

SERVICE MANUAL

Starke EcoMaxx Series

ECO-FG/FD 10-35

Rev 07/2017



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STARKE
ECOMAXX

FOREWORD

The forklift adopt the latest system of wide-view mast, hydraulic transmission, automatic pressure-increasing brake etc. and has the high quality engine and instruments to go with it. So it has the advantages of high performance, convenient operation, wide visibility, flexible steering system, reliable brake system, powerful engine, low noise, environment-friendly emission and cool exterior.

The brochure has the brief introduction of the 1-3.5T internal combustion counterbalanced forklift, including parameter, structure of main components, working theory, operation and maintenance. In order to help driver understand the forklift better and get the utmost out of it, please read this brochure carefully before the operation.

Please strictly comply the regulations and notices in the brochure, aboratively operate the forklift and get the utmost out of it.

We reserve the right to make any changes in the specifications without prior notice.

STATEMENT

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

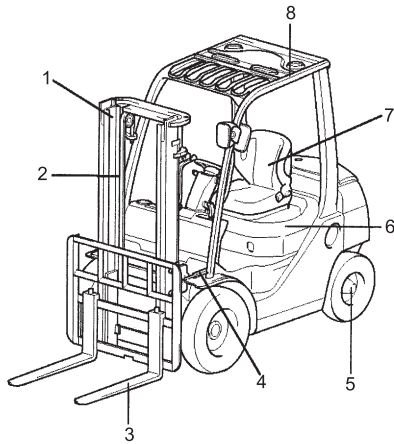
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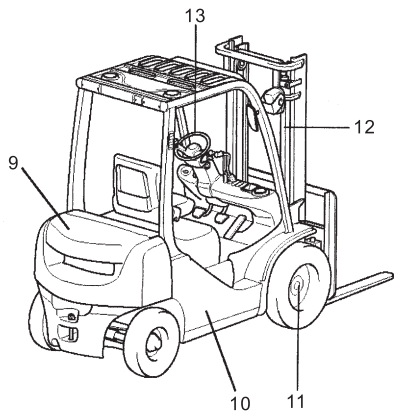
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I . Forklift components description and warning marks

MAIN COMPONENTS

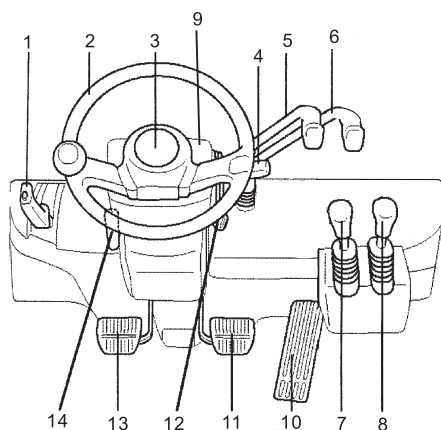


- 1.Mast
- 2.Chain
- 3.Fork
- 4.Tilt cylinder
- 5.Rear axle
- 6.Engine hood
- 7.Oprator's seat
- 8.Head guard



- 9.Counter weight
- 10.Frame
- 11.Drive axle
- 12.Lift cylinder
- 13.Steering wheel

DRIVING CONTROLS AND INSTRUMENT PANEL



1. Parking brake lever
2. Steering wheel
3. Horn button
4. Light control and turn signal switch
5. Lift lever
6. Tilt lever
7. Gear shift lever (Forward-reverse)(Mechanical models)
8. Gear shift lever (High-low speed)(Mechanical models)
9. Combination meter
10. Accelerator pedal
11. Brake pedal
12. Ignition switch
13. Clutch pedal(Mechanical transmission)
Inching and brake pedal(hydraulic transmission)
14. Steering wheel adjust lever



(1)START

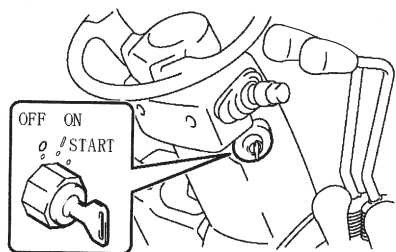
Check method of each warning lamp

Please check if all warning lamps come on when the ignition switch is set ON.

Note:

Use the light control switch to check the meter lighting lamp.

SWITCHES AND LEVERS



Ignition switch

(OFF).....Engine stop position. Key insertion and withdrawal are performed in this position.

(ON) Engine operation position . Located one position clockwise from (OFF) position . The intake heater is preheated before starting in the diesel model .

START.....Engine, start position . Located one position

clockwise from the (ON) position .

After engine starting , release the key and it will return to the (ON) position automatically .

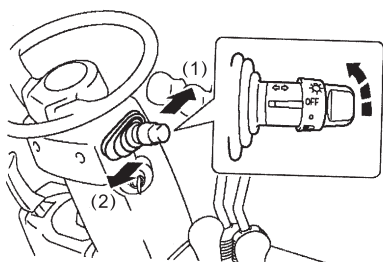
In the torque converter model , the engine does not start unless the control lever is in the neutral position .

Caution

- Never operate the ignition switch without firstly sitting on the seat .Otherwise , the forklift could start to move uncontrolled , causing an accident .
- Do not leave the switch in the (ON) position when the engine is stopped . It may cause over discharge of the battery .
- Do not turn the switch to the START position while the engine is running .
- For the sake of safety it is recommended to always start the engine of a vehicle with the transmission gear shift lever shifted in the neutral position .
- Do not operate the starter motor for more than 30 seconds continuously . Return the switch to the (OFF) position and wait at least 30 seconds prior to attempt restarting .

Caution

- In case of the anti-restart ignition switch (optionally available) , be sure to shift the switch to the (OFF) position before attempting to start the engine again .
- When the ignition switch OFF (engine off) , the fork will not move down even if the lift lever is so operated . However , if you sit in the seat and turn on the ignition switch , you can lower the fork . Do not operate the lift lever before getting on the vehicle and starting the engine . (key off lift lock)
- If the diagnosis lamp does not go off even when the operator sits on the seats , the battery power may be low . In such a case , do not drive the vehicle until the lamp goes off , otherwise the vehicle may not be operated properly . If you are obliged to drive the vehicle , do so with utmost care . Also , stop driving and ask a dealer for inspection if the lamp does not go off 1-2 minutes after the engine starting , or when you race the engine for a while . (For diesel vehicles, the diagnosis lamp may be lighted for a while to warm up the engine after cold starting . This is , however , not engine trouble or failure.)



- (1) Left turn
(2) Right turn

Integrated light and turn signal switch

This switch serves as both two-position light control and turn signal switch .

Light control switch

Irrespective of a key switch position , this switch allows you to turn on and off lighting .This switch has two positions. With the switch at each position , the lamp comes on as shown below.

Lamp name	Step 1	Step 2
Head lamps	-	○
Side clearance lamps, tail lamps	○	○
Meter illumination lamp	○	○

⚠Caution

Do not keep lamps , such as head lamps , on for a long time when the engine is stopped . It may cause over discharge of the battery to make engine starting impossible .

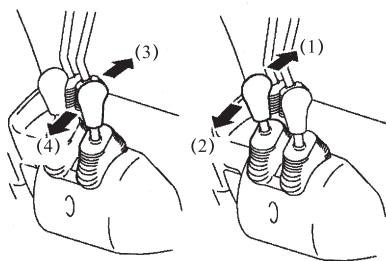
Turn signal switch (Option)

Make the turn signal lamps blink

Left turnPush forward

Right turnPull backward

The signal switch will be operated when the ignition switch is ON .



- (1) Forward
(2) Reverse
(3) Low speed
(4) High speed

Gear shift levers(Mechanical models)

Forward-reverse gear shift lever (right-hand side)

Lever for shifting between forward and reverse .

Forward.....Push the lever forward

Reverse.....Pull the lever backward

The neutral position is halfway between the forward and reverse positions .

⚠Caution

The engine cannot be started unless the shift lever is at the neutral position .Stop the vehicle before shifting between forward and reverse .

High-low speed gear shift lever (left-hand side)

Lever for shifting of traveling speed between the low (1st) speed and high (2nd) speed.

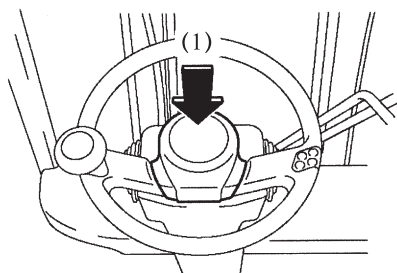
Low speed.....Push the lever forward

High speed.....Pull the lever backward

The neutral position is halfway between the high and low speed positions .

⚠ Caution

- Bring the vehicle to a perfect stop before operating the Forward-reverse shift lever .
- Always set the levers at the neutral positions before starting the engine .
- The engine cannot be started unless the gear shift lever is at the neutral position .

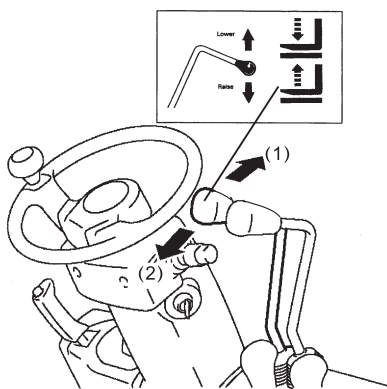


(1) Push

Horn button

Press the button in the center of the steering wheel to sound the horn .

The horn will sound even when the ignition switches off .



(1) Lower
(2) Raise

Lift lever

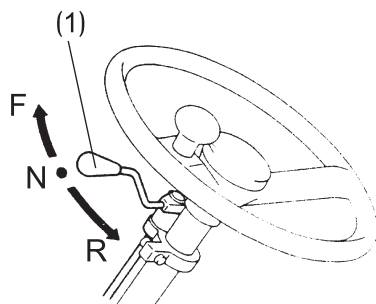
Raise and lower the forks .

Raise.....Pull backward

Lower.....Push forward

The lifting speed can be adjusted by the degrees of accelerator pedal depression and lever operating stroke .

The lowering speed can be adjusted only by the degree of lever operating stroke .



(1) Forward-reverse lever

Forward-reverse lever

Lever for shifting between forward and reverse .

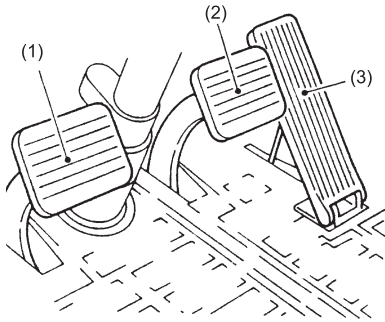
Forward IPush the lever forward(F)

Reverse IPull the lever backward(R)

The neutral position(N) is halfway between the forward and reverse positions .

⚠ Caution

The engine cannot be started unless the shift lever is at the neutral position .Stop the vehicle before shifting between forward and reverse .



Inching Pedal(1)

As the inching pedal is pressed, the oil pressure in the hydraulic clutch drops accordingly the oil allowing the operator to perform inching operation. Use this pedal to inch the truck while operating the hoist system at a high speed.

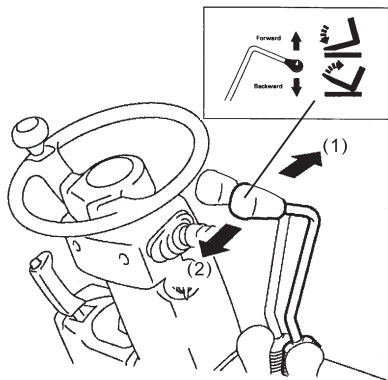
When pressed to the full, this inching pedal serves as a brake pedal.

Accelerator Pedal(3)

The accelerator pedal increases the engine speed. With this pedal released, the engine runs at idle rpm.

Brake Pedal(2)

Press this brake pedal to slow or stop the truck. At the same time, the brake lights come on.



(1)Forward tilting
(2)Backward tilting

Tilt lever

Tilt the mast forward and backward .

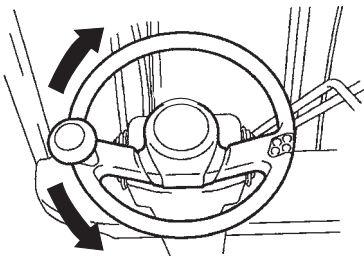
Forward.....Push forward

Backward.....Pull backward

The forward , backward or tilting speed can be adjusted by the degrees of accelerator pedal depression and lever operating stroke .

⚠ Caution

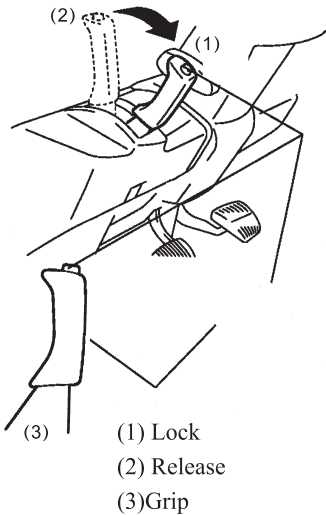
. Always operate the tilt lever from a seated position .



Steering wheel and round handle

The steering wheel controls the direction of turning left or right .

. Use your left hand to operate the round handle .

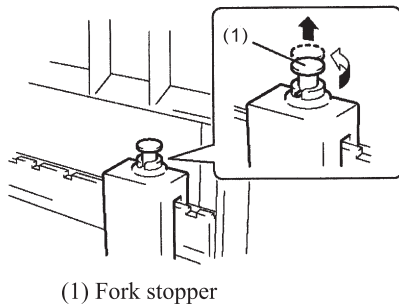


Parking brake lever

When parking , grasp the grip of the lever and fully pull it towards you . When releasing , grasp the grip of the lever and then push it back . while operating the parking brake lever , keep the brake pedal fully depressed .

⚠ Caution

- Never hold the lever at other than the grip because a finger may be pinched . when releasing the parking brake by holding the lever for starting on a slope , for example, hold the grip at above the protrusion .
- When parking on a slope , apply wheel chocks to the wheels .
- Traveling without releasing the brake will spoil the brake performance .



Forks

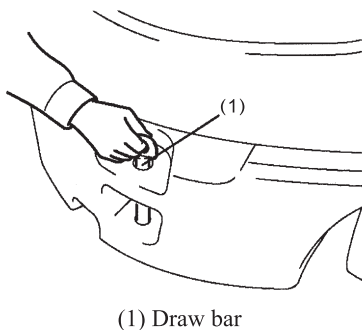
Lift each fork stopper and turn to release so that forks can be shifted left and right .

Adjust the forks in the position most appropriate for the load .

When adjusting the forks , make sure that the center of gravity of the load corresponds to the center of the vehicle . After adjustment , turn the stoppers to lock the forks in place .

⚠ Warning

Make the forks are locked before carrying a load .



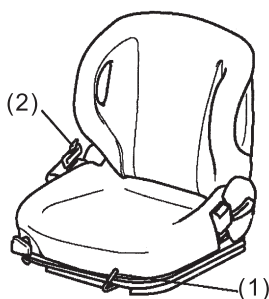
Draw bar

The draw bar is located at the back of the counterweight, and is used to pull the vehicle when its tires drop into a gutter or become stuck in mud .

It can also be used for loading the forklift onto a truck or another vehicle .

⚠ Caution

The draw bar should not be used for towing the forklift or for towing another vehicle using the forklift .



(1) Seat slide lever
(2) Seat belt

Seat slide lever

Pull slide lever to left , to adjust the back-and-forth position of the seat . The seat is secured in position when you release the lever .

⚠ Caution

After adjustment , lightly shake the seat forward and backward to confirm that the seat is firmly locked in position .

Seat belt

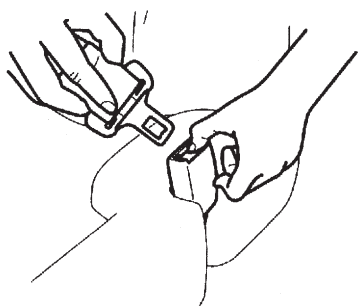
To fasten your seat belt , pull it out of the retractor and insert the tab into the buckle . You will hear a click when the tab locks into the buckle . Pull on the belt to make sure the buckle is securely latched .The seat belt length can be automatically adjusted to your size .

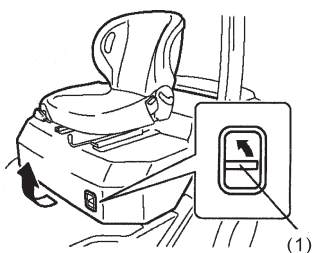
Disconnecting method

Push the release button and allow the belt to retract .

⚠ Warning

. Buckle up . Your seat and seat belt can reduce the risk of serious injury or death in case of a truck tip over . Your chances for avoiding serious injury or death in a tip over are better if you stay with the truck in the operator's compartment.
. Always wear your seat belt when driving the truck . Trucks can be tipped over if operated improperly . To protect operators from the risk of serious injury or death in the event of a tip over , it is best to be held securely in the seat . The seat and seat belt will help to keep you safely within the truck and operator's compartment , in the event of a tip over , don't jump , grip the steering wheel , brace your feet , lean away from the direction of tip over , and stay with the truck .Please always buckle up your seat belt when driving your truck .





(1) Engine hood lock release lever

Engine hood

Opening

1. Pulling up the engine hood lock release lever will release the engine hood lock , and the engine hood will pop up slightly .
2. Lift the engine hood .
3. Keep the engine hood open , then shake the hood slightly to check that the gas spring has been securely fastened before letting go .

Closing

Close the engine hood quietly , and press down the hood until you hear a click sound .

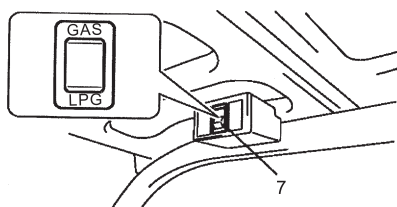
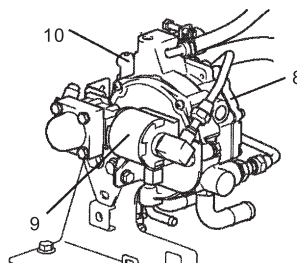
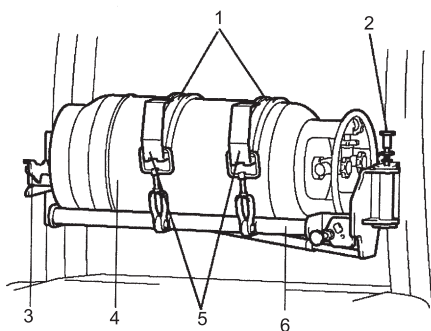
⚠ Caution

Operating the vehicle without firmly locking of the engine hood is very dangerous . Be sure to check firm locking before operating the vehicle .

LPG DEVICE (OPTION)

NAMES OF LPG DEVICE COMPONENTS

- | | | | |
|-------------------|-----------------|-------------------------|-------------|
| 1. Tank band | 2. Set pin | 3. Tank bracket stopper | 4. LPG tank |
| 5. Tank clamp | 6. Tank bracket | 7. LPG switch | 8. Filter |
| 9. Solenoid valve | 10. Regulator | | |



SWITCHES

Fuel Switch

Fuel switch (gasoline / LPG models)

This is a switch to turn on and off the LPG or gasoline fuel feeder .

OFF...horizontal position

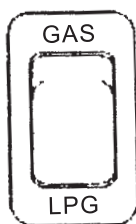
Engine cannot be started up since no fuel is fed .

LPG...low position

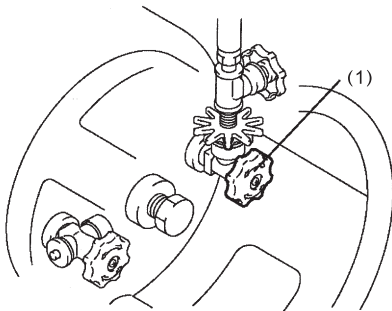
GAS...upper position

Note :

- . With the engine switch OFF , no fuel will be fed even if the fuel switch is positioned at LPG or GAS .
- . To turn off the LPG model engine , turn the fuel switch OFF , and run the engine until it naturally stops . After the engine has stopped , take out the gas tank , close the valve , turn the ignition switch OFF, and remove the key .



LPG TANK AND RELATED PARTS



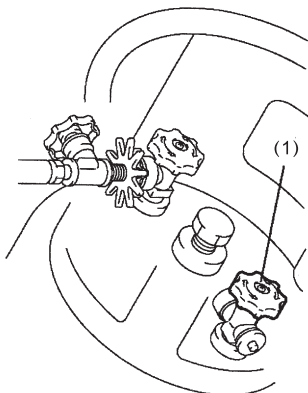
(1) Outflow valve

Outflow valve

This valve controls the flow of LPG fuel from the LPG tank to the regulator .

To open the valve ...turn it counterclockwise .

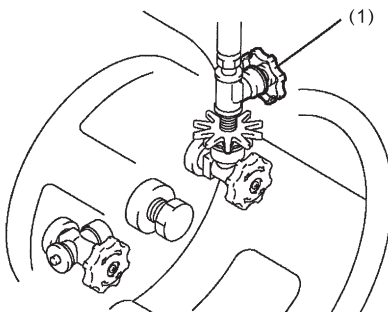
To shut the valve ...turn it clockwise .



(1) Inflow valve

Inflow valve

LPG is filled in the tank through this valve . The tank must be filled by an LPG filling station attendant . Be sure that this valve is shut tightly at all times during use .



(1) Pipe valve

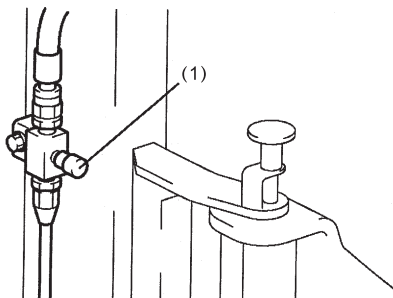
Pipe valve

When the fuel hose needs to be disconnected for tank replacement , etc , close this valve to prevent the liquid from running out of the hose .

This valve is normally left open .

To open the valve ...turn it counterclockwise .

To shut the valve ...turn it clockwise .

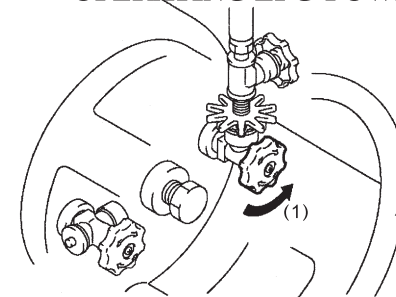


(1) Relief valve

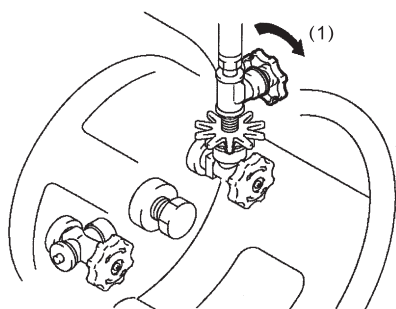
Relief Valve

This valve prevents explosion that might be caused when the LPG pressure rises above a normal level or when the hose becomes deteriorated .

OPERATING LPG-POWERED FORKLIFTS



(1) Open



(1) Open

Starting the Engine (LPG models)

1. Turn the outflow valve of the tank counterclockwise to open it .
2. Be sure that the pipe valve is open .

⚠ Caution

Never depress the accelerator pedal repeatedly or hold it down completely during starting . The engine will not start easily .

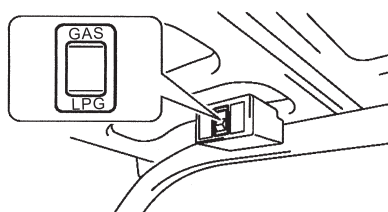
3. Wait for an initial ignition of the engine , and depress the accelerator pedal lightly . Wait for the engine to start running , and set the engine switch to the ON position .
4. Let the engine idle for 5 to 6 minutes .

⚠ Caution

Never depress the accelerator pedal completely . It will send an extra amount of LPG and its heat of vaporization may freeze the regulator and damage the engine .

Starting the Engine (Gasoline /LPG models)

If the ambient temperature is sufficiently high , start the engine in the same way as you would start the engine of LPG models . If the temperature is very low and starting the engine is difficult with LPG fuel , set the fuel switch to the GAS position and start the engine . Change the fuel setting to the LPG position after the engine becomes hot (stop the engine first) .



1. Set the fuel switch to the GAS position .
2. Start and warm up the engine as you would start and warm up an ordinary gasoline engine .See the other Operator's Manual for engine starting procedures .
3. Set the fuel switch to the OFF position and let the engine stop naturally .
4. Set the fuel switch to the LPG position and start the engine again as you would start the engine of LPG models .

⚠ Caution

Never change the fuel switch setting from GAS to LPG position while the engine is running . It will increase the engine rpm sharply and cause a serious damage to the engine .

To prolong the Engine Life

Refrain from handling and driving the vehicle roughly especially when it is new .

Parking

1. parking for a short time .

(1) Turn the fuel switch to the OFF (go-out) position .

(2) Let the engine stop naturally so that any LPG fuel in the piping leaves the system . Turn the engine switch to the OFF position and remove the key .

2. Parking for a long time

(1) Turn the LPG tank outflow valve clockwise to shut the fuel supply .

(2) Let the engine stop naturally so that any LPG fuel in the piping leaves the system . Turn the fuel switch and the engine switch to the OFF position and remove the key .

Changing the LPG Tank

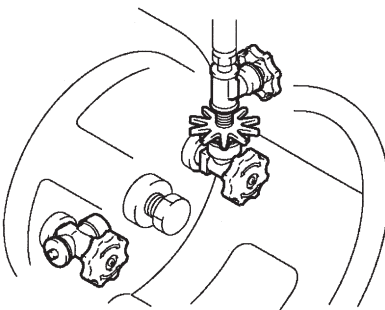
⚠ Caution

Under no circumstances what so ever may the LPG tank replacement be performed near a lighted cigarette , lighted match , gas stove burner , electric heater , motor or any other electric appliance that emits sparks , flame or any type of fire (referred to collectively as “fire” below) .

⚠ Warning

To avoid serious injury from fire or explosion , you must follow these rules :

- . Switch ignition and lights off .
- . Change tanks only in well ventilated , approved areas .
- . No fire or flames allowed .
- . Check all connections for damage or missing parts .
- . Check for leaks .
- . Do not restart until all smell of gas is gone .
- . If truck will not restart , get a mechanic to inspect it .
- . Filling tanks requires special procedures .Make sure someone explains them all to you .



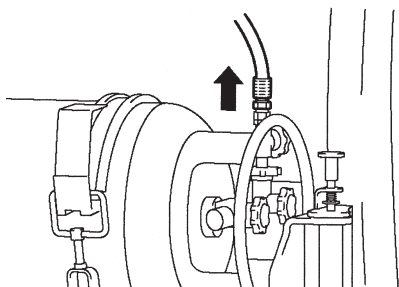
Removing the LPG Tank

1. Stop the engine according to instructions for “Parking for a long time ”.

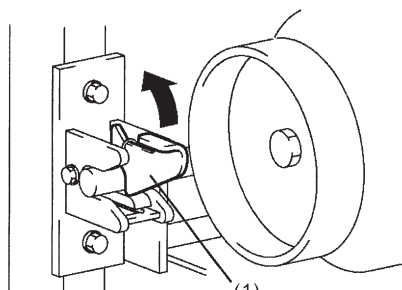
(1) Turn the LPG tank outflow valve clockwise to shut the fuel supply .

(2) Let the engine stop naturally . Turn the fuel switch to the OFF position .

2. Turn the pipe valve clockwise to shut it .

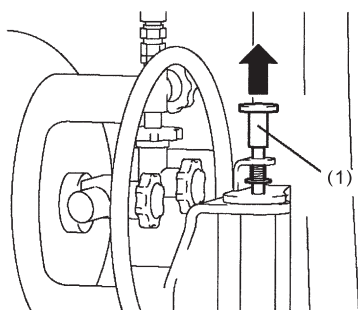


3. Disconnect the pipe from the LPG tank (turn the screw counterclockwise) .



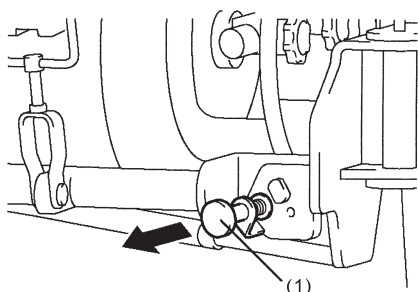
(1) Tank bracket stopper

4. Lift up the tank bracket stopper for the left tank bracket and release the lock .



(1) Set pin (Upper side)

5. Unlock the set pin (upper side) on the right side of the tank bracket by lifting it , turn the bracket rearward , and fix the set pin .



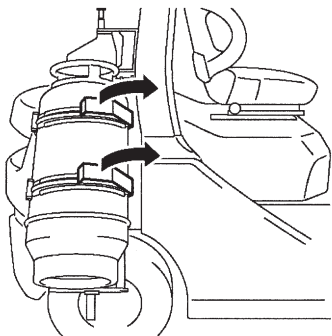
(1) Set pin (Lower side)

6. Pull the set pin (lower side) on the lower side of the tank bracket for unlocking . The tank bracket falls .

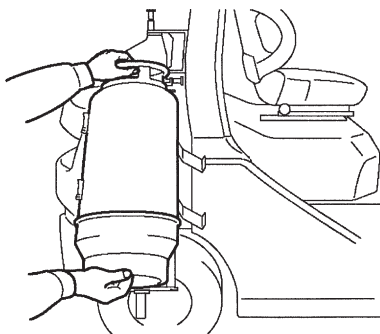
Lower the tank bracket and fix the lock pin .

⚠ Warning

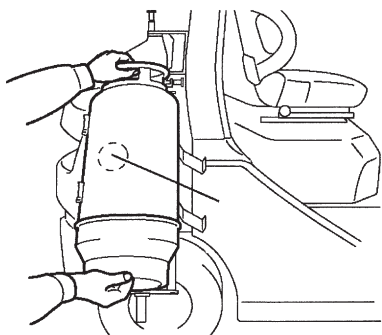
- When unlocking the tank bracket set pin , never enter the area under the tank bracket . Pay special attention as the tank bracket falls due to its own weight .
- Never unlock the set pin when the tank is full . Otherwise , the tank bracket falls rapidly to cause a dangerous state .



7. Pull the tank clamp towards you and unlock the tank bands .



8. Raise the tank bands away from you and remove the LPG tank .



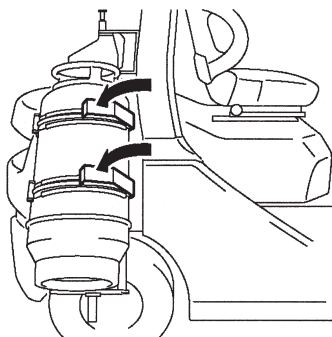
(1) Mark

Installing the LPG Tank

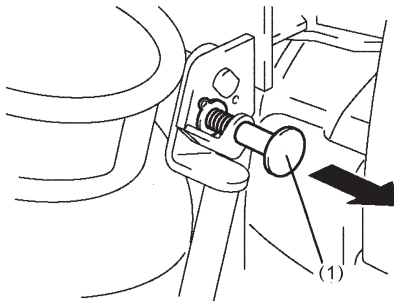
1. Put the LPG tank on the bracket .

(1) The outflow valve must face the right or upper side of the vehicle .

(2) The tank must be placed with the correct side up . Find a mark on the tank . It must face upward or rearward .



2. Put bands over the tank , hook clamps to bands and push clamps up to clamp the tank .



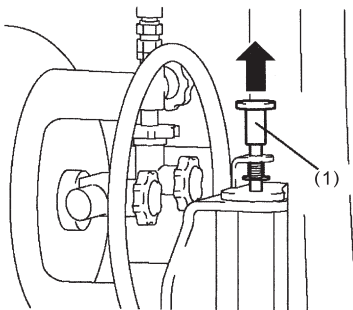
(1) Set pin (Lower side)

3. Unlock the tank bracket by pulling the set pin (lower side) under the tank bracket . Raise the tank bracket and fix the set pin .

⚠ Warning

It is dangerous to unlock the set pin without the load (tank) because the bracket may jump up due to the spring force . Unlock the set pin while the tank is loaded on the bracket .

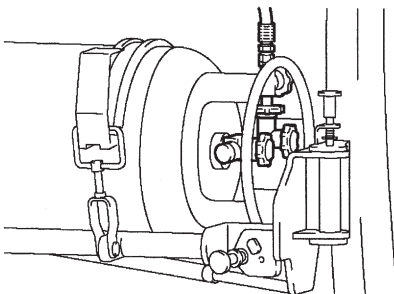
Remove the set pin , turn the tank bracket around the pivot and set the bracket stopper knob accurately .



(1) Set pin (Upper side)

4. Connect the pipe to the outflow valve of the tank (turn the screw counterclockwise) .

5. Wet the pipe connection to the tank with soap water or neutral detergent . Open the outflow valve and the pipe valve , and check the connection for any gas leaks . Wipe off the soap water or detergent after inspection is completed .



Important Information about Properties of LPG

- . LPG normally contains a substance that gives it a noticeable odor in concentration of 1/200 or more in air .If a large amount of the LPG is leaking from the tank of the system , it can be detected by the smell . LPG does not contain carbon monoxide and its not poisonous although it is explosive .

- . LPG is a highly pressurized gas and leaks very easily .The vapor has a volume 250 times than that of the liquefied gas and it twice as dense as air . Therefore , it collects in low places .

- . LPG increase in pressure as temperature increase .

Safety Precautions about Operating LPG-Powered Forklifts

- . LPG is inflammable . A tiny spark can cause a fatal explosion if it is handled carelessly . It is very crucial that the following precautions are observed most strictly to avoid hazards .

- . All LPG-powered forklifts must be operated and maintained (including the LPG tank renewal) by designated persons only .

- . Never stop or park a LPG-powered forklift near fire .

. Whenever possible , do not stop or park a LPG-powered forklift directly in sunlight . Cover it with a sheet highly recommendable . And make sure the vehicle is well ventilated .

. Do not operate a LPG - powered forklift in presence of fire .

. When operating or inspecting a LPG-powered forklift , post a large “FIRE HAZARD” sign and make sure that persons using fire do not approach to the vehicle .

. Remove the ignition key from a LPG - powered forklift before parking or storing it so that no unauthorized person can operate it .

. Use only soap water or neutral detergent to check the vehicle for gas leak. Do not use any other fluid .

. If the gas leak inspection must be performed at night with the help of a flashlight, turn the flashlight on far away from the vehicle and walk toward it . The flashlight might cause a spark when it is turned on and cause an accident .

. If a gas leak is detected , immediately put out any fire , ventilate the area and keep the area in a strictly fire free condition . Then call a qualified dealer or service garage .

. Store LPG tanks in a strictly free area having a gas detector at all times .

. Have LPG tanks refilled only by a LPG gas filling station attendant .

. Use LPG of an appropriate chemical composition according to the climate. In hot climate , use LPG with a relatively high butane content ; in cold climate , use LPG with a relatively high propane content .

INSPECTING AND SERVICING LPG-POWERED FORKLIFTS

Inspect and service LPG-powered forklifts as written below .

. Inspection before Starting Operation .

. LPG gas leak check .

. After the gas leak check is completed , wipe off the soap water or neutral detergent from wet parts .

. If gas leak is detected , immediately put out any fire , ventilate the area and keep the area in a strictly fire free condition . Then call a qualified dealer or service garage .

Caution

Never perform LPG gas leak checks near fire . Make certain that there is no source of fire the area throughout the gas leak check .

Warning

To avoid serious injury from fire or explosion , you must follow these rules ;

. Switch ignition and lights off .

. Check for leaks only in well ventilated , approved areas .

. No smoking , fire or flames allowed .

. Brush soapy water on all joints , bubbles will show leaks .

- . Never use any other liquid , or any open flame for leak check .
 - . Do not try to start engine until all gas smell is gone .
 - . If any gas leakage is found , immediately report it to the supervisor for repairing it by a qualified mechanic or your dealer . The truck is not allowed to be operated .
1. Turn the LPG tank outflow valve counterclockwise to open it .
 2. The pipe valve must be open too .
 3. Set the engine switch to the ON position .
 4. Turn the fuel switch ON and OFF repeatedly for several times , and leave it in the OFF position finally .
 5. Wet hose and LPG tank and regulator connections with soap water or neutral detergent . Lock for gas leak .
 6. Wet the hose and the regulator and carburetor connections with soap water or neutral detergent . Lock for gas leak .

■ Monthly Inspection and Maintenance

Item
Gas leak from pipes and joints (connections)
Damage to pipes and joints (connections)
Regulator adjustment
Crack , damage to and gas leak from the tank
Loose or damaged tank bracket
Damage to electrical wiring , loose terminals
Rotation of liquid drain valve
Gas leak from the regulator body

■ Quarterly Inspection and Maintenance

Carburetor and adaptor
Regulator function (to be disassembled and repaired every year)
Solenoid valve
Filter

Warning Marks

Warning Marks are attached to a vehicle . Before driving it , please be sure to read them carefully .

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INTERNAL COMBUSTION FORKLIFT CE

Model		Tire pressure	F: kPa	R: kPa
Drive mode		Equipment No.		
Engine No.		Manufacturer license No.		
Rated output of engine	kW	Serial No.		
Service weight	kg	Manufacture date		

	Load center "B"	Max. lift height "A"	Max. load capacity "G"
Without attachment	mm	mm	kg
With attachment	mm	mm	kg

GCY423

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II . The Driving , Operation and Daily maintenance of the forklift

The driver and administrator of the forklift must keep “Safety First ” in mind and conduct the safe and standard operation according to the *Instruction book of utility and maintenance* and *The Driver manual*.

1. Transportation of forklift

Pay attention to the followings when carrying the forklift to the container or the car:

- (1) Brake the brake level.
- (2) Fix the mast and count weight by steel cable both front and rear, the front and rear tire should be cushioned .
- (3) When hanging, according to the instruction of the “anging signal ” lift the loads.

