

MANUAL DE USUARIO **LG30**

ELEVADOR - LONKING

LONKING

Febrero 2023

Preface

Dear user:

Thank you for selecting the Lonking forklift trucks!

In order to help you operate and maintain the third generation engine balance forklift series, we make this book.

This manual is mainly about the performance, inspection, adjustment, repair of each main part and guideline for safe driving. Also, the manual provides you with some advice and help.

Improper operation and maintenance of the machine is dangerous, and even can cause seriously accidents, the personnel should read the book thoroughly before carrying out the operation and maintenance. The operator can not operate the machine unless completely understand the content of the manual.

We will continue to strive to improve product synthesis performance by ameliorating product design to make the machine work more efficiently. We reserve the right to make changes to machine parameters and configurations, any changes of contents about this manual will not be precaution, and any technical parameters involved in this manual will not be taken as a check or test basis.

In order to better service you and improve product and service quality, if you find any problem or have a good solution for the problem during the use of this machine and User Manual, please correspond with us timely.

This manual is suitable for the following models of engine series developed and produced by our company: LG30DT

This manual is the third version, the zeroth amendment.

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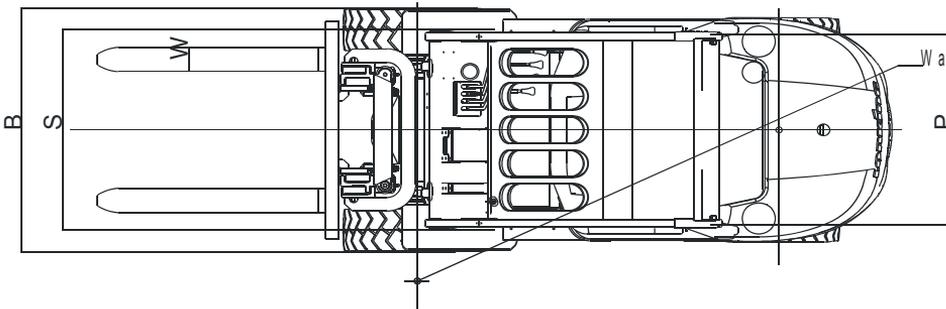
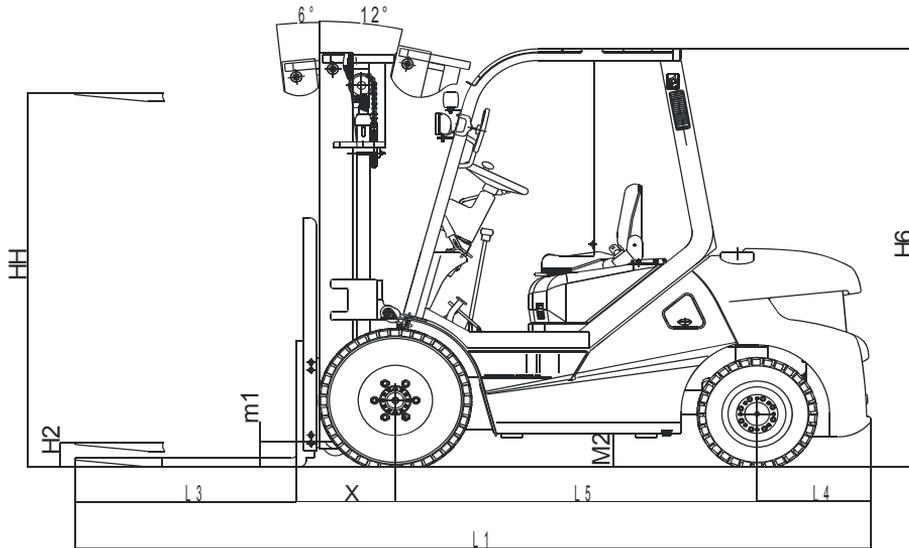
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Chapter I Main technical specifications



Technical specifications

Type		3T
power type		Diesel oil
Rated capacity (kg)		3000
Load center (mm)		500
Self weight (kg)		4200
Axle load (kg)	Front (unload /full load	1680/6552
	Rear (unload /full load))	2520/728
Tread (mm)	S front	1030
	P rear	980
L5 wheel base (mm)		1750
X front overhang(mm)		487
L4 rear overhang (mm)		550
Overall dimensions (includes fork) (mm)	L1 overall length	3850
	B overall width	1250
	H6 overall height	2150
H2 free lifting height (mm)		125
Max. Lifting height(mm)		3000
α/β mast tilt angle (front/rear) (°)		6°/12°
L3×W×T fork size (mm)		1070×125×45
Wa Min. Turning radius (mm)		2520
Min. width of right-angle aisle for stacking (mm)		4200
Min. Ground clearance (mm)	m1 mast	132
	m2 frame	165
Max.travel speed (km/h)	forward	20
	reverse	20
Max. lifting speed speed(mm/s)	Full load	450
	unload	485
Declining speed (mm/s)		<600
Max. Gradeability %		20%
H1 height from seat to overhead guard		≥1000

Chapter II Precautions for forklift use and safety operation

Drivers and management personnels should remember that "safety first" and should safely operate the machine according to Operation and Maintenance Manual and Driver Manual.

1. Transportation of forklift

- (1) Actuate the parking brake.
- (2) Both front and rear of the mast and the counterbalance should be fixed. Put wedges at related positions under front and rear tires.
- (3) Lift as the position listed by the" lifting label" when lifting.

2. Storage

- (1) Drain the cooling water (Do not drain the fluid if the cooling fluid is anti- rust and anti-icing fluid).
- (2) Lay the anti-rust oil on the surface of parts which are not painted. Paint lubricating oil on the lifting chain.
- (3) Decline the mast to the lowest position.
- (4) Actuate the parking brake.
- (5) put wedges under front and rear tires.

3. Preparations before operation

- (1) Inspect the tightening conditions of all exposed connecting parts and fastening parts.
- (2) Inspect whether the hydraulic system leaks, whether the oil capacity in working oil tank is sufficient, and whether fill enough lubricating oil for lubricating parts.
- (3) Do not smoke when inspecting the fuel system and the battery. Do not fill the fuel when running the machine.
- (4) Inspect whether the tire pressure conforms to regulations.
- (5) Inspect whether the cooling system is in normal condition.
- (6) Inspect whether there is a poor connection or short in the electrical system.
- (7) Inspect the free travel of each pedal. Check whether all control handles reset naturally.
- (8) Check the steering and braking system to ensure flexibility and reliability.
- (9) Check the mast system. Ensure the fork bracket and mast frame will be lifted, lowered and tilted freely.

4. Precautions for the operation

(1) Startup of the engine

【 put the transfer switch on the the GAS (gasoline) or LPG (liquefied petroleum gas) gear ---liquefied petroleum forklift 】, Place the speed control handle the neutral gear position. Actuate the hand brake, turn on the starting switch and switch on the starting power. The starting generator will drive the engine to start up. Each time do not use the startup machine longer than 15s. You can start the machine for more several times if the machine can not be started successfully, but interval between two times shall be not less than 2 minutes. If fail to start the machine for three times, inspect whether there are any problems in the oil passage and the electrical circuit. You can not start the machine until eliminate the trouble, Do not start the machine continuously for long time. The engine should run at idle speed for about 5 minutes. After the temperature of engine water rising up to about 65°C, operations under full load can be permitted.

(2) Inspection before and after operation

When the engine is running at idle speed, please inspect whether the readout and every alarm indicator of the water temperature gauge, the engine oil pressure gauge, the ammeter, the fuel gauge conform to regulated requirements. Check that the free travel of each foot pedal. Inspect the hand and the foot brake system. Carry out the testing operation for lifting and lowering the mast, front and rear tilting, steering and braking before operating machine.

(3) Stopping engine

Run the engine at idle speed for about 5 minutes, cool down the engine. Control the flameout wiring(electromagnetic flameout device put the ignition switch at the OFF position), [put the oil and gas transfer switch at the middle OFF gear——liquefied petroleum gas forklift], the engine shuts down.

During the operation, if the engine is stopped for no petroleum or liquefied gas, just move the transfer switch to the gear with fuel, then restart the engine.

5. Precautions for the safe operation

(1) Forklift trucks are special type devices. Only the trained operator with license can drive the forklift. Only the trained and qualified personnel is permitted to perform the maintenance and repair for the machine, which ensures the normal use of the machine.

(2) Wear protective shoes, the protective hat and protective clothes and glasses when operating.

(3) When the distance between gravity of goods and the fork arm is 500mm, the maximum load is rated load. Load should not exceeds the specified value when carrying the goods.

- (4) When the distance between gravity of goods and the fork arm is larger than 500mm, the lifting weight should be reduced as the value regulated by the load curve. Do not overload.
- (5) The forklift truck is only suitable for working on the smooth and hard ground. Make sure wipe off the grease on the road surface.
- (6) Daily inspection should be carried out before and after the machine operation. Do not operate the machine with troubles. If an abnormal working condition is found during the operation of forklift, stop the machine and perform an inspection. The machine can not resume to work until the fault is eliminated.
- (7) When operate the handle, pay more attention to avoid moving the other handle. Do not control the handle unless the personnel is at the driver's seat.
- (8) Do not load goods unfixed or loose stacking. Be careful to carry out the goods with large size.
- (9) Special forklifts are ordered by customers with attachments have wider application. At the same time, forklift with attachments will reduce the effective load and stability of the forklift. Do not apply the attachment equipped and special device for other purposes. Please read the additional information provided by us and operate the machine as the requirements strictly. Any private modification for the machine is not permitted.
- (10) Do not use the fork to pull out the embedding (if necessary, calculate the force needed).
- (11) When loading goods, please adjust the fork distance according to the size of goods. Weight of goods should be shared alike by both two forks, this can avoid bias loading or sliding off from one side of the machine. Do not use single fork to lift goods. Ensure that the load is secured.
- (12) When carrying out goods with large volume and the goods keeps off the driver's field of view, at this time, reverse the forklift truck to travel.
- (13) Put the fork on the bottom when loading goods. After the fork being inserted into the goods stacking, the fork arm should get touch with the goods. Then the mast will tilt to the limit position. Lift the fork to 200mm-300mm above the ground and travel.
- (14) When lifting or lowering goods, nobody should be under the lifting bracket. Do not use fork to lift people.
- (15) When loading or unloading, the mast should be at the vertical position. The forklift is under the braking status.
- (16) When lifting goods, according to the weight of the goods, appropriately accelerate the throttle and move the lifting handle of the fork.
- (17) The decline of the goods is resulted from the gravity action. When the goods is being lowered, keep the engine running at idle speed and move the handle slowly to decline the goods, avoid sudden fall of the goods.
- (18) Displacement of the control handle of multi-way valve can control lifting and lowering

- speed of the goods. When lifting or lowering the goods, initial velocity should not be too fast.
- (19) Before tilting forward and backward the mast, brake the forklift first. When tilting forward, decelerate the throttle and tilt slowly to avoid the goods sliding off.
- (20) For the forklift with high lifting travel, tilt the mast backward as possible as it can. Tilt forward and backward within the minimum range when loading. Do not drive and turn the forklift truck when the fork is at the high position.
- (21) For the lifting travel forklift with lifting height $\geq 3\text{m}$, pay more attention to the falling objects. Take protective measures, if necessary.
- (22) The overhead guard is a main part to prevent the object loaded on the fork from falling and sliding to the operator. Reuse after installation loosening, disassembling and use after modification are very dangerous and can cause seriously accidents.
- (23) The gear rack is a main part to prevent the goods on the fork from sliding to the operator, which may cause serious accident. Reuse after installation loosening, disassembling and use after modification are very dangerous and can cause serious accidents.
- (24) Height for loading and unloading materials is limited within the height of the gear rack. If the height of goods is higher than that of the gear rack, which may easily make the goods slide to the operator and cause serious accidents.
- (25) When work outdoors, wind force will influence the stability of the forklift. Be careful of it.
- (26) Be double careful when drive the machine on the dock or on the temporary plate. Travel slowly.
- (27) When traveling with load, do not tilt forward the mast and do not load and unload. Do not perform an emergency brake to avoid the goods sliding.
- (28) The forklift should travel into the goods stack at low speed, at the same time, check whether there are protruding and hard subjects around the goods in order to prevent subjects piercing the tire.
- (29) Pay more attention to passersby, obstacles and potholed road surface during traveling. Be careful of the upper clearance above the forklift.
- (30) Extending the hand, the foot and other parts of body out of the window is not allowed when traveling. Nobody should be on the machine.
- (31) Drive carefully on the slope. Do not turn, transversely and sidelong travel, or the forklift may overturn laterally. When carrying goods on larger slope, travel forward when upgrading, and travel reversely when downgrading. Please use the foot brake when downgrading. Be caution to drive. Do not stop the machine when traveling on the slope.
- (32) Start, turn, run, brake and stop the machine smoothly. It is necessary to decelerate, especially for steering on the humidity or smooth road surface.
- (33) Do not start, turn, run, brake and stop the machine suddenly. Do not make a sharp turning.

The forklift may overturn laterally if operate the machine unduly. In case of this condition, the driver should calm down and not jump down the machine. The driver should keep hold of the steering wheel with both hands and the body should incline to the opposite side of machine overturning.

(34) When filling fuel, the driver should not be on the machine. Then shut down the machine. When inspecting the level of battery or oil tank, do not ignite.

(35) When the forklift stops in the midway and the engine runs at idle speed, the mast should be tilted backward. After the machine stopping, do not let the engine run at idle speed but no person is in charge. Even do not hang the goods in the air while the driver leaves off the seat.

(36) After the whole day work, please refill the fuel tank with oil. This can avoid the moisture in the oil tank coagulating to water drop at night and mixing into the oil fluid.

(37) Before the forklift has not decelerated safely, do not actuate reverse gear to avoid damaging the part.

(38) Before leaving the seat, actuate the hand brake and keep it on the position. Place the fork on the ground, put the gear shifter on the neutral gear, and shut down the engine or switch off the power. When parking the forklift on small slope, actuate parking brake and keep it. If park machine for long time, place wedges under wheels. Do not park the forklift on large slope.

(39) If the engine is hot, do not open the cover of the water tank.

(40) Before leaving factory, the pressure of the multi-way valve, the relief valve has been set. Users do not adjust during the operation to prevent too high pressure from damaging the whole hydraulic system and hydraulic parts.

(41) Inflating pressure of tires should be charged as the air pressure regulated in the "tire pressure" label.

(42) On the flat, hard road surface, according to testing method of sound power(it is 7m far from the vehicle body). Maximum noise value outside the forklift is 89 db (A), and the testing method is according to JB/T3300. As conditions of the road surface change, noise will fluctuates.

(43) On the flat, hard road, when operating and traveling, the operator can feel the vibration of the forklift. And the vibration intensity will fluctuate as the operating environment changes.

(44) Exhaust emission for the forklift conforms to requirements of national regulations. Limit of smoke for domestic diesel engines is less than and equal to 5Bosch. Strength of CO for domestic gasoline engines is less than and equal to 5%. Strength of HC is less than and equal to 2500 PPM. If imported engines are adopted, exhaust emission will conform to EURO II Standard. The harm of exhaust for human body is inevitable, so that operating the forklift in close room is permitted, exhaust of the forklift may asphyxiate the operator.

(45) Pay attention and be familiar with the functions for all sorts of labels on the forklift.

(46) The forklift should be operated in the environment in which the altitude is lower

than 100km, the temperature is from $-15^{\circ}\text{C} \sim 35^{\circ}\text{C}$. In other extremely circumstances, be cautious to use the forklift.

(47) Ensure that the load is secured.

(48) Proper operation and regular maintenance: workers must operate the forklift with care and alertness and stay clear away from stunt driving or horseplay. They should regularly check the forklift to make sure that it is mechanically functional

Additional information: To ensure safety, the driver should be up and down the forklift (view from the direction which the forklift travels normally) from the left side. Up and down the machine from the right side is not permitted.

6. Daily maintenance of the forklift

6.1 General maintenance

- 1) Periodical inspection and maintenance for the forklift truck is required so as to keep the machine at the good condition. Some of key safe parts should be replaced periodically as requirements.
- 2) Use Lonking parts. Do not use different types of oil when replacing or adding oil.
- 3) If find the broken or fault parts, report to the management personnel. Do not operate the forklift before repair.
- 4) Only the trained personnel with license can repair the forklift.

6.2 Main points for startup

- 1) Hydraulic oil capacity : oil level should be in the middle position of oil level pointer scale.
- 2) Check if pipes, joints, pumps and valves leak or are damaged.
- 3) Check service brake system: The travel of brake pedal should be within 40mm. The clearance between front soleplate and pedal should be larger than and equal to 20mm.
- 4) Check the parking brake system: the forklift (unload) should be braked on the 20% slope when the parking brake handle is pulled to the limit.
- 5) Meters and lights: Check if meters, lights, wire connectors, switches and electrical circuits work normally.

6.3 Precautions for cooling system operation

- 1) If the radiator is boiling or the coolant temperature is too high during the forklift operation, do not open the radiator cover immediately. If it is necessary to open the radiator to find out the reason of "boil", you should first slow the engine down to middle speed, screw the cover of the radiator slowly and take off the cover after several minutes, which will avoid the coolant bursting out and scalding the operator.

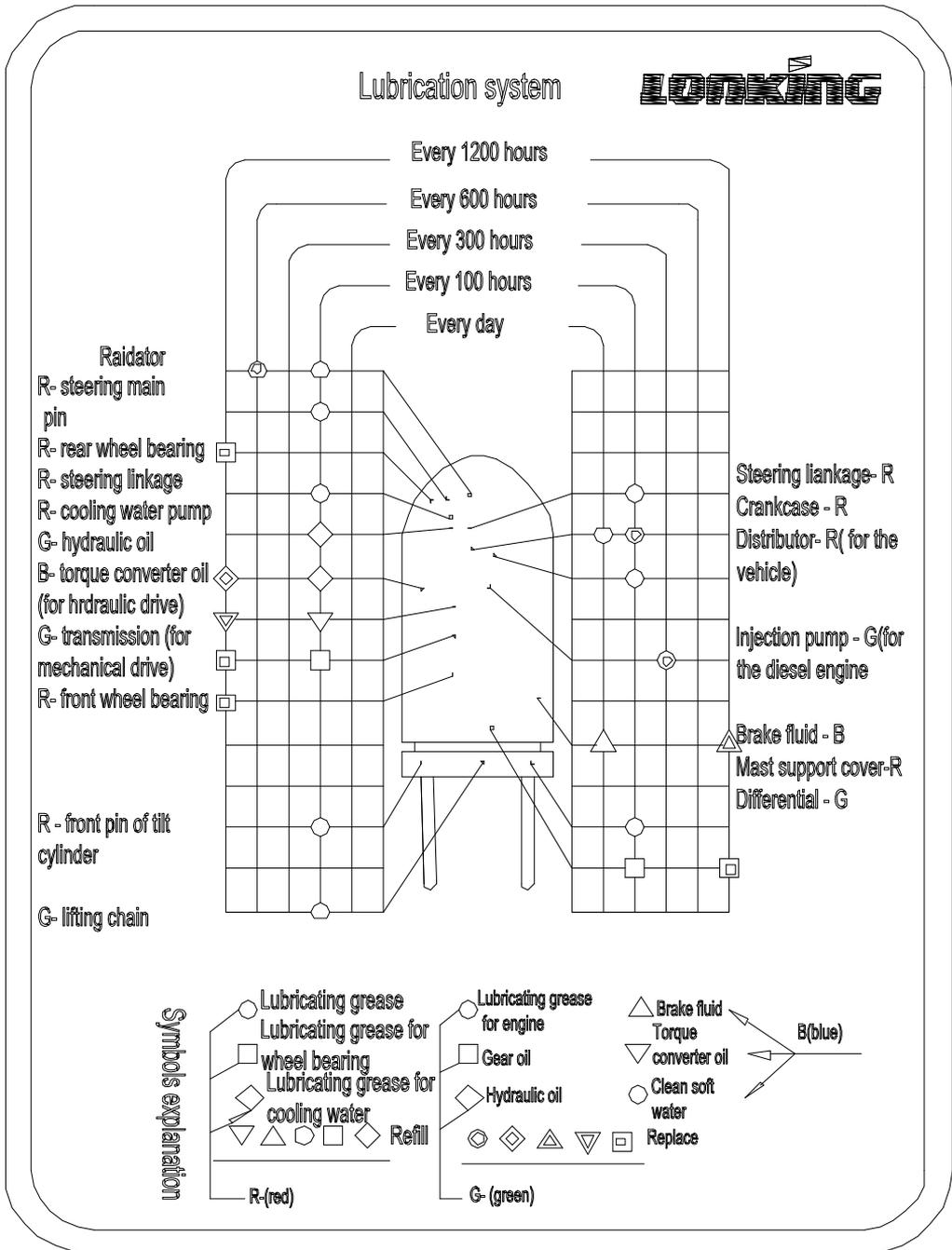
- 2) When tightening the cover, screw to the limit, otherwise the pressure system specified will not be built.
- 3) There is a tank reserver at the left side of the engine with “FULL” and “LOW” graduations, the level of antifreeze should be between the two marks. Fill the same type of antifreeze & antirust if there is any leakage or evaporation. Do not change antifreeze in different season. After a year use, filtrate and purify the antifreeze and then use continually. The antifreeze is poisonous. hazard mark should be labeled when store. Put the antifreeze in the place which the hand can not reach. If swallow, please immediately to lure spit, sent the person to hospital for treatment.
- 4) Clear the smudge on the surface of radiator periodically according to different working conditions. Cleanse, compressed air or high pressure water (the pressure should be no more than 4kg/cm²) are all available for flushing the dirt.

6.4 Oil, grease and antifreeze for the forklift

Description	Specification		Remark
	Domestic	Overseas	
Diesel oil	Select as <i>Operation and Maintenance Manual for Diesel Engine</i> , or as GB252-81 light diesel oil : in winter -10~-35#,in summer : 0#	JISK2204/2#(ordinary area) JISK2204/3# (cold area)	
Lubricating oil	Select as <i>User Manual for Diesel Engine</i> , or <i>as the regulation of diesel engine</i> GB5323-85 standard and extreme degree of working conditions, CD15W/40	SAE10W (in winter) SAE30 (in summer)	
Hydraulic oil	46#	ISOVG30	
Hydraulic drive oil	6#	SAD10W	
Gear oil	GL-485/90	SAE85E/90	
Brake fluid	DOT3 synthetical brake fluid		
Grease	3# lithium based grease drop point 170	JISK2202/2#	
antifreeze	Water or FD-2 type -35°C long effect antirust antifreeze fluid		

Refilling oil, grease and antifreeze should be carried out according to related vehicle standards. When depositing harmful materials above, obey related laws and regulations

6.5 Chart of lubricating system



Chapter III Maintenance and precautions of the battery

Engine counterbalanced type forklift of our company is configured with maintenance free batteries. It has no need of refilling distilled water. Also, it has features of shock resistance, anti-high temperature, small volume and less self discharge. The service life of this battery is as twice long as the ordinary battery.

Storage and operating precautions of the battery assembled on the forklift:

1 Safety

1.1 There is vitriol fluid in the battery, which has strong corrosive nature. Keep the battery away from children. Make sure wear protective goggles and rubber glasses. If the electrolyte is spattered into the eyes, on the skin and clothes, clean them with a dry towel immediately, flush them with lots of water. And the personnel with serious injury should see the doctor in time.

1.2 The battery can produce hydrogen and oxygen when is charged. If the strength of hydrogen in the environment exceeds 4%, once the hydrogen meets the open flame, spark and high temperature, an explosion will be caused. Therefore the battery should be kept off the open flame to avoid the short circuit.

1.3 Shell of the battery is made from the polypropylene. It is combustible. Therefore it should be away from the open flame.

1.4 There are strong acid inside the battery. Unprofessional personnel should not disassemble the battery to avoid unwanted accidents.

2. Storage of the battery

2.1 The battery is a charged lead-acid battery. It should be kept in a dry and clean environment with 5-25°C and good ventilation to avoid the sunlight shining directly. The battery should be over 2m from the heat source. If the temperature for environment is too high, it may influence the battery capacity a lot.

2.2 Do not inverse or lie the battery. Do not allow any machinery to impact or press the battery seriously.

2.3 A new battery could be kept for about 6 months at ambient temperature. Within the 6 months, generally, the battery can be used directly with no need of recharging.

If the battery has been kept for more than 6 months, it is necessary to check the voltage. If the voltage is low, the battery can be used after recharging. Under the ordinary conditions, the electric eye turns green when the battery capacity exceeds 65% (the battery voltage is about equal to 12.45V). The electric eye turns black when the battery voltage is about lower than

12.45V.

2.4 After assembling, turn off the power switch when storing the battery. Then perform an inspection to the battery every two months. For the battery losing power, charge in time. Do not keep the battery under power loss.

3. Mounting, adjustment

3.1 Before mounting the battery, please read the user manual carefully.

3.2 Make sure that the bracket and pincers are clean. Check whether setscrews on the bracket for battery are tightened. Loose installation of setscrews may cause vibration during travel and the shell will be damaged. Do not knock on the terminal post to prevent the terminal post from loosening and avoid acid leakage of the battery. Otherwise, do not put the metal on the battery to avoid short circuit.

3.3 Keep the battery at horizontal condition when install the battery. The maximum inclined angle is 40°. When connect the wire, make sure that electrical equipments are open(means that all the electrical fittings are at the "off"position).

3.4 Fasten pincers and wire terminals. make sure that the contact surface between the wire and the battery is clean, and the connection between the polar and the connector lug is reliable. You can lay the vaseline and other protective agents on them.

3.5 When clean the forklift, do not drop water onto the polar of the battery, or may cause the battery to discharge slightly.

3.6 When park the forklift, please check the battery (perform an inspection after the machine stopped for an hour). The voltage of battery should be higher than or equal to a new battery installed on the machine(The storage voltage in summer for lead-acid battery is higher than or equal to 12.4V, the storage voltage in winter is higher than or equal to 12.6V).

4. Precautions for charge and charge method

4.1 Precautions of charge

4.1.1 For loss of power batteries caused by all kinds of reasons, charge in time to avoid the vitriol of the battery salinization, and prevent the capacity of the battery from descending.

4.1.2 Do not overcharge during use or charge. Avoid the battery losing power early result from losing too much water, plate grid corrosive and falling off of diachylum

4.1.3 when the machine is in normal condition, the battery is recharged by the generator in time after discharge. The battery fulfills a whole discharge and charge process, which is defined as a cycle. If output voltage is too low or too high and do not charge sufficiently or overcharge, use the battery continuously, this will shorten the service life of the battery. Withal, it is necessary to check the charging voltage of the regulator.

4.1.4 The battery will produce gas during charge, therefore ensure that the blow vent of the battery is expedite. Do not stop the vent, or accidents may be caused.

4.1.5 When charge the battery, connect the positive polar of charger to the positive polar of the battery. Connect the negative polar of the charger to the negative polar of the battery. Reverse charge is prohibited.

4.1.6 When the temperature of the electrolyte for the battery exceeds 45°C during charge, descend the charging voltage or charging current according to conditions, therefore avoid the electrolyte splashing resulted from too high temperature.

4.1.7 For maintenance free lead-acid batteries, it is recommended that use the charger with constant voltage current limited to charge.the voltage is 14.4V, the current should be smaller than or equal to $0.1 \times C_{20}$ A (eg. the capacity of a battery is 90Ah, the current of the battery should be : $0.1 \times 90 \text{ A} = 9\text{A}$).

(a) For loss of power batteries which the voltage is higher than 11V, use constant charger to charge. Batteries can be charged individually or in series. (The voltages of batteries in series are close, the highest differential pressure is lower than or equal to 0.1V).

See the following table for the charging time.

battery voltage (V)	12.6~ 12.45	12.45~ 12.20	12.20~ 11.95	11.95~ 11.70	11.7~ 11.45	11.45~ 11.20	11.20~ 11.00
charging time (hour)	2	4	6	8	10	12	14

(b) For power- lack batteries which the voltage is lower than 11V, the pole plate is vulcanized seriously, so that it may not accept charging current. Parallel a good battery with power-lack batteries for diverter charging. Charge individually or in series when the voltage increases to more than 11V.

4.1.8 After finishing charging, the battery is not suitable for using immediately. The battery should be put into use continuously standing for an hour.

4.1.9 The electric eyes will become bright color after long time charge. It needs a standing process.

4.2 Charge mode

4.2.1 Constant charger: at the first phase, charge the battery with $0.1 C_{20}\text{A}$ current until the voltage for the end of the battery is up to 14.4V. At the second phase, the charging current is 1/2 as much as the current of the first phase. After the voltage is up to 14.4V, charge another 2-3 hours continuously.

4.2.2 Constant pressure charger: connect loss of power batteries to the charger correctly (red positive and black negative). Press the charging button and select 14.4V. The maximum charging current should not exceed $0.1 C_{20}A$. Stop charging until the current descends lower than 2A.

4.2.3 Intelligent charger: generally it is divided into three-stage charging mode. First, adopt constant charge. Comes into constant pressure charging mode after the voltage is up to 14.4V. Finally come into floating charge.

Note:

- a. Do not charge while nobody takes charge.
- b. Frameworks is prohibited when charge the battery. It is necessary to keep away from the open flame. Make sure that charge the battery in the good ventilative environment. Do not pile the combustible and explosive substance around.
- c. If the battery is too hot, smells abnormal(sour) and splashes acid during charge, stop charging the battery temporarily.
- d. The battery will produce gas during charge. Before charge, check whether air vents at the left and right sides of the battery top cover are expedite or not. Please make sure that air vents are expedite, therefore avoid the battery bursting.
- e. Do not charge the following batteries: batteries with deformative casing caused by overcharge or batteries with dry electrolyte.
- f. Personnels for charging should pay more attention to protection when charge the battery.

