10kg. m.



- | | | |
|------------------------|-------------------|----------------|
| 1. pump body | 2. drive gear | 3. driven gear |
| 4. frontend cover | 5. back end cover | 6. scaleboard |
| 7. seal ring | 8. check ring | 9. oil seal |
| 10. elastic check ring | 11. bolts | 12. and spacer |

Fig 7-22 Gear pump

7. 13 Testing.

The pilot operation makes the oil pump run in and check whether the operation is normal.

Conduct the oil pump examination on the experiment desk and examine the pump on the forklift according to the following procedures:

(If the oil pump is decomposed and repaired because the hydraulic oil causes the serious damage, then before the pump is operated on the forklift, the hydraulic oil and filter should be changed.)

(a) Install the pump on the forklift and install the pressure gauge at the pressure detecting outlet of selector valve.

(b) Loose the overflowing valve and adjust the screw and twist the pump in about ten minutes. Ensure the oil pressure is less than 10kg/cm².

(c) Increase the twisting speed of pump to the 1500–2000rpm and keep it about ten minutes.

(d) Maintain the twisting speed of pump 1500–2000rpm and increase the pressure once 20–30kg/cm², the pump should twist five minutes until to the 175kg/cm², then make each oil way work five minutes and change the strainer.

When increasing the oil pressure, pay attention to examine the temperature of oil, the surface temperature of pump and the operating sound, if the temperature of oil and the pump surface are too high, fall the loading to fall the oil temperature and continue to experiment. Make the overflowing pressure be at 175kg/cm² after the experiment and measure the flux, the quantity of oil is measured through the lifting speed.

7.14 Troubleshooting

If the hydraulic system breaks down, Find the solution below and make necessary replacement.

(1)The selector valve

Malfunction	Reason	Repairing Method
The pressure of lifting oil way can't be enhanced	The slide valve jammed	Decompose then wash
	The oil hole blocked	Decompose then wash
Jolt and lift the pressure very slowly	The slide valve jammed	Decompose then wash
	The exhaust of air isn't sufficient	Discharge gas fully
The pressure of steering oil way is larger than the standard volume	The slide valve jammed	Decompose then wash
	The oil hole blocked	Decompose then wash
Can't meet the standard volume	The adjustment of overflowing valve isn't appropriate	Adjustment
Noise	The adjustment of overflowing valve isn't appropriate	Adjustment
	The slide surface damaged	Change the overflowing valve
Leak the oil (external)	O seal ring ageing or damaged	Change the O seal ring
The pressure is too low	The spring damaged	Change spring
	The valve surface damaged	Adjust or change the overflowing valve
Oil leakage (internal)	The valve surface damaged	Amend the valve surface
Pressure is too high	The valve door blocked	Decompose then wash

(2) Main pump

Problem	Possible cause	Remedies
Less oil deduction	Lower oil level oil tank	Add oil up to specified level
	Pipeline or oil filter is blocked	Clean them or replace oil if the oil is contaminated
Gear pump can not be pressurized	Worn bushing 3 and 4 or broken down packing 9, 10, 11	Replace
	Misadjusted relief valve	Adjust the pressure of the relief valve, Notice pressure gauge when increasing pressure
	Air entering into the pump	(1) Retighten loose connections for suction pipe (2) Add oil to oil tank (3) Check oil seal (4) Don't start the pump until no air bubble is in oil tank
Noisy in Operation	Twisted suction hose or cavitations incurred by oil filter blocked	Correct hose and clean filter
	Air entering in resulting from loose suction connections	Retighten each connection
	Too high oil stickiness incurring cavitations	(1) Use oil with proper stickiness (2) Start the pump until oil is at normal temperature.
	Air bubble in oil	Find out cause and correct them
	Eccentrically mounted gear pump	Concentric mounted gear pump
Oil leakage in pump	(1) Oil seal and packing & in pump broken down (2) pump damaged	Replace

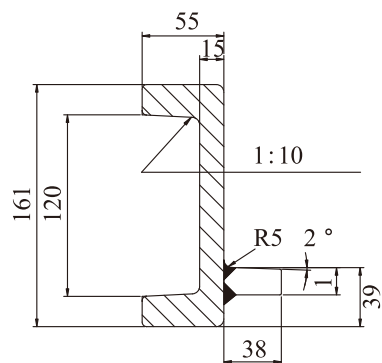
8 Lifting system

“J” type mast

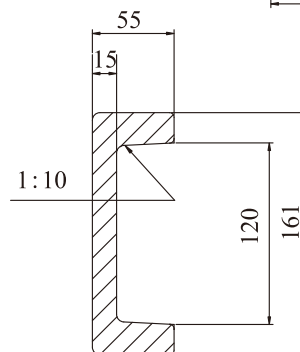
“C” type outer mast with free lift

Two stage extension type mast

Inner mast section



Outer mast section



Idler wheel

Main idler wheel	$\phi 119.2$
Choose idler wheel	$\phi 112$
Lifting chain (ISO)	LH1623 (3t)
	LH1634 (3.5t)

Fork mast lifting system	Hydraulic
Fork adjust system	Mechanical

8.1 General Description

The loading system is of the two-stage; it consists of the inner mast, the outer mast and the lift bracket.

8.2 Inner and outer Masts

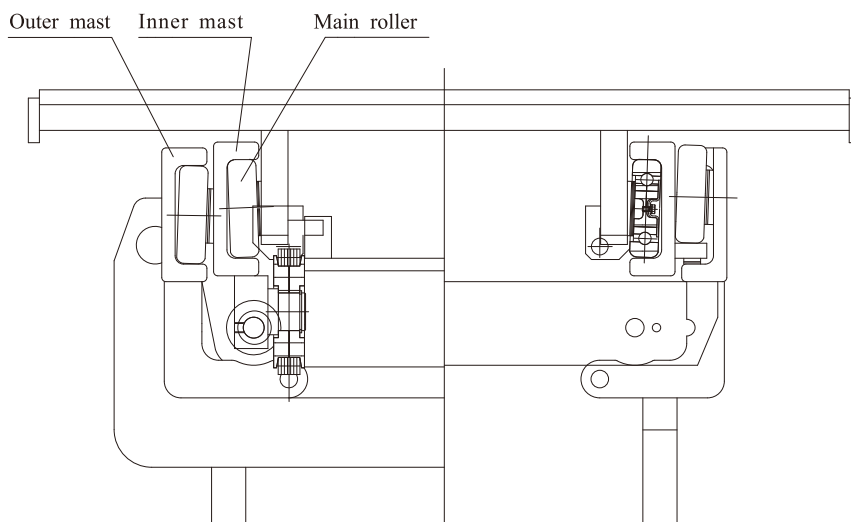
The inner and outer masts both are welded parts, the bottom of outer mast is connected with the drive axle, and the outside middle of outer mast is connected with the frame by tilt cylinders. The mast assembly can be tilted forward and backward by operating tilt cylinders. The outer mast has C-shaped cross-section. The outer mast fixed with main rollers and side rollers on the top of it. And the inner mast has J-shaped cross-section. It fixed with main rollers and side rollers at the bottom of it.

