VIPER
LIFT TRUCKS

OPERATING AND SERVICE MANUAL

VIPER 4 - 4.5 TON

INTERNAL COMBUSTION BALANCED FORKLIFT TRUCK

CONTACT US WITH ANY QUESTIONS

PARTS@VIPERLIFTTRUCKS.COM

TOLL FREE: (888) 745-0577

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 4-4.5T internal combustion counterbalanced forklift, including parameter, structure of main components, working theory, operation and maintance. 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.

Viper Lift Trucks

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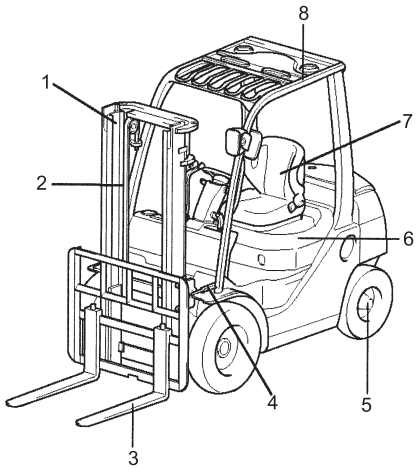

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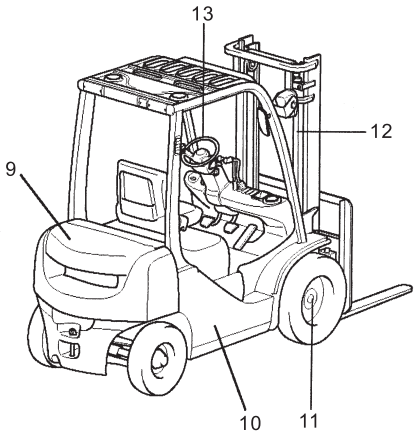

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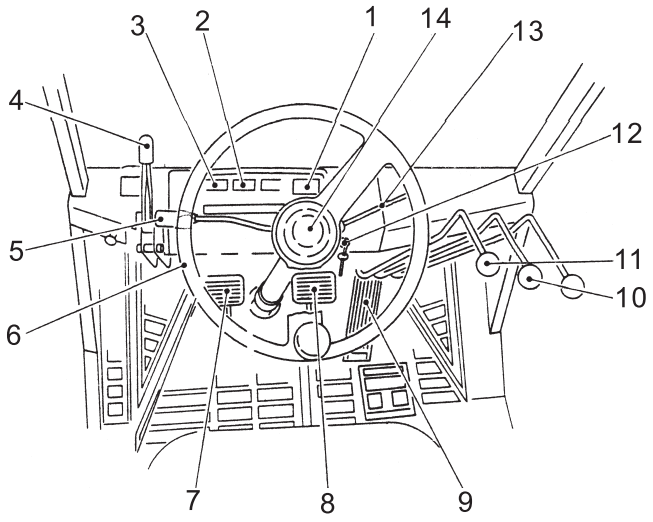

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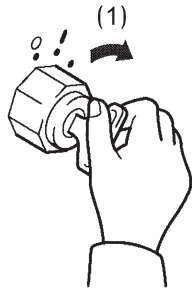


(1)START

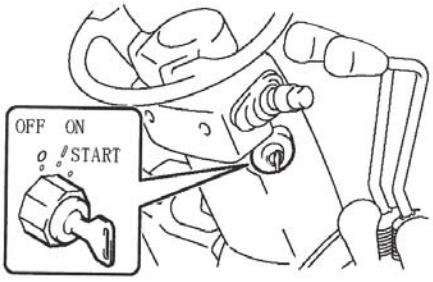
Check method of each warning lamp

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 form (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 .

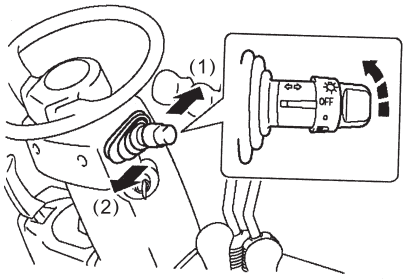
. Do not operate the starter motor for more than 30 seconds continuously . Return the switch to the (OFF) position and wait at least 30 seconds prior to attempt restarting .

⚠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 Viper 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 .

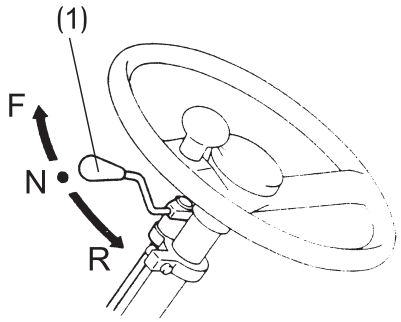
Turn signal switch (Option)

Make the turn signal lamps blink

Left turn ·····Push forward

Right turn ·····Pull backward

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



(1) Forward-reverse lever

Forward-reverse lever

Lever for shifting between forward and reverse .

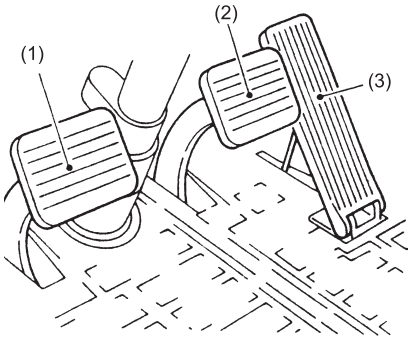
Forward Ⅰ、Ⅱ·····Push the lever forward(F)

Reverse Ⅰ·····Pull 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 needle of the oil pressure gauge swings to the left) allowing the operator to perform inching operation. Use this pedal to inch the truck while operating the hoist system at a high speed.

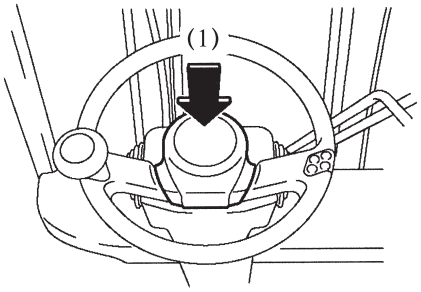
When pressed to the full, this inching pedal serves as a brake pedal.

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.

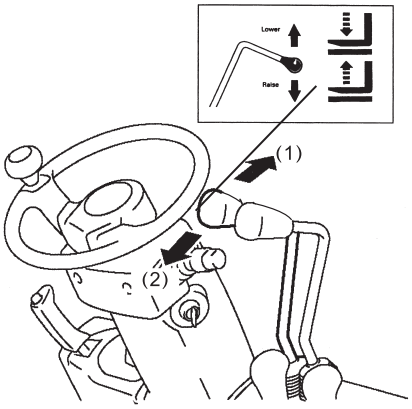


(1) Push

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

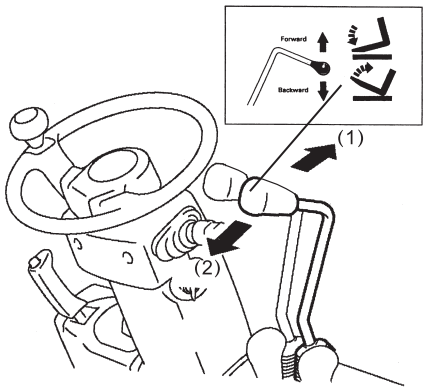
Raise and lower the forks .

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 tilting
(2)Backward tilting

Tilt lever

Tilt the mast forward and backward .

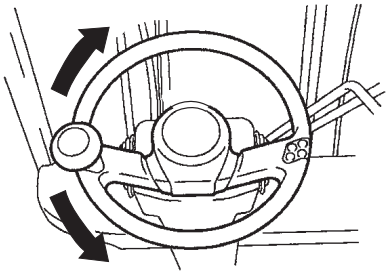
Forward·····Push forward

Backward·····Pull backward

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

⚠Caution

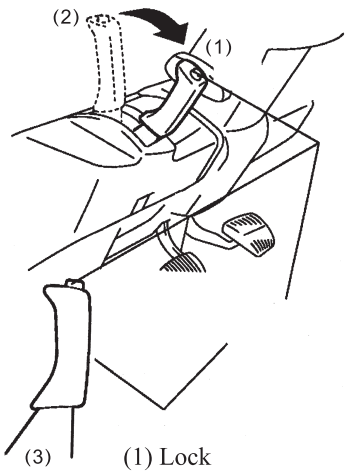
. Always operate the tilt lever from a seated position .



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 .



(1) Lock
(2) Release
(3)Grip

Parking brake lever

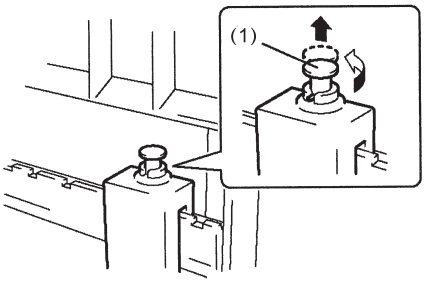
When parking , grasp the grip of the lever and fully pull it towards you . When releasing , grasp the grip of the lever and then push it back . while operating the parking brake lever , keep the brake pedal fully depressed .

⚠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 .



(1) Fork stopper

Forks

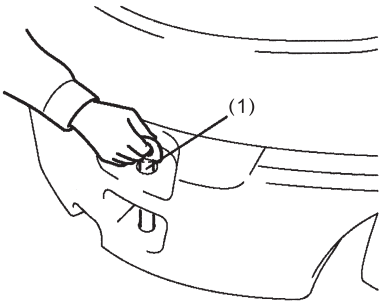
Lift each fork stopper and turn to release so that forks can be shifted left and right .

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 .



(1) Draw bar

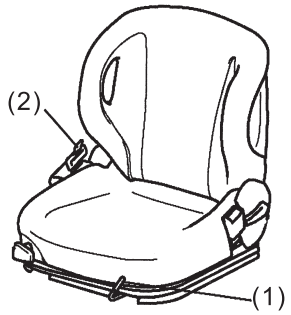
Draw bar

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

Operator's seat

The operator's seat and seat belt are provided for your safety .The seat can be moved back and forth for position adjustment while the adjust lever is pulled upward .

Suspension seat

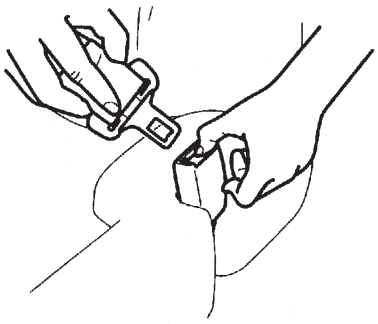
The seat suspension mechanism provides a comfortable seating position according to the weight of the driver . The optimum driving position can be set by using the knob and levers . Elastic seat can reduce the vibration of running forklift .

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 .

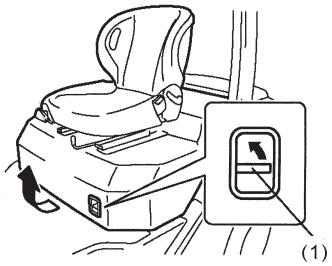
Disconnecting method

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

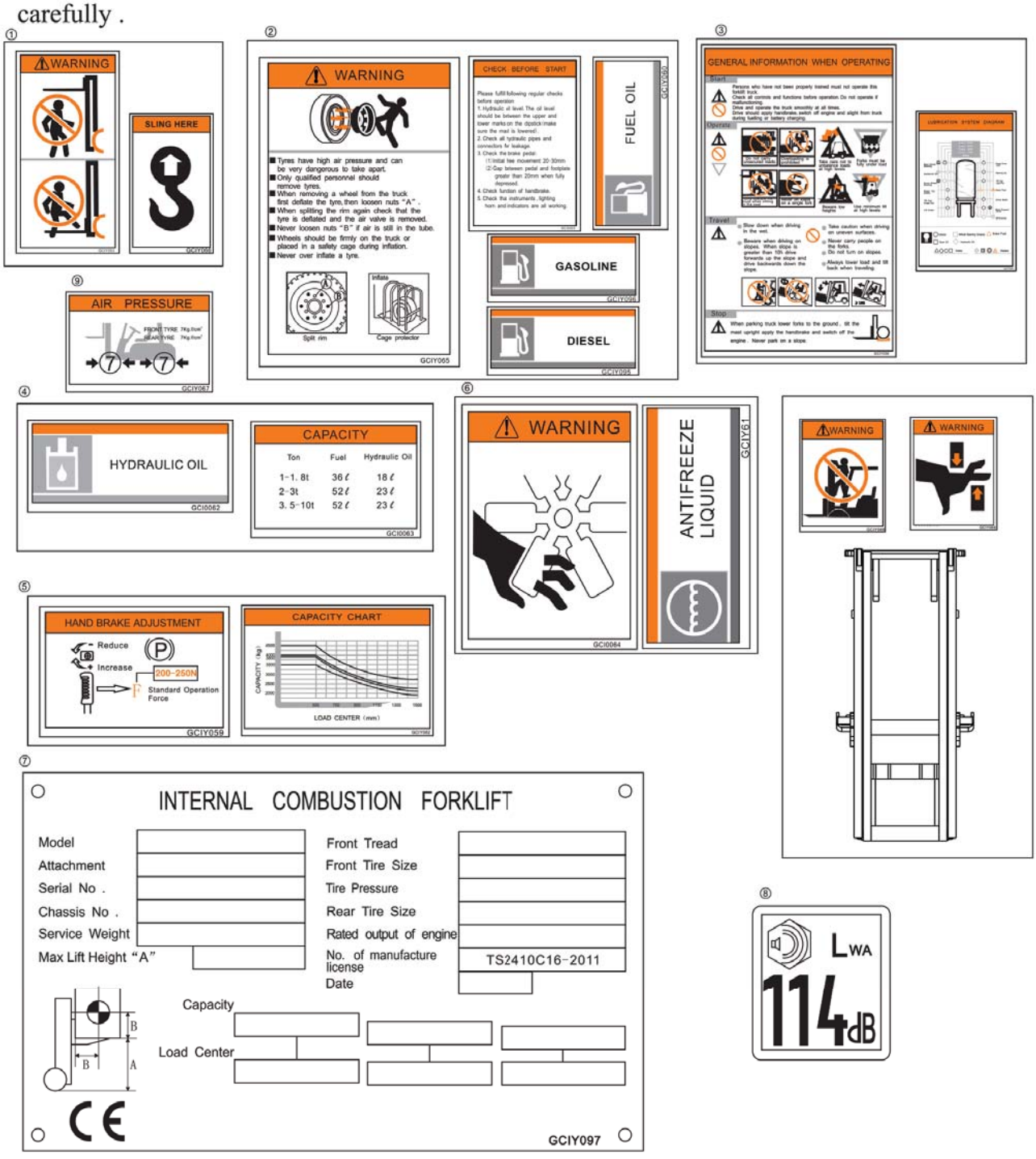
Close the engine hood quietly , and press down the hood until you hear a click sound .

⚠Caution

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

Warning Marks

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



Ⅱ. Safe Operation Rules and Daily Maintenance for 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-oparation check

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

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

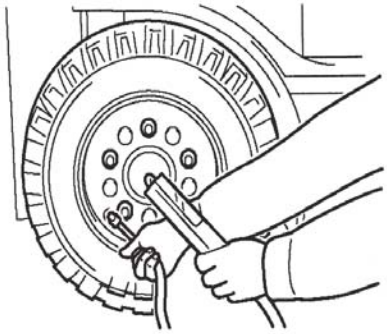
Item	Inspection
Previously detected malfunction	Correct
Exterior	Vehicle body , oil leakage , water leakage, loose parts, exterior damage .
Wheels	Tire pressure , wear or damage , rims hub nuts.
Lamps	Lamp condition , damaged lamps .
Hydraulic oil	Oil lever , contamination , consistency .
Radiator	Coolant 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 Viper dealer .

(3) Tire inspection

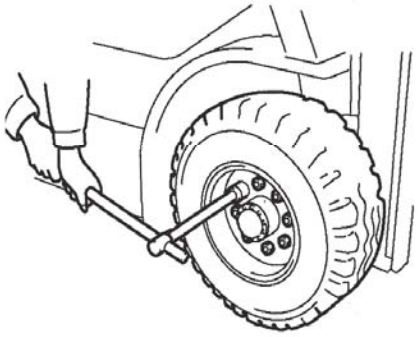
Tire pressure inspection

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

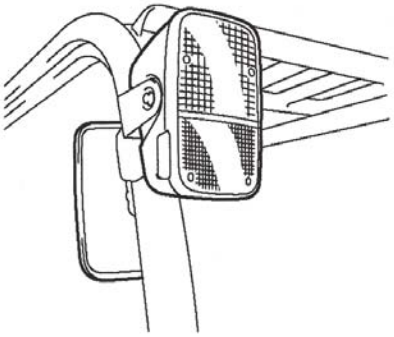
Check the tires for damage and wear , and the rims for bending . If the tires are damaged , or there is a marked difference in the wearing of tires between the front and rear or between the left and right is perceived , or bent rims are found , ask a Viper dealer for inspection .



(4) Hub nut inspection

Check the tightness of the hub nuts .

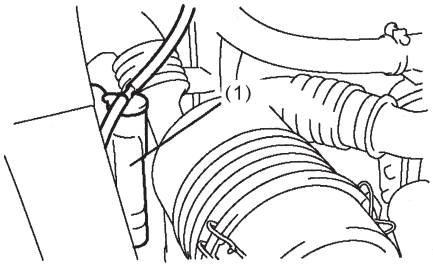
Avoid uneven torque and tighten all of the nuts uniformly .



(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

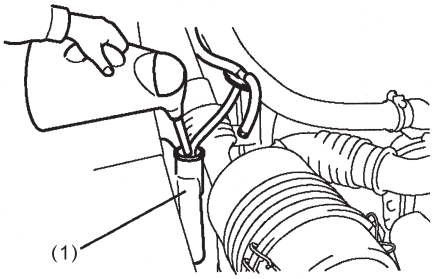
Engine coolant level check and supply

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 .



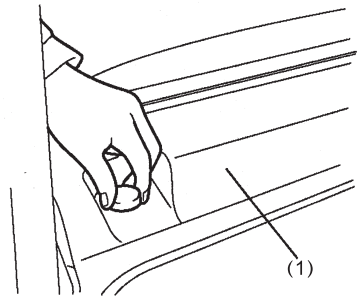
(1) Reservoir tank

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) Radiator cover

(7) Checking the engine coolant level in radiator

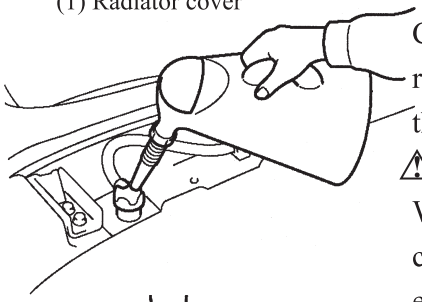
1. Remove the radiator cover .

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 .

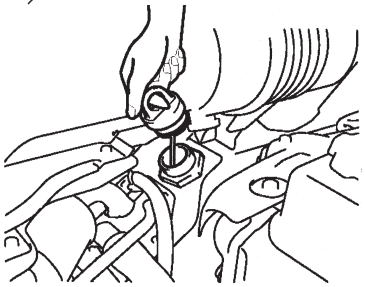
Note :

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 .



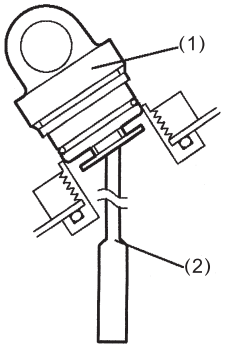
⚠Warning

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.



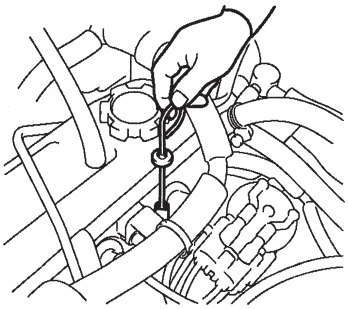
(1) Oil cap
(2) Level identifier

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 :

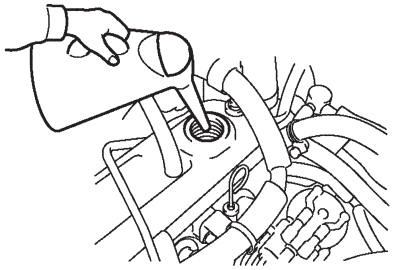
Inspect the oil level by placing the level gauge on the opening of the oil supply inlet without pushing the oil cap in .

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 .

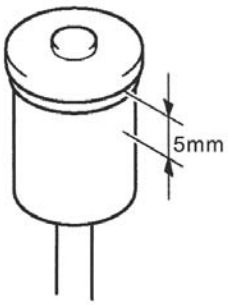
SAE40 Ambient temperature higher than 30°C
SAE40 Ambient temperature 0°C to 30°C
SAE40 Ambient temperature -10°C to 0°C

⚠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 Viper dealer for inspection as early as possible .

⚠Warning

. Never use any oil other than brake fluid .

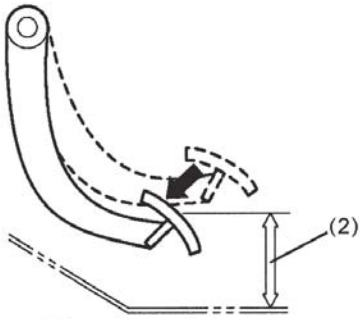
. Prevent dirt from getting into the reservoir tank . Even a small amount of dirt in the brake fluid can prevent proper braking .

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

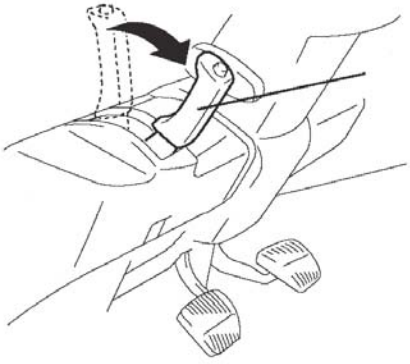
1. Depress the brake pedal fully , and check the floor clearance (clearance between the pedal and floor).
2. Make sure that the pedal does not go any further when it is kept depressed .
3. Also check that no abnormality is observed with pedal depression and return .
4. Manually depress the brake pedal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



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

⚠Warning

Ask a Viper 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 Viper dealer for inspection if any abnormality is found .

(1) Inching and brake pedal

(14)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

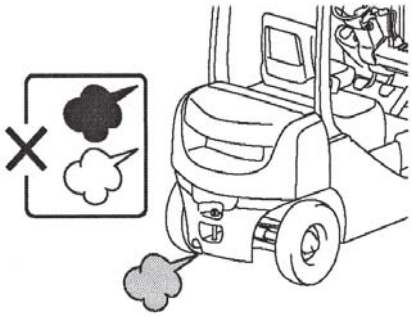
Ask a Viper dealer for inspection when any abnormality is found .

(15) 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 .

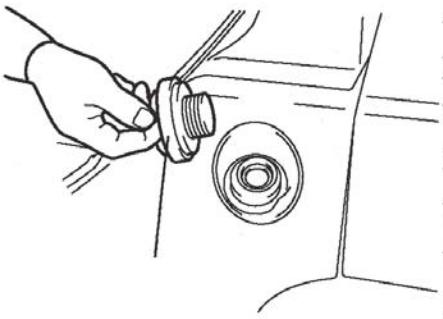
Colorless or light blue exhaust indicates complete combustion ; black exhaust , incomplete combustion ; and white exhaust , burning oil as a result of oil getting into the cylinders .

⚠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 .



(16) 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 .

(17) Load handling system

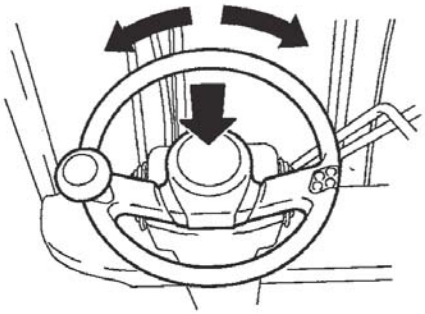
1. Check the fork installation state for cracks and bending .

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 Good Sense dealer .

(18) 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 Viper dealer for inspection .

(19) 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 Viper forklift privately, if indeed demanded , please contact Good Sense sale agent and after service department first .

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

(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.