2. Safekeeping of forklift

- (1) No fuel in tank don't let out if the cooling liquid is rustproof and antifreeze liquid.
- (2) Apply the rustproof oil to the nonlacquer surface and apply lubrication to the up-and-down roller hinge.
- (3) Low the bracket to the lowest level.
- (4) Put on the brake shift.
- (5) Cushion the forward and backward wheel.

3. Pre-operation check

Pre-operation checks and weekly inspections are the responsibility of the industrial vehicle users .

Be sure to perform a pre-operation check before beginning working with ensure safety .



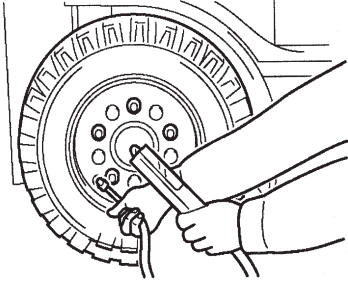
Item	Inspection
Previously detected malfunction	Correct
Exterior	Vehicle body , oil leakage , water leakage, loose parts, exterior damage .
Wheels	Tire pressure , wear or damage , rims hub nuts.
Lamps	Lamp condition , damaged lamps .
Hydraulic oil	Oil lever , contamination , consistency .
Radiator	Coolant lever , antifreeze requirement .
Engine	Oil lever , contamination , consistency , noise , exhaust .
Clutch	Engagement , pedal , play .
Brake pedal	Pedal play , braking effect .
Brake fluid	Fluid level.
Parking brake	Operating force , braking effect .
Steering wheel	Looseness , play , vibration , veering .
Horn	Sound .
Instruments	Functioning .
Load handling system	Parts , oil leakage , cracking , looseness .
Fuel	Amount .

(1) Walk around inspection

Vehicle uprightness

Does the vehicle lean to one side or the other ?

If so , check for a tire puncture or a problem of the undercarriage .



(2) Beneath the vehicle

Check for any oil or water leakage on the ground or floor where the vehicle is parked .

Check for loose parts or damage .

If any unusual condition is found , have the vehicle inspected with the help of a dealer .

(3) Tire inspection

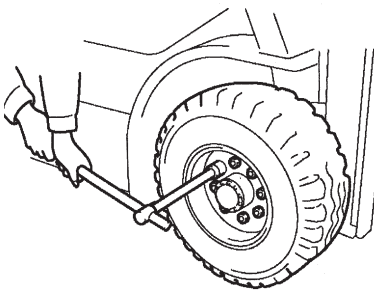
Tire pressure inspection

1. Use a tire pressure gauge and measure the inflation pressure .
Adjust it to the proper level .

2. After the adjustment , check whether air is leaking from the valve .

Damage , crack and wear of tires and rims

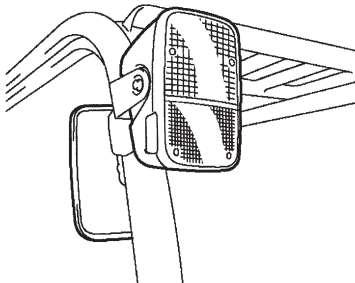
Check the tires for damage and wear , and the rims for bending .
If the tires are damaged , or there is a marked difference in the wearing of tires between the front and rear or between the left and right is perceived , or bent rims are found , ask a dealer for inspection .



(4) Hub nut inspection

Check the tightness of the hub nuts .

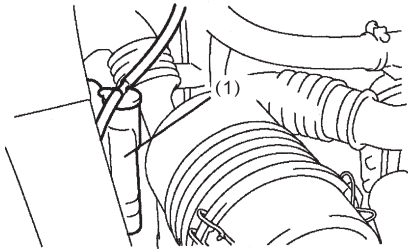
Avoid uneven torque and tighten all of the nuts uniformly .



(5) Lamp inspection

Are the filaments intact ? Is there any lens damage ?

Always keep the lenses clean to ensure proper forward vision .



(1) Reservoir tank

(6) Engine compartment inspection

Engine coolant level check and supply

Level check and supply of engine coolant shall be performed while the coolant is cool .

1. With the engine off , open the engine hood and check the engine coolant level in the reservoir tank .

Note :

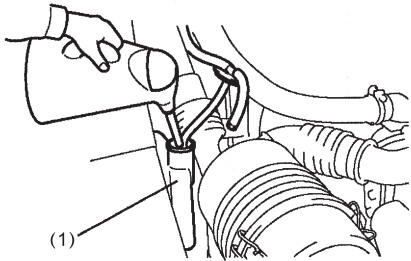
The reservoir tank equipment to the radiator automatically supplies the engine coolant when the coolant quantity in the radiator becomes insufficient .

2. Keep the coolant level between the upper and lower limits . If the level is below the lower limit , adjust coolant to the upper limit .

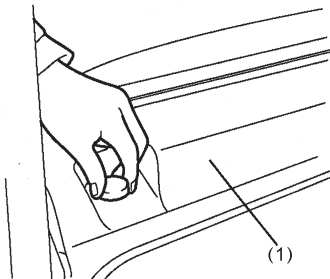
3. The concentration of long life coolant (LLC) in the engine coolant must be 30% (or 50% in a frigid zone .)

Note :

If no engine coolant remains in the reservoir tank . Be sure to check the coolant level in the radiator , too .



(1) Reservoir tank



(1) Radiator cover

(7) Checking the engine coolant level in radiator

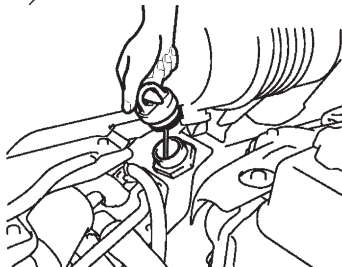
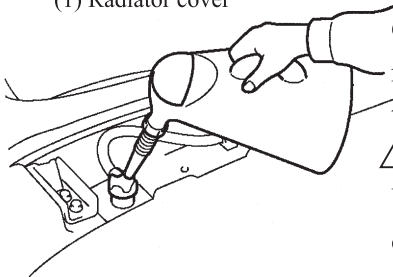
1. Remove the radiator cover .
2. Remove the cap and check the coolant level from the filler port .
3. If the engine coolant is not visible through the filler port , fill appropriately diluted coolant (LLC) into the port .

Note :

Close and tighten the radiator cap , match the pawl on the reverse side of the cap with the notch on the filler port and turn the cap fully clockwise while applying a downward force .

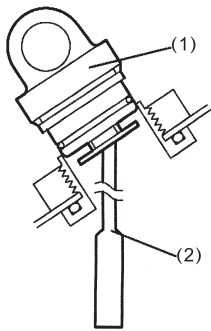
⚠ Warning

When the engine is hot , it is very dangerous to remove the cap. Coolant level check must always be performed when the engine is cold .



(8) Checking hydraulic oil level

Always stop the engine and lower the fork to the ground before checking the level of the hydraulic oil , while the vehicle is on level ground .Oil pollution level should be limited within twelve degrees.



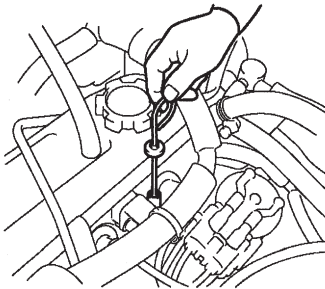
(1) Oil cap
(2) Level identifier

1. Open the engine hood and remove the oil cap .
2. Wipe the level gauge attached to the oil cap with clean cloth, and insert it again into the tank .

Note :

Inspect the oil level by placing the level gauge on the opening of the oil supply inlet without pushing the oil cap in .

3. Extract the level gauge gently and check if the oil adhesion is up to the level line .
4. If the oil level is insufficient , add oil . Spilled and splashed oil must be wiped off thoroughly . Adjust the oil level so that it will fall within a range of 0 thru +10mm from the lift-high mark on the gauge as illustrated on the left side .



(9) Engine oil inspection

1. Park the vehicle on a flat ground . If the vehicle is inclined , the indicated level may be incorrect .
2. The oil level must be checked before starting the engine or at least 3 minutes after the engine is stopped .
3. Extract the oil level gauge and wipe it with clean cloth . Insert it again and check if the oil level is between the F and L levels .
4. If the oil level is below the L line , add oil up to the F line .

(10) Adding engine oil

1. To supply oil , remove the filler cap and pour oil through the filler port . Never let the oil level exceed the F line .
2. The oil supplied must be appropriate for the season .
SAE40 Ambient temperature higher than 30°C
SAE40 Ambient temperature 0°C to 30°C
SAE40 Ambient temperature -10°C to 0°C

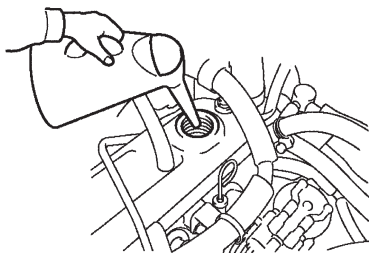
⚠ Caution

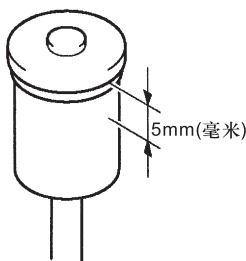
Always use the same brand of oil if possible .

Leakage inspection

Check the engine compartment for any oil or fuel leakage.

Clean the radiator if it is clogged and check if there are any foreign objects, such as paper or others, onto the radiator grill .





(11) Brake fluid inspection

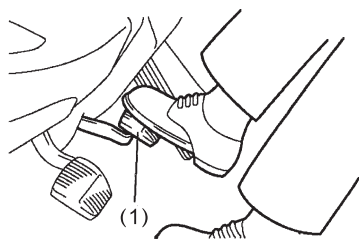
With the engine off , check the level of the brake fluid in the reservoir tank . The level should be within the range shown in the figure . If the level is below the lower limit , add brake fluid up to the proper level . If the decrease in brake fluid is excessive , the brake system may be leaky . Ask a dealer for inspection as early as possible .

⚠ Warning

- Never use any oil other than brake fluid .
- Prevent dirt from getting into the reservoir tank . Even a small amount of dirt in the brake fluid can prevent proper braking .

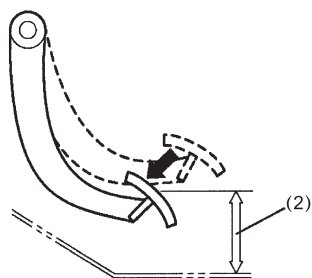
This is extremely dangerous .

- Check the small vent hole in the reservoir tank cap frequently to make sure that it is not clogged with dirt .



(12) Brake pedal inspection

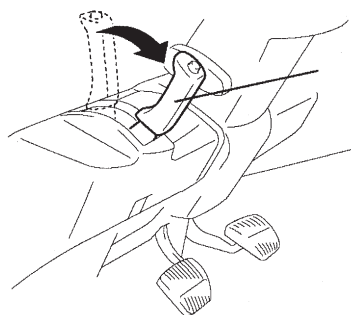
1. Depress the brake pedal fully , and check the floor clearance (clearance between the pedal and floor).
2. Make sure that the pedal does not go any further when it is kept depressed .
3. Also check that no abnormality is observed with pedal depression and return .
4. Manually depress the brake pedal to check the play until a resistance is felt .



- (1) Brake pedal
(2) Brake pedal floor clearance

⚠ Warning

Ask a dealer for inspection if the play is excessive, pedal movement is abnormal or brake performance is improper .



- (1) Parking Brake lever

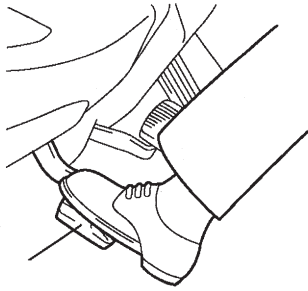
(13) Parking brake inspection

Parking brake lever

Check the operating force required for pulling the parking lever fully .

⚠ Warning

Ask a dealer for inspection if any abnormality is found .



(1) Clutch pedal

(14) Clutch pedal inspection (Mechanical models)

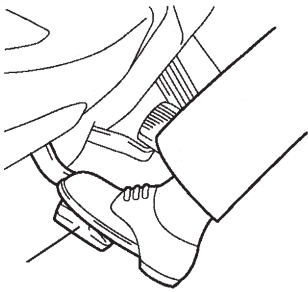
Note :

Since power clutch is adopted in oil clutch models , the clutch pedal must be inspected after starting the engine .

1. Manually depress the clutch pedal to check the play until a resistance is felt .
2. Depress the clutch pedal and check that there is no obstruction or abnormal resistance .

⚠ Caution

Ask a dealer for inspection when any abnormality is found .



(1) Inching and brake pedal

(15) Inching and brake pedal inspection (hydraulic transmission)

1. Manually depress the inching and brake pedal to check the play until a resistance is felt .
2. Depress the inching and brake pedal and check that there is no destruction or abnormal resistance .

⚠ Caution

Ask a dealer for inspection when any abnormality is found .

(16) Engine inspection

Start the engine and warm it up sufficiently .

1. Check each meter and warning lamp to see there is no abnormality .
2. Check if the engine is generating abnormal sound or vibration .
3. Check the exhaust gas color to see it is normal .

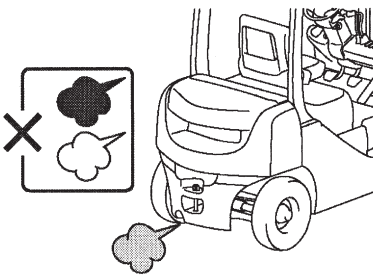
Colorless or light blue exhaust indicates complete combustion ; black exhaust , incomplete combustion ; and white exhaust , burning oil as a result of oil getting into the cylinders .

⚠ Warning

. The exhaust gas is harmful . Before you start the engine inside a building or enclosure , insure a sufficient ventilation .

. The gasoline engine carburetor is equipped with the automatic choke that keeps the engine running at a relatively high speed for a while .

Do not be bothered , however , becomes the engine resumes a normal speed upon warning enough .



(17) Fuel level check and supply

1. Observe the fuel meter to see if the fuel is sufficient .

Note :

After the end of daily operation , fill the tank with fuel to prevent the moisture of the air out side the tank from mixing with the fuel .

2. When supplying fuel , stop the engine , remove the fuel tank cap by turning it counterclockwise , and pour fuel through the fuel filler neck .

3. After fueling , be sure to tighten the fuel tank cap .

⚠ Caution

. Always stop the engine and keep any fire source away before and during the fueling operation .

. Carefully prevent entrance of water and dirt into the tank during fueling .

(18) Load handling system

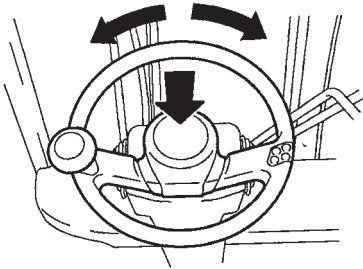
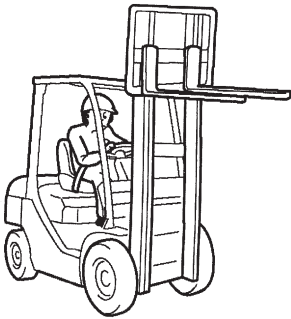
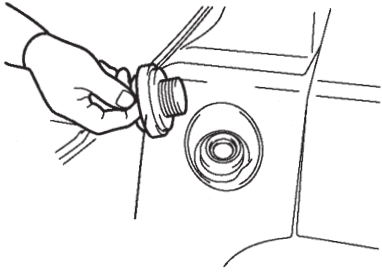
1. Check the fork installation state for cracks and bending .
 2. Check for mast distortion , chain tension and oil leakage from cylinders and piping .
 3. Operate the lift and tilt levers to check their operating state.
- If anything unusual is found , have the vehicle inspected at a dealer .

(19) Steering wheel inspection

Note :

Perform inspection after starting the engine .

1. Check the steering wheel play with the rear wheel and set in the straight traveling direction .
2. Turn the steering wheel in the circumferential direction and also move it up and down to make sure there is no looseness .
3. Push the horn button to see the horn sounds normally .
4. If any abnormality is found , ask a dealer for inspection .



(20) Safety Inspection

Note :

Keep broad safe space when inspection to prevent the sudden movement of forklift .

Parking Brake Inspection :the forklift can not move or lift until the operator leaves the seat .

Checking step :

1. Forklifts should be on the stable and flat ground , and lock the parking brake lever .
2. Set the forward /backward switch on Neutral , starting switch ON and lift the fork 10 cm off ground .
3. Release the brake pedal and the accelerate pedal .
4. Set the forward / backward switch on F or R .
5. Set the starting switch on start shift to check if the starter can work .
6. Close the starting switch .

4. Operation of the forklift

- (1) The driver who has been trained and held the driver license can drive the forklift
- (2) The operator should wear the shoes, hat, clothes and gloves, which can be used as the safety protection during the operation
- (3) Check the control and alarm mechanism before driving .If find the damage or flaw, operate after repair
- (4) The load should not surpass the standard value during the transportation , the fork should completely insert fully below the goods and put the goods on the fork evenly ,using single fork to lift the goods is not allowed
- (5)Successfully start the machine , turn around , steer , brake and stop . Drive slowly when turning around on dankish or slippy road surface .
- (6) Tilt the mast backward , and lower goods when running .
- (7) Carefully driving , when running on the ramp which lean degree more than tenth ,steering forward when up to the ramp , drive reverse when down to the ramp . Forbid turning around , loading and unloading when up or down to the ramp .
- (8) Paying attention to passerby , barrier , pothole during the running , also the space above the forklift .
- (9) Forbid to stand on the fork and not allowed carry people .
- (10) Standing under the forklift and walking under the forklift is not allowed.
- (11) Operating the vehicles and apparatus out of the drive seat is not allowed.
- (12) Pay attention to the goods in case of falling when lifting the forklift more than three meters, when necessary, take the protective action.
- (13) Lean the bracket backward as often as possible in terms of operating the longer lifting fork and the load work should be conducted upward and backward within the minimum range.
- (14) Be more careful and drive slowly when driving on the quay or the interim board.

(15) The driver should not be on the forklift and extinguish the generator when adding the fuel and don't lit fire when checking the battery or the position of the oil tank.

(16) When operating the empty forklift, operate it like the loading forklift.

(17) Don't carry unfixed or loose goods and carry the bigger goods more carefully.

(18) The fork should lay groundly, and make the handle on the neutral gear, cut off the power when leaving the forklift; Pull the parking brake when stopping on the slope or flat ground, if would stop for a long time, cushion the tire.

(19) Don't open the lid of the water tank when the generator is very hot.

(20) The pressure of relief valve of control valve and the steering unit has already been set after production, Don't adjust randomly during the operation so as to avoid to destroy the whole hydraulic system or the hydraulic components because of the pressure is too high.

(21) Charging the tire should follow the "Tire pressure " signal.

(22) Forklift noise on the operator seat is measured by sound pressure level while around the operator is measured by sound power level. The noise in the operator seat is not more than 98dB(A), radiated noise is not more than 114dB(A). Vibration pass to operator is less than 5m/s^2 .

(23) In order to move the extra-wide goods, the users can choose "The super-long fork". What should be mention is that the loading capacity of the super- long fork should comply with the loading curve. Within the standard loading criteria, its loading capacity should be equal to that of the standard forks, the loading center should be moved forward while downloading the work, but using the tip of fork or colliding the goods are not allowed. Attach great importance to safety when driving or twisting.

(24) Check the chain regularly in the process of using in order to guarantee the good lubricating condition between the chains; the degree of loosing and tightening of the left and right hinge is the same. If the chain has the phenomenon of being damaged in the process of using. When the change values of hinge distance vary from the 2% of the standard volume, the chains must be changed so as to guarantee the safety.

(25) Get protection from the accidental fires and personal injury . The position of fire extinguisher and fire aid boxes should be checked and usage of them should be familiar .

(26) Operate on the rough ground , arouse noise and strengthened vibration could be result in hurting body , such as back pain . Please operate the forklift on the flat road or ground .

(27) Do not dismount the overhead guard and backrest ! Install them for protecting operators from the falling objects . Overhead safeguard meet the safety standard .

(28) Forbid to maintain the forklift at a high position .

(29) Forbid to do dismantlement of forklift privately, if indeed demanded , please contact sale agent and after service department first .

(30) Please strictly choose preparative articles and spare parts . we will not take any corresponding responsibility if you don't normally use appointed preparative articles and spare parts .

(31) Pay special attention to the disposal of rejectment in case of polluting environment. Waste liquid should be poured into appointed container . Strictly abide rules and prescribe when dealing with deleterious matters , e.g. sump , impregnant , battery , refrigeration oil .

(32) Please repair the forklift in time when there is something wrong with the forklift . Except some parts which are prescribed in the manual can be repaired by oneself ,please contact the appointed sale agent or dealers in time when the forklift should be repair urgently or rush to repair .

(33) Forbid to install or change attachment privately , if in demand , please contact sale agent or dealers .

(34) Forbid to operate the forklift in the gale weather . The forklift may have the danger of turning over when loading the super big bulk goods in gale weather .

(35) Must check the emission value after maintenance.

5. Operating Cautions:

(1) In the process of using the forklift, if encountering the “boiling of the pot” of the radiator or the high temperature of the cooling water, don't open the radiator immediately. In order to find the reason, open the lid and let the engine run at the middle speed and then twist the radiator lid slowly, put the generator lid away again after a while to prevent the cooling liquid spurting and hurting the operators. While twisting the radiator lid, twist in the right position; otherwise cannot establish the standard pressure system.

(2) To the radiator which use the pure water as the cooling fluid, the water of the radiator can be discharged only when the water will be frozen in the cold weather . The radiator should be removed and be washed in the boiling soda water so as to eliminate the pollutants and sediments of the radiator.

(3) To the radiator of which the cooling liquid often uses the rustproof or antifreeze liquid (model FD-2 minor 35), the different kind of antifreeze liquid and water can't be added randomly. The same type of the rustproof and antifreeze liquid should be added when the antifreeze liquid is leaking or evaporating. The antifreeze liquid can be used both in summer and winter and doesn't need to be changed for a whole year. Generally, it should be discharged and be filtered, then continue to use.

(4) According to the different working conditions, the dust on the surface of the generators should be removed regularly with detergents or the condensed air or high-pressure water (the pressure is less than 4kg/cm) .

6. The oil of lift fork

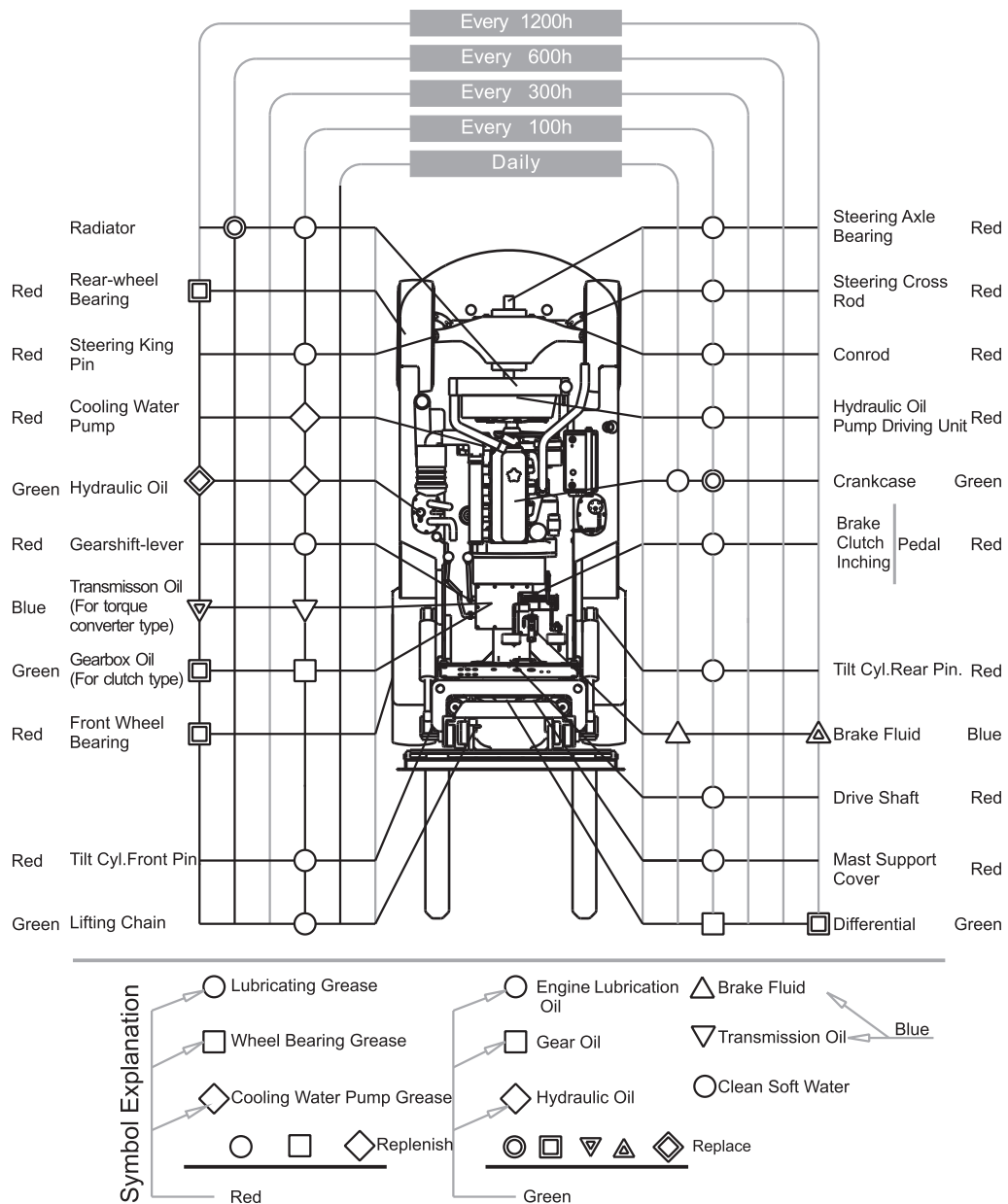
Name	The code name (domestic)	Code name (abroad)
Gasoline	RQ-85	JISK2202, 2#
Diesel	Use the diesel maintenance illustration or the GB252-94 light diesel: summer 0#, winter 10~35#, the general region summer 0#, winter 10#, the north east region 25#, guangdong region 10#	JISK2204, 2#(general region)
		JISK2204, 3#(cold region)
Lubrication	Choose according to the generator main-tenance illustration, or gasoline machine: GB485-84, diesel Machine: GB1112289 standard criteria and working conditions.	SAE10W (winter)
		SAE30 (summer)
Hydraulic oil	N46# or N68#	ISOVG30
Fluid trans- mission oil	6# or 8# fluid transmission oil	SAE10W
Gear oil	85W/90	SAE90/SAE80W
Braking fluid	4604 synthesis braking fluid	JISK-2233
Lubrication	3# dropping point of grease 170	JISK-2220, 1#, 2#

Removable parts

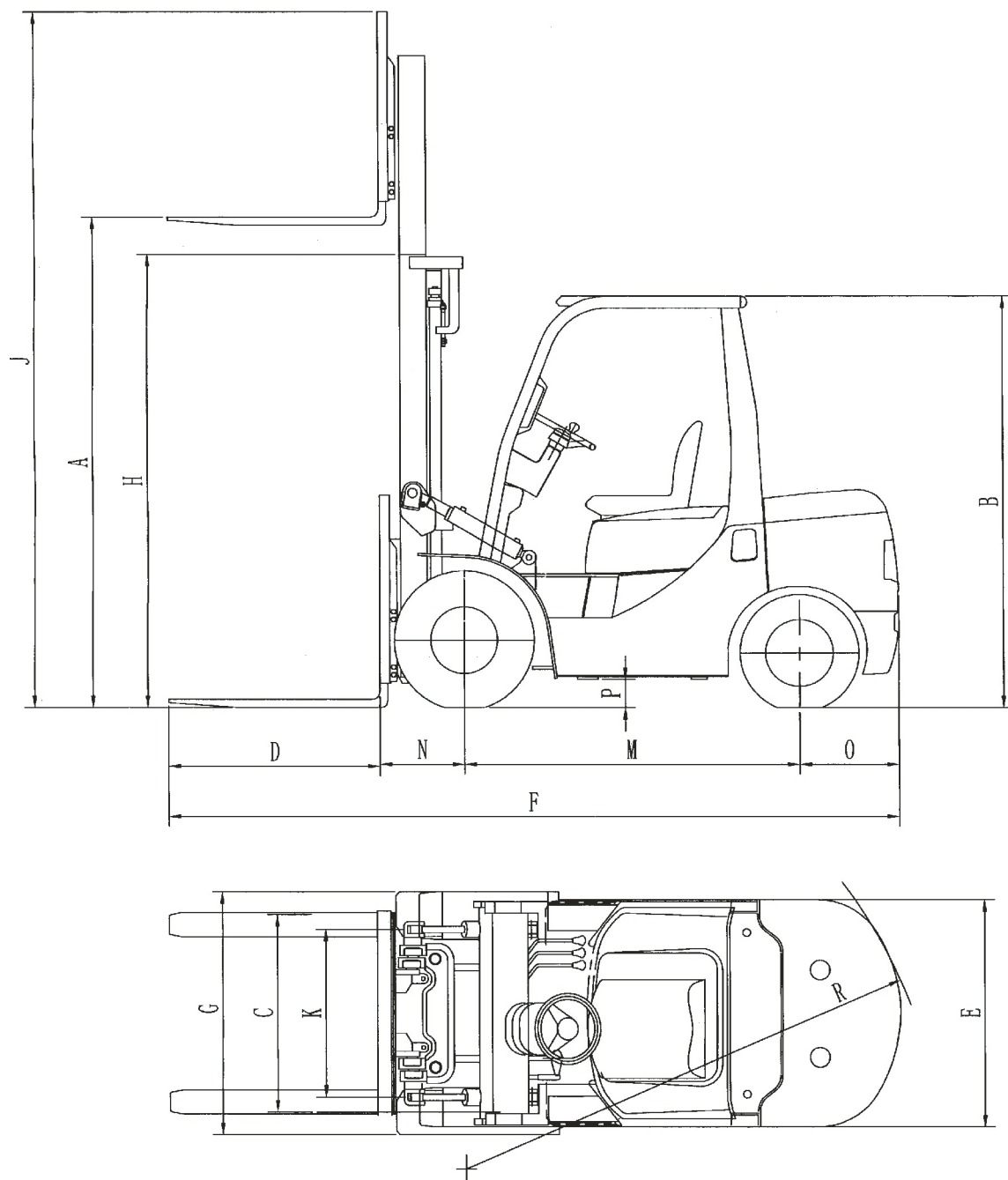
Item \ Model FD/FQ/FY		Units	10	15	18	20	25	30	35
Mast	Exterior size	mm	1990×1050×457			1985×1138×531		2045×1200×536	2105×1200×536
	weight	kg	485			710		754	775
Counter weight	Exterior size	mm	420×1070×930			578×1150×947		697×1150×955	697×1150×1000
	weight	kg	650	850	1050	1110	1400	1770	1950

7. Lubrication system picture:

LUBRICATION SYSTEM DIAGRAM



III. The main technical parameter of forklift



Forklift Figure

Main technical parameter

No.	Sign	Model Item	FD10/FY10	FD15/FY15	FD18/FY18
1	A	Lift height	3000		
2	C	Adjust internal for forklift	240/970	240/970	240/970
3	D	Length of forklift	920	920	920
4	E	Mast tilt angle (Front~Rear)	6° ~12°		
5	F	Whole length	3125	3205	3205
6	G	Whole width	1086	1086	1086
7	H	Whole height (bracket)	1995	1995	1995
8	B	Whole height (head guard)	2040	2040	2040
9	J	Whole height (bracket extension)	3940	3940	3940
10	K	The distance of wheel (Front)	890	890	890
11	L	The distance of wheel (Rear)	920	920	920
12	M	The distance for axis	1400	1400	1400
13	N	Front suspension	420	420	420
14	O	Back Suspension	465	465	465
15	P	Ground clearance (Frame)	115	115	115
		Ground clearance (Bracket)	110	110	110

Main technical parameter

No.	Sign	Model Item	FD20/FY20	FD25/FY25	FD30/FY30	FD35/FY35
1	A	Lift height	3000			
2	C	Adjust internal for forklift	240-1038	240-1038	250-1100	250-1100
3	D	Length of forklift	1070			
4	E	Mast tilt angle (Front~Rear)	6° ~12°			
5	F	Whole length	3660	3660	3780	3820
6	G	Whole width	1150	1150	1225	1225
7	H	Whole height (bracket)	1995		2045	2045
8	B	Whole height (head guard)	2070		2090	2090
9	J	Whole height (bracket extension)	4030		4150	4150
10	K	The distance of wheel (Front)	970		1000	1000
11	L	The distance of wheel (Rear)	970		970	970
12	M	The distance for axis	1600	1600	1700	1700
13	N	Front suspension	470	470	475	480
14	O	Back Suspension	520	520	530	570
15	P	Ground clearance (Frame)	110	110	140	140
		Ground clearance (Bracket)	120	120	135	135

Main technical parameter

Item \ Model		FD10/FY10	FD15/FY15	FD18/FY18
Work capacity	Rated Capacity/Load center (kg/mm)	1000/500	1500/500	1800/500
	Lift height (mm)	3000 ⁺⁷⁰ ₀		
	Lift speed (Full load) (mm/s)	FD10/FY10	FD15/FY15	FD18/FY18
		460	450	440
	Drop speed (Full load) (mm/s)	450	450	450
	Mast tilt angle (Front-Rear)	6~12		
Move-ment capacity	Movement speed	Go forward (kw/h)	0-14.5	
		Back off (km/n)	0-14.5	
	The minimum turning radius (mm)		1990	2070
	The minimum width for right-angle heap	Single Tire (mm)	2090	2170
	The degree for climb	%	>20	
	Tire model (front) air pressure (Mpa)		6.50-10-10PR 0.7	6.50-10-10PR 0.7
	Tire model (back) air pressure (Mpa)		5.00-8-10PR 0.7	5.00-8-10PR 0.7
Axis load	Whole weight (kg)		2280	2680
	Front axis load (Empty load) kg		1240	1180
	Back axis load (Empty load) kg		1040	1500

Main technical parameter

Item \ Model		FD20/FY20	FD25/FY25	FD30/FY30	FD35/FY35
Work capacity	Rated Capacity/Load center (kg/mm)	2000/500	2500/500	3000/500	3500/500
	Lift height (mm)	3000 ⁺⁷⁰ ₀			
	Lift speed (Full load) (mm/s)	FD20/FY20	FD25/FY25	FD30/FY30	FD35/FY35
		530	530	440	420
	Drop speed (Full load) (mm/s)	450	450	500	500
	Mast tilt angle (Front-Rear) °	6~12			
Move-ment capacity	Movement speed	Go forward (kw/h)		0-18	0-19
		Back off (km/n)		0-18	0-19
	The minimum turning radius (mm)		2310	2310	2440
	The minimum width for right-angle heap	Single Tire (mm)	2380	2380	2490
	The degree for climb	%	>20		
	Tire model (front) air pressure (Mpa)		7.00-12-12PR 0.7	28x9-15-12PR 0.7	
	Tire model (back) air pressure (Mpa)		6.00-9-10PR 0.7	6.50-10-10PR 0.7	
Axis load	Whole weight (kg)		3350	3750	4390
	Front axis load (Empty load)		1430	1390	1730
	Back axis load (Empty load) kg		1990	2390	2550

IV. The structure , principle , adjustment and maintenance of forklift

1. Power system

1.1 This series include the model of gasoline and diesel, the generator connects with the transmission mechanism, the generator connects with car frame through rubber cushion in order to lower vibration.

The main parameter for gasoline machine

Parameter \ Model	K21	K25
Model	Four stroke, water cool, straight arrangement, preset air gate	
NO. Of cylinder cylinder diameter*distance	4-89×83	4-89×100
Total dischargement	2.065	2.488
The ratio for compress	9.0	8.7
Rated power/rotate speed	31.2/2250	37.4/2300
Rated torque/rotate speed	143.7/1600	176.5/1600
The minimum rotate speed without load	800	800
The minimum consumption rate for flaming fuel	215	200
Length*width*height	688.2×561×677	708.2×561×677
Weight	159	161
The direction of twisting	Clockwise	
The cooling system	Forced cycled water cooling	
The lubrication system	Forced lubrication	
Battery voltage v/capacity Ah	12/60	
Lubrication fuel	3.8	
Cooling water	3.5	

The main parameter for Disel machine

Parameter	Model	C240PKJ-20/30	4JG2PE-01	NB485BPG-7	A490BPG-95	A495BPG-13
Model		Four stroke, water cool, straight arrangement, preset air gate		Four stroke, water cool, straight arrangement		
The number of cylindercylinder diameter*distance	mm	4-86×102	4-95.4×107	4-85×100	4-90×100	4-95×105
Total dischargement	L	2. 369	3. 059	2.270	2. 540	2. 977
The ratio for compress		21. 3	20. 25	18	18	18. 5
Rated power/rotate speed	kw (ps) /rpm	35.4/2500	46/2450	30/2600	36.8/2650	42/2650
Rated torque/rotate speed	N. m (kg. m) /rpm	139/1800	186. 3/1600-1800	131/1700-1900	148/1800-1900	174/1800-2000
The minimum rotate speed without load	rpm	700±25	700±25	750±25	800±25	800±25
The minimum consumption rate for flaming fuel	g/ps. h	≤215	≤215	≤244	≤238	≤238
Length*width*height	mm	698×561×667	715×544.5×732.5	695×551×635	751×565×704	696×541×696
Weight	Kg	252	252	220	260	260
The direction of twisting		Clockwise				
The cooling system		Water cooling				
The lubrication system		Forced lubrication				
Battery voltage v/capacity Ah		12/100				
Lubrication fuel		3. 8				
Cooling water		4. 6				

1.2 Installation of gasoline machine and the proceedings, which should be followed in use (apply to the H15KA4GR00, H20KA4GR00 AND H25KA4GR00)

(1) The proceeding, which should be followed while installing the gasoline machine made in Japan

Forklift assembling cautions		Requirements	Remarks
The cooling system	The permitted temperature for cooling water	The general temperature 80 °C The highest temperature 110 °C (The temperature for exit)	To avoid the overheating of generator
	The pressure of radiator lid	The general 88.3kPa (0.9kg/cm ²)	Standard value
	Emission	When pouring into the cooling water, you should exhaust air from small faucet	
The lubrication system	Allowable temperature	The highest temperature in oil plate is 120°C	

(2) The proceeding abided when using the gasoline machine made in Japan

The notification in Proceeding		Requirements	Remarks
The cooling system	The negative pressure of inspiration	The highest 6.18kPa The general under 0.98kPa	It is required to use the core of mesh filter, it should be generally changed every six months and 1200 hours, the environment is bad so it should be changed early, otherwise it will destroy the cylinder, piston and discharges the black smoke containing CO
The exhaust system	The exhaust pressure	The general 13.3kPa (Under 100mmHg)	If the pressure is too high, it will have a negative impact on the generator power and noise.
The powerout put P. T. O system	The allowable loading of oil pump	K21: 6.7kgm/3215rpm K25: 8.3kgm/3335rpm	Otherwise, the P. T. O hinge will be lengthened and break, The generator will lose the speed.

