SERVICE MANUAL

Starke EcoMaxx Series

FD120

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STARKE ECOMAXX

FOREWORD

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

The brochure has the brief introduction of the 12t 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.

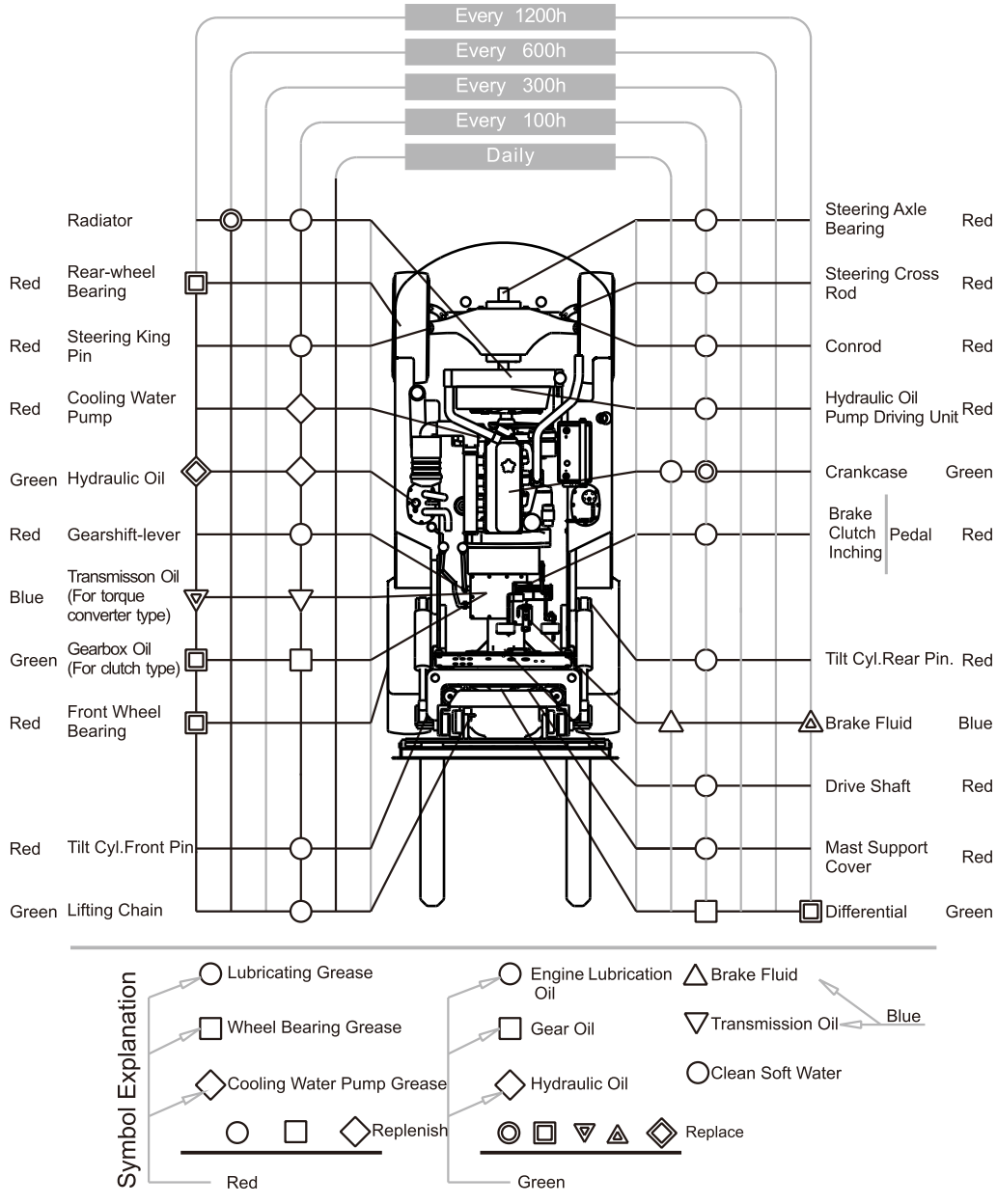
⚠ STATEMENT

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

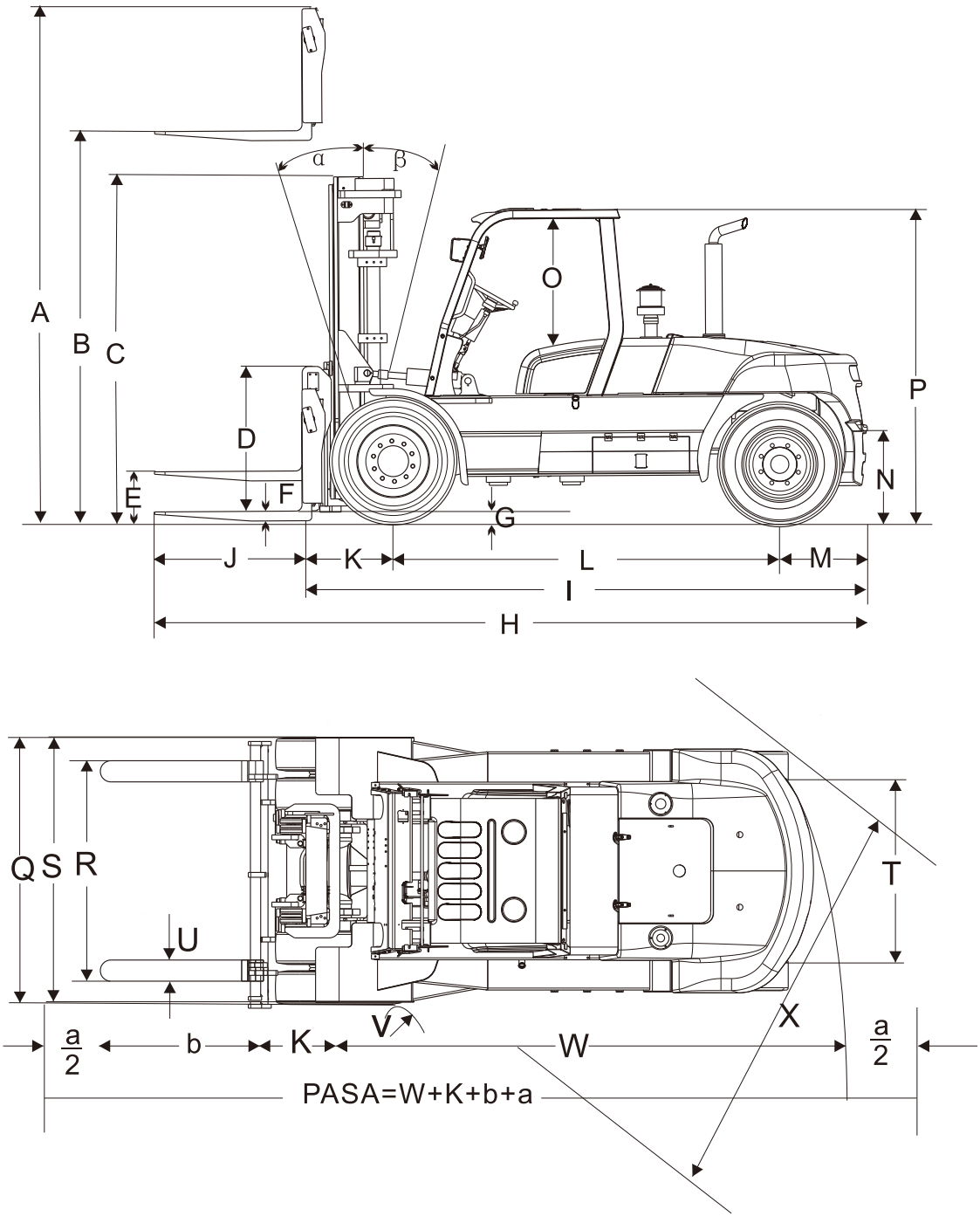
CONTENTS

7. Lubrication system picture:

LUBRICATION SYSTEM DIAGRAM



Ⅲ. Primary technic parameter of forklift



Forklift Figure

Main technical parameter

Item				12t
Rated Capacity			Kg	12000
Load center			mm	600
Max lift heigh (STD)		B		3000
Free lift heigh (STD)		E		230
Mast tilt angle		Y/Y	(°) / (°)	6/12
Min. turning radius		W	mm	4700
Min. intersecting aisle		X		4200
Min. under clearance		G		230
Wheelbase		L		3200
Tread Fed/bwd		S/T		1600/1700
Overhang Fwd/bwd		K/M		754/730
Overall length		H		6205
Overall width		Q		2200
Overall height	Mast	C		3080
	Overhead guard	P		2540
Height as fork lifting (With backrest)		A		4500
Fork	Length	J		1520
	Width(U)× thickness (F)			180×100
Fork adjustable space (outside of fork)		R		515-2055
Truck weight			Kg	14500
Axle load	Loaden (fwd/bwd)			23890/2610
	Unloaden (fwd/bwd)			6815/7685
Tyre	Front 4			11.00-20-16PR
	Rear 2			9.00-20
Battery (voltage/capacity)			V/Ah	(12/80)×2

Item		Unit	FD120
Rated Capacity		Kg	12000
Load center		mm	600
Max lift heigh (STD)			3000
Free lift heigh (STD)			230
Mast tilt angle		(°) / (°)	6/12
Min. turning radius		mm	4700
Min. under clearance			230
Wheelbase			3200
Tread Fed/bwd			1600/1700
Overall length			6205
Overall width			2200
Overall height	Mast		3080
Truck weight		Kg	14500
Max. traveling speed Laden/ Unladen		Km/h	28/30
Lift speed	Laden	mm/s	270
	Unladen		350
Max. traction force	Laden	KN	26
Type	Front 4		11.00-20-16PR
	Rear 2		9.00-20
Gradeability laden		%	20

Item \ Model			FD120
Engine	Type		CumminsQSB4.5-C130
	Cyl. Number-Bore × stroke	mm	7-107×124
	Rated output / speed	KW/rpm	97/2200
	Max. torque/speed	Nm/rpm	622/1500
	Min. fuel consumption	g/KWh	220
Speed gear Fwd/Bwd			2/2Power shift
Brake			Hydraulic power
Lifting speed laden/unladen		mm/s	270/350
Max. travel speed laden/unladen		Km/h	28/30
Max. gradeability		%	20
Max. traction force (laden)		KN	26

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.

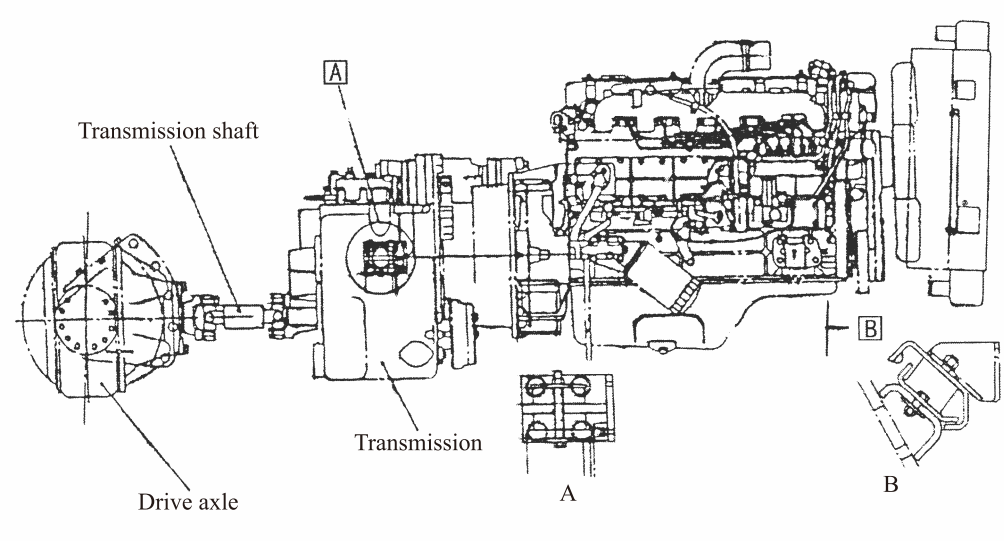


Fig.1-1 Engine mounted

(2) The engine and its accessories

The power of 12t forklift truck is provided by diesel engine CUMMINS (QSB4.5-C130), XICHAI (XC6110) .