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

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

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

(31) Pay special attention to the disposal of rejectament 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 Viper 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 Viper 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

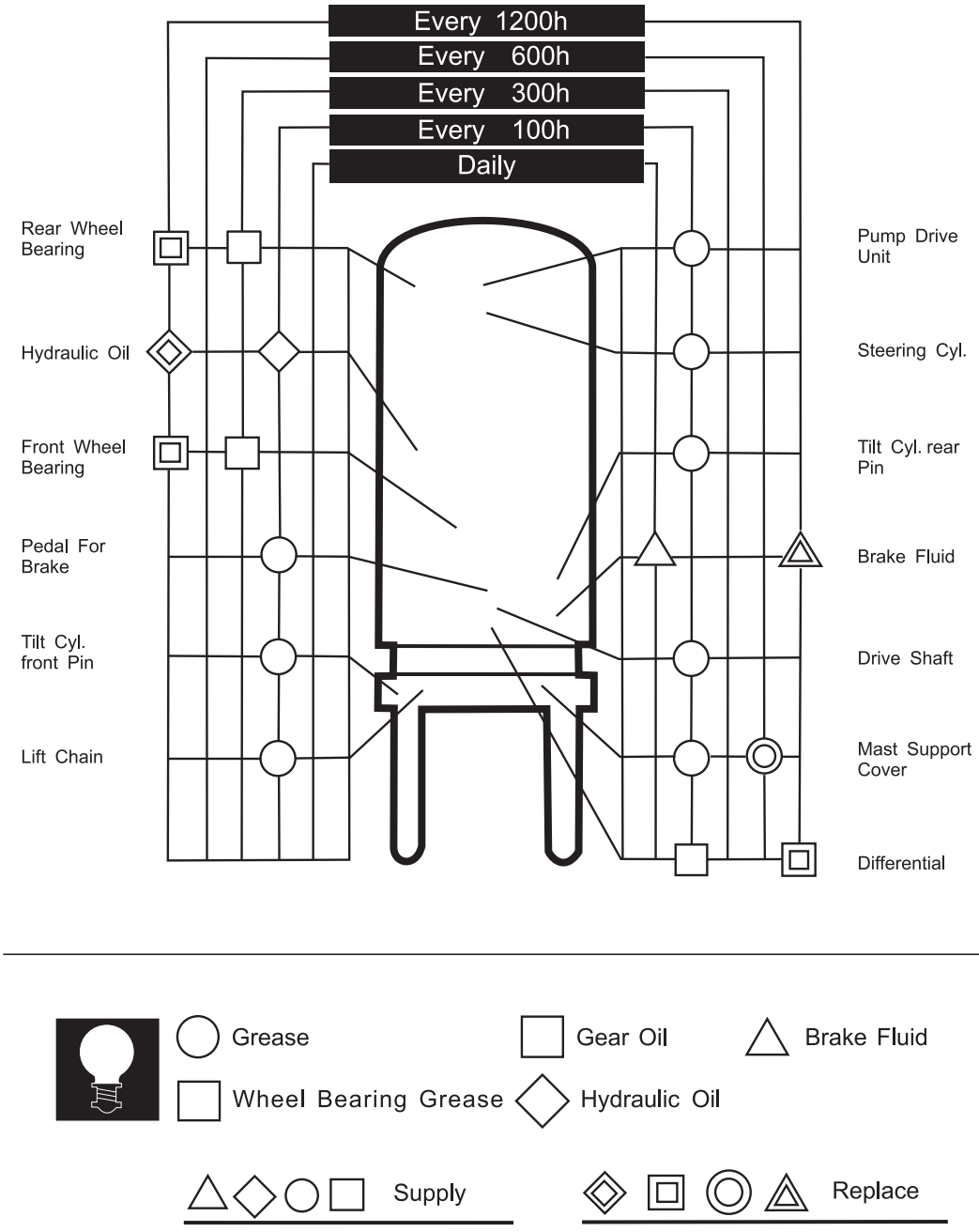
Name	The code name (domestic)	Code name (abroad)
Gasoline	RQ-85	JISK2202, 2#
Diesel	Use the diesel maintenance illustration or the GB252-94 light diesel: summer 0#, winter 10~-35#, the general region summer 0#, winter 10#, the north east region 25#,	JISK2204, 2# (general region)
		JISK2204, 3# (cold 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	N32# or N46#	ISOVG30
Fluid trans-mission oil	6# 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

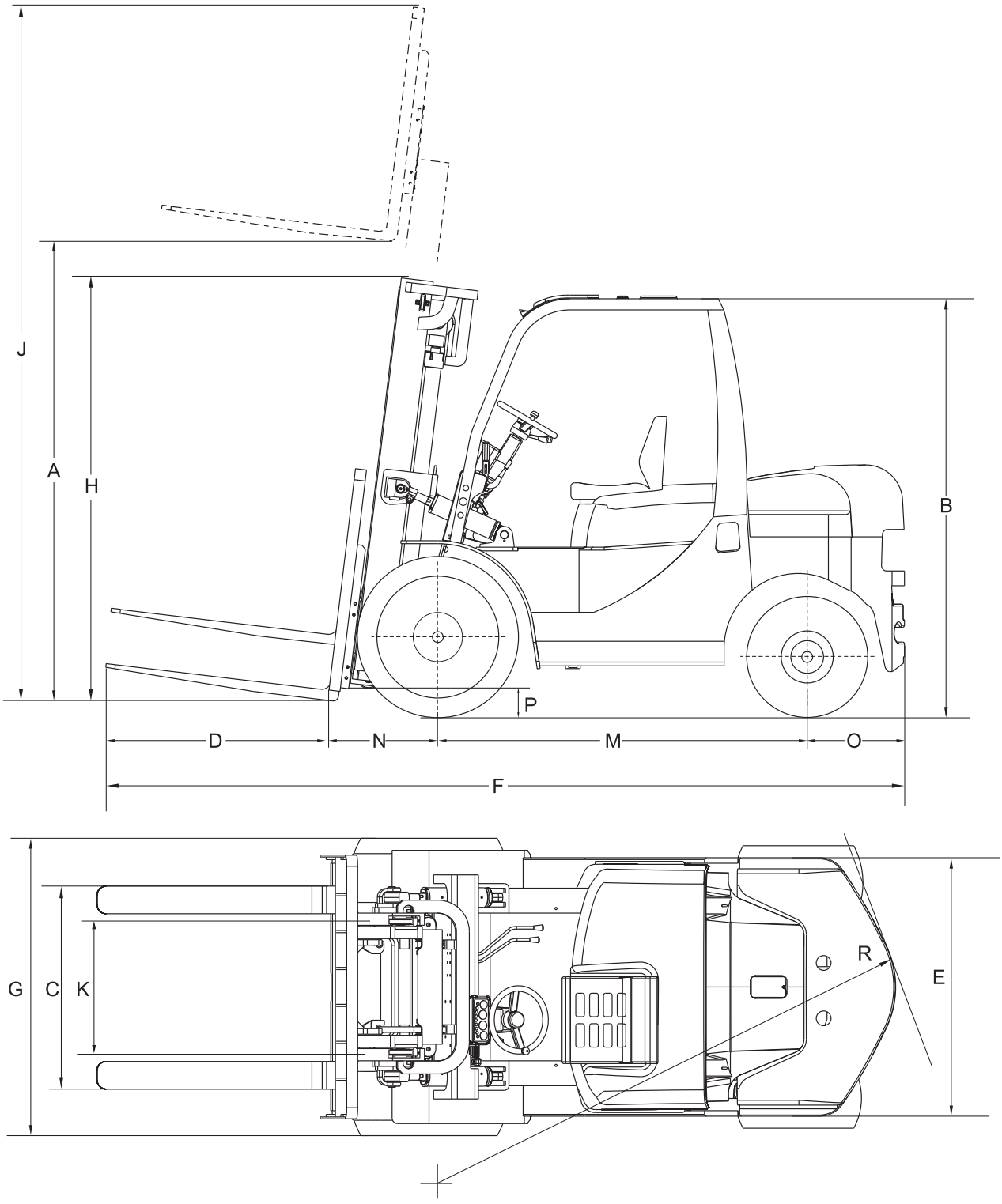
Item \ Model		Units	FD40	FD45
Mast	Exterior size	mm	2105×1398×572	2175×1480×705
	weight	kg	888	1120
Counter weight	Exterior size	mm	851×1400×1119	851×1400×1119
	weight	kg	2420	2500

7. Lubrication system picture:

LUBRICATION SYSTEM DIAGRAM



Ⅲ. Primary technic parameter of forklift



Forklift Figure

Main technical parameter

No .	Sign	Item \ Model	FD40-C1	FD45-C1	FD40-P1	FD45-P1
1	A	Lift height	3000			
2	C	Adjust internal for forklift	240-1100	240-1100	260-1100	260-1100
3	D	Length of forklift	1070			
4	E	Mast tilt angle(Front~Rear)	6◦ ~12◦			
5	F	Whole length	4180	4180	4180	4180
6	G	Whole width	1480	1480	1480	1480
7	H	Whole height(bracket)	2350	2350	2350	2350
8	B	Whole height(head guard)	2290	2290	2290	2290
9	J	Whole height(bracket extension)	4180	4180	4180	4180
10	K	The distance of wheel (Front)	1180	1180	1180	1180
11	L	The distance of wheel(Rear)	1190	1190	1190	1190
12	M	The distance for axis	2000	2000	2000	2000
13	N	Front suspension	565	570	565	570
14	O	Back Suspension	550	550	550	550
15	P	Ground clearance	158	158	158	158

Main technical parameter

Item		Unit	FD40-C1	FD45-C1	FD40-P1	FD45-P1
Rated Capacity		Kg	4000	4500	4000	4500
Load center		mm	500			
Max lift heigh (STD)			3000			
Mast tilt angle		(°) / (°)	6/12			
Min. turning radius		mm	2740	2740	2740	2740
Min. under clearance			158	158	158	158
Wheelbase			2000	2000	2000	2000
Tread Fed/bwd			1180/1190	1180/1190	1180/1190	1180/1190
Overall length			4180	4180	4180	4180
Overall width			1480	1480	1480	1480
Overall height	Mast		2350	2350	2350	2350
Truck weight		Kg	6150	6550	6150	6550
Max. traveling speed Unladen		Km/h	20			
Lift speed	Laden	mm/s	450	430	450	430
Type	Front		3.00-15-18PR	3.00-15-18PR	3.00-15-18PR	3.00-15-18PR
	Rear		7.00-10-10PR	7.00-12-12PR	7.00-10-10PR	7.00-12-12PR
Gradeability laden		%	20	20	20	20
Battery	voltage/capacity	V/Ah	24/80	24/80	24/80	24/80
Engine	Type		B3.3-C80	B3.3-C80	1104D-44	1104D-44
	Manufacturer		CUMMINS	CUMMINS	Perkins	Perkins
	Rated output/speed	Kw	60/2200	60/2200	56/2200	56/2200
	Max. torque/speed	N.m	292/1600	292/1600	260/1900	260/1900
	No. of Cylinder		4	4	4	4
	Cyl. Number-Bore × stroke	mm	95×115	95×115	105×127	105×127
	Displacement	cc	3300	3300	4400	4400

IV. Primary Assembly Introduce of Forklift

No	Name	Contents
1	Engine System	Includes engine mounting, fuel system, exhaust system, cooling system (torque converter pipelines) etc.
2	Transmission System	Includes transmission, tor-con, transmission shaft control linkages etc.
3	Drive Axle	Includes axle house, half shafts, differential, hub reduction, brake, front wheel etc.
4	Steering System	Includes powered steering unit, redirector etc.
5	Steering Axle	Includes axle box, steering cylinder, rear wheel etc.
6	Hoist System	Includes outer & inner mast, lift bracket, backrest, fork, tilt cylinder, lift cylinder, end roller, side roller, sheave, chain etc.
7	Frame System	Includes frame, cabinet, tank in frame, hood, floor, counterweight, seat, cover of radiator etc.
8	Operation System	Includes operation series of brake & inching control, parking brake and accelerator etc.
9	Hydraulic System	Includes pump, valve, high & low pressure oil pipe, connecter etc.
10	Electric System	Includes lights, battery, instruments harness, meter etc.
11	Overhead guard	Overhead guard (cab is option)

V. The structure , principle , adjustment and maintenance of Forklift

1. Dynamic System

(1) Brief introduction

The dynamic system includes the engine, air inlet system, cooling system and exhaust system, etc. The engine is linked to transmission device. The holder of engine is connected with the frame of the forklift through a rubber cushion to reduce vibration. The engine is connected to the tor-con, the transmission, transmission shaft and drive axle, see following figure.

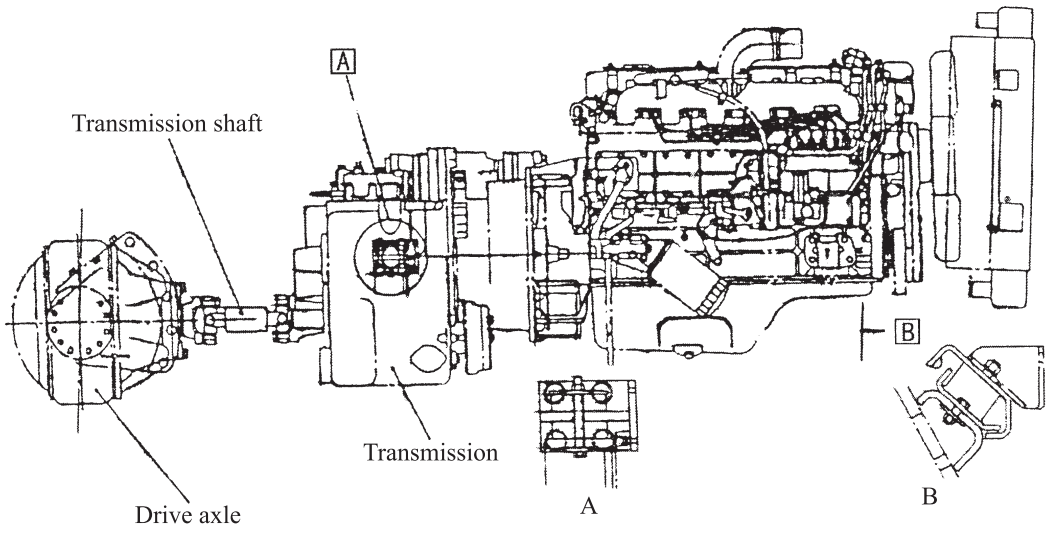


Fig.1-1 Engine mounted

(2)The engine

The power of 4-4.5t forklift truck is provided by diesel engine Perkins(1104D). The homeland diesel engine includes Weifang (R4105G32).

1.1 Fuel system

The fuel system is composed of fuel tank, filter and fuel sensor.

1.1.1 Fuel tank

The fuel tank of welding structure is connected into one body with frame and placed at the left side of frame. There is an oil tank cap plate on which the fuel sensor is mounted. Refer to Fig.1-2.

1.1.2 Fuel sensor

The function of fuel sensor is to convert the oil stored in the fuel tank into current through up and down movement of float, which will be finally displayed on the fuel meter on the instrument panel so that people can directly know the quantity of oil inside the fuel tank. Refer to Fig.1-3.

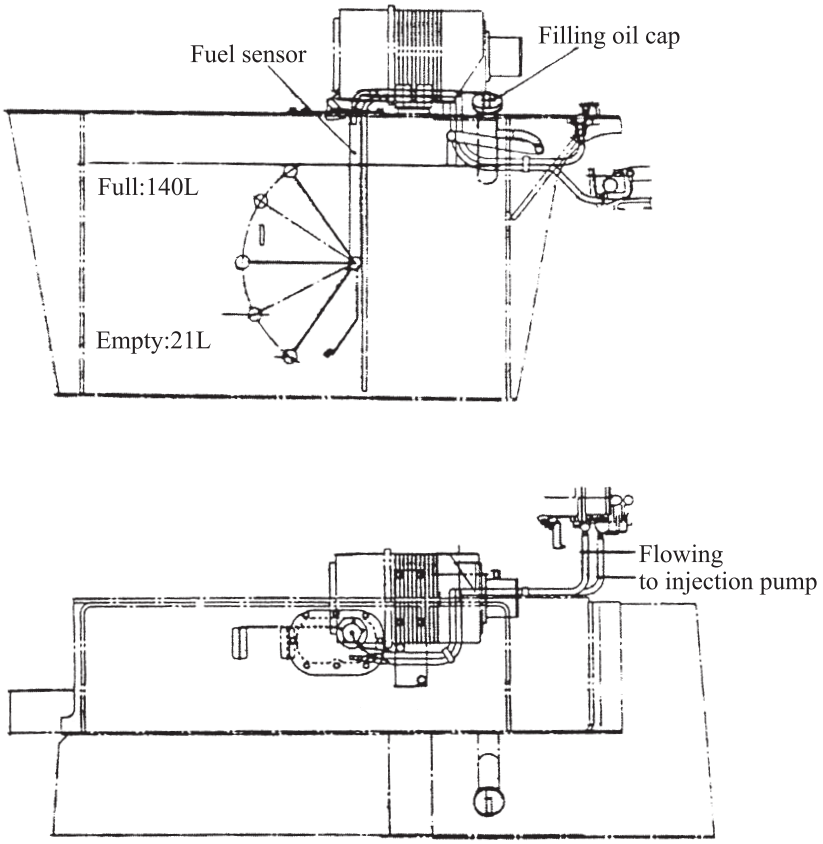


Fig.1-2 Fuel box

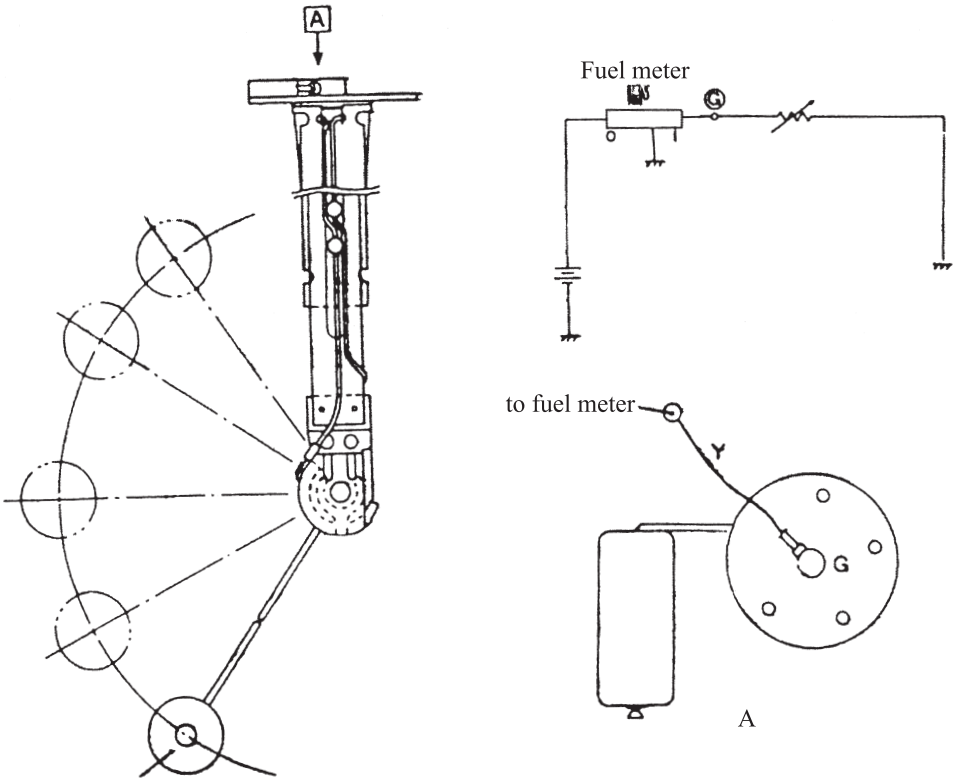


Fig.1-3 Fuel sensor unit

1.1.3 Fuel filter

The fuel filter is mounted on the fuel-feeding manifold of engine and used to filter the fuel supplied to engine. The bypass valve is mounted inside filter, which can supply fuel to engine in case of obstruction of filter element.

1.2 Check and adjustment

In order to keep the engine in good working state, it is necessary to make regular check and adjustment and the main points are as follows:

1.2.1 For air filter, please See Fig.1-4.

(1) Take out filter element

(2) Check the dust and damage state of the filter of the element. The lower pressure air is used to blow from inside to outside for purging and replace the filter element with a new one if it can't be cleaned due to serious obstruction or damaged .

(3) Clean off the dust inside the cap.

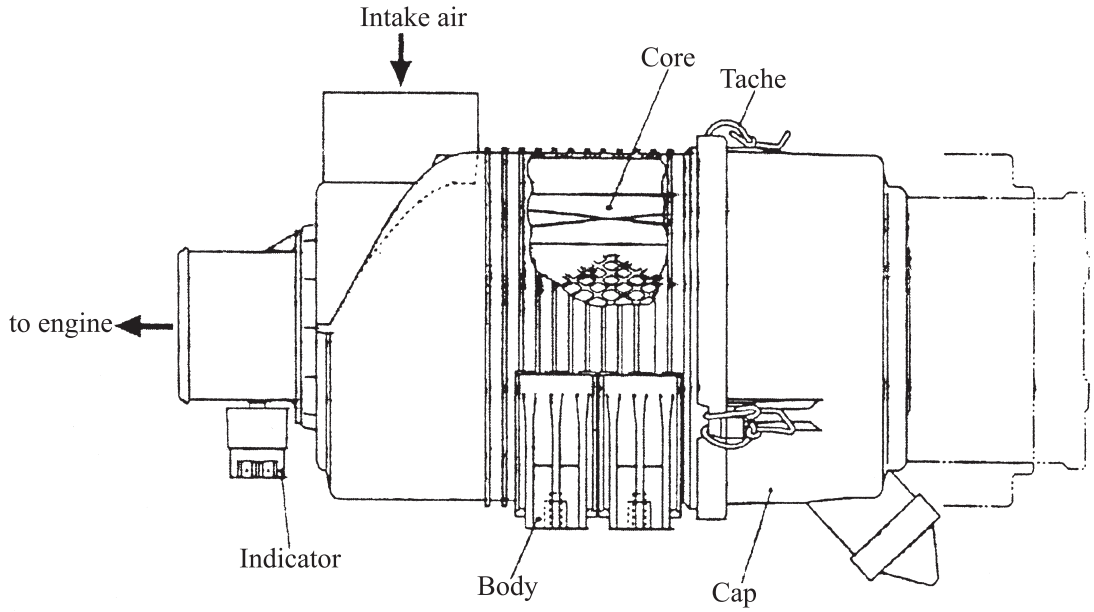


Fig.1-4 Air cleaner

1.2.2 For fuel filter, See Fig.1-5

(1) Dismantle it with the spanner specially used for filter and change it if it is damaged and obstructed.

(2) Mount it after applying a few drops of fuel oil around the sealing ring of the new fuel filter and screw in 2/3 turns after the sealing ring contacts with the main body of the fuel filter.

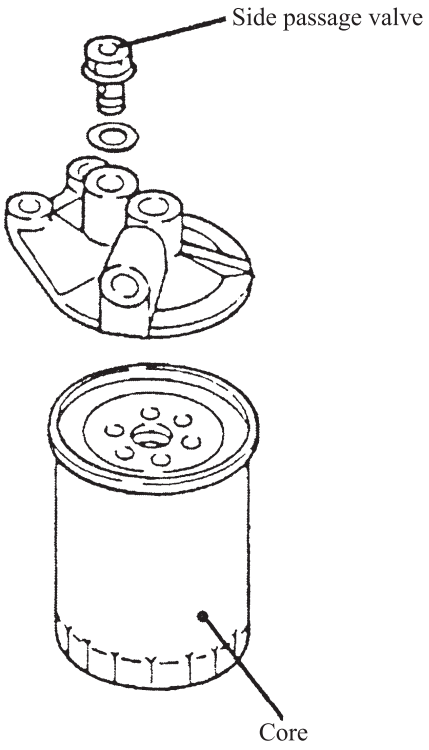


Fig.1-5

1.2.3 For the machine oil filter, See Fig.1-6.

(1) Dismantle it with a spanner specially used for fuel filter and change it.

(2) Mount it after applying a few drops of lubricating oil around the sealing ring of the new filter and screw in 2/3 turns after the sealing ring contacts with the machine body.

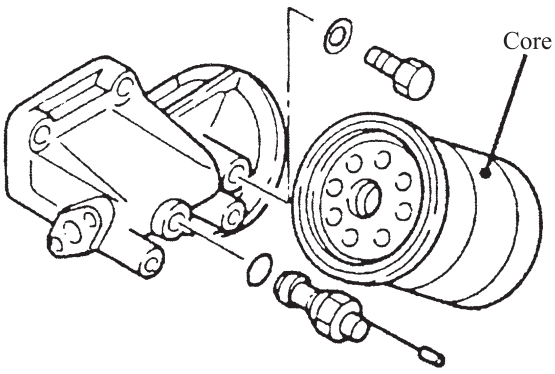


Fig.1-6

1.3 Cooling system

The cooling system is accomplish by water pump and radiator, The antifreeze is medium.

Refrigerant come into ratiator by water pump. and then turn into the cylinder block for cooling.

The thermostat is above the water pump. When the thermostat is turned on, the flow of radiator coolant to form outside the loop, when the temperature is low, the thermostat turn off, the coolant flows into the cylinder block, forming inside the loop. This will enable the engine cold start, so that the engine was maintained at optimum range.

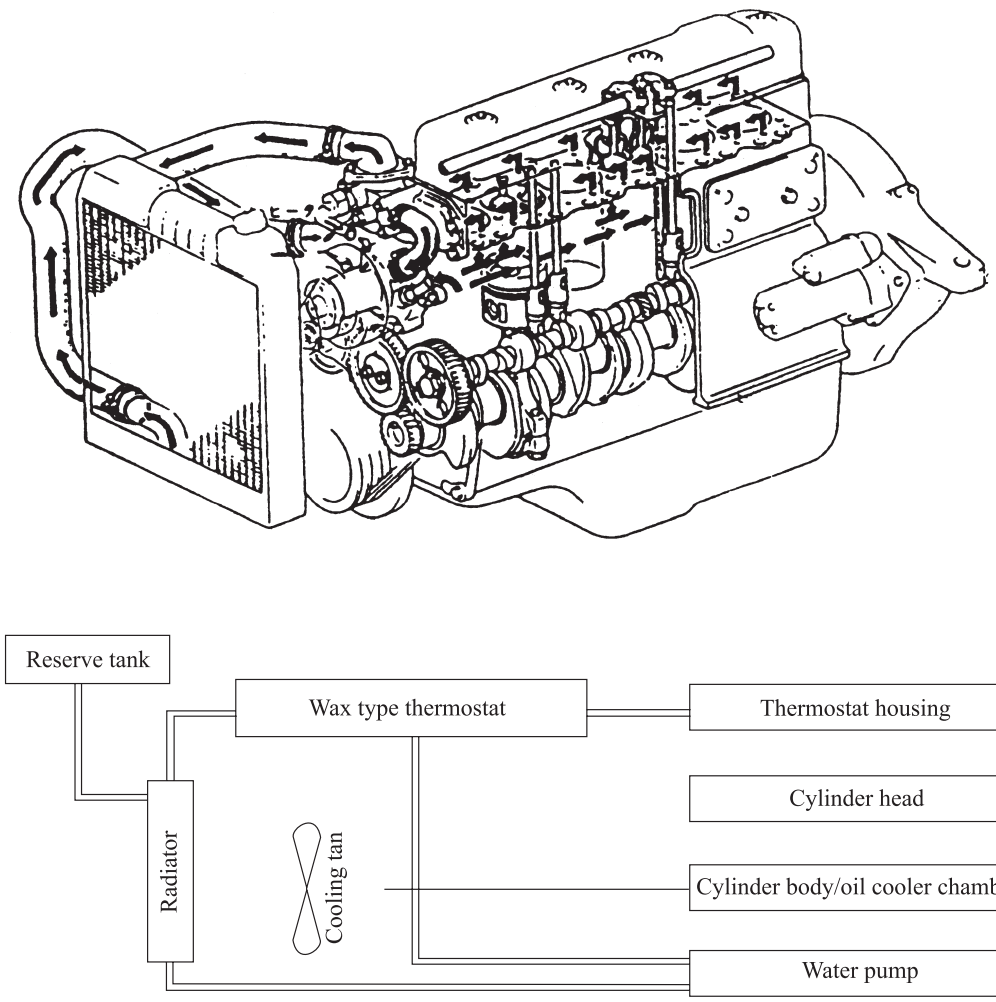


Fig.1-7 Cooling system

1.4 Maintenance

1.4.1 Tightening the cylinder head bolts of engine.

(1) Tighten the cylinder head bolts one by one with 68 Nm moment according to the order shown in Fig. 1-8.