The notification in Proceeding		Requirements	Remarks
Electric system	The capacity of accumulator	The standard value: 12V-50Ah	It is generally used under -15°C~+35°C
Operating environment	The environment temperature	The standard condition: -15°C~-35°C	
	The altitude of region	The standard condition: the standard height: under 1000m	When the gasoline machine used above altitude of 1000m, you should conduct the mixed compensation of the height

(3) The fuel , lubrication used by Japanese gasoline machine and additional requirements

Project		Requirements	Remarks
Fuel oil		Use the non-lead ordinary gasoline The octane number 89 Equal to JISK2202-1988	If use the lead gasoline, will destroy the components of the gasoline and pollute the environment.
Lubrication		The specification: API: above the SD level (above China QD level) SAE: to the general zone: 20W Cold place: 10W Change every 200 hours or one month	
Antifreeze fluid		Equal to JISK2234-1988 2 LLC density: common region (above -15°C) 30% Cold region (above -35°C) 50% Change every 2400 hours or 12 months, Change slightly according to the different using environment and conditions	
Spare Component	The fuel filter	Use the original products from Japan, alternation every 2400 hours or 12months	
	Engine oil filter	Use the original products from Japan, alternation every 600 hours or 3 months	
	Air filter	Use the original products from Japan, alternation every 1200 hours or 6 months	

The Replacement of the product above consider general situation (8h/day), should alter in advance under the condition of 24h working day or bad condition.

1.3 The check and adjustment of the generator

1.3.1 Air filter

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

1.3.2 the machine oil filter

1. gasoline machine

- (1) Remove the machine with the wrench and replace with the new filter.
- (2) To drip several oil drops around the new filter, then install it, and then rotate two-thirds circles when the seal ring touches the body of machine.

2. Diesel machine

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

1.3.3 Water tank and attached water tank

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

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

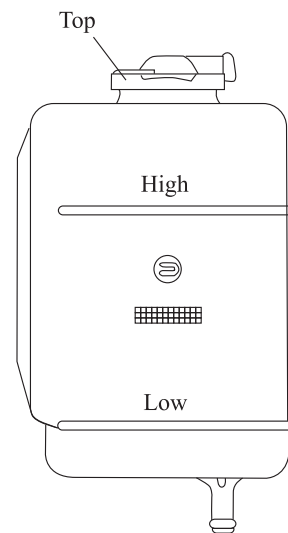


Fig1-1 attached water tank

- (2) Change the antifreeze fluid
 - (a) Wait thirty minutes after turning off the generator
 - (b) Remove the lid of water tank and loose the discharging switch on the water tank
 - (c) Loose the discharging switch of generator and drain the freezing liquid
 - (d) Twist the above two discharging switch
 - (e) Add the antifreeze liquid into the water tank according to the density of the antifreeze liquid and with the adding speed no more than 2l/min

(f) Operate generator at the idling speed after fully adding and check the surface of the attached water tank, if the liquid is lower than the criteria, continue to add until to the standard surface.

(g) Screw down the lid of water tank and add antifreeze liquid at any time until the level of the fluid surface is located above the two thirds of the container.

(3) Adjust tightness of fan belt

(a) Loose the generator and install the screw

(b) Adjust the tightness of the belt by moving engine, using finger to press belt with 10 Kg power, press down 10mm at maximum's length.

1. 3. 4 Displacement

1. Diesel machine

(1) Pull the manual pump to add the oil to the fuel injection pump

(2) If it is heavy to pull down the manual pump, then pull down five to ten times for more.

1. 3. 5 Adjustment of generator speed

(1) Idle speed

(a) Warm machine until the cooling water temperature of generator reaches 85

(b) Furnish the speedometer on the generator, and then use the adjusting carburetor screw to adjust the rotate speed of generator to the standard value 700rpm.

(c) According to the direction of the increase speed of generator, adjust the screw of which the air throttle is the smallest opening

(d) Use carburetor to adjust standard engine rotate speed to 700rpm.

(2) Maximum rotate speed (gasoline engine)

The maximum rotation speed of generator can be adjusted through regulator and pay attention to the engine knock while the speed is too fast.

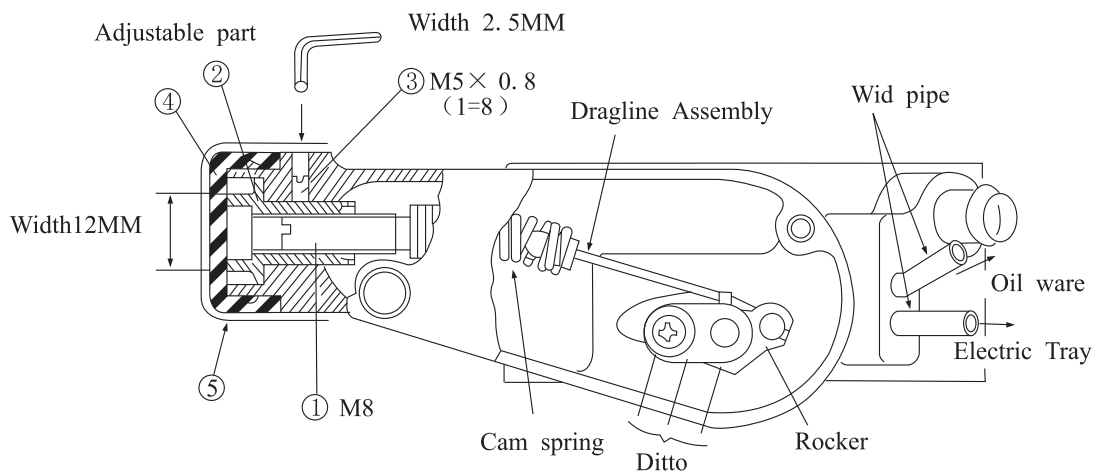


Fig. 1~2 Accelerator

1. The adjustment of the maximum rotation speed during no load

Remove the rubber lid and rotate the adjusting part to reach the standard maximum rotation speed during no load. The adjusting part should be rotated clockwise and the speed will increase, vice versa.

2. The adjustment of maximum speed when loaded (the working of overflowing valve)

(a) Rotate the adjusting screw to adjust the maximum rotation speed in the loading condition, meanwhile, can also adjust the maximum rotation speed during no load (the adjusting screw of the maximum speed during no load is located in the internal adjusting part, the adjusting direction is the same as the direction of adjusting screw with the maximum rotation speed during no load).

(b) If Can't achieve the maximum rotation speed by using the adjusting screw, use the convex tire to adjust, but it needs the high skill and the engine knock will caused by slightly adjustment.

Parameter \ Model		K21	K25
THE Maximum rotate speed without load	Instant value	2990~3150	3050~3250
	Stable value	2820~3080	2900~3100

3. The check and adjustment of the engine knock

The engine knock is the phenomenon of the instability of the generator rotation speed. No matter the maximum rotation speed during no load or the maximum rotation speed of loading is adjusted, you must pay attention to check the phenomenon of engine knock.

Check

- Close the hydraulic system and put it under the neutral gear. During the idle speed, you should button the pedal slowly and check the engine knock.

Adjustment

Adjustment in case of more than three times engine knock.

- Rotate and adjust the screw clockwise and adjust the maximum rotation speed during no load.

- If the above adjustments can't eliminate the engine knock, you can adjust the furnishing screw of convex tire.

The adjustment of other parts of generator can be observed and seen in each using and maintenance illustration book of the generator.

1.4 The fuel system

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

1.4.1 the fuel tank

The fuel tank is welded and is integrated with the frame and located on the left side of the frame. The lid of the fuel tank is located on the surface of the tank, and the fuel sensor is located on the lid. The function of gasoline machine and diesel machine is same. But the former is the oil suction pipe and the latter is the returning fuel pipe.

1.4.2 Fuel volume Sensor

The function of fuel volume sensor is to transform the existing fuel volume into the current, you can see picture 1—5.

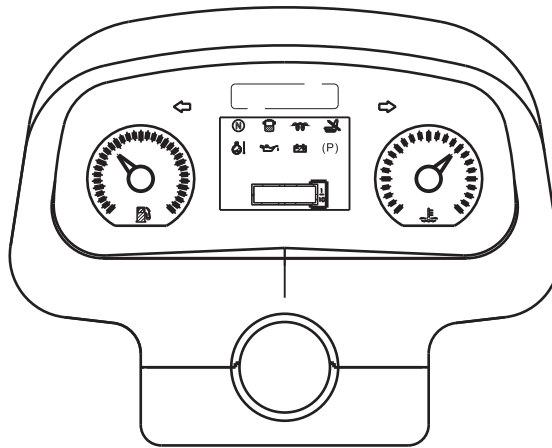
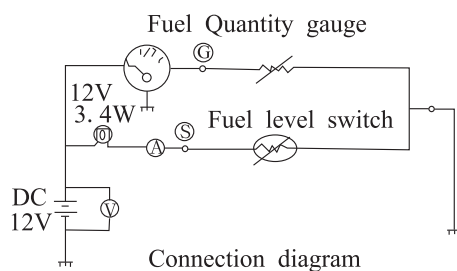
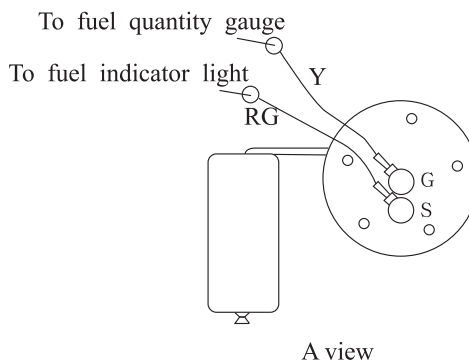
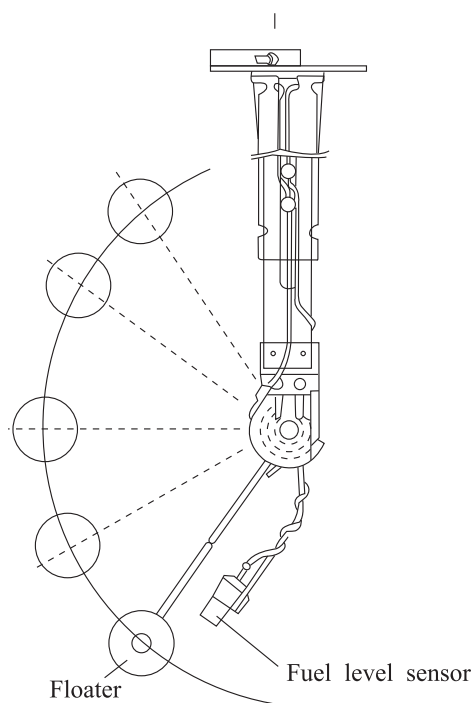


Fig 1-5 Digital Indicator

It has used a rheostat with nickel cable and a gliding part is connected with a floater. With the up-and-down movement of the floater, the resistance has changed so that the current of the rheostat has changed simultaneously.

The fuel quantity gauge belongs to the type of double metals and the swing amplitude of the clock needle depends on the electric current, which flows through the double metal component. When the floater is located in the highest place, the resistance of the flaming fuel sensor is about 9.5 to 11 so that the bigger the current is, the more the double metal bends which will cause the needle of flaming fuel table points to the fullest position “F”. On the contrary, with the decrease of the oil level, the floater will also decrease and the resistance will increase, the electric current will lessen which will cause the needle to point to the vacant side “E” .

The fuel quantity gauge is the solid pillar type, the more right the light pillar is, and the more flaming fuel of the tank is. On the contrary, the more left the light pillar is, the less flaming fuel of tank is. Of course buzzer will ring when the fuel is the minimum and it will remind drivers to refuel.

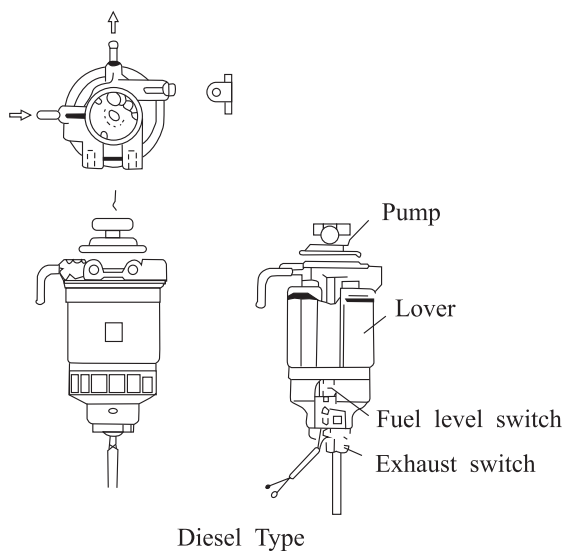
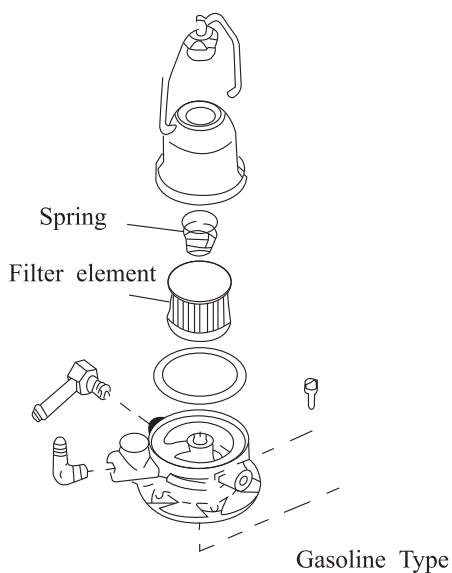


1. 4. 3 the maintenance of the flaming fuel system

Maintain once every 100 hours according to the below methods , clean the oil tank once every 600 hours.

(1)The flaming fuel filter

Furnishing on flaming fuel pipe (gasoline type) or on the flaming fuel tank (diesel type) is used to filter the flaming fuel, which supplies the generator. Also acts the role of separating the water from the flaming fuel.



1. The gasoline machine

- (a) Clean the whole filter every three hundred hours.
- (b) Loosen the rotation tire and remove the lid.
- (c) Loosen the screw and remove the filter core.
- (d) Clean or change the filter core.
- (e) After refurnishing, start the generator to let the gasoline fill the whole oil glass of the filter and check whether leakage.

2. The Diesel Machine

- (a) Clean the whole filter every six hundred hours.
- (b) Inject a few drops of oil along the seal ring of new filter and then furnish it. After the seal ring touches the filter, then rotate the two-thirds circle again.
- (c) When the alarming light of the filter is on, then loose the discharge switch to discharge the water. Ps After the discharge, ensure to turn off the discharge switch.
- (2) Clean of flaming tank
Clean the oil tank once every six hundred hours.
For those gasoline forklifts, pay attention to the fireproof when washing.

1.5 The accelerator pedal

As the picture illustrates, the accelerator pedal furnished on the floor used to control the rotation speed of the generator and connects the generator by the handrail and drag line.

2. Electric gas system

2.1 Summary

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

(1) Charging system

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

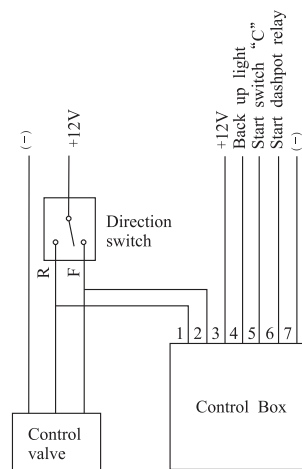
(2) Start system

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

(3) The transfer and control system for electrohydraulic.

<1>the principle picture of electric gas

<2>the major components



The electro hydraulic control valve

The direction switch

The controlling box

<3> Summary

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

(a) The similarity with the control switch

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

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

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

(4) Illumination and signal equipment

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

The forward lamp: 55W

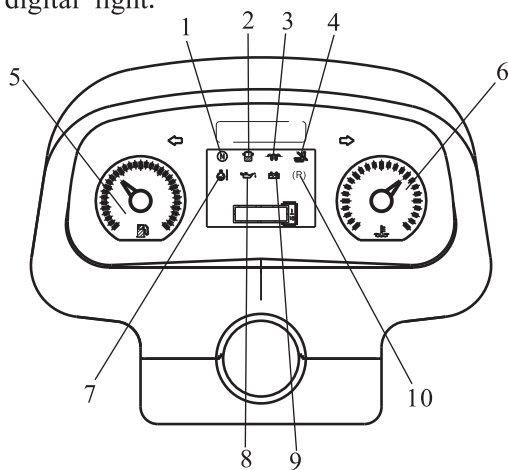
The forward combined lamp (transfer/indicating wide): 21W/8W Rear combined lamp (transfer/indicating wide/back the car): 21W(red)/8W(red) 10W (white)

The alarming lamp (Optional part): 21W

(5) Gauge system

Including the hour gauge, oil volume gauge, water temperature gauge and the indicating signal lamp, which are the checkout equipment of the forklift.

The system adopts the joined gauge furnished by the American KEDISI core engine of the combustion, the oil volume table and the water temperature table of the combustion engine are indicated by the solid Band10 colored LED and the hour table is indicated by solid digital light.



Item	Name
1	Neutral
2	Oil-water separation instructions
3	Preheat instructions
4	Seat
5	Feul instructions
6	Water temperature table
7	Oil temperature
8	Oil instructions
9	Not charging instructions
10	Handbrake

2.2 Brief operation's introduction:

(1) Startup

Before starting the generator, put the direction switch into zero; otherwise, the generator can't be operated. This is because the safety-start-protection function has been designed in the control box. Rotate the starting switch to first gear clockwise one — lectricity position, connect the gauge and the lit power supply, the diesel generator start to become hot automatically and the indicating lamp is lit, after 3.5 seconds the preheat indicating lamp is extinguished automatically and the preheat hour is controlled for 13.5 seconds by relay.

Rotate the starting switch to the second gear—the starting gear and then operate the generator.

After starting the generator, push the directing switch forward, that is at the forward gear accelerate acelerograph, speed up the forklift. If push the directing switch backward, at that time the lamp which indicates backing the car will be on and buzzer will also be on.

(2) The lamp switch: push the first gear and the forward and backward lamp is on. Put to the second place and the forward big lamp is on, at that time, the lamp indicating the width is also on.

(3) The signal indicating the transfer of direction: push the switch of the lamp of transferring direction backward, the transferring signal lamp of the forward combined lamp and the back combined lamp at the right side of forklift is twinkling. Push the switch of the lamp of transferring direction forward, the transferring signal lamp of the forward combined lamp and the back combined lamp at the left side of forklift is twinkling.

(4) The breaking signal: when the forklift needs to brake, step the stepper and the back combined lamp will be on red.

(5) Backing signal: when the forklift needs to back, pull the direction switch backward, at that time the transmission is put on the backing gear then the car—backing lamp of the back combined lamp will be on white, meanwhile, the buzzer of the forklift backing is on.

(6) Indication of non—chargeable signal: before starting the generator, put the starting switch on the electric gear, at this time, the indicating lamp is on and after starting the generator, the lamp will extinguish automatically. If the generator is on the work condition, the indicating lamp will be on indicating the chargeable circuit can't be charged and should be checked.

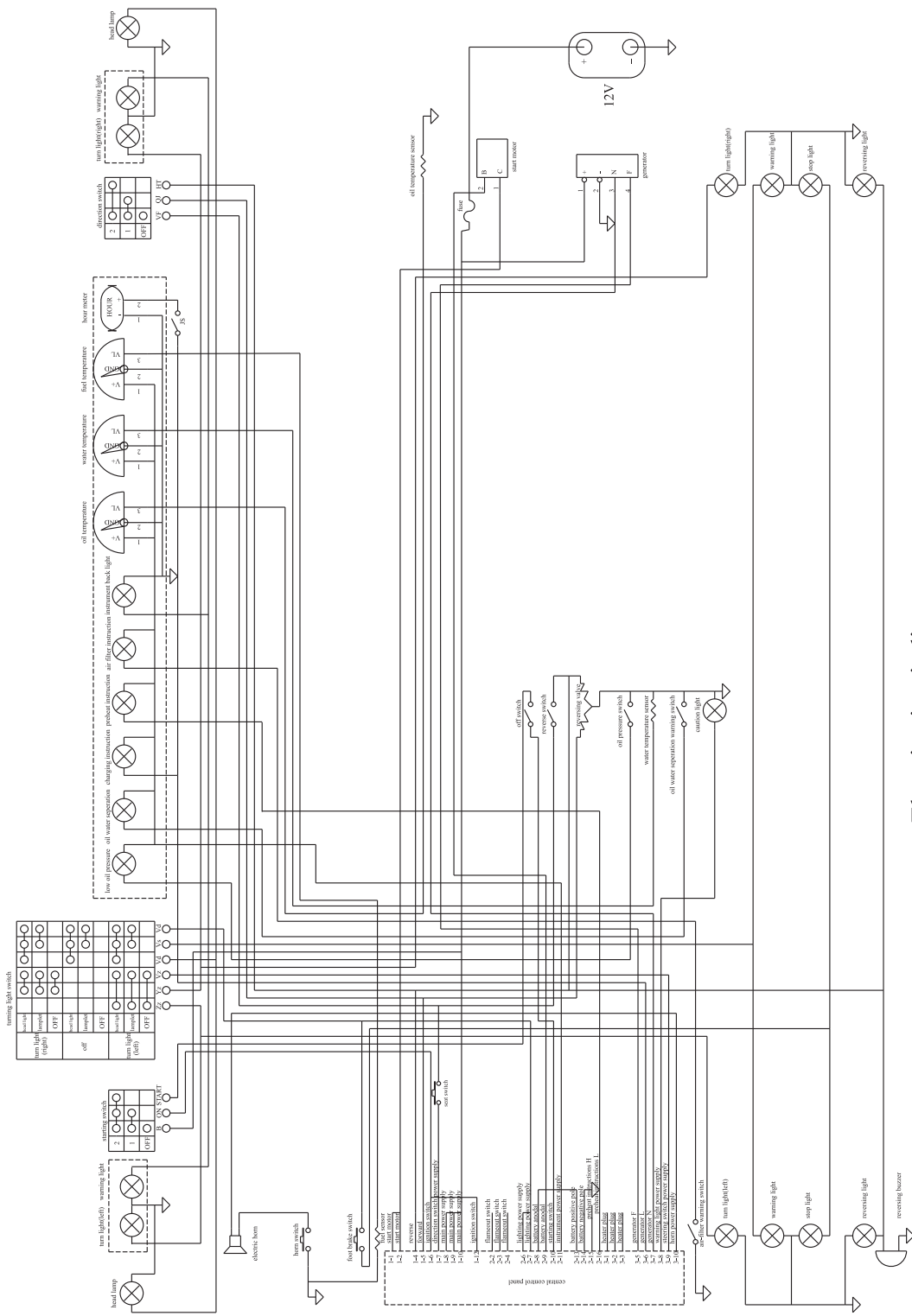
(7) Signal of oil pressure sequel of generator: before starting the generator, push the starting switch to the electric gear, at this time, the indicating light of oil pressure will be on, after the generator has started, the lamp will extinguish automatically. If the generator is on the working condition, the indicating lamp of the oil pressure will be on which indicates the oil pressure of generator is too low and the lubrication is not very good and it should be checked immediately.

(8) Signal of the oil—water separator: before starting the generator, put the starting switch to the electric gear, at this time, the indicating lamp of the oil—water separator will be on, after the generator has started, the lamp will extinguish automatically. If the indicating lamp is on in the course of the operation, which indicates the water in the oil—water separator has surpassed the alarming position. Then push the levy immediately to let out the water, and the light back to normal.

(9) Flaming oil gauge: indicating the reserve volume of the flaming oil in the oil tank, When the fuel gauge pointer reaches red, it indicates the reserve volume of oil in oil tank is too low and should add oil to the oil tank.

(10) Water temperature gauge: indicating the temperature of generator's cooling liquid

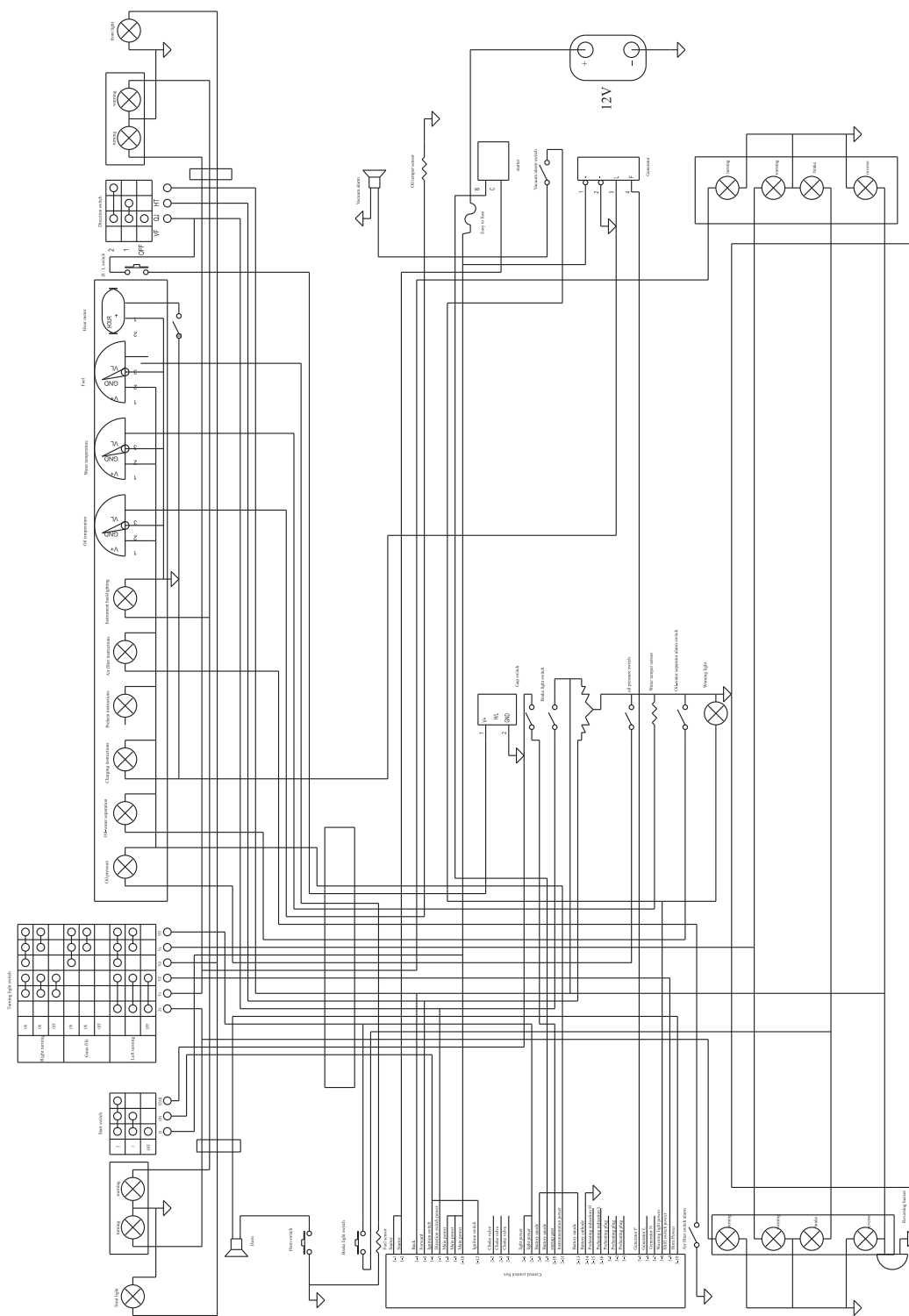
(11) Gauge: accumulate work hour of the generator



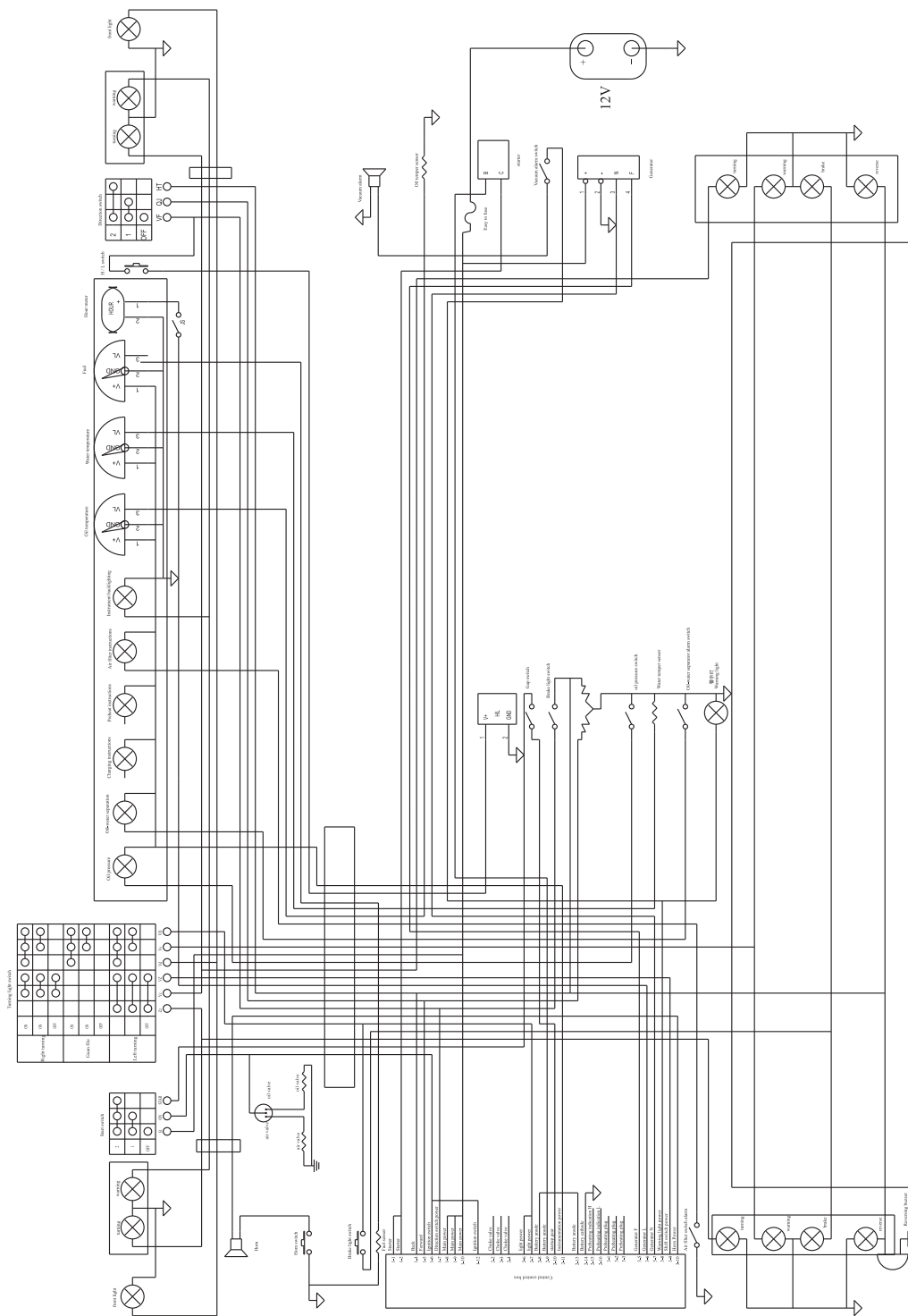
Electric circuit diagram
Model applicable:FD20~35B/C-X1/X2/X4/N1



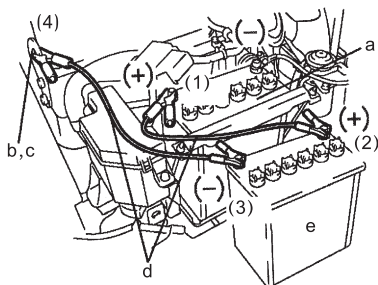
Model applicable: FD/Q/Y20~35B-X3/X5/W1/W2/R1/R2/Y1/Y2/BY1/D1/R3/S1



Electric circuit diagram
Model applicable: FD10, 15, 18B-W1



Electric circuit diagram
Model applicable:FD10,15,18B-R1



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

(12) When the battery is unavailable

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

Connect the booster cable following the sequence of the illustration .

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

⚠ Caution

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

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

3. Separators

Type	Monolithic dry type
Operating Mode	Type of pedal
Outside diameter of friction plate	275mm
Inside diameter	175mm
Thickness	8. 9±0. 3mm
Surface area	354cm ²
Weight	12. 5kg

3. 1 Summary

The clutch consists of the clutch housing , friction plate , and clutch cylinder and pressing disk. Its role is to transfer and cut the power from the generator to transmission box.

3. 1. 1 the pressing disk and the friction plate

The pressing disk is installed on the flying wheel of the generator . The friction plate is located between the pressing disk and the flying wheel and installed on the main axis of transmission through spine and then move the box forward, the rod was pushed so as to separate the pressing floor from the friction plate so that the power from the generator is cut off.

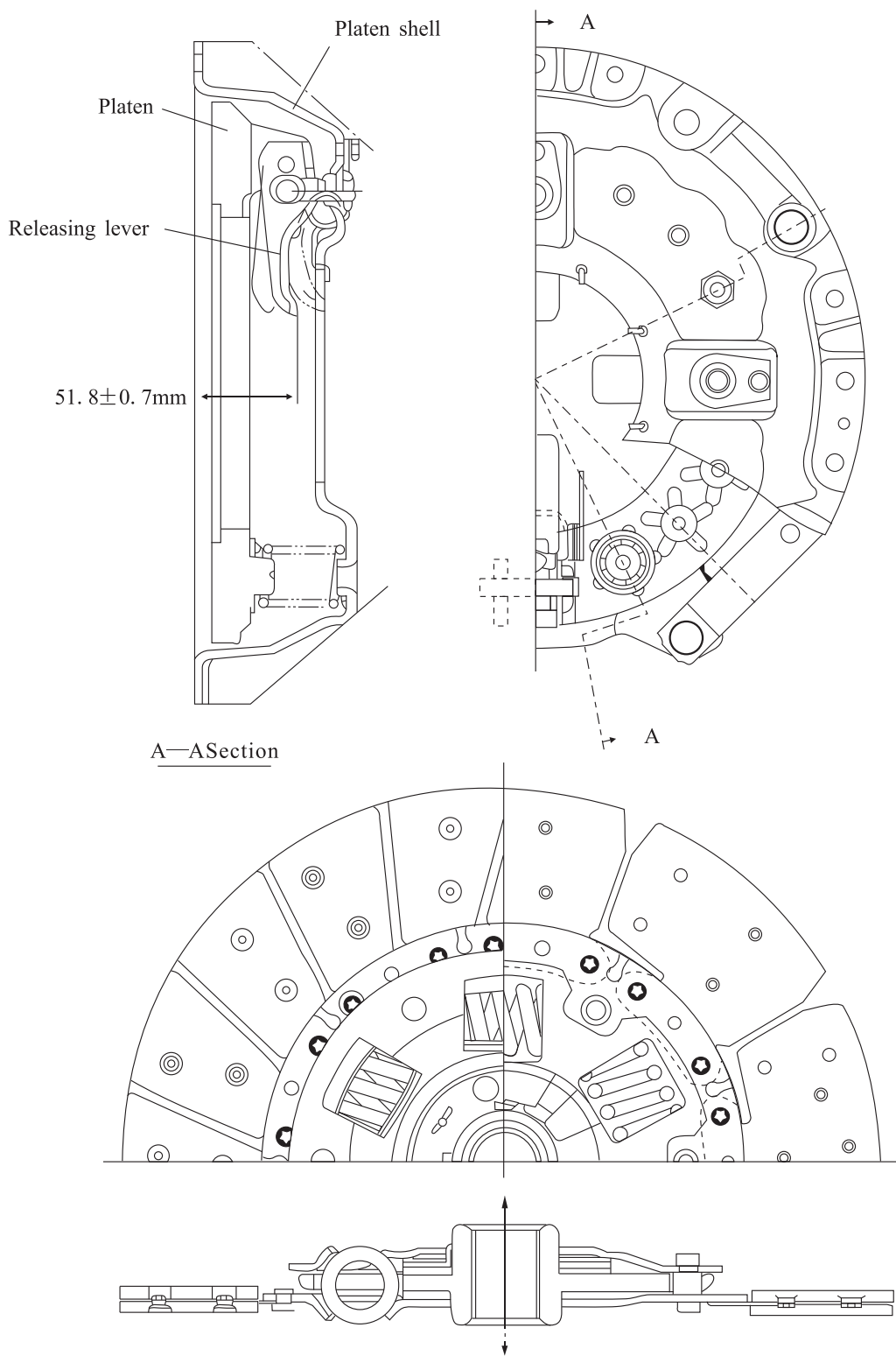


Fig 3-1 Clutch shell and friction plate

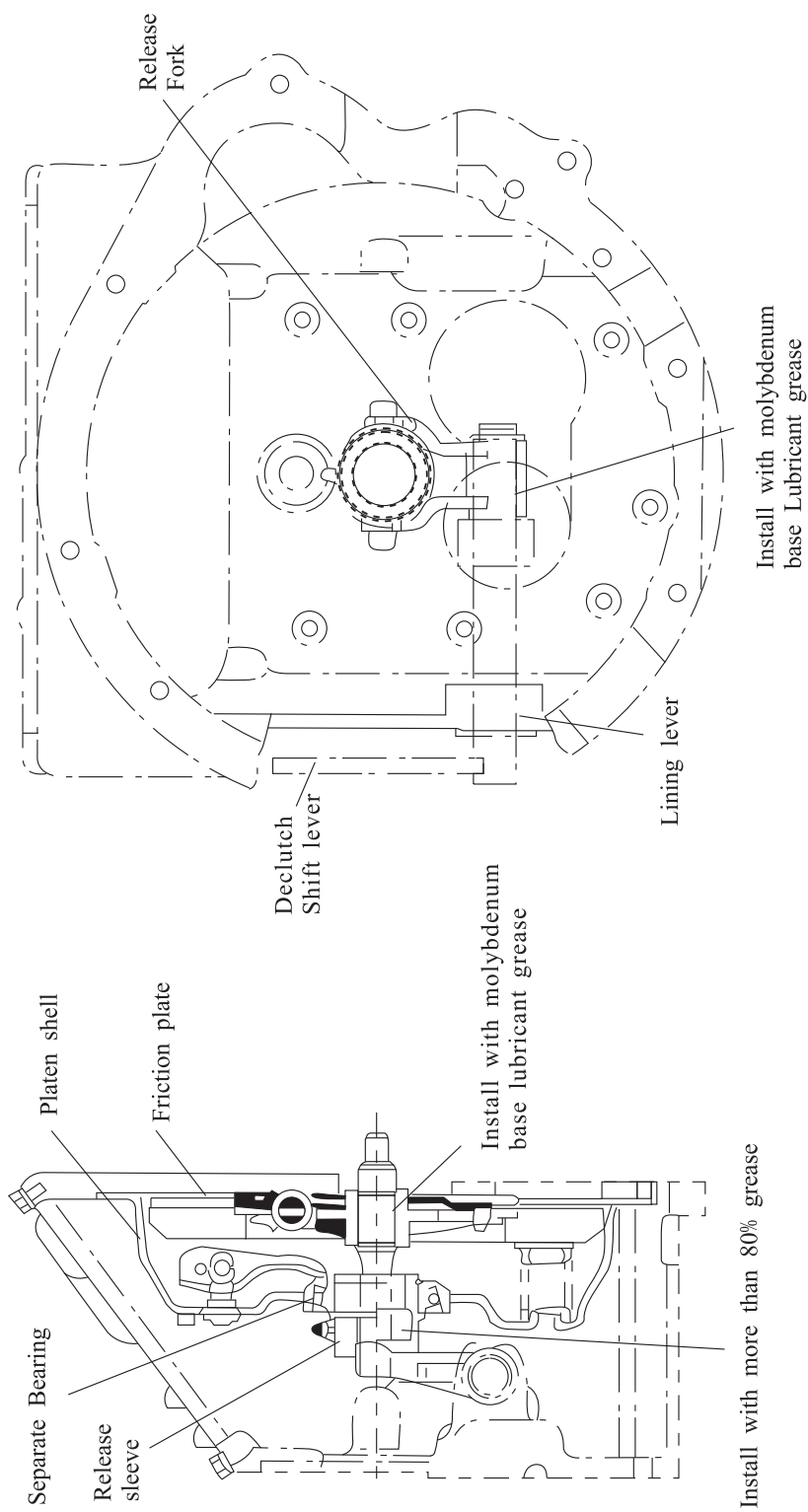


Fig 3-2 Clutch filling up area

3.1.2 clutch wheel cylinder

The structure of the clutch wheel cylinder is illustrated in the picture 3-3, it is installed on the left side of the transmission. The wheel cylinder is made up of the piston, the spring, and the handspike. Pushing the rod can transmit the movement to the disengaging rod.