The homeland diesel engine includes CUMMINS (QSB4.5-C130).Refer to relevant manual for the details of operation and maintenances for the engine. The struture figure of CUMMINS (QSB4.5-C130) engine as following:

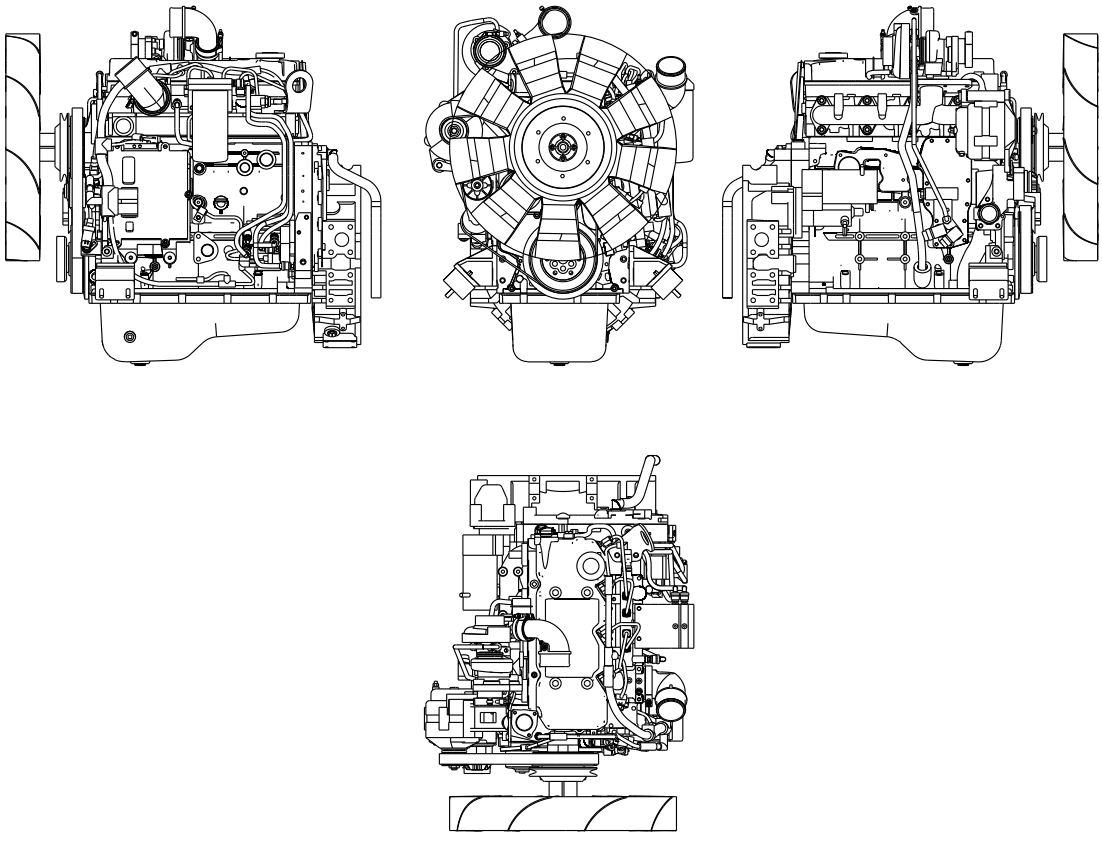


Fig. 1-2 CUMMINS QSB4.5-C130 diesel engine

Typical engine data		
Dry weight (pricing specifications)	-kg	432
Instantaneous inertia of the rotating parts (without flywheel)	-kg · m^2	0.25
The center of gravity away from the front end of the cylinder	-mm	391
The center of gravity away from the distance in crankshaft centerline (above the Crankshaft)	-mm	140
The crankshaft thrust watt load limit.		
Maximum instantaneous	-N	3425
Maximum sustained	-N	1112
Engine mounting		
The front supporting surface allows maximum (static) moment	-N.m	435
Side mounting bosses to allow the maximum (static) momen	-N.m	indeterminate
Cylinder rear to allow the maximum (static) moment	-N.m	1356
Finished engine instantaneous inertia		
Flip-axis	-kg · m^2	16.5
Pitch axis	-kg · m^2	41.1
Yaw axis	-kg · m^2	35.4
Exhaust system		
Maximum exhaust back pressure	-kPa	10
Recommended minimum inside diameter of the exhaust pipe	-mm	75
Maximum static support the weight of the turbocharger outlet flange	-N.m	13.5
Check the exhaust manifold is insulated or not.	-Yes/No	No
The turbocharger whether is insulated or not	-Yes/No	No
Intake system		
Maximum allowable intake resistance (using heavy-duty air filter)		
Clean filter	-kPa	4
Dirty filter	-kPa	6
Using heavy-duty minimum air filter with dirt interception capability	-g/litre/sec.	53
The maximum temperature rise of the outside air at the inlet to the turbocharger	-℃	17
Recommended intake manifold minimum inside diameter	-mm	76
Lubrication system		
Normal operation of the oil pressure range	-kPa	69-345
Maximum allowable oil flow rate to the engine accessories	-litre/min.	4.0
Maximum sump oil temperature	-℃	127
Minimum oil pressure		
Rated speed at full load	-kPa	276
The torque point speed with full load	-kPa	207
Low idle	-kPa	69
The minimum capacity of the lubrication system (oil pan + oil filter)	-litre	16.3
The bypass valve to be filtered	-Yes/No	No
Oil pan tilt angle (for intermittent use)		
Upward in the front	- °	45
Downward in the front	- °	45
Edge to edge	- °	45

Cooling System	
Engine Coolant capacity (engine only)	-litre 9.9
Maximum engine external cooling cycle resistance	-kPa 34
Minimum pump inlet pressure (without the pressure cap, thermostat opened)	-mmHg indeterminate
Maximum height on the top of the engine crankshaft centerline coolant static	-m indeterminate
Standard adjustable temperature of the thermostat (range)	-℃ 82-93
Maximum cylinder block coolant pressure (without the pressure cap, the thermostat is turned off)	-kPa 276
Minimum pressure of radiator cap	-kPa 50
Maximum coolant temperature (engine outlet)	-℃ 100
Maximum engine coolant temperature	-℃ 101.6
Minimum coolant temperature	-℃ 71
Minimum watering speed	-litre/min. 19
Maximum watering time	-min. 5
Relative to the system capacity with minimum coolant expansion volume	- % 6
Maximum degassing time	-min. 25
Relative to the capacity of the full system with minimum coolant filtration volume (Coolant filtration volume must be greater than the original saturation volume did not fill it in up with the saturated volume & not include the space for expansion)	- % 11%
Coolant outlet water temperature when operate the clutch fan	-℃ 93
Coolant outlet water temperature when operate the shutters	-℃ 85
Cold starting system	12V 24V
-18 ° C cold or above ,the minimum battery capacity	
Engine cold cranking amps only	-CCA 950 475
Engine reserve capacity only	-min. 260 130
Starter circuit maximum voltage drop	-Volts
No auxiliary cold start minimum ambient temperature	-℃(° F) -12(10)
No auxiliary cold starting required minimum starting speed	-rpm 125
Minimum independent starting temperature separation torque	-N.m(lb.-ft.) indeterminate
Minimum starting temperature independent starting torque	-N.m(lb.-ft.) indeterminate
-10 ° C starting torque	-N.m(lb.-ft.) indeterminate
Oil System	
Transfer pump maximum fuel flow	-kg/hr 193
Maximum oil-taking resistance	
Clean fuel filter	-kPa 14
Dirty fuel filter	-kPa 27
Maximum oil-taking resistance	
With one-way valve	-kPa indeterminate
Without one-way valve	-kPa 68
Fuel pump maximum oil-taking temperature	-℃ 71
6 inches water pressure minimum tank deflated performance	-litre/hr 340

Emission	
(Excluding the intake noise caused by the exhaust gas cooling system, and the drive assembly)	
-Right side	-dBa indeterminate
-Left side	-dBa indeterminate
-Leading end	-dBa indeterminate
-Rear end	-dBa indeterminate
Detection of gas emissions in accordance with GB 20891-2007	
-Nox	g/kW.h 6.75
-HC	g/kW.h 0.65
-CO	g/kW.h 0.66
-Particle	g/kW.h 0.25
Performance data	
Minimum idle speed	-rpm 900
Maximum speed regulating (10% of rated load)	-rpm 2460
Maximum overspeed performance	-rpm 3750
Allowed to continuous operation for the highest altitude	-m 2200
700 rev / min throttle full closed torque (900 rev / min idle speed)	-N.m 300
Adjustable rate	-% ≤8
Throttle lever angle	
-High idle	-Deg 101±10°
-Low idle	-Deg 79±10°
-Rotation angle	-Deg 22±5°
Parking handle angle	
-Free position	-Deg 340±5°
-Parking position	-Deg 42±5°
Thrust watt limit load	
-Instantaneous maximum	-N 3425
-Continuous maximum	-N 1112
Assessment of free-field sound pressure level at 15m, full load regulating speed	

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.1-3.

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.1-4.

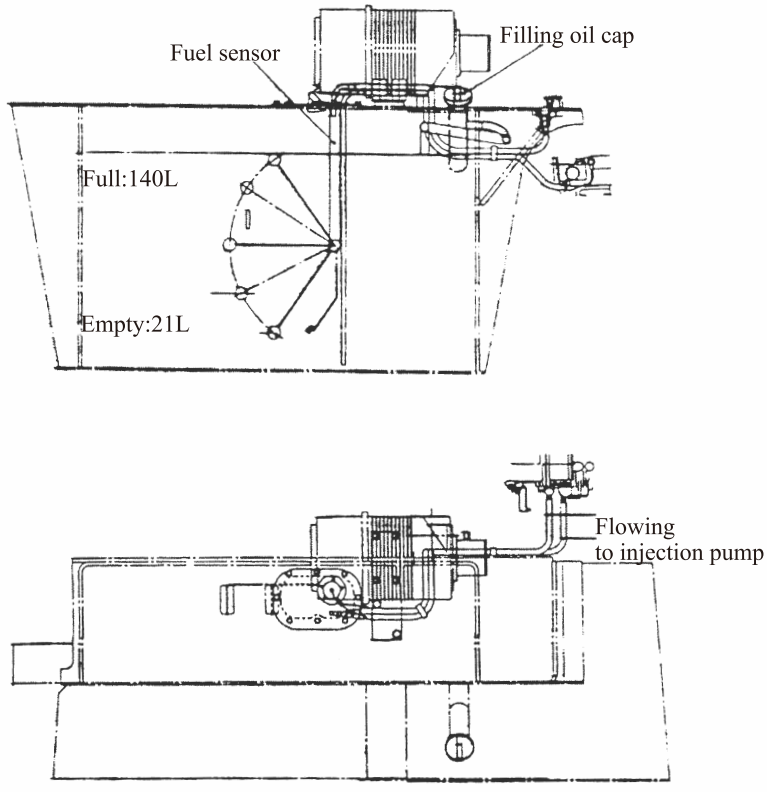


Fig.1-3 Fuel box

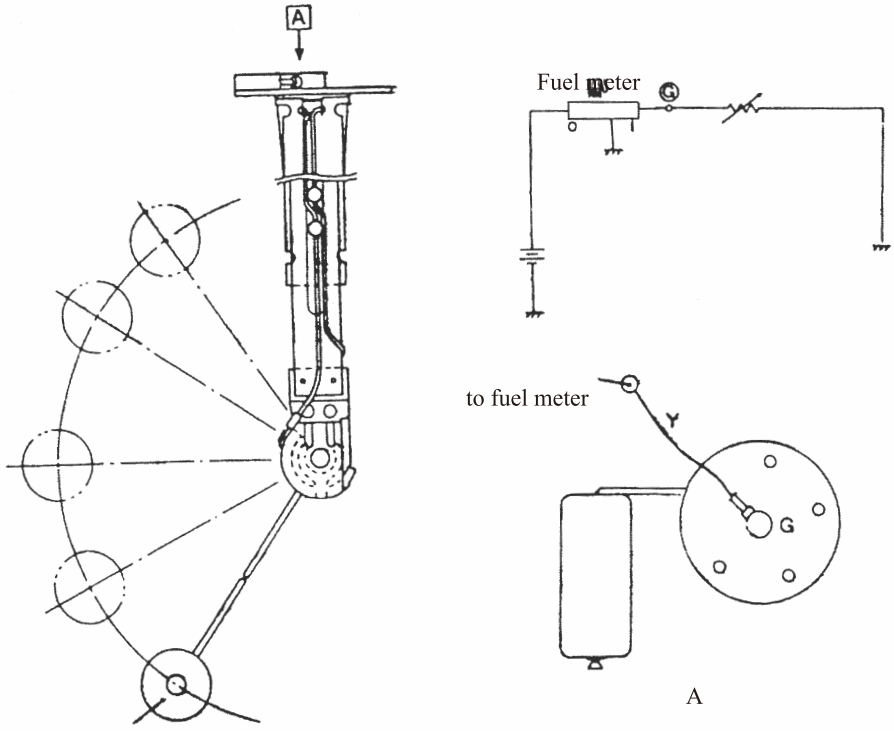


Fig.1-4 Fuel sensor unit

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 Cooling system

The cooling system is made up of water pump, fan, water tank and auxiliary water tank. The water pump is mounted on the engine and crankshaft drives the work of water pump through V-shaped rubber tape.

1.3 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:

1.3.1 For air filter, please See Fig.1-5.

(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.

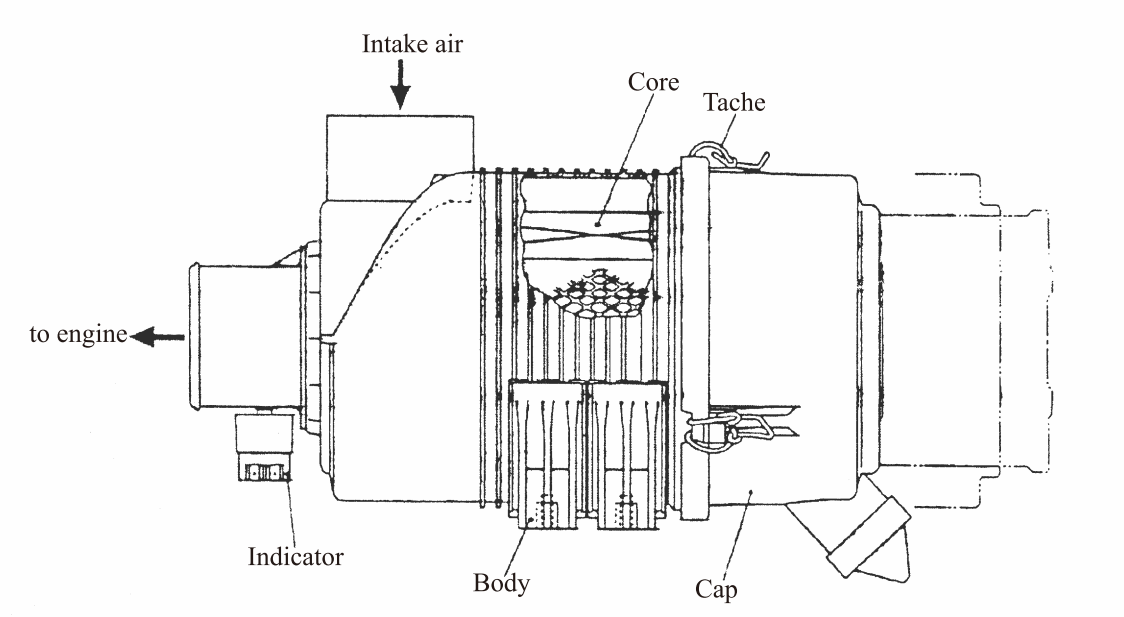


Fig.1-5 Air cleaner

1.3.2 For fuel filter, See Fig.1-6

(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.