(2) Increase the tightening moment to 93 Nm and lighten the bolts one by one.

(3) Then turn each bolt 90° and screw tightly.

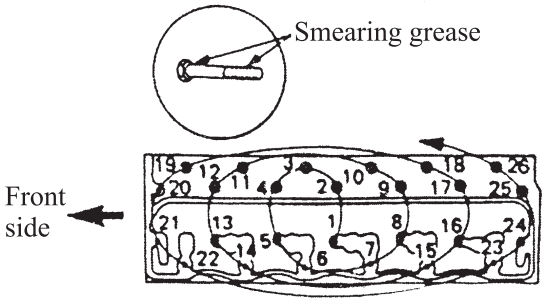


Fig. 1-8

1.4.2 Adjustment of clearance of air gate

(1) Counter-clockwise rotating crank shaft as shown in Figure 1-9 of 0 ° the location of arrows, so that the rocker between exhaust door and enterded door of a cylinder or six-cylinde form the gap.

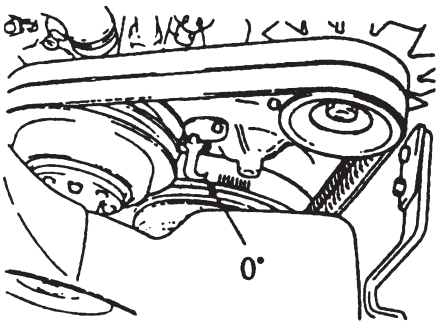


Fig. 1-9

(2) Between the rocker and valve stem put a plug, adjust the screw with a screwdriver needle, when the first cylinder at TDC compression point, to adjust marked "◯" of the cylinder, when the sixth-cylinder at the compression on the only point, to adjust marked "●" cylinder. Values shown in Figure 1-10 Valve Clearance 0.4mm (cold-machine).

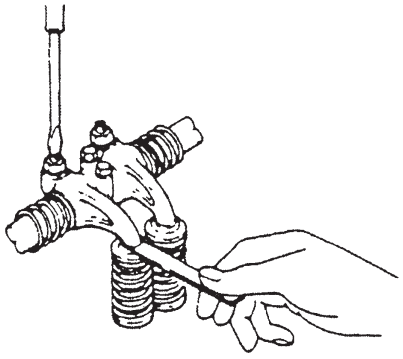


Fig. 1-10

Air cylinder Sequence No.	1		2		3		4		5		6	
Valve Sequence No. I:Suction valve E:Exhaust valve	I	E	I	E	I	E	I	E	I	E	I	E
Dead point at compression stroke of the 1st cylinder	△	△	△			△	△			△		
Dead point at compression stroke of the 6th cylinder				※	※			※	※		※	※

1.4.3 Cylinder pressure (See Fig 1-11)

(1) Turn the off rocker fixed in the oil off position, remove the nozzle on the hose.

(2) To enable the battery charger.

(3) A pressure sensor connected to the nozzle.

(4) Start the engine 3-4 seconds, measure the pressure.

(5) Repeat (c) (d) two or more times, taking the average pressure.

Compression pressure :2.6-3 .1MPa/200rpm

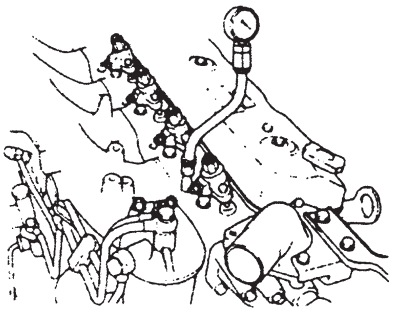


Fig.1-11

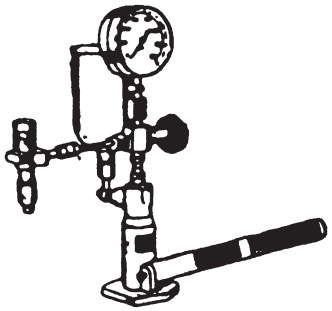


Fig.1-12

1.4.4 Nozzle adjustment (See Fig1-12,1-13)

(1) Installed the injector nozzle on the nozzle tester.

(2) Manipulate the tester handle, measure the injection pressure. Start injection pressure is 18.5MPa.

(3) If the pressure is beyond the prescribed range, by adjusting the screws to re-adjust.

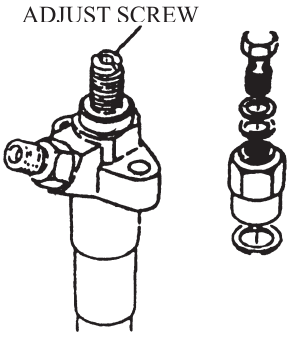


Fig.1-13

1.4.5 Release valve

If the fuel system mixed with air, should play an open valve deflated. Figure 1-14.

(1) Open valve loose with a screwdriver.

(2) To promote the handle to go to work according to counter-clockwise position.

(3) Under pressure to promote the delivery of fuel for the pumps up and down.

(4) The air is released, the clockwise rotation handle screw for the pump.

(5) Tighten the release valve with a screwdriver.

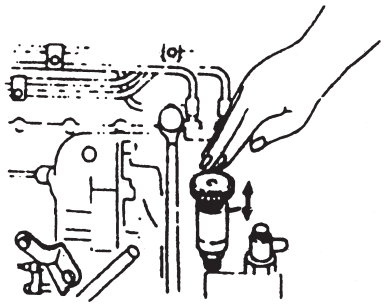


Fig.1-14

1.4.6 Adjustment of belt tension

(1) Release a fixed generator bolts, remove it from the engine, adjust the belt tension. Belt tension of 10 ~ 15mm, (when the pressure is 10Kg pm) as shown in Figure 1-15.

(2) Adjusting finished, tighten the bolts fixed generators.

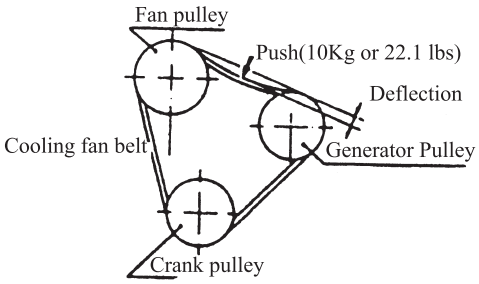


Fig.1-15

2. Electric system

2. 1 General

The electric 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: DC24V for the electric equipment of the forklift.

(2) Start system

The start system mainly consists of the preheating installation (only use for ISUZU engine), start switch, the protective circuit, starter and its function is to start generator.

(3) Stop System (use for ISUZU, IVECO and KOMATSUdiesel engine)

Stop system (use for ISUZU engine) consists of key switch, flameout and automatic flameout device. Stop system (use for IVECO and KOMATSU diesel engine) consists of key switch and shut-off fuel valve.

(4) Instruments

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.

(5) Illumination and signal equipment

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

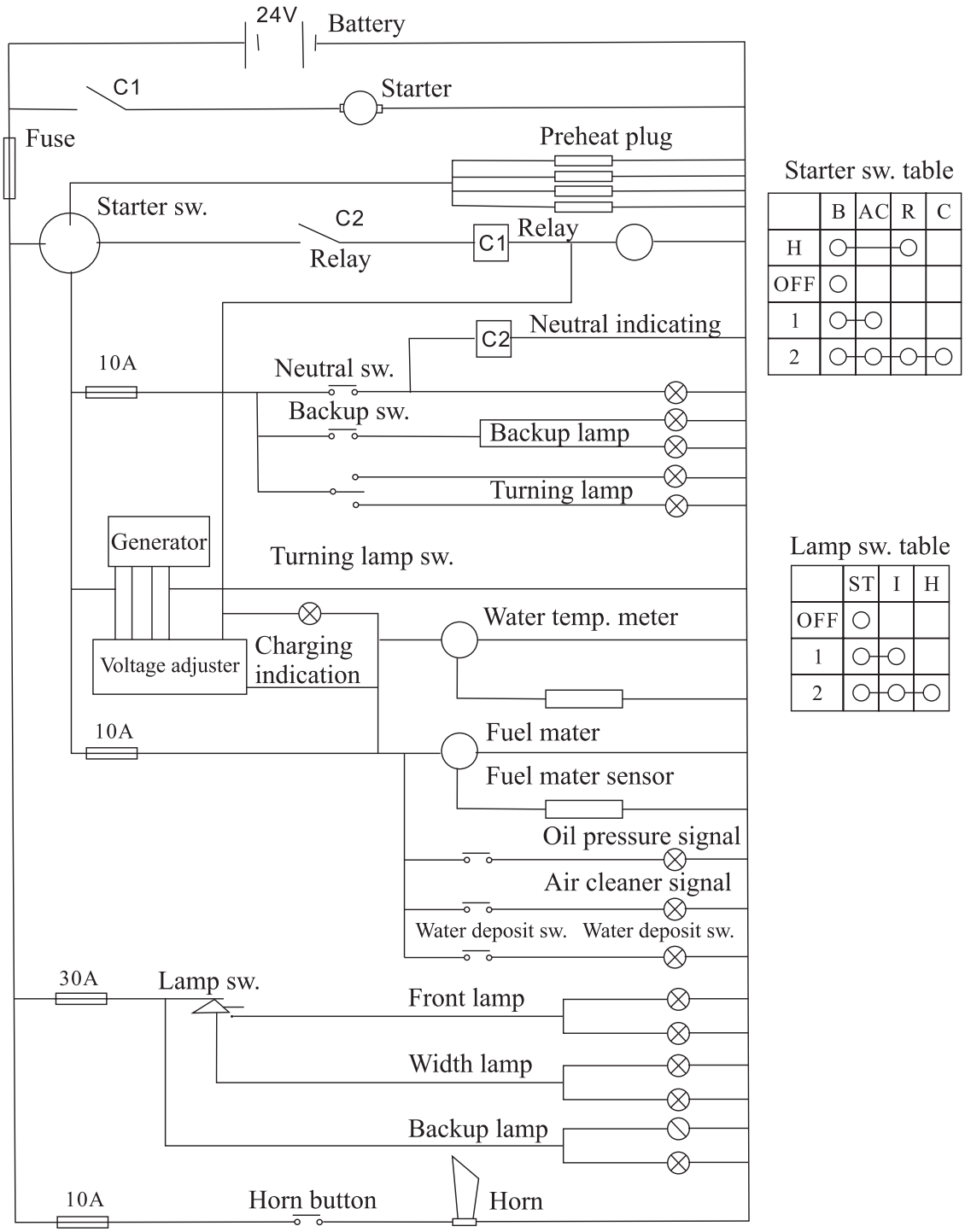
The forward lamp: 70W

The forward combined lamp (transfer/indicating wide): 21W/8W

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

10W (white)/21W(red)

The alarming lamp (Optional part): 21W



Starter sw. table

	B	AC	R	C
H	○		○	
OFF	○			
1	○	○		
2	○	○	○	○

Lamp sw. table

	ST	I	H
OFF	○		
1	○	○	
2	○	○	○

Fig.2-1 Electric principle

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 braking 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

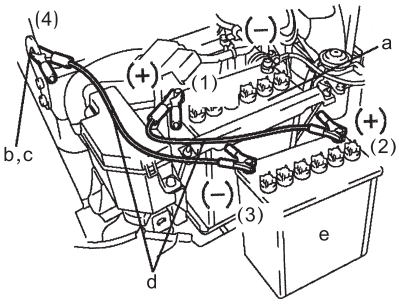
oil pressure of generator is too low and the lubrication is not very good and it should be checked immediately.

(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 oi 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.



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!

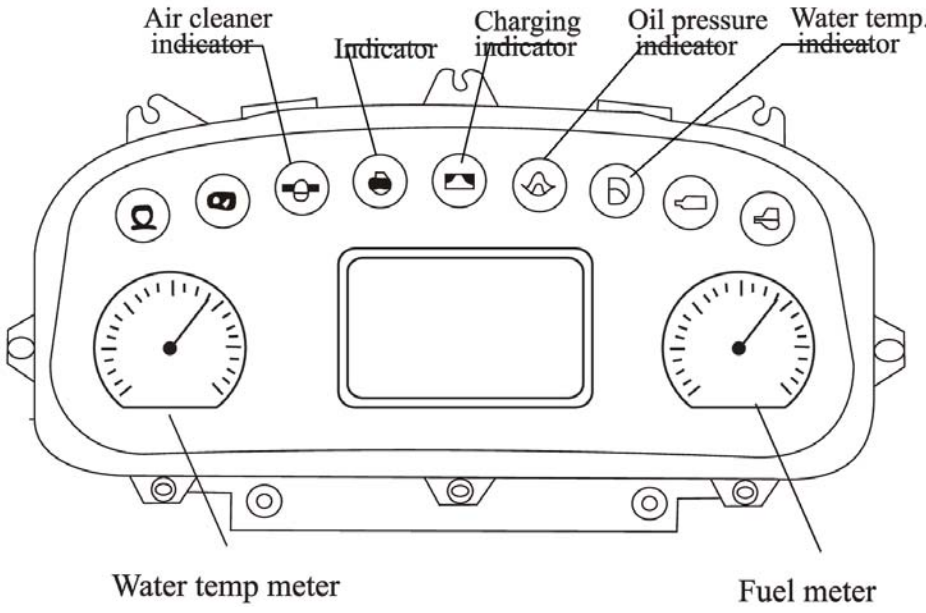


Fig. 2-2

2.3 Battery

▲! Notice:

(1) The battery can produce Combustibility air, it has explosion danger, it must be forbidden short circuit, light and fireworks.

(2) The electrolyte is a sparse vitriol, it is dangerous if skin or eye touches it. If shin touches electrolyte, it must be flush with the water immediately, While eye touches it, flush with water and see a doctor immediately.

2.4 Wire harness

B	R	G	Y	L	W	Br	Lg	P	V
black	red	green	yellow	blue	white	brown	light green	pink	violet

The GY 、GR、GW 、WB、YR 、RY 、RB 、LB etc. means two colors line, the former's quantity occupies 2/3 , and the latter's quantity occupies 1/3. The number before the two colour means section area.

(2) Laden current of low pressure wire harness allowing

Section area(mm^2)	0.5	0.8	1.0	1.5	2.5	3.0	4.0	5.0	6.0
Laden current (A)			11	14	20	22	25	25	35

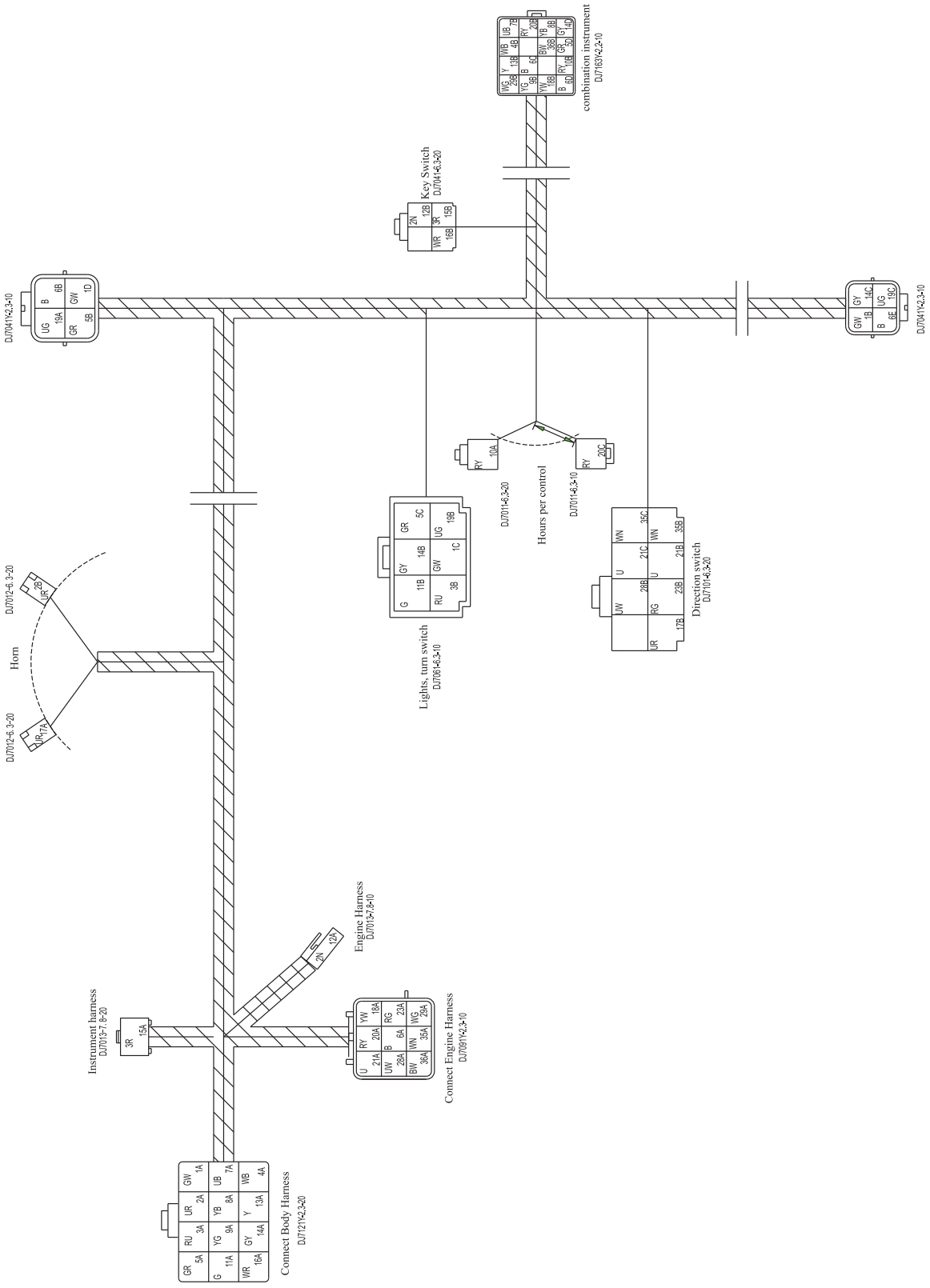


Fig.2-3 Cabinet wire harness FD40-45-WF1

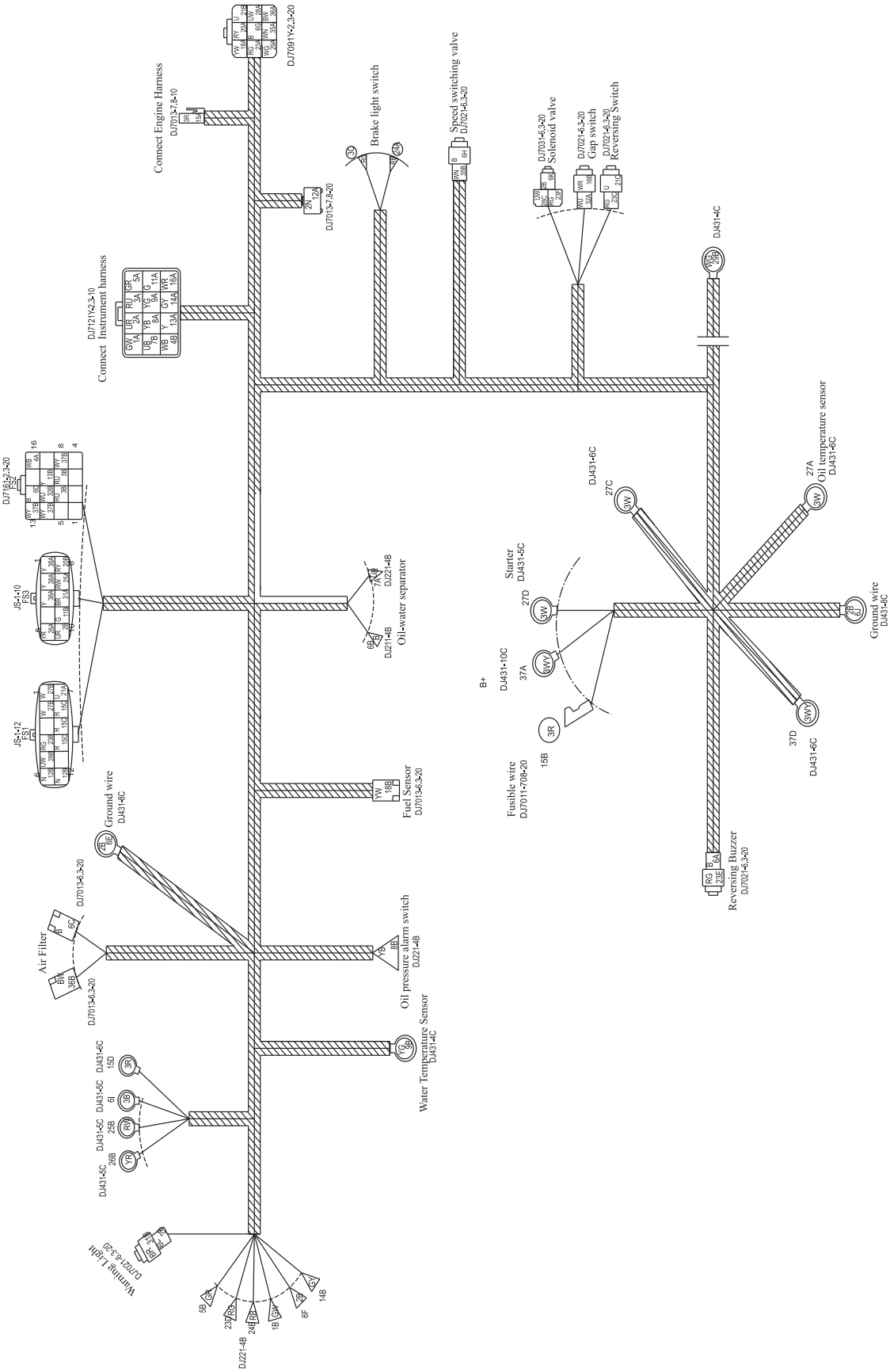


Fig. 2-4 Vehicle Harness FD40-45-WF1

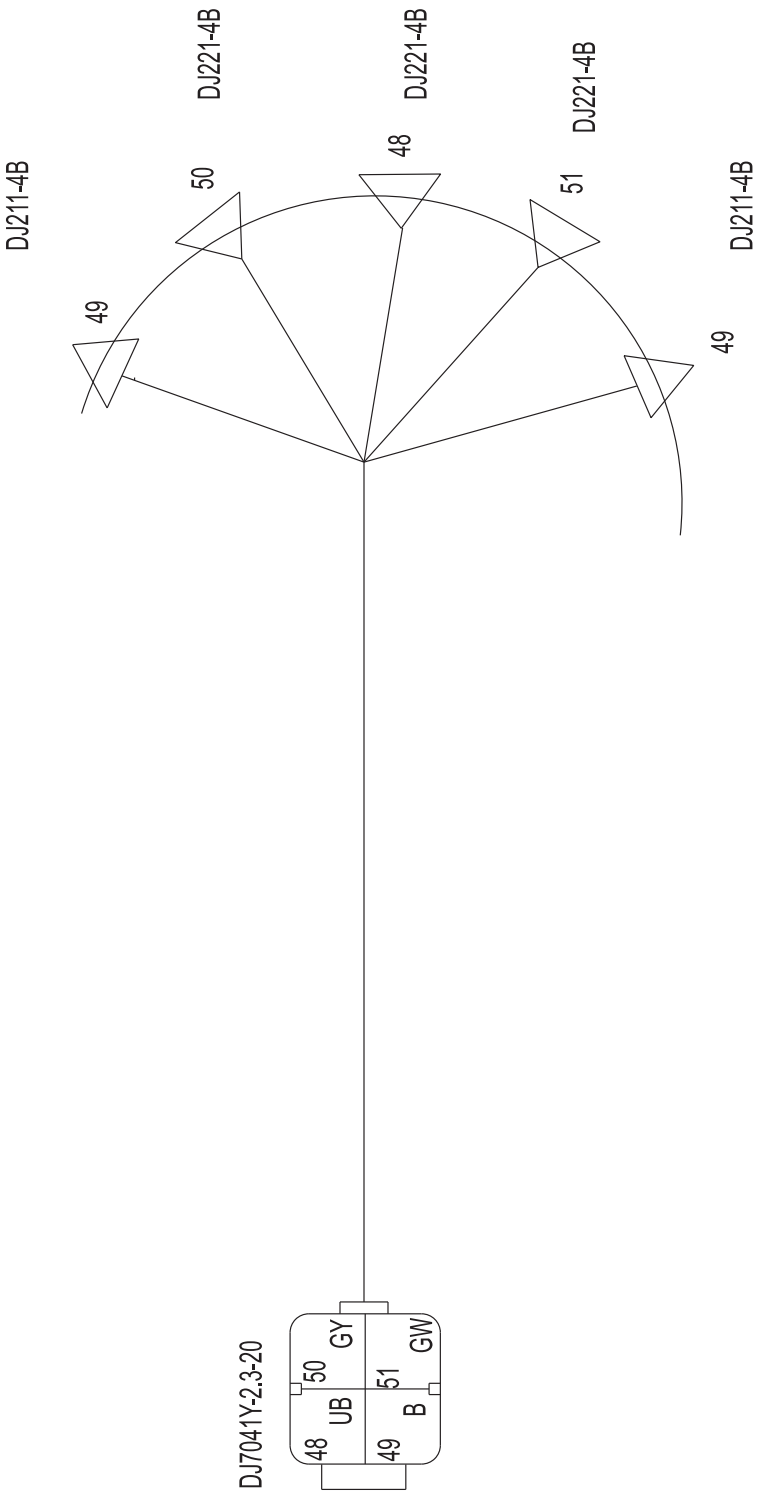


Fig.2-5 Overhead guard wire harness

3. Transmission system

The transmission system consists of torque converter transmission & torque converter. The main specifications of the system see table 3.1

table 3.1

Item			Units	Specifications
Torque converter	Type			3-element, 1-stage, 2-phase
	Stall torque ratio			3
	Pressure setting		MPa	0.5~0.7
Charging pump	Type			Grescent type, gear pump, transmission output
	Discharge		L/min	26
Torque Converter Transmission	Gear ratio	Type		Power shift type
		1st(forward)		3.232
		2nd(forward)		2.143
		2nd(forward)		2.727
	Hydraulic Clutch	Clutch outer dia.	mm	134
		Clutch inner dia.	mm	90
		Clutch thickness	mm	2.8
		Clutch surface area	cm^2	77.4
		Pressure setting	MPa	1.2 ~1.5
Differential	Weight		Kg	About 184
	Oil amount		L	About 7
	Reduction Ratio			6.333