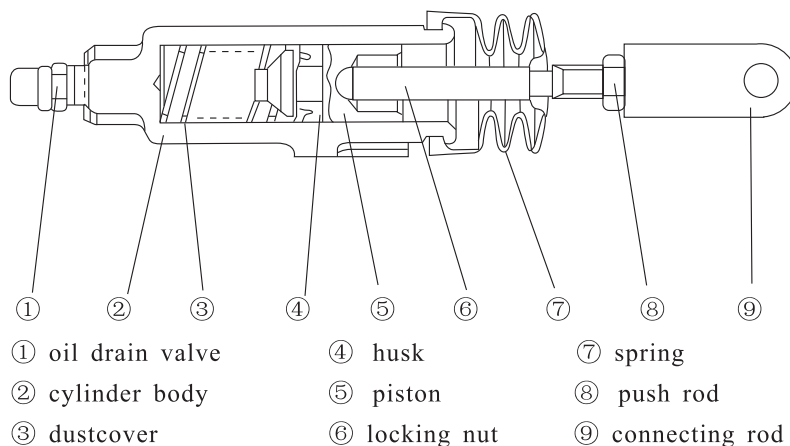


Fig 3-3 Clutch wheel cylinder

3.1.3 the clutch master cylinder

The structure of master cylinder is illustrated in the picture 34, installed on the pedal of clutch and the master cylinder is composed of piston, spring, oil reserving cup and handspike. The movement of pedal is transmitted to the piston through the handspike and transform the power of pedal to the hydraulic power.

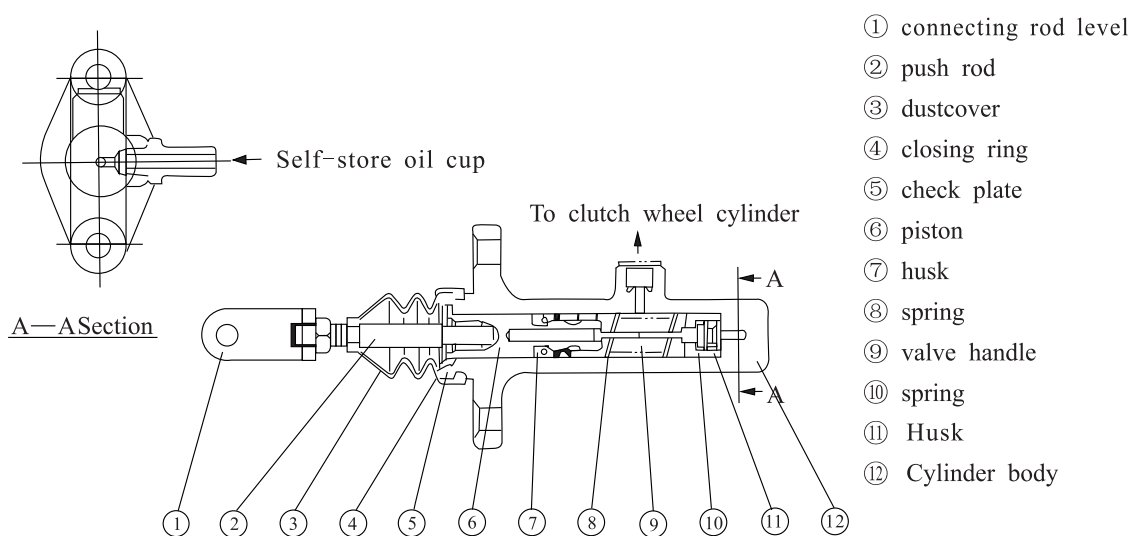


Fig 3-4 Clutch master cylinder

3.1.4 Clutch pedal

The clutch pedal and the brake pedal are installed on the same bracket and its bracket is installed on the transmission, the movement of pedal transmits to the master cylinder, the pedal power transmits into the hydraulic pressure, the hydraulic pressure pushes the rod of the clutch wheel cylinder and transmit the movement to the release release yoke.

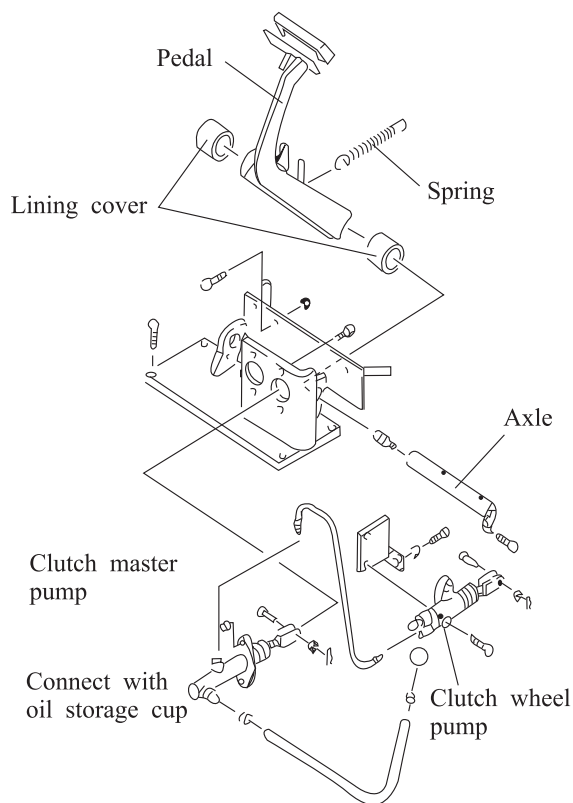


Fig 3-5 Clutch pedal

3.2 Maintenance

3.2.1 the adjustment of the clutch pedal

- (1) Remove the floorboard.
- (2) Loose the locking nut and tighten the bolts.
- (3) Rotate the stopping bolt left and right in order to adjust the height of the pedal.
- (4) Twist the locking nut and install the floorboard.

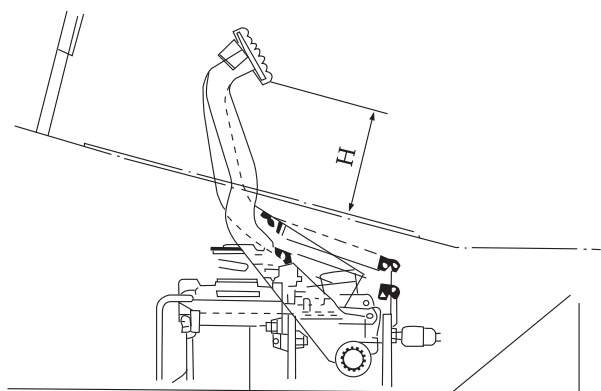


Fig 3-6 Clutch height pedal

		Height	Free path
K21	1.0—1.8t	105	10
	2.0—3.0t	118	10
K25	2.0—3.0t	120	10
C240	1.0—1.8t	105	10
	2.0—3.0t	110	10
NB485	1.0—1.8t	107	10
4JG2	2.0—3.0t	116	10

3.2.2 replace the friction plate

- (1) Remove the lid of clutch housing;
- (2) Step the pedal and use the screw to retreat the pressure disk;
- (3) Rotate the moving screw left and make the driving axis into the transmission;
- (4) Remove the fixed screw of the lid and the friction plate;
- (5) Furnish the new friction plate and the long transmission gearbox;

Note: Ensure the key of driving axis into the key of friction plate.

- (6) Move the screw and twist the torque: 10.9-12.1kg. m
- (7) Furnish the pressing disk on the flying wheel;
- (8) Step the pedal and remove the screw;
- (9) Check the free course of the pedal and adjust when necessary (the free course: 10mm);
- (10) Make the separate rock arm and the stopping screw keep the distance of 14mm.

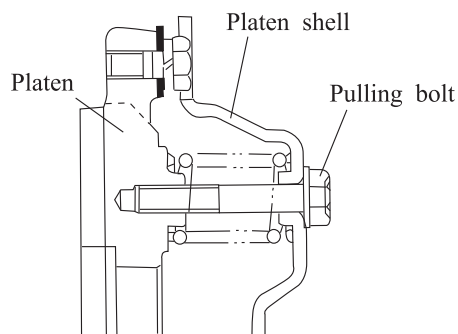


Fig 3-7 Pulling bolt

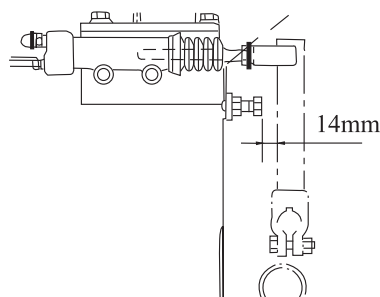


Fig 3-8 Cluster wheel cylinder adjustment

4. The mechanic transmission equipment

The mechanic transmission	
Type	Manual shift, slide synchronous engage switch Forward two and backward two
Stop number	
Gear ratio: Forward one gear/2 gear	42.2246/18.2665
Backward one gear/2 gear	41.6006/17.9962

4.1 Summary

The mechanic gear consists of the gearbox and speed-discrepancy equipment.

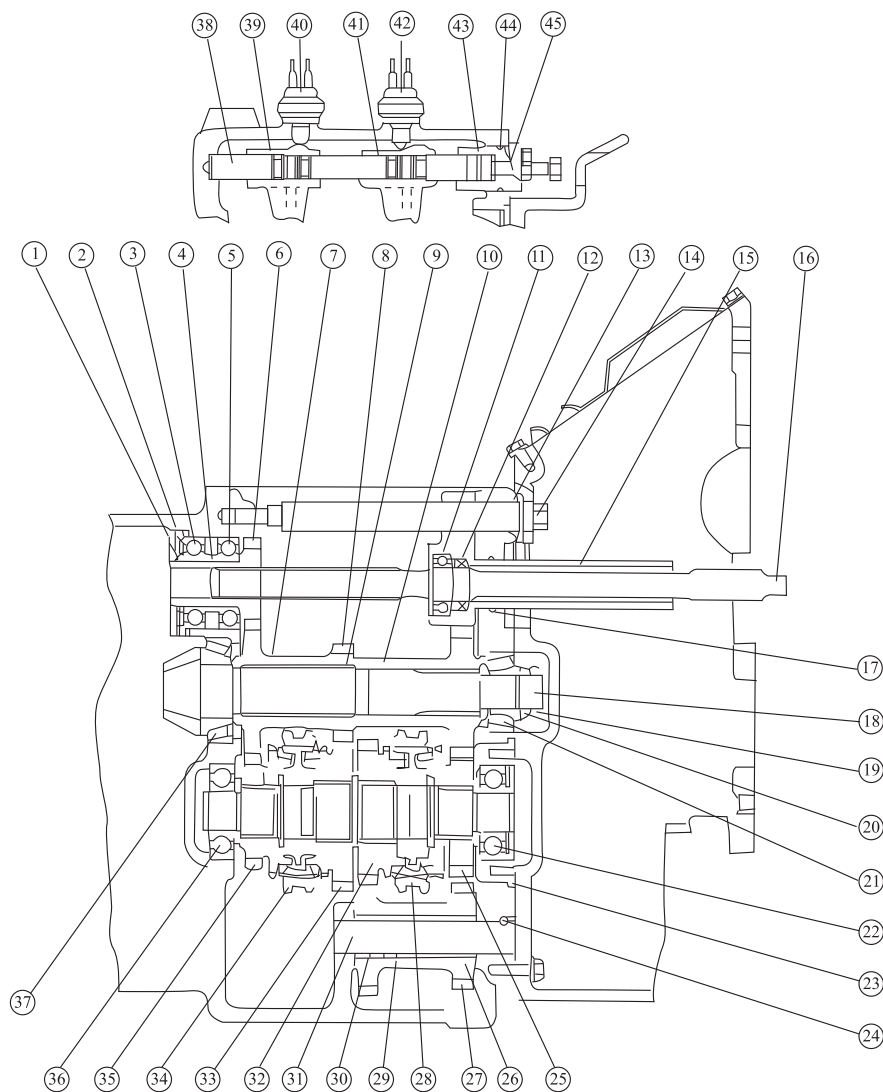


Fig 4-1 Synchronizer gear box

- | | | | |
|----------------------|---------------------------|----------------------|---------------------------|
| (1) Spring retainer | (13) "O" ring | (25) "Forward" gear | (37) Taper roller bearing |
| (2) Spring retainer | (14) slide bolt | (26) needle bearing | (38) transmission lever |
| (3) Ball bearing | (15) cage | (27) reverse gear | (39) fork |
| (4) Cage ring | (16) drive axle | (28) on-off hub | (40) zero position switch |
| (5) Ball bearing | (17) "O" ring | (29) case ring | (41) fork |
| (6) Drive gear | (18) drive gear | (30) needle bearing | (42) backup lamp switch |
| (7) Needle bearing | (19) locking nut | (31) shaft "O" ring | (43) "O" ring |
| (8) Combination gear | (20) adjusting nut | (32) "reverse" gear | (44) "O" ring |
| (9) Needle bearing | (21) Taper roller bearing | (33) low speed gear | (45) -axle ring |
| (10) Cage ring | (22) ball bearing | (34) on-off hub | |
| (11) Ball bearing | (23) cage | (35) high speed gear | |
| (12) Oil seal | (24) rigid frame | (36) ball bearing | |

4. 1. 1 the transmission with the synchronizer

(1) The dynamic transmission

The mechanic transmission mainly consists of an axis, an output axis and an inert axis. Every axis has one kind or several kinds of gears and these gears use the knob to shift the gear through the synchronizer on the major axis and transmit the power to the driving steel by the output axis through the low —speed gear, the differential and the semi axle.

The neutral gear (the middle position) —the power from the drive axle transmits to the high—speed gear (6) and the low—speed gear (11) through the import gear (2) the dual articulated gear (3) and (4). But since the shift of controlling speed and direction is on the neutral gear, the output gear of the major axis and the output axis cannot twist and the power cannot be output.

The shift position—when moving the transmitting shift rod, the fork accompanies the gear and moves through the synchronizer to coincide with the gear. The procedure of power transmission is as following: the drive axle —import gear — dual articulated gear — high speed gear or low speed gear — synchronizer —major axle — synchronizer —the backward gear and the forward gear —output gear —output axle to achieve the power output.

The procedure of power transmission during the forward first gear:

1-2-3-4-11-10-8-9-12-16-15-17-18-5-21

The procedure of power transmission during the forward second gear

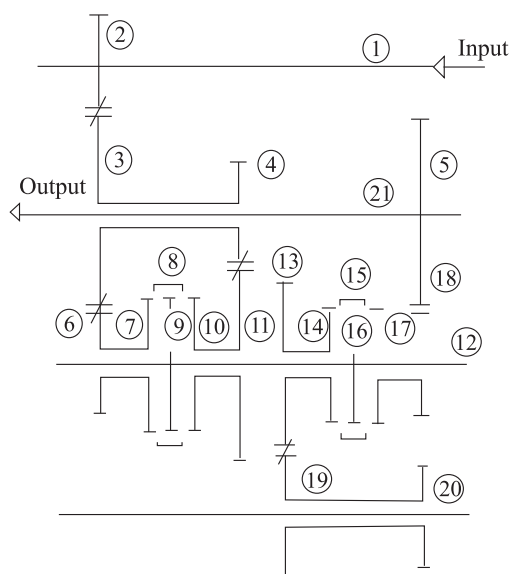
1-2-3-6-7-8-9-12-16-15-17-18-5-21

The procedure of power transmission during the backward first gear

1-2-3-4-11-10-8-9-12-16-15-14-13-19-20-5-21

The procedure of power transmission during the backward second gear

1-2-3-6-7-8-9-12-16-15-14-13-19-20-5-21

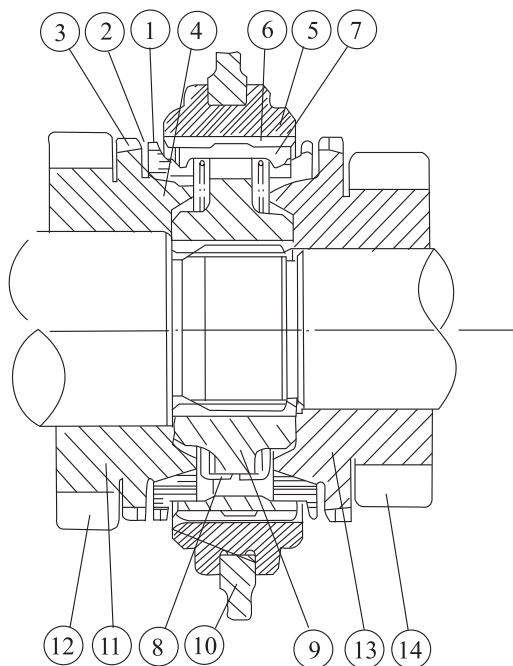


- | | |
|--------------------------|-----------------------|
| 1. drive axle | 12. main axle |
| 2. drive gear | 13. reverse gear |
| 3. dual articulated gear | 14. synchron cover |
| 4. dual articulated gear | 15. adapting cover |
| 5. driven gear | 16. clutch driven hub |
| 6. high speed gear | 17. synchron wimble |
| 7. synchron wimble | 18. forward gear |
| 8. adapting cover | 19. reverse gear |
| 9. clutch driven hub | 20. reverse gear |
| 10. synchron wimble | 21. driven axle |
| 11. low speed gear | |

Fig 4-2 Dynamic Transmission

(2) The synchronizer

The synchronizer makes the gear rotate simultaneously, avoiding gear collision when shifting the gear, especially when changing the direction. The synchronizer can make the gearshift smoothly.



- | |
|--------------------------------|
| 1. synchron ring spline tooth |
| 2. synchron ring |
| 3. the spline tooth of gear 11 |
| 4. synchron wimble |
| 5. adapting cover |
| 6. the spline tooth of 5 |
| 7. quad |
| 8. spring |
| 9. clutch driven hub |
| 10. fork |
| 11. constant mesh gears |
| 12. the tooth of gear 11 |
| 13. constant mesh gears |
| 14. the tooth of gear 13 |

Fig 4-3 Synchronizer

The synchronizer is composed mainly of the synchronous awl (a), the synchronous ring (b), and the quad (c).

(A): The synchronous awl: the gear (11) (or 13) combines the synchronous ring (2) and the gear cover (5) through the plate friction and the spine tooth.

(B) The synchronous ring: the synchronous ring has an awl and cooperates with the synchronous awl through the friction surface of the awl. Three fillisters are allocated evenly along the synchronous ring. The three troughs, the spine of gear cover and the spine of synchronous ring are relatively aiming so as to press the half through the spine of gear cover.

(C): Quad: the middle convex part of the three quad is packed into the spine of gear cover and its two sides embedded into the respective three fillisters of the synchronous ring and press the quad into the top of spine trough through two springs, the outward spring power is convenient that the spine tooth of synchronous ring can often be located in the middle position.

To operate the synchronous gear, follow the following six procedures from the neutral gear to intermeshing, illustrated: to regard the gear of picture 4-3 as one example of the process of synchronization.

The First step:

Through the power on the gear lever during the gear shift, through the fork to transmit the power to the gear covering, the gear covering (5) and the quad (7) move a distance of x_1 and x_2 towards the gear along the axle, at that time, the middle convex part of the quad still mesh with gear covering.

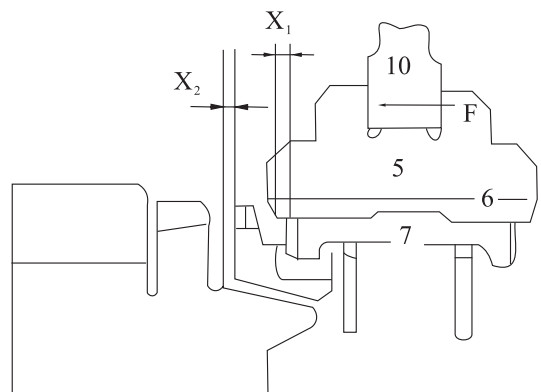


Fig 4-4

The second step:

After eliminating the distance between x_1 and x_2 , the power then adds to the quad the synchronous ring and the friction surface of synchronous awl. The power which overcomes the power of spring lead to the lean of the quad and forms the touch of bevels as the picture indicated and the gear covering moves the distance of Z under this power.

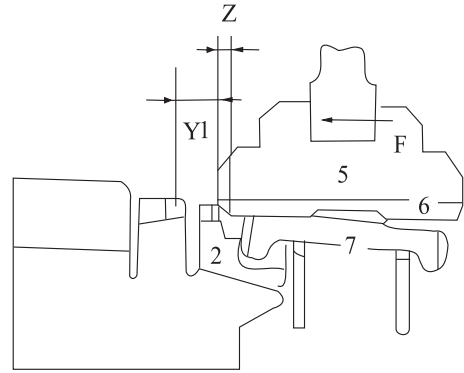


Fig 4-5

The third step:

Produce the friction torque on the friction surface of synchronous awl through the power acting on the synchronous ring by the quad and makes the synchronous ring rotate an angle. One side of the fillister of of synchronous ring touches the side of quad and makes the gear covering and the synchronous ring in the middle position.

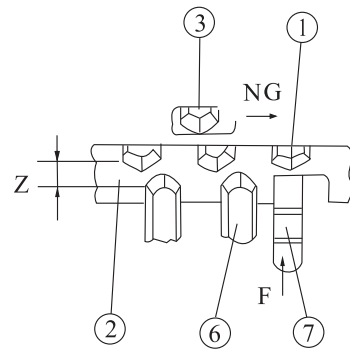


Fig 4-6

The fourth step:

After finishing the third step, the synchronous gear covering has moved the distance of Z so as to make (15) the spine tooth of synchronous ring (1) to touch the chamfer of spine of gear covering, meanwhile reach the necessary friction torque (T_c) on the surface of the synchronous awl, the original inertia torque (T_i) of the gear becomes lesser, that is $T_i < T_c$, the process of intermeshing becomes synchronous.

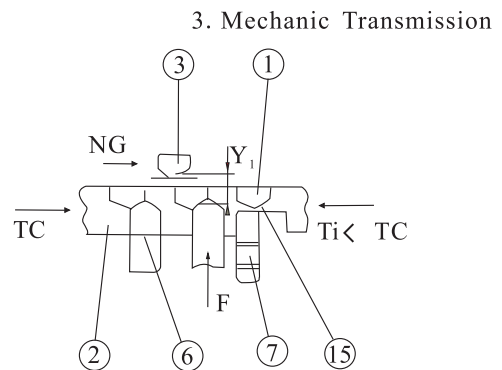


Fig 4-7

The fifth step:

When the relative gap of speed between the synchronous gear (11) and the gear covering (5) is zero, the inertia torque ($T_i=0$) makes the speed of gear (11) the same as the speed of main axle, that is the friction torque overcome the inertia torque and accomplish the synchronization. At that time because of the continuous axial force, the synchronous ring has rotated an angle in the direction of the circumference and make the gear among the (3), at the same time, the synchronous ring becomes the floating condition and makes the gear covering pass through the synchronous ring smoothly.

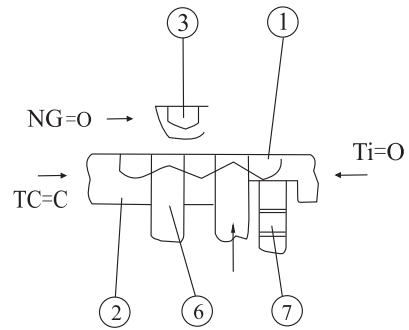


Fig 4-8

The sixth step:

After the gear covering passes through the synchronous ring, then it moves the Y1 distance to touch the chamfer of the spine of gear covering and that of the spine of gear, since the touch of chamfer adds the torque TG to gear (3) through the spine tooth of gear covering to make the gear rotate an angle along the direction of circumference relative to the gear covering so that the spine of gear covering passes through the spine tooth of gear and the synchronous course has finished. The power has been passed on from the hub, the gear covering, and the gear to the outside through the main axis separator and achieves the process of gearshift.

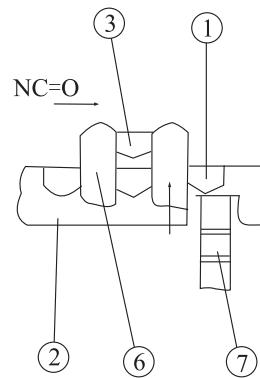
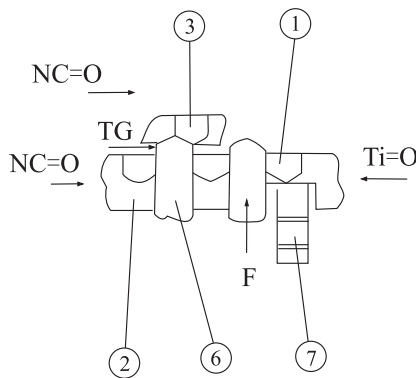


Fig 4-9

4. 1. 2 The reducer and differential

The reducer is located at the front of the transmission and this structure decreased the rotation speed from the output axis of transmission and increased the torque from the output axis, then transmits the torque to the differential. The reducer mainly consists of the small bevel gear on the output axis, the big bevel gear and a piece of small gear axis. The big bevel gear is installed on the small gear axis through spine, the two sides of small gear axis are all supported by cone bearing and the cushion adjusts the vacancy.

The differential is installed on the former half of the shell through the bearing of the gear at both sides and its former part is connected with the axle housing, the shell of differential is made the style of the left-and-right separator and has two semi axis gear, the four planet gear. The thrust washer is installed among the differential shell and gear and leave vacancy among the gear. The planet gear is supported by the gear axis 1 and 2, the gear axis 1 is fixed on the differential shell by pin, and the gear1 is fixed on the differential shell by the screw.

The power from the transmission is reduced and produces differential drive by differential and transmits to the wheel through the semi axis gear and semi axis.

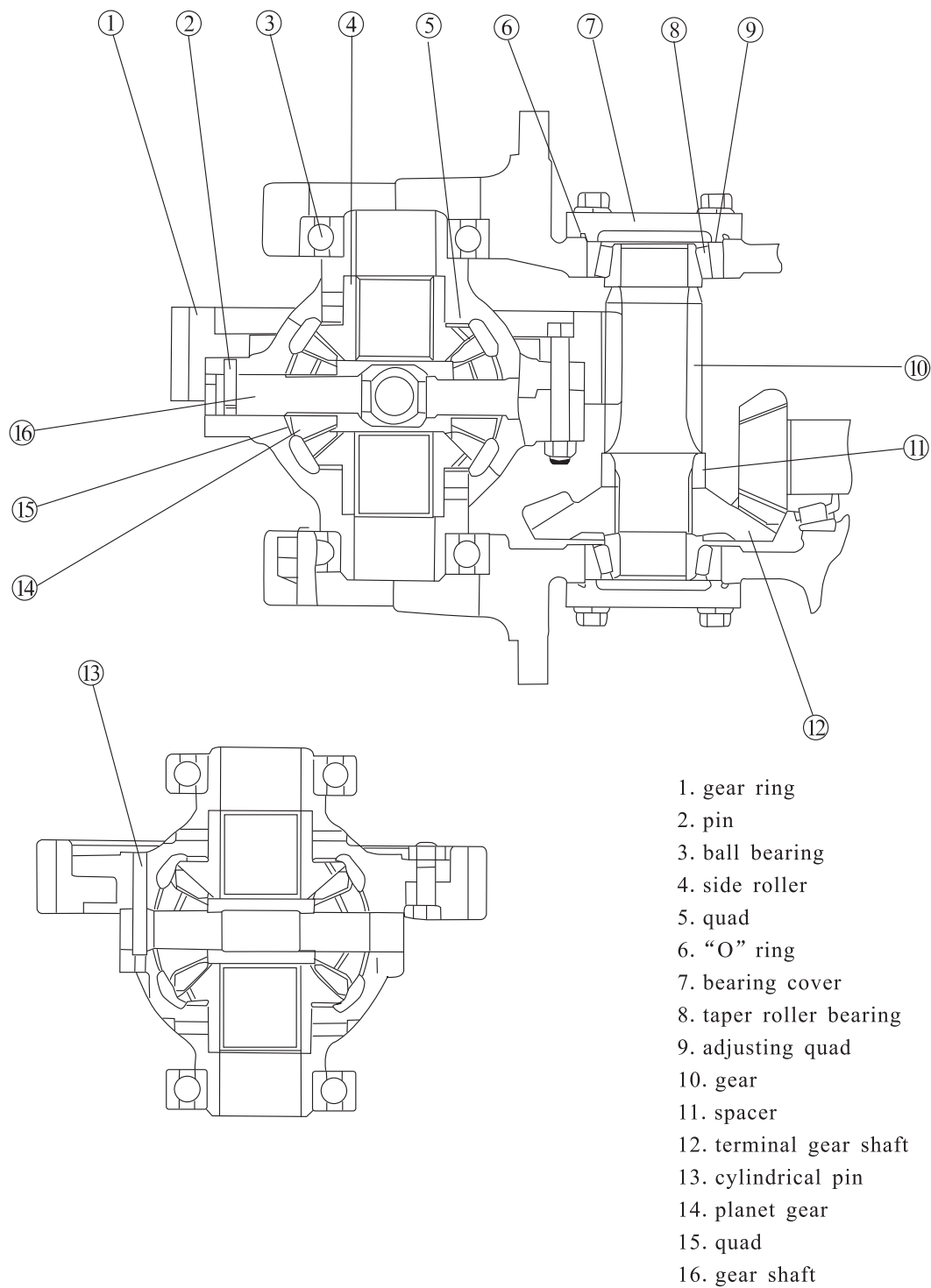


Fig 4-10 Reducer and differential

5. The hydraulic transmission mechanism

The torque-converter	
Type	the three components, the single level, two phases
Torque ratio	3
The fixed pressure	0.5—0.68MPa

The oil pump	
Type	inner gear
Flowing volume	27L/min(200rpm, 1.5Mpa)

The transmission of liquid power	
Type	the changing opposition of power
Forward	17.4972
Backward	17.4972

5.1 Summary

The hydraulic forklift which is installed with the driving equipment and composed of torque converter and transmission (picture 51) , has the following merits:

(1) The mini-valve can make the forklift conduct minute operation in the highspeed or lowspeed of the generator.

(2) The hydraulic clutch is installed with four friction plates and steels with the unique process, which increase the durability of the hydraulic clutch.

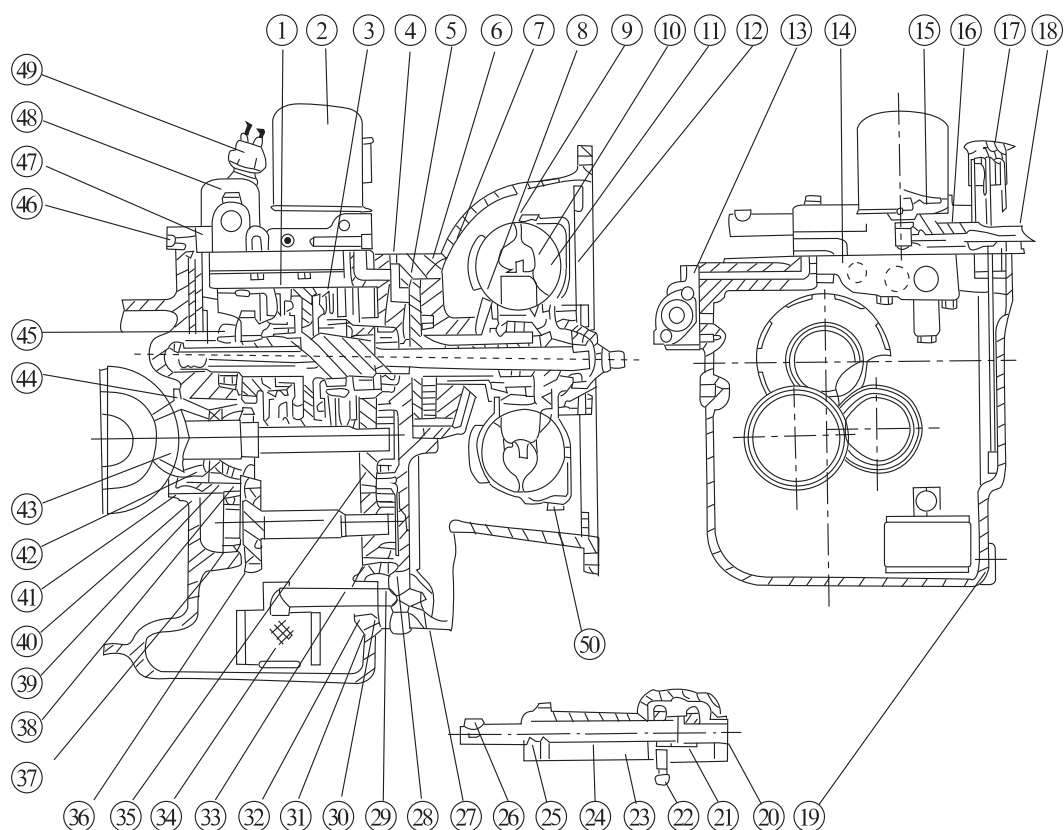


Fig 5-1 Hydraulic Transmission

- | | | |
|-----------------------------------|------------------------------------|-------------------------------------|
| 1. advance clutch | 18. relief valve cap | 35. driven gear |
| 2. filter | 19. hexagon socket head cap screw | 36. idler shaft |
| 3. backup clutch | 20. plug | 37. single row radial ball bearing |
| 4. single row radial ball bearing | 21. spring-type straight pin | 38. bearing nut |
| 5. seal ring | 22. shifting arm | 39. single row radial ball bearing |
| 6. "o" ring | 23. shell cover | 40. "O" ring |
| 7. oil feed pumps assembly | 24. shifting arm axle | 41. oil seal |
| 8. oil seal | 25. "O" ring | 42. single row radial ball bearing |
| 9. and impeller | 26. whither key | 43. driven axle |
| 10. idler pulley | 27. circlip for hole | 44. bearing plate |
| 11. turbine | 28. single row radial ball bearing | 45. single row radial ball bearing. |
| 12. elastic plate assembly | 29. single row radial ball bearing | 46. hexagon socket head cap screw |
| 13. inching valve assembly | 30. "O" ring | 47. shell cover |
| 14. control valve assembly | 31. check ring | 48. fixing bolt |
| 15. piston | 32. "O" ring | 49. backup lamp switch |
| 16. spring | 33. idler | 50. fuel drain plug |
| 17. filler cap | 34. filter | |

(3) The one-way transcending separator installed in the torque converter has improved the efficiency of power transmission.