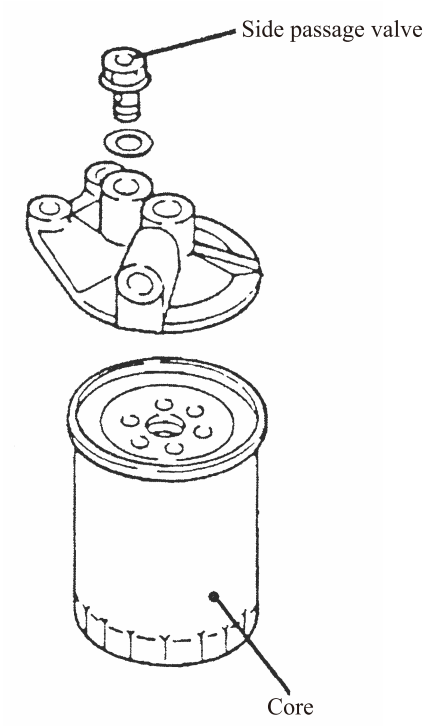


Fig.1-6

1.3.3 For the machine oil filter, See Fig.1-7.

(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.

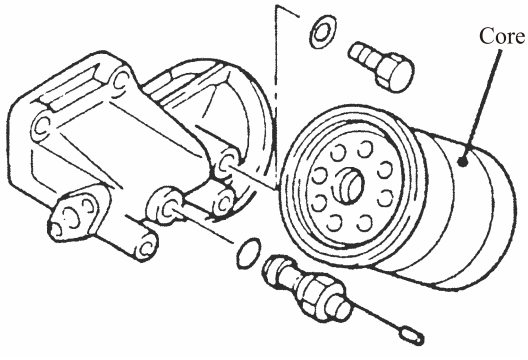


Fig.1-7

1.3.4 Cooling system

(1) Check the cooling liquid of auxiliary water tank

For auxiliary water tank, refer to 1-8. When the cooling liquid is lower than marking line of "LOW", it indicates that the supplementation amount of the water tank is small and the cooling liquid needs to be added. The cooling liquid should be added to the 2/3 graduation of upper and lower marking lines during cooling down.

(2) Replacing cooling liquid

A. Open the water tank cover after cooling when the machine stops for over half an hour and loosen the water drainage valve at the lower part of water tank.

B. Loosen the water drainage valve of engine and thoroughly drain dry the cooling liquid.

C. The above two water drainage valves should be tightened after drainage.

D. Fill in the specified cooling liquid and check if the level of auxiliary water tank is at 2/3 of the upper and lower graduation lines after running at slow speed.

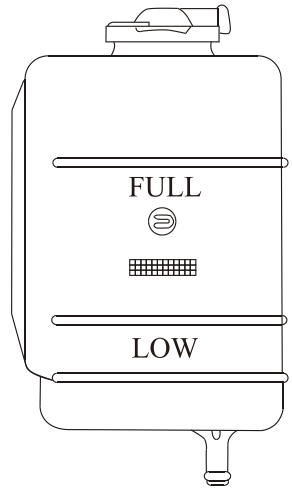


Fig.1-8

(3) Adjust the belt of fan and tighten if it is loosened Refer to Fig.1-9.

Steps: Loosen the fixed bolt B and C of the generator., move it towards outside, press down the belt at place A with finger with 10kg force. Its flexibility is about 10 mm and then tighten the B and C bolts in proper order.

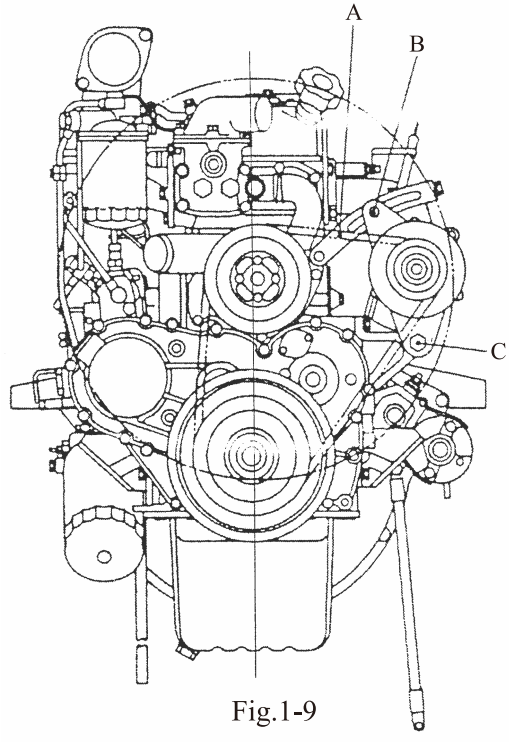


Fig.1-9

1.3.5 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. 1-10.

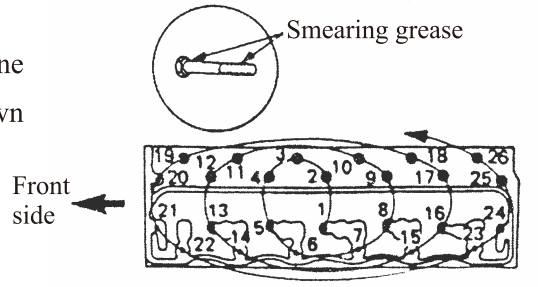


Fig. 1-10

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

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

1.3.6 Adjustment of clearance of air gate

(1) Turn the crankshaft clockwise and make the "TC" mark of belt wheel shock absorber coincide with the needle.

(2) Open the manhole cover and make sure the mark of the bottom plate and position of the needle. If the mark of the bottom plate coincides with the needle position, it indicates the upper dead point on the compression stroke of the first cylinder, adjust the clearances of the air gate with "△" and "※" as well. The clearance valve of the air gate: 0.4mm (When it is under cooling state, the air suction and exhaustion are of the same valve.) For details, please refer to Figs 1-11, 1-12, 1-13.

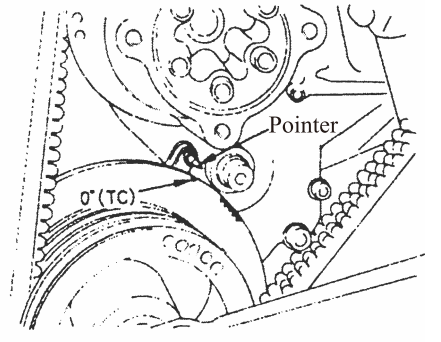


Fig. 1-11

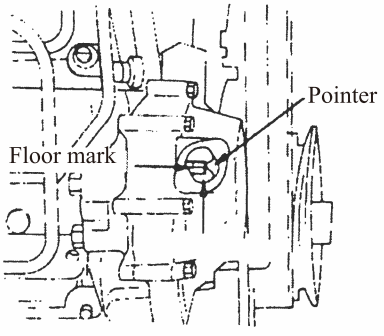


Fig. 1-12

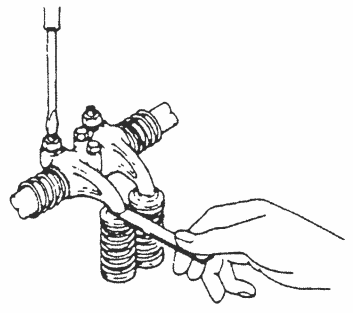


Fig. 1-13

For the concrete adjustment table, refer to Table 1.2.

Table 1.2

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				※	※			※	※		※	※

1.3.7 Confirmation of the ignition time of oil injection

(1) First make sure if the "assembly mark" on the flange of oil injection pump are in conformity with each other, See Fig. 1-14.

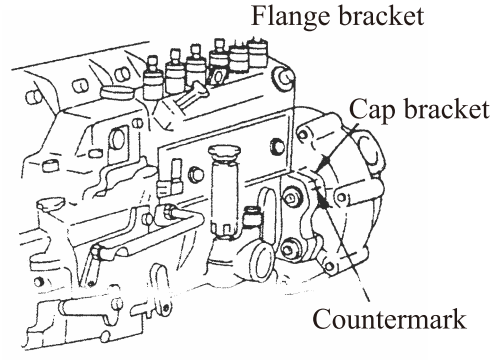


Fig. 1-14

(2) Place the first cylinder at the dead point position of compression strike and turn the crankshaft about 30 ° from this position. See Fig. 1-15.

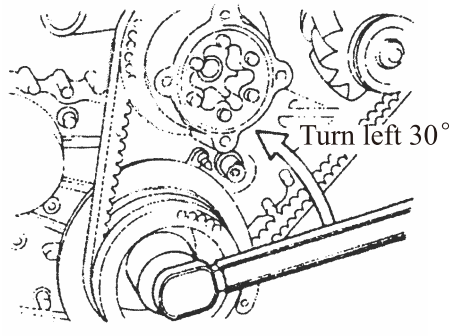


Fig. 1-15

(3) Loosen the oil injection pipe of the first cylinder; dismantle the spring of dump valve bracket and the valve. Mount the dump valve bracket on the oil injection pump. See Fig. 1-16.

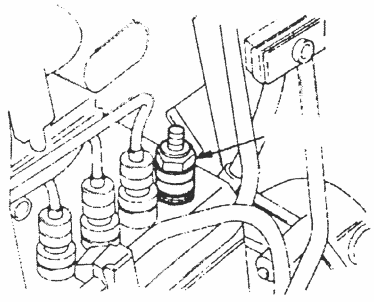


Fig. 1-16

(4) While the fuel is compressed and delivered by oil supply pump, turn slowly the crankshaft clockwise as shown in Fig.1-16 and stop turning it when the oil level of dump valve vase raises to the position it stops. See Fig.1-17 to confirm the marks of the needle.

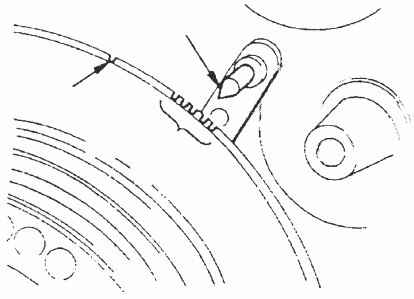


Fig. 1-17

1.3.8 Adjustment of ignition time of oil injection

(1) Dismantle the pipes mounted on the oil injection pump (fuel and lubrication oil).

(2) Loosen the mounting bolts of oil injection pump.

(3) While making sure the ignition time according to the main points of 1.3.7, adjust it in the direction far away from the engine in case of "Ahead of time"and adjust in the direction close to the engine in case of "delay".

(4) After adjustment, screw tight all the assembly bolts of oil injection pump and confirm again the ignition time.

(5) Assemble the oil discharge valve used for the first cylinder and mount each pipe on their original and respective positions.

1.3.9 Measurement of the compression pressure (See Fig. 1-18).

(1) Dismantle completely the heat spark plug and oil injection pipes.

(2) Mount the manometer on the assembly position of the heat spark plug of the first cylinder .(The nominal valve is 500 N/cm^2).

(3) Start the device with battery of sufficient electrical power and measure the pressure at this time.

(4) Measurement is made with the same method to the 6th cylinder, over twice for each, then calculate their respective average values: Compressed pressure; 304 N/cm^2 (Limiting valve 255 N/cm^2).

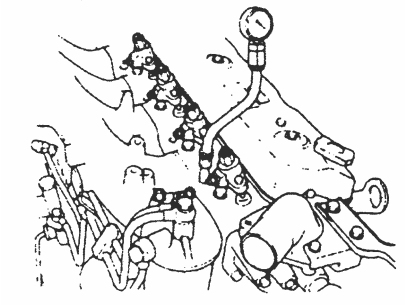


Fig. 1-18

1.3.10 Air exhaust of oil injection pump (See Fig. 1-19)

(1) Loosen the exhaust injection pump.

(2) Operate slowly the manual pump till no air bulbs come from the exhaust plug .

(3) Then tighten the air exhaust plug.

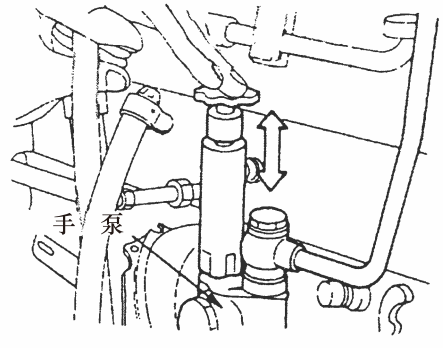


Fig. 1-19

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 start switch, the protective circuit, starter and its function is to start generator.

(3) Stop System

(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

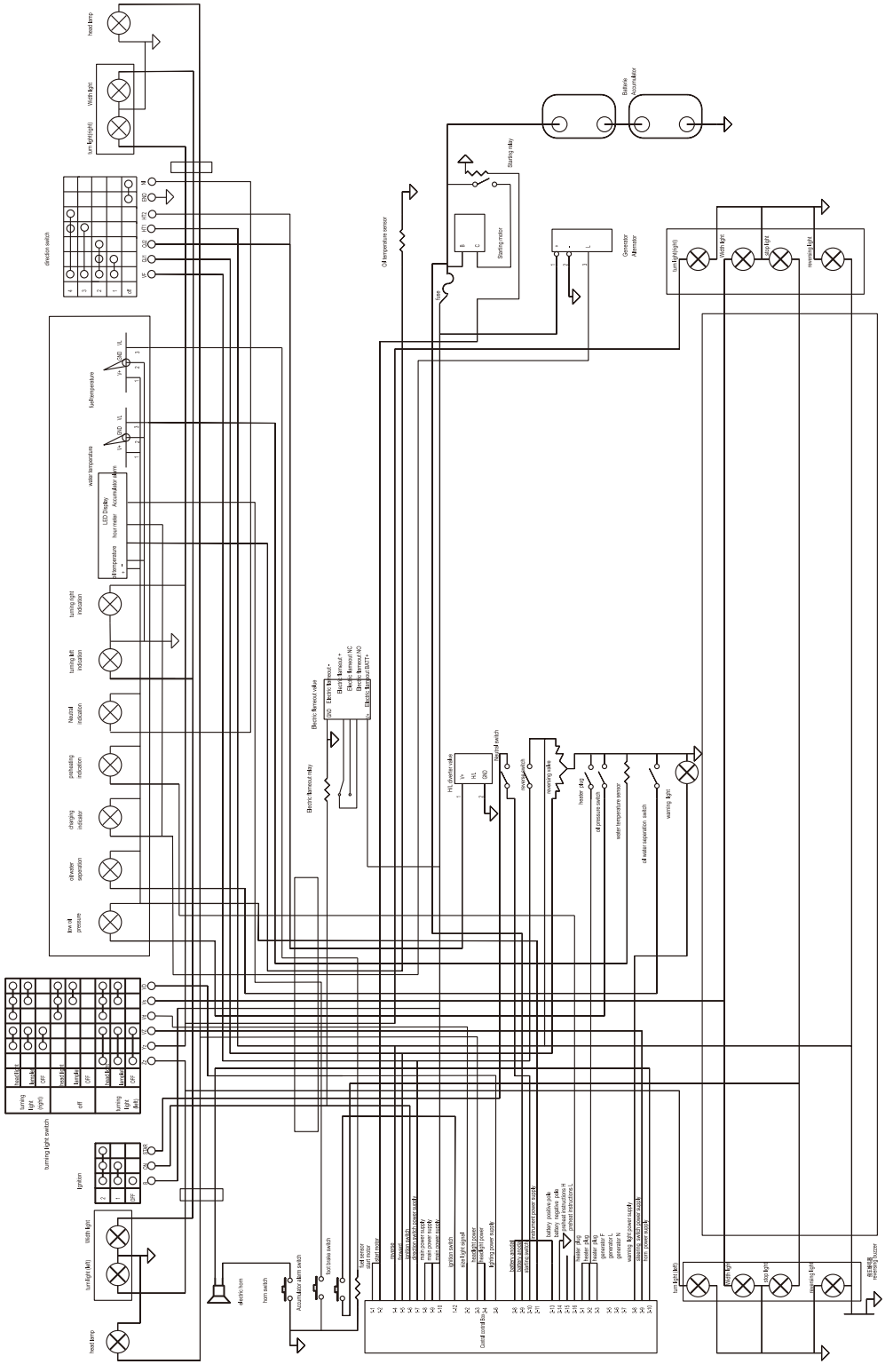


Fig.2-1 Electric principle(6BT5.9-C130Engine)