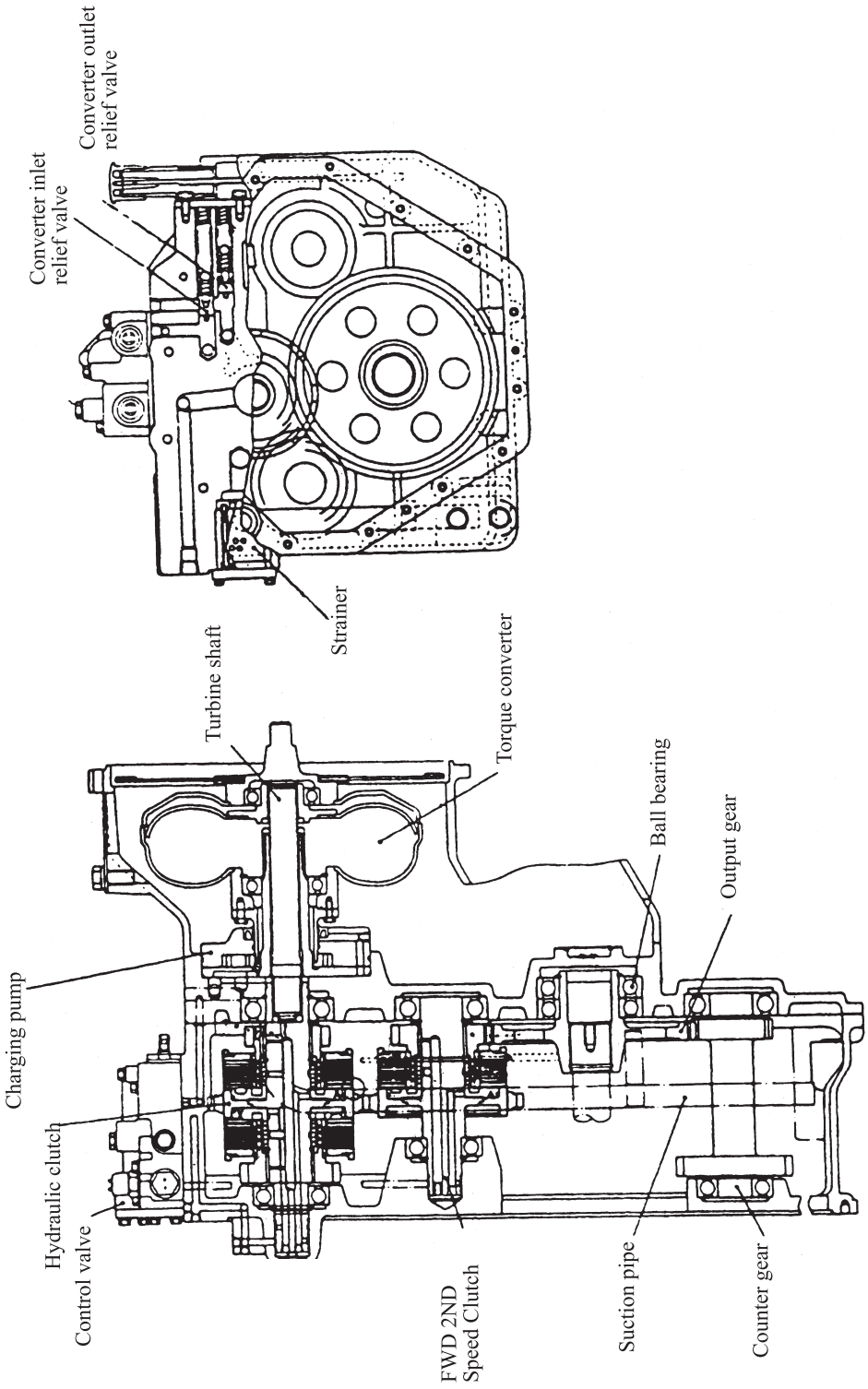


Fig. 3-1 Hydraulic torque converter and transmission assembly

3.1 General description

The transmission adopted in this machine is a rational combination of torque converter with power-shift type transmission. It has the following features.

(1) The inching valve is provided so as to improve the inching performance. Hence, the inching performance can be maintained when starting and at any rotational speed of engine.

(2) The clutch has 7 steel plates and 7 specially treated paper plates. Therefore excellent durability is ensured.

(3) The torque converter is provided with the free wheel so as to enhance the transmission efficiency (3-element, 1-stage, 2-phase type).

(4) The line filter is provided in the torque converter circuit so as to improve the durability.

3.2 Torque converter

Generally, the torque converter consists of pump wheel fitted to the input shaft, turbine wheel fitted to the output shaft, and stator wheel fixed to the housing(3-element,1-stagr type).

The pump wheel is rotated by the drive shaft, so that the fluid in the pump forced out by the centrifugal force along the vanes of pump wheel. (At this time mechanical energy is converted to kinetic energy).

Thereby the fluid flows into the impeller turbine wheel, transmitting torque to the output shaft. The direction of the fluid leaving the turbine wheel is changed by the stator wheel so that it flow into the pump wheel at the best angle. At this time a reaction torque pushing the stator is generated, as a result of which the output torque becomes larger than the input torque by the valve equal to the reaction torque.

As the rotational speed of turbine wheel increases, approaching to the input rotational speed, the change of fluid flow angle reduces, and output shaft torque also reduces. And finally the fluid begins to flow contrary to the direction of stator vanes, as a result of which the reaction torque being to affect in the reverse direction.

In this case the output shaft torque becomes smaller than the input shaft torque. So as to prevent this phenomenon, a free wheel (one-way clutch) is provided on the stator. When the reaction torque acts in the reverse direction, the stator wheel rotates idly. In this state the input torque becomes equal to the output torque so that high performance is ensured.

As the phase of torque transmission is changed by the mechanical means (clutch),the torque converter is called the 2-phase type. It features smooth operation and enhanced efficiency.

The torque converter is fixed to the flywheel through the flex plate so that it rotates always together with the engine.

Inside the torque converter are mounted the torque converter case, turbine wheel, pump wheel and stator wheel, The inside of torque converter is filled with torque converter fluid.

The pump wheel has gear at its end which is engaged with the drive gear of charging pump to drive the charging pump.

The turbine wheel is spline-jointed to the main shaft. It serves to transmit power to the wet type multidisk clutch.

The construction of torque converter see fig.3-2.

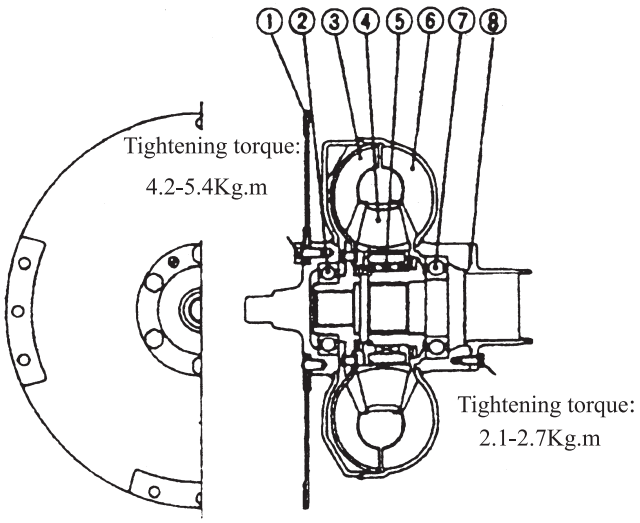


Fig.3-2 Hydraulic torque converter

1. Input plate	2.Ball bearing	3. Turbine wheel	4. Stator wheel
5. One-way clutch	6. Impeller wheel	7.Ball bearing	8."O"- ring

3.3 Charging pump

The construct of charging pump see fig.3-3.

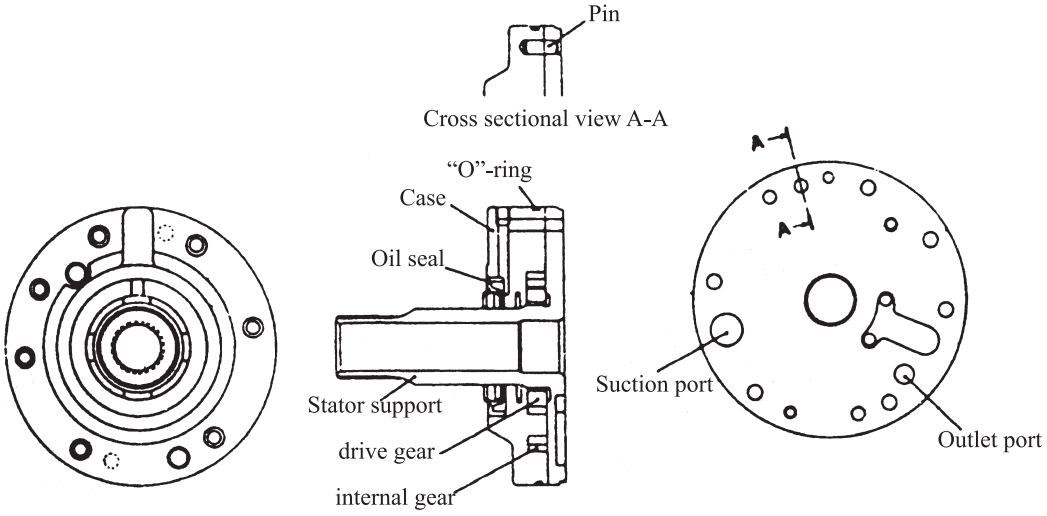


Fig.3-3 Oil pump

Charging pump consists of driving gear, inner gear (driven gear), shuck and cover, mounted on the upper end of tor-con housing. Driving gear is driven by pump wheel, idle gear and oil pump driven gear, the oil pump supply oil in lower half of the transmission for every areas of the transmission.

3.4 The hydraulic clutch group(See fig.3-4)

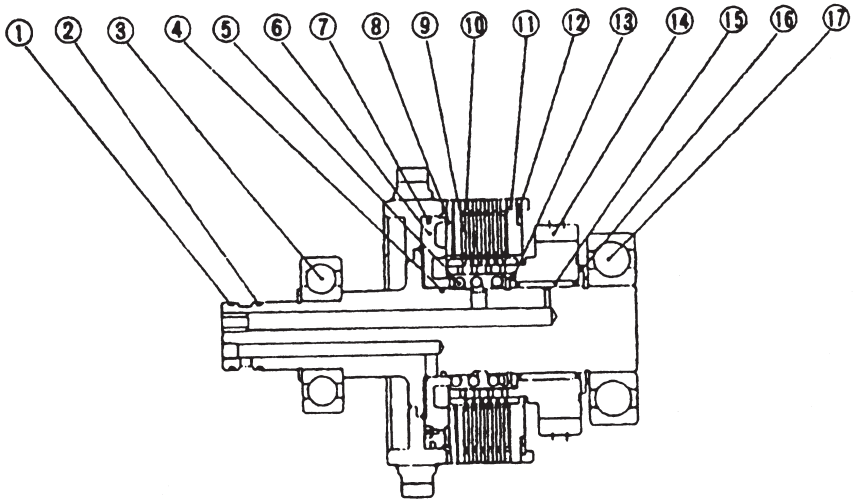
The hydraulic wet type multidisk clutch group is provided at the transmission counter drive gear of reverse clutch side engaged with the counter shaft gear.

Inside one clutch group the 6 clutch disks (sintered plates) and the 7 clutch steel disks (steel plates) are alternately and assembled together with the piston.

Oiltightness of outer periphery and inner periphery of the piston is ensured with the slipper seal and "O"-ring, respectively, when it operates, In the neutral state the coil spring acts to disengage the multidisk clutch. The clutch surface is always lubricated with the oil returned from the oil cooler so that seizure and wear of the clutch surface are prevented.

When hydraulic pressure affects the piston, the alternately arranged sintered plates and steel plates are depressed so that the clutch group is made integral and transmits power from the torque converter ti the drive gear.

Accordingly, power transmission route from the Tor-Co-Matic transmission is as follows: Turbine wheel→Main shaft →Clutch drum→Steel plate→Sintered plate→Forward or reverse gear→Output shaft.

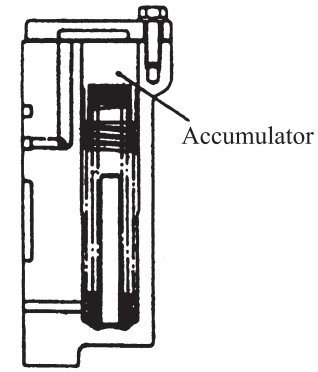


1. Seal ring	2. Seal ring	3. Ball bearing	4. Seal ring	5. Return spring
6. Piston	7. Seal ring	8. Conical plate	9. clutch plate	10. Steel plate
11. End plate	12. Snap ring	13. Thrust washer	14. Gear	15. Needle bearing
16. Thrust washer	17. Ball bearing			

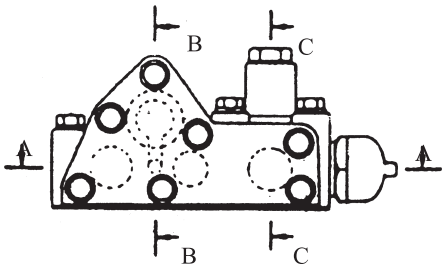
Fig.3-4 Clutch group

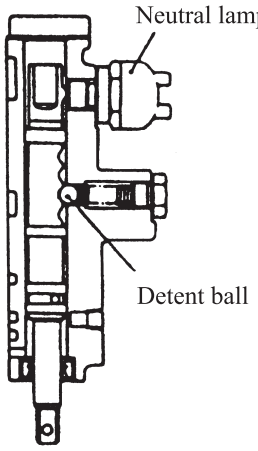
3.5 Control valve

The control valve see fig.3-5.

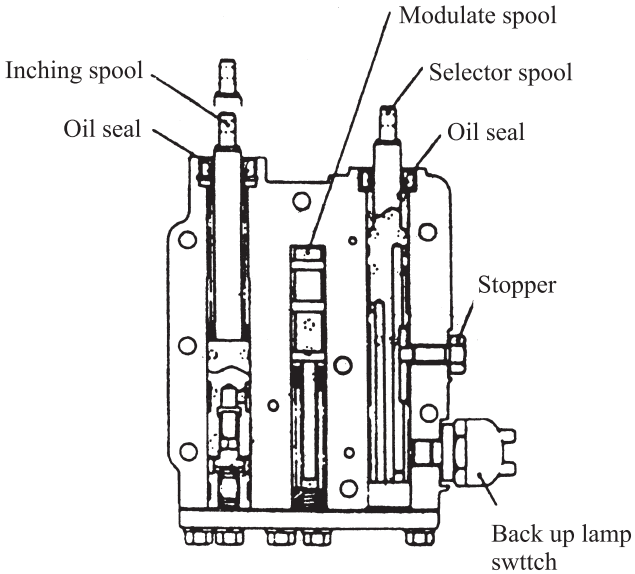


Cross sectional view B-B





Cross sectional view C-C



Cross sectional view A-A

Fig.3-5 Control valve

The control valve consists primarily of the directional selector valve, regulator valve, accumulator piston , directional selector electromagnetic valve, Speed electromagnetic valve and including valve. The accumulator piston, interlocked with the directional selector valve. Is actuated by the operation of the directional selector spool.

The oil picked up by the gear pump flows into the control valve and flow regulated by the orifice while its pressure is regulated to the specified pressure(12～15kg/cm^2).

When the directional selector electromagnetic valve is placed in the forward or reverse position, the pressure regulated oil is sent to the forward or reverse clutch pack by the directional selector valve, while the accumulator piston is moved by the oil so that the shock induced by clutch engagement is alleviated by operation of the accumulator along with the orifice.

3.6 Hydraulic circulation system(See fig. 3-6)

When the engine is stared and the charging pump is driven by the pump drive gear fitted to the pump wheel boss, torque converter oil drawn from the oil tank (transmission case) through the strainer by the pump and is routed under pressure to the main regulator valve and the control valve in the converter housing. The oil necessary for clutch operation is set to the specified pressure by the main regulator valve.

The oil which flows to the control valve is flow controlled by orifice and pressure controlled by the pressure control mechanism to the specified pressure.

When the change lever is put in forward or in reverse, the oil is sent from the control valve through the forward/reverse selector valve to the pressurization chamber of the forward or the reverse clutch. Also some of the oil from the control valve flows into the accumulator piston to help insure a smooth elevation of the clutch oil pressure.

The oil which flows to 2nd main regulator valve is pressure regulated by the conver inlet relief valve to 5~7kg/cm and makes its way to converter wheels. The oil regulated by the outlet relief valve flows through the oil cooler to the clutch groups and lubricates and cools them before returning to the oil tank.

While the forward or the reverse clutch group is operating, the other clutch group is rotating between the clutch disks and their mating plates. This area is thus lubricated with oil from the oil cooler to prevent the plates from being seized.

When the brake pedal is pressed, the inching valve operates to drain most of the oil flowing to the clutch from the inching valve into the transmission case.

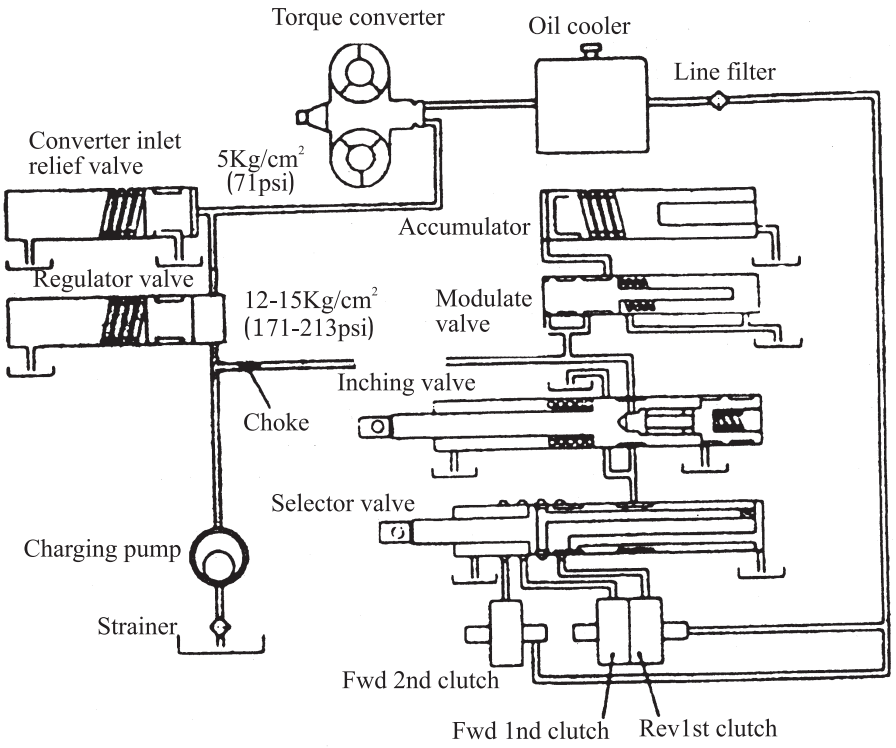


Fig. 3-6 Tor-con hydraulic system

3.7 Differential(See Fig. 3-7)

The differential is fitted to the rear case (reduction gear case)by ball bearings with bearing caps and covered with the axle housing.

The cross case of the differential is of the split type containing two side gears and four-pinion gears. The thrust plate is installed between the cross case and each gear according to the backlash.

The pinion gear is supported by the pinion shaft, which is secured to the cross case with a knock pin. The ring gear is installed on the circumference of the cross case with reamer bolts.

The rotation sent from the transmission through the reduction gear is further reduced and differentiated by this device to drive the drive shaft.

3.8. Differential maintenance

Reassemble the differential in the sequence opposite to disassembly, observing the following conditions:

(1) Adjust the backlash between the side gear and pinion to the specified value.

Specified backlash: 0.23~0.33 mm

Adjustment should be made by changing the spacers at the side gear side. Use spacers of the same thickness at each side.

Spacers: 1.8, 1.9, 2.0, 2.2, 2.3, 2.6 mm

(2) Tighten the cross case assembling bolts to the specified torque and make sure the side gears are rotating without inference.

Tightening torque: 130~195N.m

(3) Tighten the ring gear fitting bolts to the specified torque.

Tightening torque: 130~195N.m

(4) Adjust the preload of the drive pinion to the specified value.

Adjustment should be made by using the shims between the tapered roller bearing and spacer. Shims: 0.1, 0.15, 0.2, 0.5, 2.3, 2.6 mm

(5) Adjust the backlash between the drive pinion and ring gear to the specified torque.

Backlash: 0.23~0.33mm

Adjustment should be made by using the shims between the bearing case and the carrer. Adjust the engagement either.

(6) Tighten the bearing cap fitting bolts to the specified torque.

Tightening torque: 222~232N.m

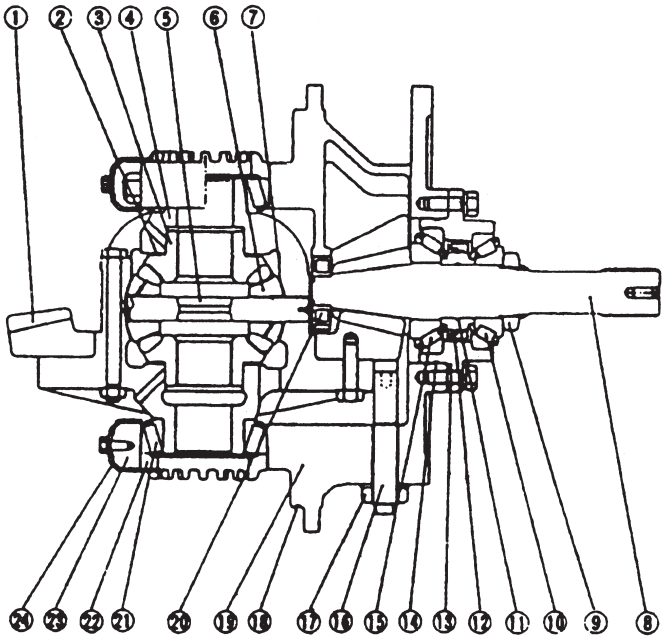


Fig. 3-7 Differential

1.Ring gear 2. Thrust washer 3.Side gear 4. Cross case
5. Pinion shaft 6. Pinion gear 7. Thrust washer 8. Drive pinion gear
9. Adjust nut 10. Tapered roller bearing 11. “O”-ring 12.Oil seal
13.Bearing case 14. “O”-ring 15. Tapered roller bearing 16. Adjust screw
17 Lock nut 18. “O”-ring 19. Carrier 20. Roller bearing
21. Tapered roller bearing 22. Adjust nut 23. Bearing cap 24. Stopper

3.9 Troubleshooting guide

(1)Low power

Possible cause		Checking method	Remedy
Torque Converter	A. Oil pressure too low		
	(1) Low oil level	Check oil level	Add oil
	(2) Air sucked from suction side.	Check joints and pipe	Retighten and replace packing
	(3) Clogged oil filter	Disassemble and check	Clean or replace
	(4) Insufficient discharge of pump	Disassemble and check	Replace
	(5) Main relief valve coil spring deteriorated	Check spring tension	Replace
	(6) Seal ring or O-ring damaged or worn.	Disassemble, check and measure.	Replace
	B. Flywheel damaged or in contact with other parts	Drain a small quantity of oil and check for presence of foreign matter.	Replace
Transmission	A. Improper oil is used or bubbles are foamed.	Check	
	(1)Air sucked from suction side.	Check joints and pipes	Retighten or replace
	(2)Torque converter oil pressure is too low and bubbles are foamed.	Measure pressure	Adjust pressure
	B. Clutch slips		
	(1) Low oil pressure	Measure pressure	Adjust pressure
	(2) Seal ring worn	Disassemble, check and measure.	Replace
	(3) Clutch piston ring worn	Disassemble and check	Replace
	(4) Clutch disks are burned and plates deformed.	Disassemble and check, Start engine and place direction control lever in forward, reverse and neural respectively. Truck runs with the level in neutral but not in fwd. or bwd.	Replace
	C. Link lever between brake shift and valve spool is improperly positioned.	Check and measure.	Adjust
Engine	Engine power drops	Check STALL rmp. Check working sound of engine. Check maximum rmp of engine with gears in neutral.	Adjust or repair engine

(2)Abnormal rise of temperature

Possible cause		Checking method	Remedy
Torque Converter	1. Low oil level	Check oil level	Add oil
	2. Clogged oil filter	Disassemble and check	Clean or replace
	3. Flywheel in contact with other parts	Drain oil from oil filter or oil tank and check for foreign matter.	Replace
	4. Air is sucked	Check joints and piping at suction side.	Retighten or replace
	5. Water mixed in oil	Drain and check oil	Replace oil
	6. Low flow rate of oil	Check piping for damage or bending	Repair or replace
	7. Bearing worn or seized	Disassemble and check	Repair or replace
Transmission	1. Clutch drags	Check whether the truck runs with gears in neutral.	Replace clutch plates
	2. Bearing worn or seized	Disassemble and check	Replace

(3)Noisy transmission

Possible cause		Checking method	Remedy
Torque Converter	1. Input plate broken	Check rotational sound at low rmp.	Replace input plate
	2.Bearings damaged or worn	Disassemble and check	Replace
	3.Gear broken	Disassemble and check	Replace
	4.Spline worn	Disassemble and check	Replace
	5.Noisy gear pump	Disassemble and check	Repair or replace
	6.Loose bolts	Disassemble and check	Retighten or replace
Transmission	1. Bearing worn or seized	Disassemble and check	Replace
	2.Gear broken	Disassemble and check	Replace
	3.Spline worn	Disassemble and check	Replace
	4.Loose bolts	Disassemble and check	Retighten or replace

(4)No power transmission

Possible cause		Checking method	Remedy
Torque Converter	1. Input plate broken	Check rotational sound at low rmp and check whether front cover rotates	Replace
	2.Lack of oil	Check oil level	Add oil
	3.Driving system of oil pump malfunctionong	Disassemble and check	Replace
	4.Shaft is broken	Disassemble and check	Replace
	5. Oil pressure too low	Check whether suction pressure generates at inlet side of pump	Replace
Transmission	1.Lack of oil	Check oil level	Add oil
	2.Damaged seal ring	Disassemble and check	Replace
	3.Clutch plates seized	Check clutch oil pressure	Replace
	4.Shaft is broken	Disassemble and check	Replace
	5.Clutch cover broken	Disassemble and check	Replace
	6.Snap ring for Clutch cover broken	Disassemble and check	Replace
	7.Foreign material in clutch oil tank	Disassemble and check	Clean or replace
	8.Spline part of shaft is worn	Disassemble and check	Replace

(5)Oil leakage

Possible cause		Checking method	Remedy
Torque Converter and Transmission	1.Damaged oil seal	Disassemble and check. Oil seal lip or its mating sliding part is worn.	Replace oil seal
	2.Case connected improperly	Check	Retighten or replace gasket
	3.Loose joints and piping	Check	Repair or replace gasket
	4.Loose drain plug	Check	Retighten or replace gasket
	5.Oil is ejected from breather	Drain oil and check for mixing of water. Check whether air is sucked from suction joint. Check air hole of air breather.	Repair oil. Retighten or replace packing. Repair
	6.Excessive oil	Check oil level	Remove excess oil.