8.3 The fork shelf and backrest

The fork shelf rolls in the inner bracket through the main roller, which installed on the main rolling axle stacked by the elastic check ring, the main rolling axle is welded on the fork shelf, the side roller is fixed on the fork shelf by bolt. They roll along the wing panel of inner bracket and can be adjusted by the adjusting cushion. To avoid the rolling clearance, using two fixed side roller to roll along the wing panel of inner bracket. The main roller supports the vertical loading, when the fork lifts to the top and the roller appears from the top of bracket. The cross loading is supported by the side roller. Backrest is fixed on the fork stand by bolt : the face of backrest should be parallel with the fork face , avoiding the goods slip down the fork .

8.4 The position of roller

There are two types of roller: The main roller and the side-roller. They are installed on the outer bracket, the inner bracket, and the fork shelf respectively. The main roller bears the front and rear loading; the side-roller bears the pressure of the side so that the inner bracket and fork shelf can move freely.



Attention (A) Clearance of the side roller is 0.5mm

(B) Please add butter on the surface of main rollers and the interface of masts.

Fig. 8-1 Position of rollers

8.5 Maintenance

8.5.1 Adjust Lift Cylinder

It must readjust stroke of the lift cylinder when lifting cylinder, the inner mast or the outer mast is replaced. As following:

(1): Place piston rod heads with the upper beam of the inner mast without shims.

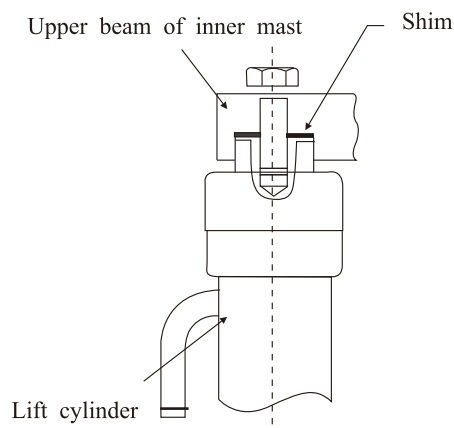


Fig. 8-2

(2): Ensure that two lift cylinders are lifted at the same time when the mast ascended the ultimately stroke.

(3): If they not lifted synchronously, add shims between the upper beam of the inner mast and the piston rod head which reaches the lift cylinder's ultimately stroke in movement. The shims' thickness is 0.2mm or 0.5mm.

(4): Adjust the tightness of lift chains. The adjustment of the lift cylinder also belongs to exalted maintenance, please be careful.

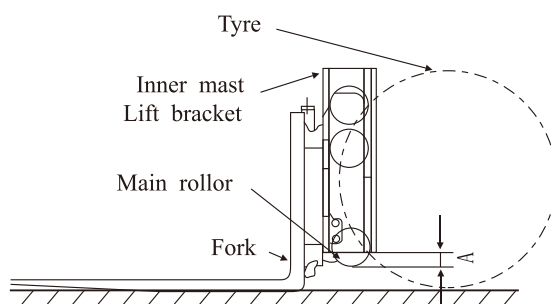


Fig. 8-3

8.5.2 Adjust lift bracket's Height

(1): The truck should be stopped on horizontal ground. and ensure the masts erect.

(2): Lower the forks on the ground; adjust the set nut of tie-in to the upper of chains to assure the distance A between main rollers and the lift bracket. $A=19-24\text{mm}$

(3) : Make the mast assembly tilt backward when forks descended to the ground. Adjust the pulling force of lift chains and let the tightness of lift chains be equal.

8.5.3 Fork and its width adjustment

Before loading and unloading , we should adjust the fork to a proper distance so as to fit the bracket size and loading.

⚠Warning :

Be careful with your hand and fingers.

1. Drive the forklift to the loading goods and then step .
2. Adjust the mast to a upright position and then lift the fork 10 cm off the ground.
3. Tilt the mast forward.
4. Lift the button , turn 90 degrees ,then loose it(under this condition , the fork can be moved to left or right .)
5. Adjust the fork distance according to loading goods, in order to let the load center in line with forklift center.
6. Adjust the mast to upright , turn the button 90 degrees , the button will be put in locking position (at this time , the fork is locked in right position) .
7. After adjusting the fork distance , please check the fork is fastened by the block or not . If the fork is not fastened by the block , when driving the forklift , the fork will move freely and maybe the goods may drop off .

Remark :

There are two types of buttons, one is to turn 90 degrees and the other is to turn 180 degrees.

8.5.4 Replacing Rollers of the lift bracket

- (1) Place a salver on the forks and make the forklift stop on the horizontal ground.
- (2) Make the forks and salver descend to the ground.
- (3) Take down tie-in top of the chains . And take out chains from sheave.
- (4) Make the inner mast rise. (Fig. 8-6 ①)
- (5) The forklift can be reversed when the lift bracket disengaged from the outer mast. (Fig. 8-6 ②)
- (6) Replacing Main Rollers.
- (a) Take apart all snap rings from the lift bracket and take out main rollers.

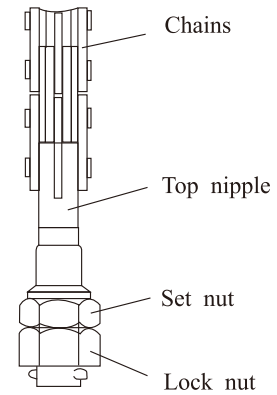


Fig. 8-4

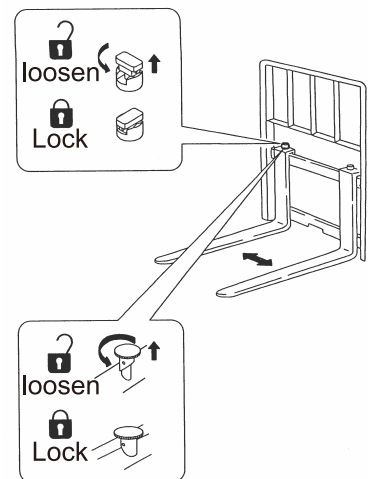


Fig. 8-5

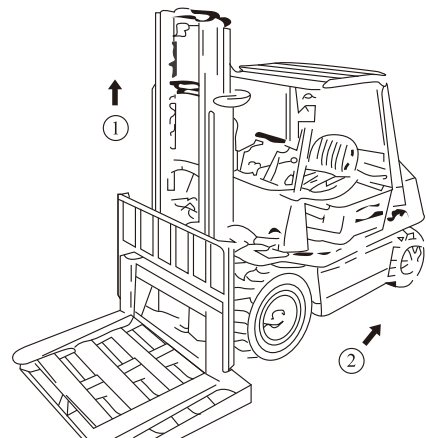


Fig. 8-6

(b) Fit the new main roller (the same type as the old one) on the lift bracket and fastened with snap ring .