(4) There is a good filter in the oil-way of torque-converter, which improve the service time of the torque converter.

5.2 The torque converter

The torque converter mainly consists disk of pump, turbine and guide pulley. The disk of pump is driven by import axis. The liquid spurts to the blade lattice of turbine along the blade lattice of pump steel in the effect of centrifugal force and transmit the torque to output axis. The liquid apart from turbine changes the direction with the effect of guide pulley so that some parts of the liquid flow to the pump disk according to the certain angle, at that time produce the counteractive torque to accelerate the guide pulley so that the output torque has bigger counteractive torque value than the import torque. When the rotation speed of turbine has increased and close to the import rotation speed, then the angle change of the liquid flow has decreased and the output torque also has decreased. In order to prevent this situation, the transcending separator in the guide pulley makes the guide pulley rotate freely in the effect of counteractive torque.

This mode of torque converting can guarantee the efficiency and stable operation. The torque converter of the gearing is connected with the flying wheel of generator through the elastic plate and rotates with the rotation of generator, the inner part of the torque-converter is filled with oil of torque-converter, the drive gear is connected with the pump disk by two claws so as to carry the oil pump to provide the oil to the torque-converter and the transmission of hydraulic power. The turbine is connected with the axis of turbine by the spine and the power transmits to the power transmission by the axis of turbine.

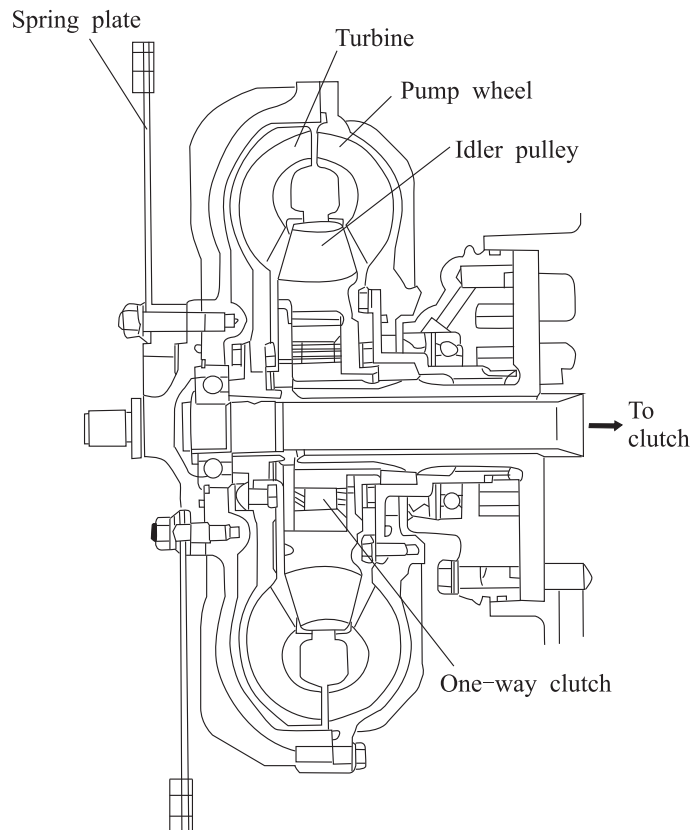


Fig 5-2 Torque-couverter

5.3 The hydraulic clutch

The hydraulic multi-clutch is installed on the import driving axis of the hydraulic transmission and allocating the oil to the forward-and-backward separator through the controlling valve to achieve the forward and backward gearshift. The whole gears of the transmission are the engaged gear. Every separator is composed of the four parting slip (24), four friction plates and a piston, the inner and outer circle of piston are all installed with the seal circle to ensure the seal of the piston during the working time. During the neutral gear, the piston doesn't work and the separate piece is isolated from the friction plate, during the gearshift, the oil pressure affects the piston, the parting slip presses the friction plate with each other. The connecting machine formed by the friction power is used to transmit the power from torque converter to the drive gear (the forward gear4 or the backward gear13).

The power procedure from the torque converter to the hydraulic transmission is following:

Turbine---the import axis assembly---the parting slip---friction piece---forward gear or the backward gear---output axis

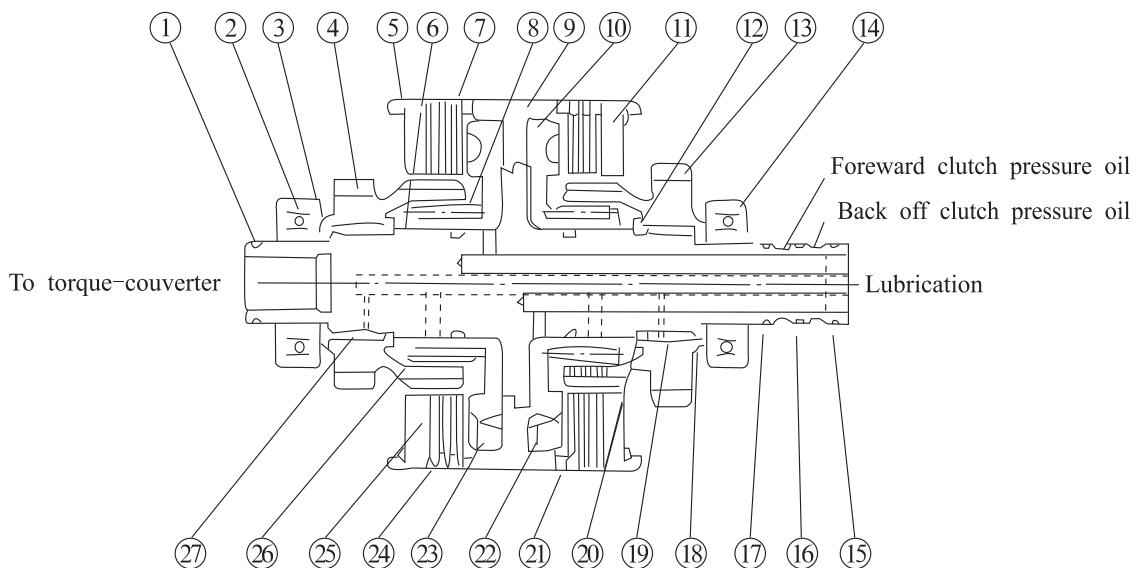


Fig 5-3 hydraulic clutch

- | | | | |
|-------------------------|-----------------------|---------------------|-----------------|
| 1. seal ring | 2. bearing | 3. thrust collar | 4. forward gear |
| 5. retaining ring | 6. elastic check ring | 7. spring seat | 8. "O" ring |
| 9. driven axle assembly | 10. earring | 11. end plate | 12. Collapsible |
| 13. reverse gear | 14. bearing | 15. seal ring A | 16. seal ring A |
| 17. seal ring A | 18. thrust collar | 19. needle Bearing | 20. collapsible |
| 21. elastic check ring | 22. non-return ball | 23. piston assembly | 24. septa |
| 25. friction piece | 26. backward spring | 27. needle bearing | |

5.4 Control valve, flowing valve, minuteness valve

5.4.1 The controlling valve is installed in inner side of the transmission lid, the controlling valve includes three parts: the controlling glide valve, the priority valve, and the adjusting valve. (The picture 5-4)

5.4.2 The priority valve is used to control the oil pressure of the hydraulic separator among 1.1 to 1.7MPa and transmit the oil to the overflowing valve then to the torque converter through it

5.4.3 Adjusting valve: located between the mini—moving valve and the controlling valve, when the controlling valve has opened completely, then the valve has worked to decrease the attack when the hydraulic separator touches.

5.4.4 Overflowing valve: connecting with the transmission shell maintains the oil pressure of lever changing machine among 0.5 to 0.7Mpa to avoid the corrosion.

5.4.5 Inching valve: installed on the outer side of transmission, the rolling of valve is connected with the rod of the mini-pedal, when stepping down the mini pedal, then the roller moves to the right and decreases the oil pressure of hydraulic separator in the short time to reach the effect of mini-moving

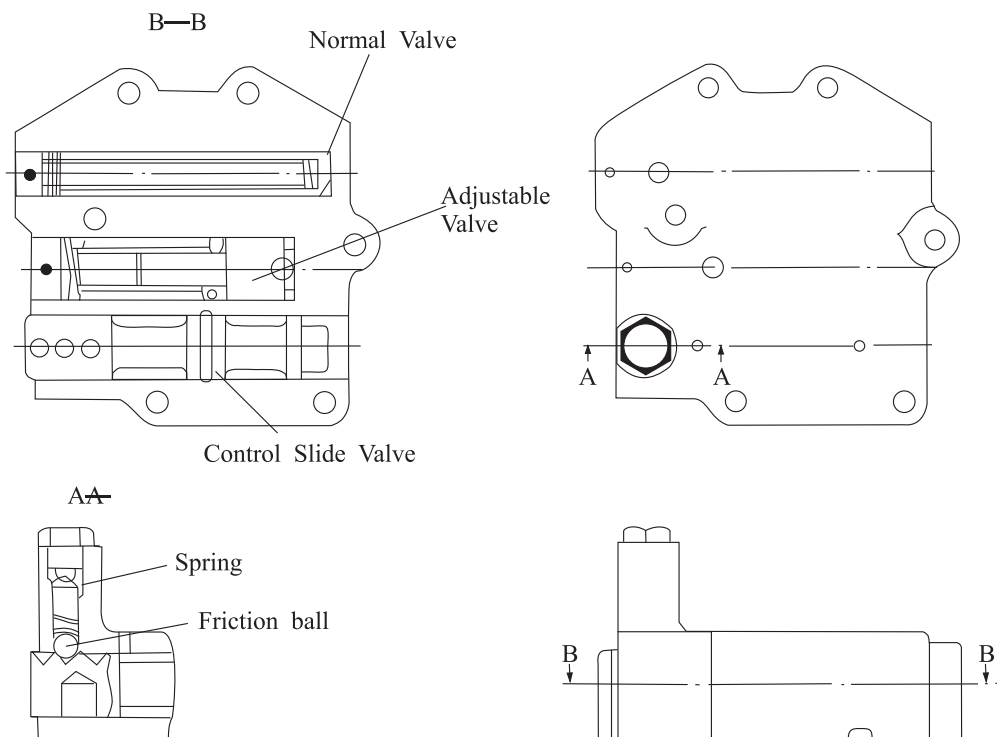


Fig 5-4 Control Valve

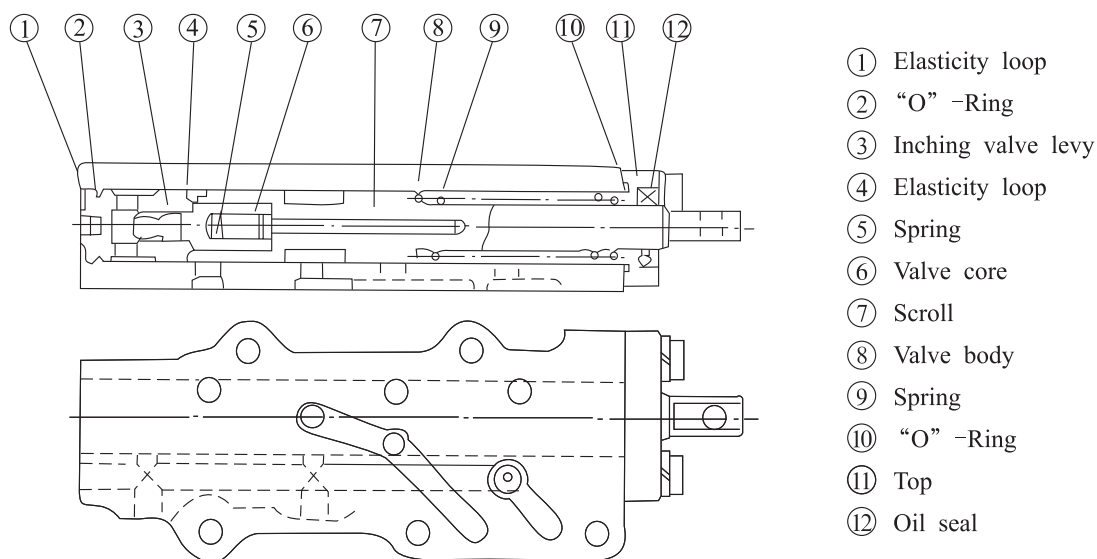


Fig 5-5 Inching valve

5.5 The transmission case shell

In addition to installing the import axis and output axis, the transmission shell also functions as the oil tank, its bottom has the oil filter I (the filter mesh is 150 items) to filter and absorb the oil supplying the pump. The channel oil filter II, the oil lid are installed above the shell lid.

5.6 The oil pump

The oil pump is installed between the torque converter and import axis, using the pump shaft to carry the gear pump composed by a pair of inside engaged gear and supply the torque converter, hydraulic transmission with oil.

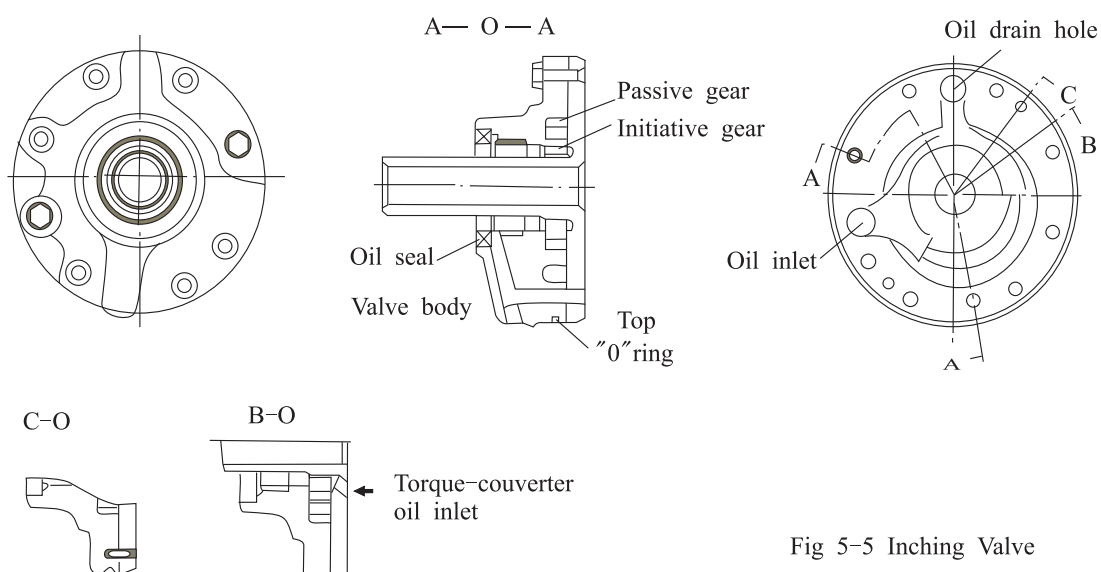


Fig 5-5 Inching Valve

5.7 The hydraulic oil path (the hydraulic gearing)

After the generator starts, the oil feed pump takes out the oil from oil tank (the bottom of transmission case shell) through the oil filter and the oil flows through the controlling valve, dividing the pressure oil into two parts in the valve: the one part is for the hydraulic separator, the other is to supply oil to torque-converter.

The oil needed by the hydraulic separator flows into the fixed pressure valve (the pressure is set to 1.11.4Mpa), the oil from the fixed pressure valve further flows to the inching valve and controlling valve, on the other hand, the oil is also supplied to the leaf wheel of torque-converter through flowing valve the oil from torque-converter is cooled through the oil radiator, then the lubricant hydraulic separator then return to the oil tank.

During the neutral gear, the oil way from the controlling valve to separator is close, at this moment the fixed pressure valve opens and transmits the oil to the torque converter completely through the overflowing valve. When the controlling valve is in the forward and backward position, the oil circuit from the selector to the forward separator or backward separator is integrated so that each separator can work respectively. When a separator works, the parting slip and the friction plate of the other separator are in the isolated condition and are lubricated by the cooling oil and carried away the heat. When the inching pedal operates the inching valve, a small part or a large part of the oil of the separator is sent to the oil tank through the inching valve rod, at that time the oil circulation of the torque-converter is the same during the neutral gear.

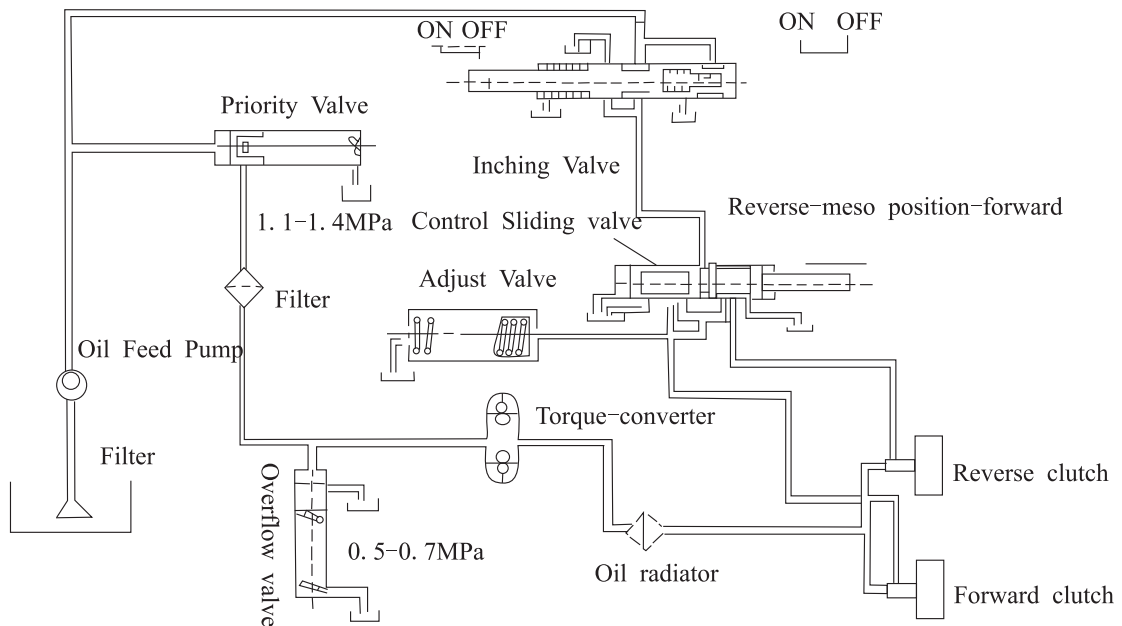


Fig 5-7 Hydraulic oil way

5.8 Drag the forklift to be repaired

When the hydraulic driven forklift is damaged, it needs to be towed by other cars, Pay attention to the following things:

- (1) The semi-axis should be taken down from the front wheel
- (2) The shifting rod should be set to neutral position

5.9 The linking position of oil outlet, the oil pressure and the measurement of oil temperature (see the picture of 5-8)

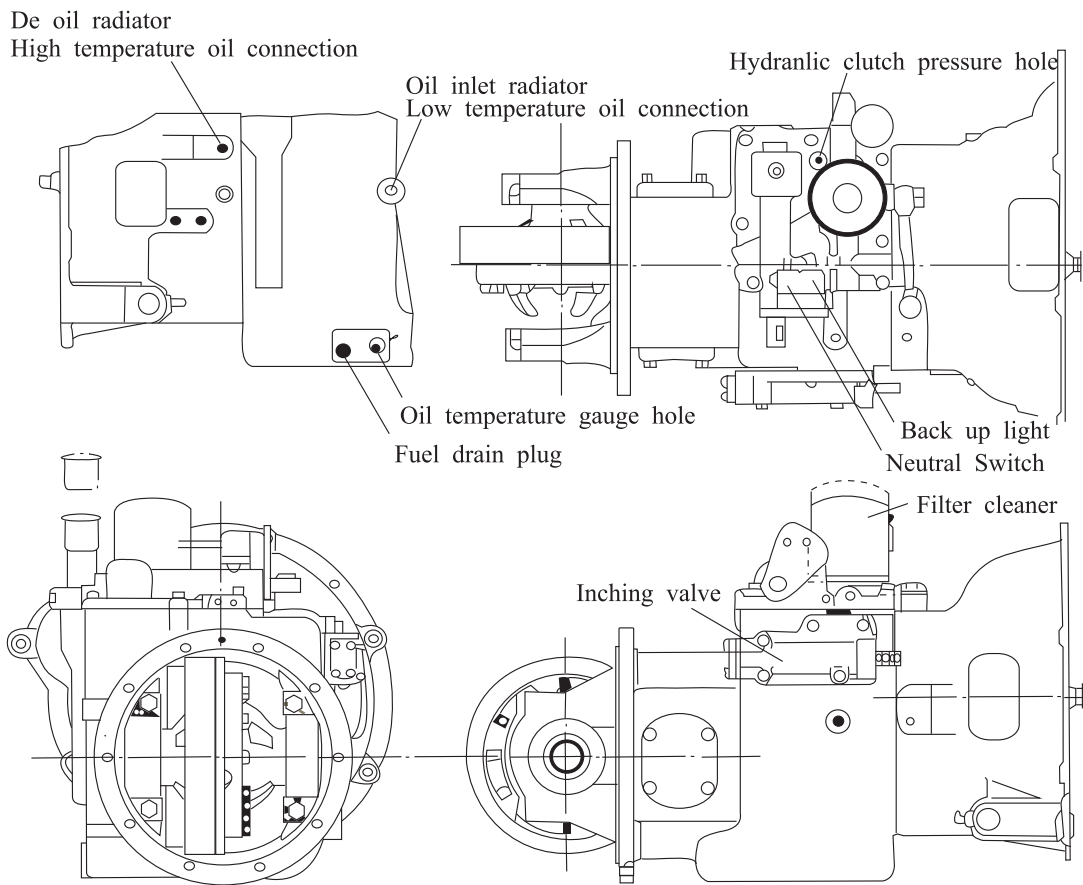


Fig 5-8 Oil temperature and oil pressure survey

6.0 The drive Axle

Model	Front-wheel driving, body of drive bridge fixed with frame, fully suspension				
Tonnage of forklift	1~1.8t	2~2.5t		3~3.5t	
	Single tire	Single tire	Double tire	Single tire	Double tire
The size of tire	2*6.5-10-10PR	2*7.00-12-12PR	4*7.00-12-12PR	2*28*9-15-12PR	*28*9-15-12PR
The size of hub	5.00F-10	5.00S-12	5.00S-12	7.00T-15	7.00T-15
The pressure of tire	0.79MPa	0.86MPa		0.83MPa	

6.1 Summary

The drive axle mainly consists of the housing, the wheel-hubs, the half-shafts and the brakes. The housing is an integrally cast. The tire with the rim is fixed to the hub with studs and nuts. The power is transmitted to the half-shafts through the differential and drives the front wheels through the hubs. Each hub is fixed on the housing with two tapered roll bearings. So that the half-shafts bear only the torque transmitted to the hubs. In the inside of the hub are oil seals to prevent water and dust from entering or oil leakage. The rim and the pressure of the front wheel.

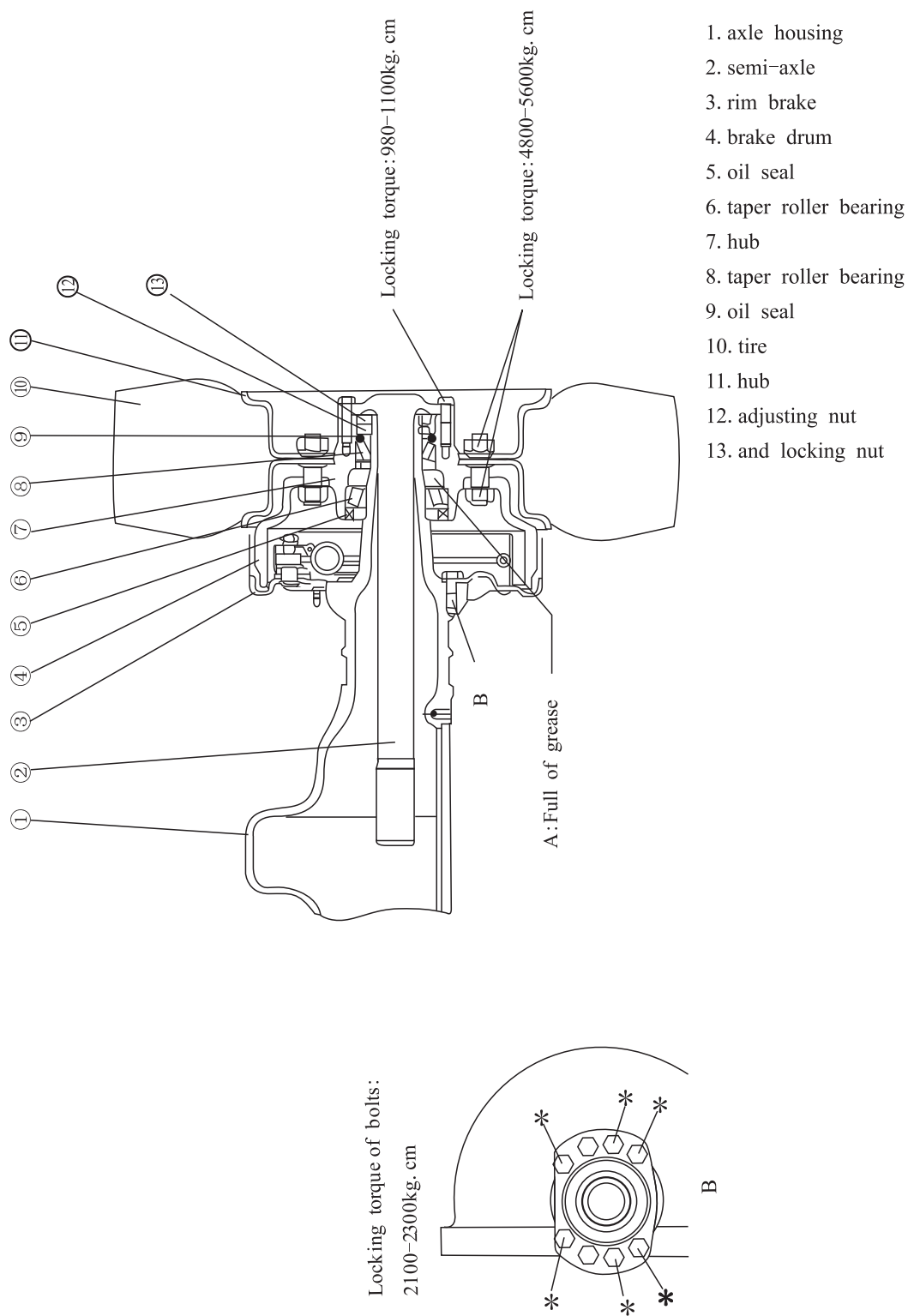


Fig 6—1 Differential

6.2 Inspection on Reassembly of Wheel hub

(1) Fill the chamber of wheel hub with lubricating grease about 100cc. then install it on the axis.

(2) Screw down the hub nut with a torque of 1kg. m, and then loosen it for 1/2 turn.

(3) Measure the torque value that the wheel hub starts rotating. When the torque value measured is up to 5-15kg. m, screw down the hub nut.

(4) Screw down the locking nut and lock the locking pin.

(5) Assembling

Fix the drain tap and the cover on the tire, and screw down wheel-rim bolts.

Note

(a): The drain tap is on the harelip of rim and face outside.

(B): the end of rimbolt should be the same direction with drain tap

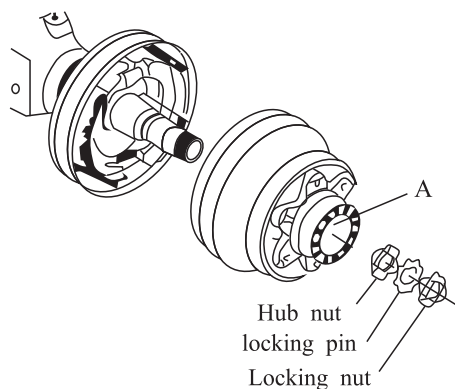


Fig. 6-2 Adding grease

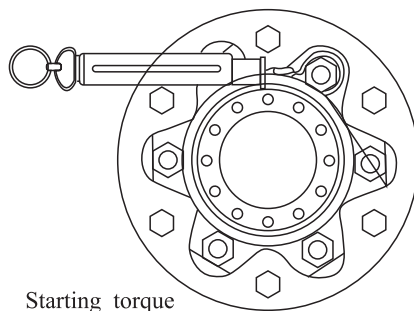


Fig. 6-3 Measure the starting torque

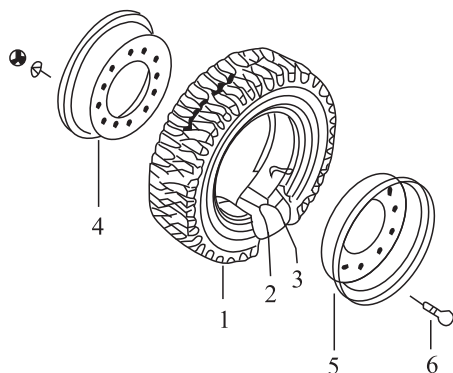


Fig. 6-4 Assembly of tire

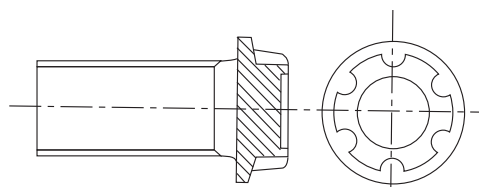
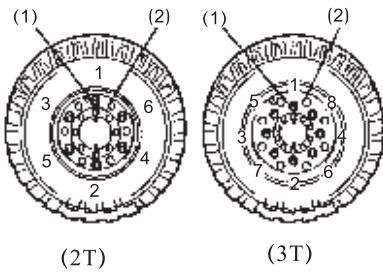


Fig. 6-3 Wheel bolt structure

- | | |
|---------------|---------------|
| 1. tire | 4. inner tire |
| 2. valve stem | 5. outer tire |
| 3. nut cap | 6. rim bolt |

Front wheels



(1) Hub nuts

(2) Rim nuts

(Never loose without removing the air)

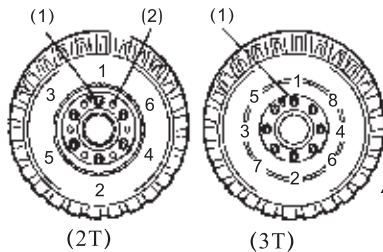
1. Unload the vehicle and place it on level ground .
2. Set the parking brake and chock the wheels . Locate the jack-up point on the bottom surface of the frame in the rear of a front tire . Securely insert the jack there .Confirm that the jack is properly positioned .

3. Jack up to just prior to the wheels coming up off the ground and loosen the hub nuts .

4. Jack up until the wheels come off the ground . Completely remove the air pressure from tires then remove the hub nuts and remove the wheels .

5. To reinstall the wheels after changing a tire , perform the steps for removing in reverse order . The hub nuts should be tightened evenly and in the sequence shown in the figure .

6. After replacing the wheel, check and adjust the tire pressure.



(1) Hub nuts

(2) Rim nuts

(Never loose without removing the air)

Rear wheels

1. Place the vehicle on level ground .

2. Set the parking brake and chock the wheels then insert the jack under the weight .

⚠Caution

Never loosen divided rim nuts .Should any of the nuts be found loose or otherwise abnormal , deflate tires and then loosen hub nuts to remove the tires .

Changing tires

⚠Caution

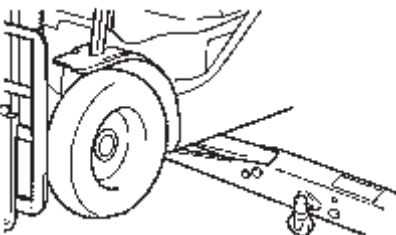
. Use proper safety precautions when jacking the vehicle .

Never get under the forks or frame .

. In the case of a wheel with a divided rim , do not loosen the rim bolts and nuts when loosening the hub nuts . When loosening the rim nuts or removing the rim bolts , be sure to completely remove the air before loosening .

. Refer to service data for hub nut tightening torque and tire air pressure .

. Tire air pressure is very high , so pay attention to rim deformation , cracks , etc .Never exceed proper air pressure .



. Do not replace any tire without turning on the ignition switch before jacking up the vehicle . Upon completion of the tire replacement , return the ignition switch to the OFF position (SAS models .)

7. Steering system

Project \ Forklift type		1~1. 8t	2~2. 5t	3~3. 5t
Type		Real wheel steering		
The type of redirector		Arbitral		
The number of redirector		BZZ-100		
The turning Cylinder	Model	Double-action piston		
	Diameter of cylinder	70		
	Diameter of the piston pile	50		
	Distance	160		
Rated pressure		7		9
Radius of steering wheel		$\Phi 300$		
Specification of tire		5. 00-8-8PR	6. 00-9-10PR	6. 50-10-10PR
The air pressure of tire		1MPa	0.86MPa	0.79MPa

7. 1 Summary

The steering system mainly consists of the steering wheel, the steering axle and the steering unit, the steering axle connects with the steering unit by joint and the link connects with the steering wheelby joint The column can lean to the appropriate position both forward and backward. (Picture7-1)

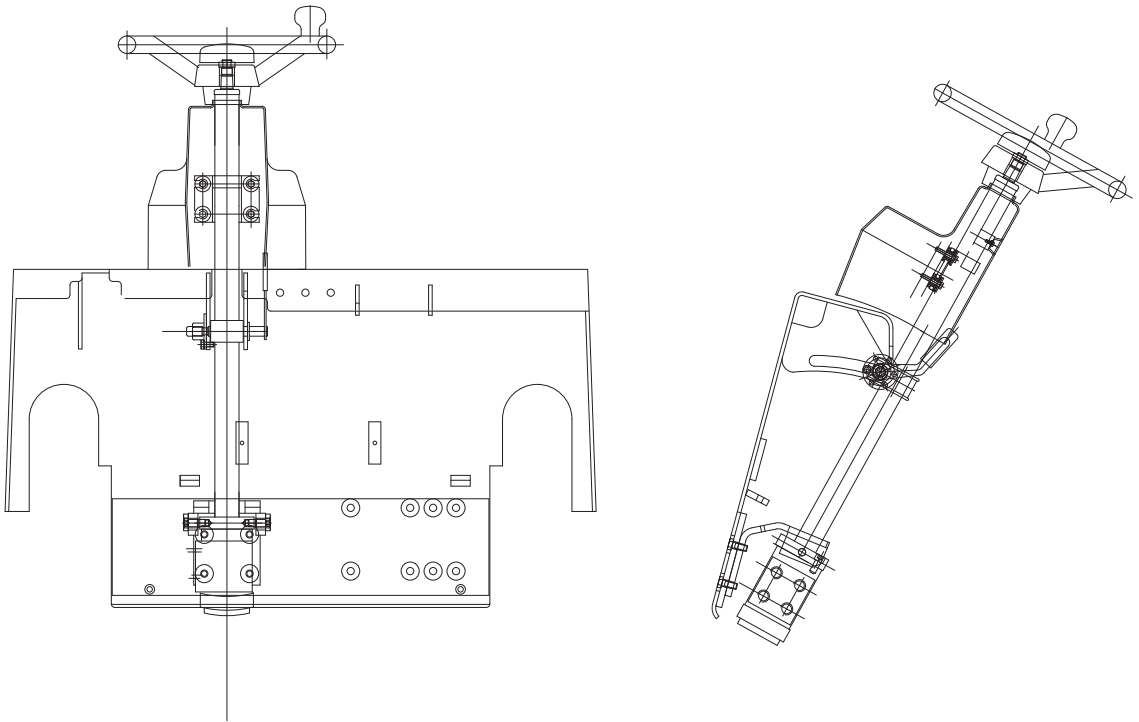


Fig 7-1 Turning control device

7.2 Arbitral

The arbitral (picture 7-2) can transmit the pressure oil from the valve to the steering cylinder by the channel according to the angle measurement. When the generator extinguishes, then the oil pump can not provide oil and can be rotated by manpower.

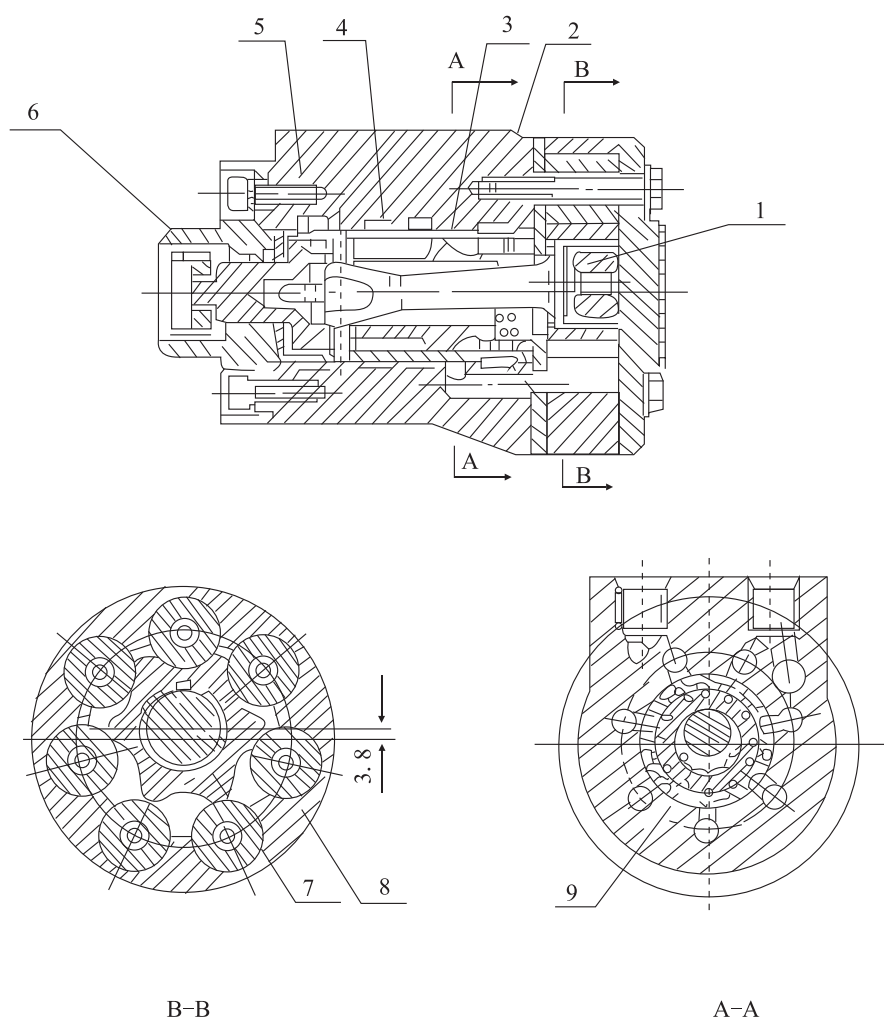


Fig. 7-2 Full hydraulic redirector

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

7.3 The inspect after reassembling the steering system

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

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

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

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

8. Steering axle

8.1 General Description

The steering axle is of section-boxed welded construction type. (Picture 8-1). It consists of the axle body, the steering cylinder, the link, the knuckle and the steering wheel. The steering trapezoid uses the curved handle and the slippery piece, the pressure oil accelerate the joint to twist by the piston rod of cylinder through the link and make the roller twist. The steering axle is connected with the back bracket by the buffering machine.