4. Front Axle

The main specifications of front axle see Table 4-1.

Table 4-1

	4-4.5t	
Type	Front two-wheel drive, full-floating	
Tire	300—15—18PR	9.00—20—14PR
Rim	8.00V—15	7.0—20
Air pressure Kpa	840	760

4.1 General Description

The front axle is a full-floating type and cast into one piece construction consisting of the axle housing, wheel hub, brake drums and wheel brakes, as shown is Fig.4-1. It is installed at the front of the frame.

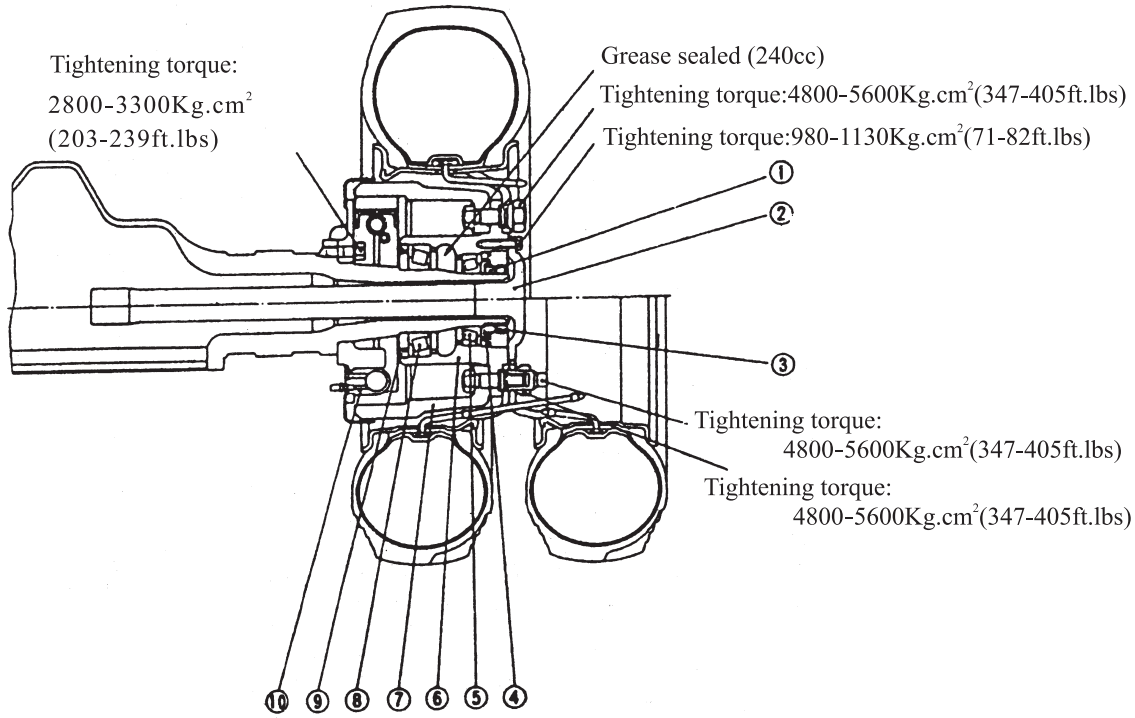


Fig.4-1 Front Axle

1. Adjust nut 2. Axle shaft 3. Lock nut 4. Oil seal 5. Tapered roller bearing
6. Hub 7. Brake drum 8. Tapered roller bearing 9. Oil seal 10. Wheel cylinder

4.2 Axle housing

The axle housing is a one –piece construction consisting of a banjo-shaped differential housing and spindle and is secured to the frame with ban sector.

4.3 Front wheel hub

The front wheel hub receives the power from the differential through the drive shaft and drives the front wheels. The brake drum and rim are fitted to the front wheel hub with hub bolts and nuts. The hub is installed on the axle housing by two tapered roller bearings. The back-up plate is secured to the axle housing and house inside the brake drum.

The total weight of the truck is sustained by the hub and axle housing, and thus the drive shaft only drives the wheels.

Inside the hub are inner and outer oil seals to prevent oil leaks.

4.4 Maintenance

4.4.1 Preload adjustment

(1) Tighten the bearing nut and then turn back 1/8 circle.

(2) Tighten the bearing nut gradually while measuring the preload.

(3) When the preload is reached locks the nut with the lock nut and lock washer.

4.4.2 Wheel installation procedure

(1) the installation of single

[1] Align the wheel fitting holes and the hub stud bolts and install the wheel.

[2] Hand tightens 6 wheel nuts in a diagonal order.

[3] Tighten 6 wheel nuts evenly in several stages in a diagonal order.

[4] Tighten all wheel nuts to the specified torque.

Tightening torque: 480~560N.m

(2) the installation of twin

[1] Align the wheel fitting holes and the hub stud bolts and install the inside wheel.

[2] hand-tighten the 6 inside column nuts.

[3] Tighten 6 column nuts evenly in several stages in a diagonal order.

[4] Tighten all wheel nuts to the specified torque.

Tightening torque: 480~560N.m

[5] the foreign ship rim install hole column nut and gas core.

[6] hand-tighten 6 nuts.

[7] Tighten 6 wheel nuts evenly in several stages in a diagonal order.

[8] Tighten all wheel nuts to the specified torque.

Tightening torque: 480~560N.m

Notes: Remove sand or any other contamination on the mating surfaces of the rim and the hub and on the thread of the nuts or stud bolts.

4.5 Troubleshooting Guide

Table 4-2

Cause	Trouble	Correction
1.Oil leaks from differential carrier	Loose bolt or broken gasket of differential carrier.	Replace or retighten.
	Breather is clogged.	Clean or replace.
	Oil seal is worn or damage.	Replace.
2.Noisy differential	Gear is worn, damaged or broken.	Replace.
	Bearing is worn, damaged or broken.	Replace.
	Improper backlash	Adjust.
	Loose spline fitness of side gear to propeller shaft	Replace parts.
	Insufficient gear oil	Add as necessary.

5.Brake System

The main specifications of the brake system See Table 5-1.

Table 5-1

Item \ Model		FD 40,45
Wheel brake	Brake type	Front-wheel braking ,hydraulic type
	Brake model	
	I.D. of brake drum mm	Φ317
	Wheel cylinder drum mm	Φ31.75
	Lining size mm	330×63×10
	Surface area of lining cm^2	416
	Pedal ratio	5.0
Brake valve	Type	Hydraulic type
	Servo ratio	4.5
	Pressure setting Kg/cm^2	50
Parking brake		Front-wheel braking ,internal expansion type, hydraulic type

5.1 General description

The brake system consists of a brake pedal, wheel brakes and brake drums, a booster, pipes and so on.

5.2 Brake pedal

The brake pedal is installed on the transmission as shown in Fig.5-1. The push rod connected to the brake pedal pushes the booster reaction piston and its force is converted into oil pressure and transmitted to the wheel cylinders.

The un-lubricated bearing is mounted between the brake pedal and shaft, so the lubrication is not to be needed.

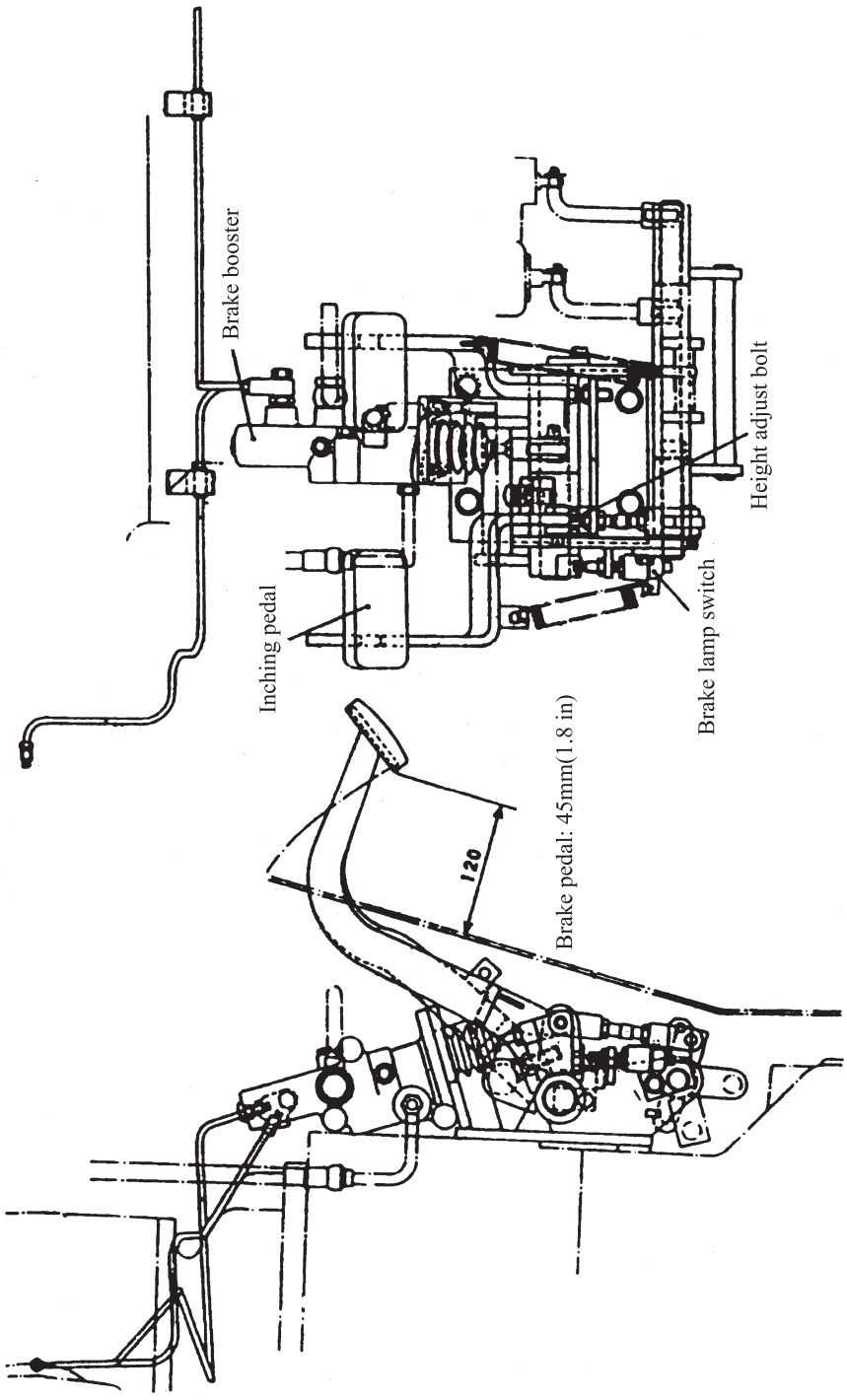


Fig.5-1 Brake system

5.3 Brake valve

The brake valve which converts pedal pressing force into hydraulic pressure, and the master cylinder and the flow divider, as shown in Fig.5-2.It makes uses of the power steering hydraulic pressure for its operation.

When the brake pedal is pressed, the depression of the brake pedal is transmitted through the push rod to the control vale input piston, narrowing the part “A”. This in creases the oil pressure at the part “B”,

moving the input piston to the left while opening the part “A”, so that the oil pressure at the part “B” ceases to rise and the input piston stops.

The action of the input piston pushes the master cylinder piston, increasing the oil pressure inside the wheel cylinder.

Some of the pressure at the part “B” acts on the input piston as a reaction force so that it is felt by the driver as steering feel.

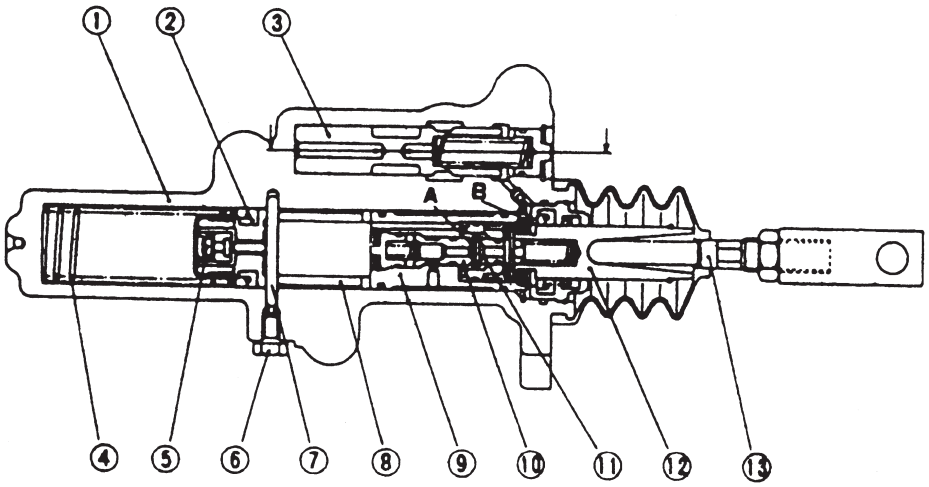


Fig.5-2 Brake valve

1. Body 2. Cup 3. Flow divider 4. Spring 5. check valve
6. Plug 7. Stopper 8. Piston 9. Power piston 10. Control valve
11. Seat 12. Reaction piston 13. Push rod

5.4 Wheel brake (Fig.5-3)

The wheel brake is the internal expansion, hydraulic type consisting of brake shoes, springs, a wheel cylinder, an adjuster and backing plates. Two wheel brakes are provided on each end or the front axle. The brake shoe, its one end being connected to the anchor pin and the other end to the adjuster, is forced against the backing plate with a hold spring and pin. The primary shoe is provided with the parking brake lever and the secondary shoe with the actuator lever of the automatic clearance adjuster.

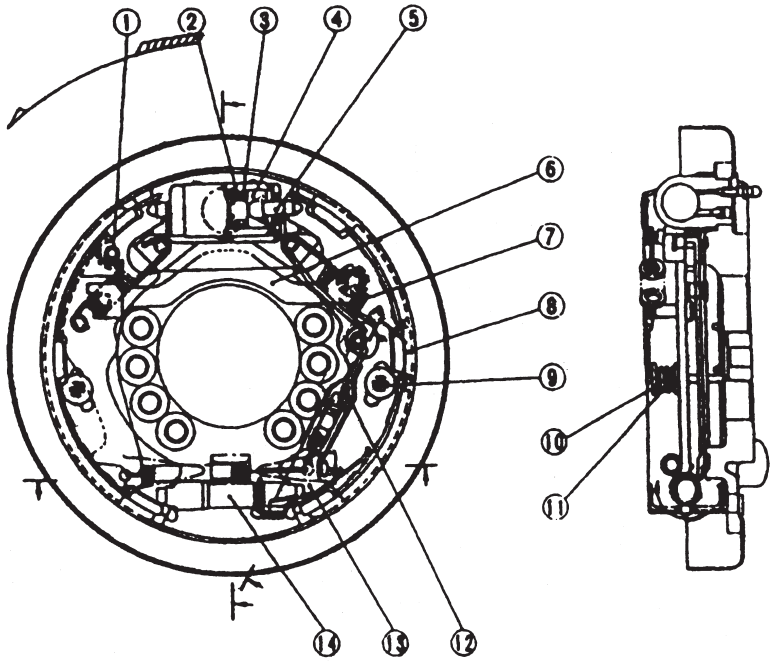


Fig.5-3 Wheel Brake

1. Retainer	2. Wheel Cylinder	3. Cup	4. Piston
5. Push rod	6. Strut	7. Return spring	8. Brake shoe
9. Hold-down pin	10. Cap	11. Spring	12. Spring
13. Adjuster lever	14. Adjuster		

The braking operation in forward travel is as follows: (see Fig.5-4) the primary and secondary shoes are forced by an equal force, by operation of the wheel cylinder to bring the lining in contact with the brake drum. The primary shoe forces the adjuster with the aid of lining to drum friction force. Due to this, the adjuster pushes the adjuster end of the secondary shoe by a large force than that offered by the wheel cylinder operation. The secondary shoe anchor end is forced strongly against the anchor pin, providing large braking force. On the other hand, the braking operation in reverse travel is performed in the reverse direction, but the braking force is the same as in the case of the forward travel. (Fig.5-5)

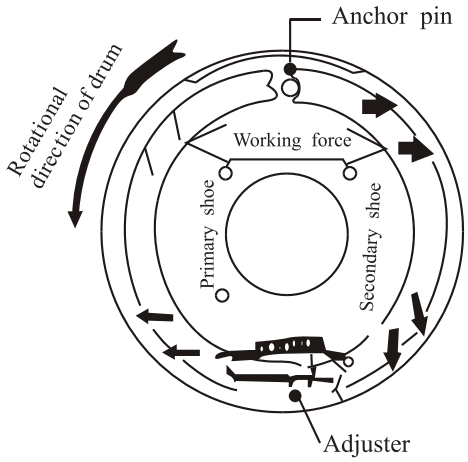


Fig.5-4 The movement of forward drive

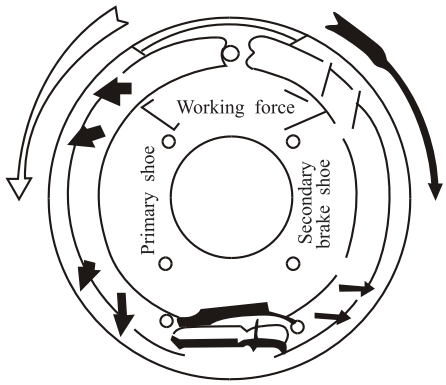


Fig. 5-5 The movement of Backward drive

5.5 Parking brake

The parking brake consists of the parking brake lever and cable as shown in Fig.5-6. The brake shoes and brake drum are commonly used with the wheel brake system. The brake lever is a toggle type which allows the adjustment of braking force with the adjuster at the tip or the lever.

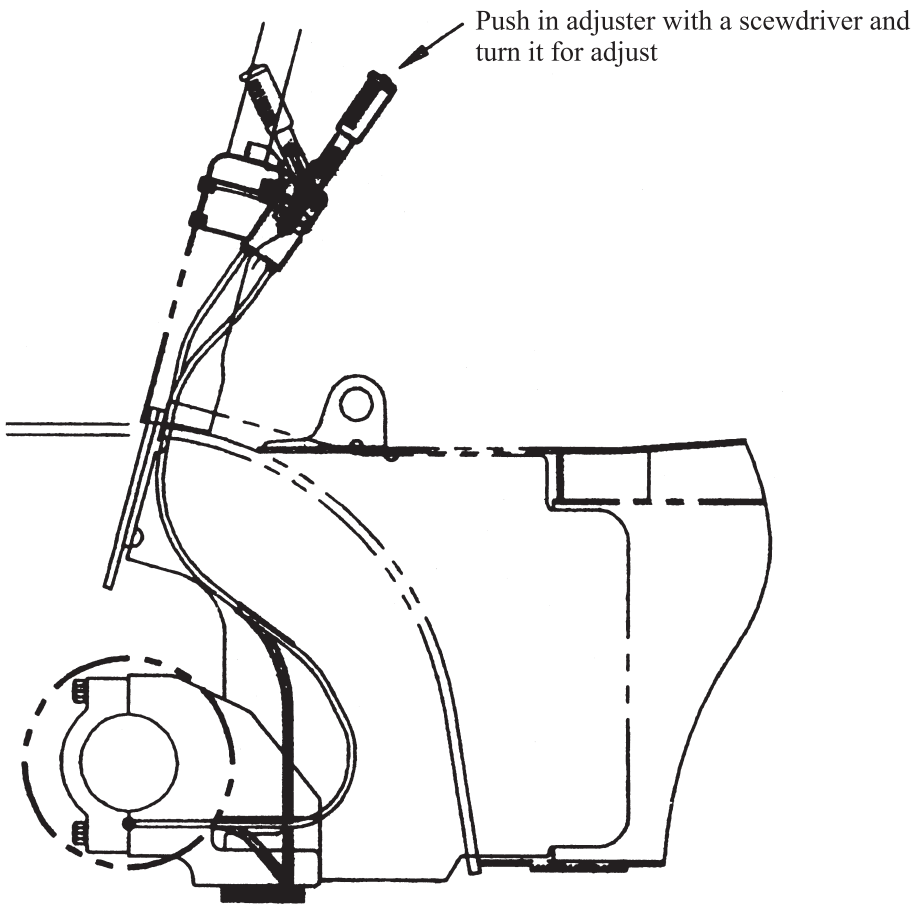


Fig.5-6 Parking Brake

5.6 Automatic clearance adjuster

The automatic clearance adjuster keeps a lining to break drum clearance of 0.4~0.6mm automatically. This adjuster, however, actuates only when the truck is braked in reverse travel. When the break pedal is pressed in reverse travel, the brake shoes are expanded. As a result of this, the secondary and primary shoes come into contact with the brake drum and rotate together until the upper end of the primary shoe comes into contact with the anchor pin.

On the other hand, as the secondary shoe leaves the anchor pin, the section (A) of the actuator lever is relatively pulled. Therefore, the actuator lever turns around the section (B) so that the section (C) of the actuator lever lowers carsing the section (D) of the adjuster to turn to the left. As the brake pedal is further pressed, compression force applied on the adjuster becomes larger. This result in increased resistance on the thread so that the actuator lever force can not turn the section (D).

5.7 Maintenance

This paragraph covers the procedures for disassembling, reassembling and adjusting the wheel brake, and the procedure for adjusting the brake pedal. Some sketches may be different from the actual unit. But the maintenance procedure is the same.

5.7.1 Wheel brake disassembly

(1) Remove the secondary shoe hold-down spring, adjuster ever, adjuster and return spring.(See Fig.5-7)

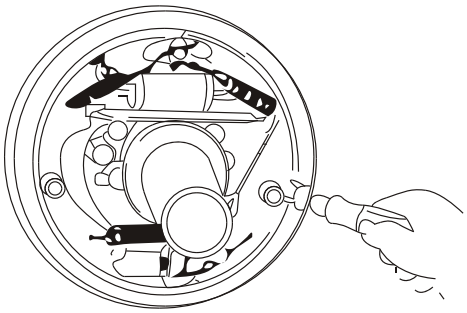


Fig.5-7

(2) Remove the shoe return spring.(See Fig.5-8)

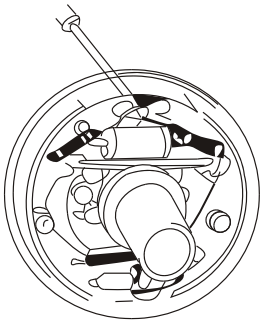


Fig.5-8

(3) Remove the primary shoe hold-down spring. (See Fig.5-9)

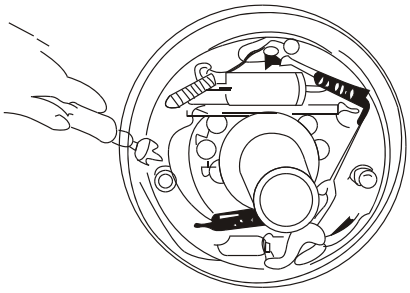


Fig.5-9

(4) Remove the primary and secondary shoes along with the adjuster and adjuster spring.(See Fig.5-10)

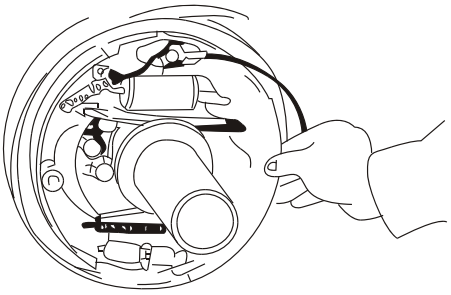


Fig.5-10

(5) Remove the brake pipe from the wheel cylinder. Remove the wheel cylinder mounting bolts and take the wheel cylinder off the backing plate.(See Fig.5-11)

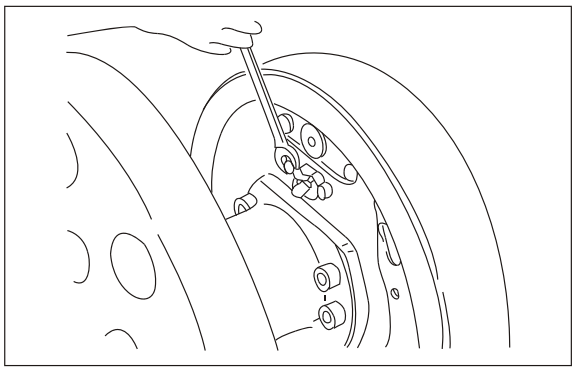


Fig.5-11

(6) Remove the “E” retainer securing the parking brake cable to the backing plate. Remove the backing plate fitting bolts and detach the backing plate from the axle.