8.5.5 Replacing Rollers of Masts

(1) Take apart the fork bracket from the inner mast, then replace the main roller follows the way as 8.5.4.

(2) Park the truck on the horizontal ground and lift up the wheel-wheel 250mm~300mm from the ground

(3) Pull parking brake level fully , and use a wedge to make back-wheel stationary .

(4) Take apart bolts, which fastened, lift cylinders and the inner mast. Hang up the inner mast without losing shims of the piston rod heads carefully.

(5) Uninstall bolts which jointed lift cylinders and the bottom of outer mast and take part the oil-pipe between two lift cylinders without losing the nipple .

(6) Main rollers on the upper outer mast will be showed on the top of the inner mast as soon as main rollers were taken apart from the bottom of the inner mast after laying down the inner mast.

(7) Replacing main rollers.

(A) Take apart the upper main rollers without losing shims .

(B) Fit the new main roller and shims together on the outer mast

(8) Hang up the inner masts and let all rollers in the inner mast .

(9) Assembly the lift cylinder and the lift bracket as disassembly contrarily.

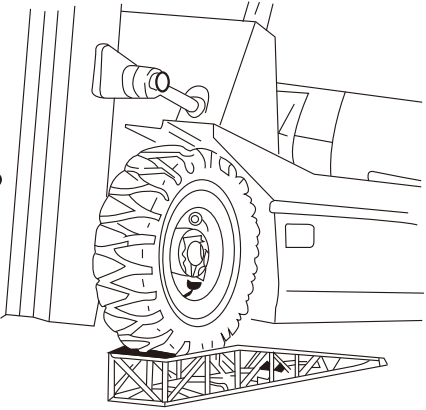


Fig. 8-7

F Periodic servicing

This service schedule is worked out on the assumption that the lift truck will be used under typical working conditions. If the lift truck is used under severer working conditions, earlier preventive maintenance services are required. (The black dots in the table means “Replacement”.) G: Gasoline Truck D: Diesel Truck

ENGINE

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Engine	Visually inspect condition of engine rotation.		○	○	○	○	○
	Check for working noise from engine.		○	○	○	○	○
	Check that exhaust gas has proper-color.		○	○	○	○	○
	Check air cleaner element for dirt and clean.			Replace every 300 hrs			
	Check crankcase air breather for dirt and clean				○	○	○
	Check that valve clearnce is correct.	Thickness gauge				○	○
	Check cylinders for proper compression.	Compres-sion gauge.					○
PCV Device	Check metering valve and pipe for clogging or damage (G).					○	○
Governor or Injection Pump	Check no-load maximum rpm.	Tachometer					○
Lubrica-tion System	Check for engine oil leak.		○	○	○	○	○
	Check engine oil for level and dirt.		○	○	○	○	○
	Replace engine oil.			Change at initial 50 hrs, after that, change every 500 hrs			
	Replace engine oil filter cartridge.			Change at initial 50 hrs, after that, change every 500 hrs			

ENGINE

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Fuel System	Visually check for fuel leak from pipe, pump or tank.		○	○	○	○	○
	Check fuel filter for clogging.				○	○	○
	Replace fuel filter cartridge				Change every 500 hrs		
	Drain off water from fuel tank.				○	○	○
	Clean fuel tank.					○	●
	Check for fuel level.		○	○	○	○	○
Cooling System	Check for coolant level.		○	○	○	○	○
	Check for coolant leak.		○	○	○	○	○
	Check hoses for deterioration.				○	○	○
	Check radiator cap for condition and installation.		○	○	○	○	○
	Clean and change coolant.						●
	Check fan belt for tension and damage.		○	○	○	○	○

POWER TRAIN

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Torque converter transmission	Check for oil leaks.		○	○	○	○	○
	Check for oil level, or change oil.			○ (at initial 50 hrs)	○	●	●
	Check change level for operation and looseness.			○	○	○	○
	Check control valve and clutch for proper operation.		○	○	○	○	○
	Check inching valve for proper operation.		○	○	○	○	○

POWER TRAIN

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Torque converter transmission	Check inching pedal for free travel and pedal travel.		○	○	○	○	○
	Replace line filter element.			● (at initial 50 hrs)		●	●
Front Axle	Check for oil leak.		○	○	○	○	○
	Change oil.			○ (at initial 50 hrs)		●	●
	Check mounting bolts for looseness.	Test hammer		○	○	○	○

WHEELS

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Tires	Check for inflation pressure.	Tire gauge	○	○	○	○	○
	Check for cracks or damage.		○	○	○	○	○
	Check for tread wear.	Depth gauge		○	○	○	○
	Check for undue wear.		○	○	○	○	○
	Check for spikes, stones, or foreign matter.			○	○	○	○
Tire Fastners	Check for looseness.	Test hammer	○	○	○	○	○
	Check for damage.		○	○	○	○	○
Rim,side ring	Check for rim, side ring and disk wheel for damage.		○	○	○	○	○
Wheel Bearing	Check for looseness and noise.			○	○	○	○
	Clean and repack grease.					●	●
Axle	Check axle for deformation, cracks or damage.			○	○	○	○

STEERING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Steer Handwheel	Check for peripheral play.		○	○	○	○	○
	Check for vertical looseness.		○	○	○	○	○
	Check for sideways looseness.		○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
Steering gear box	Check mounting bolts for looseness.			○	○	○	○
Knuckle rear axle	Check king pins for looseness or damage.			○	○	○	○
	Check for oil leak.		○	○	○	○	○
	Change oil.			○ (at initial 50 hrs)		●	●
Knuckle rear axle	Check for deflection, deformation, cracks or damage.			○	○	○	○
	Check for mounting condition.	Test hammer		○	○	○	○
Power steering	Check for operation.		○	○	○	○	○
	Check for oil leaks.		○	○	○	○	○
	Check for mounting parts and joints for looseness.			○	○	○	○

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Brake pedal	Check for free travel.		○	○	○	○	○
	Check for pedal travel.	Scale	○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
	Check for air mixed in brake piping.		○	○	○	○	○