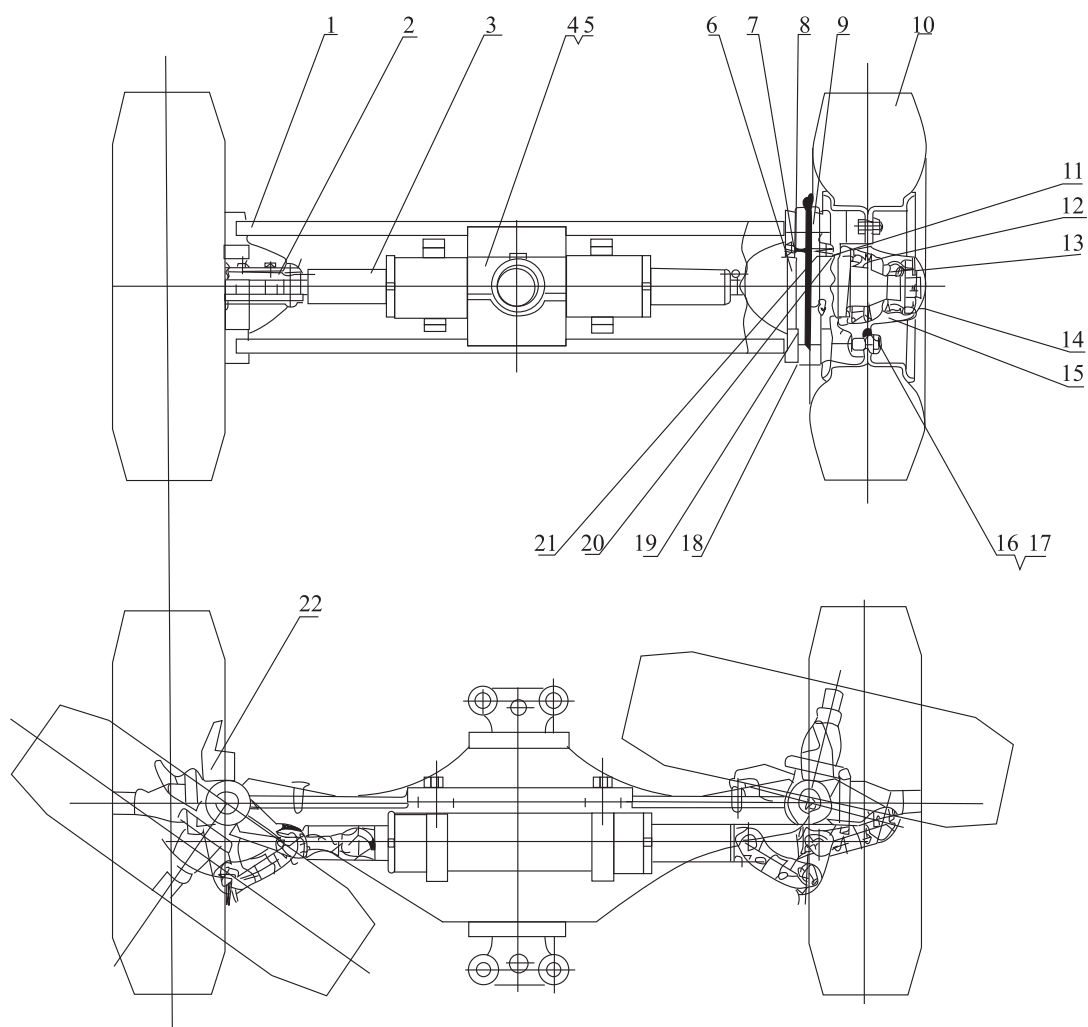


Fig. 8-1 Steering axle

- | | | |
|---------------------------|-------------------------|-------------------------------|
| 1. steering axle body | 2. connecting rod level | 3. steering cylinder |
| 4. back axle seat | 5. bushing | 6. clockwise knuckle assembly |
| 7. thrust bearing | 8. needle-bearing | 9. knuckle main pin |
| 10. tire | 11. oil seal | 12. taper roller bearing |
| 13. taper roller bearing | 14. hub cover | 15. hub |
| 16. hub bolts | 17. hub nut | 18. oil seal |
| 19. "O" ring | 20. bushing | 21. dustproof cover |
| 22. left knuckle assembly | | |

8.2 Steering knuckle and steering main pin

The steering knuckle is installed between the upper and lower of steering axle by the steering main pin, tapered rolling bearing, dust-proof cover and “o” ring, the top of the main pin is fixed on the body by check pin, the down of the main pin is fixed on the body using nuts.

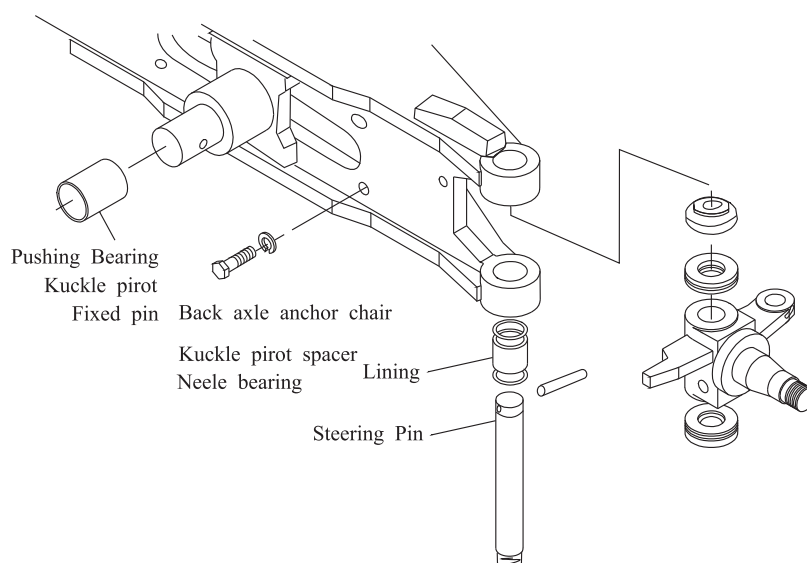


Fig. 8-2 Kuckle pirot

8.3 Hub

Hub is installed on the knuckle by two Tapered roll bearing, tire is installed to hub by rim, there is oil seal in the inner side of bearing, maintaining the lubrication oil in the hub and cavity of knuckle, adjust the tightness of the bearing with nuts

8.4 steering cylinder

The steering cylinder is of double-action piston type. The seal components of piston adopts the combination seal of supporting pin and “O” ring, the cover and rod of piston adopts YX Shaft seal ring, through the cover in both side to fasten the steering cylinder to the steering axle.

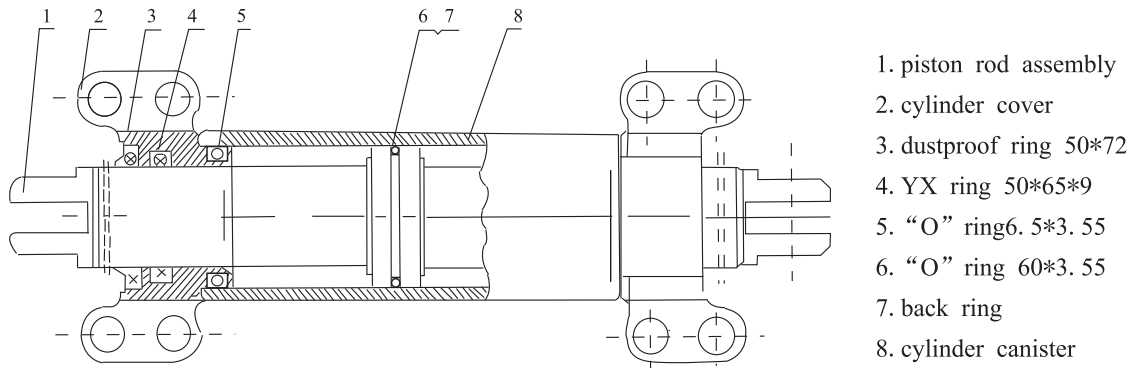


Fig. 8-3 Steering cylinder

8.5 Rear Wheel bearing pre-load adjustment

(1) Shown in 8-4. Fill up the chamber formed by wheel hub bearing and wheel hub covers with lubricating grease. Coat the lips of the oil seals with lubricating grease.

(2) Press the hub bearing into the hub and fit the hub on the knuckle shaft.

(3) Fit a flat washer and tighten a castle nut to a torque of 206–235Nm (21–24kgm), and loosen it, and then tighten it, and then tighten it again to a torque of 9.8N.m (1kgm).

(4) To ensure firm installation of the hub, slightly knock at it with a wooden hammer and in the meantime, rotate the hub for 3–4 turns.

(5) Tighten the castle nut and align one of its notches with a cotter pin hole drilled in the steering knuckle.

(6) Again slightly knock at the hub with a wooden hammer and in this time. Rotate manually the hub to ensure its smooth rotation with a specified torque of 2.94–7.8N.m (0.3–0.8kgm).

(7) If the torque value necessary to rotate the hub is more than the specified one above mentioned, screw out the castle nut for 1/6 turn and measure the torque value.

(8) When the torque value measured is up to the specified one. Lock the castle nut with a cotter pin.

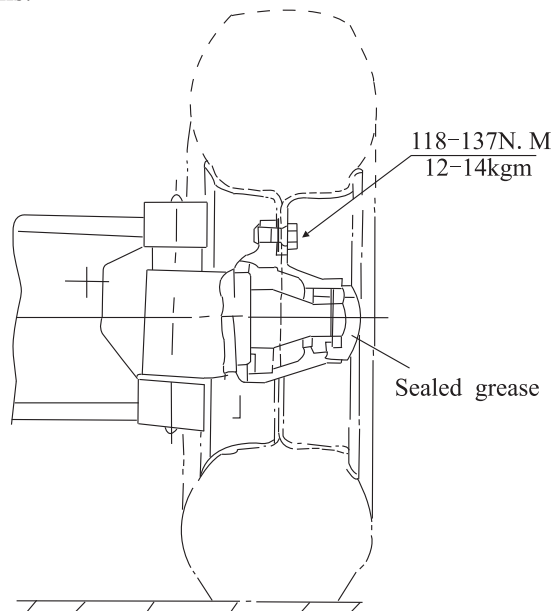


Fig. 8-4 Pre-load adjustment

9, Braking system

Model: Front-double brake, internal swell, hydraulic			
Ratio of brake pedal: 5.66			
Cylinder diameter of main pump: 19.05mm			
Wheel brake	1~1.8t	2~2.5t	3~3.5t
Model: with brake mechanism			
Cylinder diameter of operating cylinder:	22.22mm	28.58mm	
The size of friction plate (l*w*t)	279*48.5*5mm	324*60*7mm	348*76*8mm
Area of friction plate	135.3cm*4	194.4cm*4	264cm*4
Inner diameter of brake drum:	254mm	310mm	314mm
Wheel brake Front-double brake, internal swell, hydraulic			

9.1 Summary

The brake system is the front two-wheel braking type consisting of a master cylinder, wheel brakes and brake pedal mechanism.

9.1.1 Brake pedal

The structure of the brake pedal is shown in fig. 2-19-1, install it on the transmission through the bracket, when the pedal is moving, it accelerates the lever to move the piston and increase the pressure of oil circuit.

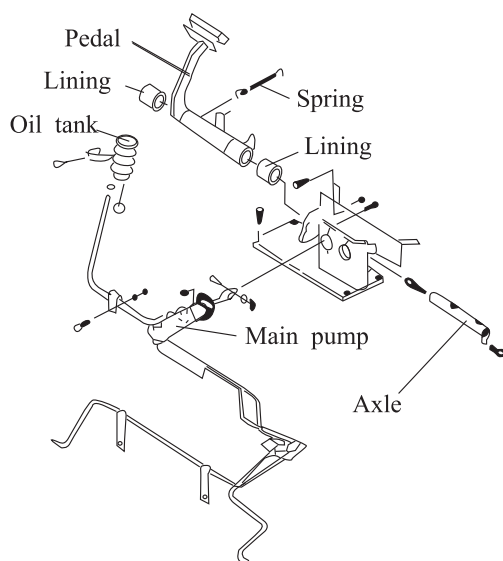


Fig. 9-1 Braking Pedal (Machauical)

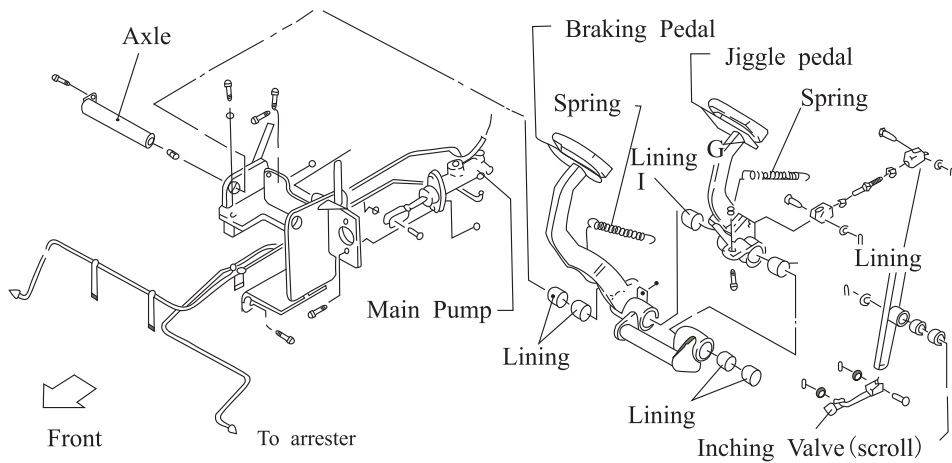


Fig. 9-2 Braking Pedal (Hydraulic)

9. 1. 2 the master cylinder

The master cylinder contains valve supports, check valve, return spring, primary cup, piston and secondary cup, which are all kept in place with a stop washer and a stop wire. The exterior of the cylinder is protected from dust by means of a rubber dust cover. The piston is actuated through the push rod by operation of the brake pedal. As the brake pedal is pressed, the push rod pushes the piston forwards. The brake fluid in the cylinder flow back to the reserve tank through the return port until the primary cup blocks up the return port . After the primary cup passes through the return port, the brake fluid in the cylinder is pressurized and opens the check valve, flowing through the brake pipeline to the operating cylinder; thus, each operating cylinder piston is forced outwards . This brings the friction pieces on the brake shoes into contact with the brake drum and slows or stops the truck. Meanwhile , the cavity caused behind the piston is filled with brake fluid led through the return port and inlet port. When the brake pedal is released. The piston is forced back by the return spring. At the same time. The brake fluid in each operating cylinder is pressurized by the return spring. Returning into the master cylinder through the check valve. With the piston in the original position, the fluid in the master cylinder flow into the reserve than through the return port. The brake fluid in the brake pipeline and the operating cylinders has a residual pressure proportioned to the set pressure of the check valve, which makes each operating cylinder piston cup securely seated to prevent oil leakage and eliminates a possibility of air locking when the truck is sharply braked.

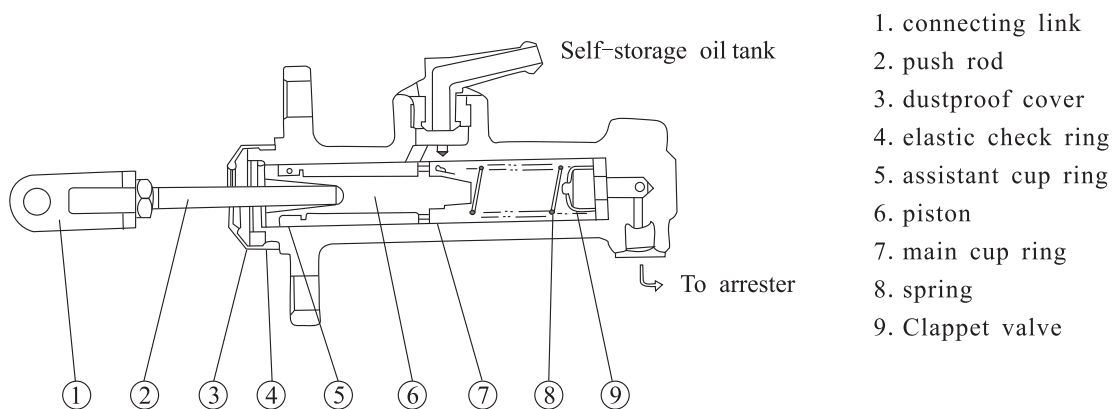


Fig. 9-3 Braking main pump

9. 1. 3 The wheel brake

The wheel brake is the hydraulic type of internal swell, composing of the brake shoe, spring, wheel cylinder, adjuster and soleplate, and two brakes are installed on the both sides of front axle respectively. The one side of brake shoe is connected with the supporting pin, the other side is connected with the clearance adjuster and is pressed towards the soleplate by spring and tie rod, the hand brake pull rod is installed on the main brake shoe, the adjusting rod of the automatic clearance adjuster is installed on the assistant brake shoe. See the picture 9-4, 9-5.

1. spring
2. cup ring
3. piston
4. cylinder body
5. piston mandrill
6. return spring
7. mandrill
8. return spring
9. adjusting lever
10. assistant brake shoe
11. clearance adjuster
12. spring
13. brake cable assembly
14. compressor spring cover
15. compressor spring pull rod
16. hand brake pull rod
17. hand brake push rod
18. brake wheel cylinder assembly
19. return spring
20. man brake shoe.

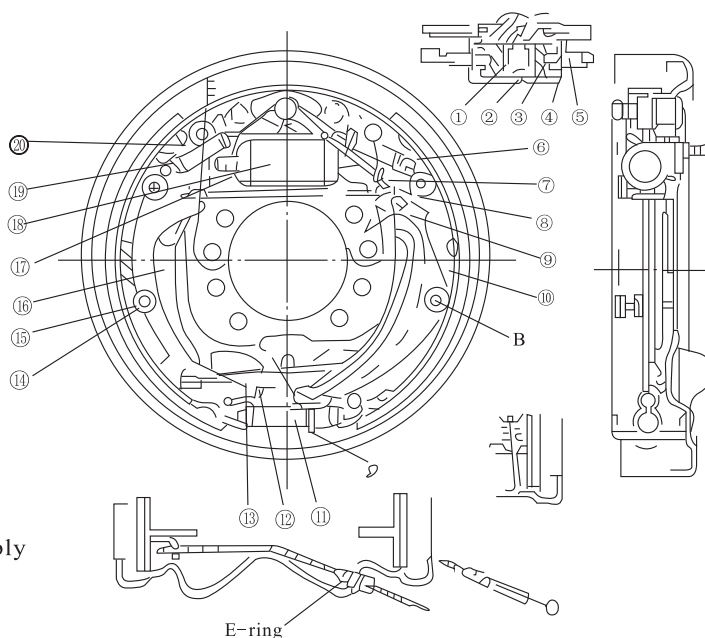


Fig. 9-4 Arrester(2-2.5t)

1. brake wheel cylinder assembly
2. spring
3. cup ring
4. piston
5. wheel cylinder shell
6. piston mandrill
7. brake shoe return spring
8. friction plate
9. spring
10. hand brake push rod
11. spring mechanism
12. brake shoe
13. compression spring seat
14. compressor spring pull rod
15. compressor spring
16. spring
17. detent
18. spring
19. clearance adjuster assembly
20. pin
21. Soleplate
22. break shoe return spring
23. hand brake pull rod
24. brake cable assembly

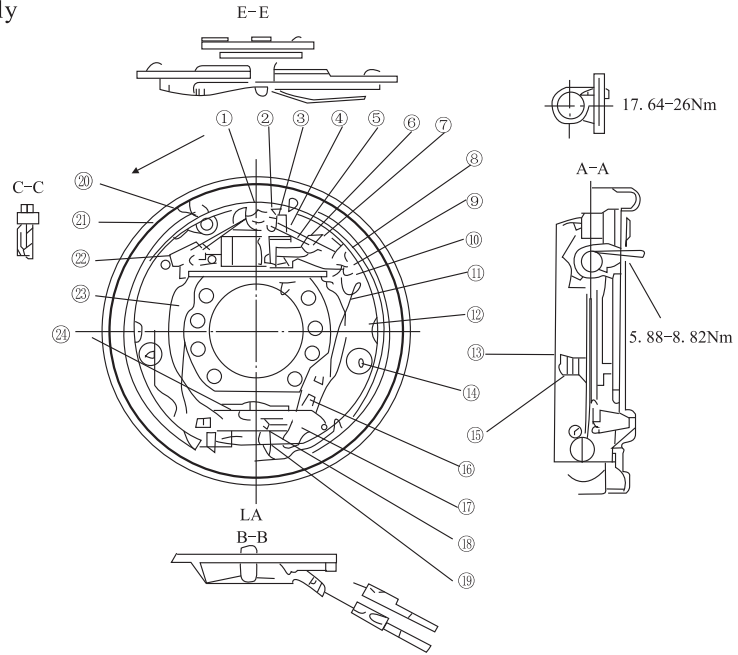


Fig. 9-5 Arrester (3t, 3.5t)

1. wheel cylinder piston mandrill
2. hood shield
3. piston
4. spring
5. leather cup
6. wheel cylinder body
7. assistant brake shoe
8. brake shoe return spring
9. spring
10. handbrake pull rod
11. spring mechanics
12. compressor spring pull rod
13. compressor spring seat
14. spring
15. return spring
16. detent
17. spring
18. clearance adjuster
19. "E" check ring
20. parking brake cable
21. compressor spring pull rod
22. compressor spring seat
23. hand brake pull rod
24. main brake shoe
25. return spring

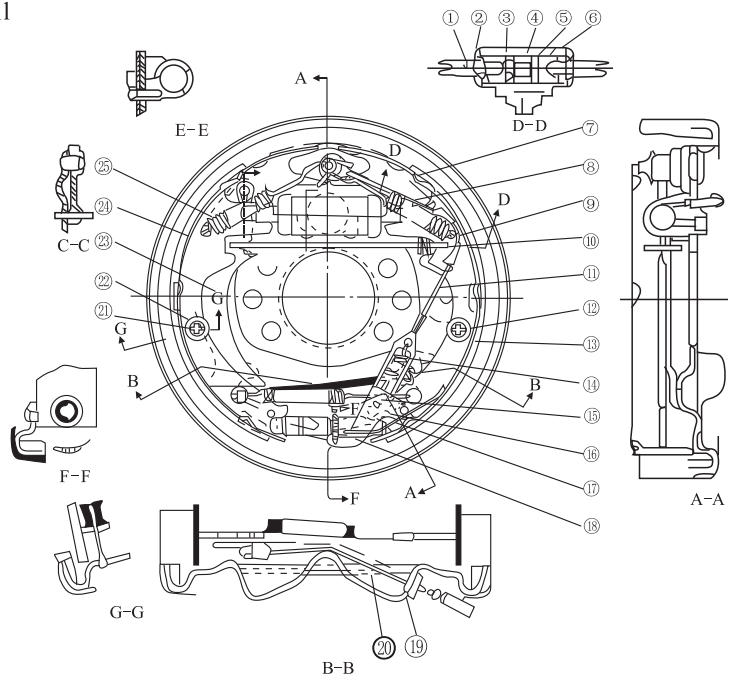


Fig. 9-6 Arrester (1-1.8t) (Left)

(1) Movement of brake

The primary and secondary shoes are respectively given the same force to press the brake drum by the operating cylinder, till contact of the end of the secondary brake shoe hold-down pin, the brake shoe move to the twisting direction of the brake drum. By operation of the operating cylinder tubing the friction piece in contact with the brake drum. The Primary shoe forces between the friction piece and the drum, Due to this, the adjuster pushes the secondary shoe by the large force than that offered by operation of the operating cylinder.

The braking operation in the truck's reverse travel is performed contrary to that of forward reverse.

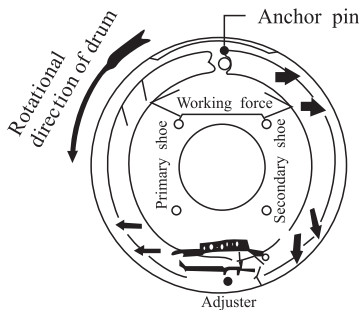


Fig. 9-7 The movement of forward drive

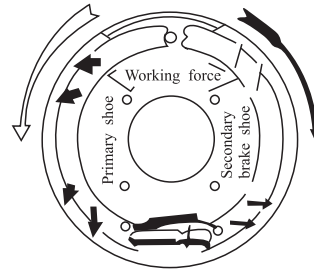


Fig. 9-8 The movement of Backward drive

(2) Parking Brake

The parking brake is of mechanical, internal expansion type and built in the wheel brake. It shares the brake shoes and brake drum with the wheel brake system. As the parking brake lever actuate, through the brake cables. Parking pull rod, which pushes. In turn, the parking push rod to the right with the aid of the pin as a fulcrum, forcing the secondary shoe against the brake drum.

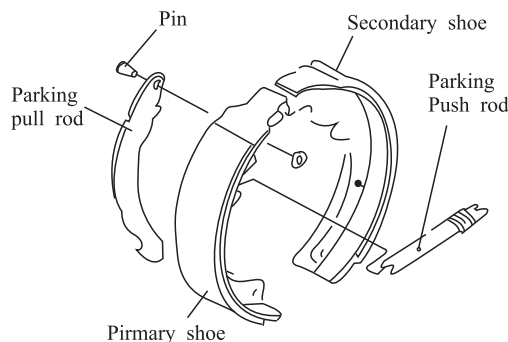


Fig. 9-9 Parking Braking mechanism

(3) Clearance Self-regulating structure

The self-regulating clearance structure can maintain an appropriate clearance between the friction plate and brake drum. See the picture 9-10 and 9-11, the self-regulating clearance structure only works during the reverse driving. There are two kinds of self-regulating structure because of the different model.

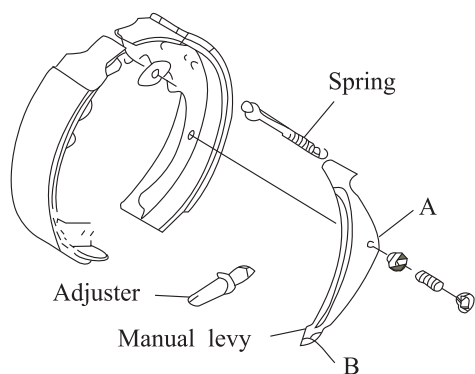


Fig. 9-10 2~2.5t Forklift

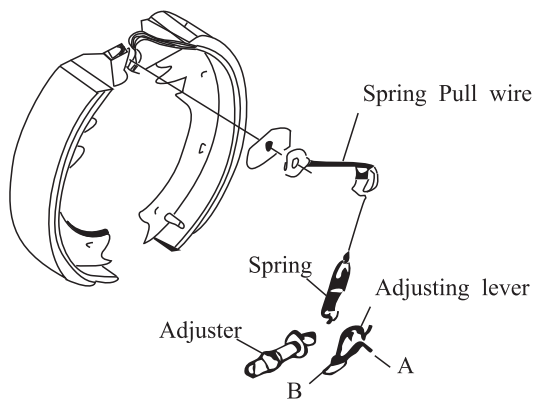


Fig. 9-11 1~1.8t, 3t, 3.5t Forklift

The self-regulating clearance structure

(a) 2~2.5t forklift self-regulating clearance structure

Only work during the reverse movement. The assistant brake shoe touch the brake shoe and rotate together, therefore, the tie rod rotates rightward along point A, see the picture 9-10, The point B is elevated. After the brake is released, the pull rod rotates leftward under the action of the spring force and the point B falls.

When the distance between the friction plate and brake drum becomes bigger, the rotating vertical distance of the detent of point B becomes bigger, when the distance is more than 4mm, the adjuster is stirred by one tooth, the adjusting rod becomes longer and the clearance becomes smaller accordingly.

The range of clearance adjustment: within 0.4~0.45mm

(b) 1~1.8t, 3t adjustment structure of forklift clearance

When the forklift brakes in the reverse motion, the assistant brake shoe touch the brake drum and rotate together. Therefore, the pull rod rotates rightward along point A, the detent of point B stir and adjust tooth of adjuster.

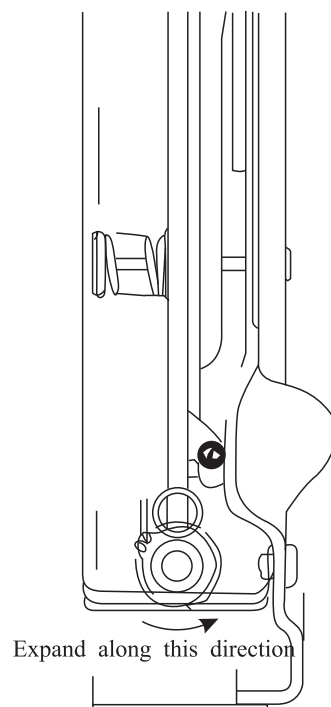


Fig. 9-12 Self-adjuster

After the brake is released, the brake shoe returns to normal, the pull rod rotates leftwards along point A, the point B falls. Therefore, when the interval becomes bigger, the adjuster starts to the next tooth.

The range of adjustment: within 0.25–0.4mm

9.1.4 Parking brake mechanism.

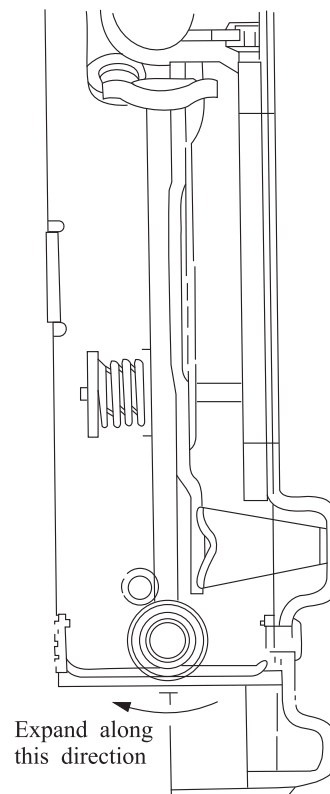
The handrail of Parking brake mechanism is type of cam; the adjuster located on the end of the handrail can adjust the brake force.

Adjustment of the brake force:

Rotate the adjuster clockwise, the brake force will increase; rotate anticlockwise, brake force will decrease.

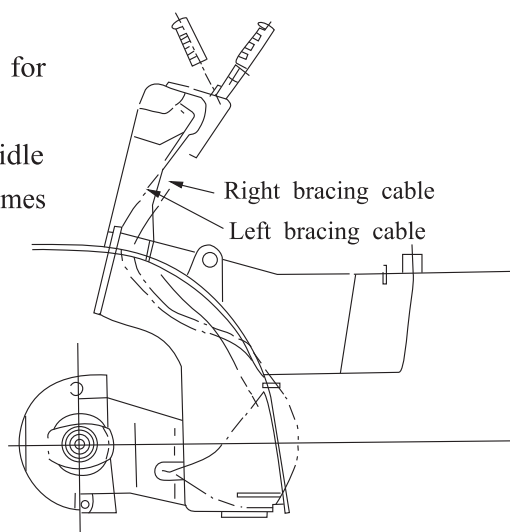
Force: 20–30kg

Note: 2~2.5, rotate the screw inside of adjuster to adjust.



9.1.5 Brake pedal adjustment

- (1) Shorten the push rod.
- (2) Adjust the pedal to height of 130mm for the ton trucks.
- (3) With the brake pedal pressed by the idle stroke of, pull the rod out until its front end comes into contact with the master cylinder piston.
- (4) Tighten the push rod locking nut.



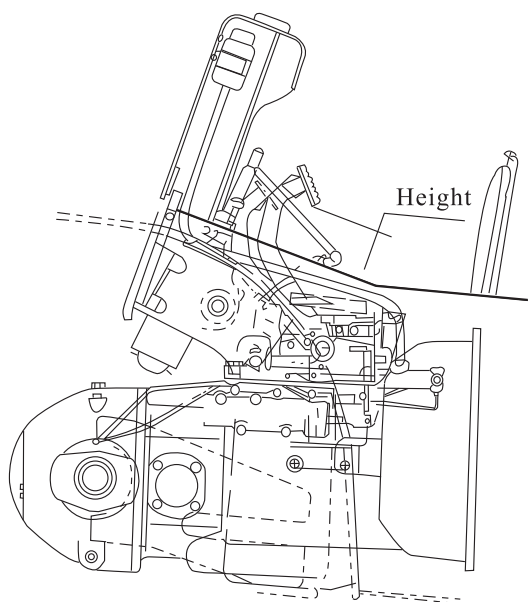


Fig. 9—15 Adjust pedal height

Unit : mm

Motor	Ton	Type	Height	Free stroke	
				Brack	Tremor
K21	2~2.5t	CL	118	10	*
		TC	121	30	0
K25	3~3.5t	CL	120	10	*
		TC	124	30	0
NB485	1~1.8t	CL	118	10	*
		TC	121	30	0
C240	1~1.8t	CL	105	30	*
		TC	100	50	0
	2~3.5t	CL	110	10	*
		TC	116	30	0
4JG2	2~3.5t	CL	116	10	*
		TC	119	30	0

CL: Mechanical forklift TC: Hydraulic forklift

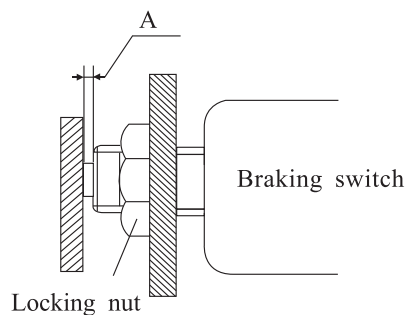
Adjustment of brake switch

(A): After adjustment of the brake pedal height, loose the lock nuts of the brake switch.

(B): Pull out the plug and separate lead.

(C): Rotate the switch, making the clearance A=1mm

(D): Test stopping lamp when stepping down the brake pedal.



9.2 Maintenance of Wheel Brake

This section includes the covers the disassembly, reassembly and adjustment of the wheel brake and the adjustment of brake pedal which apply to the 1-1.8t, 3t forklift arrester, although the adjuster function of 2-2.5t arrester is different, the method of maintenance is basically the same.

9.2.1 Wheel brake Disassembly

(1) Remove toehold-down spring of secondary shoe. Remove the adjusting lever, pole lever stopper and return spring for push rod.

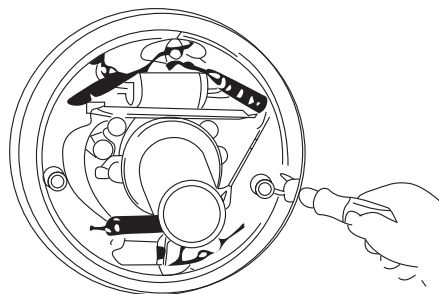


Fig. 9-16

- (2) Remove two shoes return springs.

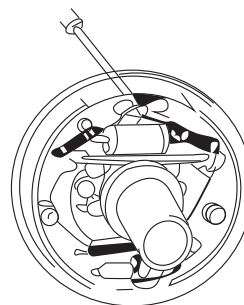


Fig. 9-17

- (3) Remove three hold-down springs.

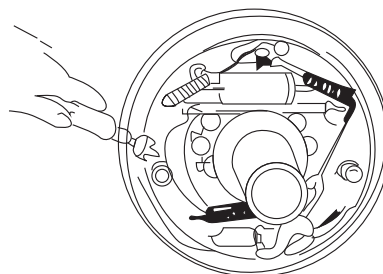


Fig. 9-18

- (4) Remove the primary and secondary shoes. At the same time, remove adjuster spring.

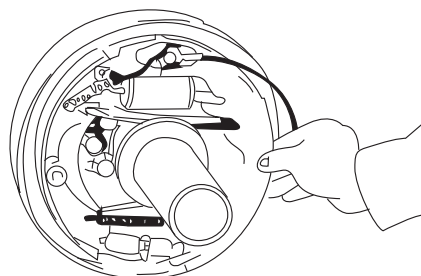


Fig. 9-19

- (5) Remove the brakeline from the wheel cylinder, Remove wheel cylinder mounting bolts and detach the wheel cylinder from the backing plate.

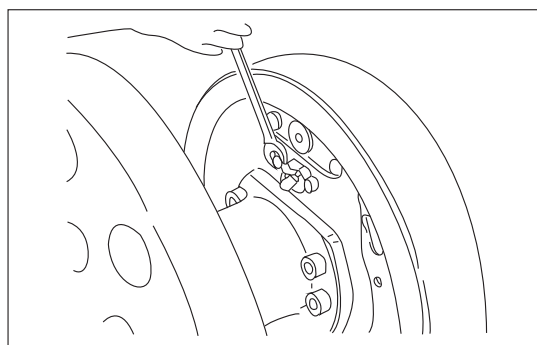


Fig. 9-20

(6) Remove the E-retainer for securing the parking brake cable to the backing plate. Remove the backing plate. Remove the backing plate mounting bolts and detach the backing plate from axle.