(See Fig.5-12)

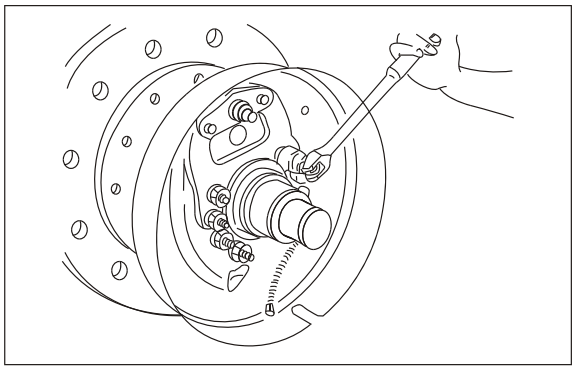


Fig.5-12

(7) Remove the boot, and push the piston into the cylinder from one side while removing the parts at the other side. Then push out the remaining parts from the opposite side shoes along with the adjuster and adjuster spring.(See Fig.5-13)

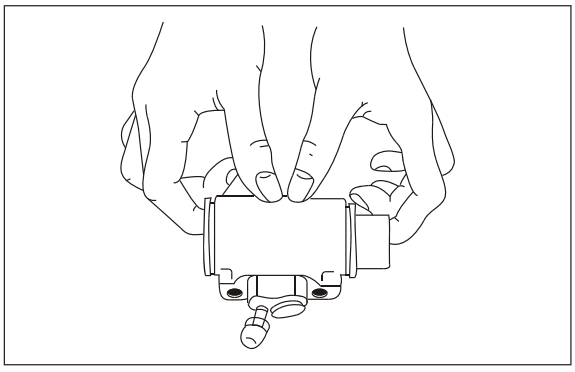


Fig.5-13

5.7.2 Inspection

Inspect all the parts for wear and damage. Repair or replace any defective parts with new ones.

(1) Inspect the wheel cylinder's inner surface and piston's outer surface for sign of rust. Measure the clearance between the piston and cylinder. Specified value: 0.03～0.10 mm

Limit: 0.15 mm

(2) Visually check the piston cup for damage or deformation and replace it, if defective, with a new one.

(3) Measure the free length of the wheel cylinder spring. If unsatisfactory, replace.

(4) Measure the brake lining thickness and if worn beyond the limit. Replace it with a new one. Specified value: 10.0 mm

(5) Visually check the brake drum inner surface for scratches, nicks or uneven wear, and if found, repair by grinding. If the surface is badly scratched or worn, replace.

Standard size: 317.5 mm Limit: 319.5 mm

(6) Measure the free length and setting load of the anchor side shoe return spring.

(7) Check the adjuster for damage and operation, and the contact area between the pole lever and the gear for defect. Replace if necessary.

5.7.3 Wheel brake reassembly

(1) Apply brake fluid to the wheel cylinder cup and piston, and reinstall the spring, piston cup, piston and boot in that order.

(2) Install the wheel cylinder to the backing plate. Note: Make sure each of the parts is located on the right position.

Tightening torque: 18～27 N.m

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

Tightening torque: 120～140 N.m

(4) Apply heat-resisting grease on the points indicated in Fig.5-14. Using caution so as not to allow the lining to be contaminated with grease.

(a) Backing plate shoe ledge surface.

(b) Anchor pin.

(c) Cable guide surface on which adjuster cable is to contact.

(d) Parking brake lever pin.

(e) Adjuster thread and its rotating part.

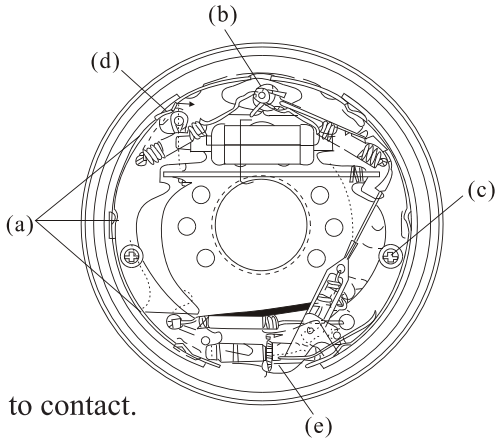


Fig. 5-14

(5) Install the parking brake cable with “E” retainer.

(6) Install the shoes with the hold-down spring.

(7) Put the anti-rattle spring in the strut and install them on the shoe.

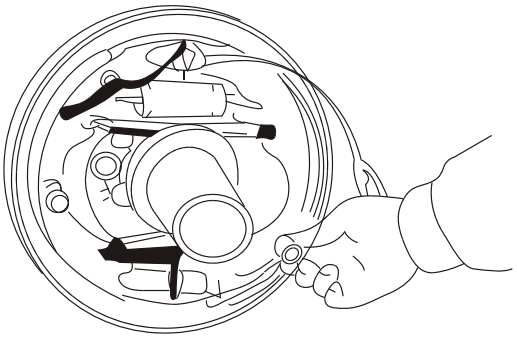


Fig. 5-15

(8) Install the shoe guide pin on the anchorpin. Install the shoe return spring. For this procedure, start with the primary shoe and then proceed with the secondary one.

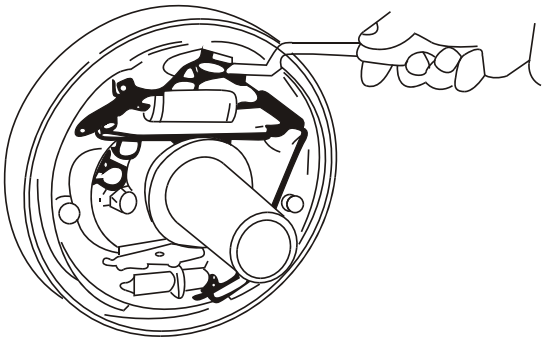


Fig. 5-16

(9)Tall the spring, adjuster, adjuster spring and adjuster lever, observing the following points:

[1] The left-side brake unit has a left threaded adjuster and the right-side brake unit has a right threaded one.

[2]The adjuster teeth do not contact the spring.

[3] The adjuster shoe return spring is installed with the longer hook going to the adjuster lever.

[4]After reassembly, make sure the adjuster lever end is in contact with the adjuster teeth.

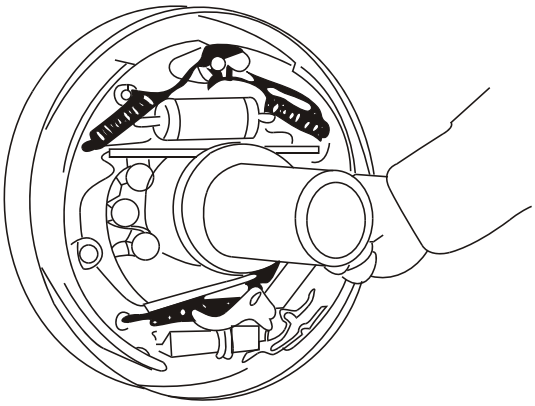


Fig. 5-17

(10)Install the brake pipe on the wheel cylinder.

(11)Measure the brake drum inner diameter and the shoe outer diameter. Adjust the adjuster so that the brake shoe outer diameter is drum inner diameter-1.0mm.

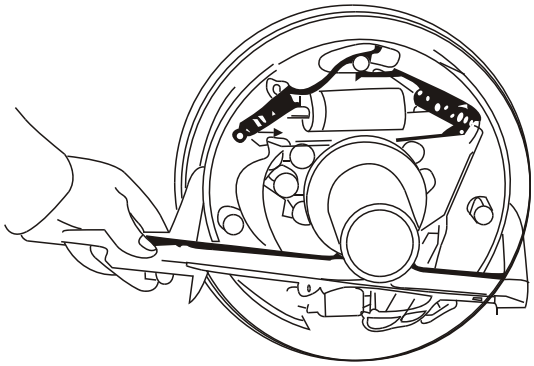


Fig. 5-18

5.7.4 Operation test of automatic clearance adjuster

(1) Make the brake shoe diameter nearly to the specified setting size, and pull the adjuster lever by your hand to turn the adjuster gear. When removing off your hand, the adjuster lever returns to the original position.

Note: the adjuster gear may turn back slightly along with the adjuster lever when removing your hand, but the adjuster will operate normally when it is put back on the truck.

(2) If the adjuster fails to do normal operation when pushing the adjuster lever, tack the following steps:

(a) Make sure the adjuster lever, adjuster, adjuster spring, adjuster cable and shoe return spring is securely installed.

(b) Check the shoe return spring and adjuster spring for deterioration. Also check whether the adjuster is rotating properly, its teeth are free from damage and wear.

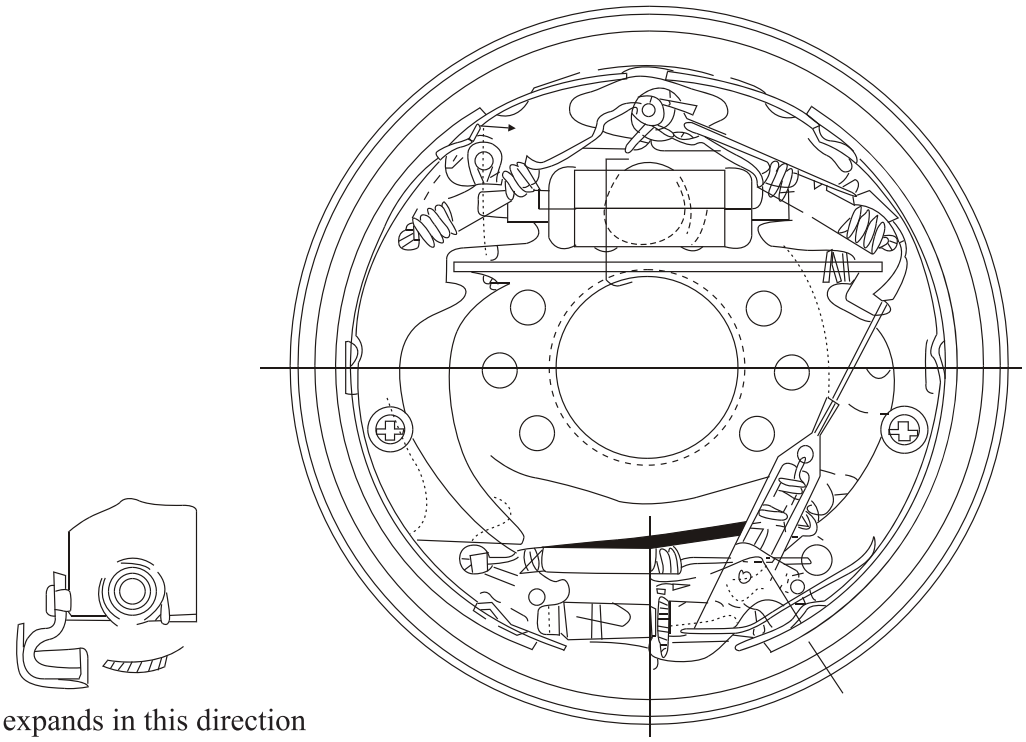


Fig. 5-19

5.7.5 Brake pedal adjustment

(1) Shorten the master cylinder push rod properly.

(2) Adjust the pedal height with the stopper bolt as shown in Fig.5-20.

(3) Keeping the pedal pressed 30mm, extend the push rod so that the its end contact the master cylinder piston.

(4) Tighten the push rod lock nut.

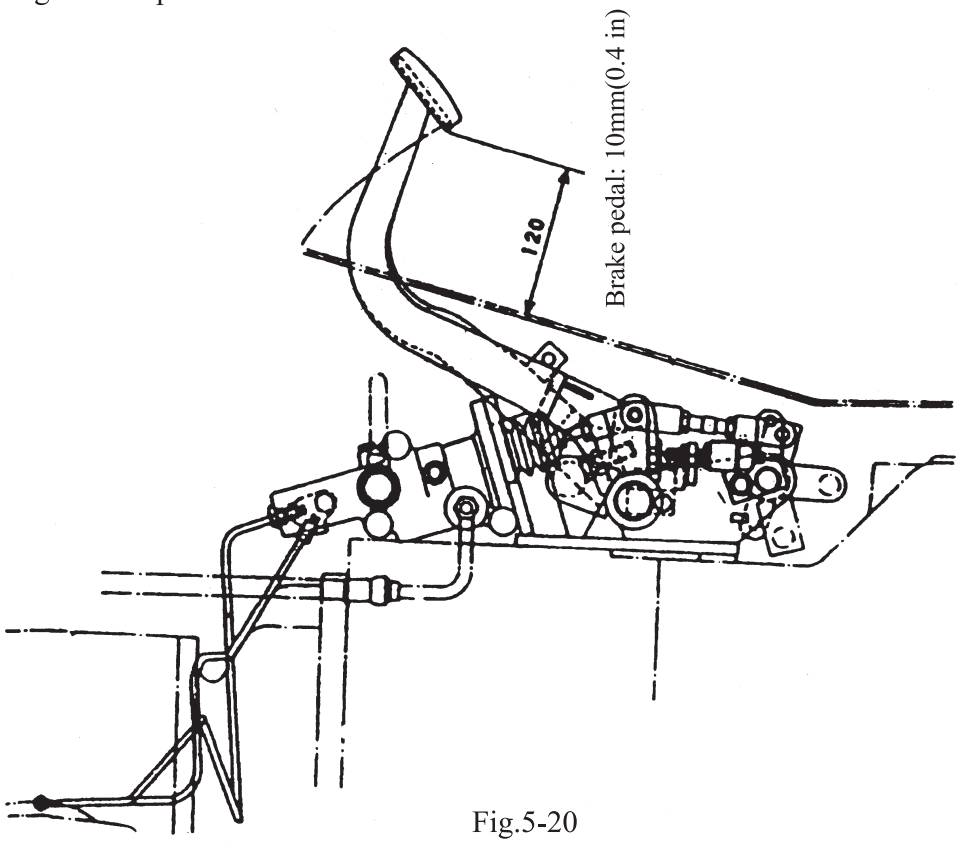


Fig.5-20

5.7.6 Brake switch adjustment

(1) After making sure that the brake pedal height is as indicated in Fig.5-21, loose the brake switch lock nut.

(2) Remove the brake switch lead wire from the connector.

(3) Turn the switch so that the size at “A” is 1mm.

(4) Make sure the brake lamps turn on when the brake pedal is pressed 30mm.

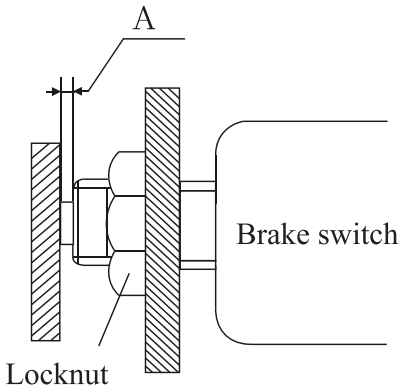


Fig.5-21

5.7.7 Air bleeding

(1) Place the truck on a level surface and apply the parking brake securely.

(2) Shift the transmission in neutral and shut off the engine.

(3) Connect a vinyl tube to the bleeder plug of the wheel cylinder and put the open end of the hose in a pan.

(4) Start the engine.

(5) Press the brake pedal and hold it. Loosen the bleeder plug.

(6) When no air bubbles are observed in the oil coming from the bleeder plug, tighten the bleeder plug.

(7) Use the same procedure for the other side of the brake unit.

5.8 Troubleshooting Guide (See Table 5-3).

Problem	Possible cause	Remedy
Poor braking force	Fluid leakage from brake system	Repair
	Improper clearance of pads	Adjust
	Overheat of brake	Checking if it sliding
	Improper cantact of rotor and pads	Adjust
	Foreign material adhering to pad surface	Repair or replace
	Foreign material mixed in brake fluid	Change fluid
	Incorrect adjustment of pedal (inching valve)	Adjust
Noisy braking operation	Hardened pad surface foreign material adhered to it	Repair or replace
	Loose carrier mounting bolts, floor distortion	Repair or replace
	Deformed or incorrectly installed pad	Repair or replace
	Worn pad	Replace
	Loose ball bearing	Replace
	Bearing of wheel improper	Repair
Uneven braking	Foreign material adhering to pad surface	Repair or replace
	Auxiliary pump act improper	Repair or replace
	Drum eccentricity	Repair or replace
	Improper clearance of pads	Adjust
	Improper tire pressure	Adjust
Soft or spongey pedal	Brake fluid leakage from brake system	Repair
	Improper clearance of pads	Repair or replace
	Air mixed in brake system	Bleed air
	Incorrect pedal adjustment	Readjust

6. Steering system

The main specifications of the steering system see table 6-1

Table 6-1

Item \ Parameters / Model		Parameters, structure
		4-4.5t
Hydraulic Steering	Type	Open-entered, no-load reaction type
	Delivery rate	160 ml/r
	Rated Pressure	12.5 Mpa
Steering cylinder	Type	Double-acting piston typ
	Dia. of cyl./Dia. of piston rod	Φ90/Φ60 mm
	Stroke	226 mm
Steering axle	Type	Center-pin supported
	King pin Angle	0°
	Ton-in	0°
	Camber	1°
	Caster	0°
	King pin spacing	1030 mm
	Steering angle (Inner wheel)	78.42°
	Steering angle (Outer wheel)	54.36°
Steering wheel	Tire	7.00-12-12PR
	Rim	5.00S-12
	Inflation pressure	840 Kpa

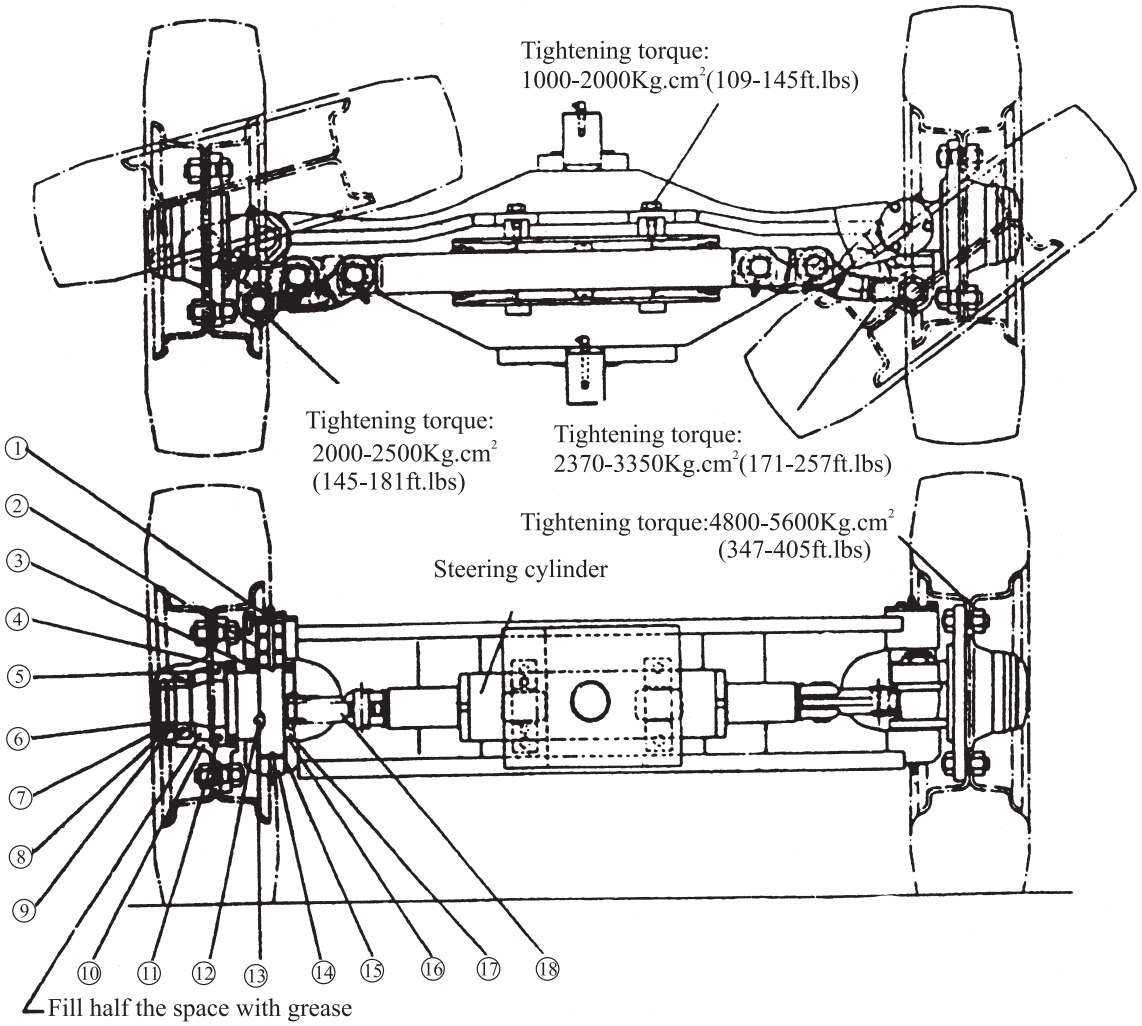
6.1 General description

The steering system consists primarily of a steering wheel, orbitrol flow regulator valve, steering axle, and steering cylinder. When the steering wheel is turned, the movement is transmitted to the orbitrol. The oil passages in the orbitrol are changed over to direct the hydraulic pressure from the flow regulator valve to the steering cylinder which extends or contracts depending on the hydraulic pressure, thereby steering the truck. The oil can not be supplied from the pump while the engine stops. The truck is steered by the manpower, but it is too difficult.

The steering cylinder is double acting type. Two sides of piston rod are connected with the knuckle by the push rod. The pressure oil from the orbitrol is transmitted to the steering cylinder, and pushes the piston rod to rotate. So the truck is steered.

6.2 Steering axle

The steering axle is of steel-welded construction with a box shaped cross section, incorporating a steering cylinder inside it. See Fig.6-1. The steering cylinder is housed in the axle to protect it from being damaged by obstacles on the road surface. The axle is installed onto the truck frame through a center pin with bushing and cap, and it cradles around this center pin.



1.shaft cover	2 shaft spacer	3.thrust bearing	4.oil seal
5.taper roller bearing	6. shaft cover	7.lock nut	8.lock washer
9.adjusting nut	10.hub	11. taper roller bearing	12.lock pin
13.oil seal	14.king pin	15.plate	16.sealed ring
17.knuckle	18.connecting board		

Fig.6-1 Steering axle

6.3 Steering wheel assembly

The steering wheel assembly is arranged as shown in Fig.6-2.The full-hydraulic steering unit is located at the bottom of the assembly. At the center of the wheel is the horn button.
The steering shaft is connected through the universal joint to the drive shaft of the steering unit so that the steering wheel can be moved to a certain extent back and forth to suit the driver's physique.

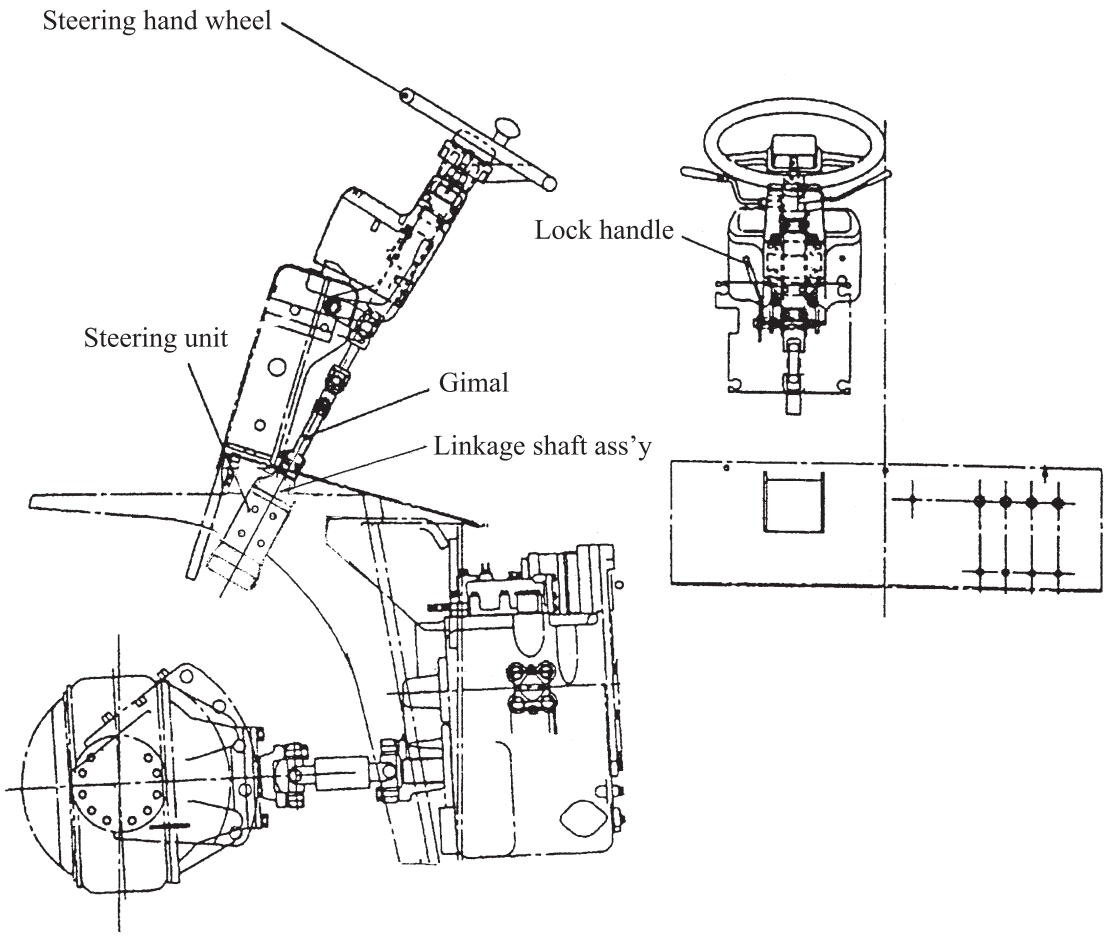


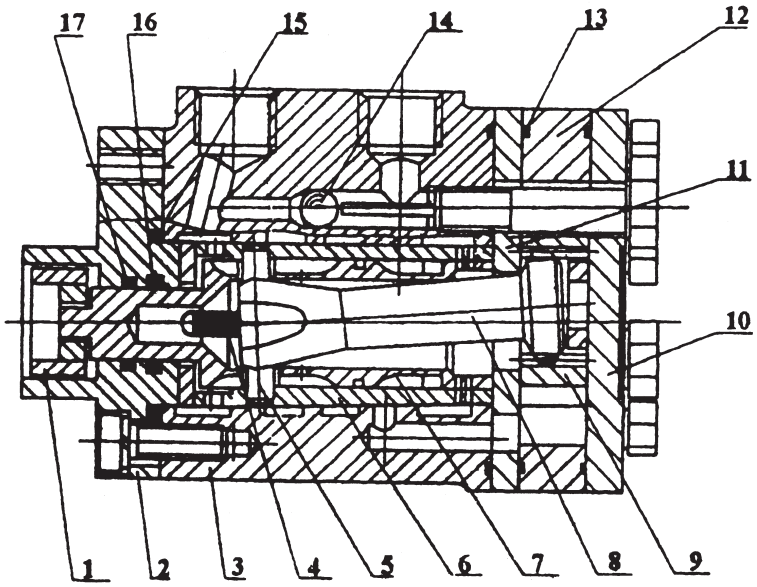
Fig.6-2 Steering Wheel Assembly

6.4 Full-hydraulic steering unit

The steering unit of model BZZ cycloidal type is open-centered, no-load reaction device (Fig.6-3). The rotor and the stator is a pair of cycloidal pin gear internal mesh gears. It is serried between the flow dividing valve and the steering cylinder during normal operation, it operated as an oil motor. The turning angle is direct proportion with the oil which flows to or from the steering cylinder because the oil must flows through the oil motor.