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Parking Brake Lever	Check that lever is securely locked and has sufficient lever stroke.		○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
Rod, cable, etc.	Check for operation.			○	○	○	○
	Check connections for looseness.			○	○	○	○
Hoses and pipes	Check for damage, leakage or collapse.			○	○	○	○
	Check for loose connections or clamping parts.			○	○	○	○
Brake master cylinder wheel cylinder	Check for fluid leaks.			○	○	○	○
	Check for fluid level. Change brake fluid.		○	○	○	●	●
Brake master cylinder wheel cylinder	Check master cylinder and wheel cylinders for proper operation.						○
	Check master cylinder and wheel cylinders for fluid leaks or damage.						○
	Check master piston cup, and check valve for wear or damage. Change.						●
Disc brake	Check lining for wear.	Slide calipers					○
	Check anchor pin for rust.						○
	Check return spring for deterioration.	Scale					○
	Check automatic clearance adjuster for operation.						○
Back Plate	Check back plate deformation.						○
	Check for craks.	Penetrant test					○
	Check mounting parts for looseness.	Test hammer					○

LOADING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semiannually (1200hrs)	Annually (2400hrs)
Fork	Check forks for damage, deformation or wear.		○	○	○	○	○
	Check for stopper pins for damage or wear.				○	○	○
	Check fork base and hook weldings for defective cracks or wear.			○	○	○	○
Mast & Lift Bracket	Check cross members on outer and inner masts for defective weld, cracks or damage.			○	○	○	○
	Check tilt cylinder bracket and masts for defective weld, cracks or damage.			○	○	○	○
Mast & Lift Bracket	Check outer and inner masts for defective weld, cracks or damage.			○	○	○	○
	Check for defective weld, cracks or damage of lift bracket.			○	○	○	○
	Check roller bearings for looseness.			○	○	○	○
	Check mast support bushings for wear or damage.						○
	Check mast support cap bolts for looseness.	Test hammer		○ (for 1st time only)		○	○
	Check lift cylinder tail bolts, piston rod head bolts, U-bolts, and piston head guide bolts for looseness.	Test hammer		○ (for 1st time only)		○	○
	Check rollers, roller pins and welded parts for cracks or damage.			○	○	○	○
Chains & Sheave	Check chains for tension, deformation, damage or rust.		○	○	○	○	○
	Lubrication of chains.			○	○	○	○
	Check connection of chain anchor pin and chain for looseness.			○	○	○	○
	Check sheave for deformation or damage.			○	○	○	○
	Check sheave for deformation or damage.			○	○	○	○
Optional Attachment	Perform general inspection			○	○	○	○

LOADING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Cylinders	Check piston rod, screw and rod end for looseness, deformation or damage.	Test hammer	○	○	○	○	○
	Check cylinders for proper operation.		○	○	○	○	○
	Check for oil leaks.		○	○	○	○	○
	Check pins and cylinder bushings for wear or damage.			○	○	○	○
Hydraulic Pump	Check hydraulic pump for oil leaks or noise.		○	○	○	○	○
	Check pump drive gear for wear.			○	○	○	○

HYDRAULIC SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Hydraulic Reservoir	Check for oil level. Change oil.		○	○	○	○	●
	Clean suction strainer.					○	○
	Drain foreign matter.					○	○
Return Filter	Replace return filter.					●	●
Control Lever	Check levers for looseness at link.		○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
Control Valve	Check for oil leaks.		○	○	○	○	○
	Check relief valve and tilt lock valve for proper operation.			○	○	○	○
	Measure relief pressure.	Oil pres. gauge.				○	○
Hose, piping hose Reel & Swivel Joint	Check for oil leaks, looseness, collapse, deformation and damage.		○	○	○	○	○
	Change hoses.						● (1 or 2 years)

ELECTRICALS

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Starter	Check pinion gear for correct engagement.				○	○	○
Battery	Check battery electrolyte level. Clean battery.			○	○	○	○
	Check specific gravity of electrolyte.	Hydrometer			○	○	○
Wiring	Check wire harness for damage and clamps for looseness.			○	○	○	○
	Check connections for looseness.				○	○	○

SAFETY APPARATUS & ACCESSORIES

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Overhead Guard & Load Backrest	Check for tight installation.	Test hammer	○	○	○	○	○
	Check for deformation, cracks or damage.		○	○	○	○	○
Turn Signal	Check for proper operation and tight installation.		○	○	○	○	○
Horn	Check for proper operation and tight installation.		○	○	○	○	○
Lights & Lamps	Check for proper operation and tight installation.		○	○	○	○	○
Back-up Buzzer	Check for proper operation and tight installation.		○	○	○	○	○
Rear View Mirror	Check for dirt or damage.		○	○	○	○	○
	Check for good field of vision.		○	○	○	○	○
Meters	Check meters for proper operation.		○	○	○	○	○
Driver's Seat	Check for damage or loose bolts.					○	○
Body	Check frame and cross members for damage or cracks						○

SAFETY APPARATUS & ACCESSORIES

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Body	Check for loose rivets or bolts.	Test hammer					○
	Check items repaired in preceding inspection, if any.		○	○	○	○	○
	Inspection general condition of body.						○
Grease-up & oil change	After cleaning, check for greased condition of chassis.	Grease pump		○	○	○	○
	Check oil condition of oil and fluid in reservoir.						○

▲ CAUTION

Local refined oils and cooling water, coolant, or anti-freeze do not allow the same operation period designated in this manual.

So must be changed more frequently as half or quarter of the designated period in this manual.

Multi-viscosity oils allow a wider temperature range for operation but must be changed more frequently as the addition that provides the multi-viscosity gradually deteriorates lowering the viscosity. Degradation of viscosity at the higher temperatures can be very detrimental to the hydraulic system.

Appendix

1 Forklift operator safety norms

Warning

No overguard or backrest driving is dangerous.

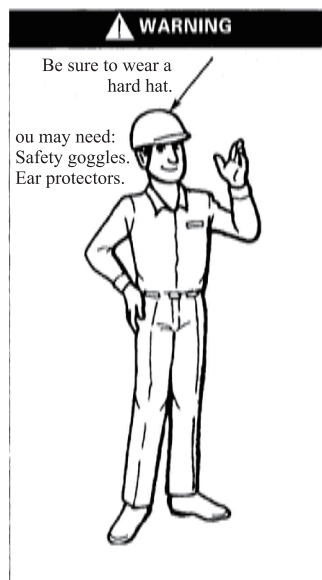
(1) Authorized , trained operator only !



(2) DO NOT travel on public roads !



(3) Dress properly for the job !



(4) Be alert !



(5) Know your forklift truck and attachments !



(6) Unauthorized addition or modification is prohibited !



(7) Know all signals and traffic rules !



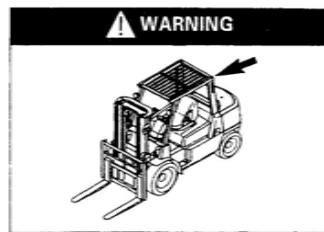
(8) Exhaust fumes can kill you !