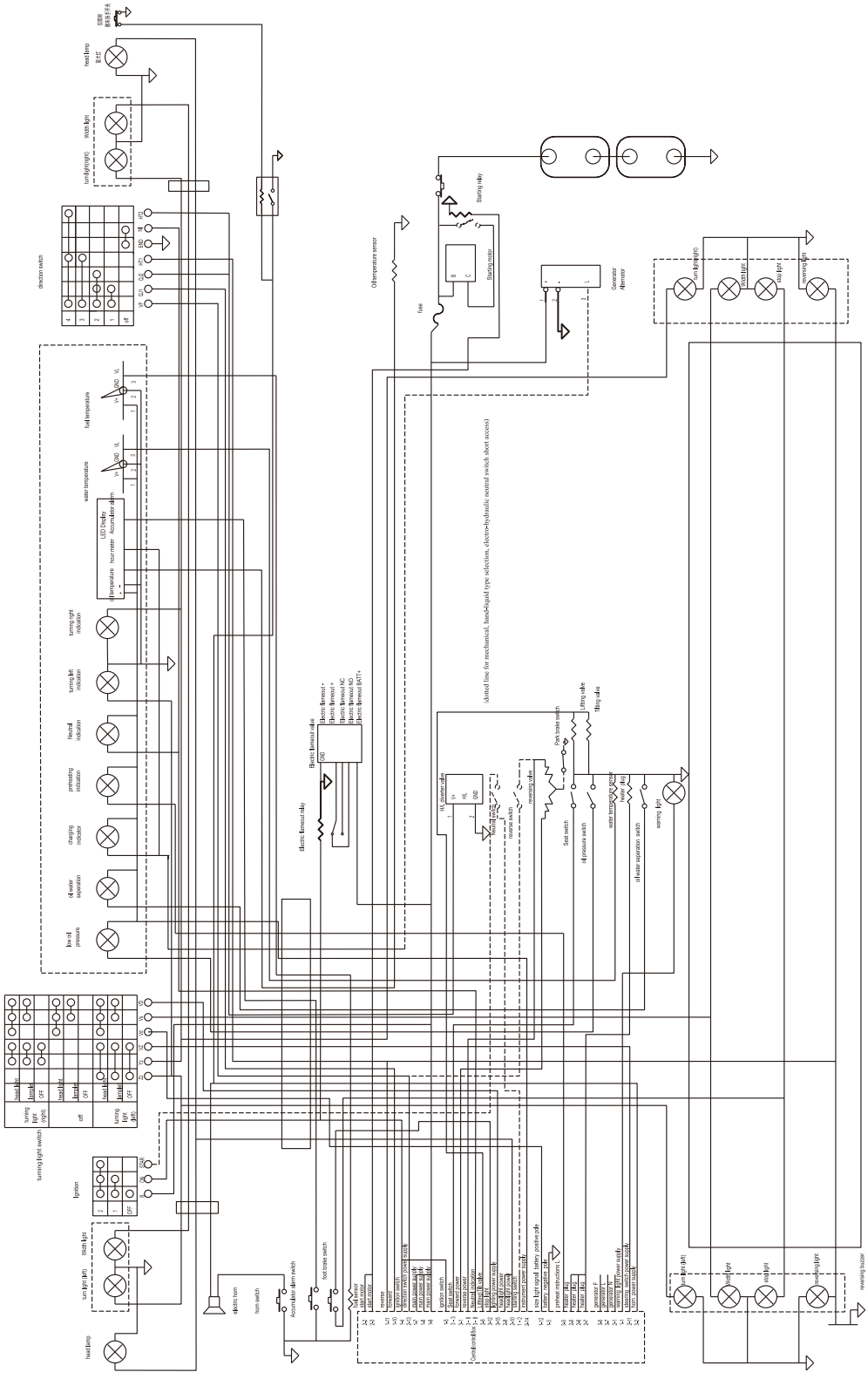


Fig.2-2 Electric principle(6BT5.9-C130Engine) European Standard

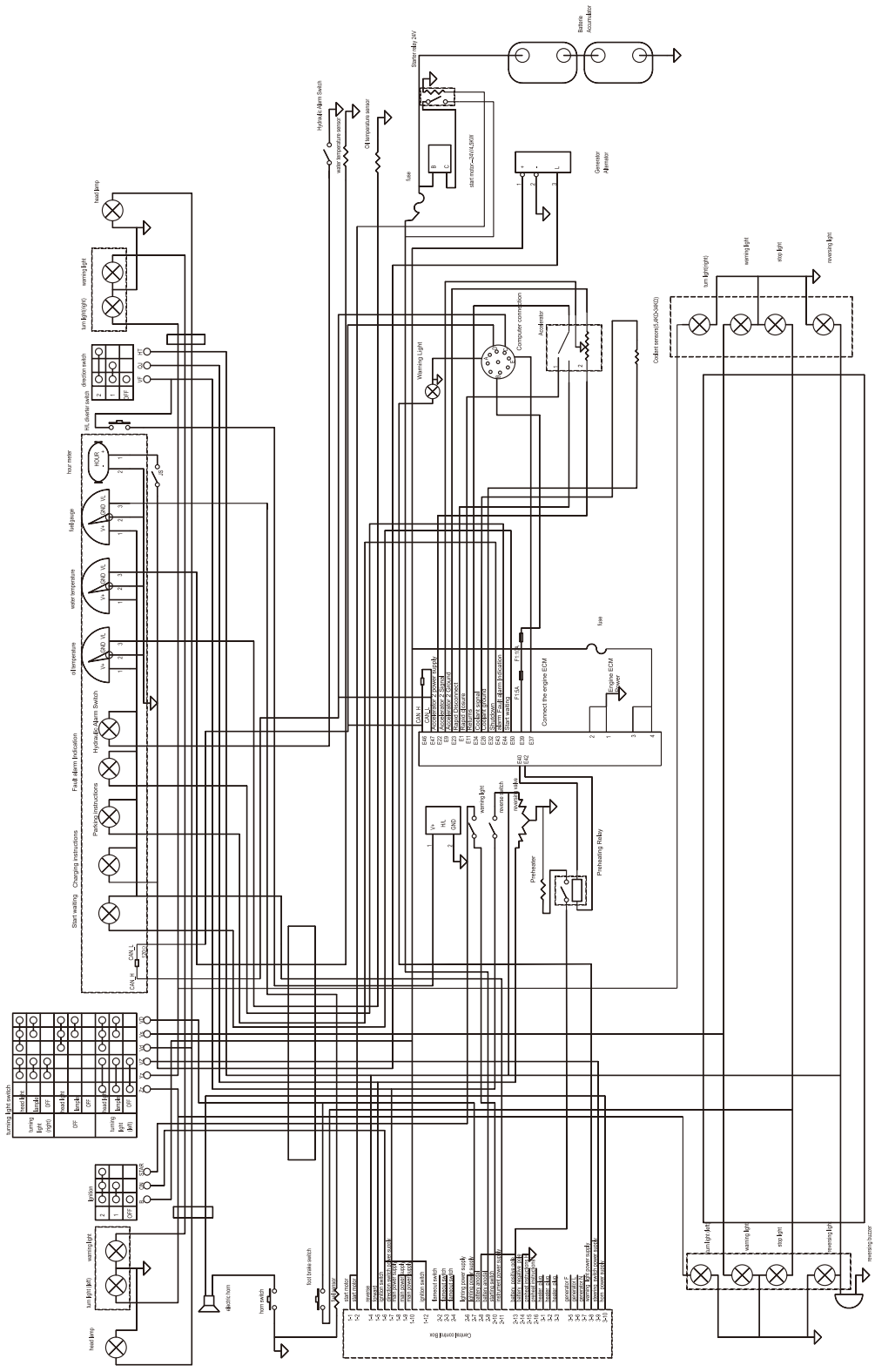


Fig.2-3 Electric principle(QSB4.5-C130Engine)

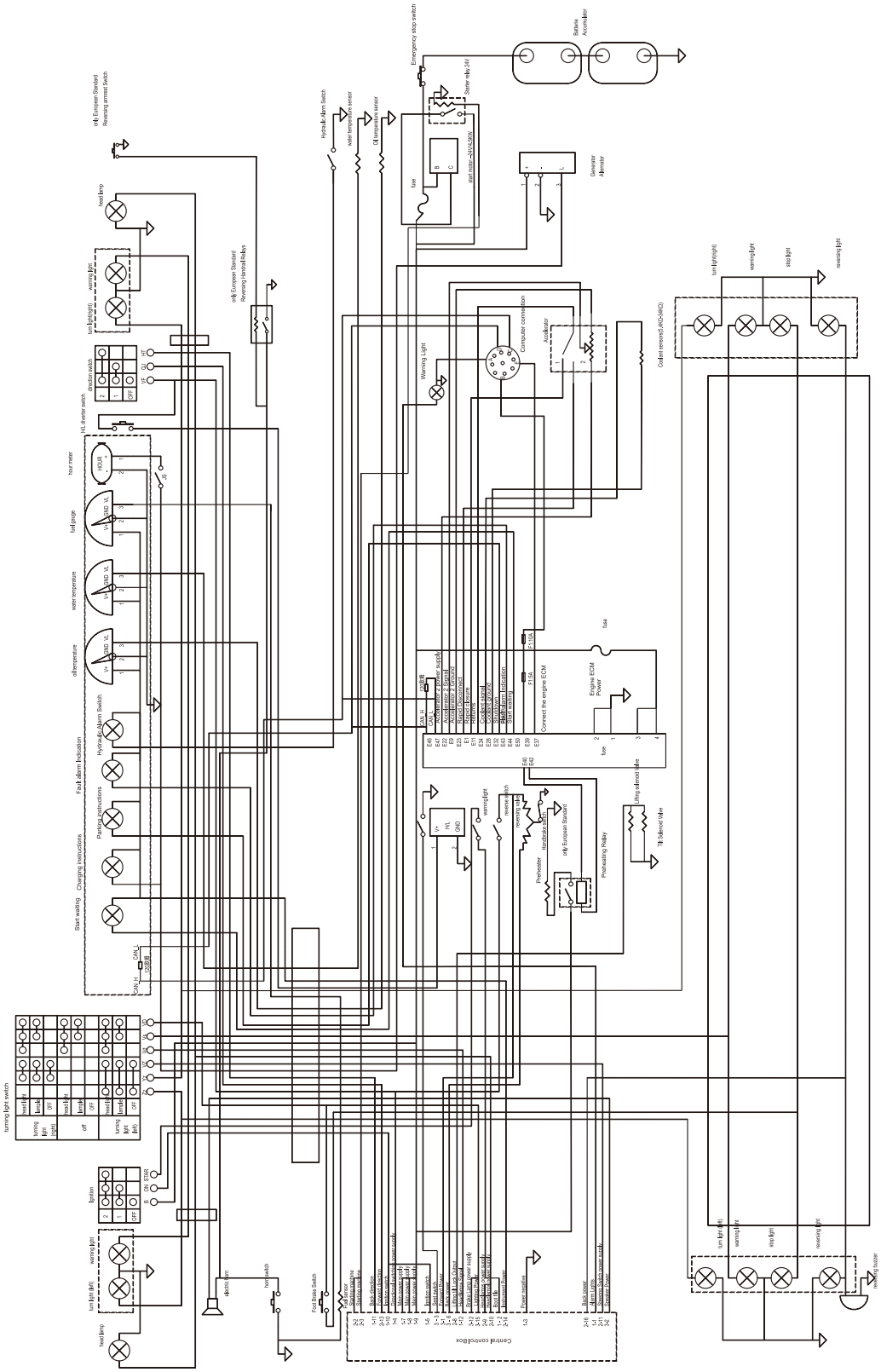


Fig.2-4 Electric principle(QSB4.5-C130Engine) European Standard

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

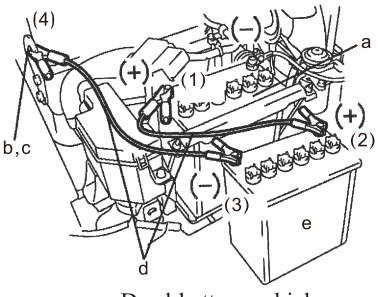
oil pressure of generator is too low and the lubrication is not very good and it should be checked immediately.

(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!