4.3 After the battery finishing charging, clean the battery. Make sure the appearance of the battery is clean, and the air vent is expedite.

5. Maintenance

5.1 The voltage of the battery should be sufficient before installing on the machine for storage. After storage, disconnect the negative pincers or turn off the main power switch of the circuit. Therefore it will reduce the consumption of the circuit for vehicle.

5.2 For batteries installed for use, disassemble from the forklift truck and put in the dry, cool place if do not use the batteries for long time(more than 15 days generally). Charge the battery sufficiently before storage. Inspect and charge the battery at regular intervals.

5.3 If do not use the battery for long time, take out of the battery from the vehicle and charge sufficiently before use.

5.4 In normal work, before stopping working every day or at night, it is necessary to turn off all electrical equipments normally.

5.5 In daily work, the current for startup machine is very large when it is working. Time for using startup machine is not long (3-5s). When start the machine continuously, intervals should not exceed 10~15s. Do not continuously start the machine for more than 3 times; if it is not successful to start the machine for more than 3 times, find out the cause. Do not start the machine until the failure has been removed, so that avoid the plate of batteries damaging by frequent large current discharge

5.6 It is recommended that inspect the voltage regulator for vehicle at a at regular intervals. Too high voltage will cause large current to charge the battery, or too low voltage will result in charging sufficiently for long time, both two will cause the battery to lose power. Keep the voltage within the specified range to avoid the battery malfunction. For the bloody battery, please get touch with the dealer.

5.7 keep air vents of the battery expedite

6. Troubleshooting

If the forklift can not be started after mounting the battery, working personnels should supply the following data:

6.1 Visible inspect the appearance: 1) whether there is damage on the extrinsic feature, whether the fluid leaks, whether there is deformation.

2)whether the terminal is damaged.

3) whether the air vent is expedite.

6.2 Inspect the condition of the electric eye.

6.3 Inspect the voltage for open circuit.

6.4 Inspect the connection is in good condition.

Chapter IV Forklift structure, principle, adjustment and maintenance

In order to keep the forklift in the best condition all the time, it is important to understand completely the structure, principle, adjustment and maintenance methods of main parts. If the forklift is out of work, only the qualified personnel can carry out the repair operation. Purity parts of the forklift should be adopted when replace parts.

1. Power system

1.1 General

For models of forklifts related to in this manual, the engine are connected with the drive device. The bracket of the engine is connected to the frame through some rubber pads, which will reduce the vibration.

The power system basically consists of the diesel engine, the fuel system, the cooling system and the exhaust system. The engine is mounted on the frame through some rubber pads which will absorb the vibration. The engine, the torque converter, the clutch and the transmission are connected with the drive axle in a single unit, see the following figure:

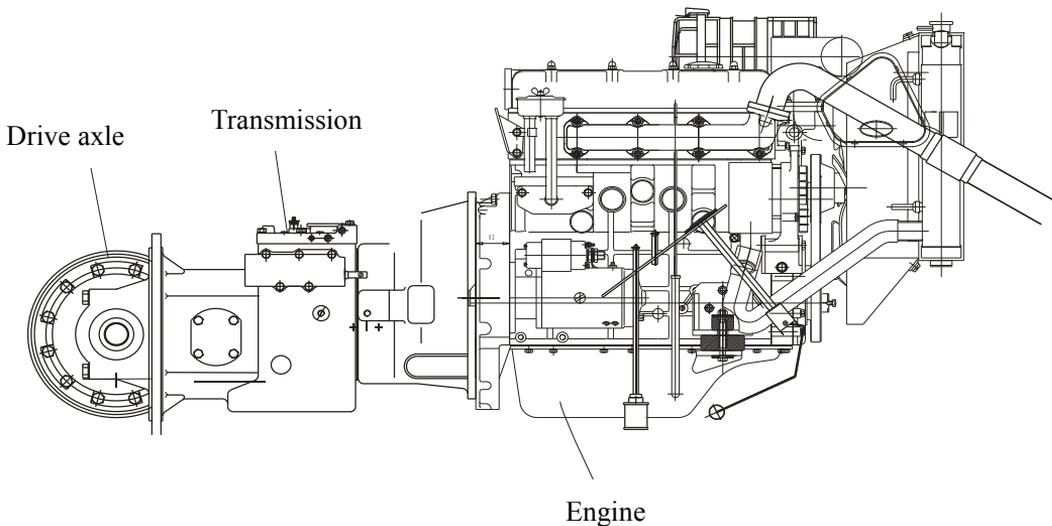


Fig. 2.1 Figure of engine installation

1.2 Table of the engine specifications and applicable models

Model	C490BPG-225
Rated power/rotation speed kw/ (r/min)	40/ 2650
Rated torque /rotation speed N.m/ (r/min)	145/ 1900
Cylinder number-cylinder bore×stroke mm	4-90×100
Compression rate	18.5
Total displacement L	2.67
Weight kg	260
Dimension mm length×width×height	751×565×704
Applicable models	LG30D T

Please see *Use and Maintenance Manual of the Engine* for details of engine structure and adjustment.

1.3 Inspection and adjustment of the engine

1.3.1 The air filter

- 1) Take off the air filter core.
- 2) Check whether there is dust in the core and the damage condition, if the filter core is dirty, blow with air at low pressure from inside to outside. If the filter core is damaged, replace it with a new one.
- 3) clean the cover with dust on it.

1.3.2 The engine oil filter

Diesel engine

- 1) Take off the oil filter with the wrench of the oil filter. Replace the oil filter.
- 2) Drop several drops of engine oil around the seal ring on the new oil filter. Then mount the new oil filter, tighten another 2/3 circle after touching the machine body.

1.3.3 Water tank and auxiliary water tank

- 1) Inspect the coolant level in the auxiliary water tank.

Inspect the coolant level in the auxiliary water tank, if the coolant is lower than the "low" calibration tail, add antifreeze to specified level.

The level should be higher than "high" calibration tail when the engine is warm. The level should be at 2/3 position of "high" calibration tail when the engine is cold.

- 2) Replacing antifreeze

- a. Shut down the engine and wait for 30 minutes.
 - b. Remove the cover of the water tank. Loose the drain switch on the water tank.
 - c. Loose the drain switch on the engine and drain coolant.
 - d. Tighten both switches above.
 - e. Fill the water tank with antifreeze, the filling speed should be slower than 2l/min.
 - f. Start the engine and run the engine at idle speed for a moment after filling antifreeze fully. Inspect the level of the auxiliary water tank. If the level is low, continue to add antifreeze to the specified level.
 - g. Tighten the cover for the water tank. In order to keep the level at the 2/3 capacity position, add antifreeze at any moment.
- 3) Tightness adjustment for the fan leather belt
 - a. Loose mounting bolts for the generator.
 - b. Move the generator to adjust the tightness of the leather belt. Press the leather belt with 10Kg force. Press down 10mm at the maximum place.

1.3.4 Exhaust

Diesel engine

1. Press the hand pump in order to pump the oil into the injection pump.
2. When it is hard to press down, press another 5-10 times.

1.3.5 Speed adjustment for the engine

Idle speed

- 1) Warm the engine until the temperature of the cooling water in the engine is up to 85°C.
- 2) Mount a tachometer on the engine. Adjust the rotation speed of engine to the specified value 700rpm with a idle speed adjustment screw of the carburettor.
- 3) According to accelerating direction of engine, adjust setscrew which is used for adjusting the minimum open degree of the valve.
- 4) Adjust the engine to stable speed 700rpm with a idle speed adjustment screw of the carburettor.

Maximum speed (gasoline engine)

The maximum speed of the engine can be adjusted with the regulator, pay attention to two quick change of the speed may cause piston slap.

Maximum speed adjustment (unload)

Remove

1.4 Fuel system

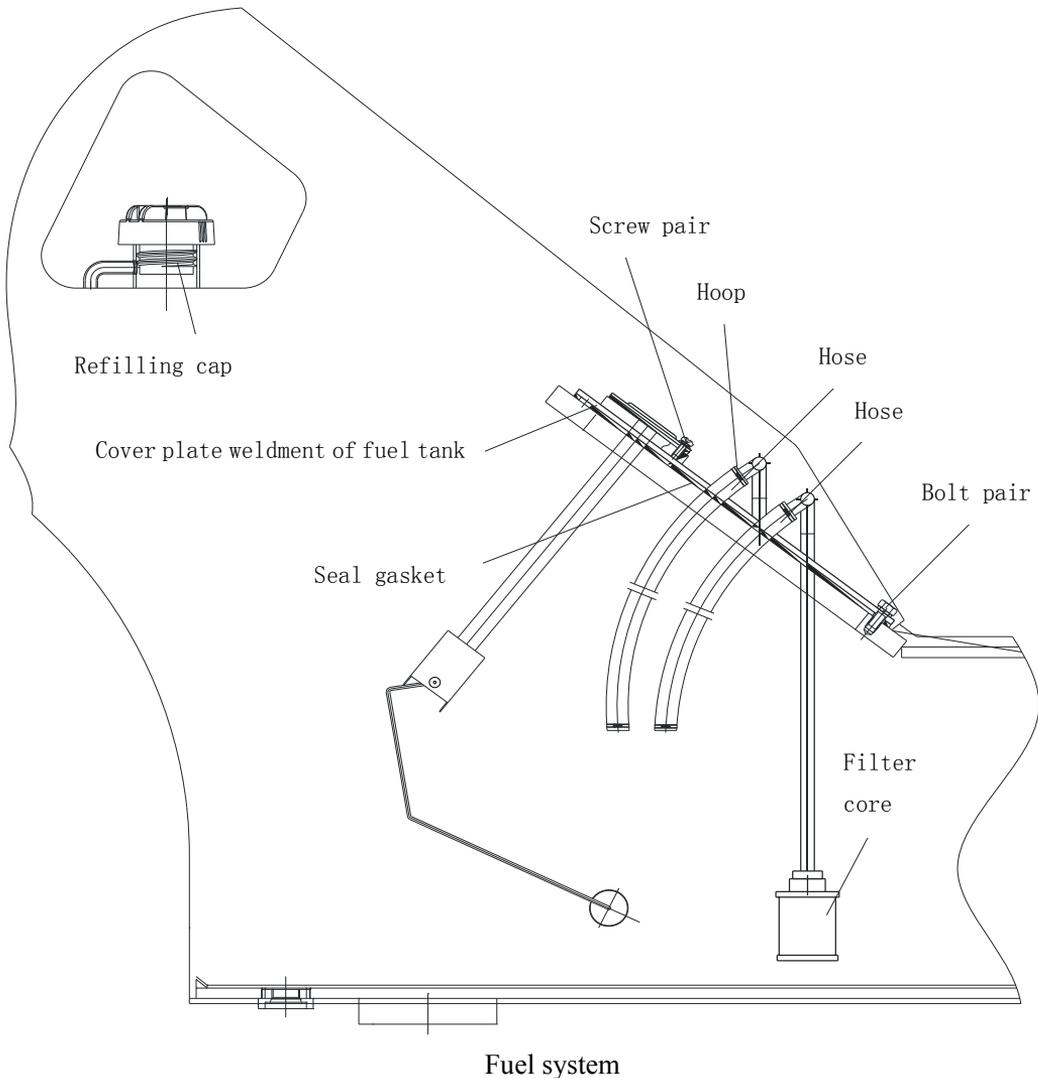
The fuel system consists of a fuel tank, a filter, a fuel sensor device and a fuel gauge to indicate the oil level.

1.4.1 Fuel tank

The fuel tank combines with the frame by welding as a unit. It lies on the left of frame . The cover plate is located on the upper plane of the oil tank. A fuel sensor used for monitoring the oil capacity is mounted on the cover plate.

1.4.2 Oil capacity sensor

The oil capacity sensor is used to transform the oil in the oil tank into the current value.



Fuel system

1.4.3 Maintenance for the fuel system

Maintain the fuel system for every 100h. Clean the fuel tank for every 600h.

(1) Fuel filter

A filter is mounted on the fuel pump (gasoline engine type) or on the fuel tank (diesel engine type). It is used for filtering the fuel provided for the engine. Also, the oil filter of the diesel engine can separate the water from oil.

A. Gasoline engine

- a. Replace the whole filter for every 300h.
- b. Loosen the rotation wheel and remove the cover.
- c. Screw off the nut and take off the filter core.
- d. Clean or replace the filter core.
- e. After finishing reassembly, start the engine to fill the oil cup of the filter with gasoline. Check whether the oil cup leaks.

B. Replace the whole filter for every 600h.

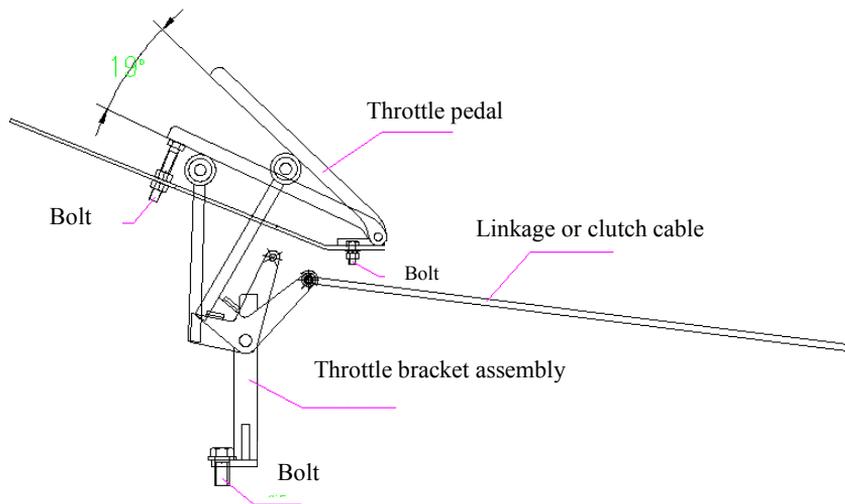
- a. Drop several drops of engine oil around the seal ring on the new oil filter. Then mount the new oil filter, tighten another 2/3 circle after touching the machine body.
- b. When the oil filter lamp is on, loose the drain switch to drain the water.
- c. Note: after draining water, make sure that turn off drain switch.

2) Cleaning the fuel tank

Clean the fuel tank for every 600h. For the forklift truck equipped with the gasoline engine, pay attention to avoid the fire when cleaning.

1.5 Throttle control

As the figure shown, a throttle pedal is mounted on the bottom plate. It is used for controlling the engine speed. The throttle pedal is connected to the engine through the linkage or the clutch cable.



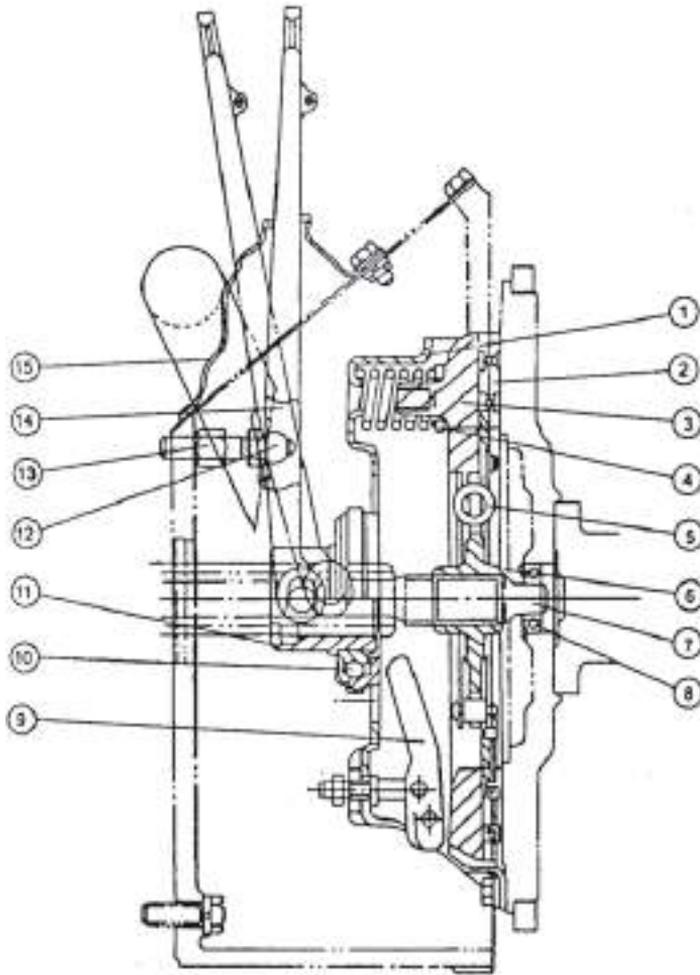
Throttle control

2 Clutch device

Type	Dry, single plate
Operation mode	Foot pedal type
Outer diameter of friction plate	275mm
Inner diameter	175mm
Thickness	8.9±0.3mm
Surface area	345cm ²
weight	12.5kg

2.1 General

The clutch device is made up of the clutch casing, the friction plate, the jib and the pressure plate assembly. It is used for transferring and cutting off the power from the engine to the transmission.(Fig. 2.1)



- 1、 Friction plate of clutch
- 2、 Pressure plate
- 3、 Pressure spring
- 4、 Damping disc spring
- 5、 Wheel hub
- 6、 Drive axle
- 7、 Bearing
- 8、 Disengaging rod
- 9、 Separating bearing
- 10、 Separating bearing sleeve
- 11、 Nut
- 12、 Disengaging fork
- 13、 cover

2.1.1 The pressure plate casing and the friction plate

The pressure plate casing is mounted on the engine flywheel. The friction plate is between the pressure plate and the flywheel. The friction plate is mounted on the drive axle of the transmission through the spline. The separating sleeve moves forward, which will impel the separating rod and let the pressure plate depart from the friction plate, thereby the power from the engine will be cut off.

2.1.2 The clutch operating pump

The operating pump is on the left side of the transmission body. The clutch operating pump is made up of the piston, the spring and the pushing rod. Moving the pushing rod can transfer the movement to the disengaging rod.

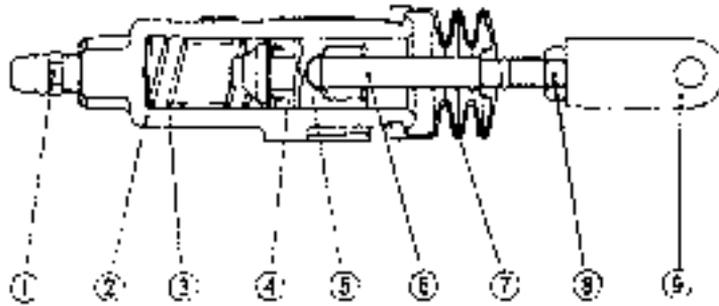


Fig.2.2 The clutch operating pump

- | | | |
|-------------------|----------------|---------------|
| 1.Oil drain valve | 4. Leather cup | 7. Dust proof |
| 2. Cylinder body | 5.piston | 8.locknut |
| 3. Spring | 6 .Pushing rod | 9. Linkage |

2.1.3. The clutch master pump

The pump is mounted on the pedal of clutch. The pump consists of the piston, the spring, the oil cup and the pushing rod. The movement of pedal is transferred to the piston through the pushing rod, which will transform the acting force of pedal to hydraulic force.

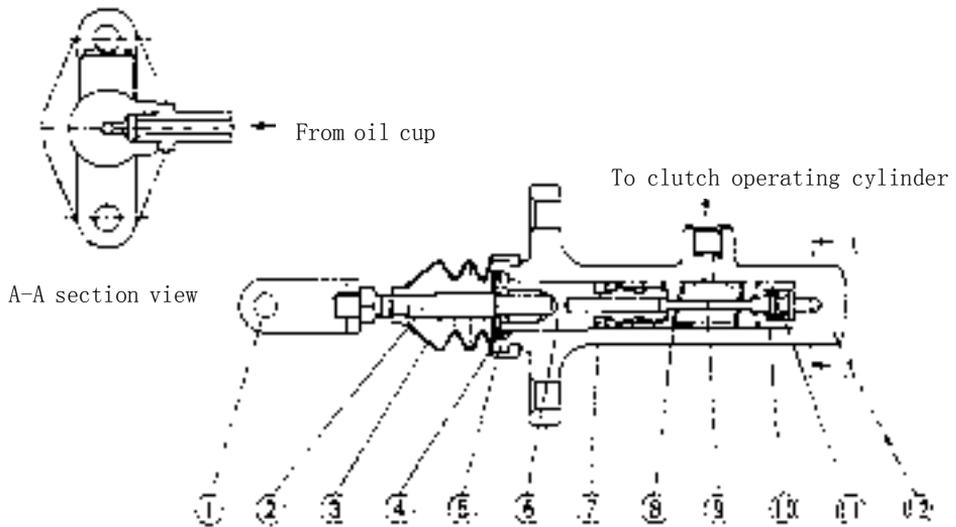


Fig.2.3 Clutch master pump

- | | | | |
|----------------|------------------|----------------|-------------------|
| 1. Linkage | 4. Retainer ring | 7. Leather cup | 10. Spring |
| 2. Pushing rod | 5. Safety plate | 8. Spring | 11. Leather cup |
| 3. Dust proof | 6. Piston | 9. Valve stem | 12. Cylinder body |

2.1.4 The clutch pedal

The clutch pedal is mounted on the same bracket with the brake pedal. The bracket of the clutch pedal is installed on the transmission body. The movement of the pedal will be transferred to the pump, which will transform the acting force of the pedal into the hydraulic

force. Then the hydraulic force will impel the pushing rod of the clutch pump and transfer the movement to the disengaging fork.

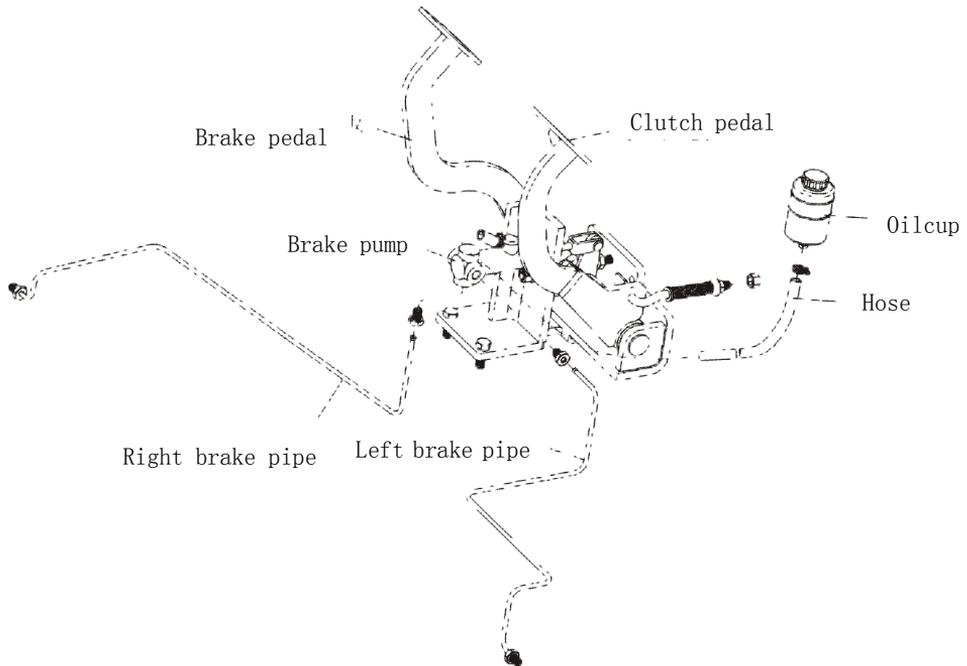


Fig. 2.4 Clutch pedal

2.2 Operation, repair and maintenance

2.2.1 Adjustment for the clutch pedal

- 1) Remove the bottom plate;
- 2) Loosen the catch bolt and the locknut.
- 3) Turn left and tighten the catch bolt in order to adjust the pedal to the appropriate height.
- 4) Tighten the locknut, install the bottom plate.



Fig. 2.5 Height adjustment for the clutch pedal

2.2.2 Replacing the friction plate

- 1) Remove the cover plate of the clutch casing.
- 2) Press down the clutch pedal, take down the pressure plate with the bolt(see the Fig.2.6)

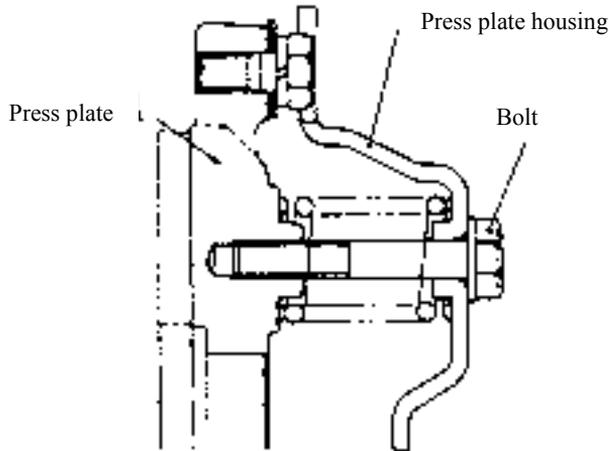


Fig. 2.6 The bolt

- 3) Turn left the sliding bolt, which will let the drive shaft come into the transmission.
 - 4) Take down the fixed bolt of the pressure plate cover. Take off the friction plate.
 - 5) Mount a new friction plate, face the longer end of spine to the transmission.
- Note: be sure that the spline of the drive shaft is put into the spline slot of the friction.
- 6) Tightening force for the sliding bolt is 10.9-12.1kg.m.
 - 7) Mount the pressure plate casing on the flywheel.
 - 8) Step down the pedal, take off the bolt.
 - 9) Check the free travel of the pedal. Carry out adjustment if necessary (free travel: 10mm).
 - 10) Keep a distance of 14mm between the disengaging rocker and the catch bolt.

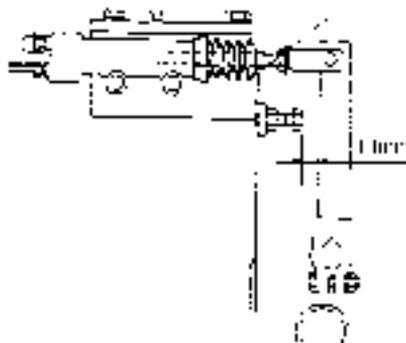


Fig. 2.7 Adjustment for the clutch operating pump

3. Mechanical drive device

Mechanical transmission	Type		Hand shifting, sliding type synchronic mesh gear
	Gears		Two gears for both forward and reverse
	velocity ratio	Forward gear I/II	3.253/1.407
		Reverse gear I/II	3.204/1.386
Reducer	Reduction gear		Spiral bevel gear
	Speed reducing ratio		2.1
Differential	Reduction gear		Spur gear
	Speed reducing ratio		6.182
	Differential gear		Spur bevel gear
Oil capacity			8 L
Weight (oil-free)			165kg

3.1 General

Mechanical drive device is made up of speed-change gearbox with the synchronizer and the differential.

See the figure 3.1 for the structure of the transmission with synchronizer.

3.1.1 Transmission with synchronizer

(1) Power transfer of the transmission

Mechanical transmission is mainly made up of a piece of drive axle, an output shaft, a main shaft and an idler shaft (for reverse gear). On every shaft, there is a kind or there are many kinds of gears with different number of teeth. These gears are shifted by the shifting level through two sets of meshing sleeve synchronizers mounted on the main shaft. The output shaft transfers the engine power to the drive wheel through the low speed gears and the differential.

Neutral gear (middle position)- power from the drive shaft is passed to the high speed gear and low speed gear through constant mesh input gear and duplex gear. However, the shifting meshing sleeve used for controlling the speed and direction is at the neutral position, the output gear of drive shaft and output shaft will not rotate, therefore the power can not be output.

Shifting position- when move the speed shifting rod, the shifting fork drives the meshing sleeve to move and engages gears of each gear through the synchronizer. The power transmission is

shown below: drive axle- input shaft - duplex gear - high speed or low speed shifting gear - synchronizer - Reverse or Forward gears - output gear - output shaft realizes power output.