(9) Inspect your forklift truck prior to operation !



(10) Do not remove the overhead guard !



(11) Keep the operator's compartment clean !



(12) Do not operate an unsafe forklift truck !



(13) Always stay healthy on the job !



(14) Know your forklift truck is safe !



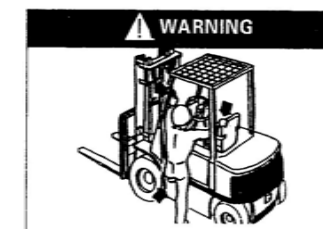
(15) Operate only in approved areas !



(16) DO NOT operate a damaged or defective forklift truck !



(17) Be sure the assist grip is properly tightened



(18) Position controls correctly for starting !



(19) Operator should know where the fire extinguishers located



(20) Adjust the seat before operation !



(21) Make sure your forklift truck is in safe operating condition !



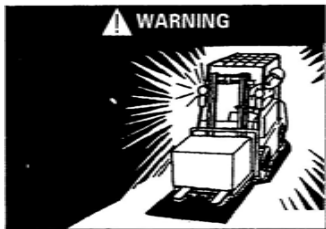
(22) Fasten the seat belt properly



(23) Always check overhead clearance !



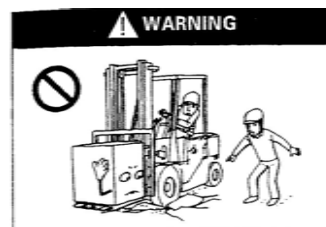
(24) Use lights in dark, dim areas !



(25) Stay within the confines of the truck !



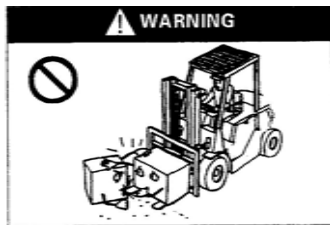
(26) Avoid travelling on weak or nonprepared ground .Only running on a level and rigid placel.



(27) Stay under the overhead guard !



- (28) Be careful of forks that extend beyond the load !



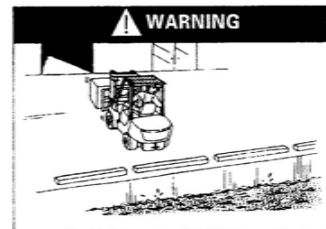
- (29) Avoid off-center loading !



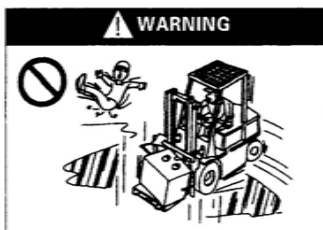
- (30) Check fork stopper pin for engagement !



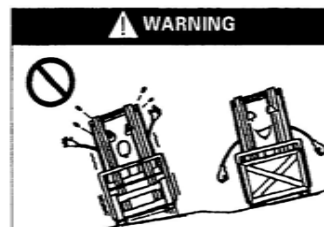
- (31) Check work areas for high risk !



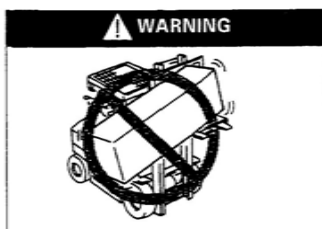
- (32) Stay away from slippery surfaces !



- (33) Be aware of the stability of an empty forklift truck !



- (34) Take special care when carrying a long or wire load .



- (35) Do not allow any riders !



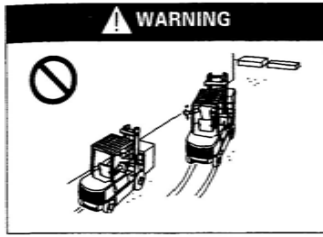
- (36) If you cannot see where you are going , do not move!



- (37) Use pallets and skids suitable for the load .



(38) Do not pass another truck !



(39) Do not allow anyone to hold loads !



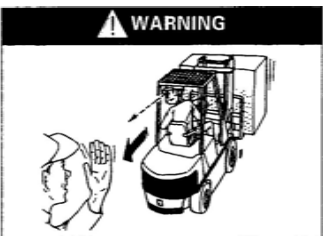
(40) Always look in the direction of travel !



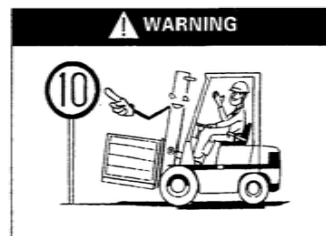
(41) Do not engage in stunt driving or horseplay !



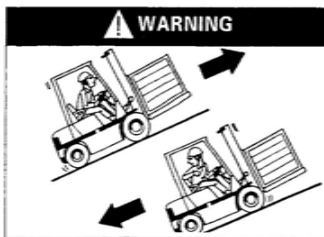
(42) Travel in reverse if forward visibility is blocked !



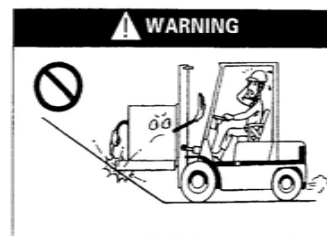
(43) Obey all traffic rules and warning signs !



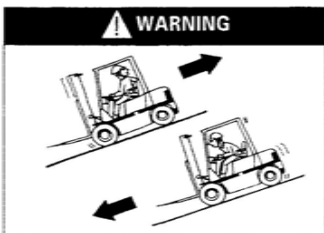
(44) Travel safely on grades with a loaded forklift truck !



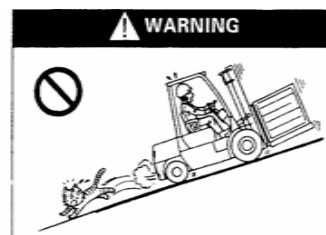
(45) Be particularly careful when driving up or down a steep slope !



(46) Travel safely on grades with an empty forklift truck !



(47) Start forklift truck upgrade carefully !



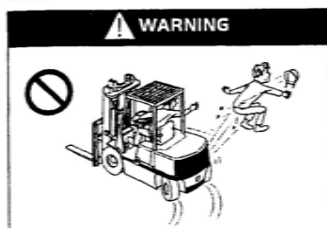
(48) Do not turn on a ramp or grade !



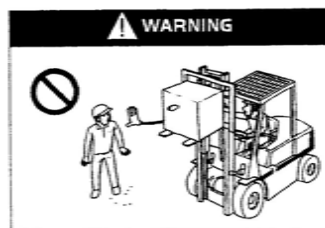
(49) Move your forklift truck safely !



(50) Allow for counterweight swing distance !