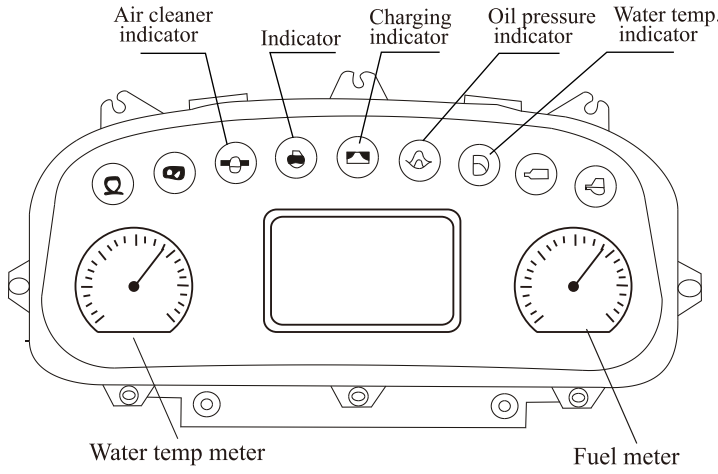


Fig. 2-2

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	U	W	N	V
black	red	green	yellow	blue	white	brown	violet

The GY 、GR、GW 、WB、YR 、RY 、RB 、UB 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

(3) Forklift truck type and wire harness

Type / Name	FD120
Vehicle wiring harness	Fig.2-5
Head guard cable	Fig.2-6—2-7

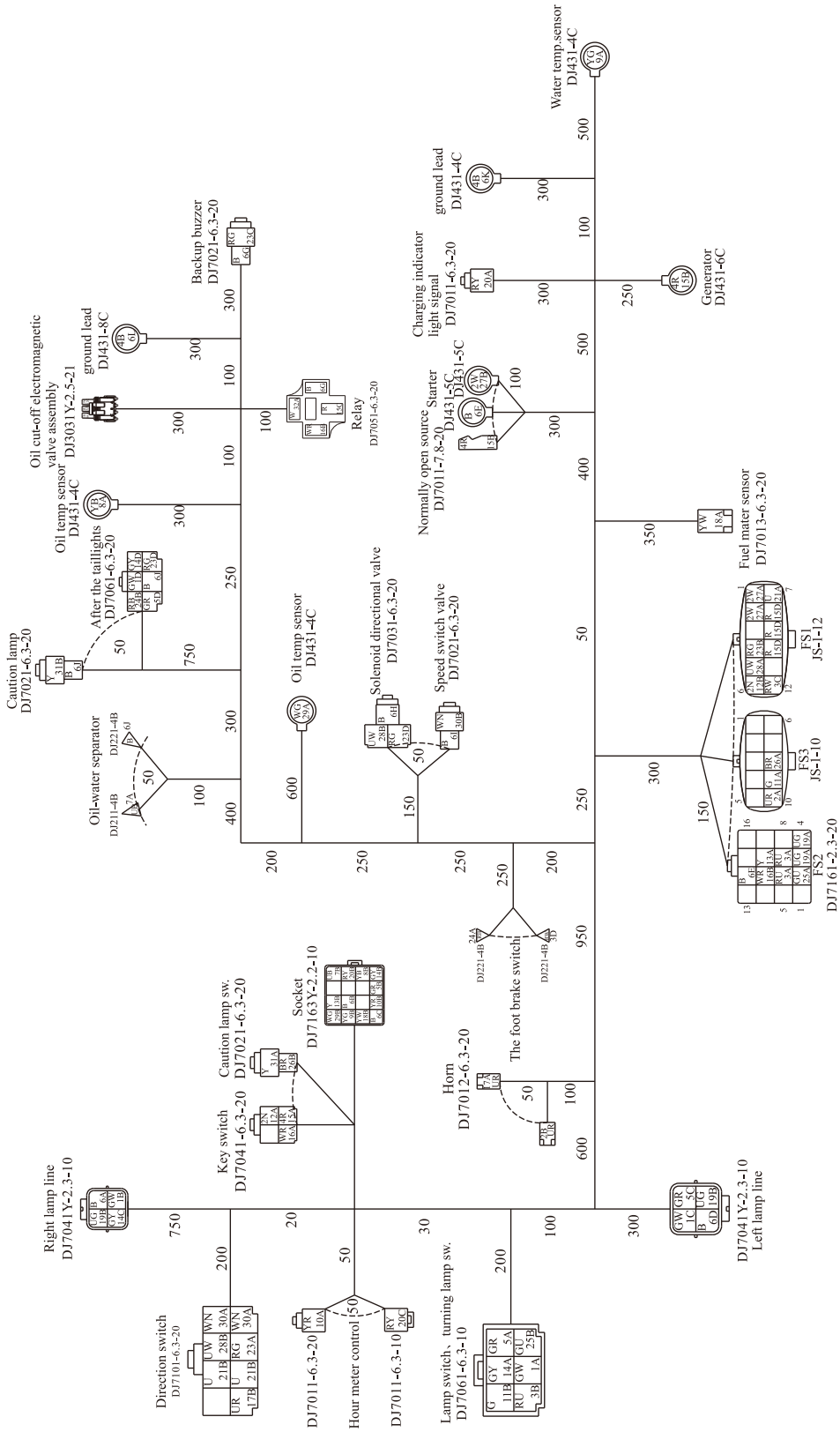


Fig.2-5 Vehicle wiring harness

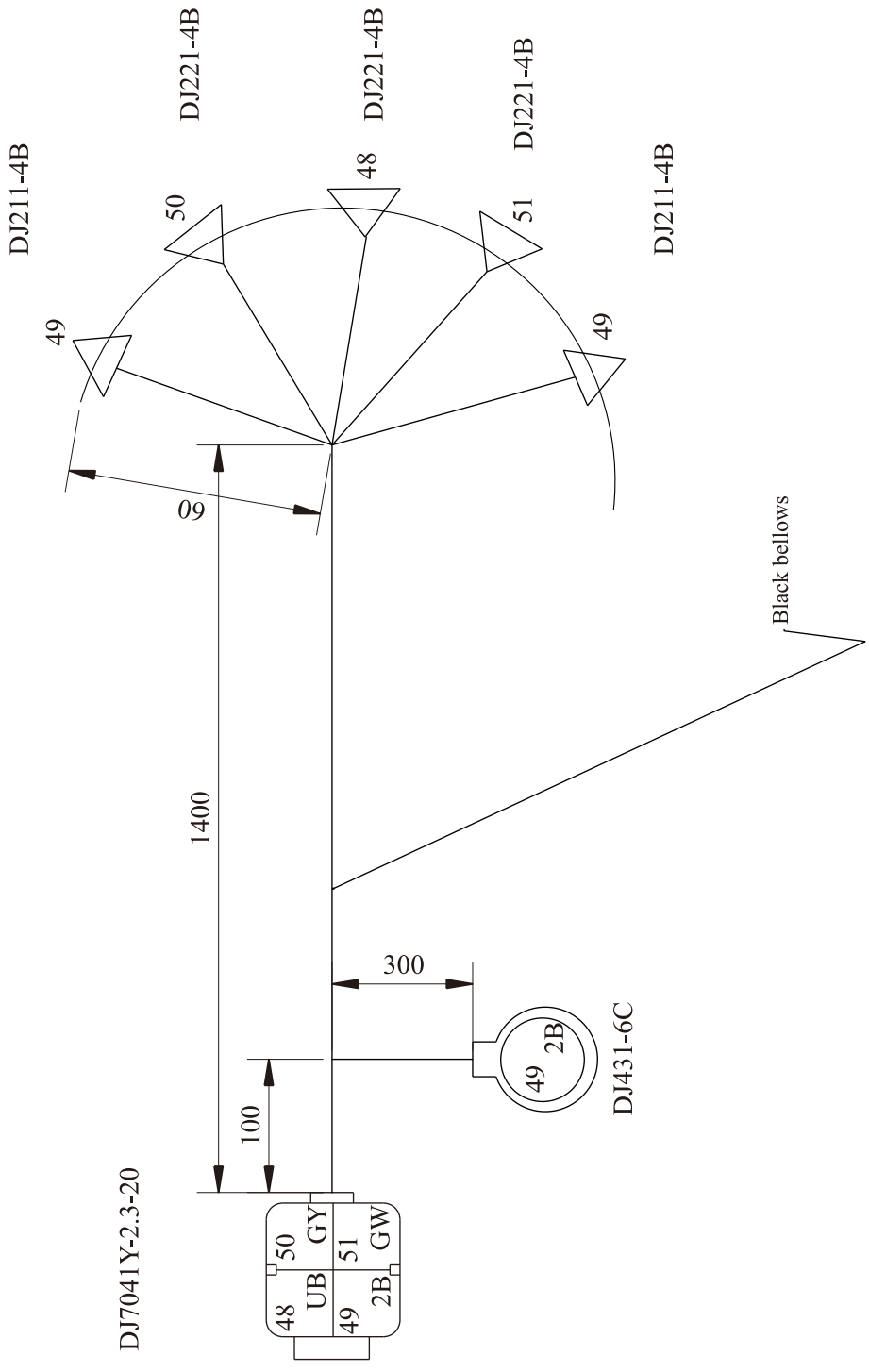


Fig.2-6Left overhead guard wire harness

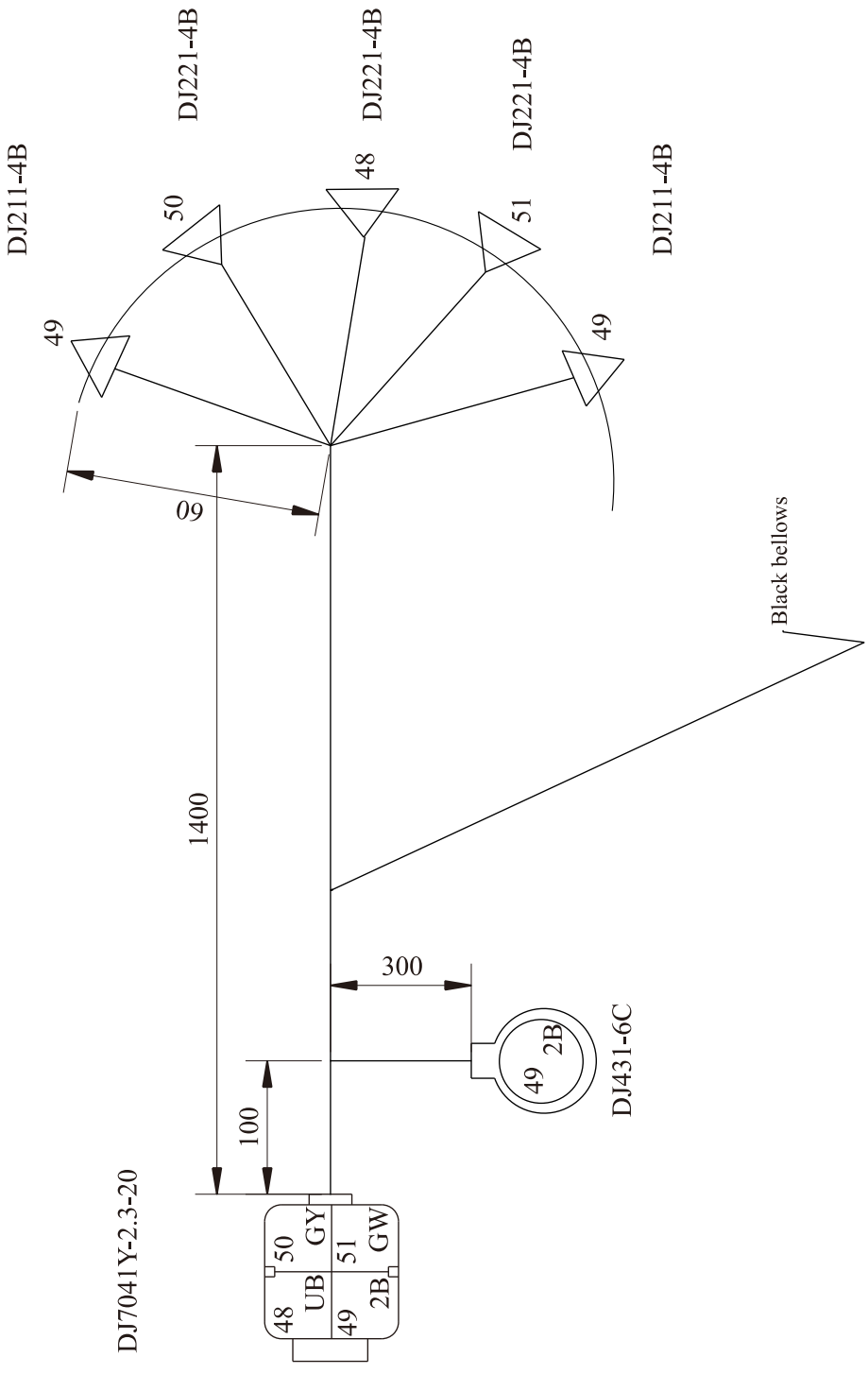


Fig.2-7 Right overhead guard wire harness

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
	Circular Dia.& stall torque ratio			Dia.12.5″ (Φ323), stall torque ratio 3:2
	Pressure setting		MPa	0.5~0.7
Charging pump	Type			Grescent type, gear pump, transmission output
	Discharge		L/min	40 (2000rpm , 2MPa)
Torque Converter Transmission				Power shift type
	Gear ratio	1st(forward and backward)		1.621
		2nd(forward and backward)		2.08 /0.642
	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
Weight			Kg	About 295
Oil amount			L	About 20
Oil type				Model SAE10W engine oil or No. 6 torque converter oil made in China