The power transmission at forward gear I :

① - ② - ③ - ④ - ⑪ - ⑩ - ⑧ - ⑨ - ⑫ - ⑯ - ⑮ - ⑰ - ⑱ - ⑤ - ⑳

The power transmission at forward gear II:

① - ② - ③ - ⑥ - ⑦ - ⑧ - ⑨ - ⑫ - ⑯ - ⑮ - ⑰ - ⑱ - ⑤ - ⑳

The power transmission at reverse gear I:

① - ② - ③ - ④ - ⑪ - ⑩ - ⑧ - ⑨ - ⑫ - ⑯ - ⑮ - ⑭ - ⑬ - ⑲ - ⑳ - ⑤ - ⑳

The power transmission at reverse gear II:

① - ② - ③ - ⑥ - ⑦ - ⑧ - ⑨ - ⑫ - ⑯ - ⑮ - ⑭ - ⑬ - ⑲ - ⑳ - ⑤ - ⑳

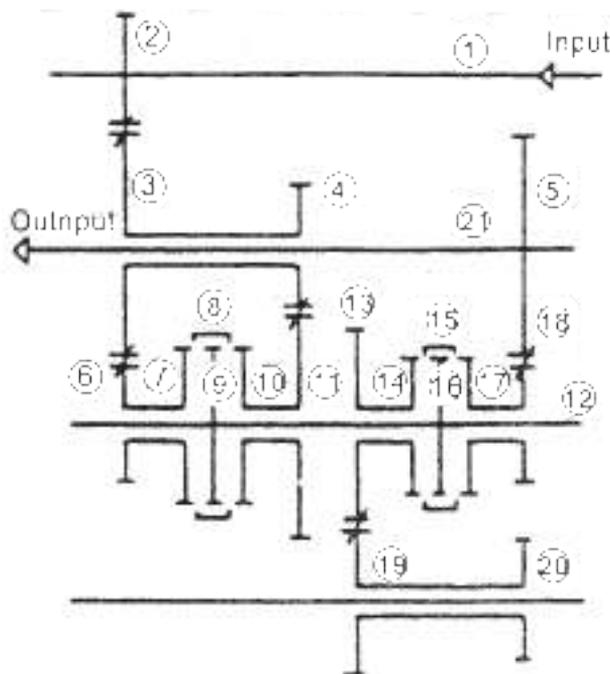


Fig. 3.1 The power transmission

1. Drive shaft	7. Synchronic cone	13. Reverse gear	19. Reverse gear
2. Input shaft	8. Mesh sleeve	14. Synchronic cone	20. Reverse gear
3. Duplex gear	9. Hub plate of clutch	15. Mesh sleeve	21. Output shaft
4. Duplex gear	10. Synchronic cone	16. Hub plate of clutch	
5. Output shaft	11. Low speed gear	17. Synchronic cone	
6. High speed gear	12. Main shaft	18. Forward gear	

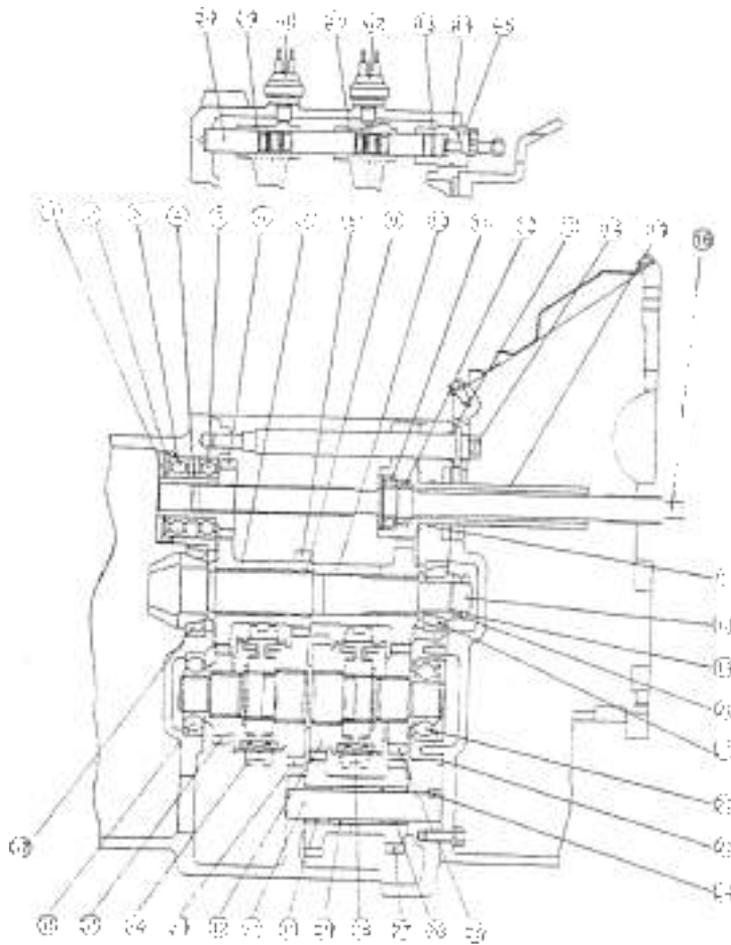
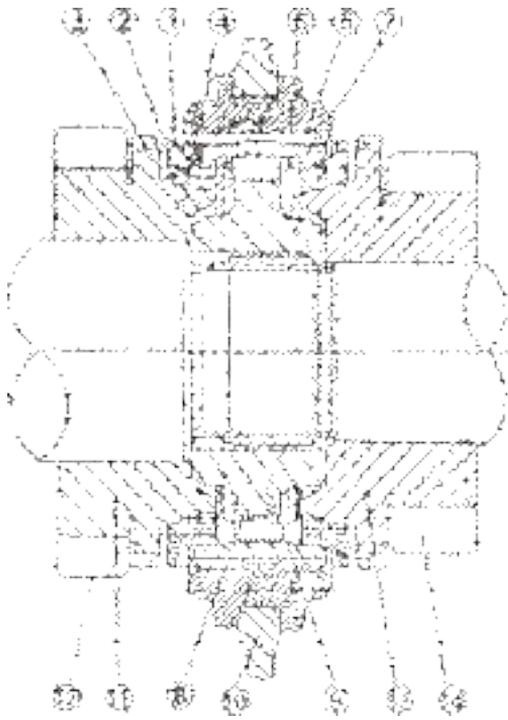


Fig. 3.2 Transmission with synchronizer

1.Spring snap ring	13.O-ring	25.“Forward”gear	37.Tapered roller bearing
2.Spring snap ring	14.Sliding bolt	26.Needle bearing	38.Shifting rod
3.Ball	15.Bearing cage	27.Reversing gear	39.Shifting fork
4.Separating ring	16.Drive axle	28.Clutch hub	40.Zero position
5.Ball bearing	17.O-ring	29.Space ring	41.Shifting fork
6.Drive gear	18.Drive gear	30.Needle bearing	42.Backup light switch
7.Needle bearing	19.Locknut	31.Shaft	43.O-ring
8.Combined gear	20.Adjustment nut	32.“Reverse ”gear	44.O-ring
9.Needle bearing	21.Tapered roller bearing	33.“Low speed gear”	45.Shaft collar
10.Space ring	22.Ball bearing	34.Clutch hub	
11.Ball bearing	23.Bearing cage	35.“High speed ”gear	
12.Oil seal	24.steel ball	36.Ball bearing	

(2) Synchronizer

Synchronizer rotates the meshing gears in step. When shifting, prevent gears from impacting, especially for changing direction between forward and backward, which keep shifting smooth.



- 1.Spline tooth of synchronic ring
- 2.Synchronic ring
- 3.Spline tooth of gear 11
- 4.synchronizing taper
- 5Meshing sleeve
- 6.Spline of meshing sleeve 5
- 7.Block
- 8.Spring
- 9.Hub plate of clutch
- 10.shifting fork
- 11.Constant meshing gear
- 12.Tooth of gear 11
- 13.Constant meshing gear
- 14.Tooth of gear 11

Fig. 3.3 synchronizer

Synchronizer mainly consists of (a) the synchronizing cone, (b) the synchronic ring and (c) the block.

(a) synchronizing cone: gear [11] (or [13]) has an involute spline on its shaft conical surface (synchronizing cone). Friction face and spline tooth through the conical surface separately combine with the synchronic ring (2) and meshing sleeve (5).

(b) synchronic ring : there is an orifice conical surface on the synchronic ring. The friction surface through this conical surface matches with the synchronizing cone. Three slots are evenly distributed around the round circle. These three slots are centered between mesh sleeve spline and synchronic ring spline, so that the slots can press half to synchronic ring through mesh sleeve spline ⑥.

(c) Block: mount protrudes of three blocks into the spline slot of the mesh sleeve (5). Embed both ends of blocks separately into three corresponding slots of the synchronic ring, and press blocks to the top of spline slot by two springs, which will produce a spring force outside. The spring force will keep spline tooth at the middle position.

From the following six steps, users can understand the whole synchronizing process.

The first step: shifting can produce a force acting on gear shifter. The force will be transferred

to mesh sleeve 5 through shifting fork. Mesh sleeve 5 and 7 separately make a displacement to gear 11 along axle direction. Suppose the displacement are separately X_1 and X_2 , the middle protrude of block 7 is still inside the mesh sleeve gear slot.

The second step: after eliminating clearances X_1 and X_2 , the action force is added up to the friction surface of block 7, the synchronic ring(2) and the synchronizing cone(4). This force overcomes action force of the spring force and inclines the block to an angle, which forms a bevel contact. The mesh sleeve makes a displacement under the force. suppose the displacement is equal to Z .

The third step: a force acts on the synchronic ring through the block 7. The force will produce a frictional moment on the friction surface of the synchronizing cone. Also the force can rotate the synchronic ring at a certain degree. Therefore the side of the synchronic ring with slots contacts lateral surface of the block. At this moment, the mesh sleeve and the synchronic ring are at the middle position.

The fourth step: after finishing the third step, the synchronic meshing sleeve has reached Z . Therefore synchronic ring spline gear 1 and 5 start to contact with chamfering edges parts of meshing sleeve spline 6, and at the same time, frictional moment is increasing to the expecting value on the surface of synchronizing cone, suppose the frictional moment is T_c . Suppose the original moment of inertia of gear is T_i , and T_i decreases. That is to say, $T_i < T_c$. Mesh process has been synchronized.

The fifth step: when constant mesh gear 11 is synchronizing with meshing sleeve 5 and the relative speed difference between them is almost equal to 0, inertia moment $T_i=0$, means that frictional moment overcomes the inertia moment and keep gear 11 at the same speed as the main shaft to finish synchronization. Result from the continuous action of the axle direction force, the synchronic ring rotate an angle along the circle, gears of mesh sleeve are among the three. Also, subjected to outside force, the synchronic ring will become floating condition, so that mesh sleeve can run through the synchronic rings successfully.

The sixth step: when mesh sleeve overpasses synchronic ring, a distance will be produced. Suppose the distance is Y_1 , therefore chamfering edges part of mesh sleeve the spline 6 begins to contact with chamfering edges part of the spline teeth 3 of gear 11. The contact of the chamfering edges adds a moment up to teeth 3 through mesh sleeve spline gear, suppose the moment is T_G , therefore gear 11 turns an angle around the circle related to mesh sleeve. This makes mesh sleeve spline overpass between the gear 11 and the spline gear 3, then the synchronic process will be finished. Power is transferred outside through the hub plate of clutch, the mesh sleeve and the gear 11(speed or directional gear). Moreover the shifting process is realized.

3.1.2 Reducer and differential

Reducer is at the front of transmission. The mechanism reduces the speed from the transmission output shaft and increases the torque transferred from the output shaft. The mechanism can transfer the torque to the differential. The reducer is mainly made up of the small spiral bevel gears on the output shaft, a spiral bevel gear and a piece of small gear shaft. The large spiral bevel gear is mounted on the small gear shaft through spline. There are taper roller bearings supporting at the both ends of the small gear shaft. And there are some gaskets to adjust the lateral clearance.

The differential is mounted on the half front housing with bearing seat through ball bearings at both ends. Front end of the differential is connected to the axle housing. the left part of the differential housing can be divided. There are two axle shaft gears and four planetary gear in the left part of the differential. Thrust washer is mounted between the differential housing and the gear. Make sure there is a clearance among the gear. The planetary gear is supported by the gear shaft I and II. Gear shaft I is fixed on the differential housing with the collar pin. Annular gear I is secured on the differential housing with hinged bolts.

Power passed from the transmission will produce differential drive through reducer. The power will be transferred to drive wheel through the axle shaft gear and axle shaft.

See the figure 3.4 for the structure of reducer and differential.

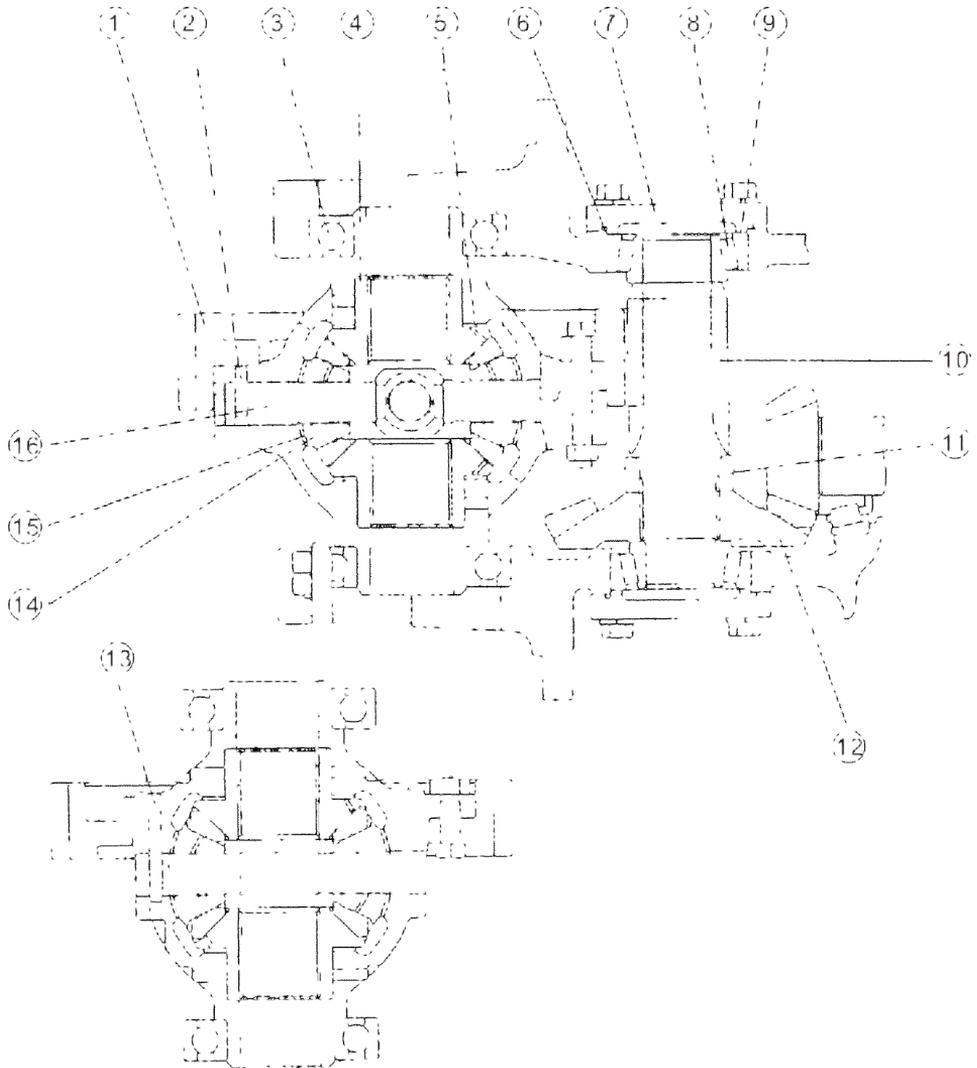


Fig. 3.4 Reducer and differential

- | | | | |
|-----------------|---------------------------|-----------------------|--------------------|
| 1. Annular gear | 5. Gasket | 9. Adjustment gasket | 13. Collar pin |
| 2. Pin | 6. O ring | 10. Gear | 14. Planetary gear |
| 3. Ball bearing | 7. Bearing cover | 11. Separating sleeve | 15. Gasket |
| 4. Lateral gear | 8. Tapered roller bearing | 12. End helical gear | 16. Gear shaft |

4 Hydraulic drive device

Torque converter	Type	Three-elements, single-stage, two -phase
	Torque ratio	3
	Set pressure	0.5~0.68MPa
Oil pump	type	Internal mesh gear pump
	Flow	27L/min(2000rpm, 1.5MPa)
Hydraulic transmission	Type	Power shifting
	Gear ratio(forward/reverse)	1.35/1.35
Hydraulic torque	Friction piece outer diameter×inner diameter×thickness	125×8×2.7mm
	Friction area	71cm ²
	Set pressure	1.1~1.4MPa
Weight		165kg
Oil capacity		7L
Oil type		Engine oil SAE10W Domestic hydraulic drive oil 6#

4.1 General

Hydraulic drive forklift is equipped with a drive device, which consists of the torque converter and the power shifting transmission. It has the following advantages:

- 1) Inching valve can allow the forklift to carry out an inching operation when the engine of machine runs at a low speed or high speed.
- 2) Hydraulic clutch is equipped with four papery friction plates and steel plates, which were treated specially, so wear resistance of the hydraulic clutch has been improved greatly.
- 3) The overload clutch mounted on the torque converter improves the drive efficiency.
- 4) A better filter in the oil passage of the torque converter prolongs the service life of the torque converter.

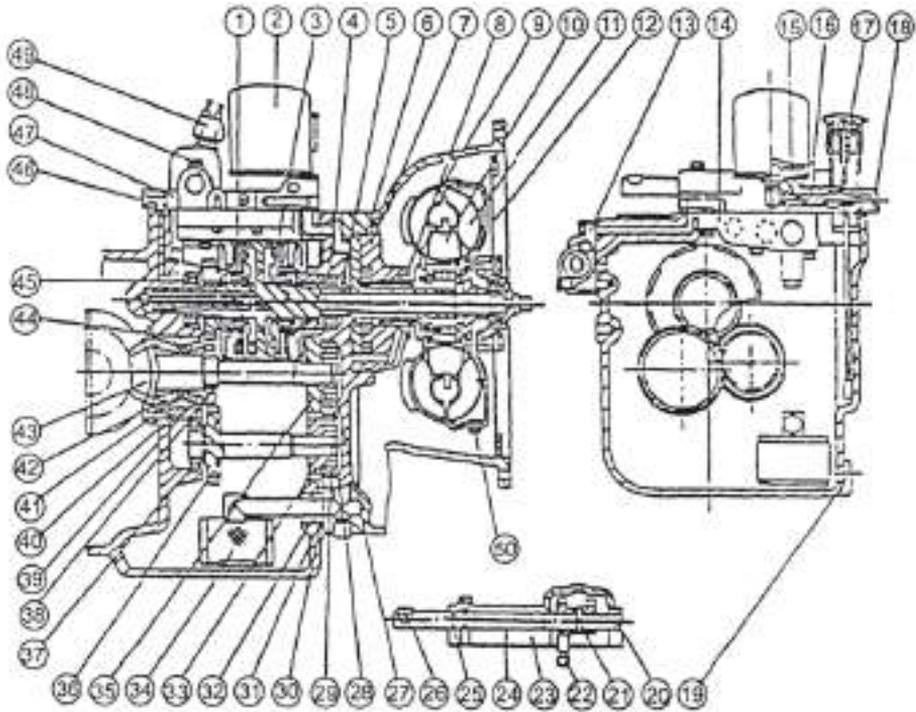


Fig. 4.1 Drive device

- | | | |
|------------------------------|-------------------------------|-------------------------------|
| 1. Forward clutch | 18. Cover of relief valve | 35. Output gear |
| 2. Oil filter | 19. Socket head plug | 36. Idler shaft |
| 3. Reverse clutch | 20. Plug | 37. Single-row radial bearing |
| 4. Single-row radial bearing | 21. spring pin | 38. Bearing nut |
| 5. Seal ring | 22. Speed change arm | 39. Tapered roller bearing |
| 6. O-ring | 23. Casing cover | 40. O-ring |
| 7. Oil pump assembly | 24. Speed change arm shaft | 41. Oil seal |
| 8. Oil seal | 25. O-ring | 42. Tapered roller bearing |
| 9. Impeller | 26. Woodruff key | 43. Output shaft |
| 10. Stator | 27. Orifice snap ring | 44. Supporting plate |
| 11. Turbine | 28. Single row radial bearing | 45. Single row radial bearing |
| 12. Elastic plate assembly | 29. Single row radial bearing | 46. Inner hexagon plug |
| 13. Inching valve assembly | 30. O-ring | 47. Cover of housing body |
| 14. Control valve assembly | 31. Sprag | 48. Fixed bolt |
| 15. Piston | 32. O-ring | 49. Back-up light switch |
| 16. Spring | 33. Idler wheel | 50. Oil drain plug |
| 17. Cap | 34. Oil filter | |

4.2 Torque converter

The torque converter is made up of the impeller, the turbine and the stator.

The impeller is driven by the output shaft. The fluid in the impeller wheel is injected to the blades of the turbine wheel through the impeller wheel blades as a result of centrifugal effect (At this moment the kinetic energy converts into hydrodynamic energy), which routes the torque to the output shaft. The flowing direction of the fluid left from the turbine wheel changes for the action of the stator wheel. Thus the fluid flows into the impeller wheel at a certain angle and produces a countertorque that impels the stator wheel. As a result, the output torque is one countertorque bigger than the input torque. When the speed of the turbine wheel is increasing and approaching to the input speed, the change of the fluid angle reduces and the output torque decreases as well. Finally, the fluid flows into the stator wheel blades in the contrary direction, which makes the countertorque act reversely. In this case, the output torque is smaller than the input torque. In order to prevent such case from occurring, an overrunning clutch is installed inside the stator wheel. When the countertorque acts reversely, the stator wheel runs freely.

Thus it ensures the torque converter runs in high efficiency and stability.

Torque converter of the drive device is connected with the flywheel through the elastic board. It rotates when the engine runs. The torque converter is filled with torque converter oil. The drive gear is connected to the impeller with two pawls, which drives the oil pump to provide oil for the torque converter and hydraulic shifting transmission. The turbine wheel is connected to the turbine shaft with the spline. Power is transferred to power shifting transmission through the turbine shaft.

The structure of the torque converter is shown in Fig.4.2

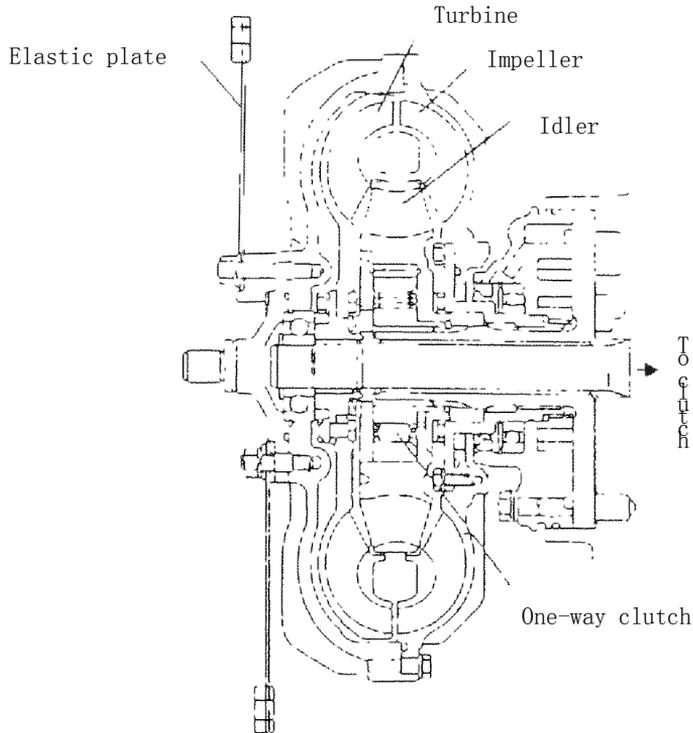


Fig. 4.2 Torque converter

4.3 Hydraulic clutch

The hydraulic clutch is a wet, multi-plate type clutch, it is assembled on the output shaft inside the transmission. The hydraulic clutch distributes the pressure oil to the forward or reverse clutch through the control valve. Thus it will realize shifting between forward and reverse gear. All gears in the transmission are constant mesh gear. The clutch is made up of four distance pieces fixed alternately, four friction plates and a piston. The distance piece departs from the friction plate. When shifts the gear, the pressure oil acts on the piston, the distance pieces and the friction plate, which make them press one another and form a connection under the action of the friction force. The connection can transfer the power from the torque converter to the drive gear.

The power transmission flow from torque converter to transmission is shown below:

Turbine wheel—Input shaft assembly—distance pieces—friction plates—Forward or Reverse gears—Output shaft.

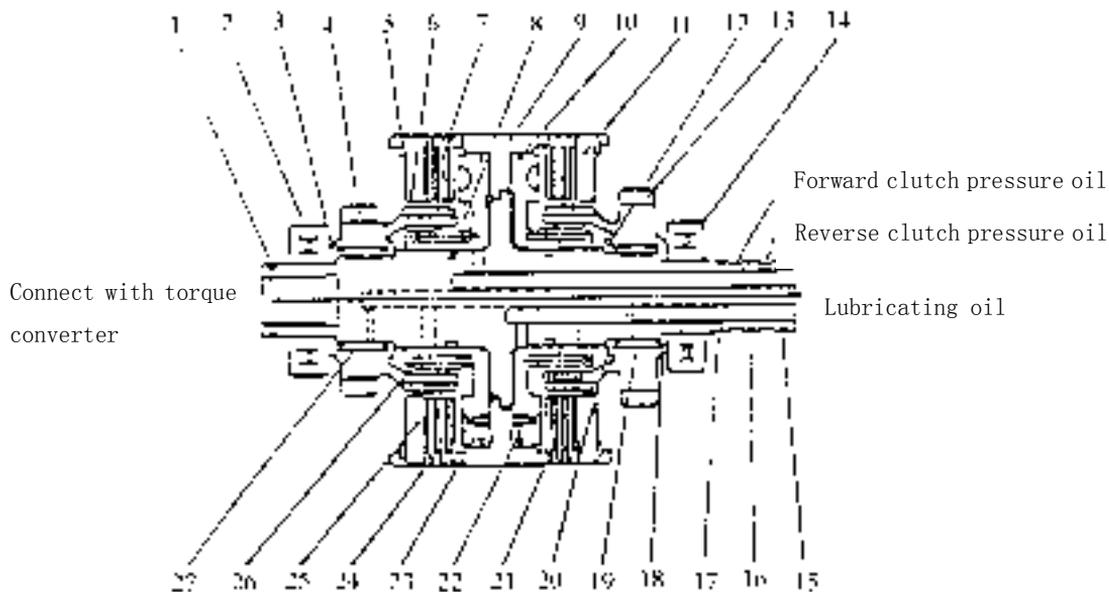


Fig. 4.3 Hydraulic torque converter

1.Seal ring	8.O ring	15.Seal ring	22.Check ball
2.Bearing	9.Input shaft	16.Seal ring	23.Piston assembly
3.Thrust shaft ring	10.Seal ring	17.Seal ring	24.Separating plate
4.Forward gear	11.End plate	18.Thrust shaft ring	25.Friction plate
5.Snap ring	12.Shaft ring	19.Needle bearing	26.Return spring
6.Snap ring	13.Reverse gear	20.Shaft ring	27.Needle bearing
7.Spring seat	14.Bearing	21.Snap ring	

4.4 Control valve, overflow valve and inching valve

4.4.1 The control valve is installed inside of the transmission, it consists of a control sliding valve, a pressure control valve and a governor valve.

4.4.2 Pressure control valve: it is used for keeping the oil pressure of the hydraulic clutch within the range: 1.1-1.7MPa. The pressure control valve also can distribute the oil to the overflow valve and send the oil to the torque converter.

4.4.3 Governor valve: it is between the inching valve and the control valve. When the control slide valve opens completely, the valve begins to work, therefore it can reduce the impaction from the connection of hydraulic clutches.

4.4.4 Overflow valve: it is connected with the transmission housing. The overflow valve can keep the oil pressure of the transmission within the range:0.5-0.7 MPa, which will avoid loss.

4.4.6 Inching valve: the inching valve is installed outside the transmission. The scroll of

valve is connected to the inching pedal linkage. When step down the inching pedal, the scroll moves right. Therefore this will descend the oil pressure of hydraulic clutch for a short time and make the forklift approach the inching effect.

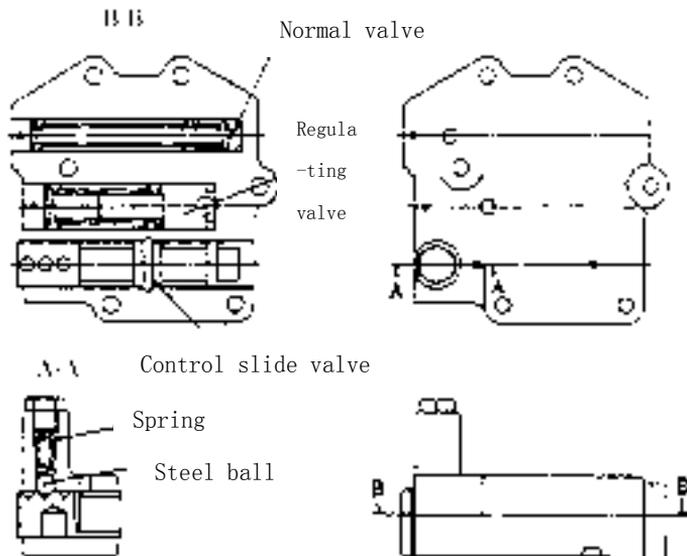


Fig. 4.3 Control valve

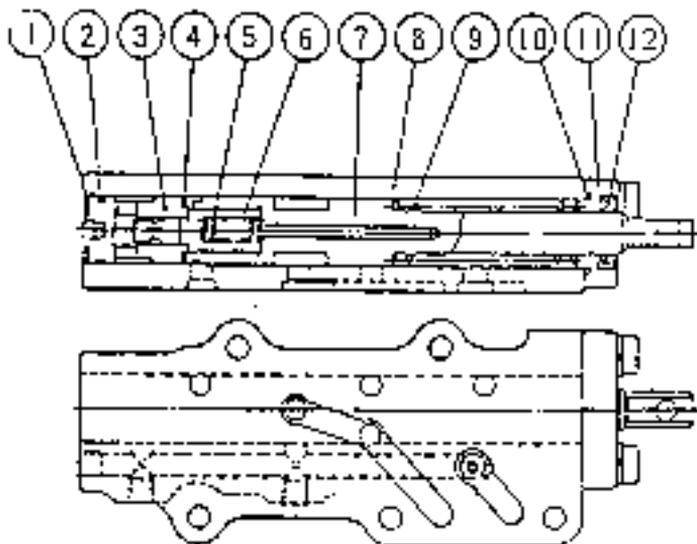


Fig.4.4 Inching valve

- | | | |
|----------------------|--------------|-------------|
| 1.Snag ring | 5.Spring | 9.Spring |
| 2.O ring | 6.Valve plug | 10.O ring |
| 3.Inching valve stem | 7.Scroll | 11.Cover |
| 4.Snag ring | 8.Valve body | 12.Oil seal |

4.5 Transmission housing

Besides input shaft and output shaft are mounted, the transmission is used as an oil tank. There is an oil filter I (the filter net is 150 mesh) at the bottom of the transmission housing, which will suck the oil from the oil pump. Oil piping air filter II, oil filling cover and the oil level are mounted above the cover of transmission housing.