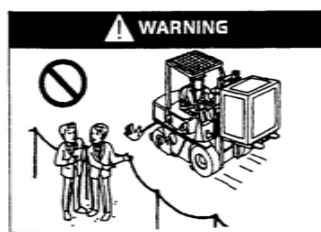
(51) A helper should not be near the forklift truck !



(52) Always be alert for tipovers !



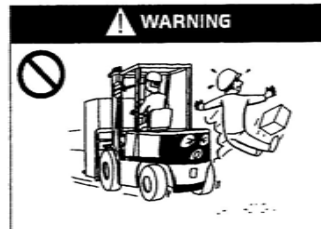
(53) Danger ! Keep out !



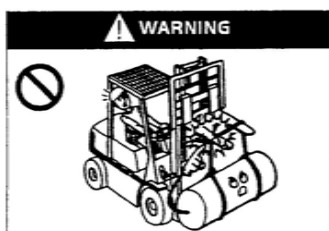
(54) Be careful of changes in rated capacity !



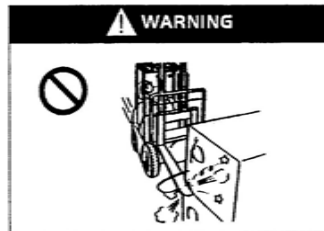
(55) Watch out for pedestrians at all times !



(56) Use forks properly !



(57) Do not speed when approaching loads !



(58) Do not move when someone's next to truck !



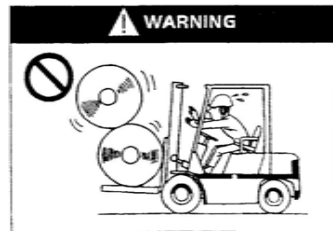
(59) Do not allow anyone to walk or stand under raised forks !



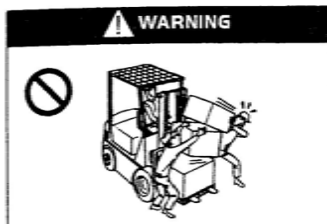
(60) DO NOT pick up unsecured loads that extend above the backrest extension height !



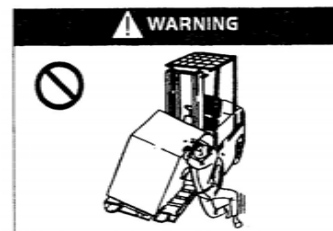
(61) Handle only stable loads !



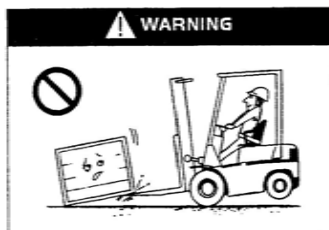
(62) Do not allow unloading from raised loads !



(63) Do not use damaged pallets !



(64) Do not abuse your forks !



(65) Drive onto a trailer carefully !



(66) Do not allow any riders !



(67) Do not abuse your equipment !



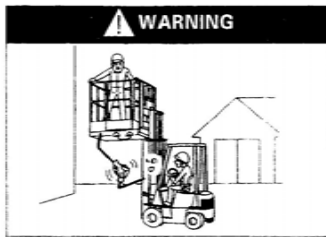
(68) Stay clear of pinch points !



(69) Shift the transmission smoothly !



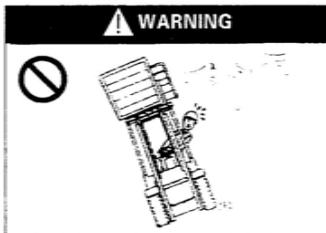
(70) Use only specialized equipment designed to safely raise personnel to high work areas !



(71) Always stay within the rated capacity !



(72) Do not operate in blustery weather .



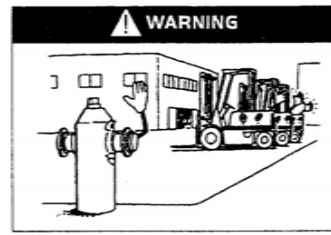
(73) Forbid to operate in the circumstance here is easy to explode .



(74) Park a disabled machine safely !



(75) Park in authorized areas only !



(76) Do not park on a grade



2 How to avoid a tipover; how to survive one

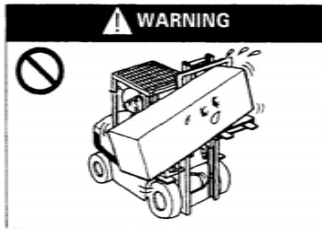
(1) Do not tilt elevated loads forward !



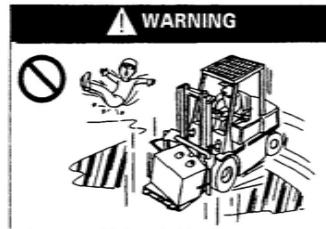
(2) Do not elevate tilted loads !



(3) Do not pick up an off-center load !



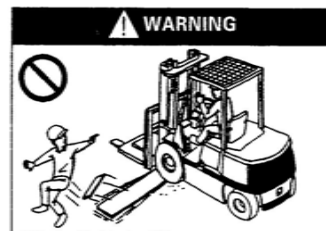
(4) Do avoid slippery surfaces !



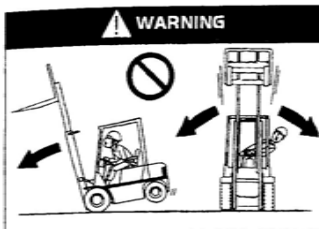
(5) Do not attempt to pick up or deposit a load unless the forklift truck is level !



(6) Do not go over obstacles-curbs,ditches, ridges and railroad tracks !



(7) Do not travel with forks higher than 15 to 20cm(6 to 8 in.)above the ground !



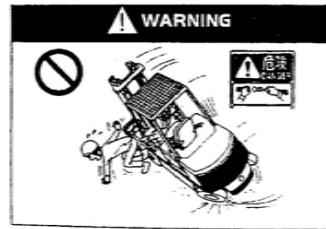
(8) Do not make fast or sharp turns with a loaded or unloaded truck !



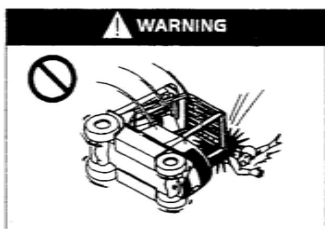
(9) Do not turn too sharply , even with an empty raised mast , to avoid a tipover !



(10) DO fasten your seat belt !



(11) Do not jump off your truck if it starts to tipover !



(12) Do wear a hard hat !