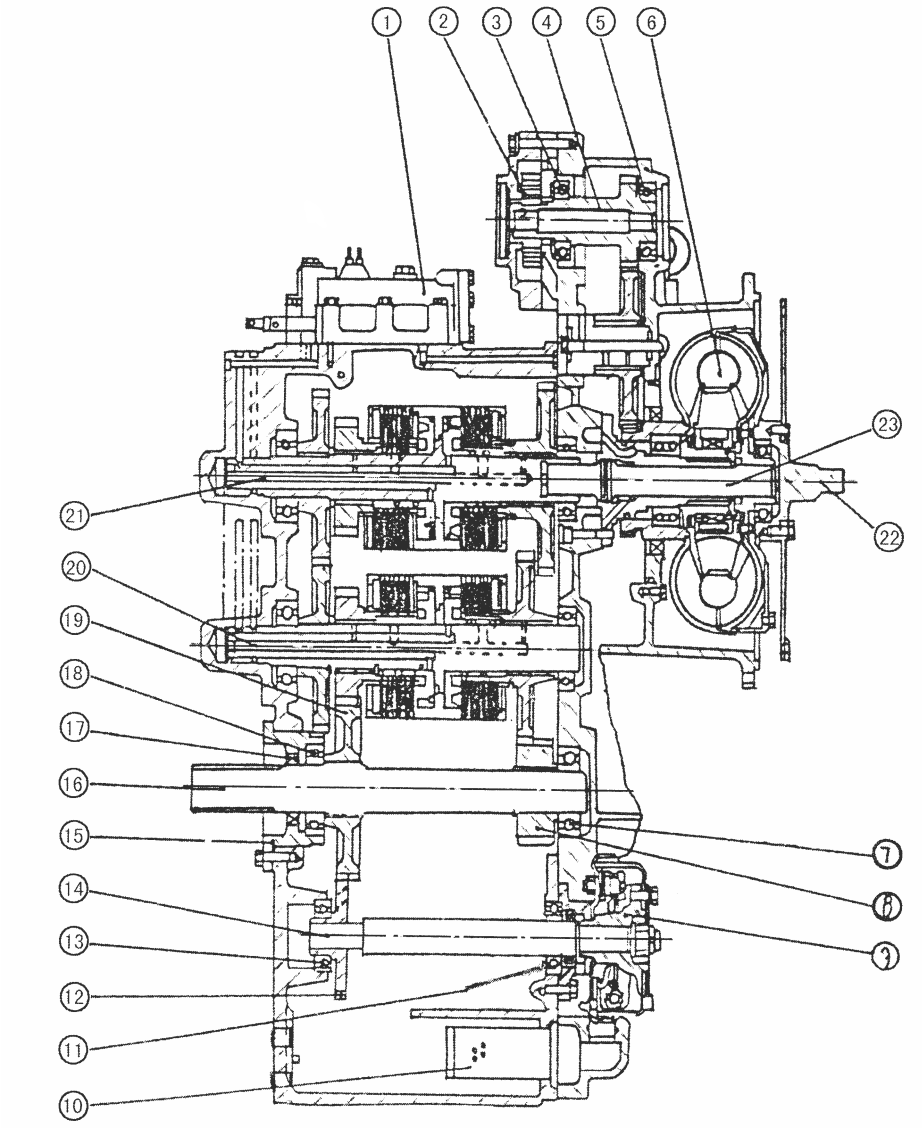


Fig.3-1 Hydraulic Transmission

1.Control	9.Parking brake	17.Oil seal
2.Charging	10.Strainer	18.Ball bearing
3.Ball bearing	11.Oil seal	19.Gear(47T)
4.Drive shaft	12.Gear(32T)	20.Reverse clutch pack
5.Ball bearing	13.Ball bearing	21.Forward clutch pack
6.Torque	14.Shaft	22.Input plate
7.Ball bearing	15.Balling cage	23.Transmission output shaft
8.Gear(30T)	16.Output shaft	

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.

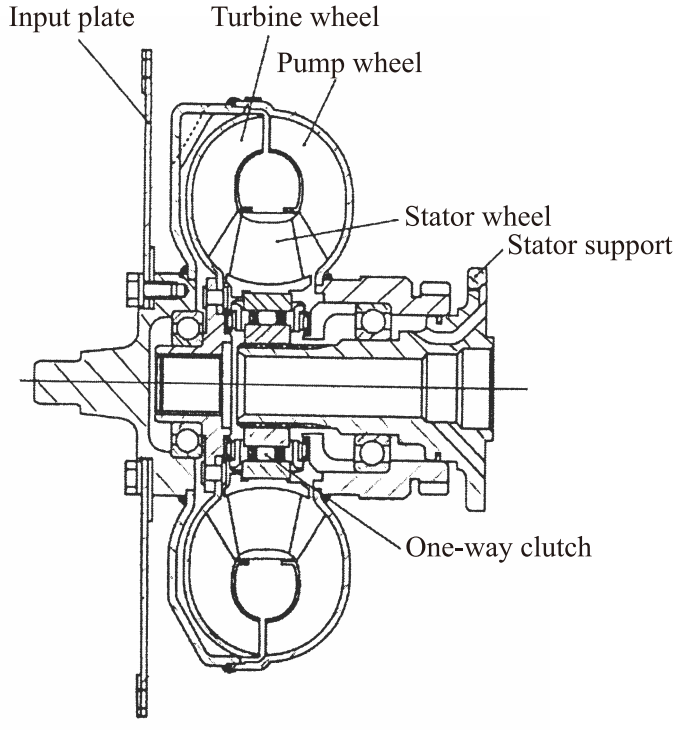


Fig.3-2 Torque converter

3.3 Charging pump

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

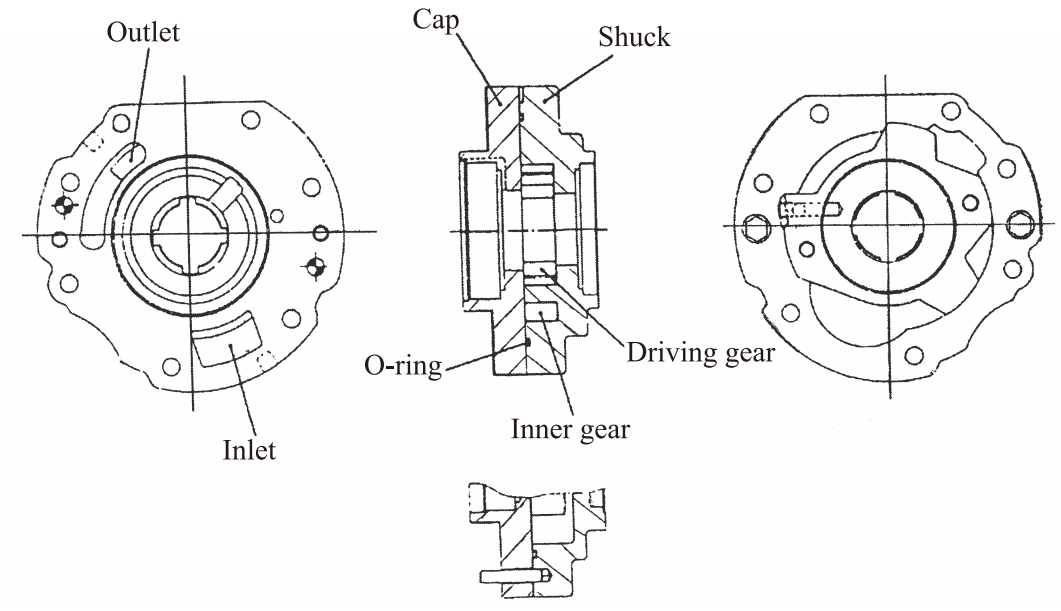


Fig.3-3 Oil pump

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

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.

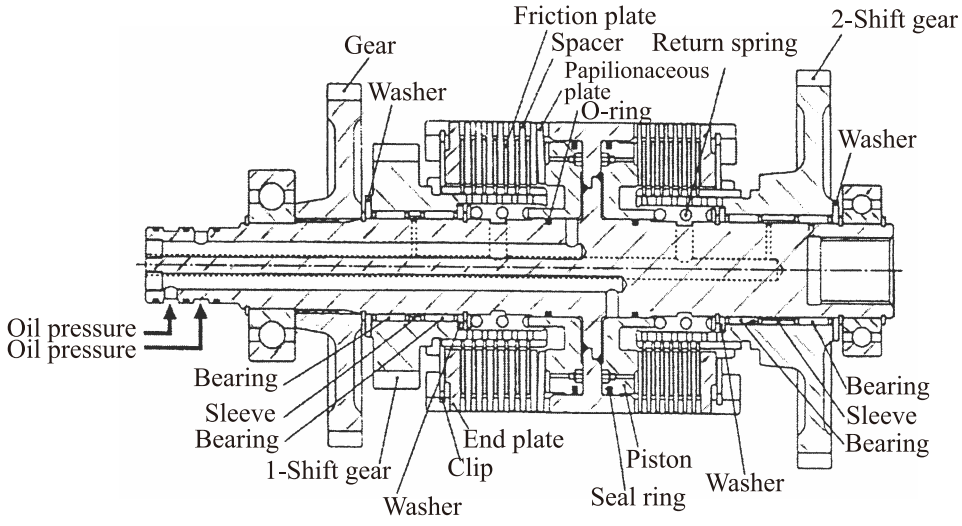


Fig.3-4 Forward Clutch

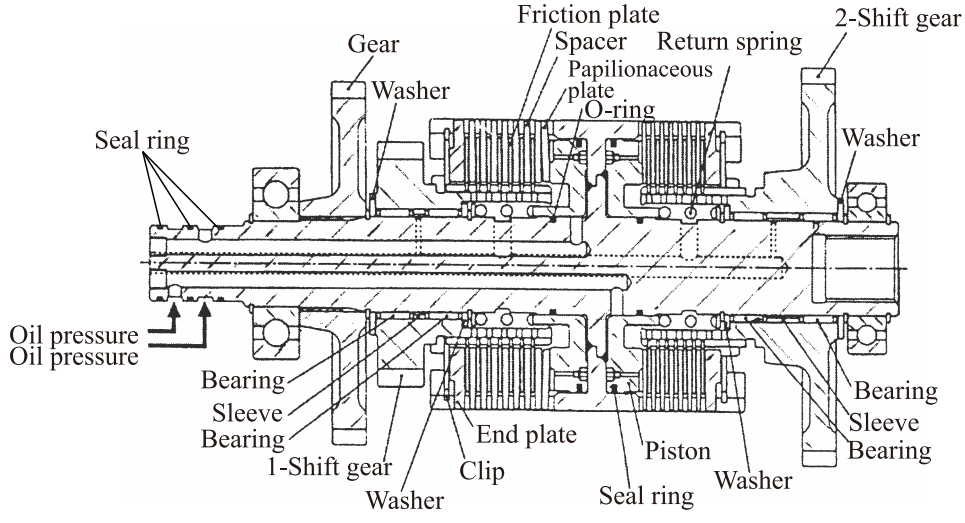


Fig.3-5 Reverse Clutch

3.5 Control valve and Inching valve

The control valve see fig.3-6.

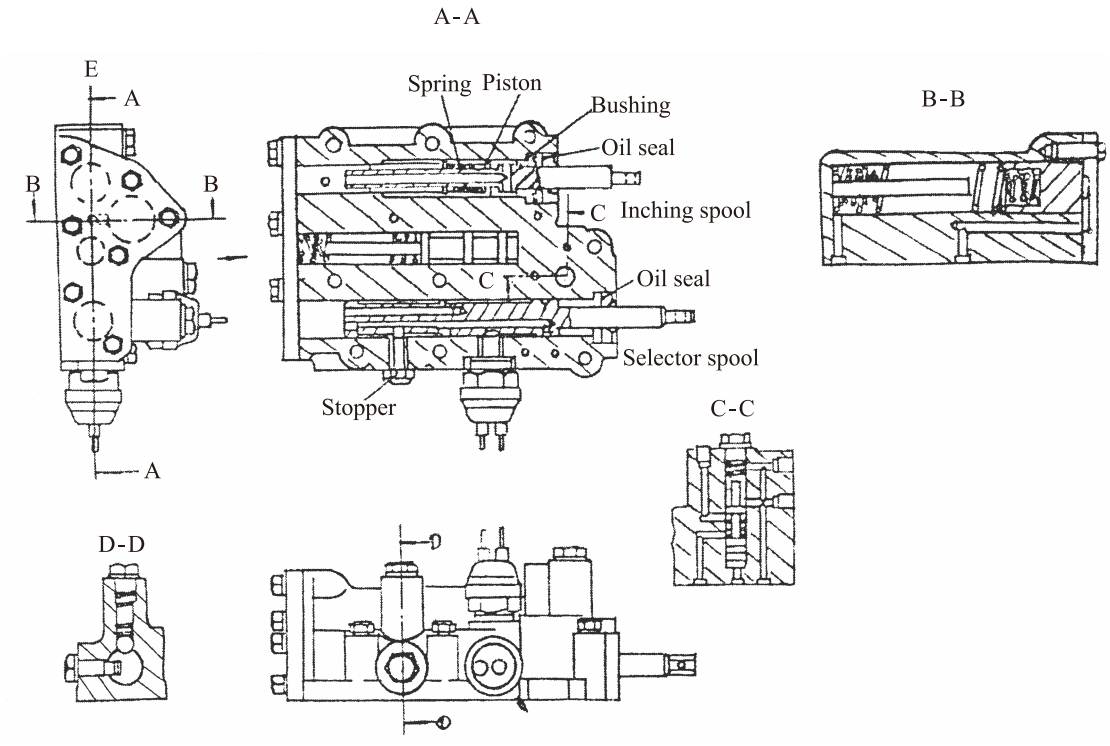


Fig. 3-6 Control valve

The control valve is provided on the upper part of transmission case. The change spool and inching spool are incorporated in the valve body.

The clutch relief valve is designated to adjust the hydraulic pressure of the hydraulic pressure of the transmission clutch. The converter relief valve servers to adjust the hydraulic pressures of fluid which fills the converter.

The inching spool is connected to the link of brake pedal. When the brake pedal is depressed, the spool is forced in, so that hydraulic pressure of clutch is lowered temporarily to disengage the clutch.

3.6 Hydraulic circulation system(See fig. 3-7)

When the engine is started and the charging pump is put into operation, the torque converter fluid in the oil tank (transmission case) is forcibly sent to the control valve from the pump through the strainer.

The fluid sent from the charging pump is divided to two directions in the torque converter case, one for torque converter and the other transmission.