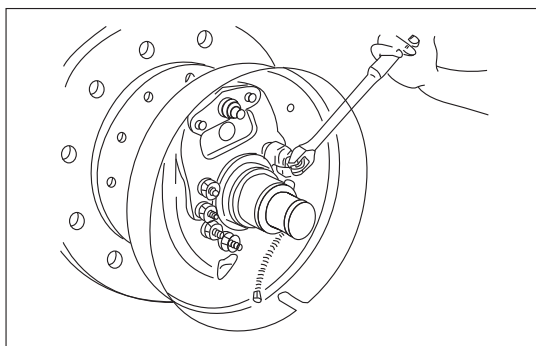


Fig. 9-21

(7) Remove the boot and push the piston assembly out of the operating cylinder.

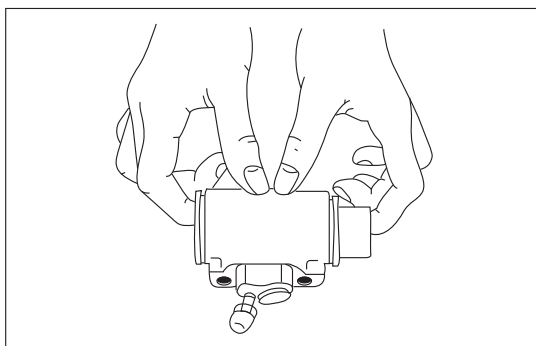


Fig. 9-22

9. 2. 2 Inspection of wheel brake

Inspect all parts to make sure if there's worn out or damaged part. If unqualified, repair or replace with new one.

(1) Check whether the operating cylinder inner surface and the piston periphery surface is rusted? Then measure the clearance between the piston and cylinder.

Specified clearance: 0.03mm-0.10mm

Maximum clearance: 0.15mm

(2) Visually check the piston cup for damage or deformation. If unqualified, replace with new one.

(3) Check the free length of the operating cylinder spring. If unqualified, replace it

(4) Check the thickness of the friction piece to see if it is excessive worn. If necessary, replace it.

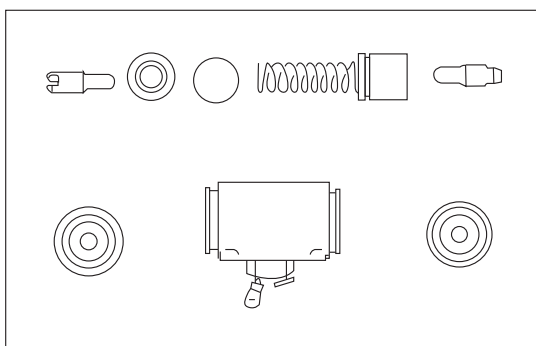


Fig. 9-23

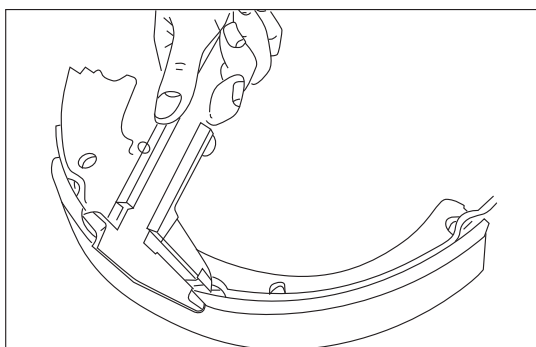


Fig. 9-24

Unit: mm

	1.0-1.8t	2.0-2.5t	3-3.5t
Standard value	4.87	7.2	8.0
Marginal value		5.0	6.0

(5) Check the inner surface of the brake drum, if any damage or worn-out, repair by machining or replace it.

Unit: mm

	1.0~1.8t	2.0~2.5t	3~3.5t
Standard value	254	310	314
Max value	256	312	316

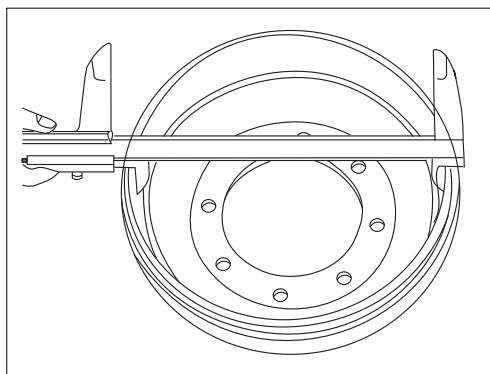


Fig. 9-25

9.2.3 Wheel Brake Reassembly

(1) Apply brake fluid to the piston and the piston cup, and reinstall the spring, cup, the piston and the dust cover in this order.

(2) Install the operating cylinder on the backing plate

Caution: make sure that each component is in position when installing it; Bolts should be a torque to 1~1.8T: 8~12N.m

2~2.5t: 14.7~19.6N.m

3~3.5t: 17.6~26.5N.m

(3) Install the backing plate on the front axle.

Torque moment for bolts: 20.6~22.5N.M

(4) Add lubricating oil to the lubricating point, shown as Pic 9-26.

(A) Backing plate-bearing surfaces

(B) Anchor pin

(C) Contact surfaces between brake shoe and spring seat

(D) Parking pull rod pin

(E) Surfaces of the screw of the adjuster and other rotating part

(5) Install the brake cable assembly on the backing plate with an e-retainer.

(6) Install shoes on the backing plate with hold-down springs. However, the hold-down spring at the secondary shoe lower part should be fitted only after the spring seat and adjusting lever are properly mounted. Make sure the spring seat settles snugly in the shoe and the adjusting lever holes.

(7) Put the spring on the parking push rod then install the rod on the shoe.

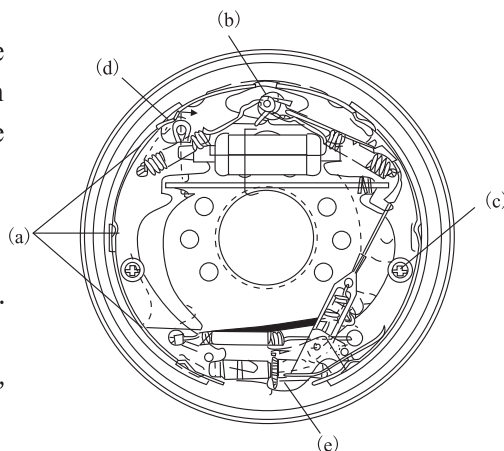


Fig. 9-26

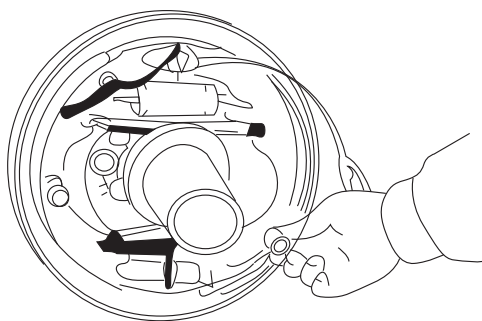


Fig. 9-27

(8) Install the shoe guide plate on the anchor pin, and install the shoe return spring.

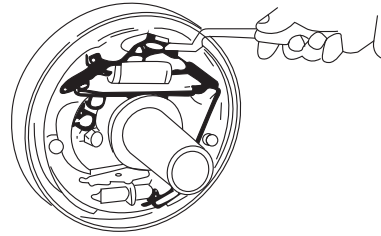


Fig. 9-28

(9) Install the adjuster. Adjuster spring. Push rod, and its return spring.

Pay attention to the following points:

(A): Adjuster thread direction and its mounting direction

(B): Adjuster spring direction

(C): Return spring direction of the push rod: spring hook at anchor pin side should be located at the opposite side to push rod

(D) Push rod and its return spring should be located in the groove on the anchor pin

(E): Make sure that the adjusting lever end is in contact with the adjuster gear teeth.

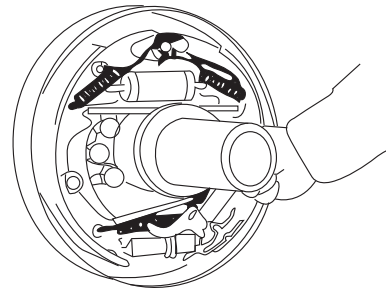


Fig. 9-29

(10) Install the brake vittaon the operating pump.

(11) Measure the insider diameter and outside diameter of the braking shoes. Adjust the adjuster to obtain the difference needed between the drum inner diameter and the friction piece outer diameter less than 1mm.

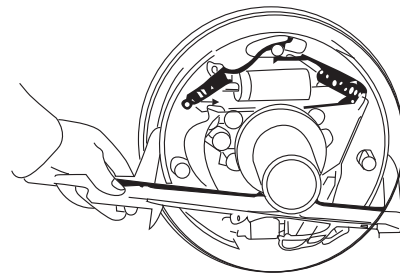


Fig. 9-30

Specified difference:

9.2.4 Operation Test to clearance self-adjuster

(1) Make the brake shoe diameter approach the specified mounting size. And pull the adjusting level with your finger along the arrow marks as shown in ... to turn the adjuster gear, when removing off your finger. The adjusting lever should return to its original position without rotation of the adjuster gear

Note: The adjuster gear turn back with the adjusting lever motion when released. The adjuster will still operate normally after it is built in the machine.

(2) If the adjuster fails to do the above operation when the adjusting lever is pulled. Proceed with the following inspections:

(A): Make sure that the adjusting lever, push rod and the return spring for push rod are securely installed.

(B): Check to see if the adjusting lever and adjuster gear are damaged. If necessary, replace them. Also check if the adjusting lever is in contact with the gear, Check the push rod return spring and adjuster spring for deterioration. And also check the adjuster gear for rotating condition, and undue wear or damage of the meshing section.

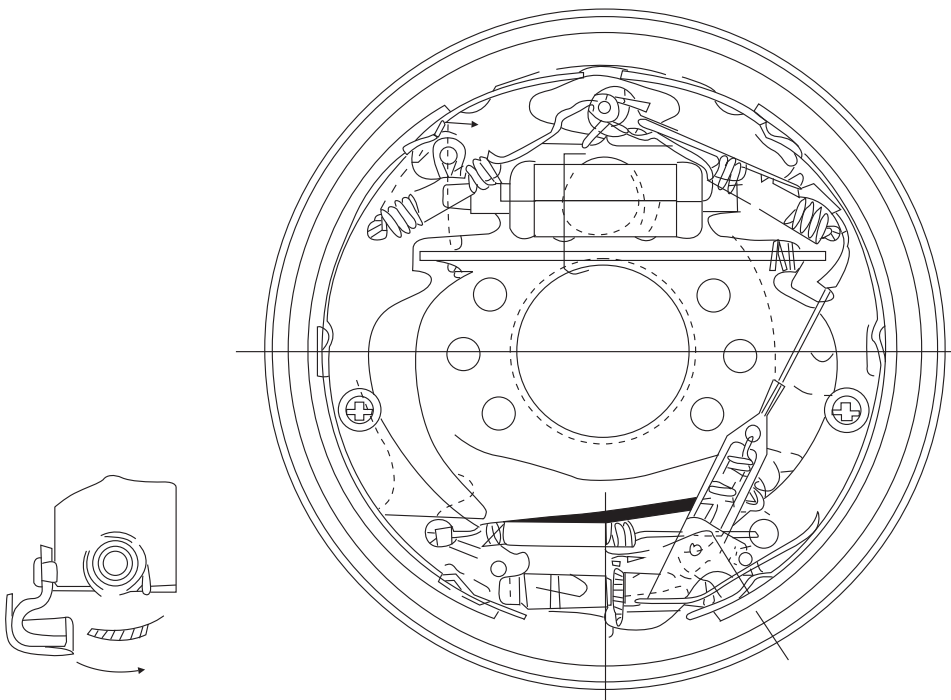


Fig. 9-31

9. 2. 5 troubleshooting

Problem	Probable Cause	Remedy
Poor braking	1. oil leakage from brake system 2. Maladjustment of brake shoe clearance 3. Brake overheating 4. Poor contact between drum and friction piece 5. Foreign matter adhered on friction piece 6. Foreign matter mixed in brake fluid 7. Maladjustment of brake pedal (inching valve)	Repair Adjust the adjuster Check for skid Readjust Repair or replace Check brake fluid Adjust
Noisy brake	1. Hardened friction piece surface or foreign matter adhered there 2. Deformed backing plate or loose bolts 3. Deformed shoe or incorrect installation 4. Worn friction piece 5. loose wheel bearing	Repair or replace Repair or replace Repair or replace Replace Repair or replace
Uneven braking	1. Oil-contaminated friction piece 2. Maladjustment of brake shoe Clearance 3. Malfunction of operating cylinder 4. Shoe return spring deteriorated 5. Deflected drum	Repair or replace Replace Repair or replace Repair
Soft or spongy brake	1. Brake fluid leakage 2. Maladjustment of brake shoe clearance 3. Air mixed in brake system 4. Maladjustment of brake pedal	Repair Adjust the adjuster Emit the air Readjust

10、Hydraulic system

Item \ Forklift Type		1~1. 8t		2~2. 5t		2~2. 5t		3~3.5t		3~3.5t	
		Gasoline machine	Diesel machine	Gasoline machine		Diesel machine		Gasoline machine		Diesel machine	
Motor Type		K21	NB485	K21	K25	4JG2	C240PKJ	K21	K25	4JG2	C240PKJ
Main Pump Multiport Valve	Type	Gear pump									
	Displace- ment	23ml/r		28ml/r				32ml/r			
	Type	Double sliding Valve with Overflow Valve, flow divider and tilt self-lock valve									
	Adjustable pressure	17. 5MPa									
	Pressure divided	7MPa						10MPa			
	Flow divided	11L/min						13L/min			
Lifting Cylinder	Type	Single-acting Piston									
	Cylinder diameter	45		50				56			
	Stroke	1495mm (When lifting height 3m)									
Tilt Cylinder	Type	Double-acting piston									
	Cylinder diameter	63		70							
	Stroke	147mm		167mm							
Oil tank Capacity		45L		60L							

10.1 general description

The hydraulic system consists of lift pump, steering pump, control valve, lift cylinder, tilt cylinder and hydraulic pipelines.

10.2 Main pump

The main pump is the gear pump, it is driven directly by the power output mechanism of generator, and the oil of oil tank is transmitted to the control valve through the main pump.

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

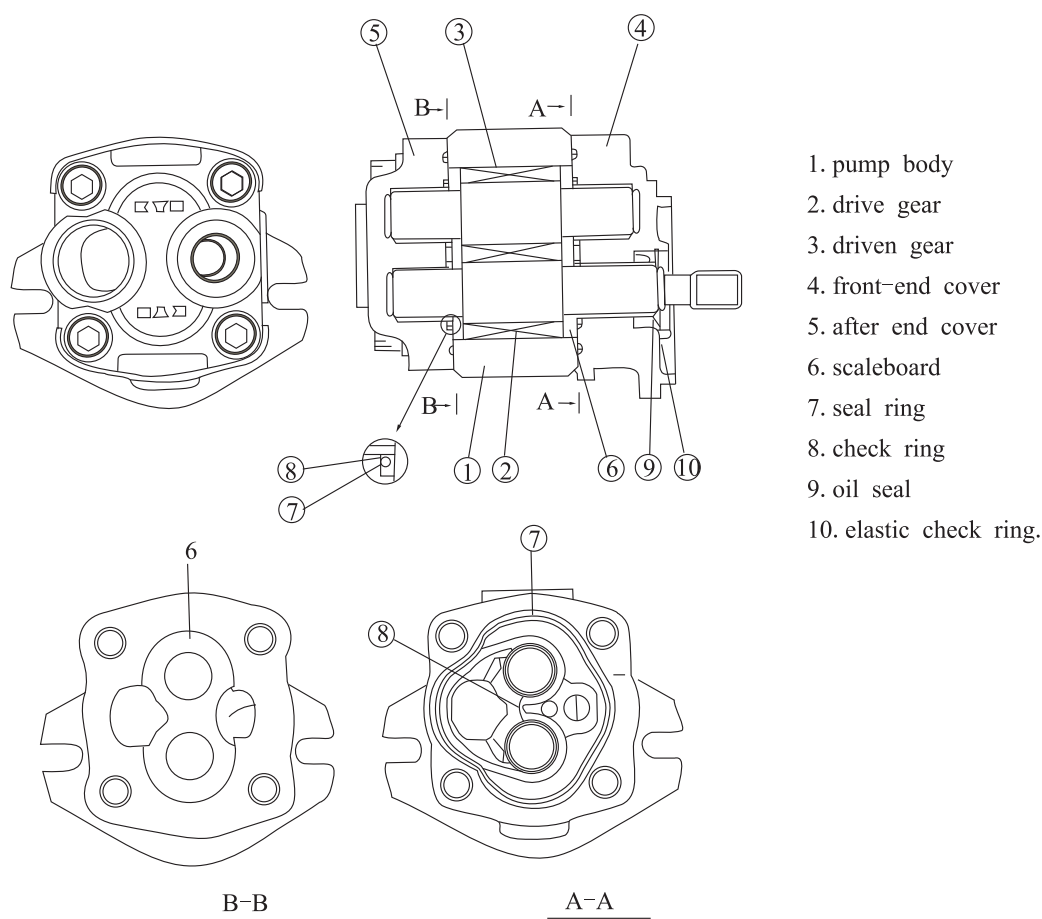


Fig. 10-1 Main Pump

10.3 Control valve

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

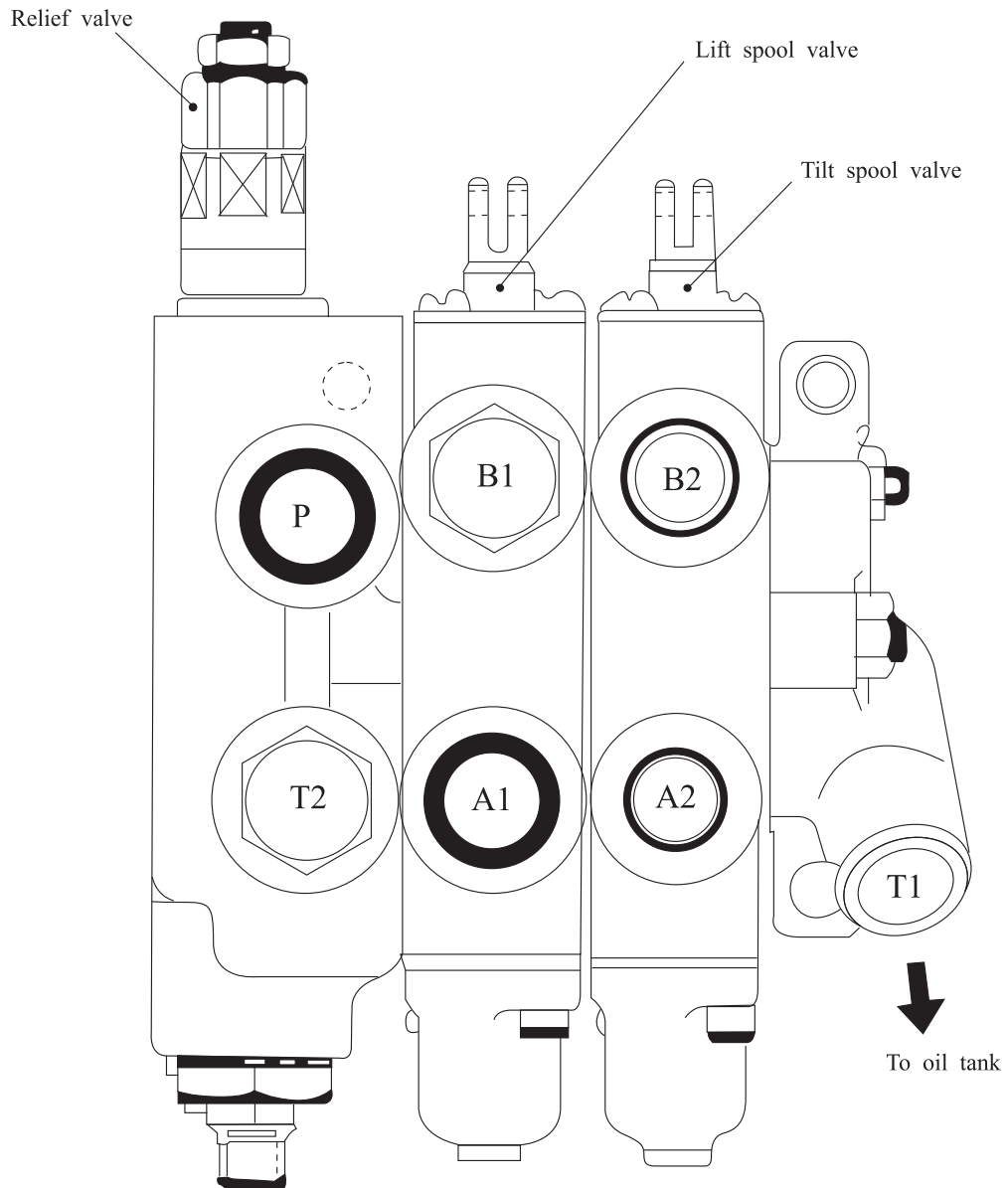


Fig. 10-2 Control valve

10.3.1 Slide valve operation (take the tilt slide valve for example)

(A) : Neutral position

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

(B) : Pushing-in of spool

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

(C) Drawing-out of slide valve

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

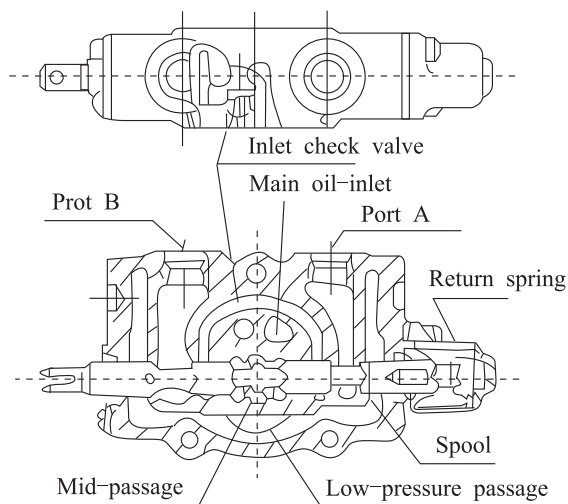


Fig. 10-3

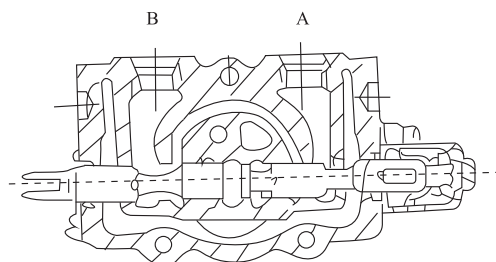


Fig. 10-4

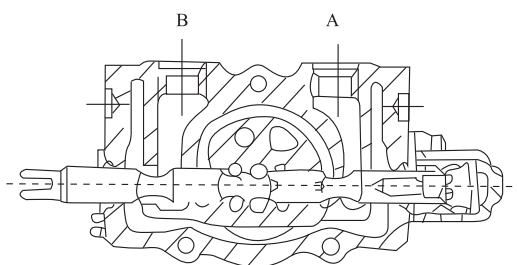


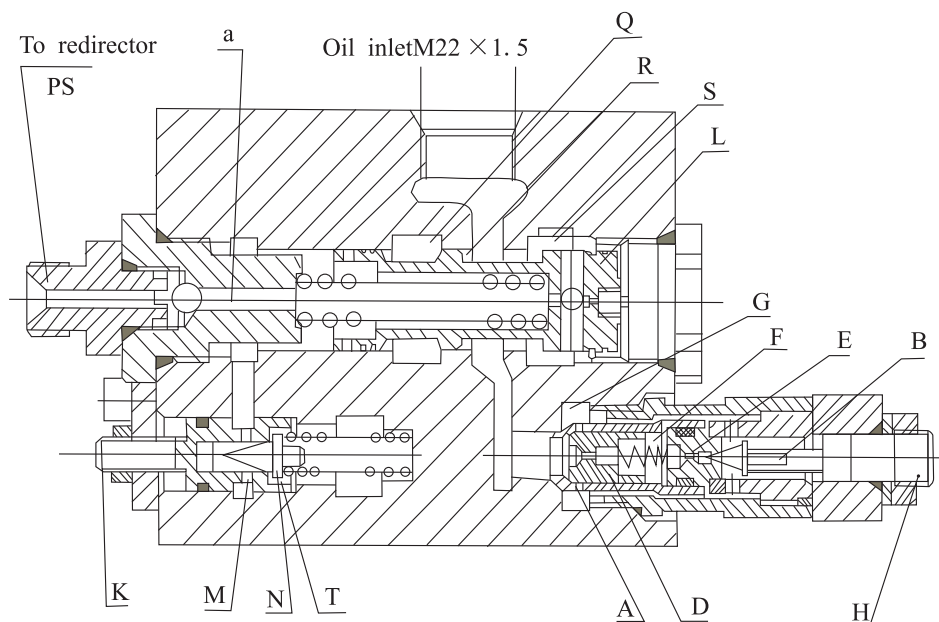
Fig. 10-5

10.3.2 Main safe overflow valve and the flow-dividing safe valve (picture 10-6)

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

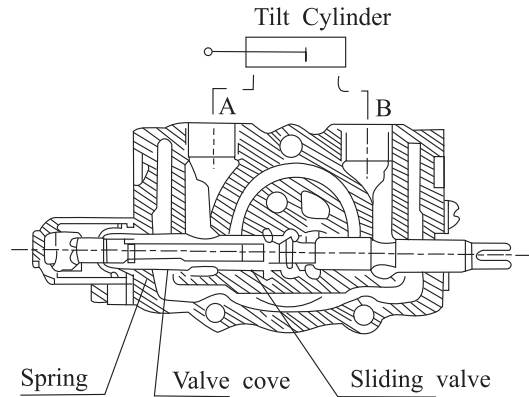
The structure of flow-dividing valve is simple and is vertically overflowing and uses the principle of balancing the liquid pressure with the spring force directly to acquire the stable pressure value of steering system. When operating the steering wheel, the oil cavity M is connected with the high-pressure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

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



10.3.3 Action of tilt-lock valve

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



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

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

10.4 Hydraulic Oil Circuit

The high-pressure oil from the lift pump comes to the control valve first, then high-pressure oil is sent to lift cylinder or tilt cylinder. When the lift and tilt spool are in neutral position, the oil from the lift pump directly returns to oil tank through the passage in the control valve, when the lift spool is pulled, the oil from the lift cylinder to push the piston up, when the lift spool is pushed, the circuit between the lower part of the lift cylinder and the oil tank is connected and the piston begins to descend due to the weight of the load and all of lifting parts. In this case, the oil flows returning to the control valve is regulated by the flow regulator valve, and the forks descend speed is controlled. When the tilt lever is operated, the high-pressure oil reaches the front or rear chamber of the cylinder and pushes the piston forward or backward. The oil is pushed to the oil tank through the control valve by the piston returns and the mast then tilts forward or backward.

The high-pressure oil from the steering pump comes to the powered steering until valve first. Then high-pressure oil is sent to the steering cylinder, when turning steering wheel right or left. The rear wheels are turning.

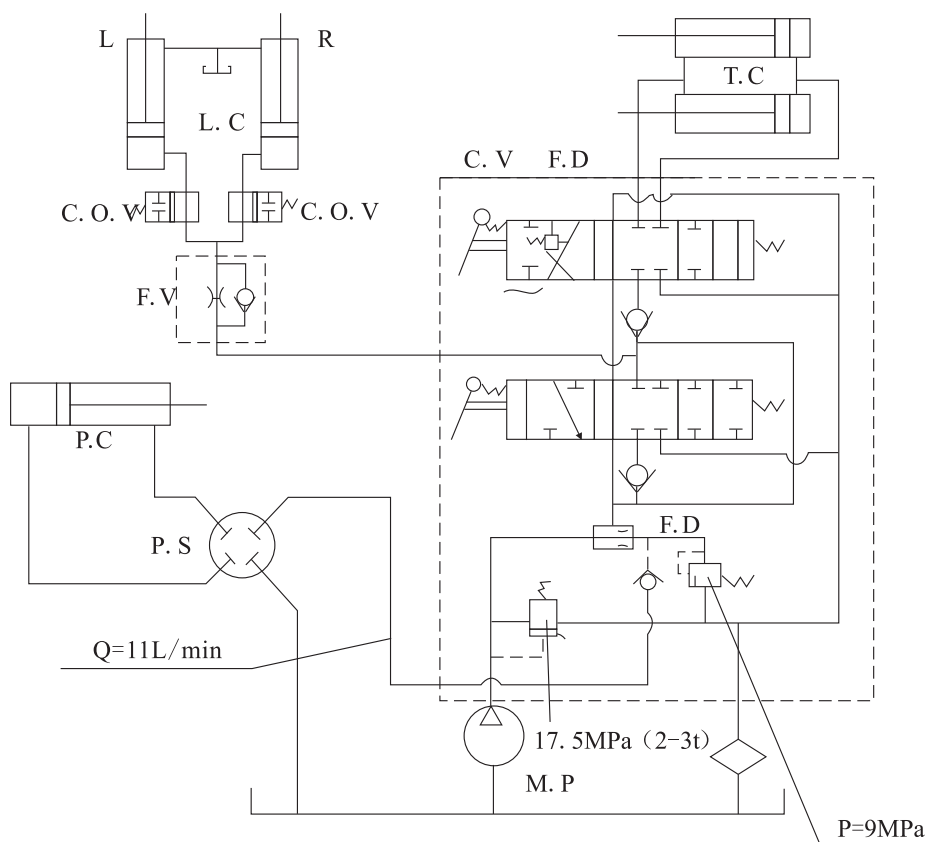


Fig. 10-8 Hydraulic System oil way

10.5 Operation of the multi-control valve

The control valve is operated with the valve levers. All valve levers are assembled together with a shaft and the shaft is assembled on the front guard with the bracket. The valve levers operate the control valve with the joins.

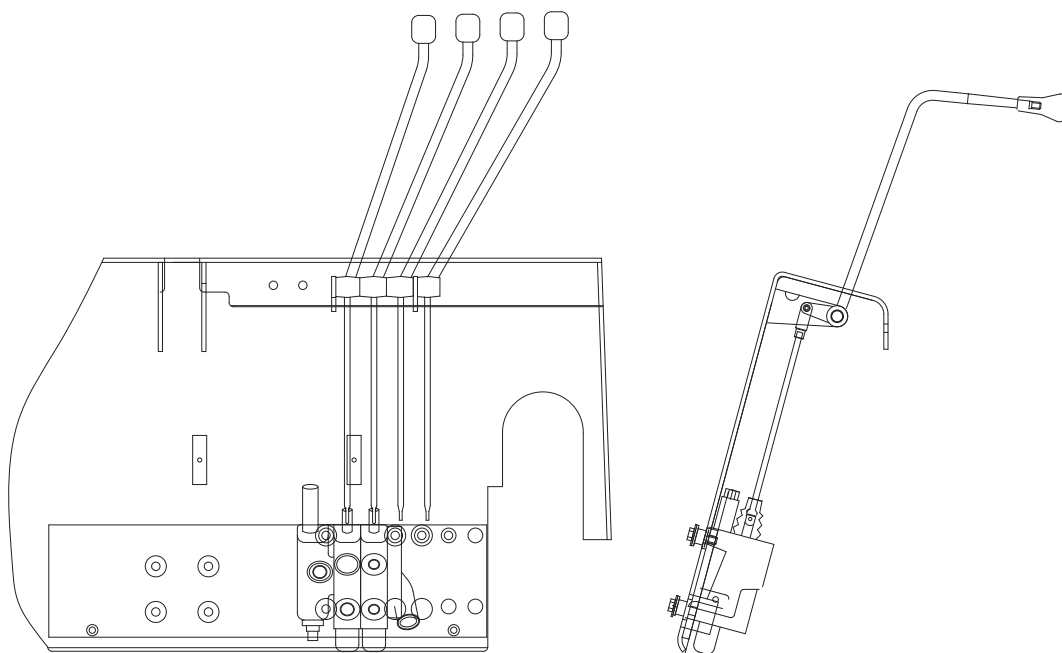


Fig. 10-9 Operation of the multi-control valve

10.6 Lifting cylinder

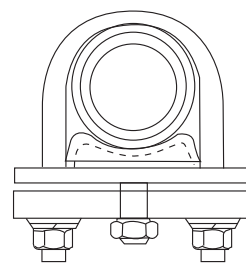
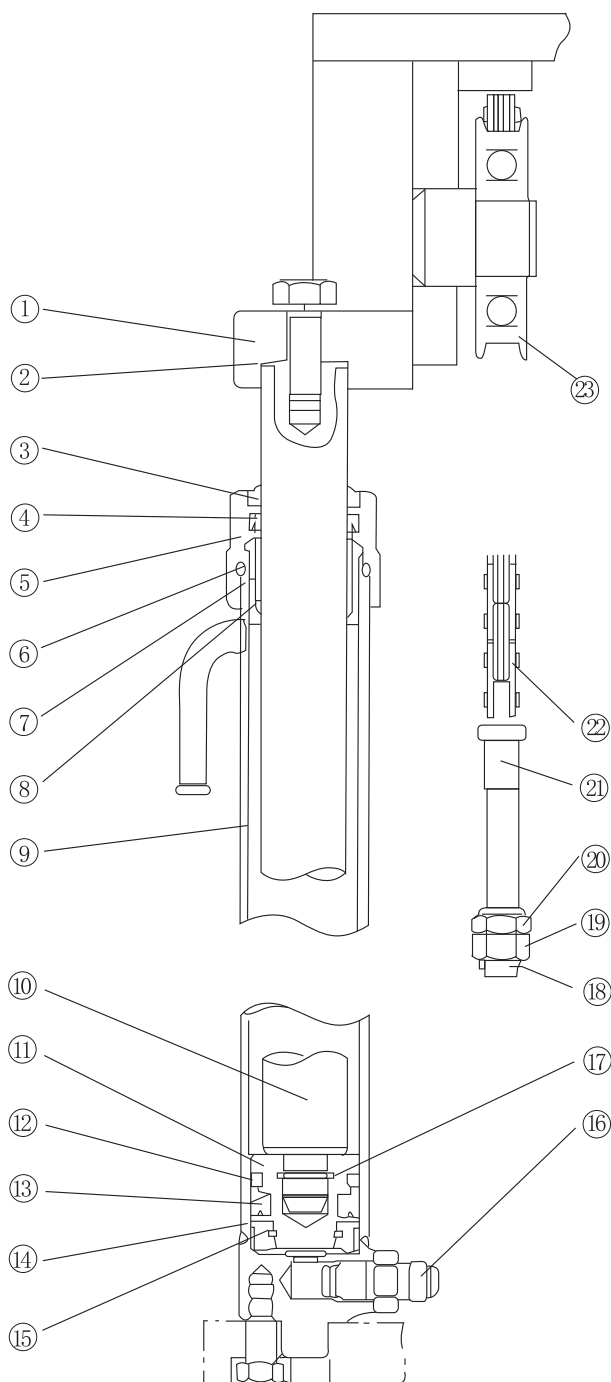
The two single acting type lift cylinder is composed of cylinder body, piston, piston rod, cylinder cap, cylinder base, and oil seals

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

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

There is a cut-off valve at the bottom of lifting cylinder (see the picture 10-11) when the high-pressure pipe cracks suddenly, the goods can be avoided to fall sharply.