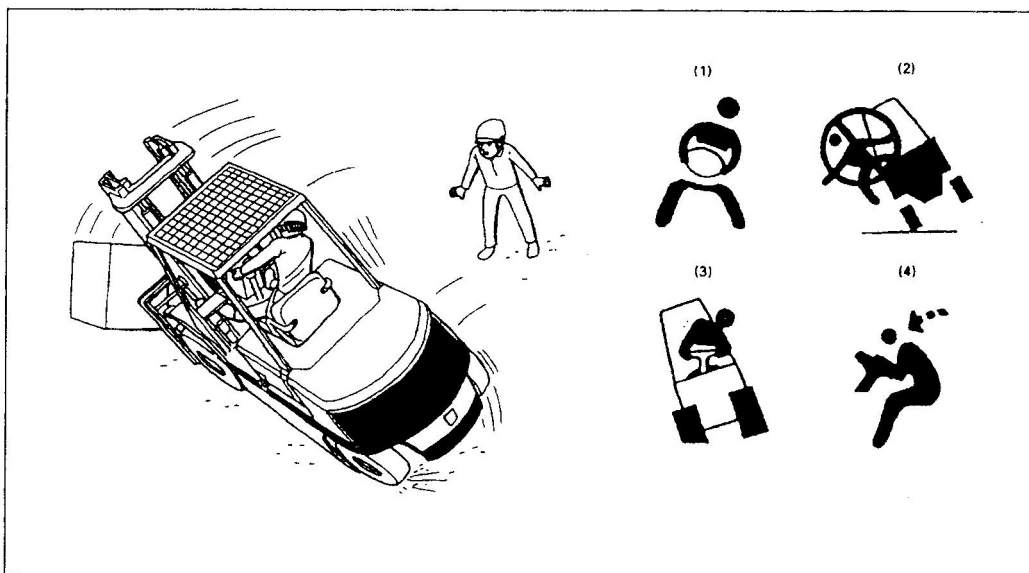


How to Survive in a Tipover

DANGER

Remember , your chances for survival with your seat belt fastened in a tipover are better if you stay in your truck . If your truck starts to tipover :

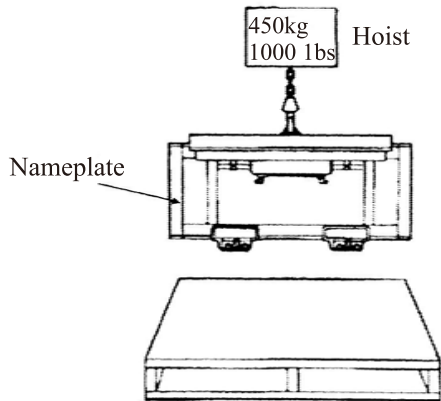
- 1.Firmly hold on to the steering wheel and brace your feet .
- 2.DO NOT jump off !
- 3.Lean away from impact .
- 4.Lean forward .



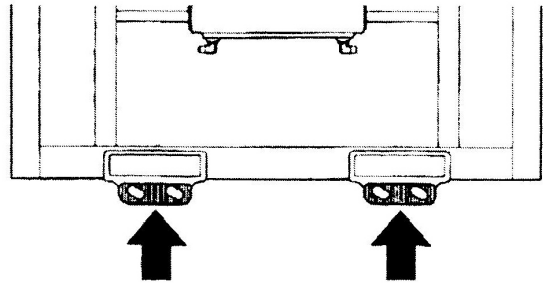
3 Notice of Sideshift's installation,employment and security

Installation

1.Remove from pallet

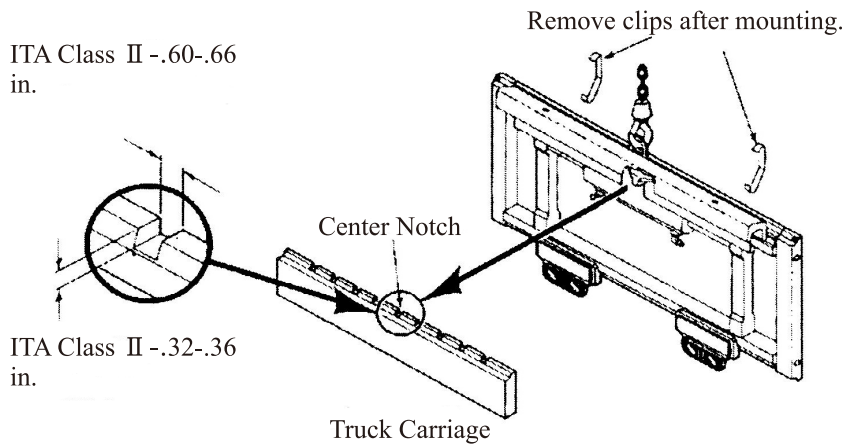


2.Remove Lower Hooks



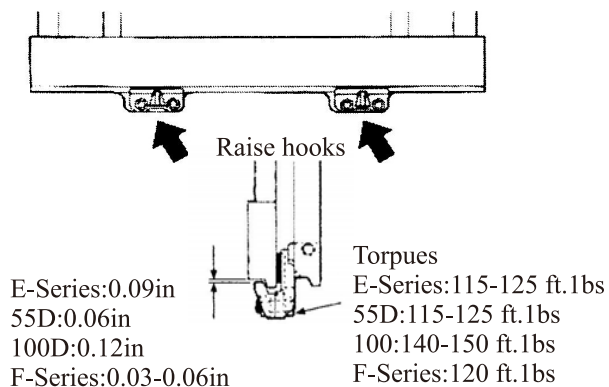
3.Mount on Lift truck

ITA Class II -.60-.66
in.

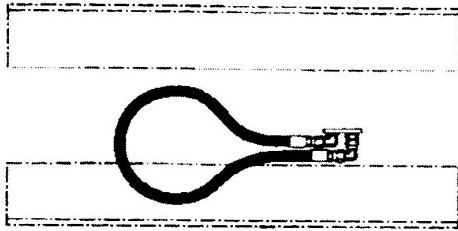


ITA Class II -.32-.36
in.