4.6 Oil pump

Oil pump is mounted between the torque converter and the input shaft. Through the impeller shaft, It is used to drive the gear pump which is made of a pair of inner meshing gears, and supply the torque converter and the hydraulic transmission with oil.

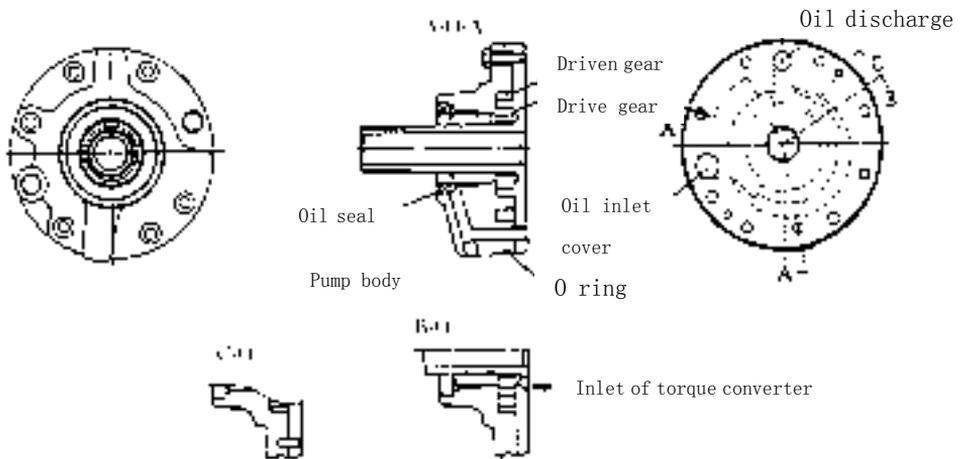


Fig. 4.5 Oil pump

4.7 Hydraulic oil pipeline

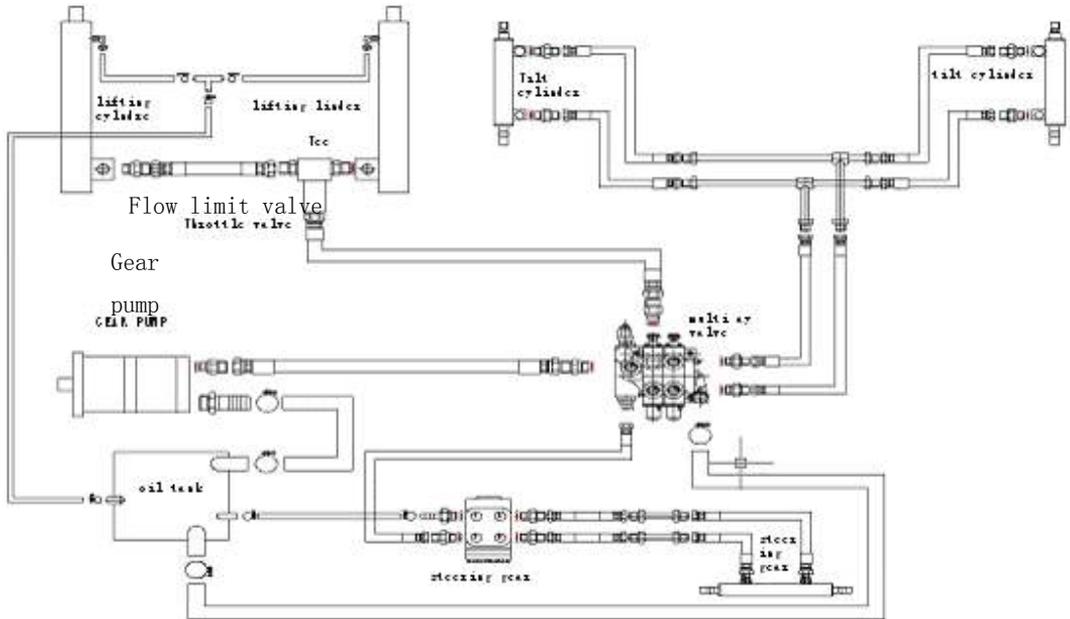


Fig. 4.6 Oil piping system of the transmission

After the engine startup, the oil pump sucks the oil from the oil filtering tank (transmission oil sump). Then the oil flows through the control valve. The oil is distributed to two parts: one part is offered for hydraulic and the other part for the torque converter. Oil for operating the hydraulic clutch flows into the set pressure valve (the pressure of valve is set to 1.1~1.4MPa) and comes into the rim wheel of the torque converter. Oil from the torque converter is cooled down by the oil cooler. Then oil can be used to lubricate the hydraulic torque converter. After that, the oil comes back to the oil tank again. When operate the machine at the neutral gear, oil passage from control sliding valve to clutch is close, at this time, the set pressure valve is open, oil is transferred to the torque converter through the overflow valve. When the control slide valve is at the forward or reverse position, the oil passage from the slide valve to the forward clutch is connected, which makes each clutch act separately: when a clutch is working, spacers are departed from friction plates in the other clutch. Use cooling oil to cool the clutch and take away the heat. When press down the inching pedal to control inching valve, part or most part of oil which flew into clutch is discharged to the oil tank through the inching valve stem. At this time, when the oil passage cycling pedal of the torque converter controls the inching valve, part or most part of the oil which flows into the clutch is discharged to the oil tank through the inching valve stem. Thus the oil passage cycle of the torque converter is the same as that of the neutral gear.

4.8 Towing the malfunction forklift truck

When the hydraulic forklift truck is damaged and necessary to be towed. Pay attention to that:

- 1) The axle shaft should be taken down from front wheel.
- 2) The Gear shifter should be at the neutral position.

4.9 Oil port adapter and oil pressure, oil temperature measurement

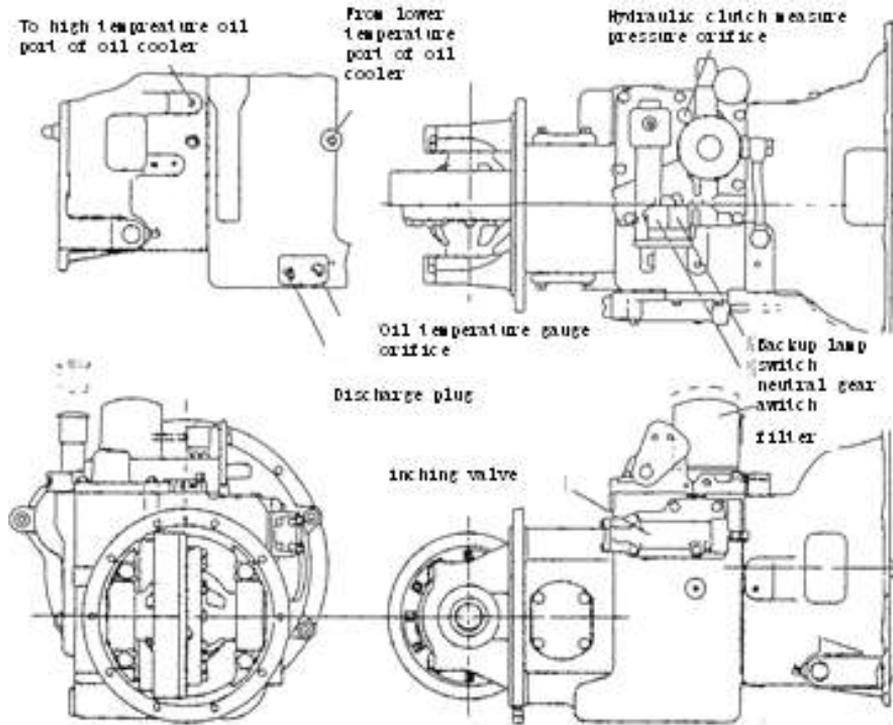


Fig. 4.7 Oil temperature and oil pressure measurement

5. Drive axle

Type	Drive axle body of the front wheel is fixed on the frame, full-floating type
Tonnage	3
Tyre size	28×9-15-14PR
Rim size	7.00T-15
Tire pressure	0.83MPa

5.1 General

Drive axle consists of the axle housing, the wheel hub, the axle shaft and the brake. The axle adopts integral casting structure. Tire through 0 torque. Oil seal is mounted inside the wheel hub to prevent water and dust from coming and avoid oil leakage.

See the figure figure 5.1 for the structure of the drive axle.

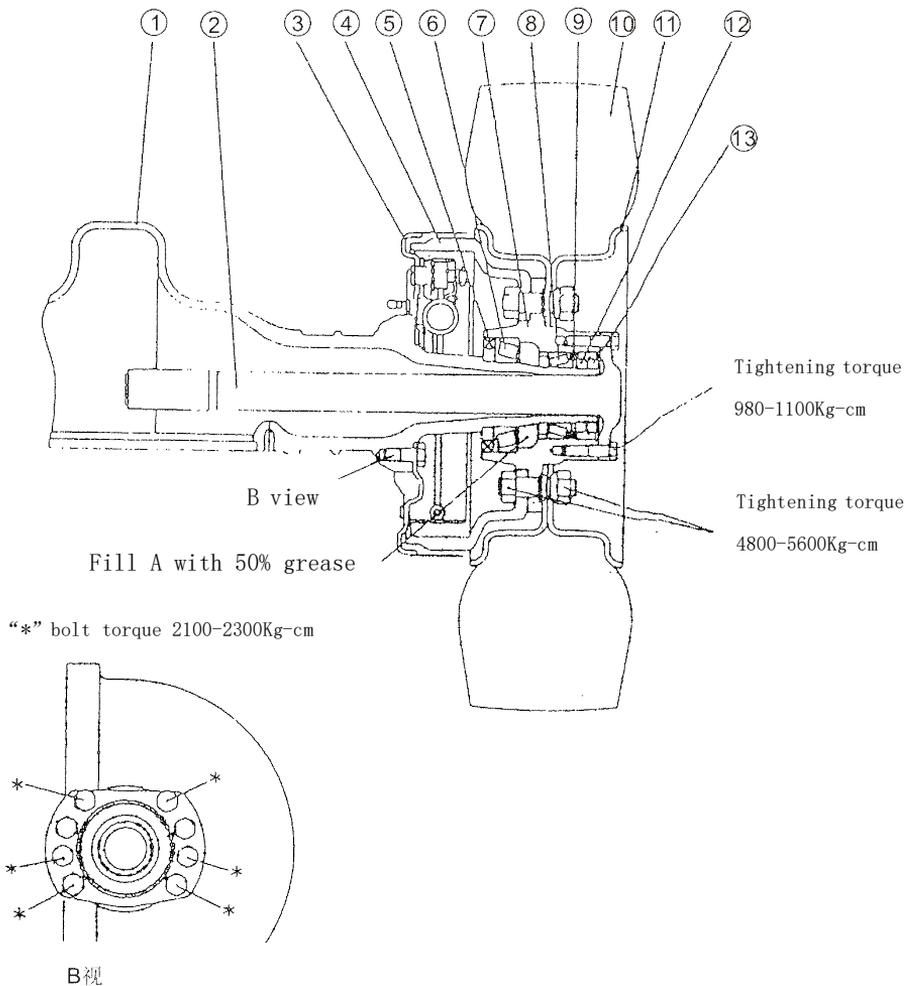


Fig. 5.1 Structure of drive axle

- | | | |
|-----------------|---------------------------|--------------------|
| 1. Axle housing | 6. Tapered roller bearing | 11. Rim |
| 2. Axle shaft | 7. Wheel hub | 12. Adjustment nut |
| 3. Hub brake | 8. Tapered roller bearing | 13. Locknut |
| 4. Brake drum | 9. Oil seal | |
| 5. Oil seal | 10. Tyre | |

5.2 Mounting procedure of wheel hub

- 1) Add 100cc grease into the wheel hub, then assemble the wheel hub on the axle. (figure 5.2)
- 2) Tighten the adjustment nut with the force about 1kg.m. Then turn around 1/2 circle.
- 3) Hang the spring on the bolt to measure the beginning moment of the wheel hub. After the beginning moment approaching to the specified value, lock the nut slowly.

The beginning moment is 5-15kg.m. (figure 5.3)

- 4) Mount the locking split and the locknut. Pull up the locking split to lock and stop .
- 5) Tire assembly (figure 5.4)

The coherent rod and the cap are mounted on the wheel. Assemble the rim. Pay attention to the following conditions:

- (a) Air valve stem is at the gap and faces outside.
- (b) The head of rim bolt should be mounted toward outside of the vehicle.

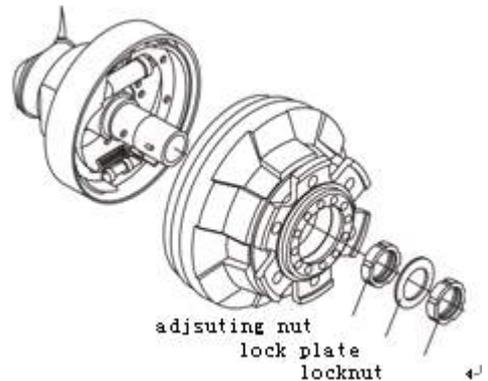


Fig.5.2 Filling lubricants

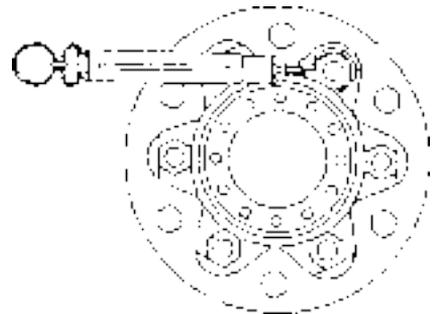
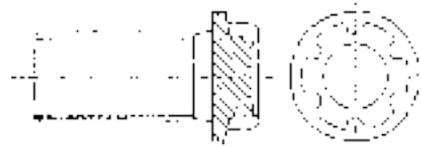
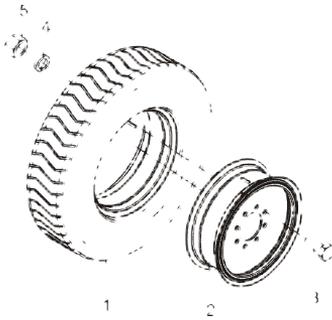


Fig. 5.3 Measuring the beginning moment



Structure of rim bolt

Fig. 5.4 Wheel assembly

1.Tyre

3.Rim bolt

5.Rim nut

2.Rim

4.Washer

6. Steering system

Tonnage of forklift		3T
Item		3T
Type		Rear wheel power steering
Type of steering gear		Cycloid full hydraulic steering gear
Mode of steering gear		BZZ1-E100BA-H
Max. pressure of inlet		16MPa
Max. continuous back-pressure		2.5MPa
Steering cylinder	Type	Double- action piston type hydraulic gauge
	Cylinder bore mm	$\phi 70$
	Diameter of piston mm	$\phi 50$
Radius of steering wheel mm		$\phi 320$
Tyre specification		6.5-10-10PR
Air pressure of the tire		0.79Mpa

6.1 General

The steering system is mainly made up of the steering wheel, the steering shaft and the steering gear. Steering shaft is connected to the steering gear through the universal joint. Connecting shaft is connected to the steering wheel through the universal joint. The steering column can be tilted forward and backward to the proper position. (figure 6.1)

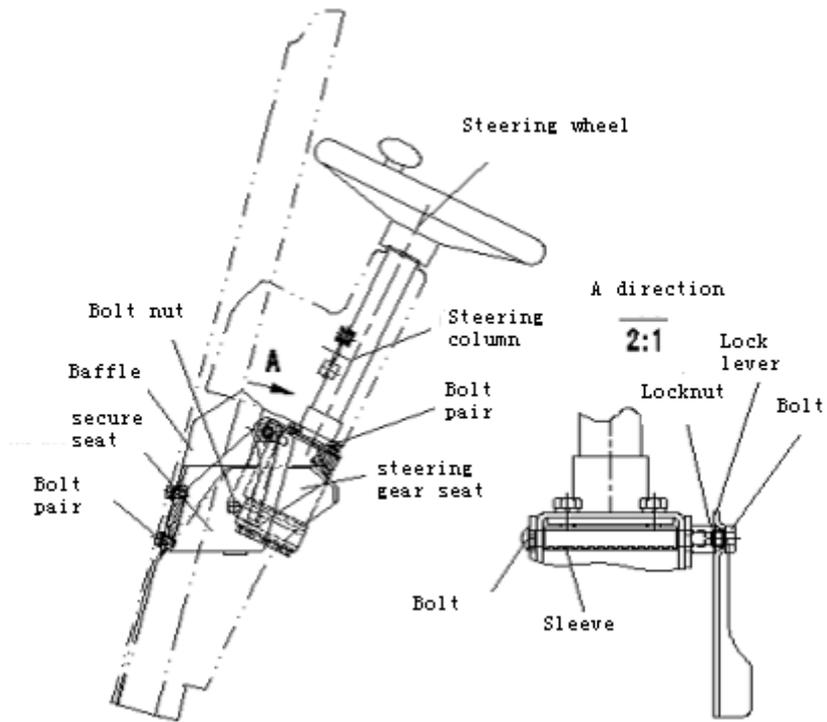
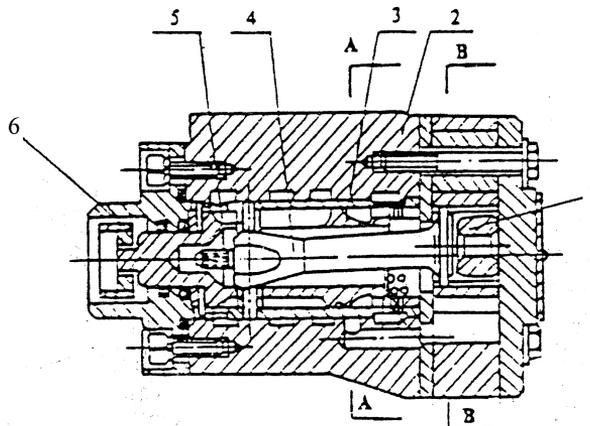


Fig.6.1 Steering control device

6.2 Cycloid full hydraulic steering gear

According to the rotational angle, the full hydraulic steering gear (figure 6.2) can transport the pressure oil from the diverter valve to steering cylinder through the oil pipe. When shuts down the engine, the oil pump can not suck oil, at this moment, carry out steering operation artificially.



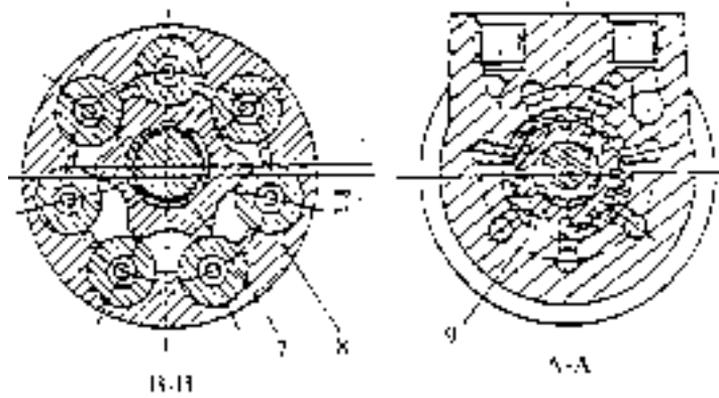


Figure 6.2 Cycloid full hydraulic steering gear

- | | | |
|--------------------|----------------------------|------------------|
| 1. Limiting column | 4. Universal driving shaft | 7. Rotor |
| 2. Valve body | 5. Spring plate | 8. Stator |
| 3. Valve core | 6. Connecting block | 9. Valve housing |

6.3 Check after reassembling the steering system

- 1) Turn the steering wheel left and right to the limit position. Check if the rotation is smooth.
- 2) Check if pipe lines are rightly laid and the left and right hose for steering are changed with each other.
- 3) Support the rear wheel, then turn steering wheel left and right slowly several times to get rid of the air in hydraulic pipelines and the steering cylinder.

6.4 Troubleshooting for steering system

Troubles	Causes	Solutions
Steering wheel can not be moved	Oil pump is damaged or out of work.	Replace
	Diverter valve is stopped or damaged	Clean or replace
	Hose or connector is damaged, or the pipeline is stopped.	Replace or clean
Steering wheel is heavy.	Pressure of the diverter valve is too low.	Adjust the pressure
	There is air in the oil passage.	Discharge the air
	Reset of steering gear fails, locating spring plate is broken or has not enough flexibility.	Replace the spring plate
	Steering cylinder leaks inside seriously.	Check the piston seal
Forklift makes snake motion or pendulum motion.	The steering flow is too large.	Adjust the flow of the diverter valve
	The spring is broken or has not enough elasticity.	replace
There is a large noise when the machine is working	Oil level in the oil tank is too low.	Add oil
	Suction pipe or oil filter is stopped.	Clean or replace
Oil leaks	Guide seal of the steering cylinder is damaged or the connection is damaged.	replace

6.5 Steering axle

Steering axle is adopted box horizontal section welded structure type. It is made up of the steering axle body, the steering oil cylinder, the linkage, the steering knuckle and the steering wheel. Steering trapezoid is adopted crank-slider mechanism. The pressure oil is driven by the cylinder piston rod through the linkage, which impels the universal joint to carry out steering operation. As the result, steering deflects and the steering operation is realized. The steering axle is connected to the rear tail of the frame through the damping seat.

6.5.1 Steering knuckle and the steering king pin

Steering knuckle is mounted between the upper end and lower end of the steering axle body through the steering king pin, the tapered bearing, the dust proof and the O ring. The upper end of the king pin is fixed on the axle body with stop pin. The lower end of the king pin is fixed on the axle body with nut cotter pin. Support is realized by the tapered bearing pressing on the axle body.

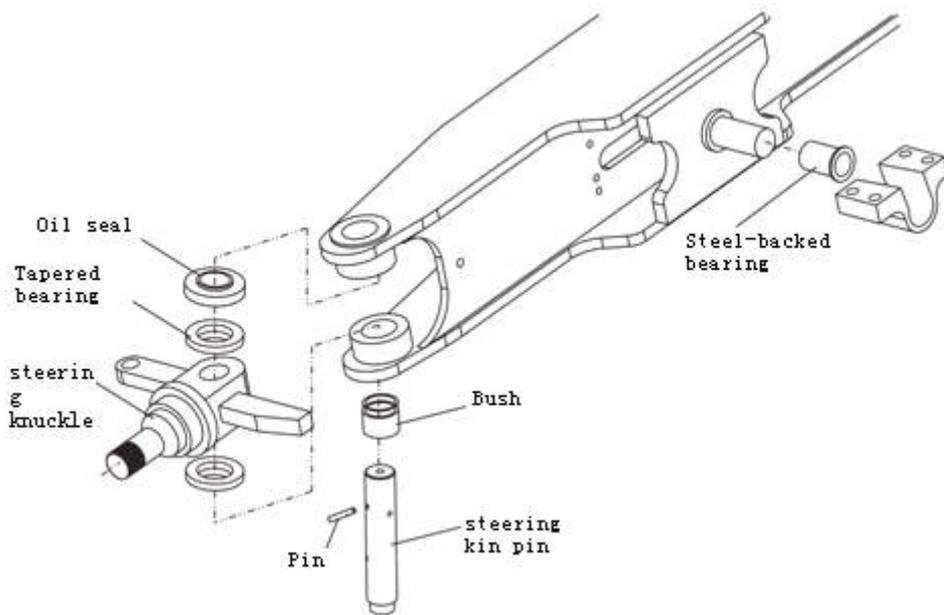


Fig. 6.4 Steering knuckle

6.5.2 Hub

Hub is mounted on the shaft of the steering knuckle with two tapered roller bearings. Wheels are pried up to hubs through the rim. There are oil seals on the internal lateral surface. Keep grease inside the hub and the universal joint chamber. Use nuts to adjust the tightness degree.

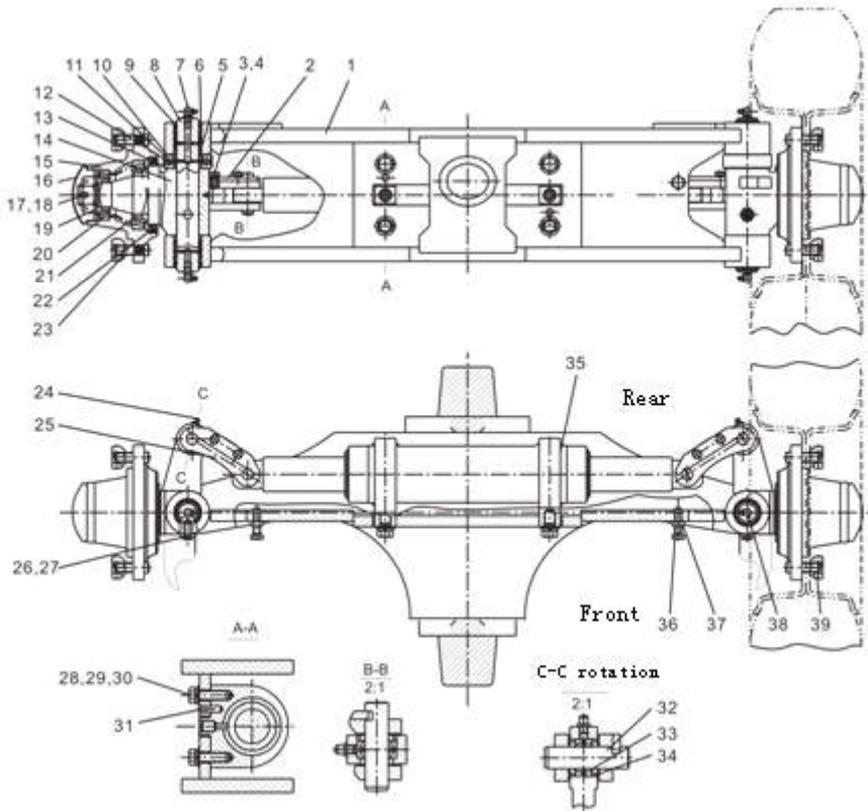


Fig. 6.3 Steering axle assembly

- | | | |
|-----------------------------------------|--------------------------------------------|-------------------------------------------|
| 1. Steering axle body | 14. Right steering knuckle welded assembly | 27. Nut M12 |
| 2. Steering knuckle arm pin clamp plate | 15. Steering axle hub | 28. Bolt M14×45 |
| 3. Bolt M8×16 | 16. Wheel axle cover | 29. Washer 4 |
| 4. Washer 8 | 17. Steering knuckle locknut | 30. Washer 14 |
| 5. O ring 31.5×5.3 | 18. Cotter pin 5×50 | 31. Internal thread round pin 10×30 |
| 6. Needle bearing 943/32 | 19. Steering knuckle washer | 32. Steering knuckle arm pin |
| 7. Oil cup M10×1 | 20. Rolling bearing 30207 | 33. Bearing snap ring |
| 8. Steering knuckle pin | 21. Rolling bearing 30211 | 34. Bearing GEEW16ES |
| 9. Steering knuckle dust seal | 22. Frame seal B85×110 | 35. Steering drive cylinder |
| 10. Bearing guard | 23. Steering axle hub bolt | 36. Bolt M12×1.5×50 |
| 11. Thrust ball bearing 51208 | 24. Oil cup M6 | 37. Nut M12×1.5 |
| 12. Bearing housing | 25. Steering pull rod | 38. Left steering knuckle welded assembly |
| 13. Steering knuckle adjusting gasket | 26. Socket head screw | 39. Steering axle hub nut |

6.5.3 Steering cylinder (figure 6.5)

The steering cylinder is adopted double- action, piston type cylinder. Piston seal parts adopt the combination seal grouped with the support ring and the O ring. There is a YX circle axle seal between the cylinder cover and the piston rod. The seal fixes the oil cylinder on the steering axle with the cylinder covers at both sides.

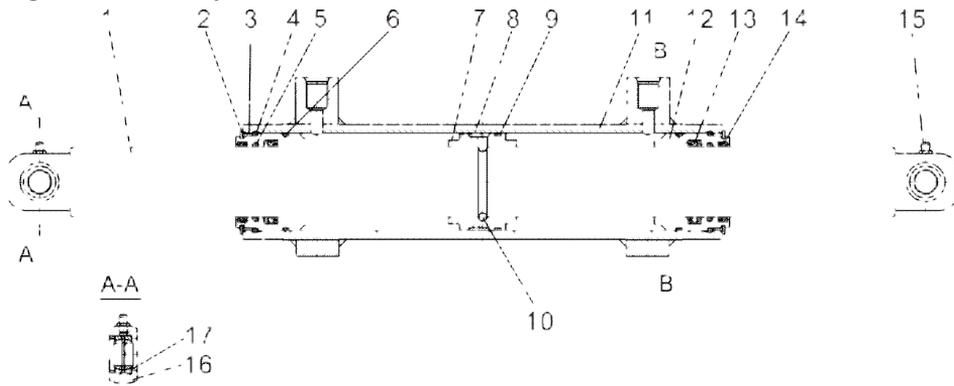


Fig. 6.5 Steering cylinder

- | | | |
|----------------------|----------------------------------|---------------------|
| 1.Piston rod | 7.Piston | 13.Combined seal |
| 2.Elastic sprag 65 | 8.Support ring | 14.Dust seal |
| 3.Ring | 9.Seal ring | 15.Oil cup M6 |
| 4.Steel wire sprag70 | 10.Steel ball 6 | 16.Bearing GEEW16ES |
| 5.O ring | 11.Cylinder body welded assembly | 17.Bearing sprag |
| 6.O ring | 12.Guide sleeve | |

6.5.4 Preload adjustment of steering wheel axle

(1) As figure 6.6 shown, add grease to the wheel hub, internal and external bearing and inner chamber of the hub cover. At the same time, lay some grease on lips mouth of the oil seal.