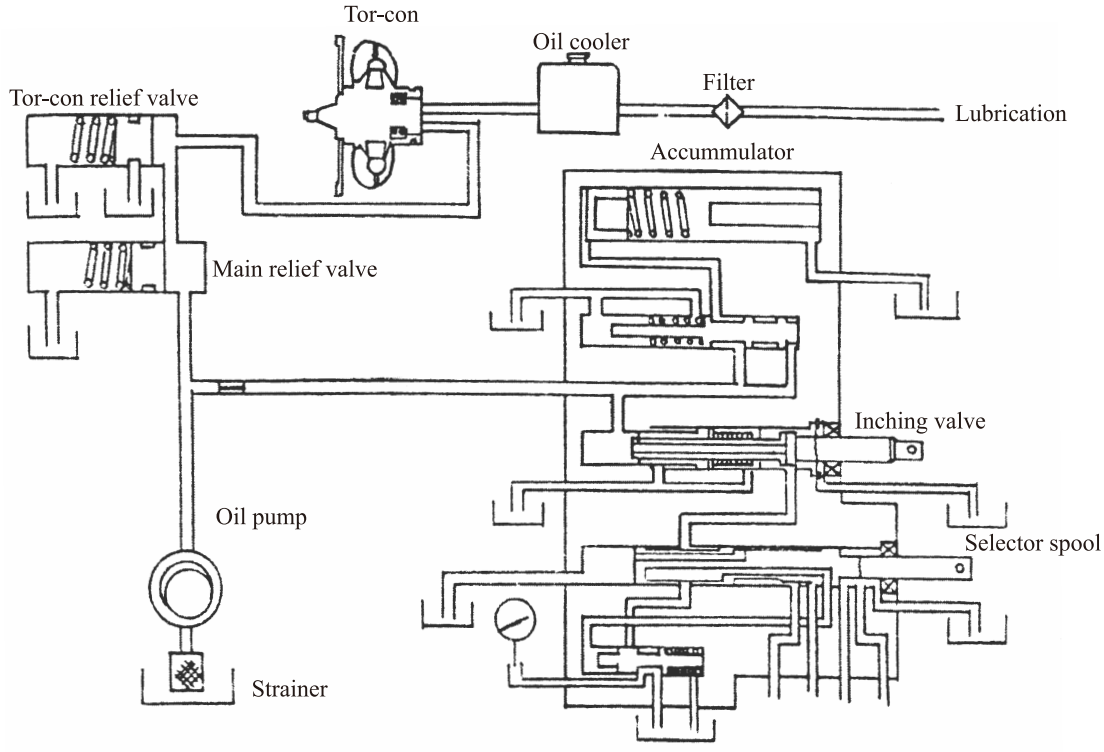


Fig. 3-7 Tor-con hydraulic system

Pressure of the fluid for clutch is adjusted to 1.2 to 1.5 Mpa with the relief valve. And then it is supplied to the control valve. Pressure of the fluid divided for the converter is adjusted to 0.5 to 0.7 Mpa with the converter relief valve. After that this fluid reaches the wheel of torque converter. After it is cooled by the oil cooler, it lubricates the clutch group and then returns to the oil tank through the filter.

When the selector valve is in neutral position, the circuit from the selector valve to the clutch is closed . Therefore the fluid is joined with the torque converter filling fluid.

When the selector spool is set to the forward or reverse position, fluid flows into the accumulator due to action of modulate valve, so that pressure rises gradually, During time the clutch starts to engage.

When the accumulator is filled with fluid, hydraulic preesure rise intensively so that the hydraulic clutch is completely engaged.

While the forward or reverse clutch is operating, another clutch is rotating between the sintered plates and the steel plates. Therefore this part is lubricated with oil sent from the oil cooler to prevent seizure of plates.

When the brake pedal is depressed and the inching valve is actuated, most of hydraulic oil

supplied to the clutch is drained from the inching valve and returns to the hydraulic oil supplied to the clutch is drained from the inching valve and returns to the transmission case. The fluid for the torque converter circulates in the same manner as in neutral state.

3.7 Cautions when the machine trouble occurs

When the machine with Tor-Co-Matic transmission cannot run by itself due to trouble and must be dragged with another machine, be sure to observe the following requirements.

(1) Remove the propeller shaft between the differential and the transmission.

(2) Set the change lever in neutral position.

Since the torque converter pump does not operate, normal lubrication is not performed. Therefore, if rotation is transmitted from the front wheel to the transmission gear and clutch disk, seizure may occur.

3.8 Troubleshooting Guide

(1) Low power: See Table 3-2

(2) Abnormal rise of oil temperature: See Table3-3

(3) Noisy transmission : See Table3-4

(4) No power transmission : See Table3-5

(5) Oil leakage : See table3-6

	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

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

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

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

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.

		12t
Type		Cast-steel,full-floating type
Main reduction	Type	Spiral bevel pinion type
	Reduction ratio	6.33
Hub reduction	Type	Planetary gear type
	Reduction ratio	3.58
Total reduction ratio		22.66
Oil amount	Main reduction, differential	10L
	Hub reduction	Left and right each 10L
Driving wheel	Tire(left and right each2)	9.00—20
	Rim	7.0—20
	Air pressure Kpa	760

4.1 General Description

The front axle that consists of a main reduction, differential, hub reduction and brakes as shown in fig. 4-1 is bolted to the front side of the frame. The masts are installed on the axle housing.

4.2 Main reduction and Differential

The main reduction and differential consists primarily of a cross case, ring gear and drive pinions, which are all assembled on the differential carrier as shown in fig.4-2, and is fitted to the axle housing through packings.

The cross case of the split type. The cross case, assembled with bolts, contains side gears and pinions fitted to the spider, being in mesh with each another. The drive pinions supported by two taper roller bearings are installed in the bearing cage fitted to the differential carrier through shims and packings . The ring gear is of the spiral bevel gear type. It is bolted to the cross case. Power from the transmission is reduced by the combination of the ring gear and drive pinions.

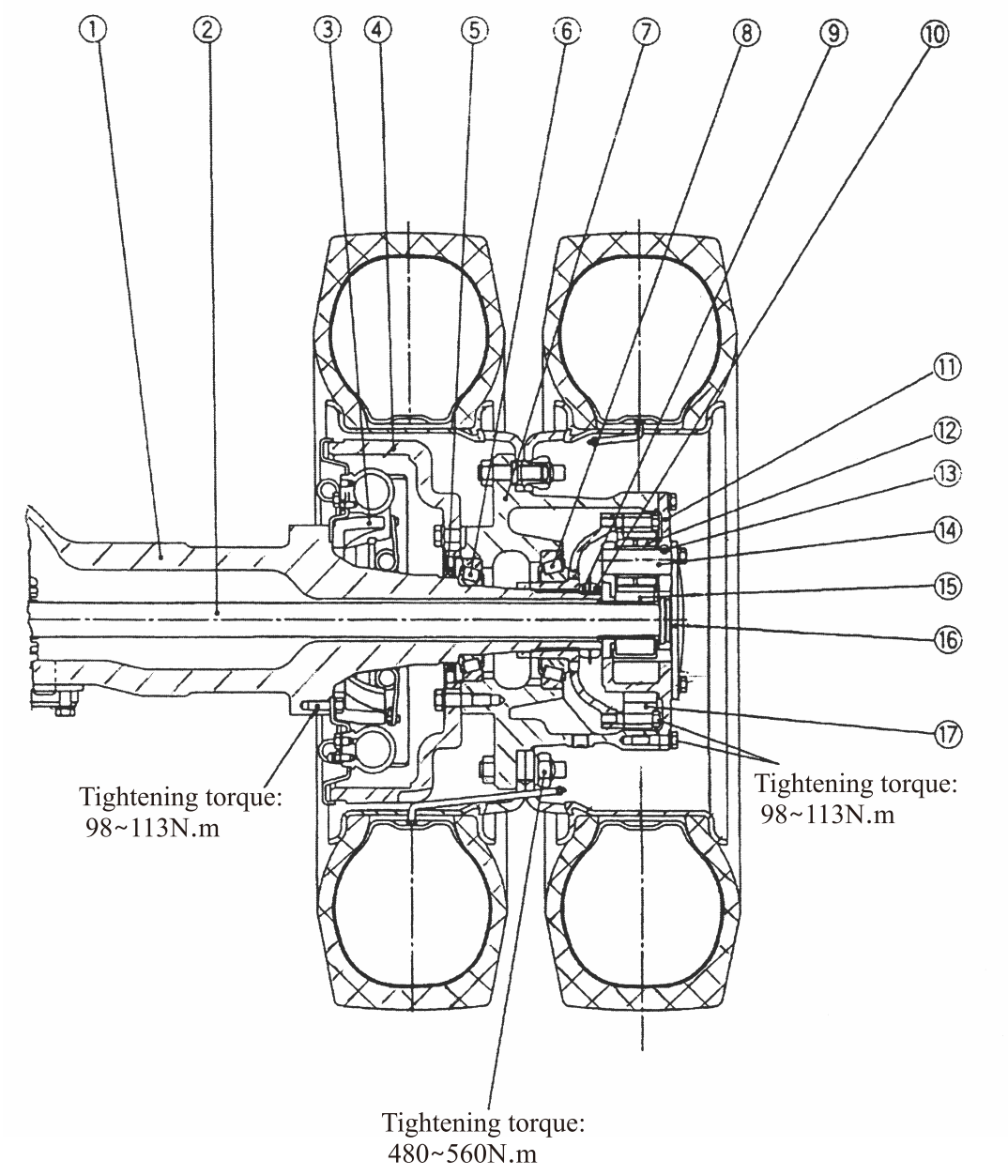


Fig.4-1 Front axle (12t truck)

1.Axle house	6.Taper roller bearing	11.Planet carrier	16. Thrust cap
2.Half-shaft	7.Hub	12.Thrust cap	17.Gear
3.Wheel brake	8.Taper roller bearing	13.Steel ball	
4.Brake drum	9.Adjust nut	14.Shaft	
5.Oil seat	10.Lock nut	15.Sun gear	

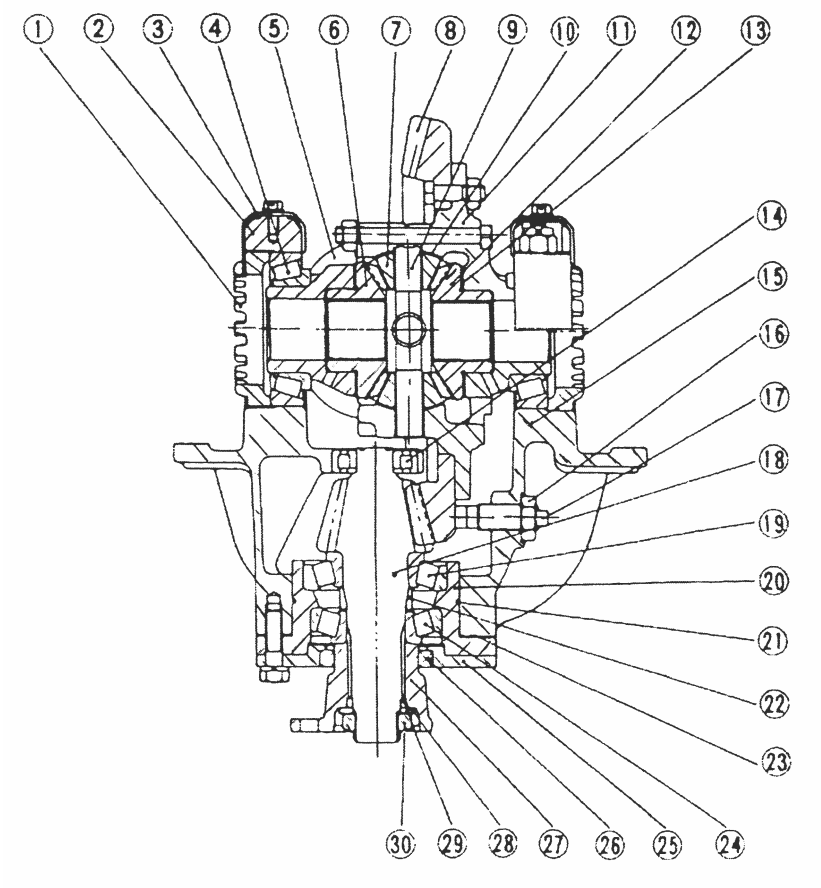


Fig.4-2 Main reduction, differential

1.Adjust nut
2.Thrust cap
3.Lock plate
4.Tapper roller bearing
5.Differential house
6.Half-shaft gear
7.Planet gear
8.Gear
9.Spider
10.Thrust washer
11.Differential house(right)
12.Half-shaft gear
13.Thrust washer
14.Needle bearing
15.Main reduction house
16.Lock nut
17.Adjust nut
18.Driving pinion
19.Tapper roller bearing
20.Bearing cage
21.O-ring
22.Spacer
23.Shim
24.Tapper roller bearing
25.Oil seal carrier
26.Oil seal
27.Flange
28.O-ring
29.Washer
30.Lock nut

4.3 Hub reduction

The hub reduction is of the planet gear type consisting of a sun gear, planetary gears and an internal gear. Two hub reduction are installed on each end of the axle housing. The sun gear is splined to the axle shaft and locked with snap ring. The planetary gears are installed onto the shafts in the planet carrier which is fixed to the wheel hub. The internal gear is splined to the axle spindle through hub.

The principle of power transmission is as follows(see fig 4-3),: When the sun gear turns, the rotation is transmitted to the pinion gears and ring gear. However, since the ring gear is fixed to the spindle, the pinion gears revolve around the sun gear while spining themselves. The pinion gears are installed to the carrier which is fixed to the wheel hub, therefore, power of the drive shaft causes the wheel to turn.

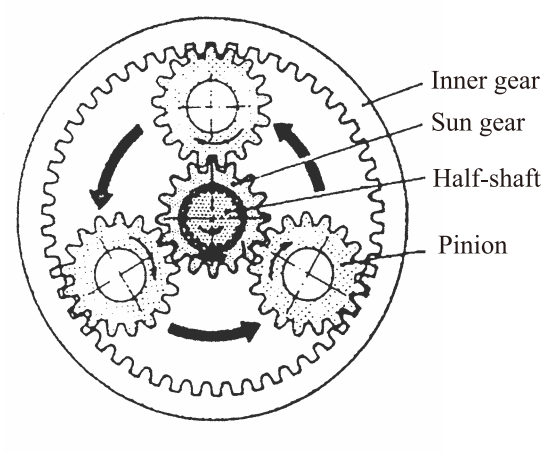


Fig.4.3 Hub reduction

4.4 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.