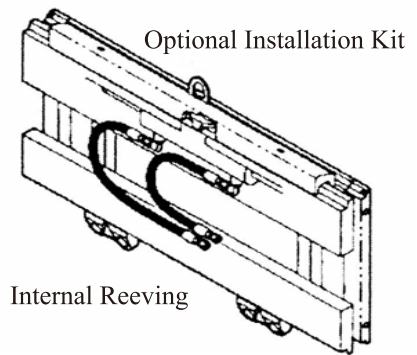
4.Install lower hooks



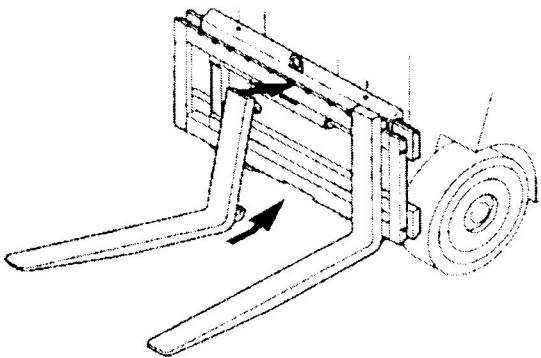
5. Flush supply hoses



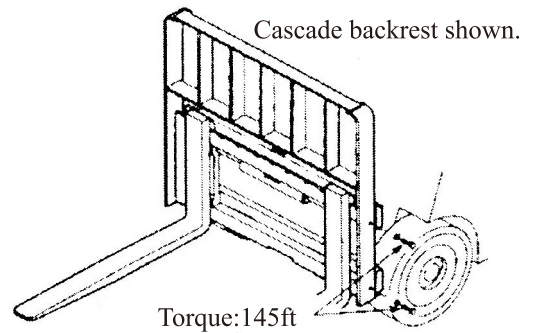
6. Install hoses



7. Install fork

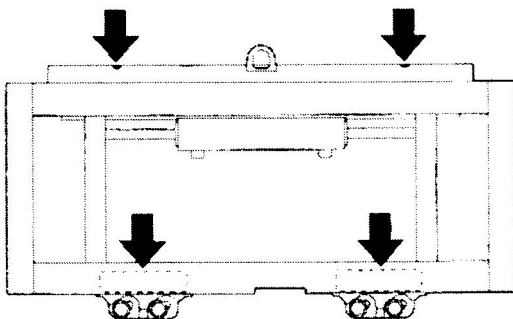


8. Install backrest

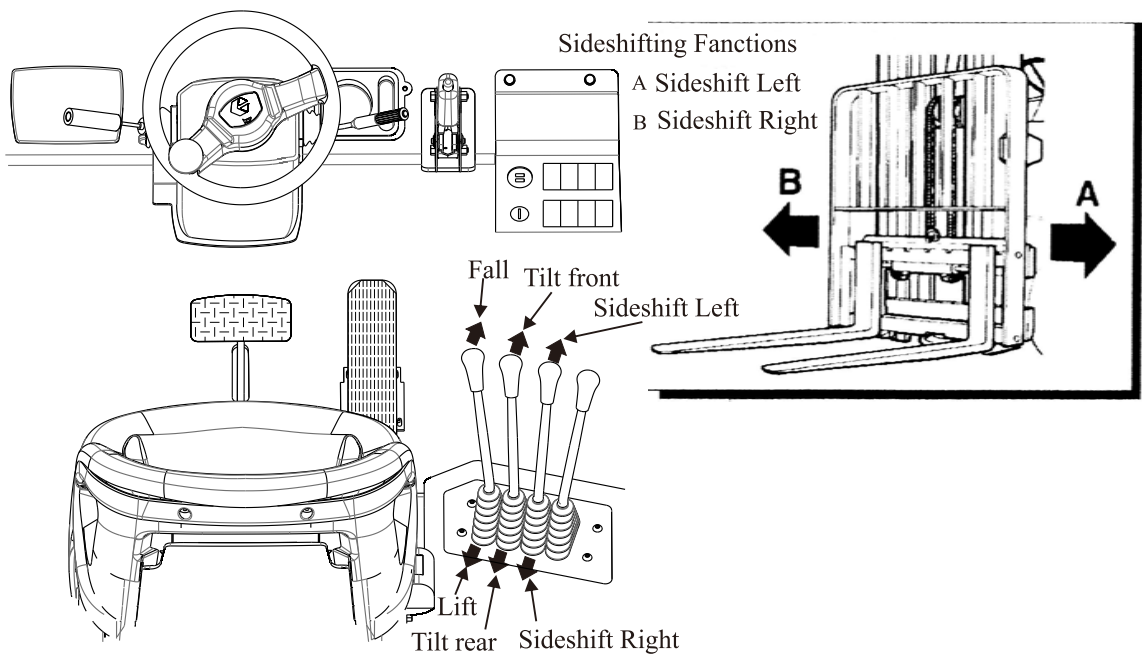


9. Lubrication Points

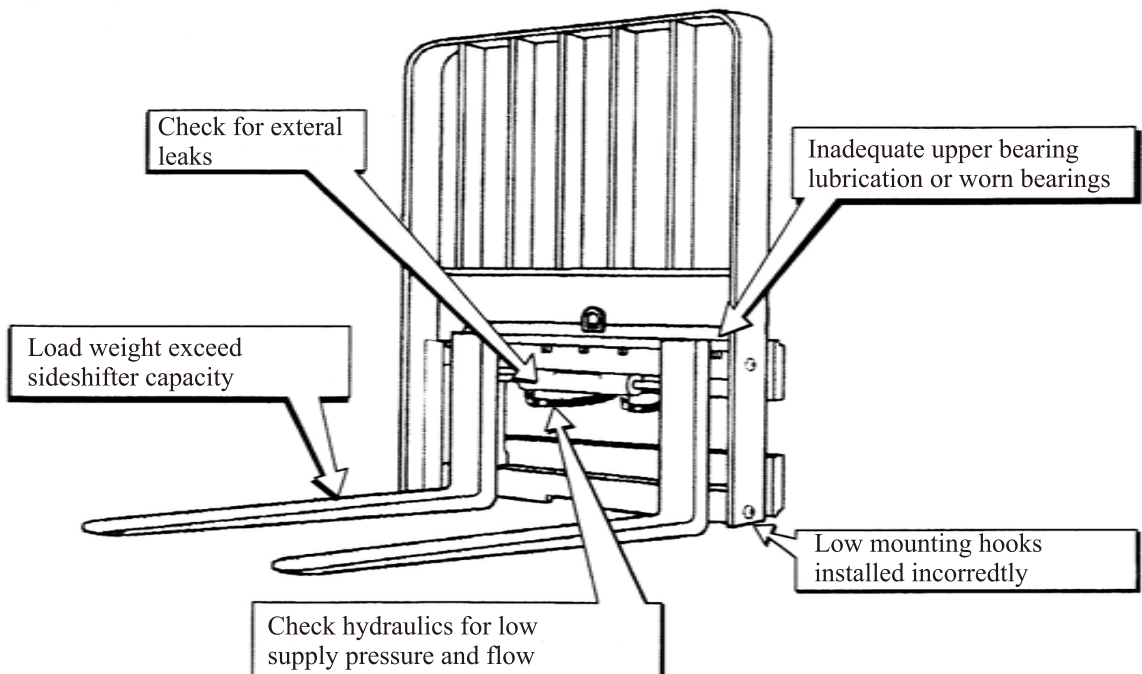
- The upper bearings and lower bearings should be greased at
- After first 500 hours, lube all bearings with chassis grease.



Sideshifter operation



Load will not sideshift



4 Maintenance records

[illegible]



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