(2) Fix the outer circle of the bearing on the hub and mount the hub on the steering knuckle shaft.

(3) Install the plain washer and tighten castle nuts. The moment is $206\sim 235\text{N.m}$ ($21\sim 24\text{kgm}$).
Loose castle nuts and tighten the nut again. The moment is 9.8N.m (1kgm).

(1) Knock on the hub slightly with a wood hammer. Turn the hub 3-4 circle. Make sure the hub is not loose.

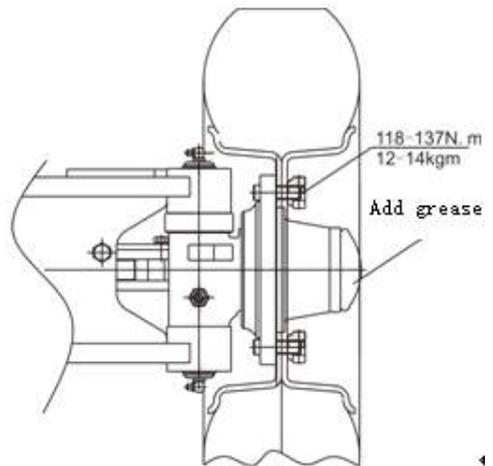
(2) Tighten castle nut and keep the slot aligning with the cotter pin hole on the steering knuckle.

(3) Knock on the hub slightly again with a wood hammer. Turn the hub 3-4 circle with both hands, make sure hub runs smoothly. Measure the rotative moment, the value is $2.94\sim 7.8\text{N.m}$

($0.3\sim 0.8\text{kgm}$).

(4) When the rotative moment is higher than the specified value, turn around $1/6$ circle and measure the rotative moment again.

(5) When reaches the specified rotative moment, lock the castle nut with the cotter pin.



7. Brake system

Type	Double front wheel brake, internal expanding, hydraulic type
Pedal lever ratio	5.66
Master pump bore	19.05mm
Wheel brake	3-3.5t
type	Double servo with parking brake
Wheel cylinder bore	28.58mm
Friction plate size (length ×width×thickness)	348×76×8mm
Area of friction plate	164cm ² ×4
Inner diameter of brake drum	314mm
Parking brake	Double front wheel brake, internal expanding type

7.1 General

The brake system adopts double front wheel brake type system. The brake system is made up of the brake pump, the brake and the brake pedal mechanism.

The brake pedal is mounted on the transmission through the bracket. Movement of the pedal drives the jib and impels the piston to move. Thus the pressure of oil passage will increase.

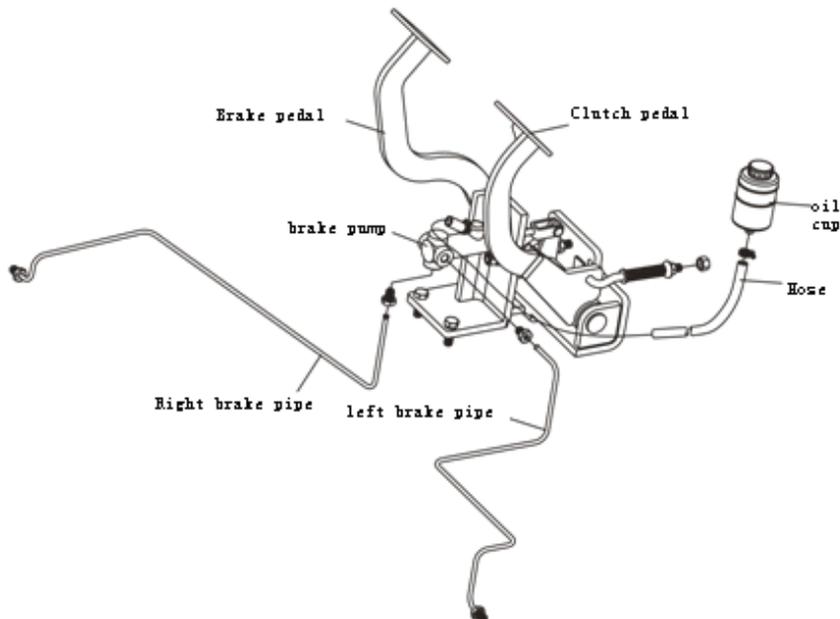


Fig. 7.1 Brake pedal (mechanical type)

7.1.1 Brake master pump

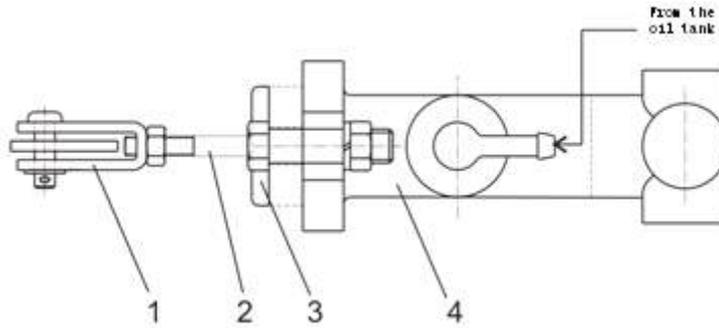


Fig. 7.2 Brake master pump

- | | |
|------------------|--------------|
| 1.Connecting rod | 3.Dust cover |
| 2.Push rod | 4.Piston |

The master pump consists of a valve seat, a check valve, a return spring, the leather cup, the piston and the auxiliary leather cup. The end part is fixed by the lock washer and the steel wire. The external part is protected by the rubber dust cover. The piston of master pump will move by means of the brake pedal through push rod. When step down the brake pedal, the push rod drives the piston forward. The brake fluid in the pump body flows back to the oil tank through the oil return port. The oil will not flow until the main leather cup blocks the oil return port. After the leather cup passing across the oil return port, the brake fluid in the front chamber of master pump is compressed and check valve is open. Therefore the brake fluid flows to the wheel cylinders through the brake pipeline. So piston of each wheel cylinder extends outside, which makes the brake shoe contact to the brake drum to realize the speed reduction and brake effect. At this moment, rear chamber of the piston is refilled with brake fluid from oil filling port and the inlet port. When release the brake pedal, the piston is pressed backward by the return spring. At the same time, brake fluid in the brake wheel cylinder will be compressed by the brake shoe of the return spring, which will make brake fluid flow back to the master pump (front chamber of piston) through the check valve of the oil return port, and the piston will return to the beginning position. The brake fluid in the master pump will flow to the oil tank through the oil return port. The pressure in the check valve will be adjusted in certain proportion to residual pressure in the brake pipe and the brake wheel cylinder, which assures correct the leather cup installation and avoid oil leakage. It will eliminate vapor lock phenomena, which may be caused by emergency brake.

7.1.2 Wheel brake

The wheel brake adopts internal expanding, hydraulic type brake. It is made up of the brake shoe, the spring, the wheel cylinder, the high speed regulator and the bottom plate. The two brakes are separately mounted at both ends of the front axle. One end of brake shoe is

connected to the supporting pin, the other end is connected to the clearance regulator. The brake shoe is pressed to the bottom plate by the spring and the spring pull rod. A hand brake pull rod is mounted on the main brake shoe. A adjustment pull rod for automatic clearance regulator is installed on the auxiliary brake shoe. See the figure 7.4, 7.5 and 7.6.

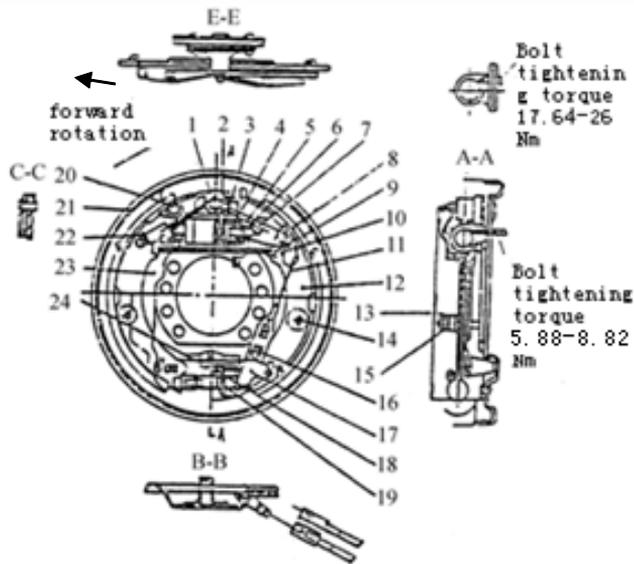


Fig. 7.6 Wheel brake (3t)

- | | | |
|----------------------------|--------------------------------|-----------------------------------|
| 1.Brake wheel cylinder | 9.Spring | 17.Pawl |
| 2.Spring | 10.Hand brake push rod | 18.Spring |
| 3.Leather cup | 11.Spring pull wire device | 19.Clearance adjustment regulator |
| 4.Piston | 12.Brake shoe | 20.Pin peg |
| 5.Wheel cylinder guard | 13.Compression spring | 21.Soleplate |
| 6.Piston rod | 14.Compression spring pull rod | 22.Brake shoe return spring |
| 7.Brake shoe return spring | 15.Compression spring | 23.Hand brake pull rod |
| 8.Friction plate | 16.Spring | 24.Brake cable assembly |

7.1.3 Brake operation

When the forklift travels forward, operate the brake wheel cylinder, then the main brake shoe and the auxiliary brake shoe will separately subject two forces with the same strength and on the contrary direction. The two forces allow the friction plate to contact with the brake drum. The friction force between the main brake shoe and the brake drum is applied to the regulator, therefore the clearance regulator will produce a larger force to drive auxiliary brake shoe than

that for wheel cylinder operation. The force impels the upper end of the auxiliary brake shoe to press supporting pin with a strong force. As a result, larger brake force will be obtained. Alternately, brake action should be operated in the contrary direction when the machine travels reversely, but the brake force should be equal to that of the forward travel.

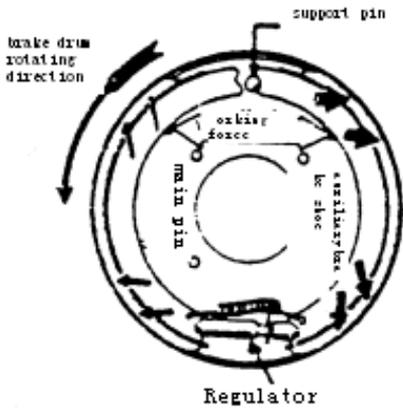


Fig. 7.7 Brake operation when machine travels forward

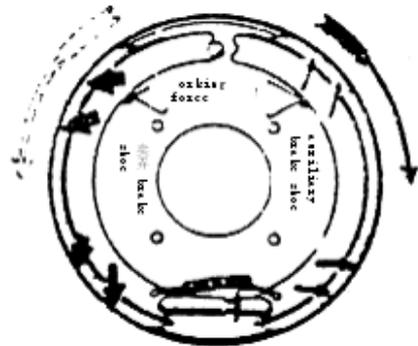


Fig. 7.8 Brake operation when machine travels backward

7.1.4 Parking brake

The parking brake is a mechanical, internal expanding type brake. It is arranged inside the wheel brake. The parking brake makes use of the brake shoe and the brake drum with the foot brake. When pull the parking brake handle, the valve handle will drive the hand brake rod through the brake cable. This pull rod will move the hand brake pull rod right by means of pins of rotating shaft action. Keep the brake shoe pressing to the brake drum.

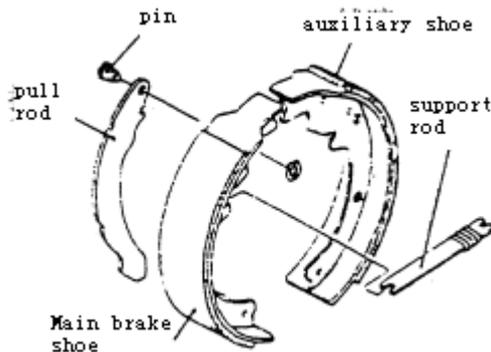


Fig. 7.9 Parking brake device

7.1.5 Clearance self adjusting mechanism

Clearance self adjusting mechanism can keep a proper distance between the friction and the brake drum. There were two different structures of self- adjusting mechanism as different types of vehicle.

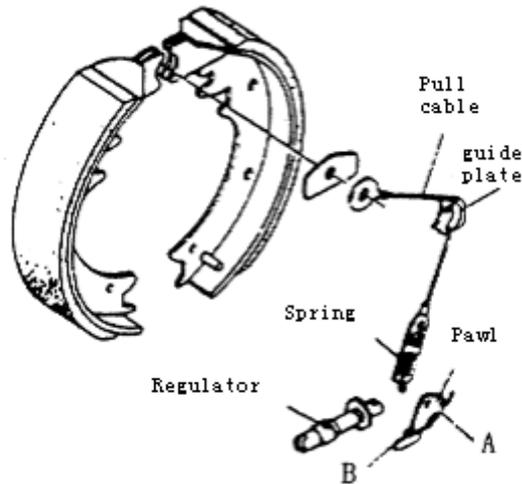


Fig. 7.10 3t forklift

b) Clearance self adjusting mechanism of forklift
 When perform brake operation during the forklift travels backward, the auxiliary brake shoe contacts to the brake drum and rotates with the brake drum. Therefore the pull rod rounds right with A point. As the movement of A point, the pawl at B point will move the regulator gear. After releasing the brake, the brake shoe returns to the beginning position. The pull rod rounds left with A point and B point declines. Therefore the clearance becomes larger, the regulator will be moved to another gear.

Adjusting range: within 0.25-0.4mm

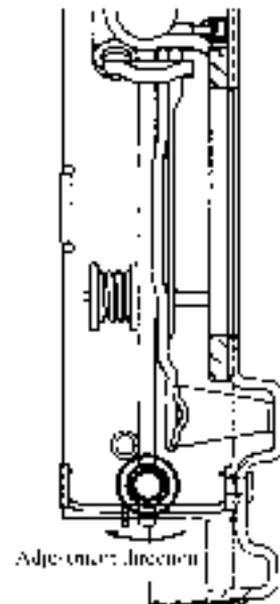


Fig.7.11 Clearance self-adjusting mechanism (3T)

7.1.6 Parking brake handle

Parking brake handle adopts cam type. The brake force can be adjusted by the regulator at the end of the brake hand.

Adjustment for the brake force:

Turn the regulator clockwise, the brake force will increase. Turn the regulator counterclockwise, the brake force will decrease.

Pull force: 20-30kg

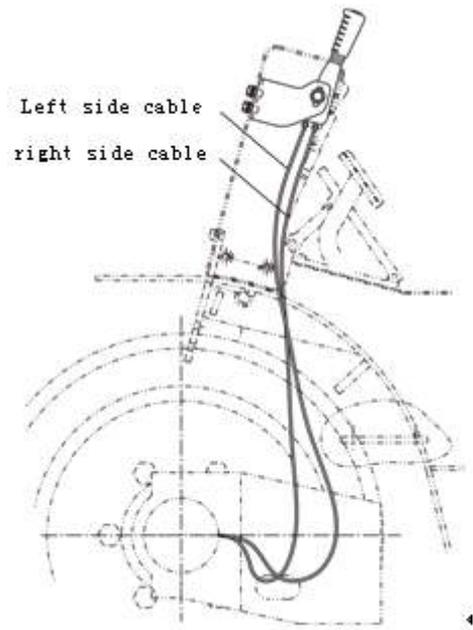


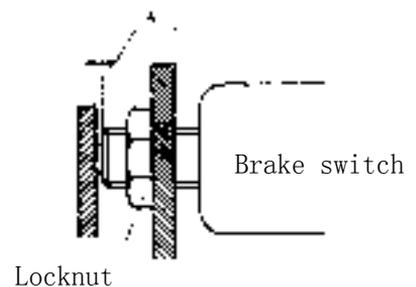
Fig. 7.12 parking the brake handle

7.1.7 Adjustment of the brake pedal

- (1) Shorten the push rod.
- (2) Regulate stop bolts. Adjust the pedal to the proper height.
- (3) Step down the brake pedal and extend the push rod until the front end begins to contact to the master pump.
- (4) Tighten the locknut of the push rod.

7.1.8 Adjustment for the brake switch

- a. After height adjustment of the brake pedal, loose locknut of brake switch;
- b. Disconnect the plug to keep the conducting wire separating.
- c. Turn switch until the clearance approaches $A=1\text{mm}$.
- d. Make sure that the brake lamp should be on when press down brake pedal.

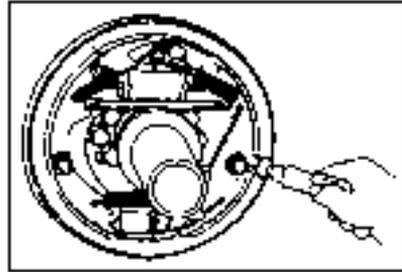


7.2 Maintenance

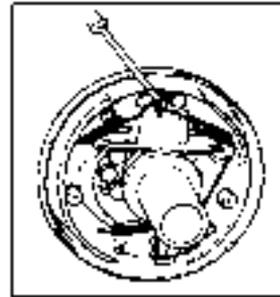
The section concludes disassembly, reassembly and adjustment for the brake and adjustment for the brake pedal. It is suitable for brakes of 1-1.5,3-4 tonnage of forklifts. Brakes for 2-2.5T forklifts are different, the maintenance methods are basically the same.

7.2.1 Disassembly of the wheel hub

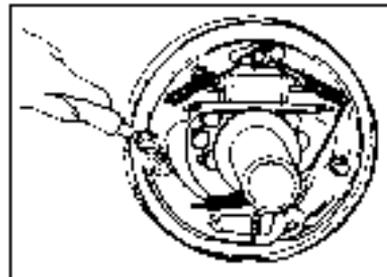
- 1) Take off the set pin of the auxiliary brake shoe, the adjustment rod, the regulator and the spring.



- 2) Take down the return spring of the brake shoe plate .



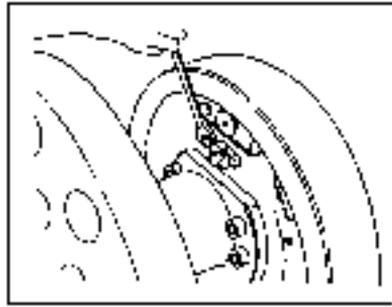
- 3) Take down the fixed spring of the main brake shoe plate



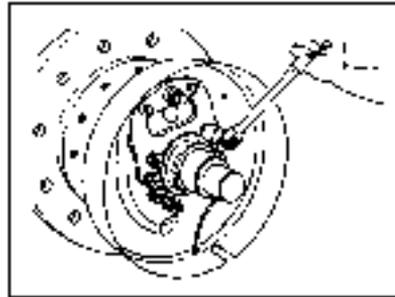
- 4) Take down the main brake shoe, the auxiliary brake shoe and the regulator spring.



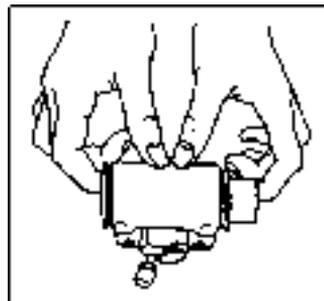
- 5) Take down the brake pipe from the wheel cylinder, then take off mounting bolts of the wheel pump to separate the wheel cylinder from the bottom plate.



- 6) Take off the E type sprag fixed by the brake cable, then take off the bottom plate mounting bolts. Take off the bottom plate from the axle.



- 7) Take off the dust cap of the wheel cylinder. Push out all parts inside the pump.



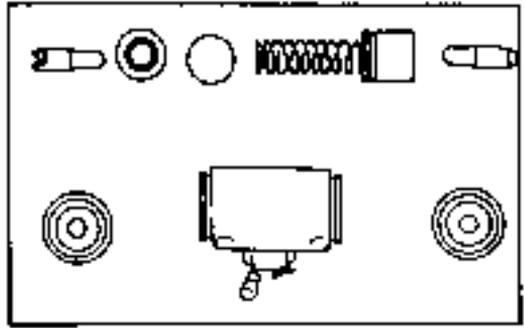
7.2.2 Inspecting the wheel brake

Check whether all parts are damaged or broken. Repair and replace the part if it is not qualified.

- 1) Inspect whether the surface of the wheel cylinder body and the piston cylinder is rusted. Measure the clearance between piston and the cylinder body.

Specified value: 0.03~0.10mm

Limit: 0.15mm

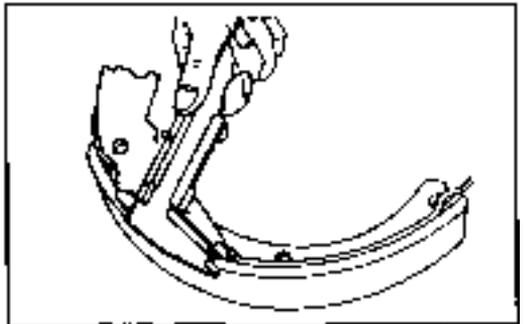


- 2) Observe whether the leather cup of the wheel cylinder is damaged or damaged, replace it.

- 3) Check the free length of the wheel cylinder spring. If it is not proper,replace it.

- 4) Check the thickness of the friction plate. If the part wears excessively, replace it.

Unit: mm

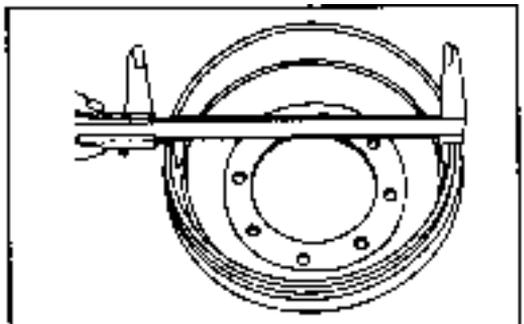


Standard size	8
Limit	6

- 5) Inspect the internal surface of the brake drum. If the surface is damaged or broken, repair and replace it.

Unit : mm

	3t
Standard size	314
limit	316



7.2.3 Reassembling wheel brake

1) Dip the leather cup of wheel cylinder and piston in the brake fluid, then assemble the spring, leather, piston and guard one by one.

2) Mount the wheel cylinder on the bottom plate.

Tightening torque:

$$3-4t: 17.6-26.5N.m$$

3) Mount the bottom plate on the front axle.

Tightening torque : 20.6—22.5N.m

4) Add the lubricating oil to every lubricating point.

- a. Supporting surface of the bottom plate
- b. Supporting pin
- c. Shoe plate and contact surface of the compression spring seat.
- d. Regulator thread and other rotative parts.

5) Mount the brake steel cable on the bottom plate with E type sprag.

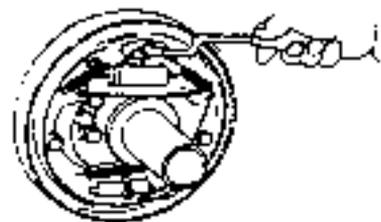
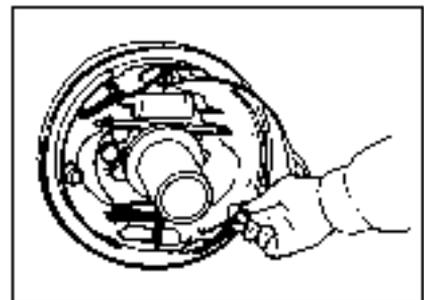
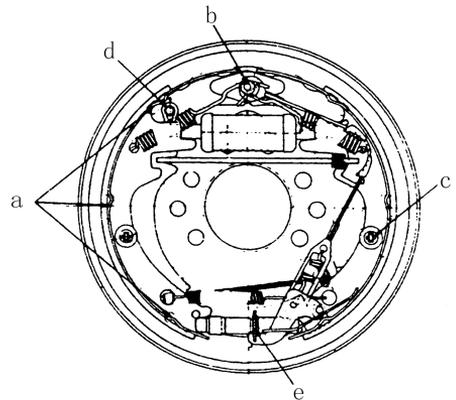
6) Mount the brake shoe with the fixed spring on the bottom plate.

7) Mount the compression spring on the hand brake push rod. Mount the push rod on the brake shoe.

8) Mount the brake shoe guide on the support pin. Then mount the return spring of the brake shoe. Mount the main shoe, then mount the auxiliary shoe again.

9) Install the regulator, the regulator spring, the lifting rod and the lifting rod return spring.

Pay attention to the following points:



a. Regulator thread direction and the mounting direction.

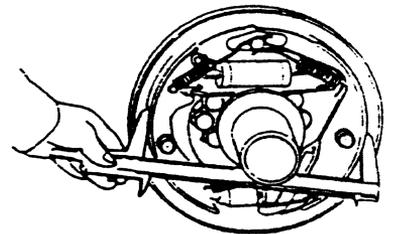
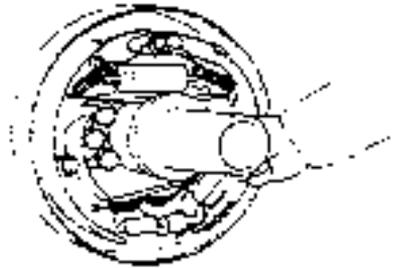
b. Regulator spring direction(do not allow the teeth of regulator to contact to spring)

c. Lifting rod return spring direction(spring hook at the supporting pins should be fixed on the opposite side of the lifting rod.

d. Lower end of the adjustment lever should contact to the regulator teeth.

10) Connect the brake oil pipe to the wheel cylinder.

11) Measure the inner diameter of the brake drum and the outer diameter of brake shoe. Adjust the regulator in order to keep a difference 1mm between inner diameter of the brake drum and outer diameter of the brake shoe friction plates.



7.2.4 Operating test of automatic clearance regulator

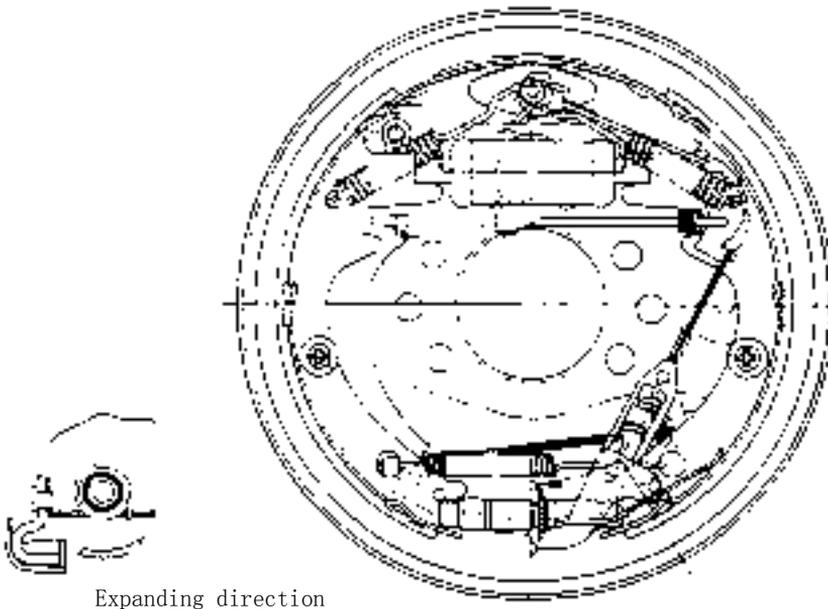
1) Above all, make sure that the diameter of the brake shoe should be close to the specified mounting size. Adjust the lever with hand to turn the regulator. when loose the hand, the adjustment lever will return to the beginning position. However, do not rotate the adjustment gear.

Note: Even if loose the hand, the regulator gear returns with adjustment lever. After installation, the regulator can work normally.

2) When pull the adjusting lever, the regulator can not do above action. It is necessary to perform the following inspection.

Fix the adjustment lever, the lifting rod and the lifting rod spring and the compression spring seat.

Check whether the return spring and the regulator spring of the lift rod are damaged. Inspect the turning condition of the regulator gear and whether the mesh part is worn excessively or broken. Inspect whether the lever contacts to the gear. Replace damaged parts.



7.2.5 Troubleshooting

Troubles	Causes	Solutions
Poor Brake force	1. Fluid leaks of brake system	Repair
	2.Improper clearance of friction plates	Adjust the regulator
	3.Overheating of brake	Check if sliding
	4.Poor contact of bake drum and friction plate	Adjust again
	5.Impurity adheres to the surface of the friction plate	Repair or Replace
	6. Impurity interfuses into the brake fluid	Check the brake fluid
	7. Improper adjustment of the brake pedal	Adjust
Noises in braking	1.Hardening of friction plate surface or impurity adheres to it	Repair or Replace
	2. Distortion of the bottom plate or loosening of bolts	Repair or Replace
	3. Distortion of shoe brake or impurity adheres to it	Repair or Replace
	4. Partial wear abrasion of friction plates	Replace
	5. Wheel bearing is loosing	Repair
Uneven braking	1. Oil dirty adheres to the surface of friction place	Repair or Replace
	2.Improper clearance of friction plates	Repair the regulator
	3.Malfunction of wheel cylinder	Repair or Replace
	4.return spring of the brake shoe is damaged	replace
	5. Eccentricity of brake drum	Repair or replace
Inability of brake pedal	1.Fluid leakage of the brake system	Repair or replace
	2.Improper clearance of friction plates	Adjust the regulator
	3.Air is mixed in brake system	Discharge air
	4.Improper adjustment of brake pedal	Adjust again

8. Lifting system

8.1 General

The lifting system adopts rolling type duplex telescopic mast. It is made up of the inner and outer mast, the lifting bracket and the fork.