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



Cylinder support

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

Fig. 10-10 Lifting Cylinder

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

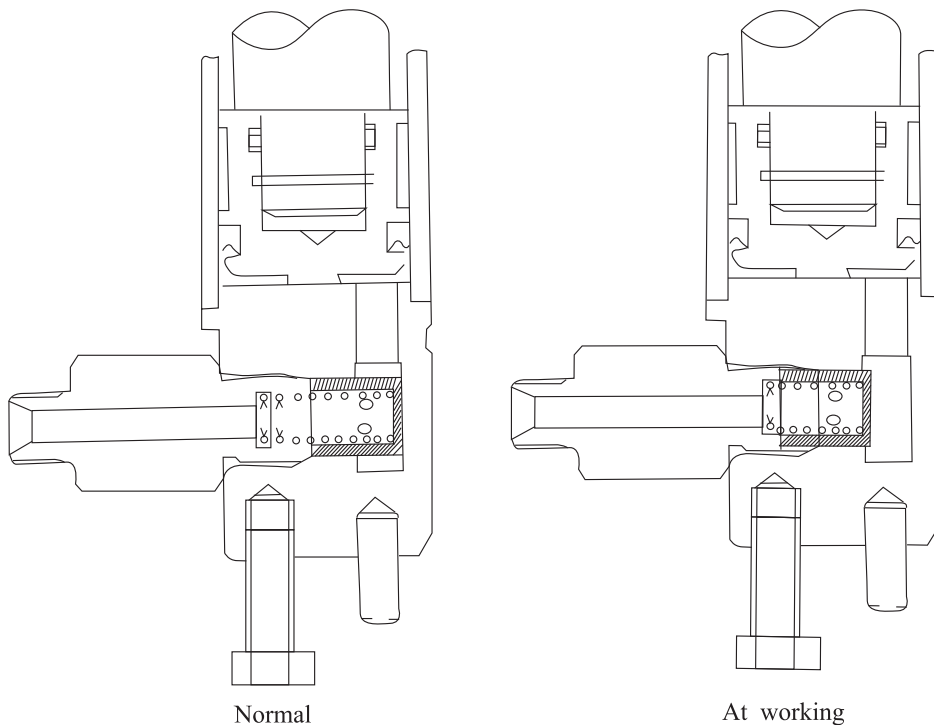


Fig. 10-11

10. 7 Flow Regulator Value

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

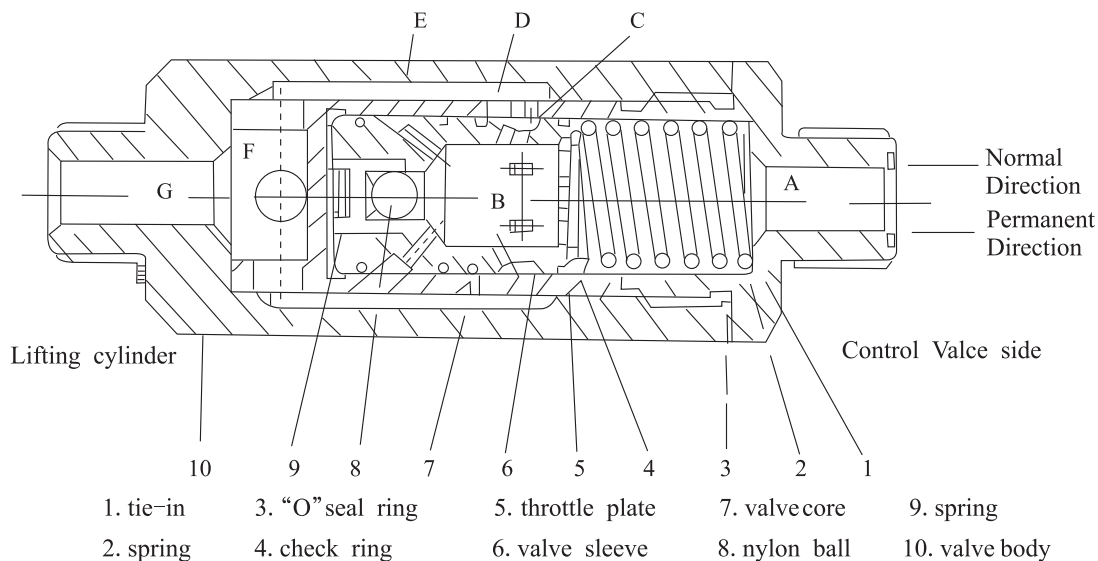


Fig. 10-12 Flow regulator valve

10.8 Tilt Cylinder

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

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

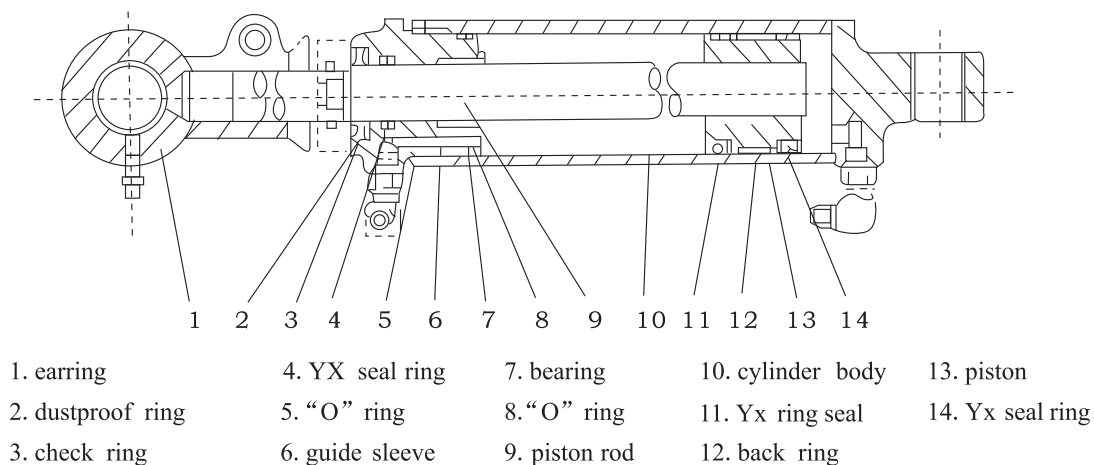


Fig. 10-13 Tilt cylinder

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

10.9 The hydraulic oil tank

The hydraulic oil tank does not suck oil and filter the dust as the component of frame on the right tank.

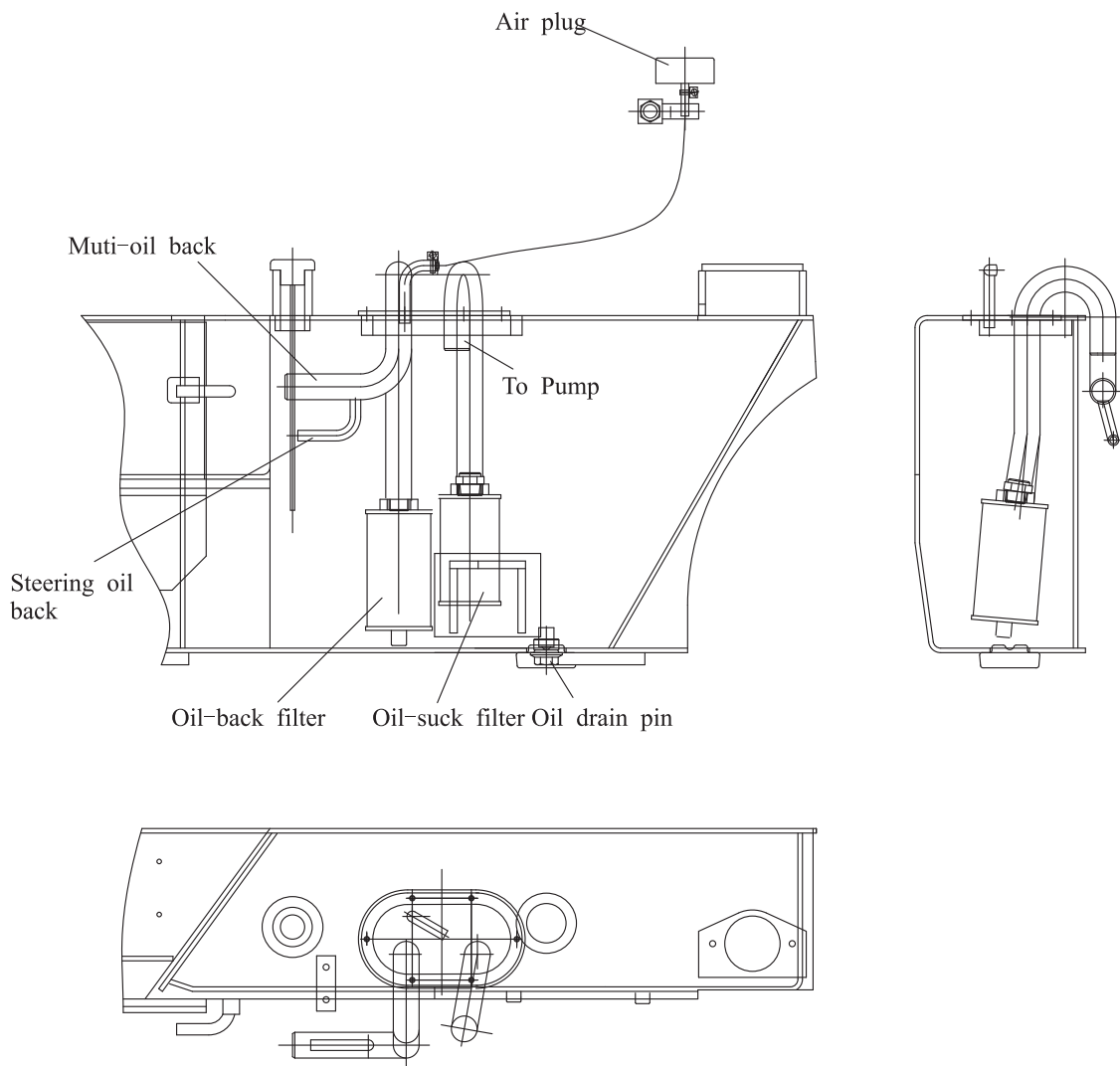


Fig. 10-14 Hydraulic oil tank

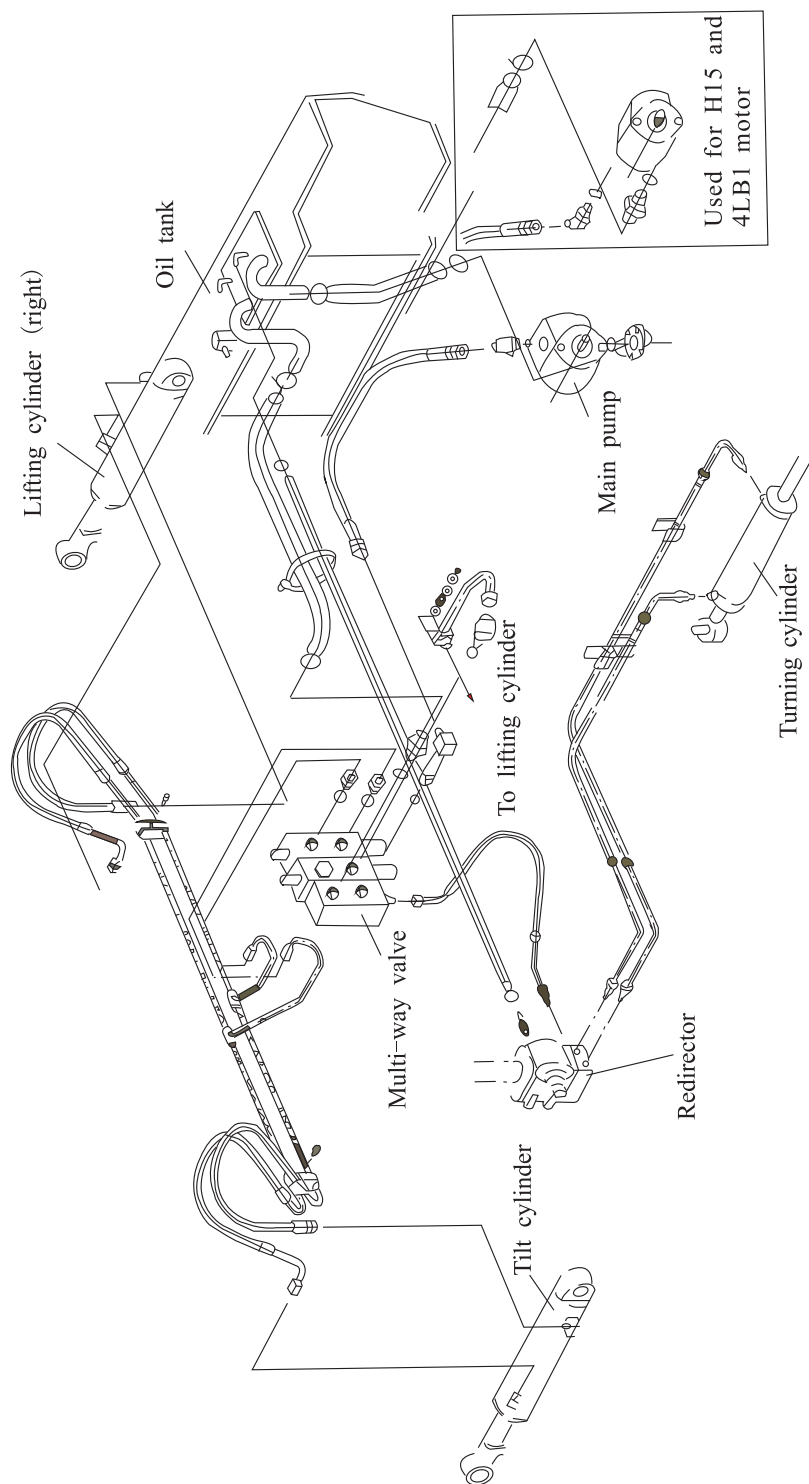


Fig. 10-15 Hydraulic Pipeline (1-1. 8t)

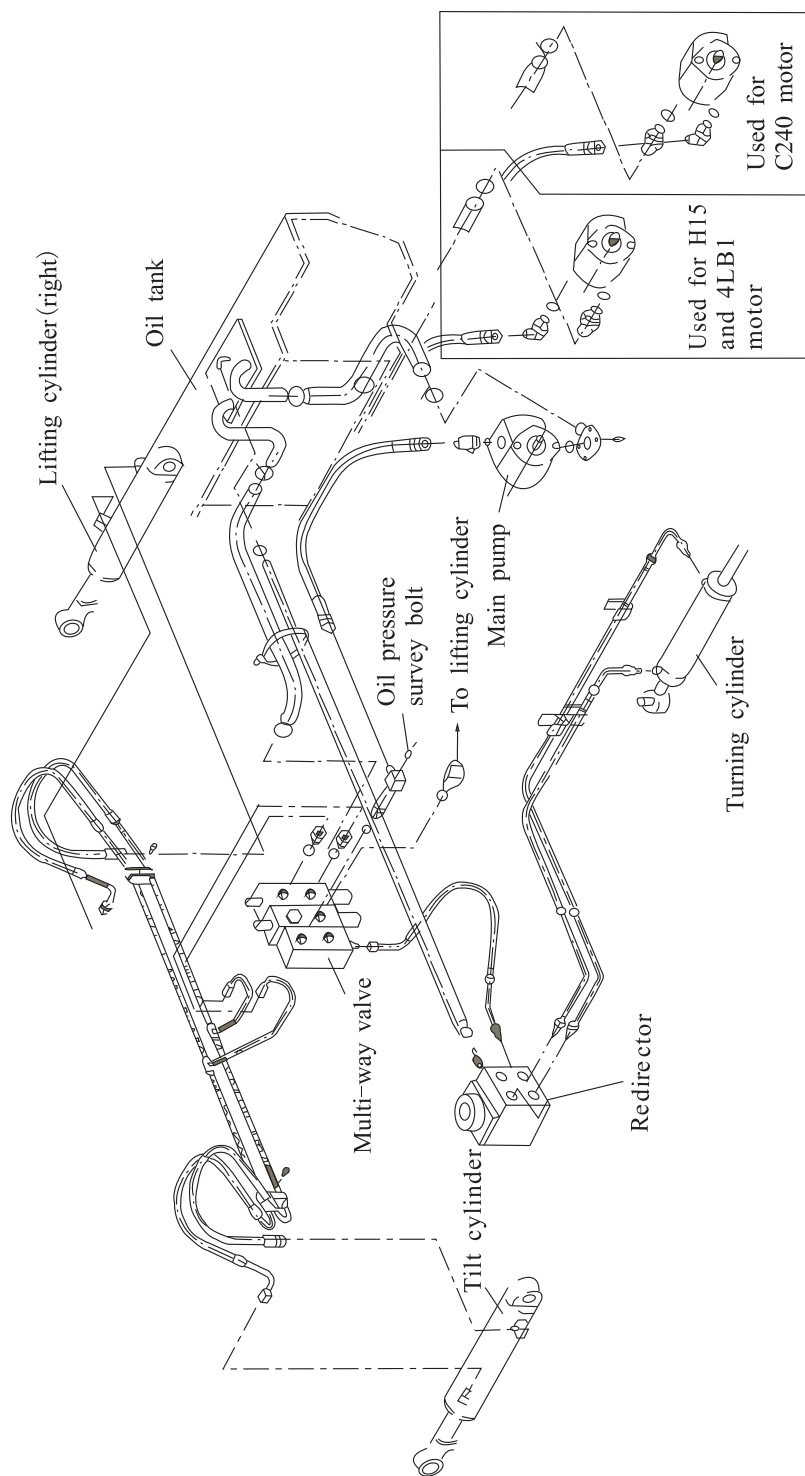


Fig. 10-16 Hydraulic Pipeline (2~3.5t)

10.10 Maintenance of Main oil Pump

(1) Disassembly

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

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

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

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

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

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

(2) Inspection

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

(A): Body inspection

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

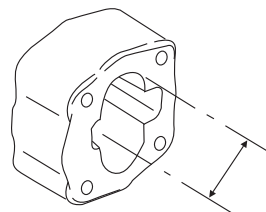


Fig. 10-17

(B): Scale board inspection

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

The standard thickness: 4.94mm

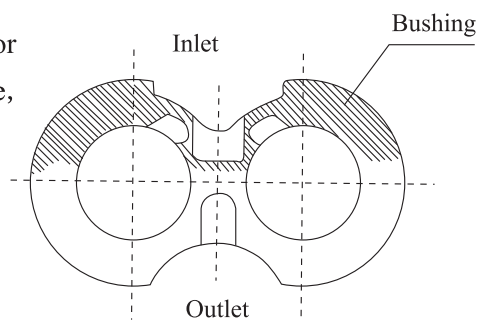


Fig. 10-18

(C) The front and rear pump cover

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

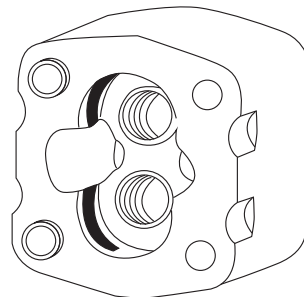


Fig. 10-19

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

$D=20.961\text{mm}$

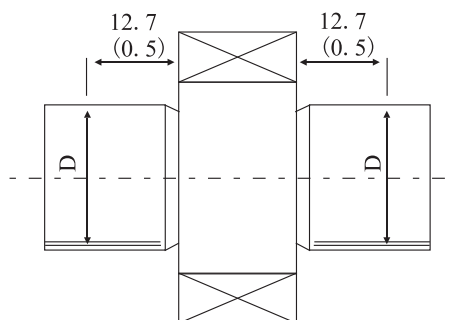


Fig. 10-21

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

(3) Assemble

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

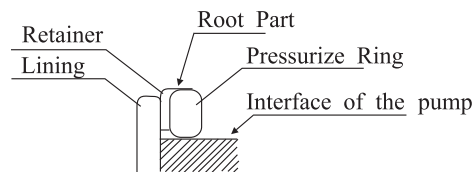


Fig. 10-21 Lining seal cap

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

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

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

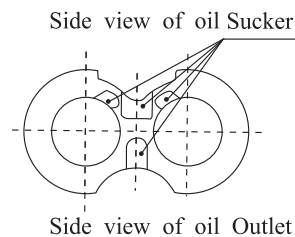
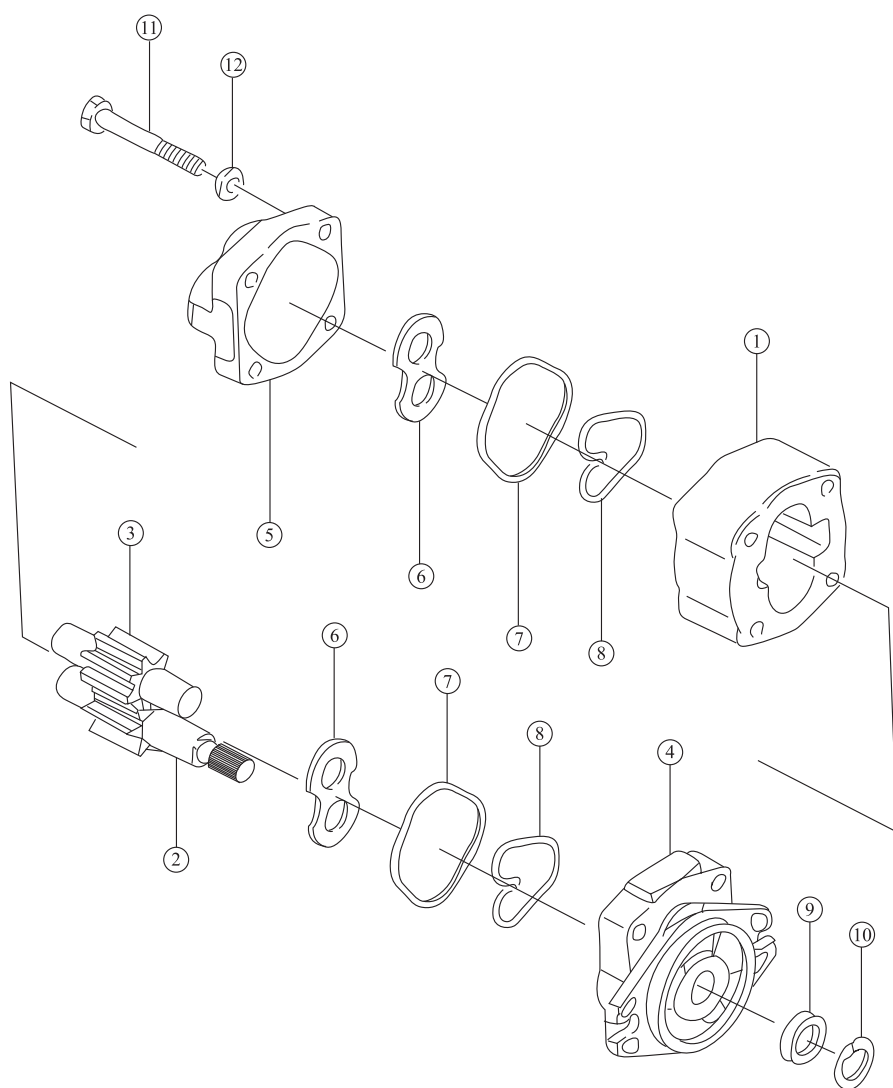


Fig. 10-22 Scale board

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

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

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



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

Fig. 10-23 Gear pump

10. 11 Testing.

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

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

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

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

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

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

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

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

10. 12Troubleshooting

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

(1)The selector valve

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

(2) Main pump

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

11. Lifting system

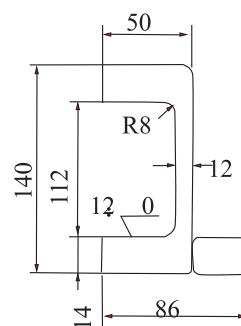
1-1. 8tType

“J” type mast

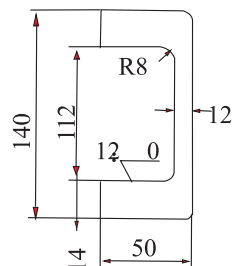
“C” type outer mast with free lift

Two stage extension type mast

Inner mast section



Outer mast section



Idler wheel

Idler wheel $\phi 112.3\text{mm}$

Restrict idler wheel $\phi 80\text{mm}$

Side idler wheel $\phi 91.5\text{mm}$

Side idler wheel $\phi 40\text{mm}$

Idler wheel;

Lifting Chain LH1223

Fork, mast lifting device Hydraulic

Mast tilt device Hydraulic

Fork clearance adjuster Mechanical

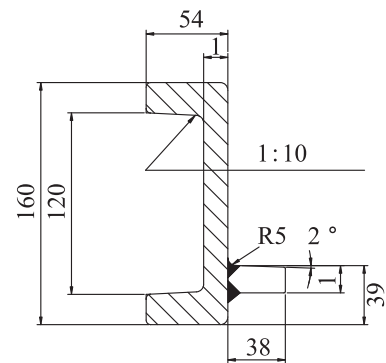
2-3. 5t Type

“J” type mast

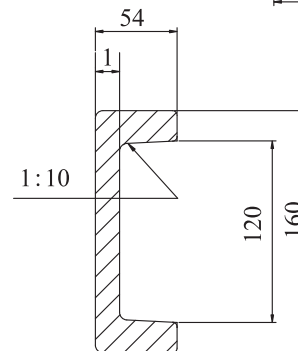
“C” type outer mast with free lift

Two stage extension type mast

Inner mast section



Outer mast section



Idler wheel

Main idler wheel	φ120.5
Choose idler wheel	φ119.5
Choose idler wheel	φ118.5
Lifting chain (ISO)	Lh1623 (2t~3t)
	Lh1634 (3.5t)

Fork mast lifting system Hydraulic

Fork adjust system Mechanical

11.1 General Description

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

11.2 Inner and outer Masts

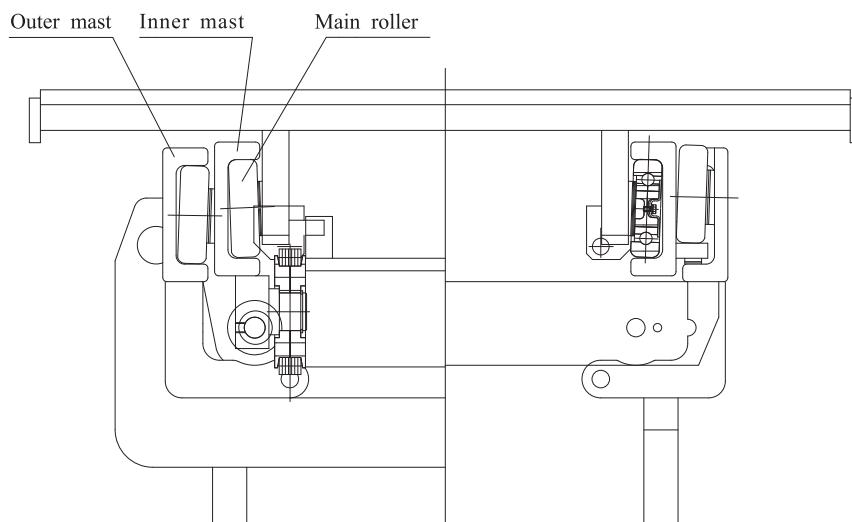
The inner and outer masts both are welded parts, the bottom of outer mast is connected with the drive axle, and the outside middle of outer mast is connected with the frame by tilt cylinders. The mast assembly can be tilted forward and backward by operating tilt cylinders. The outer mast has C-shaped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

11.3 The fork shelf and backrest

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

11.4 The position of roller

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



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

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

Fig. 11-1 Position of rollers

11. 5Maintenance

11. 5. 1 Adjust Lift Cylinder

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

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

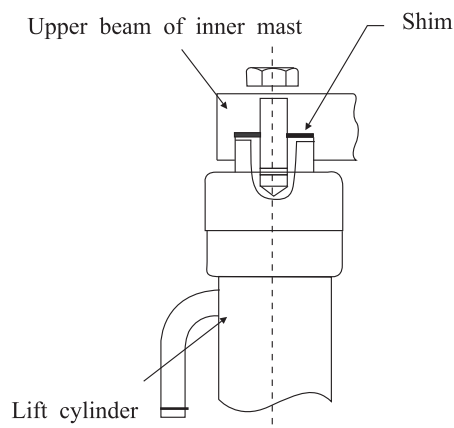


Fig. 11-2

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

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

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

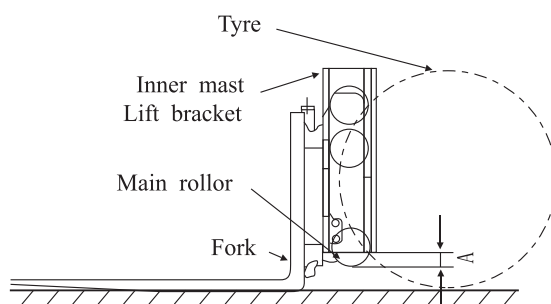


Fig. 11-3

11. 5. 2Adjust lift bracket's Height

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

(2): Lower the forks on the ground; adjust the set nut of tie-in to the upper of chains to assure the distance A between main rollers and the lift bracket.

The kind of forklift	A mm
1-1. 8t	36-41
2-2. 5t	24-29
3~3. 5t	19-24

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

11.5.3 Fork and its width adjustment

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

⚠Warning :

Be careful with your hand and fingers.

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

Remark :

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

11.5.4 Replacing Rollers of the lift bracket

- (1) Place a salver on the forks and make the forklift stop on the horizontal ground.
- (2) Make the forks and salver descend to the ground.
- (3) Take down tie-in top of the chains . And take out chains from sheave.
- (4) Make the inner mast rise. (Fig. 11-5 ①)
- (5) The forklift can be reversed when the lift bracket disengaged from the outer mast. (Fig. 11-5 ②)
- (6) Replacing Main Rollers.
- (a) Take apart all snap rings from the lift bracket and take out main rollers.

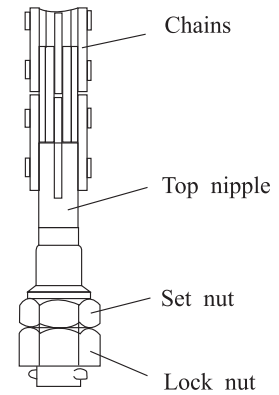


Fig. 11-4

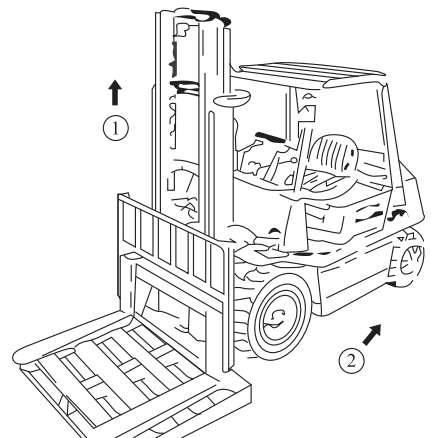
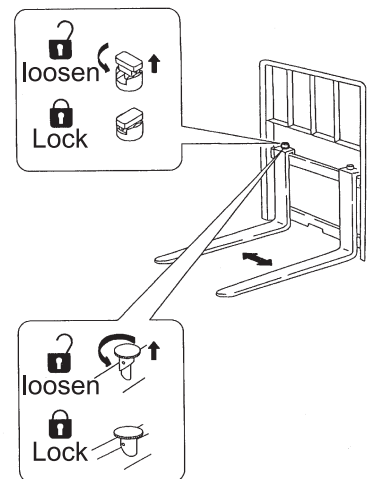


Fig. 11-5

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

11. 5. 5 Replacing Rollers of Masts

(1) Take apart the fork bracket from the inner mast, then replace the main roller follows the way as 11.5.4.

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

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

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

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

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

(7) Replacing main rollers.

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

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

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

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

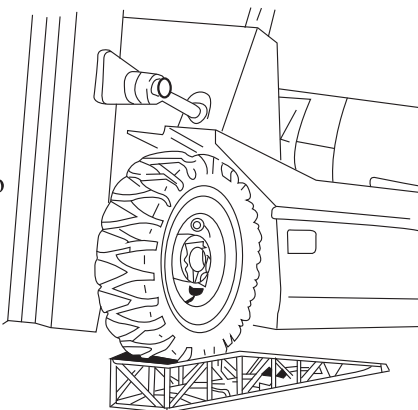


Fig. 11-6

V. Periodic servicing

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

ENGINE

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Engine	Visually inspect condition of engine rotation.		○	○	○	○	○
	Check for working noise from engine.		○	○	○	○	○
	Check that exhaust gas has proper-color.		○	○	○	○	○
	Check air cleaner element for dirt and clean.			○	○	●	●
	Check crankcase air breather for dirt and clean				○	○	○
	Check that valve clearnce is correct.	Thickness gauge				○	○
	Retighten cylinder head bolt.	Torque wrench		○ All gas engines, for 1st time only			○ C240 diesel only
	Check cylinders for proper compression.	Compression gauge.					○
PCV Device	Check metering valve and pipe for clogging or damage (G).					○	○
Governor or Injection Pump	Check no-load maximum rpm.	Tachometer					○
Lubrication System	Check for engine oil leak.		○	○	○	○	○
	Check engine oil for level and dirt.		○	○	○	○	○
	Replace engine oil.			● (at initial 25 hrs)	●	●	●
	Replace engine oil filter cartridge.			● (at initial 200 hrs)	●	●	●

ENGINE

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Fuel System	Visually check for fuel leak from pipe, pump or tank.		○	○	○	○	○
	Check fuel filter for clogging.				○	○	○
	Clean fuel filter (G).				○ (H20)	○ (H20)	● (A15& H20)
	Replace fuel filter cartridge (D)				●	●	●
	Check that injection nozzle has correct inject press and pattern(D)	Nozzle tester				○	○
	Check carbureter link mechanism for looseness or dirt (G).				○	○	○
	Check for ignition timing (G).	Timing light			○	○	○
	Check for ignition timing (D).						○
	Drain off water from fuel tank.				○	○	○
	Clean fuel tank.					○	○
	Check for fuel level.		○	○	○	○	○
Cooling System	Check for coolant level.		○	○	○	○	○
	Check for coolant leak.		○	○	○	○	○
	Check hoses for deterioration.				○	○	○
	Check radiator cap for condition and installation.		○	○	○	○	○
	Clean and change coolant.				●	●	●
	Check fan belt for tension and damage.		○	○	○	○	○

POWER TRAIN

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Frictional Clutch	Check clutch pedal for free travel and clearance between pedal surface and floor when clutch is unlocked.	Scale	○	○	○	○	○
	Check for noise and operation.		○	○	○	○	○
	Check for slipping and engagement.		○	○	○	○	○
Transmission	Check change lever for operation and looseness.			○	○	○	○
	Check for oil leaks.		○	○	○	○	○
	Change oil.					●	●
Torque converter transmission	Check for oil leaks.		○	○	○	○	○
	Check for oil level, or change oil.			○	○	●	●
	Check change lever for operation and looseness.			○	○	○	○
	Check control valve and clutch for proper operation.		○	○	○	○	○
	Check inching valve for proper operation.		○	○	○	○	○
	Check inching pedal for free travel and pedal travel.		○	○	○	○	○
	Replace line filter element.			● (at initial 200 hrs)		●	●
Front Axle	Check for oil leak.		○	○	○	○	○
	Change oil.					●	●
	Check mounting bolts for looseness.	Test hammer		○	○	○	○

WHEELS

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

STEERING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Steer Handwheel	Check for peripheral play.		○	○	○	○	○
	Check for vertical looseness.		○	○	○	○	○
	Check for sideways looseness.		○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
Steering gear box	Check mounting bolts for looseness.			○	○	○	○
Knuckle rear axle	Check king pins for looseness or damage.			○	○	○	○

STEERING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Knuckle rear axle	Check for deflection, deformation, cracks or damage.			○	○	○	○
	Check for mounting condition.	Test hammer		○	○	○	○
Power steering	Check for operation.		○	○	○	○	○
	Check for oil leaks.		○	○	○	○	○
	Check for mounting parts and joints for looseness.			○	○	○	○

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Brake pedal	Check for free travel.		○	○	○	○	○
	Check for pedal travel.	Scale	○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
	Check for air mixed in brake piping.		○	○	○	○	○
Parking Brake Lever	Check that lever is securely locked and has sufficient lever stroke.		○	○	○	○	○
	Check for proper operation.		○	○	○	○	○
Rod, cable, etc.	Check for operation.			○	○	○	○
	Check connections for looseness.			○	○	○	○
Hoses and pipes	Check for damage, leakage or collapse.			○	○	○	○
	Check for loose connections or clamping parts.			○	○	○	○
Brake master cylinder wheel cylinder	Check for fluid leaks.			○	○	○	○
	Check for fluid level. Change brake fluid.		○	○	○	●	●

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Brake master cylinder wheel cylinder	Check master cylinder and wheel cylinders for proper operation.						○
	Check master cylinder and wheel cylinders for fluid leaks or damage.						○
	Check master piston cup, and check valve for wear or damage. Change.						●
Brake Drum & Brake Shoe	Check drum mounting part for looseness.	Test hammer		○	○	○	○
	Check lining for wear.	Slide calipers					○
	Check brake shoes for proper operation.						○
	Check anchor pin for rust.						○
	Check return spring for deterioration.	Scale					○
	Check automatic clearance adjuster for operation.						○
	Check drum for wear or damage.						○
Back Plate	Check back plate deformation.						○
	Check for craks.	Penetrant test					○
	Check mounting parts for looseness.	Test hammer					○

LOADING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Fork	Check forks for damage, deformation or wear.		○	○	○	○	○
	Check for stopper pins for damage or wear.				○	○	○
	Check fork base and hook weldings for defective cracks or wear.			○	○	○	○
Mast & Lift Bracket	Check cross members on outer and inner masts for defective weld, cracks or damage.			○	○	○	○
	Check tilt cylinder bracket and masts for defective weld, cracks or damage.			○	○	○	○

LOADING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Mast & Lift Bracket	Check outer and inner masts for defective weld, cracks or damage.			○	○	○	○
	Check for defective weld, cracks or damage of lift bracket.			○	○	○	○
	Check roller bearings for looseness.			○	○	○	○
	Check mast support bushings for wear or damage.						○
	Check mast support cap bolts for looseness.	Test hammer		○ (for 1st time only)		○	○
	Check lift cylinder tail bolts, piston rod head bolts, U-bolts, and piston head guide bolts for looseness.	Test hammer		○ (for 1st time only)		○	○
	Check rollers, roller pins and welded parts for cracks or damage.			○	○	○	○
Chains & Sheave	Check chains for tension, deformation, damage or rust.		○	○	○	○	○
	Lubrication of chains.			○	○	○	○
	Check connection of chain anchor pin and chain for looseness.			○	○	○	○
	Check sheave for deformation or damage.			○	○	○	○
	Check sheave for deformation or damage.			○	○	○	○
Optional Attachment	Perform general inspection			○	○	○	○
Cylinders	Check piston rod, screw and rod end for looseness, deformation or damage.	Test hammer	○	○	○	○	○
	Check cylinders for proper operation.		○	○	○	○	○
	Check for oil leaks.		○	○	○	○	○
	Check pins and cylinder bushings for wear or damage.			○	○	○	○
Hydraulic Pump	Check hydraulic pump for oil leaks or noise.		○	○	○	○	○
	Check pump drive gear for wear.			○	○	○	○

HYDRAULIC SYSTEM

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

ELECTRICALS

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annually (2400hrs)
Ignition Device (for gasoline truck)	Check distributor cap for crack.				○	○	○
	Check spark plug for burn.						○
	Adjust spark plug clearance.	Plug gap gauge			○	○	○
	Clean spark plug .				○	○	○
	Check distributor cap high-voltage cord for installation.						○
	Check distributor segment for burn.						○
	Check distributor center piece for wear or damage.						○

ELECTRICALS

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semianually (1200hrs)	Annually (2400hrs)
Ignition Device (for gasoline truck)	Apply grease on shaft, cam heel and breaker fulcrum.				○	○	○
	Check high-voltage cord for breakage.	Tester					○
Starter	Check pinion gear for correct engagement.				○	○	○
Battery	Check battery electrolyte level. Clean battery.			○	○	○	○
	Check specific gravity of electrolyte.	Hydrometer			○	○	○
Wiring	Check wire harness for damage and clamps for looseness.			○	○	○	○
	Check connections for looseness.				○	○	○

SAFETY APPARATUS & ACCESSORIES

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

SAFETY APPARATUS & ACCESSORIES

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

▲ CAUTION

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

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

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



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