The steering wheel is connected with the valve core by the retainer 1, and moves the sleeve 6 by the spring 4. The sleeve 6 is connected with the rotor 9 by the shift arm 5 and the drive shaft 8. The rotor 9 does not move because the oil route is not connected. When the steering wheel is turned, the rotor 9 moves between the valve core and the sleeve. So the oil is sent to the steering cylinder through the oil motor. When the steering wheel is not turned, the valve core and the sleeve is located in neutral position by the spring 4 to shut off the oil route.

In an emergency, the safety valve 14 is opened by vacuum to from return route within the valve. The oil motor can be used as hand pump to send the oil from one chambers of the steering cylinder to another, so the manpower turning is accomplished.



1. Retainer	2. Head cap	3. Valve	4. Spring	5. Shift arm
6. Sleeve	7. Valve core	8. Drive shaft	9. Rotor	10. End cap
11. Spacer	12. Stator	13. “O”-ring	14. Steel ball	15. “O”-ring
16. “X”-ring	17. “O”-ring			

Fig.6-3 Orbitrol

6.4.1 Operation of full-hydraulic steering unit

(1) In “Neutral”

While the steering wheel is in straight position, the oil from the pump flows through oil passage (1) to oil groove (2). The sleeve has 24 oil holes (3) which are now in line with the holes (4) in the spool so that the oil that flowed into groove (2) passes through oil holes (3) and (4) to space (5) between the spool and drive shaft. Then the oil flows through spool groove (6) and sleeve groove (7) back to the oil tank.

Since cylinder ports (20) and (21) are respectively open to oil holes (18) and (17) in the sleeve but not to groove (16) nor (19) in the spool, the oil in the cylinder does not go any where.

Oil passage (15) that leads to the hydraulic motor is open to oil hole (14) in the sleeve which is used as the inlet and outlet for the hydraulic motor, but not to grooves (13) nor (16) in the spool and thus the oil remain unmoved.

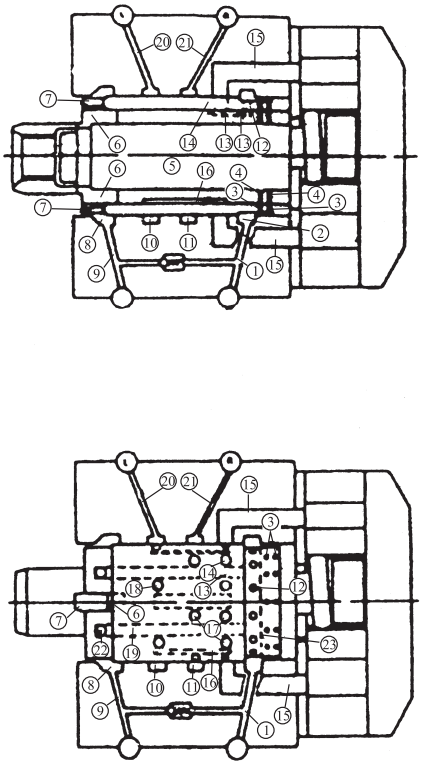


Fig.6-4

(2) When steering wheel is turned counter-clockwise

As the steering wheel is turned counter-clockwise, the grooves in the spool shift to the left in relation with the holes and grooves in the sleeve so that holes (4) in the spool get out of line with holes (3) in the sleeve. The oil that has flowed into groove (2) thus far begins to flow into hole (12) in the sleeve, passing through grooves (23) and (13) in the spool, hole (14) in the sleeve, and oil passage (15) in the housing, to the hydraulic motor.

The hydraulic motor thus rotates in the counter-clockwise direction and the oil discharged from the hydraulic motor flows through oil hole (14) in the sleeve, groove (16) in the spool, and oil hole (18) in the sleeve to the cylinder port L and thus actuates the steering cylinder.

The returning oil from the steering cylinder flows, assign through the cylinder port R, groove (11) in the valve housing, oil hole (17) in the sleeve, groove (19) in the spool, oil hole (22) in the sleeve, and groove (8) in the valve housing, back to the oil tank.

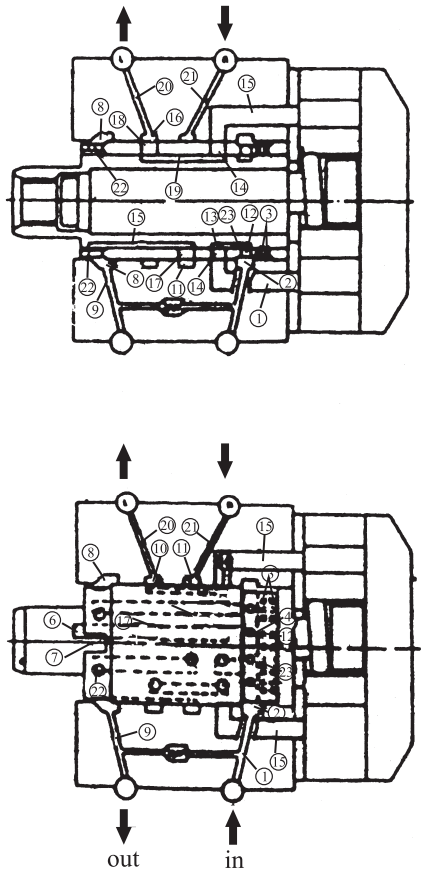


Fig.6-5

(3) When steering wheel is turned clockwise

As the steering wheel is turned clockwise, the grooves in the spool shift to the right in relation to the oil holes and grooves in the sleeve so that oil holes (4) in the spool get out of with holes (3) in the sleeve. The oil that has flowed into groove (2) thus far begins to flow into hole (12) in the sleeve and then flows through grooves (23) and (13) in the spool, oil hole (14) in the sleeve, and oil passage (15) in the valve housing to the hydraulic motor. The hydraulic motor thus rotates in the clockwise direction and the oil discharged from the hydraulic motor flows through oil hole (14) in the sleeve, groove (16) in the spool, and oil hole (17) in the sleeve to the cylinder port R in the housing and thus actuates the steering the steering cylinder.

The returning oil from the steering cylinder flows, passing through the cylinder port L, groove (10) in the housing, oil hole (18) in the sleeve, groove (19) in the spool, oil hole (22) in the sleeve and groove (9) in the housing back to the oil tank.

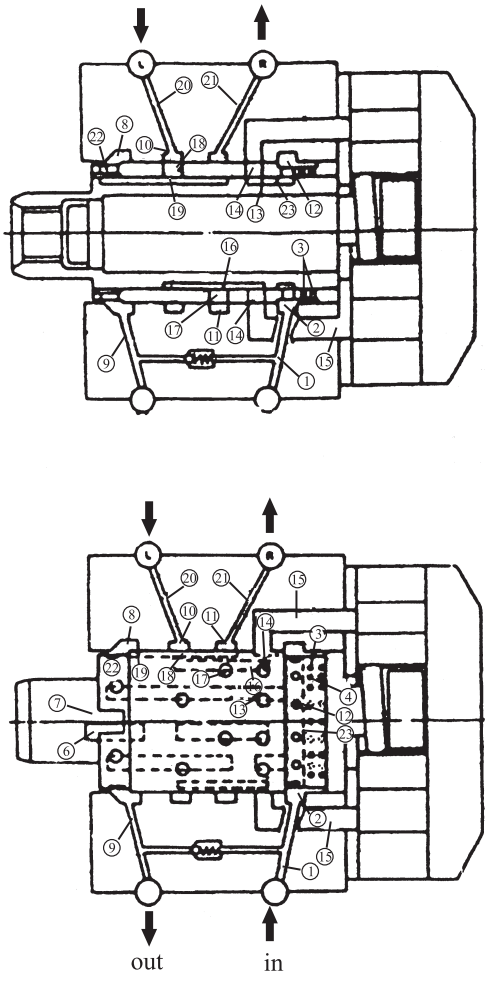


Fig.6-6

6.4.2 Relationship between rotating speed and operation force of steering wheel

In principle, the force required to operate the orbitrol is only the force to change over the valve, the force of compressing the centering spring is 0.3kg.m. In other words, since there are no mechanical connections between the steering wheel and the tires and only the spring compressing force is required, constant steering force is kept even at increased rotational speed. The discharge of oil supplied from the rotor of the orbitrol to the cylinder is 160ml/r.

6.4.3 Neutral feedback of orbitrol

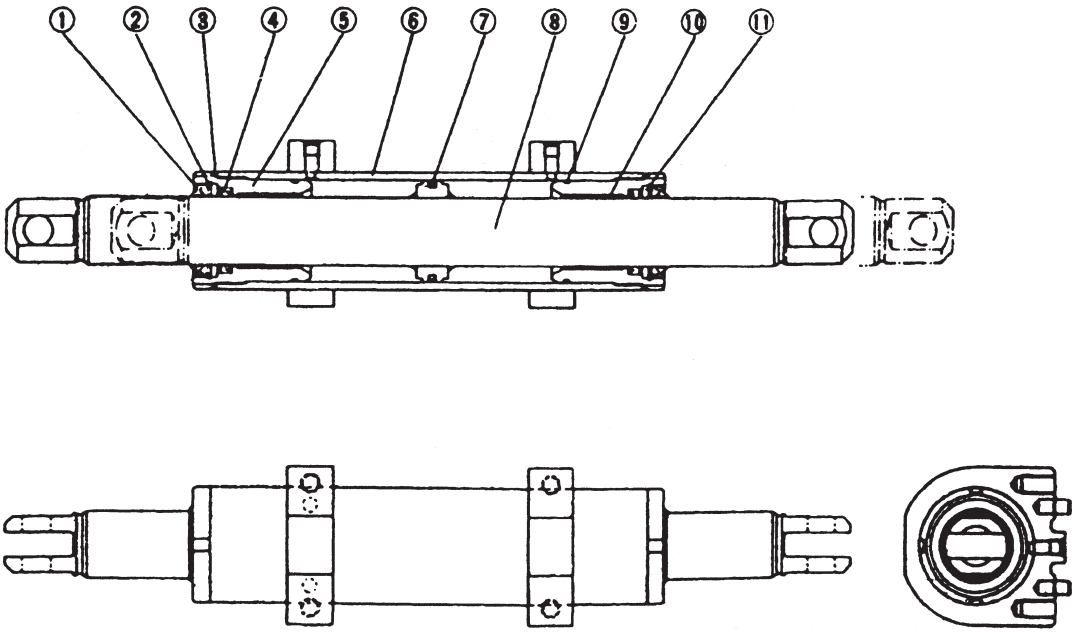
The neutral feedback of the orbitrol is performed by changing-over in oil passages of the valve, due to the reactions force of centering spring. (When the steering wheel is turned and then released with the engine at rest, the steering wheel returns to the initial position.) Unless the nentral feedback is completely performed, the steering wheel may be turned, even through the operator does not turn the steering wheel.

6.4.4 Steering with defective pump

When the pump fails to supply hydraulic oil the orbitrol serves as an emergency hand steering device. When the steering wheel is turned, the spool rotates. When turned by about 8° , the spool contacts the cross pin, which rotates the drive shaft, which in turn rotates the rotor. Thus, the metering device serves as a hand pump to supply oil to the cylinder. In this case the check valve provided between the return port and the suction port opens, so that oil flows from the cylinder to the suction side, thereby effecting an emergency steering.

6.5 Steering cylinder (Fig.6-7)

The steering cylinder is installed in the rear axle and is operated by oil from the orbitrol. The cylinder body is secured to the axle, with both rod ends connected to the knuckle with joints.



1.dustproof ring	2.snap ring	3.lock washer	4.sealed ring
5.cylinder cap	6.cylinder	7.sealed ring	8.piston rad
9.o-ring	10.shaft spacer	11.wearing	

Fig.6-7 Steering Cylinder

6.6 Troubleshooting Guide

Problem	Possible cause	Remedy
Steering wheel won't operate	Defective or damaged pump	Replace
	Relief vale stuck or damaged	Clean or replace
	Control valve stuck, damaged, or worn	Replace or repair
	Damaged hose joint or clogged oil line	Replace or clean
Hard steering wheel	Low oil level in oil tank	Add oil
	Insufficient air bleeding	Air bleeding
	Low oil pressure	See previous item
	Control valve stuck or damaged	Clean or replace
Truck wanders or vibrates	Loose control valve spool	Retighten lock nut
	Damaged control valve	Replace
	Broken or deteriorated spring	Replace
Noisy operation	Low oil level in oil tank	Add oil
	Clogged suction pipe or filte	Clean or replace
	Control valve stuck or damaged	Replace
Oil leaks	Improperly-installed or damaged “O”-ring or oil seal for piping or control valve	Replace

7.Hydraulic system

Item \ Model		4-4.5t
Oil pump	Model	CQBL-F532/F532-AFHL
	Type	Gear type
	Drive	Crank shaft PTO
	Discharge	32×2ml/r
	Loaded pressure	20MPa
Flow dividing valve	Model	IWFL-F15L-6
	Discharge	6L/min
	Pressure	19MPa
Control valve	Model	CBDF-F20U
	Type	Spool sliding type, with relief valve, tilt lock valve, and flow divider.
	Pressure setting	19MPa
Lift cylinder	Type	Double acting type
	Cylinder bore	70mm
	Rod diameter	50mm
	Stroke	1495mm
Tilt cylinder	Type	Double acting type
	Cylinder bore	90mm
	Rod diameter	45mm
	Stroke	202mm

The machine adopts double pumps hydraulic system (Fig.7-1). The pressure oil within the oil pump is driven by the P.T.O. fixed on the pump wheel bed of the torque converter, to flow through the flow dividing valve into the brake system to brake. The other way into the control valve, through the flow dividing valve within the control valve can be supplied to the orbitrol, and then is transmitted through pipe into the steering cylinders according to steering condition. The control valve controls the lift and tilt cylinders.

7.1 Hydraulic pump

The model of the hydraulic pump is CQBL-F532/F532-AFHL type high-pressure gear pump. Its displacement is 32× 2ml/r. The pump is double gear pump type, consists of the driving gear, driven gear and pump body.

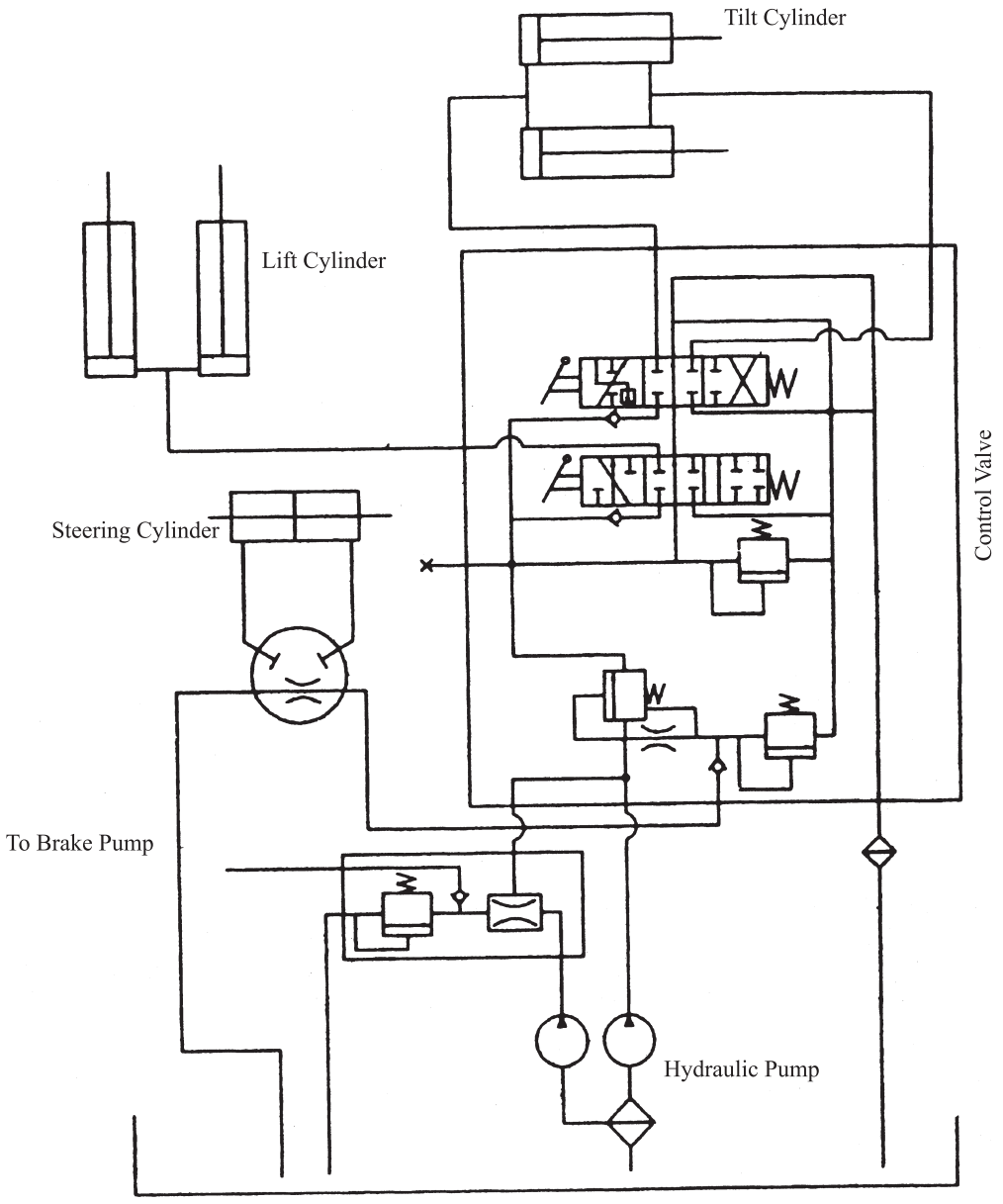


Fig.7-1 Hydraulic System Principle Diagram

7.2. Flow dividing valve (Fig.7-2)

The model of the flow-dividing valve is IWFL-F15L-6 type . Its function supplying hydraulic oil to the loading system (except lift and tilt cylinder). In addition supplying part oil to the brake system to complete power brake.

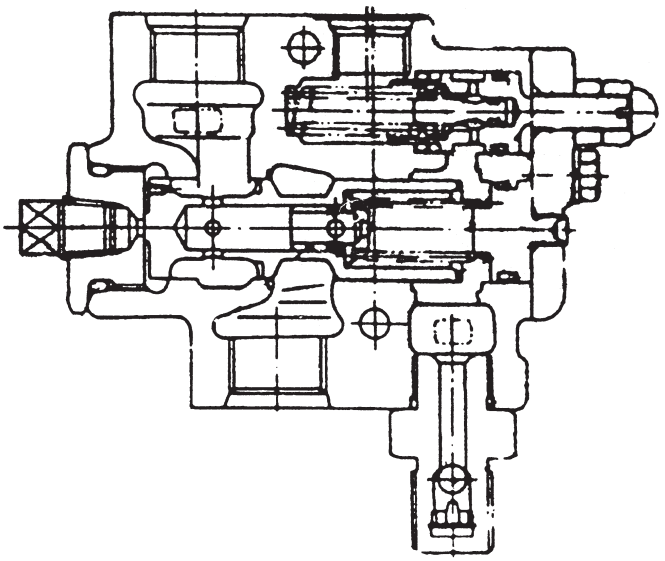


Fig.7-2 Flow Dividing Valve

7.3 Control valve

The model of the control valve is CBDF-F20U, unit combination type. Add control valves if needs. The valve's function is carrying respectively high pressure oil came from oil pump to each hydraulic cylinder, making back oil returning to the tank, and changing the flow direction by operating control lever.(Fig.7-3)

The control valve consists of an inlet section. Two plunger sections and an outlet section which are assembled with three bolts. The control valve is slice type. On the inlet section has a main relief valve. Under it has a steering valve, which regulates the main and steering circuit oil pressures respectively.

The two plunger sections are used for lift and tilt circuits, separately. The oil flow is changed by operating lift and tilt valve stems to control the cylinders.

The tilt plunger has a tilt lock valve. The oil from the cylinder returns through the tilt lock valve to the tank. Every slice of the valves is sealed by the O-ring. There is a load check valve on the high-pressure passage.

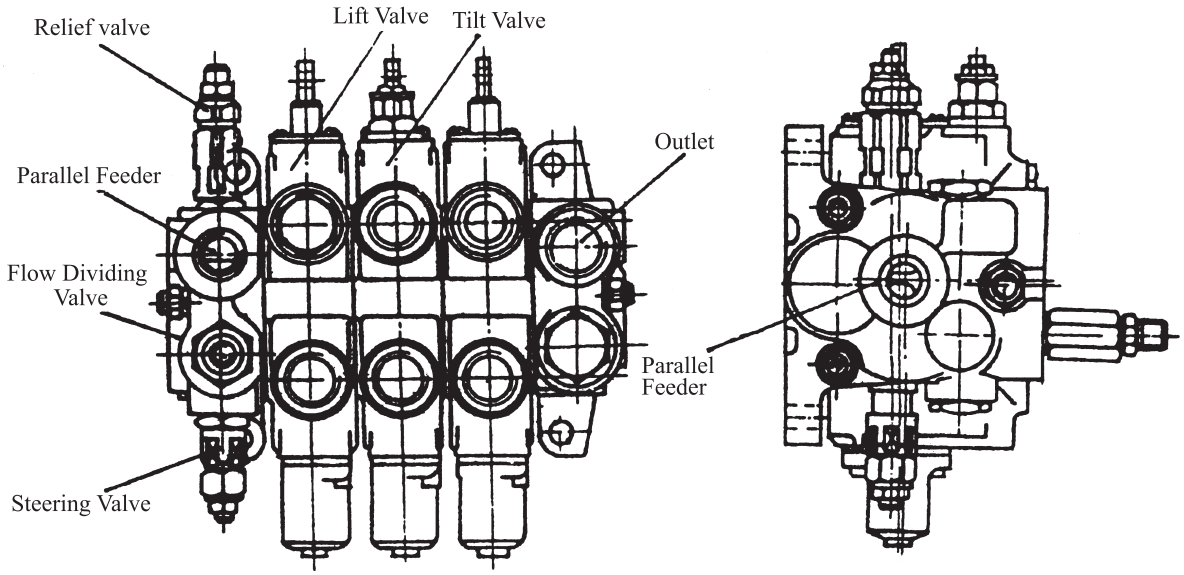


Fig.7-3 Control Valve

7.4 Operation of control valve

(1) Neutral position (See Fig. 7-4)

The high-pressure oil from lift pump returns to the oil tank through the mid-passage. The cylinder ports “A” and “B” are kept closed.

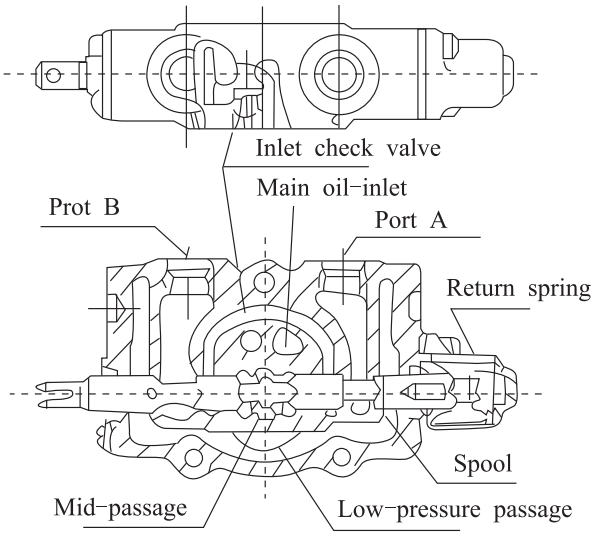


Fig. 7-4

(2) Pushing-in of spool (See Fig. 7-5)

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.