8.2 Inner and outer masts

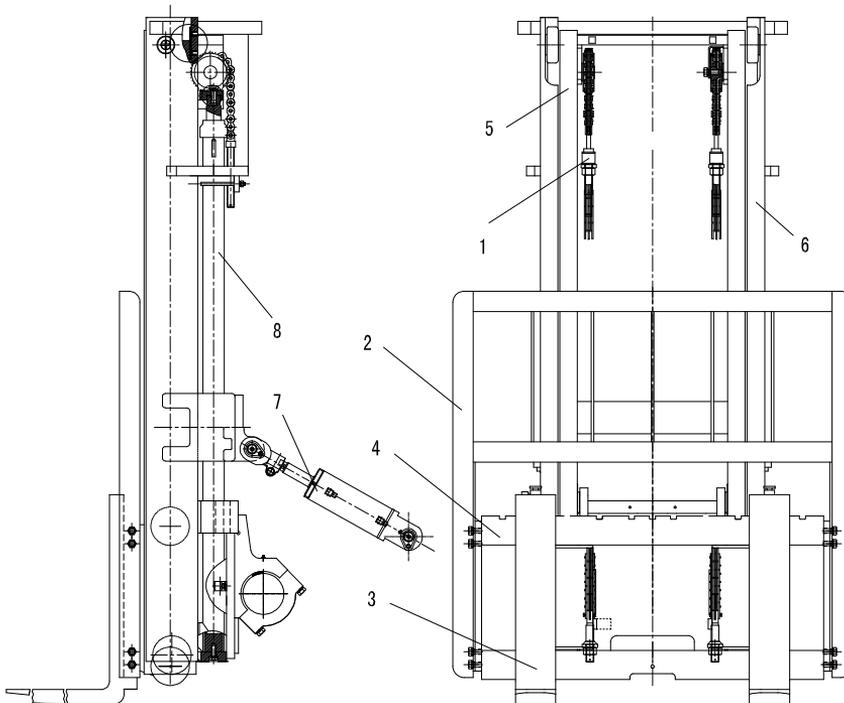


Fig. 8.1 Mast

- | | | | |
|-----------------|-------------------|------------------|-----------------|
| 1.Lifting chain | 3.Fork | 5.Inner mast | 7.Tilt cylinder |
| 2. Gear rack | 4.Lifting bracket | 6.Outer cylinder | 8.Lift cylinder |

Inner and outer mast are welded parts. The lower part of the outer mast is mounted on the drive axle with the support.

Middle part of the outer mast is connected to the frame through the tilt cylinder. Also, it can tilt forward or backward under the tilt cylinder action.

Channel steel of the outer mast is C type. The main roller and the side roller are mounted on the upper part.

Channel steel of the inner mast is J type. The main roller and the side roller are mounted on the lower part.

Maintenance for the main roller and the side roller on the inner and outer mast belongs to high

position maintenance. Please pay more attention when performing the maintenance operation.

8.3 Lifting bracket

The lifting bracket rolls inside the inner mast through the main roller. The compound roller is trapped on the roller shaft with the spring sprag. The roller is welded on the lifting bracket. When working, the lifting bracket rolls along the inner mast flange and can be adjusted by the adjusting gasket. Longitudinal load is bore by the main roller, radial load is bore by the side roller.

8.4 Roller location

Rollers are mounted on the inner mast, the outer mast and the lifting bracket separately. Compound bears load in the front and rear direction, which keeps the inner mast and lifting bracket moving freely.

Note: Do not modify the fork. Forbid welding on the surface of the fork.

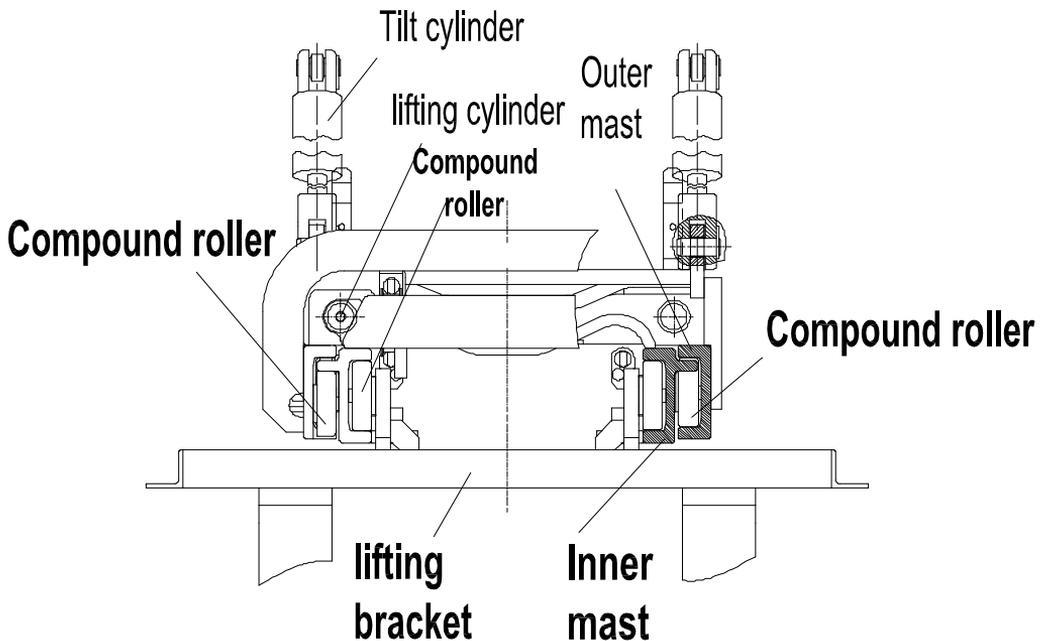


Fig. 8.2 Roller device

Note: (a) Clearance of the side rollers should be adjusted to 0.5mm.

(b) Fill some grease to the compound roller surface and the contact surface of the mast.

8.5 Repair

8.5.1 Adjustment of lifting cylinder (see the figure 8.3)

When replace the lifting cylinder, the inner mast and the outer mast, the lifting cylinder stroke should be adjusted again. The method is as follow:

- 1) Do not mount the adjusting shim on the head end of the piston. Mount the head end of the piston rod into the upper beam of the inner mast.
- 2) Slowly rise the mast up to the maximum stroke of the cylinder. Check whether two cylinders are synchronization.
- 3) Then stop moving, mount the adjusting shim between the head end of cylinder and the upper beam of the inner mast. There are two different thickness of shims: 0.2 mm and 0.5 mm.
- 4) Adjust the tension degree of the chain.

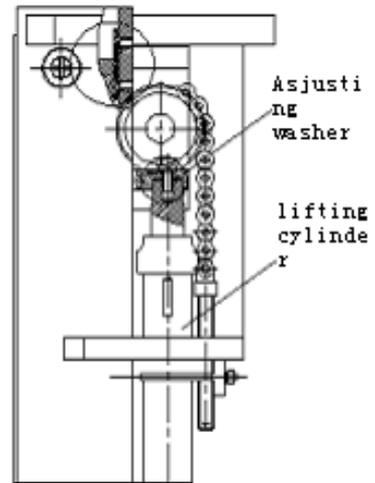


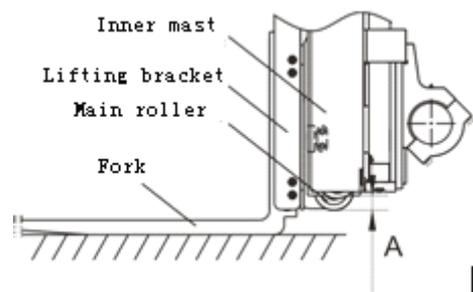
Fig. 8.3

Maintenance for the lifting cylinder belongs to high position maintenance. Be careful when maintaining.

8.5.2 Height adjustment for fork bracket

- (1) park the machine on the horizontal ground and keep the mast vertical.
- (2) Make the bottom surface of the fork contact to the ground. Adjust the adjustment nut of end connector on the upper part of the chain to keep a distance A between the main roller and the lifting bracket.

Type	A (mm)
3-3.5T	19-24



- (3) Lower the fork on the ground and tilt it back ward to the expected position. Adjust the end connector on the upper part of the chain. Adjust the nut to keep both chains with same tension degree.

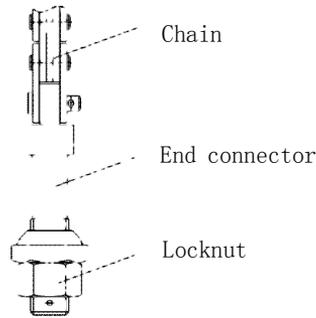


Fig. 8.4

8.5.3 Replacing the lift bracket roller

- (1) Place a tray on the fork and park machine on the level ground.
- (2) Lower the fork and the pallet on the ground.
- (3) Take off the end connector on the upper part of the chain. Take down the chain from the chain wheel.
- (4) Lift the inner mast (see the ① in figure 8.5)

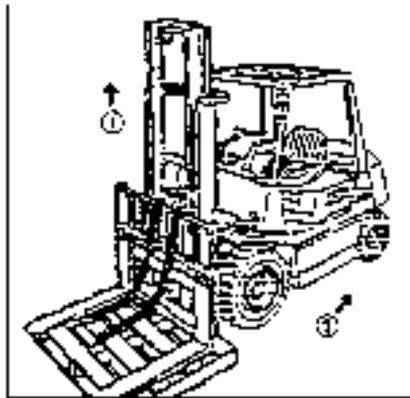


Fig. 8.5

- (5) make sure that the fork departs from the outer mast, then reverse the forklift.
- (6) Replace the main roller.
 - A. Take down all spring sprags. Take off the main roller with the drawing equipment. Make sure that the adjusting shim should be reserved.
 - B. Make sure the new roller is the same as the one replaced. Mount the new roller into the lifting bracket and trap them with spring sprags.

8.5.4 Replace the mast roller (see figure 8.6)

- 1) According to the same method for replacement of lifting bracket rollers in 8.5.3, take off the lifting bracket from the inner mast.
- 2) Drive the machine to the horizontal ground. Support the front wheel up to 250-300mm above the ground.

- 3) Pull up the hand brake and block the rear wheel with a wedge.
- 4) Take down fixed bolts between the lifting cylinder and the inner mast. Lift the inner mast. Do not lose the adjusting shim on the head end of the piston.
- 5) Take off the connecting bolt between the lifting cylinder and the bottom for the outer mast. Take down the lifting cylinder and oil pipe between two cylinders. Do not loose the oil pipe connection .
- 6) Put down the inner mast, take off the main roller at the bottom of the inner mast. Main roller on the upper part of the outer mast will expose from the top of inner mast.
- 7) Replace the main roller
 - A. Take off the main roller on the upper part. Do not lose the adjusting shim .
 - B. Mount new rollers and the adjusting shim taken off in the A step together.
- 8) Lift the inner mast until all rollers come into the mast.
- 9) Mount the lifting cylinder and the lifting bracket as the contrary steps of disassembling.

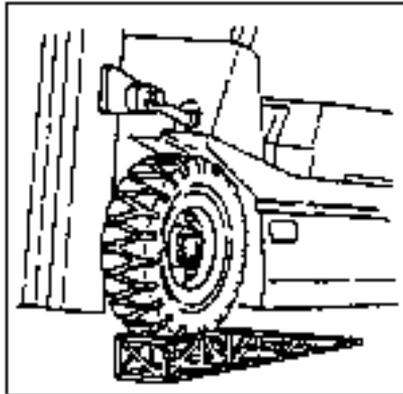


Fig. 8.6

9. Hydraulic system

Engine type		C490BPG-225
Main pump	Type	Gear pump
	Model	CBHZ-F32-ALH6L
	Displacement	32ml/r
Multi-way valve	Type	Double sliding valve type, with overflow valve, diverter valve and tilt self-lock valve.
	Nominal pressure rating	20MPa
	Allowable back pressure of T port	1.5MPa
	Set pressure of main system relief valve	17.5MPa
	Rated flow	65L/min
Lifting cylinder	Type	Single acting piston, with cut-off valve
	Cylinder bore	φ56
	Stroke	1495mm (lift to 3m height)
Tilt cylinder	Type	Double acting piston
	Cylinder bore	Φ80
	Maximum stroke	120mm

9.1 General

Hydraulic system mainly contains the main oil pump, the multi-way valve, the lifting cylinder, the tilt cylinder and the oil pipeline. The hydraulic oil tank is on the right side of the machine.

9.2 Main oil pump

Main pump is a gear pump. It is driven by the power output device of the engine. Oil in the tank flows to the multi-way valve through the main pump. The main pump is made up of the pump body, a pair of gears, the welt and the snap ring. In order to keep the clearance small, apply pressure balanced bearings and special lubricating method. Oil discharged between the welt and the pump body pressure makes the welt press to the lateral surface of gear, therefore pressure balancing type method results is applied.

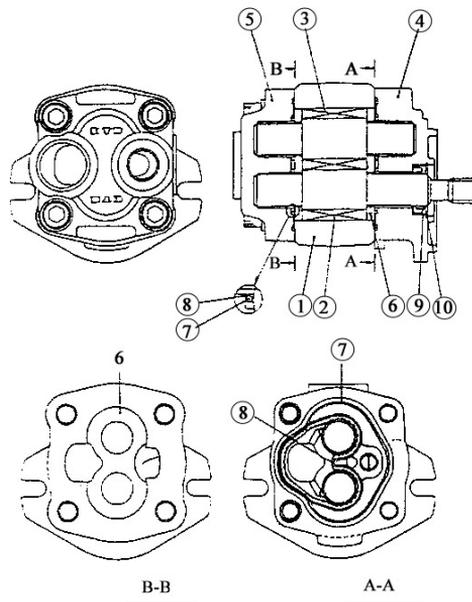


Fig. 9.1 Main pump

- | | | |
|-------------------|------------------|--------------|
| 1.Pump body | 5.Rear end cover | 9.Oil seal |
| 2.Drive gear | 6.Welt | 10.Snap ring |
| 3.Driven gear | 7.Seal ring | |
| 4.Front end cover | 8.Snap ring | |

9.3 Multi-way valve and diverter valve

Two-piece type multi-way valve is made up of four pieces of valve bodies, two slide valves, a relief overflow valve and a diverter valve. The four pieces valve bodies are grouped by three threaded studs and nuts. The tilt slide valve is equipped with 0 tilt self-lock valve.

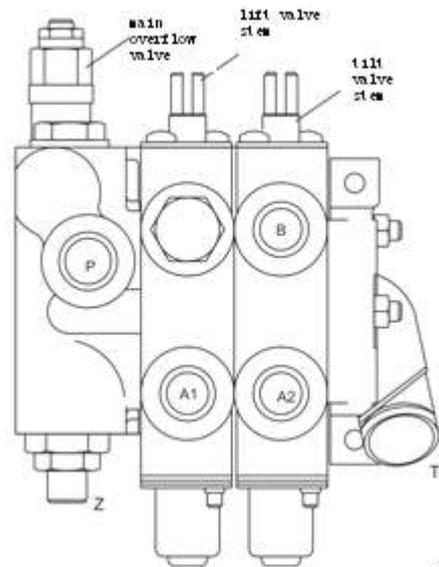
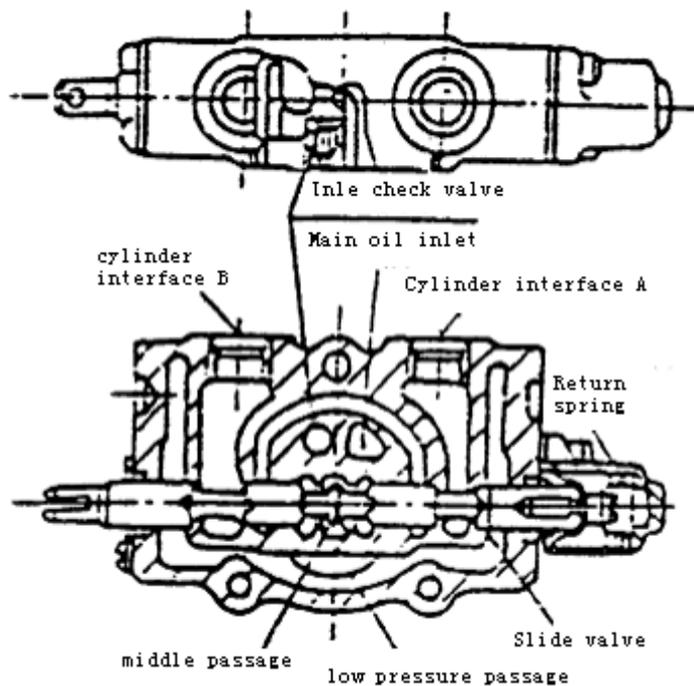


Fig 9.2 Multi-way valve

9.3.1 Operation of sliding valve (example for tilt slide valve)

1) Middle position

Pressure oil that is discharged from the oil pump goes through the middle passage and gets back to the oil tank.



2) Pushing slide valve in

At this moment, the middle passage is close, oil from the inlet port opens the check valve and flows into cylinder interface B. Oil discharged from the cylinder interface A returns to the oil tank through the low pressure passage. By means of the return spring, the slide valve will get back to the middle position.

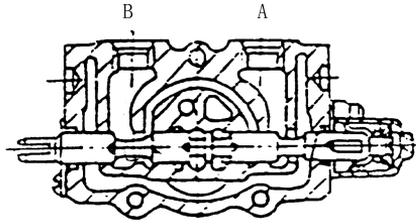


Fig. 9.4

3) Pulling slide valve out

At this moment, the middle passage is also close. Oil from the inlet port opens the check valve and flows into the cylinder interface A and oil discharged from the cylinder interface B returns to the oil tank through the low pressure passage. The slide valve can get back to the middle position by means of the return spring.

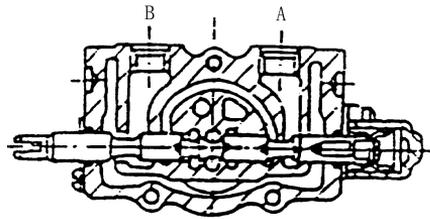


Fig. 9.5

9.3.2 See the figure 9.6 for structure of the main relief valve and the diverter relief valve

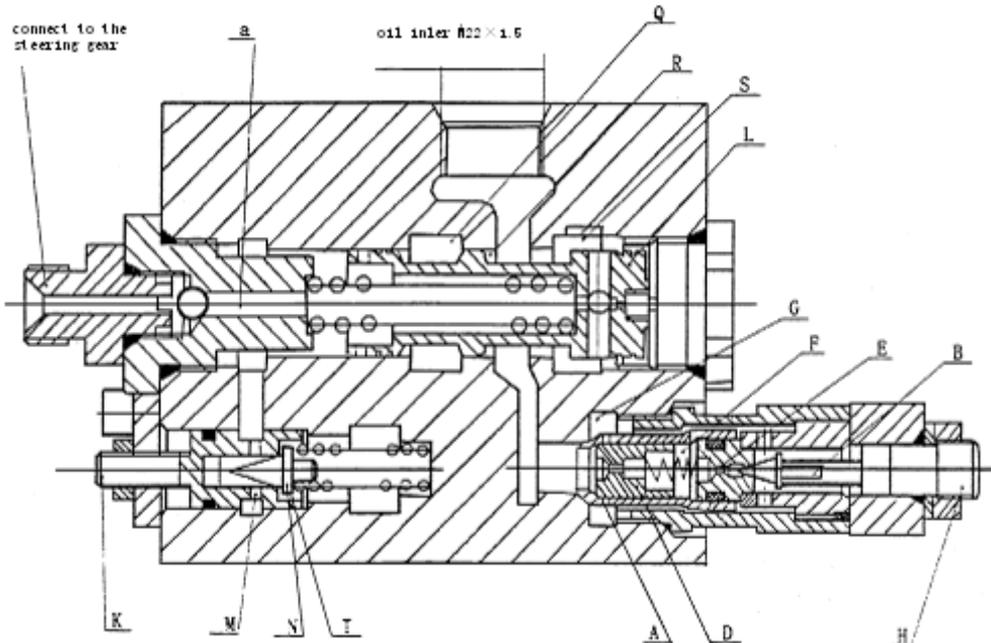


Fig. 9.6 Main relief valve and diverter relief valve

Main relief valve is made up of two parts: the independent valve A and the pilot valve B.

When changes the direction of the multi-way valve, pressure oil in working mechanism (such as the lifting cylinder, the tilt cylinder) will flow to Q chamber. The pressure oil flows to orifice D, E through fixed knot and acts on the pilot valve B. When the pressure in the system is higher than set pressure of system. The pilot B is open. As the result, the pressure of chamber F declines and the whole valve moves right. The pressure oil passes through the low pressure passage G and let the chamber Q load to ensure a stable system pressure. The adjusting screw H can be used to adjust the stable pressure value of the system.

Structure of the diverter valve is simple. It adopts direct action overflow. A stable pressure value from the steering system is obtained through the principle that fluid pressure can keep balance with spring force directly. When operates the steering wheel, the oil chamber M is connected with the pressure oil passage. When the system pressure is higher than the spring pressure, valve core N moves right, the pressure oil will flow to the low oil passage from T chamber. As the result, the M chamber unloads, which assure the pressure of the steering system is stable. The adjusting screw K can be used to adjust the stable pressure value of the system.

L valve is a balanced slide valve. The continuous change of the flow rate and pressure drive the slide valve L to move right and change the opening of R, S points. Also, the valve can make sure that the flow rate to working chamber Q is kept automatic balance with the flow from outlet PS to full-hydraulic steering gear and distributes the flow stably as proportion. A is a fixed orifice.

9.3.3 Pressure adjusting method of the relief valve

Do not adjust the pressure of the main relief valve at will. If it is necessary to perform an adjustment, follow the steps below.

- (a) Screw down the measure orifice plug at the multi-way inlet. Mount an oil pressure gauge which can measure up to 20MPa.
- (b) Operate the tilt handle. Measure the pressure when the cylinder is at the bottom of stroke.
- (c) When oil pressure is different from the specified value, release the locknut of overflow valve. Rotate the adjusting screw left and right to the specified value. Turn around left when the pressure is high. Turn around right when the pressure is low.
- (d) Tighten the nut after finishing adjustment

	3T
Adjusting pressure	17.5

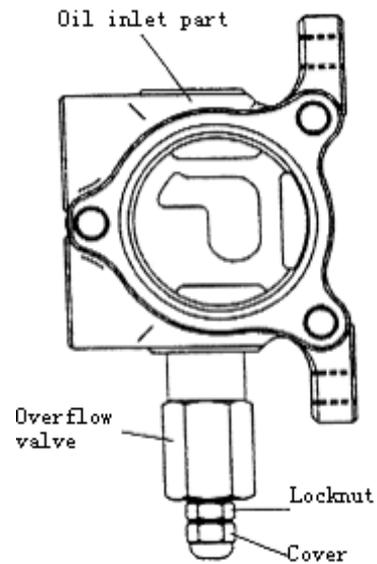


Fig. 9.7 Pressure adjusting method for the relief valve

9.3.4 Operation of the tilt self lock valve

Tilt slide valve is equipped with a self lock valve. It is used to avoid shocks which are caused by the internal negative pressure produced by tilting. At the same time, it prevents the serious result caused by the misoperation. In common traditional structure, although the engine stops running, it can still control the tilt slide valve to incline forward. Since the applying of the new type tilt lock valve, the mast won't incline forward even if push the tilt control lever roughly. Fig. 9.8 shows the construction of tilt lock valve.

"A,B" ports of valve body are separately connected to front and rear chamber of tilt piston. When pull out the slide valve, pressure oil comes into port "A". Oil in the rear chamber flows back to the oil tank (T) from "B". At this moment, the mast is tilting backward.

When push the slide valve, the pressure oil comes into port "B" and high pressure oil then drives the self lock valve in tilt slide valve to connect A port with low pressure. When engine shuts down or stops, there will no high pressure oil to operate the self lock valve and A port will not connect to the low pressure, so the mast will not incline forward and negative pressure will not come into being in the tilt cylinder.

9.4 Main oil pipeline in the hydraulic system

Pressure oil from the main pump flows to the multi-way valve. Oil is divided into two parts by the diverter valve inside multi-way valve. One part supplies oil for the lifting cylinder or the tilt cylinder, the other part flows to the steering gear in order to control the steering cylinder. When the lift and tilt slide valve are at the middle position, the pressure oil flows back to the oil tank through the oil passage directly. When pull the lift slide valve, pressure oil flows through the throttling valve. Then oil drives the piston rod upwards from the lower part of the lifting cylinder piston. When push the lift slide valve, the low pressure comes through the lower part of the lifting cylinder. Piston declines as the result of self weight and the goods weight. At this time, oil discharged from lifting cylinder passes through the throttle valve, so that the decline speed will be controlled. When operate the tilt slide valve, pressure oil will flow into the front chamber of the tilt cylinder. Low pressure will be connected to the other side, so that the mast can incline forward or backward. Figure 9.9

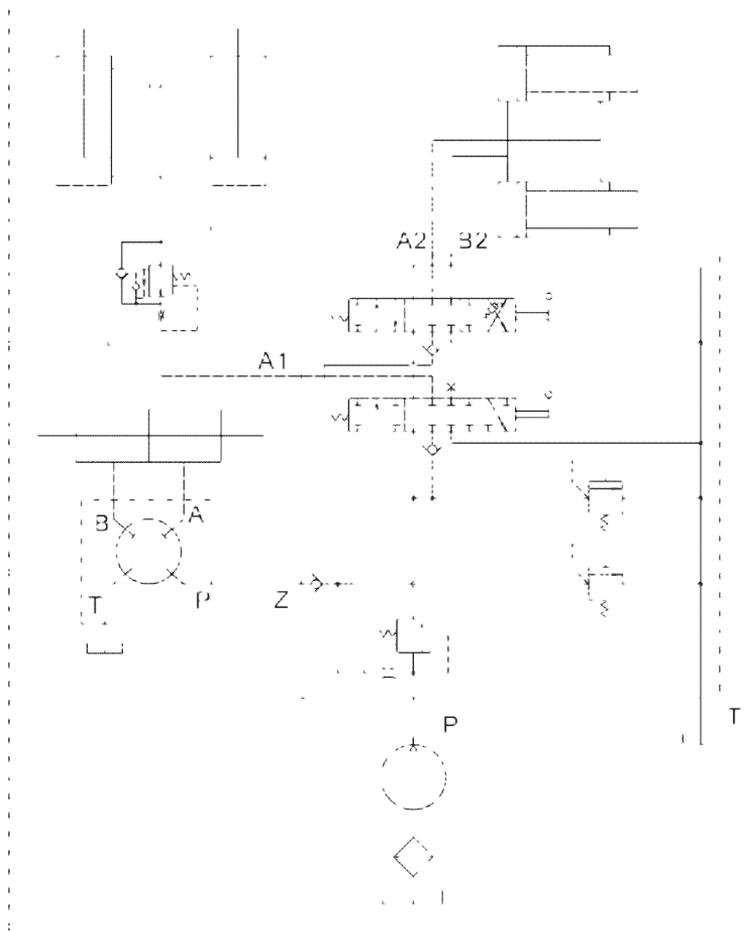


Figure 9.9 Oil pipeline of hydraulic system

The multi-way is controlled by the control rod, as shown in the following figure:

9.5 Operation of multi-way valve

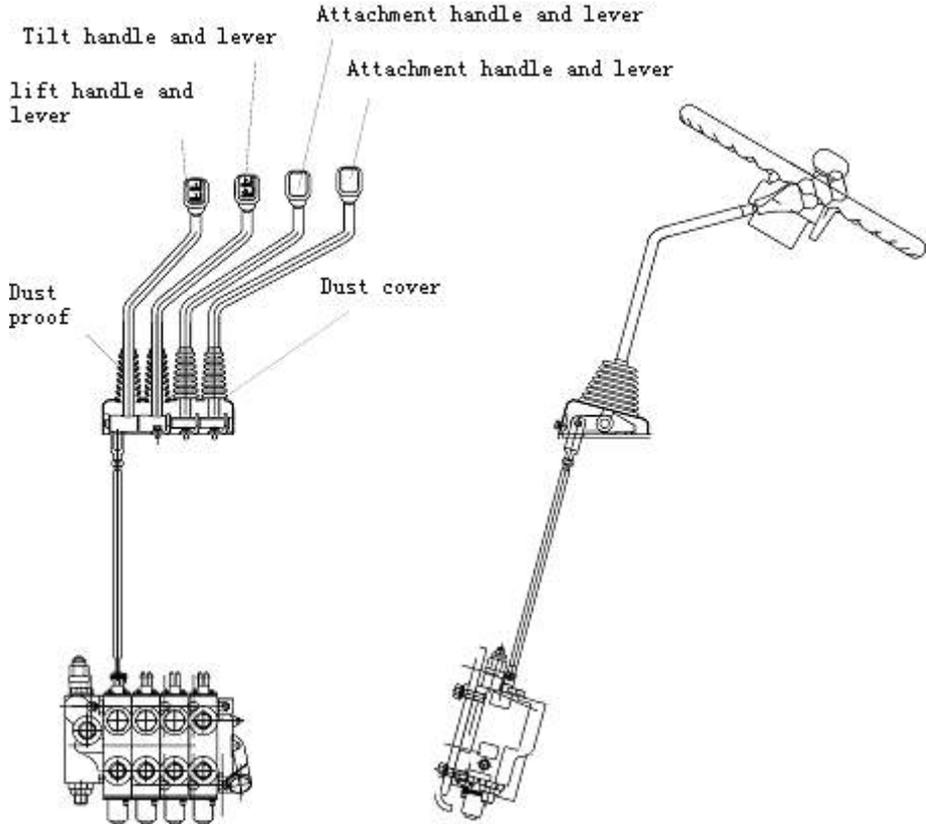


Fig. 9.10 Operation of multi-way valve

No.	symbols	Item
1		Lift
2		Tilt

As the arrowhead direction shown in the figure, push forward and pull backward the lift handle, the mast will rise and decline separately. Push forward and pull backward the tilt handle, the mast will incline forward and backward separately.