(3) Drawing-out of slide valve(See Fig. 7-6)

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

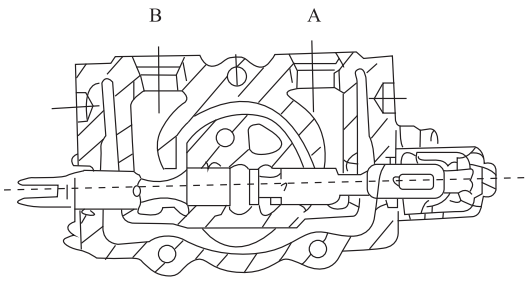


Fig. 7-5

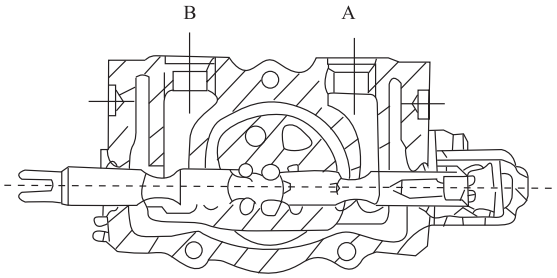


Fig. 7-6

7.5 Operation of relief valve

(1) The relief valve is mounted between the cylinder port “HP” and the low-pressure passage “LP”, The oil flows through the poppet “C” and affects the two areas “A” and “B” different in diameter, so that check valve poppet “K” and the relief valve poppet “D” are securely seated. (See Fig. 7-7)

(2) When the pressure in the cylinder port “HP” reaches the set pressure of the pilot poppet spring force, the pilot poppet “E” opens. The oil passes around the poppet, flowing through the drilled hole to the low pressure side “LP”.(See Fig. 7-8)

(3) As the pilot poppet “E” is opened. The pressure behind the poppet “C” drops, due to which the poppet “C” is moved to seat on the pilot poppet “E”. As a result of this, the oil flowing behind the relief valve poppet, “D” is shut off and the pressure at the inner side is reduced. (See Fig. 7-9)

(4) As compared to the pressure at the cylinder port “HP” side, the inner pressure becomes unbalanced, causing the relief valve poppet “D” to open and thereby sending the oil directly to the low-pressure passage “LP”. (See Fig. 7-10)

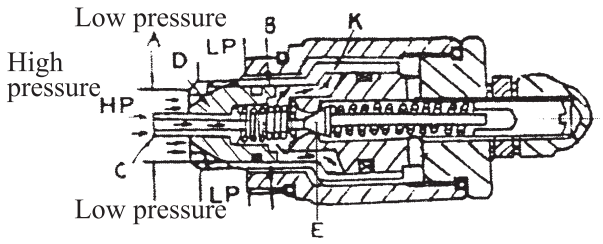


Fig. 7-7

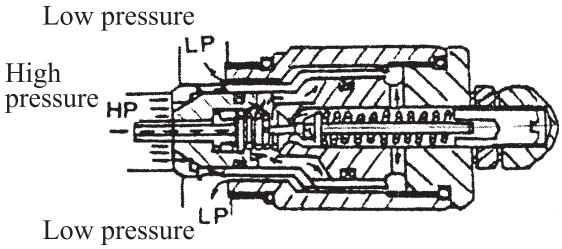


Fig. 7-8

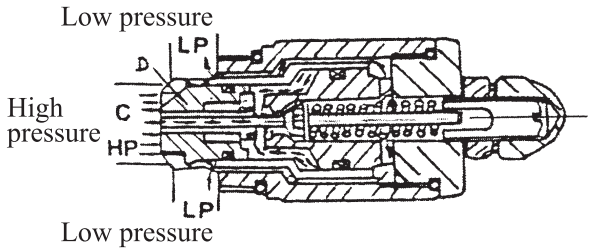


Fig. 7-9

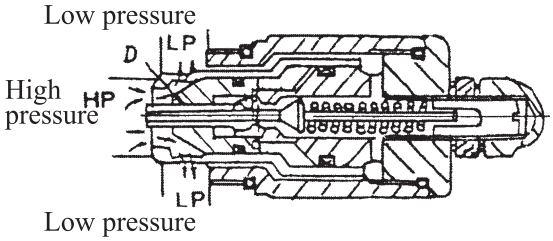


Fig. 7-10

7.6 Operation of tilt lock valve (See Fig. 7-11)

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.

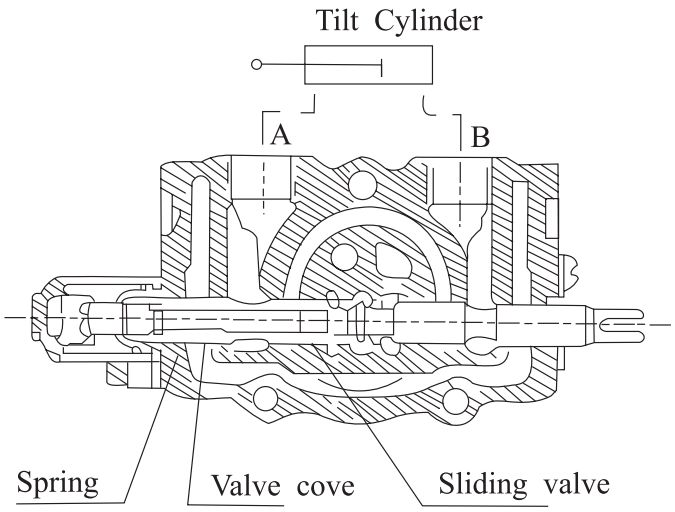


Fig. 7-11 Tilt lock valve

7.7 Lift cylinder

The lift cylinders are the single-acting type and are located behind the outer mast frame. The bottom of each cylinder is supported by the mast support of outer mast frame with knock pin and bolts. The piston head is held by the inner mast piston head guide.

The lift cylinder assembly consists primarily of a cylinder body, piston, piston rod, cylinder cap, and piston head. A cut-off valve is installed on the right-hand side of the cylinder body. At the lower part of the cylinder body is provided a high-pressure oil inlet, the upper part is provided with a low-pressure oil outlet to which a return pipe is connected.(Fig.7-12)

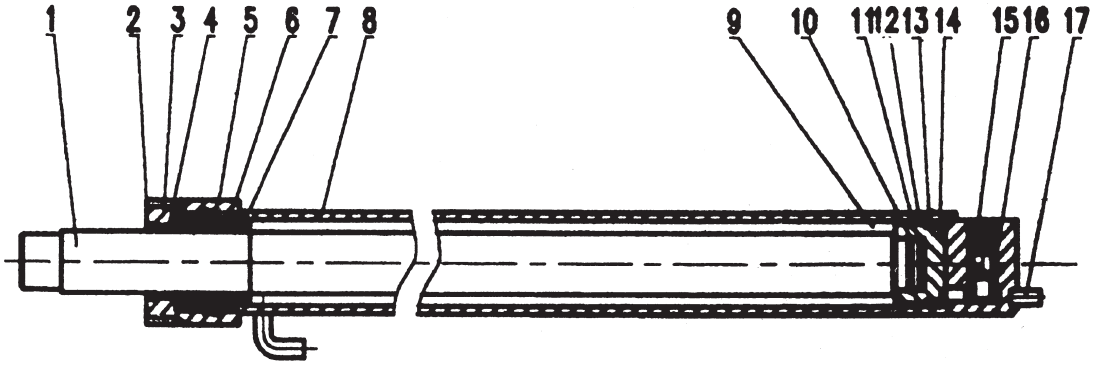
The piston is fastened to the piston rod with a lock ring and has a wear ring and a packing on its circumference and slides along the inside of cylinder by high-pressure oil. It slides in the cylinder by high-pressure oil.

The cylinder cap is fitted with a bushing and an oil seal and is screwed into the cylinder body. The bushing supports the piston rod, and the oil seal prevents dirt from entering the cylinder. The right and left piston rods are connected with a connecting member with snap rings.

When the lift lever is pulled toward the operator, the high-pressure oil flows into the lower part of each lift cylinder so that both the piston rod and piston is raised. This lifts the forks through the lift chains. On the other hand, when the lift lever is pushed forward, the piston descends by the weights of the piston rod, piston head, lift bracket, finger bar and forks, causing the oil under the piston to flow out of the cylinder. The oil discharged from the cylinders is regulated by the flow regulator and returns through the control valve to the oil tank, the upper

part of the cylinder is filled with the air from the oil thank.

Since the flow rate of the returning oil from the lift cylinders is usually regulated by the flow regulator, the pressure differential generated by the oil passing through the oil hole in the piston's circumference is smaller than the spring force, and thus the piston won't move. If the hose piston's circumference, therefore, the forks drops at a low speed as the oil in the lift cylinders flows out of the piston head hole in a small amount..



1. Piston Rod	2. Dust Seal	3. Cylinder Cap	4. Seal Ring	
5. O-ring	6. Bearing	7. Bushing	8. Cylinder Body	
9. Shim	10 Snap Ring	11.Back ring	12. Snap piece	
13. Yx Seal Ring	14. Piston	15. Spring	16. Valve	17. Pin

Fig.7-12 Lift Cylinder

7.8 Flow regulator valve

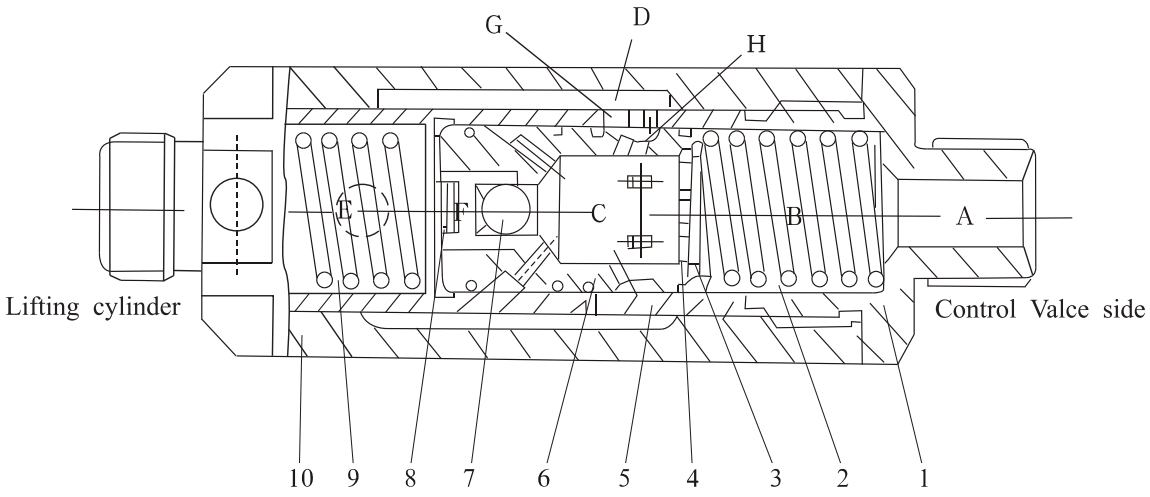
The flow regulator valve is located between the control valve and the high pressure ports of the twp lift cylinders, near the left cylinder.

The flow regulator valve serving bolt as a flow regulating valve while forks are being lowering and a safely device if rubber hoses between the control valve and lift cylinders are damaged due to any reason.

The operation of the flow regulator valve is given below.

See Fig. 7-13. With the forks upraised, high pressure oil led from the control valve flows into the chamber(A) and shifts the sleeve (2) to the left. This opens the opening (G) to allow the high pressure oil to flow along the two routes(A-B-C-D-E and A-B-C-D) and both flows of oil lead to the lift cylinders. In this case, the flows of oil is not regulated. When the forks begin to lower oil discharged from the lift cylinders enters the chamber(E) and shifts the sleeve unit it contacts the nipple. This closes the opening (C) so that oil flows through (E), (D),(H),(C),(B)

and (A) to the tank. If the amount of oil discharged from the lift cylinders is rapidly increased, the pressure in the chamber (F) rises and moves the piston (5) to the right in spite of the spring force, narrowing the opening (H). So the flow of oil from the chamber (D) to the chamber (C) is decreased so that the descending speed of the forks is controlled.



1. tie−in	3. check ring	5. valve sleeve	7. nylon ball	9. spring
2. spring	4. throttle plate	6. valvecore	8. spring	10. valve body

Fig. 7-13 Flow regulator valve

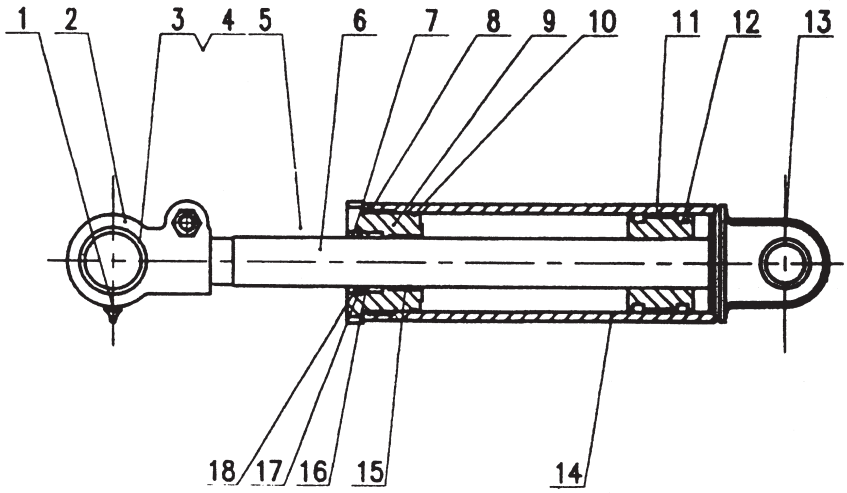
7.9 Tilt Cylinder(See Fig. 7-14)

The tilt cylinder is a double-acting type, and its piston rod end is supported by the mast and the cylinder tail is connected to the frame with a pin. This is provided with two tilt cylinders on both sides of its front.

The tilt cylinder assembly consists primarily of a cylinder body, cylinder cap, piston and piston rod. The piston is welded to the piston rod and has two packing and one wear ring on the circumference and moves along the inner surface of the cylinder by the force of hydraulic oil.

Inside the cylinder cap a bushing are pressed fitted together with a packing and dust seal to provide oil tight-ness for the piston rod and the cylinder cap. This bushing also supports the piston rod. The cap is fitted with an “O”-ring on the outer periphery and is screwed into the cylinder body and fastened with a lock ring.

When the tilt lever in the drive's room is tilted forward, the high-pressure oil enters the cylinder tail, moving the piston forward. This causes the mast to tilt forward 6 degrees. When the tilt lever is tilted backward, high-pressure oil enters the cylinder cap side and moves the piston backward, tilting the mast 12degrees backward.



1. Oil Cup	2. Earring	3. check ring	4. Spherical Plain Bearings	5. Limit sets
6. Piston assembly	7. Dust ring	8. check ring	9. Cylinder Head	10. “O”- ring
11. Supporting ring	12. Ring	13. Bushing	14. Cylinder	15. Bushing
16. Ring	17. Block film	18. Check ring		

Fig. 7-14 Tilt Cylinder

7.10 Troubleshooting Guide

Problem	Possible cause	Remedy
The pump does not operate	The oil within the cylinder is not enough.	Add oil to the specified lever.
	The pipe or the filter is struck.	Clean, change oil if necessary.
The pressure of the high pressure oil is not enough	The bearing in the pump is worn.	Replace
	The pressure of the relief is not right.	Readjust
	There is air within the pump.	Retighten the joint.
		Add oil in the cylinder.
		Check the oil seal.
		Drive the pump until there is not air bubble within the cylinder.
Noisy operation of the gear pump	The side joints have loosened make air in.	Retighten every joint.
	From the free chamber because the oil viscosity is too high.	Replace the right viscosity oil.
		The pump is driven when the oil temperature returns to normal.
	Not concentric.	Readjust and make them concentric.
	There are air bubbles within the hydraulic oil.	Check and repair.
The oil within the hydraulic pump leaks	The oil seal of the pump is damaged.	Replace
	The sliding area is worn. (internal)	Replace
Lifting is weak or can not lift	Hydraulic pump gear is damaged or oil leaks.	Renew gear or replace pump.
	The oil seal of lift cylinder is damaged.	Replace oil seal.
	The relief valve of control valve is out of order.	Repair
	Hydraulic oil temperature is too high, oil has gone thin, and oil flow is reduced.	Change oil, check.
The lower slippage the forks are too large and the mast tilts automatically.	The control valve has oil leakage.	Repair
	The oil seal of the lift cylinder is damaged.	Replace oil seal.
	The return spring of control valve is damaged. The sleeve is not in right position.	Replace return spring.

8.Hoist system

The main specifications see table8.1.

table8.1

Item \ Model	4-4.5t
Mast type	Rolling type 2-stage telescopic mast with free lift (J-shaped inner rail and C-shaped outer rail)
O.D. of end roller mm	Φ123
O.D. of side roller mm	Φ67
O.D. of retaining roller mm	Φ55×Φ135×Φ155
Lift chain	LH1634,3×4
Fork lifting method	Hydraulic
Upper roller	80308
Mast tilting method	Manual

Loading system is used forking, loading and unloading piling, and so on, consisting of forks, mast, lift chain, lift cylinder, tilt cylinder and so on. There are masts from 3m to 6m can be chosen (Fig .8-1).

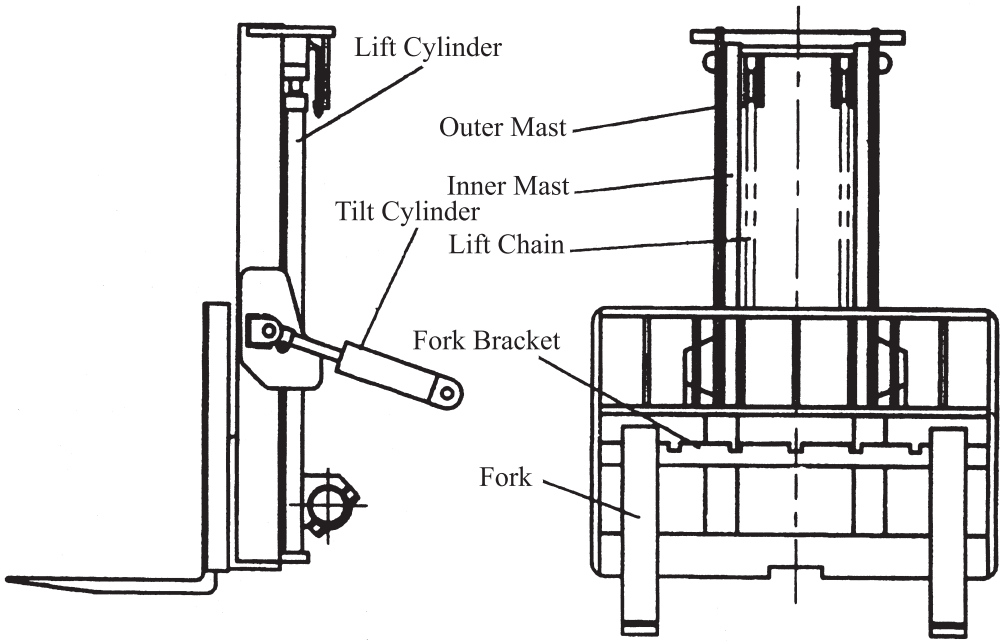


Fig.8-1 Loading System

8.1 Mast

The mast is of the two-stage, CJ type rolling telescopic mast. The outer mast and the inner mast are frame type welded construction. The support is welded to the under of the outer mast, make the mast to connect with the driving axle body, to support loading system, and return around the axle body. The support, which connects with the tilt cylinder, is welded in the middle of the outer mast, the loading system returns around the driving axle center to complete tilting forward or backward when the piston rod in the tilt cylinder telescopes. The support, which supports the lift cylinder, is welded to the bottom of the outer mast. Each set of rollers are located at the top outside and inside of each outer mast, are used to guide which the inner mast is lifting in the outer mast. A sideward roller is installed at the lower outside of the each inner mast. The end rollers connecting clearance of single side is from 0.5 to 1.0 mm .The side ward rollers connect with the outer mast channel steel web plate to avoid the inner mast tilting in crosswise. The clearance is from 0.5 to 1.0mm .The clearance is adjusted by adding or reducing shims.

8.2 Lift bracket and the backrest

An end roller and a sideward roller are installed to the carriage. The way that to adjust the clearance between bracket and flange plate of the outer or inner mast, or bracket and web plate of mast is same as that above about inner and outer mast. Fork and bracket can run up or down in the inner mast. The distance between two forks can be adjusted according to needs; its range is from 300mm to 1200mm.

Backrest is fixed on the fork stand by bolt: the face of backrest should be parallel with the fork face , avoiding the goods slip down the fork .

8.3 Lift chain

The lift chain is flat type chain. Each of the ends of two chain is connected with the fork bracket. and the other is connected with the top of outer mast after chain run round the chain wheel.

8.4 Adjustment of hoist system

8.4.1 Adjustment of lift cylinder

When replace the lift cylinder, inner mast or outer mast, we shall readjust the stroke of the lift cylinder as following.

(1) Install the piston rod in the upper beam of the inner mast without shims.

(2) Lift the mast slowly to the max, stroke of the cylinder and check the two cylinder synchronize or not.

(3) Install shims between the top of the piston rod of the cylinder which stop first and the upper beam of the inner mast. The shim are 0.2 mm or 0.5 mm thick.

(4) Adjust the tightness of lift chains.

The adjustment of the lift cylinder also belongs to exalted maintenance. Please be careful.

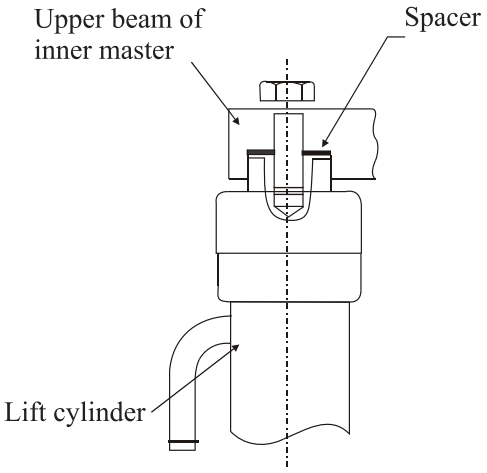


Fig.8-2

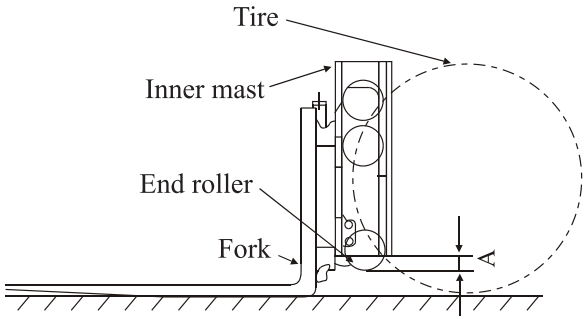


Fig.8-3

8.4.2 Carriage adjustment

(1) Let the truck parking on the horizontal ground and make the mast vertical.

(2) Let the bottom of the fork contact with the ground. Adjust the adjusting nut for the end nipple of the upper chain and make a distance A between the main roller and the carriage A. The A's valve equals the 1/4-1-3 valve of the main roller's radiu.

(3) Lift the fork to the max. height position, to ensure the clearance B between the stopper of bracket and the stopper of inner mast is 5-10 mm.

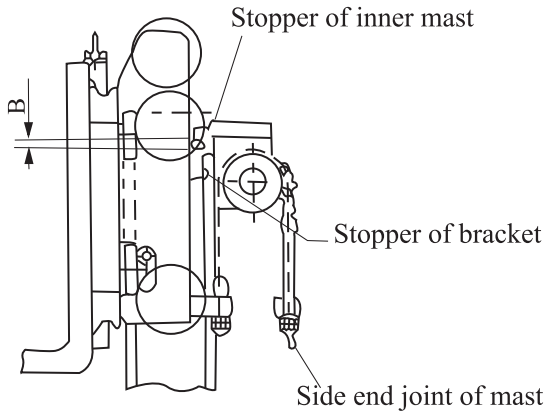


Fig.8-4

(4) Make the fork down to the ground and tilt backward fully . Adjust the adjusting nut for the end nipple of the upper chain and make the two chains' tightness equal .

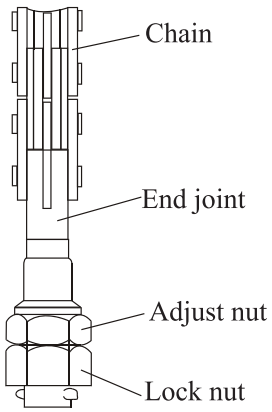


Fig.8-5

8.4.3 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.

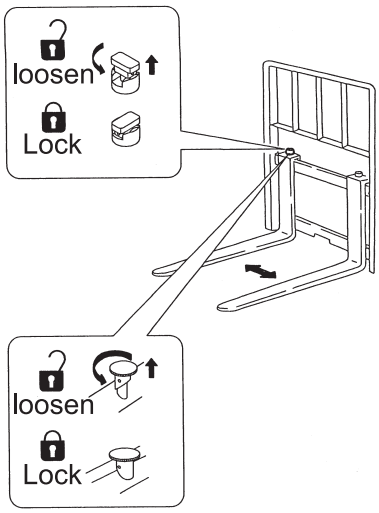
3. Tilt the mast forward.

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.

VI. 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".)

ENGINE

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (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				○	○
	Check cylinders for proper compression.	Compres-sion gauge.					○
PCV Device	Check metering valve and pipe for clogging or damage (G).					○	○
Governor or Injection Pump	Check no-load maximum rpm.	Tachometer					○
Lubrica-tion System	Check for engine oil leak.		○	○	○	○	○
	Check engine oil for level and dirt.		○	○	○	○	○
	Replace engine oil.			● (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)	Annualy (2400hrs)
Fuel System	Visually check for fuel leak from pipe, pump or tank.		○	○	○	○	○
	Check fuel filter for clogging.				○	○	○
	Replace fuel filter cartridge.				●	●	●
	Check that injection nozzle has correct inject press and pattern.	Nozzle tester				○	○
	Check for injection timing.						○
	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 deterio-ration.				○	○	○
	Check radiator cap for condition and installation.		○	○	○	○	○
	Clean and change coolant.				●	●	●
	Check fan belt for tension and damage.		○	○	○	○	○

POWER TRAIN

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
Torque converter transmi-ssion	Check for oil leaks.		○	○	○	○	○
	Check for oil level, or change oil.			○	○	●	●

POWER TRAIN

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
Torque converter transmission	Check change level 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)	Annualy (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.		○	○	○	○	○

WHEELS

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

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
Brake pedal	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.		○	○	○	●	●
	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.						○

BRAKE SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
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)	Annualy (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.			○	○	○	○
	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 craks or damage.			○	○	○	○
Chains & Sheave	Check chains for tension, deformation, damage or rust.		○	○	○	○	○
	Lubrication of chains.			○	○	○	○

LOADING SYSTEM

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
Chains & Sheave	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)	Annualy (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.			○	○	○	○

HYDRAULIC SYSTEM

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

SAFETY APPARATUS & ACCESSORIES

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (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.		○	○	○	○	○

SAFETY APPARATUS & ACCESSORIES

Checking Item	Service Required	Tools	Daily (8hrs)	Monthly (200hrs)	Trimonthly (600hrs)	Semainnually (1200hrs)	Annualy (2400hrs)
Rear View Mirror	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						○
	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.

VIPER
LIFT TRUCKS

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