9.6 Lifting cylinder

Lift cylinder is adopted single action piston type. It is made up of the cylinder body, the piston rod and the piston and the cylinder head. The bottom of lift cylinder is fixed on the lift cylinder support seat of the outer mast with the pin and bolt. Top (top of the piston) of the cylinder is connected to the beam on the outer mast .

The piston is fixed on the piston rod by spring steel. Outer circle of piston is equipped with oil seal and pivot ring.

A cut- off valve is mounted at the bottom of the cylinder. If the mast rises, high pressure pipe may burst all of sudden. The valve plays a protective action.

bearings and oil seals are mounted on the cylinder head. they are used to support piston and avoid dust coming into the cylinder.

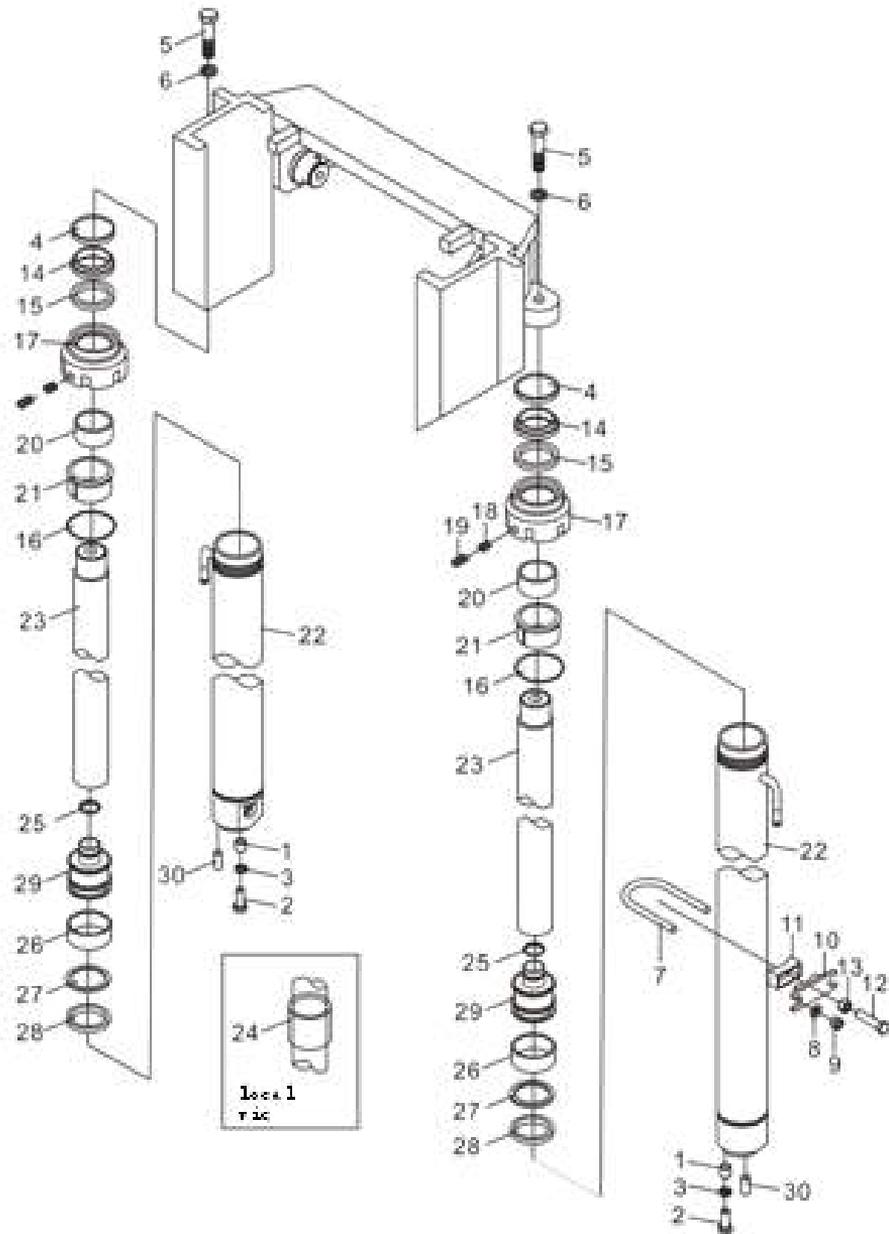
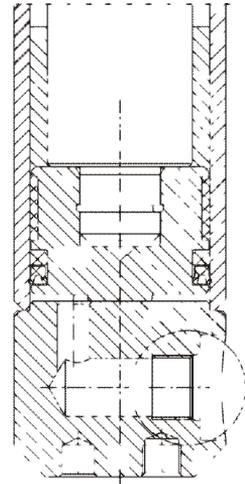


Fig. 9.11 Lifting cylinder

- | | | | |
|-------------------|----------------------|----------------------|--------------------------|
| 1. Shaft sleeve | 9. Locknut | 17. Cylinder cover | 25. Steel wire snap ring |
| 2. Bolt | 10. Hoop seat | 18. Plug | 26. Pivot ring |
| 3. Washer | 11. Rubber shim | 19. Screw | 27. Plate |
| 4. Adjusting shim | 12. Bolt | 20. Bearing | 28. U type seal ring |
| 5. Bolt | 13. Nut | 21. Bush | 29. Piston |
| 6. Washer | 14. Dust seal | 22. Cylinder | 30. Pin |
| 7. Hoop | 15. U type seal ring | 23. Piston rod | |
| 8. Washer | 16. O type seal ring | 24. Adjusting sleeve | |

There is a cut-off valve at the bottom of the lift cylinder. When the high pressure hose bursts all of sudden, the cut-off valve will prevent the goods from falling fast. Oil from the oil cylinder goes through the slide valve of the cut-off valve. Oil orifices around the slide valve will keep a pressure difference between the two chambers. When the pressure difference is smaller than the spring force, the slide valve will not work. if the high pressure hose is broken, which will produce a large pressure difference. The pressure difference will move the slide valve to block the orifices around it and allow a small amount of oil to flow through the orifice at the end of slide valve. As the result, the fork will decline slowly.



9.7 Speed limit valve

Speed limit valve (the throttle valve) is mounted in oil pipeline of the lifting cylinder, so that the valve limits the declining speed when the fork loads heavily. The structure of the speed limit valve is shown in the figure 7.7. When the slide valve is at the "lift " position and pressure oil from multi-way valve is not throttled, the pressure oil will flow into the lifting cylinder through the chamber A, B and orifices C, D, E, F and chamber G. When multi-way valve is at the "declining" position, oil from the lifting cylinder flows over the whole valve through the chamber G, orifices F, E, D, C and chamber A, B. At this time, a pressure difference will be produced between chamber A and B. The Ball valve (part 8) is open. When the pressure difference exceeds the spring force of the spring 2, the valve core 7 moves right, which makes the oil flow reduce as the orifices D, C become small, which can reduce the flow rate through the throttle orifice. Normal flow rate of the lifting cylinder:

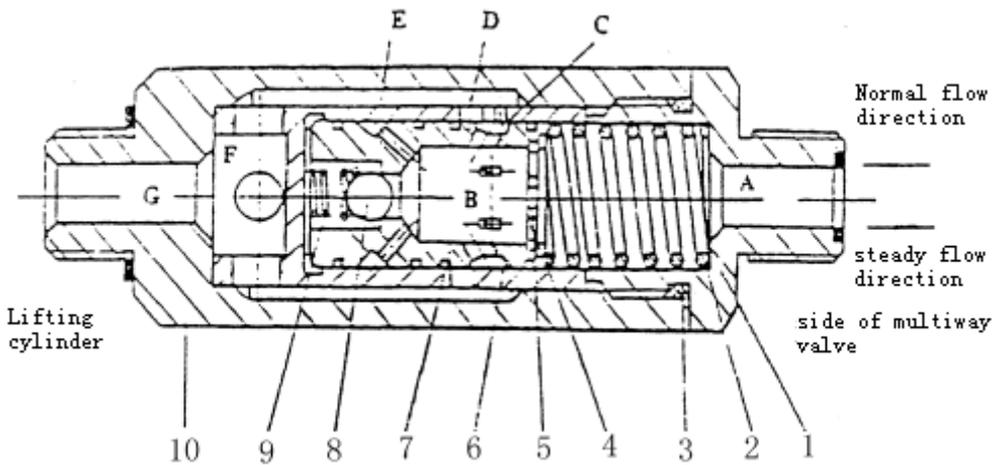


Fig. 9.13 Throttle valve

- | | | | |
|--------------------|------------------|--------------|---------------|
| 1.Connector | 4.Snap ring | 7.Valve core | 10.Valve body |
| 2.Spring | 5.Throttle plate | 8.Nylon ball | |
| 3.O type seal ring | 6.Valve sleeve | 9.Spring | |

9.8 Tilt cylinder

Tilt cylinder is a double acting type cylinder. It is mounted on both sides of the mast. Piston of tilt cylinder is connected with mast. The bottom of the tilt cylinder is connected to the frame with the pin.

Tilt cylinder assembly is mainly made up of the piston, the piston rod, the cylinder body, the guide and the Yx seal ring. The shaft sleeve is pressed and the Yx seal ring, the snap ring and the dust proof are mounted at the inner orifice of guide. The bearing supports the piston rod,

the seal ring, the snap ring and the dust seal to avoid the oil leakage and dust. Screw the bearing to cylinder body with O-ring.

When the push forward the tilt slide valve. Pressure oil will come into the cylinder from the bottom. Moreover the oil impels the piston forward and tilt the mast forward at 6°. When pull back the slide valve, the pressure oil will come into the oil cylinder from the front end of cylinder body. Push the piston backward until the mast tilts backward to 12°.

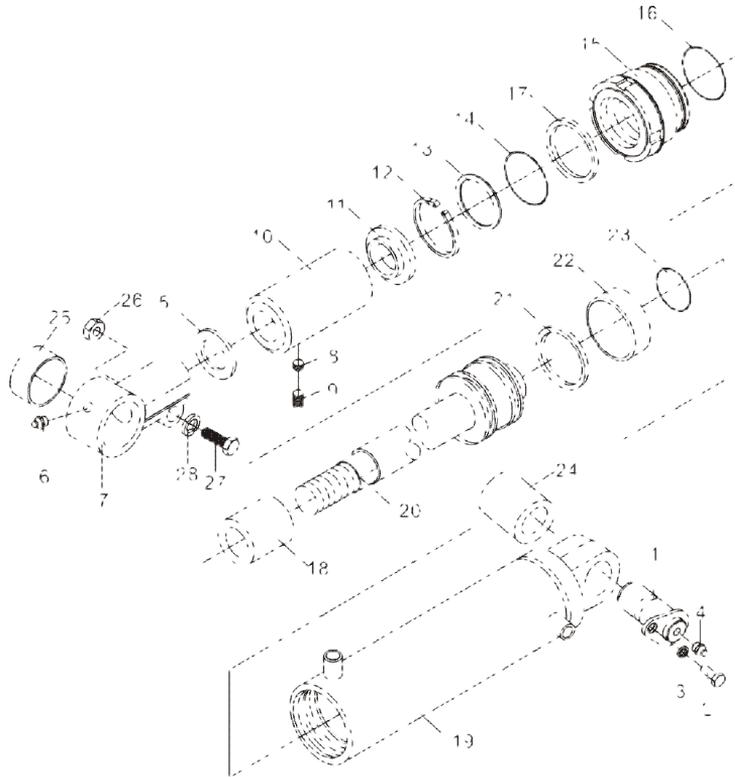


Fig. 9.14 Tilt cylinder

- | | | | |
|-------------------------------|---------------------------|----------------|------------------|
| 1.Rear shaft of tilt cylinder | 8.Plug | 15.Guide | 22.Support ring |
| 2.bolt | 9.Screw | 16.O seal ring | 23.O seal ring |
| 3.Washer | 10.Adjusting shaft sleeve | 17. Washer | 24.Bearing |
| 4.Oil cup | 11.Dust seal | 18.Bearing | 25.Joint bearing |
| 5.Adjusting shim | 12.Snap ring | 19.Cylinder | 26.Nut |
| 6.Straight grease nipple | 13.U seal ring | 20.Piston body | 27.Bolt |
| 7.Ring | 14.O seal ring | 21.U seal ring | 28.Washer |

9.9 Hydraulic oil tank

Hydraulic oil tank is a structural part of the frame. It is arranged on the right tank. There is a hydraulic filter core inside the oil tank to filtrate the abnormal materials. When replace the oil filter core, it is necessary to discharge 15L hydraulic oil. After 200 hours operation of the forklift, replace the hydraulic and the filter core. Lay sealant on both faces of the oil tank cover plate and mount the cover.



Fig. 9.15 Hydraulic oil tank

- | | | | |
|--------------------------------------------------|-----------------|----------------------|-------------------------|
| 1. Oil filter assembly | 4. Oil dipstick | 7. Breather assembly | 10. Oil filter assembly |
| 2. Cover plate welding of the hydraulic oil tank | 5. Bolt | 8. Plastic pipe | |
| 3. Seal gasket | 6. Washer | 9. Hoop | |

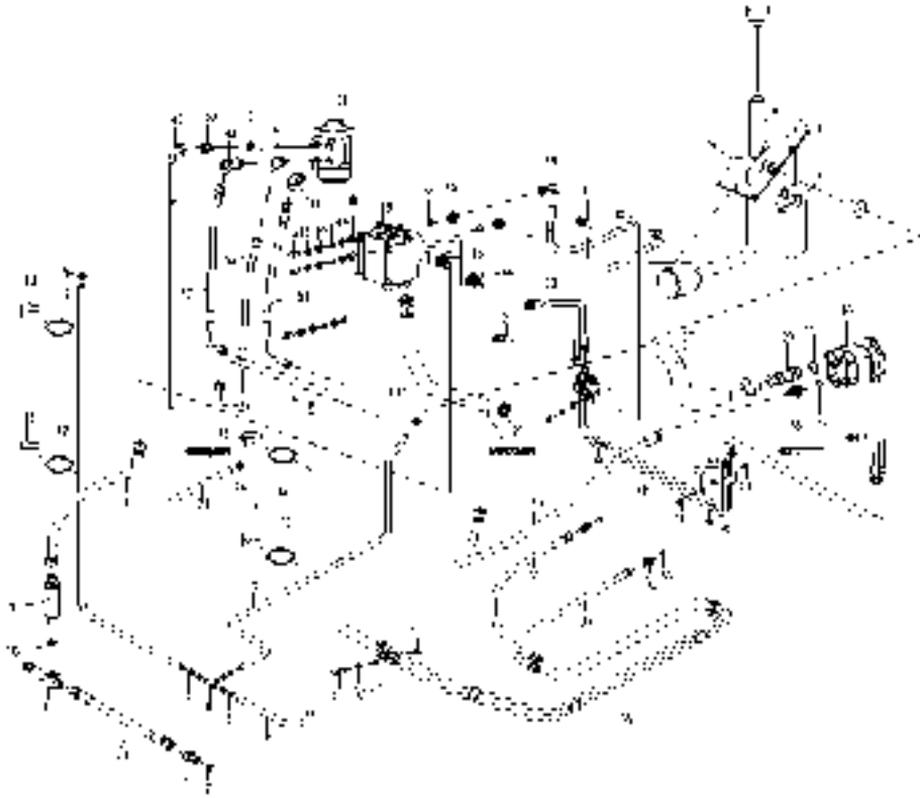


Fig. 9.16 Hydraulic pipeline

- | | | | |
|--------------------------------|----------------------------------------------------|--------------------------|-------------------------|
| 1. Transition connector | 16. Rubber pad | 31. Hose assembly | 46. Hose assembly |
| 2. O seal ring | 17. Sleeve | 32. Transition connector | 47. Hose assembly |
| 3. Hose assembly | 18. Multi-way valve | 33. O seal ring | 48. Steel pipe weldment |
| 4. Plastic pipe | 19. Molding pipe | 34. Hose assembly | 49. Buffer |
| 5. Ring hoop | 20. Hoop | 35. Steel pipe welding | 50. Bolt |
| 6. T- connector | 21. Hose assembly | 36. Transition connector | 51. Nut |
| 7. Plastic pipe | 22. Hose assembly | 37. Hose assembly | 52. Washer |
| 8. Hose assembly | 23. Oil return pipe | 38. Steering gear | 53. Washer |
| 9. Throttle valve | 24. Hoop | 39. Transition connector | 54. Hose assembly |
| 10. O seal ring | 25. Hose assembly | 40. Transition connector | 55. Hose assembly |
| 11. T-connector | 26. Cover plate assembly of the hydraulic oil tank | 41. Transition connector | 56. Hose assembly |
| 12. Binding tape | 27. Molding pipe | 42. Transition connector | 57. Bolt |
| 13. Oil return pipe cloth clip | 28. Transition connector | 43. Transition connector | |
| 14. Bolt | 29. O ring | 44. Transition connector | |
| 15. Washer | 30. Gear pump | 45. Transition connector | |

9.10 Maintenance of master oil pump

1) Disassembly

Before disassembly, clean the master oil pump drastically. Put parts removed on a piece of clean paper or cloth. Do not contaminate or damage the part.

- a. Clamp the flange part of the pump to the clamp bench.
- b. Take down the connecting bolt(11),the pump cover(5) and the pump tank(1).
- c. Take down the welt(6), the drive gear(2) and the driven gear (3).
- d. Take off the seal ring(7)and the snap ring(8).

Note: if the seal ring is not replaced, do not take down it from the front end.

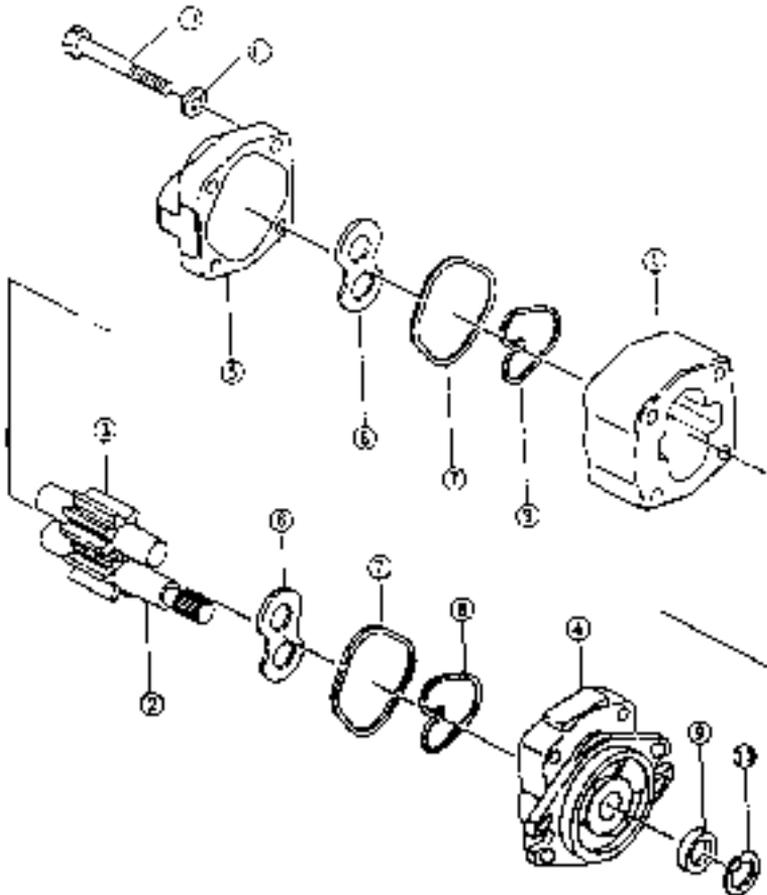


Fig. 9.17 Gear pump

- | | | | |
|----------------|--------------------|--------------|------------------|
| 1. Pump body | 4. Front end cover | 7. Seal ring | 10. Spring sprag |
| 2. Drive gear | 5. Rear end | 8. Snap ring | 11. Bolt |
| 3. Driven gear | 6. Welt | 9. Oil seal | 12. Washer |

2) Inspection

Check the part disassembled. Clean the part with the gasoline(except the rubber part).

a. Pump body inspection

If the contact length between the inner chamber of the pump body and the gear is longer than half of the perimeter, replace the pump body.

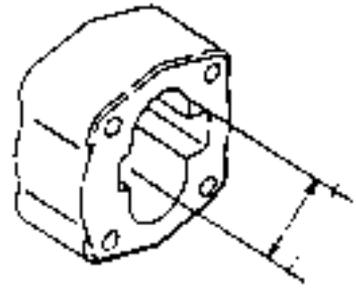


Fig. 9.18

Checking the pump body

b. Welt inspection

Inspect the contact surface of the welt. If the surface is damaged or the thickness of the welt is smaller than the specified value, please replace the welt.

The specified value of welt is 4.94mm.

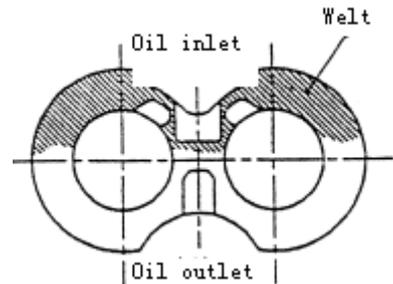


Fig. 9.19

Checking the welt

c. Front and rear pump covers

If the bush color of internal surface changes (brown) beyond the range of 150°, replace it.

d. Inspect the drive gear and the driven gear from the front and rear direction. If wear excessively, replace a pair. If the size D is smaller than the specified value, replace the team.

D=20.961mm.

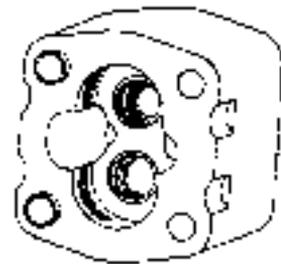


Fig. 9.20

Checking the front and rear pump covers

e According to requirements, replace the seal ring, the snap ring, the bush seal ring, the snap ring, the oil seal and the spring sprag.

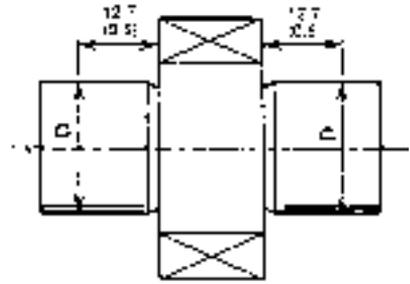


Fig. 9.21 Gear inspection

3) Assembly

a Mount a new seal ring and a new snap ring at the front end of pump.

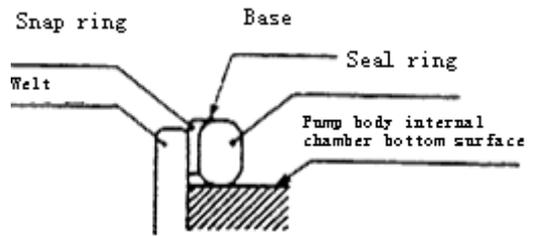


Fig. 9.22 Seal part of the welt

b Mount the welt on the slot of front end cover. Do not confuse the oil suction port with the discharge port.

c Mount the drive and driven gear on the front end cover.

d Mount the welt on the side of gear to align the slot with the gear point. Do not confuse the oil suction side with the discharge side.

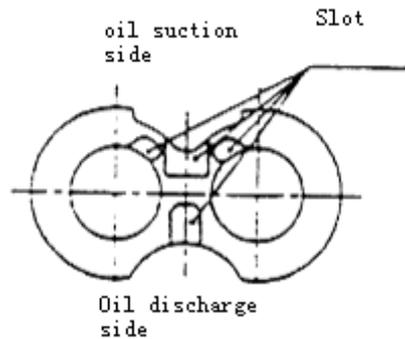


Fig. 9.23 The welt

e Mount a new seal ring and a new snap ring at the slot of the rear cover.

f Mount the rear cover on the pump body. Do not confuse the oil suction port with the discharge port.

g After mounting all parts well, tighten the connecting bolt to definite torque 9-10kg.M.

9.11 Test run

Test run makes oil pump run-in. Check whether the run is normal. You had better perform the oil pump test on the test bench. Also you should perform the test as follow steps on the forklift: Due to hydraulic oil,the oil pump can be stopped or damaged seriously. If the oil pump is disassembled and repaired for this reason, hydraulic oil and oil filter should be replaced before perform test run on the forklift.

- a. Install pump on the forklift. Mount pressure gauge on the pressure measurement point of the multi-way valve.
- b. Loose overflow valve to adjust screw, run the pump at 500-1000rpm for about 10 minutes. Make sure the oil pressure is lower than 10kg/cm^2 .
- c. Increase the speed of pump to 1500-2000rpm and run the pump for about 10 minutes.
- d. Keep the speed at 1500-2000rpm, increase the pressure at $20\text{-}30\text{kg/cm}^2$ a time, run for 5 minutes until the pressure is up to 175kg/cm^2 . keep every oil pipe working for 5 minutes, replace the oil return filter.

When increase the oil pressure, pay attention to check the oil temperature, surface temperature of pump and sound of run. Reduce the load to lower the oil temperature. Then continue to perform the test.

- e. After the test, assure the overflow pressure is 175kg/cm^2 , measure the flow rate. Oil capacity is measured through lift speed.

9.12 Instructions for troubleshooting

If there are some troubles in the hydraulic system, find the causes and perform necessary repair following the table below.

1) Multi-way valve

Troubles	causes	solution
Pressure of steering passage can not rise up. Can not reach the specified oil capacity.	Slide valve blocks	Clean and replace oil after disassembly.
	Sliding face is damaged	Replace the slide valve
	Spring is broken	Replace spring
	Oil orifice is stopped	Clean after disassembly
	Improper adjustment for overflow valve	Adjust the overflow valve
Pressure of lift oil pipeline can not rise up.	Slide valve blocks	Clean after disassembly
	Oil orifice is stopped	Clean after disassembly
Vibration pressure rise up slowly.	Slide valve blocks	Clean after disassembly
	Do not discharge sufficiently	Discharge sufficiently
Pressure of steering oil pipeline is larger than the specified value.	Slide valve blocks	Clean after disassembly
	Oil orifice is stopped	Clean after disassembly
Can not reach the specified oil capacity.	Improper adjustment for overflow valve .	Adjust
There is noise	Adjustment for overflow valve is improper.	Adjust
	Sliding face is worn out	Replace overflow valve
Leak oil (external)	O seal ring is aging and damaged.	Replace O seal ring
Set pressure is low	Spring is broken	Replace spring
	Valve seat face is broken	Adjust and replace the overflow valve
Leaks oil (internal)	Valve seat face is broken	Modify the valve seat face.
Set pressure is high.	Valve blocks.	Clean after disassembly

2) Master pump

Troubles	Causes	Solution
Oil discharge is less	Level of oil tank is low	Fill oil to the specified value
	Oil pipe or oil filter is stopped	Clean or replace according to needs
Pressure of pump is low	Weld is broken	replace
	Support is broken	
	Seal ring, bush seal parts or snap ring is poor.	
	Improper adjustment for overflow valve.	Adjust overflow valve to the specified value with pressure gauge.
	There is air in the system	
		Fill oil
		Replace the oil seal of oil pump
There is noise when running	Oil suction pipe is broken or oil filter is stopped.	Check the oil pipe or repair the oil filter
	Oil suction side is loose and leaks air	Tighten the loose point
	Oil viscosity is too high.	replace
	There are bubbles in the oil.	Find the causes of bubbles and take measures.
The pump leaks oil.	Seal ring of pump oil seal is damaged.	replace
	The pump is damaged	Replace

10 Electrical system

10.1 General

The electrical system is a one wire circuit with cathode ground strap connection. There are several systems in the electrical system:

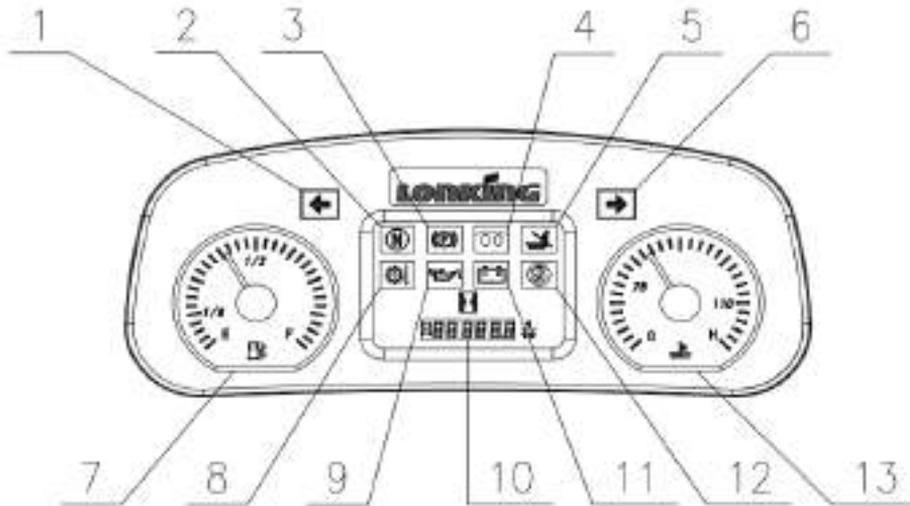
(1) Charging system

The charging system is made up of generator, voltage regulator, batteries and charging indicator and supplies the DC12V power for electrical equipments of the forklift.

(2) Starting system

The starting system contains automatic preheating system (only for diesel engine), starting switch, starting protective circuit (normally start when the machine is at the neutral speed) and starter. It is used to start the engine.

(3) Instrument system.



(1) left steering lamp (2) neutral indicating lamp (3)parking lamp (4)preheat lamp (5)seat lamp (6)right steering (7)oil capacity gauge (8) oil temperature lamp (9)oil pressure lamp (10) hour meter (11) charging indicating lamp

(12) oil and water separator/ail filter stopping lamp (13) water temperature gauge

Combined instrument is equipped with oil capacity indicator, water temperature indicator, timer. Also, the instrument displays a total ten functional and alarm indicating lamp: including charging indicating lamp, preheating indicating lamp, oil and water separator/ail filter stopping lamp and oil pressure gauge,etc. After switching on, the instrument begins to self -check, all alarm indicating lamps should be on. Self -check action is over after 500ms(at the same time, buzzer sounds) . Then related indicating lamp begins to work, the corresponding lamp on the panel will be on.

Functional indicating lamp: upper row of the light display area (No is 2, 3, 4, 5)is functional

indicating area. The corresponding lamp should be on when neutral gear , hand brake, preheat and seat switch are activated.

(note: neutral indicating lamp is selected. It is controlled by function selected switch. When press the switch, the indicating lamp is effect.

Alarm indicating lamp:

Measurement range: 60~75~110~120°C. Therein 110~120°C scale area is red area. When the water temperature is higher than 110°C , the buzzer should sound and conform to the water sensor 75°C/200Ω、 110°C/75Ω.

Oil capacity gauge:

Measurement range: 0~1/8~1/2~1. Therein 0~1/8(corresponding resistance is 22±3Ω)scale area is red area. When the fuel level is lower than 1/16(corresponding resistance is 15±3Ω), the buzzer should sound and conform to the measurement requirements of full oil level 180±5 (Ω) , middle oil level 95±5 (Ω) and empty oil level 10±3 (Ω).

(4) Lighting signal equipments

Lighting signal equipments contain lighting, signal lamp, horn and buzzer,etc. Related specification is as follow:

Front headlamp: 12V 35W

Front combination lamp(steering/width): 12V 21W/5W

Rear combination lamp (steering/width/back-up): 12V 21W/5W/10W

10.2 Operation information and condition state

1) Start-up

Before starting up the machine, please put the reversing and gear shifter at the neutral position, or the engine will not be started. As safety protective function is designed for the forklift inside the control box.(assembling the transmission will influence this function).

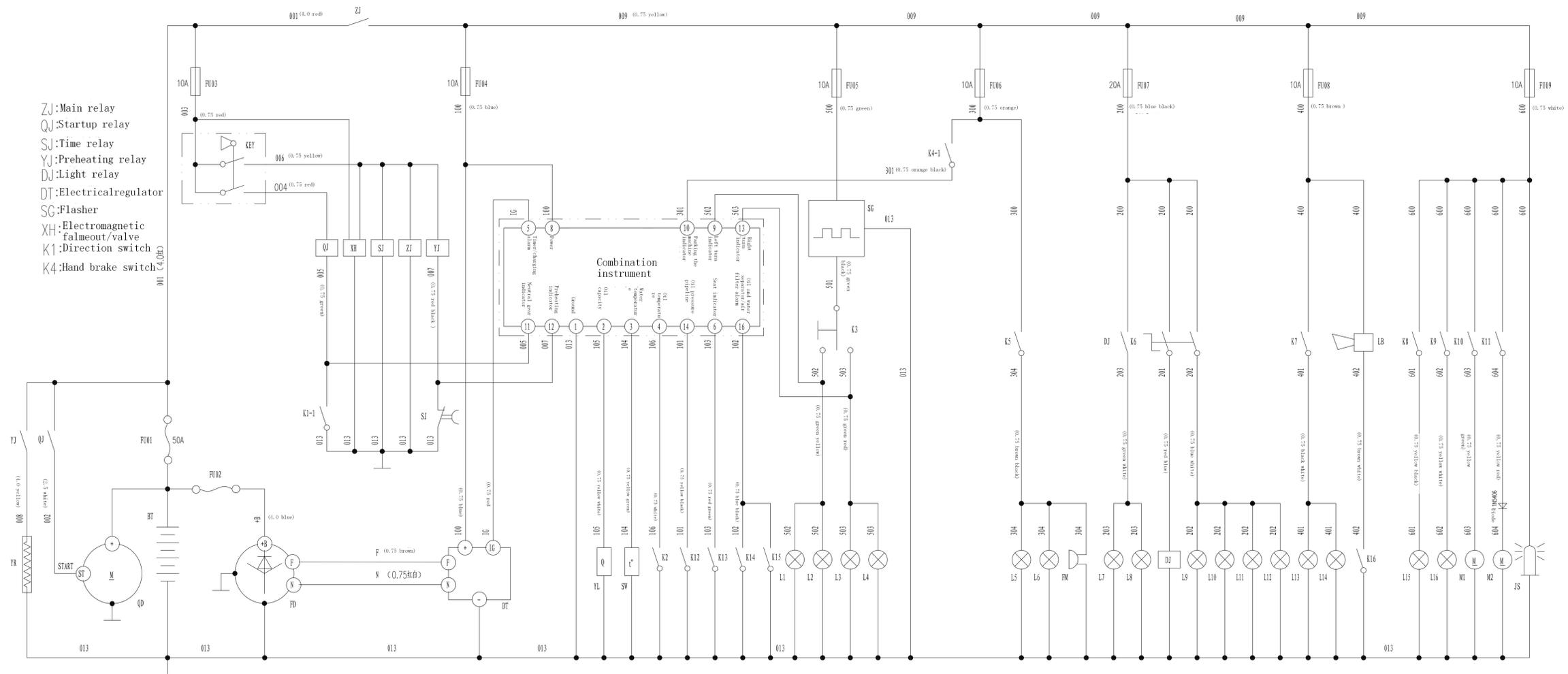
Turn the starting switch clockwise to the first gear- switching on gear, instrument and igniting source switch on. For the diesel engine, preheater will get current and start to work. At the same time, preheating lamp will be on. The preheating time is controlled by the time relay and delayed to 13±3s to finish. Then rotate the starting switch clockwise to the second gear-starting gear, Which will start the engine. After starting the engine, drive the forklift as the correct operation method.

2) Steering signal: when pull backward the steering switch, right front combination lamp and right rear combination lamp of the forklift will flash. When push forward the steering lamp, left front combination lamp and left rear combination lamp of the forklift will flash.

3) Brake signal: when the forklift should be braked, step the brake pedal with foot, and the rear combination lamp brake lamp(red) will be turned on.

- 4) Back- up signal: when the forklift should travel backward, pull backward the commutating column. At this time, transmission is at the reversing gear. Rear combination lamp reversing lamp(white) will flash and the back-up buzzer will sound.
- 5) Charging signal: before starting the engine, when starting switch turns on the switching on gear, charging lamp will be on. After engine start-up, the lamp will be off. When the engine is working, oil pressure lamp is on. At this time, faults may exist in the charging circuit. The battery can not be charged. Park the machine and perform inspection.
- 6) Engine oil pressure signal: before starting the engine, when starting switch turns on, oil pressure indicating lamp will be on. After engine start-up, the lamp will be off. When the engine is working, oil pressure lamp is on. At this time, oil pressure of the engine may be too low, stop the machine and perform inspection.
- 7) Fuel gauge: it is used to indicate the storage of fuel. When the fuel gauge indicator points to red area, the alarm buzzer will sounds. It means that fuel capacity in the oil tank is too low, remind you to fill the oil tank with oil.
- 8) Water temperature gauge: it indicates the temperature of the engine coolant.
- 9) Hour meter: accumulates the working time of the engine.

10.3 Attached figure (electrical schematic diagram)



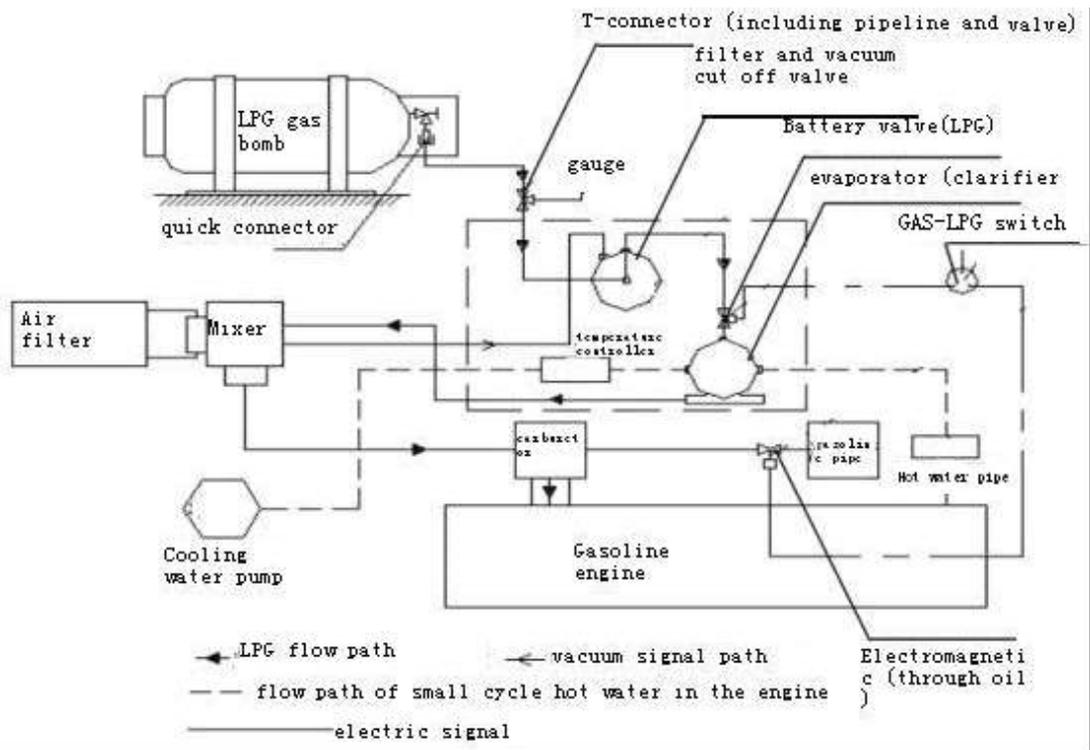
Preheating wire	Startup machine		Generator	Regulator		Oil capacity	water temperature	Oil temperature	Oil pressure	Seat switch	Oil and water separator	Air filter warning	Steering lamp		Backup lamp	Buzzer	Headlamp		Width lamp	Brake lamp	Electric horn	Rear vision lamp	Colling lamp	Wiper	Fan	Warning lamp
																										(Selected)

Electrical system diagram

11 Liquid gas system

Operating principle of the liquid gas system:

LPG is stored inside the steel cylinder. Before the forklift startup, turn on the handle switch at the outlet port of the steel cylinder. Liquid LPG passes through the filter /vacuum cutoff valve, on the one hand, the valve removes the impurities in the LPG . On the other hand, when the engine is stopped because of some reason, the vacuum signal from the carburetor disappears, internal valve will be close immediately and cut off the flow of LPG. When the LPG flows to the carburetor/ pressure regulator, LPG is warmed and vaporized to the gaseity. After reducing the pressure twice, the LPG approaches to the operating pressure status of the engine, however, the internal valve is close constantly. Only when the engine is running and causes vacuum attraction force, the LPG begins to flow outside. The evaroration process absorbs a lot of heat. In order to prevent the device from icing, it is necessary to guide the hot water of the engine into the carburetor/pressure regulator. At this time, the gaseous LPG comes into the LPG mixer, there the LPG is mixed with the clean air as a certain proportion and forms to the combustibile gas, then the combustibile gas comes into the combustion chamber of the engine. The engine can run normally and work outside. When the duel-fuel system selects the combustibile gasoline, open the fuel oil transfer switch. The system will switch off the LPG supply system automatically through the electromagnetic valve, and the gasoline supply system can run normally.



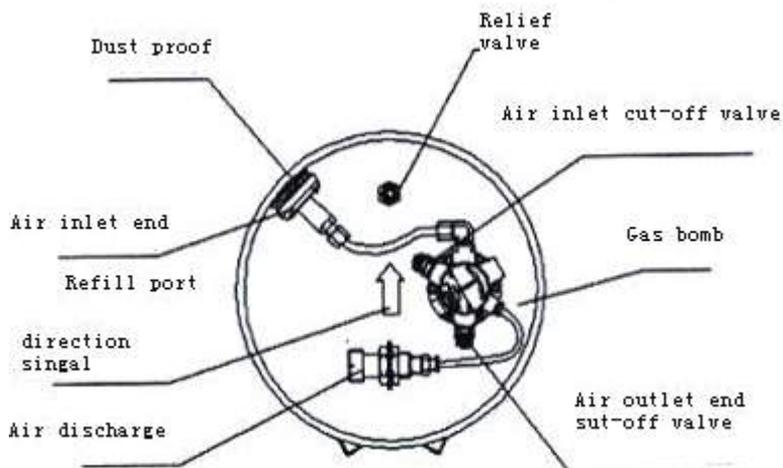
11.1 Liquefied gas system compositions of the LPG liquefied petroleum gas forklift

- LPG steel cylinder
- Filter and the vacuum cutoff valve
- Electromagnetic valve
- Evaporation regulator(low pressure regulator)
- Mixer
- Wire harness
- steel cylinder bracket

11.1.1. LPG steel cylinder

The LPG steel cylinder belongs to the on-vehicle steel cylinder. It should conform to GB17259-1998 national standard at home. It is mainly made up of the bomb body and the valve part. It has four features of discharging fluid limit, charging fluid limit, safe discharge and fluid level display. Through the excess flow valve mounted internally, when the external LPG steel cylinder is damaged and causes the LPG leaks outside with large amount. The valve can be close rapidly and realizes to limit the discharge flow of the fluid. When charge the fluid, a double check valve is mounted inside the steel cylinder, and some steel cylinders equip with the 80% fluid level orifice. When the internal gas approaches to the 80%, the white mist will burst out. The double check valve can cut off and stop charging the air. The safety relief is set a starting injection pressure. When the pressure of the internal gas phase structure exceeds the specified value ,the internal gas can be discharged in order to assure the safety. Observe the capacity inside the cylinder through the float type liquid meter.

The structure of the LPG steel cylinder is as follow:



11.1.1.1 Integrated valve assembly operating manual of forklift LPG steel cylinder

a、Function

The assembly consists of the CYSW314 steel cylinder, the CYFJ315-0I integrated valve, the relief valve, LPG gas filling port for vehicles, the quick connector at the air outlet end and other related accessories. It is a system which can keep and supply the fuel for the LPG forklift. It is arranged on the rear part of the forklift. The main functions are as follows:

- The cut off valve

A hand valve controls the air inlet and outlet pipe.

- Charge limiting valve

When the LPG which is charged into the steel cylinder reaches to the 70%~80% of the total capacity, the valve will be closed automatically.

- Fluid level display

Display the LPG level in the steel cylinder directly.

- Throttle valve

When the flow rate is too large excessively (the system is damaged, the flow rate exceeds the design value, the valve will be closed automatically.

- Relief valve

When the internal pressure exceeds the regulated pressure, the relief valve opens automatically and discharges the pressure, it plays a safe protection action

b、Main specifications

Operating temperature: $-40\sim+60^{\circ}\text{C}$; Working pressure: 2.2MPa; opening pressure of the relief valve: $2.5\pm 0.2\text{MPa}$; Max. charging capacity: 80% of the steel cylinder capacity.

c、Precautions during the operation

- When charging the LPG to the assembly, open the air inlet end cut off valve, close the air outlet end cut off valve. After finishing the charge, close the air inlet cut off valve.
- When mounting the assembly on the machine, fix it firmly. The direction arrowhead on the steel cylinder end face should face upwards. The cut off valve at the air inlet and outlet end should be closed. Connect the input end interface of the forklift to the outlet end interface of the assembly, screw it and open the air outlet end cut off valve. Check whether there is any leakage, then the assembly can be put into use.
- After charging the LPG for the assembly and when operating the assembly mounted on the forklift, it is necessary to check whether there is leakage in time.
- The gas filling port at the air inlet end should avoid dust. Rotate the dust proof in time after charging the LPG to assure the seal capacity of the check valve at the gas filling port.
- The opening pressure of the relief valve has been set, do not change it at will.

- If there is any abnormal situation, inspection and repair should be carried out by the qualified department, any modification privately is not permitted..
- Apply two measuring methods for charging the LPG to the assembly. They are the volumetric method and the weight method. When adopt the weight method to charge the LPG, the steel cylinder should stand. When adopt the volumetric method to charge the LPG, lay down the steel cylinder, and the direction mark should face upwards.

Disobeying these requirements will disturb the normal work of the steel cylinder. The steel cylinder also will lost the quality assurance completely. The manufacturer will not be irresponsible for any result caused by not conforming to the regulation above.

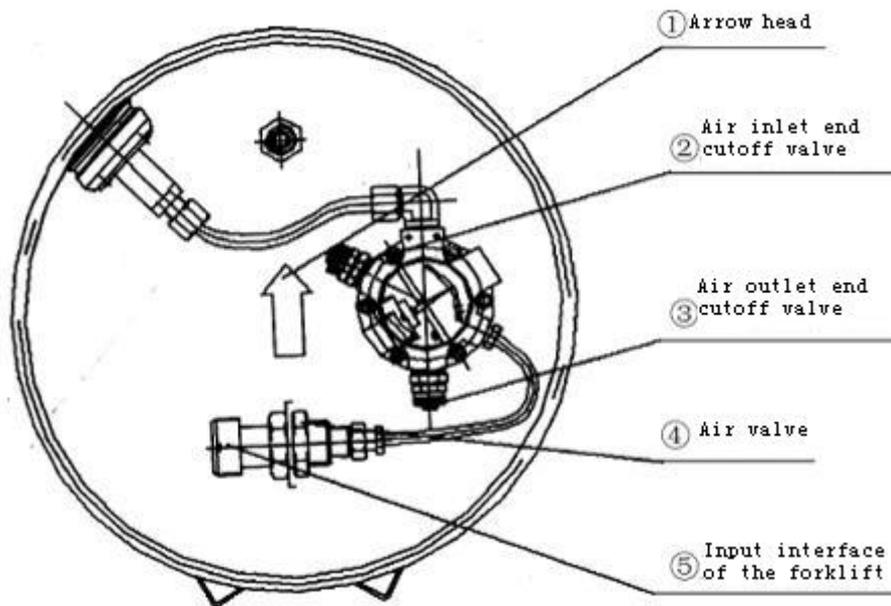
11.1.1.2 Operating manual of the forklift LPG steel cylinder

1. Charging and installation, transportation, storage, and testing should strictly abide by the *Gas Cylinder Safety Supervision Regulations* of Bureau of Quality and Technical Supervision.
2. The steel cylinder should be assembled and disassembled slightly, do not collide with each other, do not allow the other things outside to impact the steel cylinder. Keep the element of the steel cylinder integrate, do not disassemble, adjust and replace the part privately.
3. The steel cylinder can be charged with the liquid petroleum gas of GB1174 standard repeatedly. The maximum charge capacity should not be larger than the 80% water capacity of the steel cylinder.
4. The bracket should get the steel cylinder fixed firmly. The steel cylinder should be assembled and located as the vertical mounting label on the section of the steel cylinder.
5. The steel cylinder should be filled at the gas filling station which has got liquefied gas filling license from the Bureau of Quality and Technical Supervision. Do not fill the steel cylinder privately.
6. When the new and rechecked steel cylinder are put into use for the first time, the charging unit should pump vacuum the steel cylinder or carry out the replacement treatment with nitrogen.
7. Before charging the steel cylinder, designate the professional personnel to check the steel cylinder, if one of the following conditions happens, the measurement should be taken, otherwise do not charge the steel cylinder.
 - a. Steel seal and color marks do not conform to the regulation or can not be recognized, and do not affirm the the medium inside the steel cylinder.
 - b. The accessory is broken, incomplete, or the accessory does not conform to the regulation.
 - c. There is no residual pressure in the steel cylinder.
 - d. Exceeds the period of the test.
 - e. After the appearance test, there is some obvious damages, it is necessary to check the steel cylinder further .

- f. Charge the steel cylinder first, pump vacuum or replace with the nitrogen in advance.
 - 8. Before charging the steel cylinder, the steel cylinder should be located as the vertical label on the steel cylinder, lay down stably. Turn off the air outlet cutoff valve. Switch on the air outlet cutoff valve. When charging the steel cylinder, watch whether the fluid level gauge goes up with the charging fluid. After the action of the charge-limit valve, stop charging the fluid, check whether the fluid level gauge is at the normal position. After charging, it is necessary to switch off the air inlet cutoff valve.
 - 9. Before the use of the steel cylinder, check whether there is any leakage or other abnormal status, do not use the steel cylinder when it is out of work.
 - 10. Avoid isolation of the steel cylinder. Do not keep close to the hot source and the opening flame. Do not adopt the hot source whose temperature is higher than 40°C to heat the steel cylinder.
 - 11. Do not use up the air inside the steel cylinder, the quantity of the residual gas should not be less than 0.5% of regulated charging capacity.
 - 12. Do not change the steel seal and the color mark of the steel cylinder privately.
- As the test date regulated, every 5 years, send the steel cylinder to the test unit to test periodically. The test unit should be qualified by the pressure vessel Safety Supervision Organization.

11.1.1.3 Replacement steps of the LPG forklift steel cylinder

- 1. When replacing the steel cylinder, do wear canvas gloves in order to avoid the gas discharged vaporizing and freezing.
- 2. When replace the steel cylinder, carry out the operation at the good ventilation, spacious place, do not smoke to avoid the other opening flame.
- 3. Check whether the status of every part is good and whether there is no damage.
- 4. Fix the steel cylinder firmly , the arrowhead (①) should face upward.
- 5. Make sure the cutoff valves (②③) at the air inlet and outlet ends are close.
- 6. Connect the input end interface (⑤) to the air outlet valve (④) , screw it firmly.
- 7. Open the air outlet end cutoff valve (③) slowly.
- 8. If there is no leakage after inspection, if there is any leakage, close the air outlet end cutoff valve (③), unscrew the input end interface (⑤) .
- 9. If find an abnormality, report to repair in time. Do not disassemble and repair the abnormality privately. At the same time, separate the abnormal steel cylinder and keep it well.



11.1.2 Filter and vacuum cutoff valve

Configure with a large size filter, which has large filtrating area. It is specially configured for the national situation that the China has more air impurities. The filter can prolong the working time effectively and improve the filtration precision, the air inlet resistance is small, the screen plate can remove the impurities in the LPG in order to prevent the impurities from coming into the lower gasification equipment and cause to stop the equipment.. At the same time, when the engine is stopped because of the malfunction, the vacuum signal of the engine from the carburetor disappears, the internal valve will be close immediately and cut off the LPG circulation, it is a necessary equipment of the LPG conversion device.

11.1.1.3 Electromagnetic valve

According to the purpose of the operator, apply conversion equipments when there are two kinds of fuels. They are the petroleum electromagnetic valve and the liquefied petroleum gas electromagnetic valve separately, both they should be close often.

11.1.4 Diverter switch

The diverter switch can realize the conversion between the petroleum and the liquefied petroleum gas through the controlling the action of the electromagnetic valve. Put the diverter switch on the GAS gear, and the petroleum electromagnetic valve is open, the liquefied petroleum gas electromagnetic valve is close, the petroleum oil passage is open, the engine will make use of the petroleum to work. When put the conversion switch on the LPG gear , the electromagnetic valve of the liquefied petroleum gas is open, and the petroleum electromagnetic valve is close, the oil passage of the liquefied petroleum gas is open, the engine will use the liquefied petroleum gas to work. Put the diverter switch at the OFF gear, the

petroleum electromagnetic valve and the liquefied petroleum gas electromagnetic valve are close, there is no fuel in the engine, and the engine will stop working.

11.1.5 Evaporation regulator (namely low pressure regulator)

The evaporation regulator can change the pressure of the the liquefied petroleum gas from the high pressure to the low pressure. Reduce the 2.2Mpa liquefied petroleum gas to 0~1K Pa, the LPG will be heated to vaporize to the gaseity, meanwhile reduce the pressure, however, the internal valve is close often. When run the engine to produce a certain vacuum suction force, the LPG flows outside. Make use of the engine cycling water to warm the LPG, which can overcome the low temperature and freezing phenomena when reducing the pressure and throttle the flow. The evaporation regulator is the key part. Through it, the engine working condition change providing the mixer with enough fuel, it should have the following functions:

(1) Evaporation and reducing pressure function: the evaporation and pressure reducer changes 2.2Mpa liquefied petroleum gas to the petroleum gas which is lower than the atmospheric pressure.

(2) Flow regulating function: As the engine working condition changes, the output flow of the evaporation and pressure reducer will change, which can supply enough fuel consumption for the engine. When the engine runs, it is under the negative pressure working condition.

(3) Warming the fuel function: Because reducing pressure of the liquefied petroleum gas may produce the hot suction phenomena. When the high pressure valve is at the regulating situation, the throttle, heat suction and temperature decline phenomena must be produced, moreover it will affect the speed of the liquefied petroleum gas from the liquid evaporation to the gaseity. In order to keep the warm capacity stable, the motor fuel gas pressure regulator adopts the engine cycling hot water to warm the pressure regulator housing, which keeps the petroleum gas vaporizing continuously.

11.1.6 Mixer

Mix the gasified LPG with the air in a certain proportion into combustible fuel gas, which can supply the engine. At the same time, the idle speed air-fuel ratio and the power air-fuel ratio also be controlled and regulated through the mixer. The mixer is mounted on the air inlet of the engine carburetter. When the engine runs, the inlet air bypass of the engine will produce vacuum, which makes the upper part of the carburetter produce vacuum. When the degree of the vacuum is higher than -0.2kPa, the air in the mixer diaphragm chamber will come into the air inlet pipe of the engine carburetor the the orifice. The mixer diaphragm chamber will produce vacuum, and the other chamber will connect to the air filter. The mixer diaphragm can overcome the gravity of the diaphragm group and the spring force of the mixer spring, then the diaphragm goes up. The mixer diaphragm will open the air inlet valve seat and the mixer air valve seat. The LPG gas and the air are mixed in the mixing chamber and come into the engine.

Then the engine works. The mixer diaphragm moves up and down according to the vacuum degree change in the engine carburetor, and the open degree of the air inlet valve and the air valve will change. When the engine stops working, the air pressure in the inlet pipe of the engine carburetor is equal to the barometric pressure. The mixing diaphragm chamber comes into the air through the air orifice, the air pressure reaches to the air pressure, therefore the mixing diaphragm will not bear the pressure difference from the atmosphere. Under the pressure of the mixer spring, close the natural gas inlet pipeline. The LPG gas will not come into the engine. When the engine backfires, some gas of the backfire is discharged to the air inlet pipe through the mixer air valve, some gas comes into the mixer diaphragm through the air orifice and expands in the air chamber. The gas is discharged to the air through the mixer explosion proof cup to avoid the damage of the mixer diaphragm.

11.1.7 Wire harness

It supplies the power for the normal work of the electromagnetic valve in the LPG system. It is paralleled in the wire harness of the instrument panel. It controls closure of the electromagnetic valve through the key switch in order to realize fuel conversion.

11.1.8 The steel cylinder bracket

It is mounted on the counterbalance and used to fix the LPG steel cylinder. In order to replace the steel cylinder, apply the rotating bracket. Lubricate the rotating bearing of the steel cylinder bracket to avoid the malfunction.

11.2 Use precautions of the LPG forklift

11.2.1 Working site:

- Good ventilation, if necessary, assistant with the fan to diffuse the LPG gas leaked out.
- Fireworks, hot source and equipment which may produce flame sparks are prohibited around, such as the grinding machine, the grinder and etc.
- There is no low-lying place around, such as the trench, because the LPG gas may be accumulated.
- Prepare the necessary fire fighting equipments, the extinguisher or the water source. Provided with emergency evacuation plan.

11.2.2 Dealing with the suddenness

- If suck too much LPG gas, the person will be anoxic and feel dazed, have a headache or the body will become soft, at this time, move the sufferer the place with good ventilation, send the sufferer to hospital if necessary.
- If the body touches the liquid LPG gas, it can cause frostbite. At this moment, dip the injured part into the cold water. Send the sufferer to hospital if necessary.

- If smell abnormal(sour), stop the machine and flameout, close the hand valve of the steel cylinder. Find out the leakage carefully, remedy it .

If the forklift fires, close the hand valve of the steel cylinder immediately if possible, water the steel cylinder with cooling water, which can keep the steel cylinder cool and avoids the steel cylinder expanding exploding for heat. If the steel cylinder fires, evacuate personnels nearby quickly and inform the firefighter of dealing with the fire.