4.5 The remedy specifications

Table 4-3

Part	Item	STD Valve
Differential	Thickness of bearing cage shim.	0.1 , 0.2 , 0.5
	O.D. of oil seal sliding part of companion flange.	69.95-70
	Backlash of spline part companion flange and drive pinion.	0.036 -0.067
	Backlash of drive pinion and ring gear.	0.20-0.30
	Preload of drive pinion.	2.5-3.5 (N.m)
	Back swing of ring gear.	0.25-0.38
	Tightening torque of ring gear set bolt.	100-150 (N.m)
	Tightening torque of cross case set bolt.	100 -150 (N.m)
	Thickness of pinion washers.	1.562-1.613
	Backlash of spline of side gear and drive shaft.	0.038-0.130
Axle housing	Tightening torque of the set bolt for axle housing and differential carrier.	150-175 (N .m)
	O.D. of Hub bearing fitting part of spindle.	89.66-89.88
	O.D. of spindle oil seal sliding part.	109.913 -110
	Tightening torque bolt securing axle housing to frame.	630-946(N.m)
	Tightening torque bolt securing brake floor to axle housing.	280-330(N.m)
	O.D. of mast support part.	189.2-190
Hub	I.D. of hub bearing fitting part(Inside).	159.32-159.72
	I.D. of hub bearing fitting part(Outside).	179. 32- 179.72
	I.D. of hub oil seal fitting part.	164. 6-165
	Tightening torque of set bolt securing brake drum to hub.	280-330(N.m)
	Tightening torque of set bolt securing planet carrier to hub.	98-13 (N.m)
	Tightening torque of hub nut.	480-560 (N.m)

5.Brake System

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

Table 5-1

			FD 120
Wheel brake	Brake type		Power brake
	Brake model		Front wheel, internal expansion type, lining brake
	I.D. of brake drum	mm	Φ438.15
	Wheel cylinder drum	mm	Φ47.62
	Lining size	mm	489×100×12.7
	Surface area of lining	cm^2	4×489
Parking brake	Type		Transmission middle shaft-mounted, internal expansion mechanical type
	I.D. of brake drum	mm	Φ160
	Disk size	mm	140×36×3.5
	Surface area of disk	cm^2	50.4
Brake pump & valve	Brake cylinder	mm	/
	I.D. of Vaccum assistant Fwd/bwd		/
	Brake valve	Type: main valve/ safety valve	Open core type/Close core type
		Move model	Spring type
		Intake flux L/min	25
		Max. working oil pressure Mpa	16
Reserver	Type		液压囊式
	Capacity	cc	1000
	Piston: I.D.×Stroke	mm	/
	Oil pressure: Max./ Working time	Mpa	20/16
	Relief oil pressure	Mpa	15

5.1 General description

The braking system consists of traveling and stopping brakes. The traveling brake is mounted inside the driving wheel, while the stopping brake is mounted on a intermediate shaft at the rear side of the gear box. The traveling brake has two models of power brake and vacuum brake.

5.2 Power brake (For the schematic diagram of the system, refer to 5-1)

The traveling braking system that adopts the power brake mode consists of brake pedal, brake valve, energy storage and brake.

The power brake is to make use of the pressure oil transferred by pinion pump set specially for the hydraulic system of forklift, one way oil enters into brake valve and the sub-pump of brake to produce braking, while the other way of oil enters into accumulator to store energy for spare use. Both ways of the oil are controlled by the stroke of brake pedal.

5.2.1 Brake pedal device (See Fig. 5-2)

Brake pedal and inching pedal are mounted at the left side of the frame through a bracket. The brake pedal at the right side pushed forward the piston assembly of brake valve through connecting bar and makes the pedal control the pressure oil. The inching pedal at the left side and brake pedal at the right side play the role of linkage and can manipulate the brake valve and the inching valve of gearbox as well.

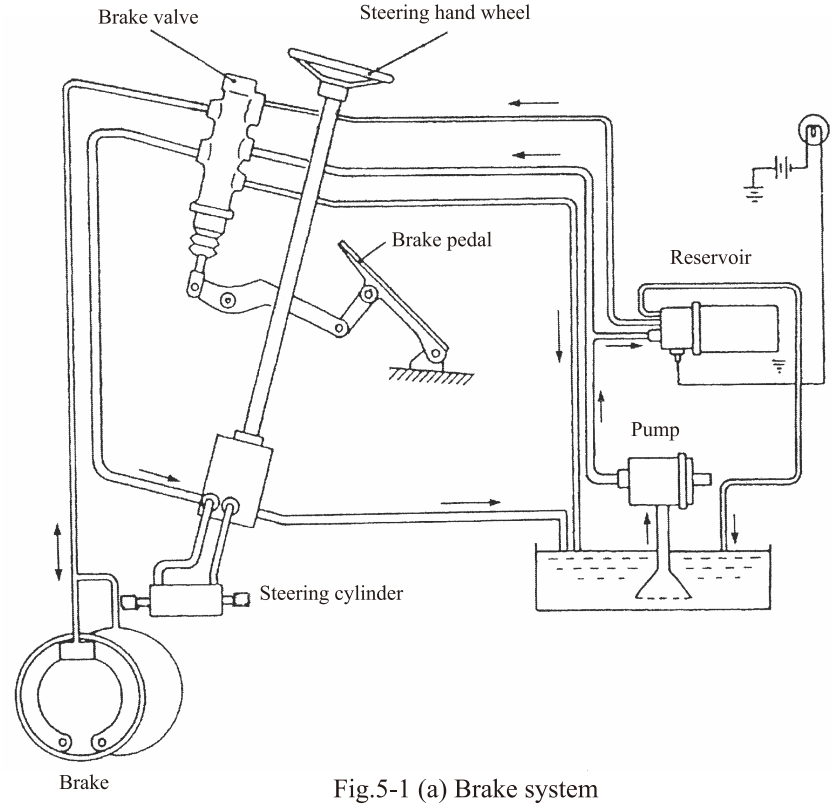


Fig.5-1 (a) Brake system

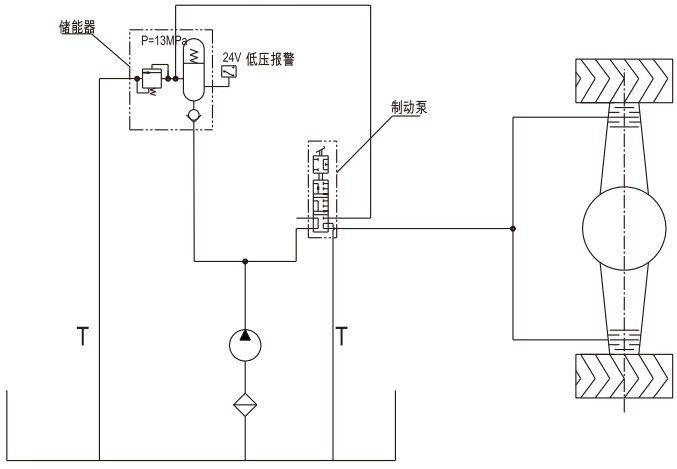
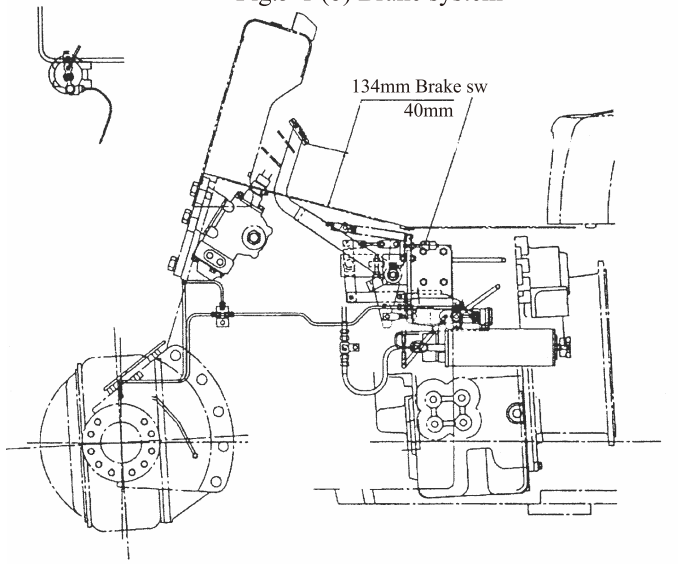


Fig.5-1 (b) Brake system



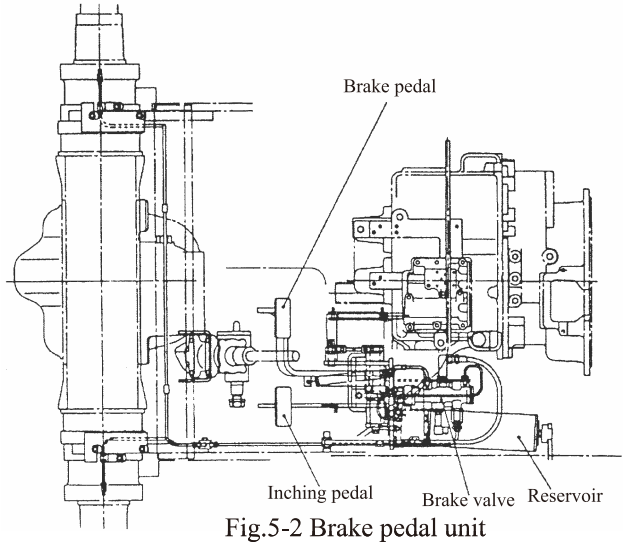


Fig.5-2 Brake pedal unit

5.2.2 Brake valve (See Fig.5-3)

(1) Non-brake status

In case of not-braking state and due to opening of port A of brake valve, the pump interface and the steering interface are interlinked and the steering works normally. When the brake pedal is not stepped on, even if the steering operation will not produce braking, the oil pressure of control oil pressure chamber D will not rise as the port B is closed at this time.

(2) Starting and finishing of the braking

A. When the brake pedal is stepped on, the piston assembly (part NO.10) moves to the left, the valve sleeve (part NO.7) and backflush piston (part NO.5) are pressed to the left side by the spring set (part NO.8) and meanwhile the return spring (part NO.6) is compressed to the left side.

B. The movement of work piece (part NO.7) closes the place A, breaks the interface of D and oil return tank. B opens correspondingly and makes D chamber and pump interface connect.

C. At this time, the valve sleeve(part NO.7) moves to the left and the oil pressure that leads to the sub-pump of brake rises along with the increase of oil pressure of pump interface and chamber D due to compression. Meanwhile, the relatively higher oil pressure in chamber D moves to the right and push the backflush piston (part NO.5) and this pushing force is in balance with pedal force.

D. When the maximum pedal force is input in the right end of piston and in order that the oil pressure of D chamber will not exceed the maximum adjusting oil pressure, the bolts and pedal brackets are used for position limitation.

E. When your foot leaves off the pedal, the counterforce of backflush piston and the spring counterforce of work pieces (part NO.6) and (part NO.8) return the valve sleeve (part NO.7) to the original position and the braking process is finished.

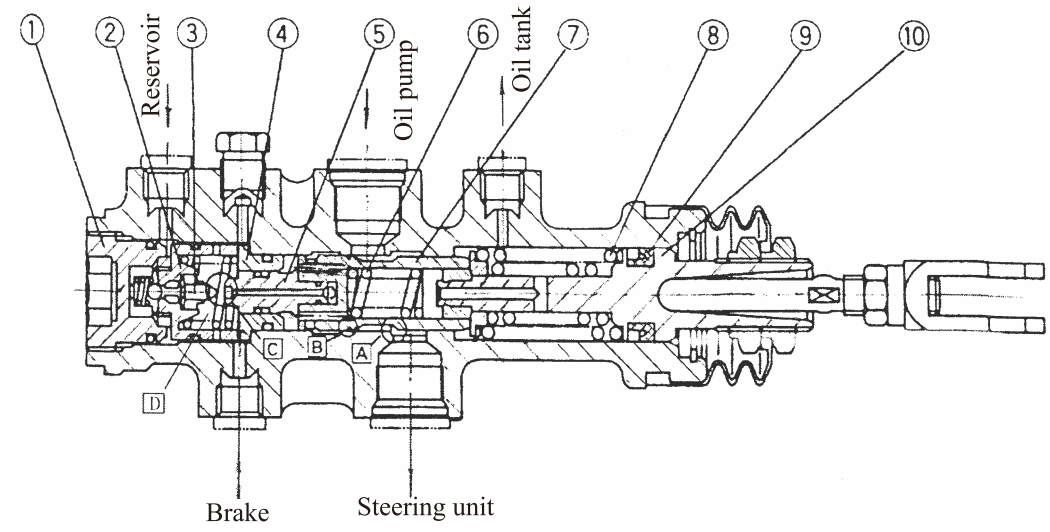
(3) The working process of accumulator

When the oil pump stops working, (due to engine stops) or is damaged, the accumulator needs to enter into working state.

A. When the brake pedal is further stopped on, valve sleeve (part NO.7), back flush piston (part NO.5) and contact pin of check valve move together towards left, the contact pin will prop open the ball and chamber D and accumulator are interlinked at this time and the pressure oil of accumulator is utilized to play the braking role for brake sub-pump.

B. When your foot leaves off the pedal, the valve sleeve, back flush piston and contact pin move to the right at the same time. The ball of the check valve restores joining with valve seat under the action of spring force (check valve closes) and the contact pin stops at this position correspondingly.

C. The backflush piston moves to the right and C open to make the oil of brake sub-pump of brake return to the fuel tank through chamber D.



1.Plug
2.1-Way valve seat
3.1-Way valve pin
4.Bounce-back piston seat
5.Bounce-back piston
6.Return spring
7.Valve sleeve
8.Spring
9.Oil seal
10.Piston ass'y

Fig.5-3 Brake valve

5.2.3 Accumulator (See fig. 5-4)

When the engine stops working or there is trouble on the oil pump, the accumulator can be used as the abnormal (extra) energy to meet the needs of braking.

The accumulating mode is of spring type.

The Fig. Shown the non-accumulating state and the buzzer of alarming switch is in normal sounding state.

When the brake pedal is operated and the oil pressure reaches over 3.9 Mpa, the check valve opens and feeds the oil to the accumulator so as push forward the piston.

Move to the left and compress the combined spring to set oil pressure.

Meanwhile, the piston moves towards left and makes the switch control lever at alarming switch moves towards left under the action of spring pressure and the switch valve spool drop into recess of switch control lever. Now t he alarm is in the silence state.

With the increase of oil pressure of the pump, the left moving stroke of the piston is restricted by the stop tube in the middle of combined spring. The accumulator stores the maximum energy at this time and the oil pressure is 15 Mpa, which is controlled by safety valve.

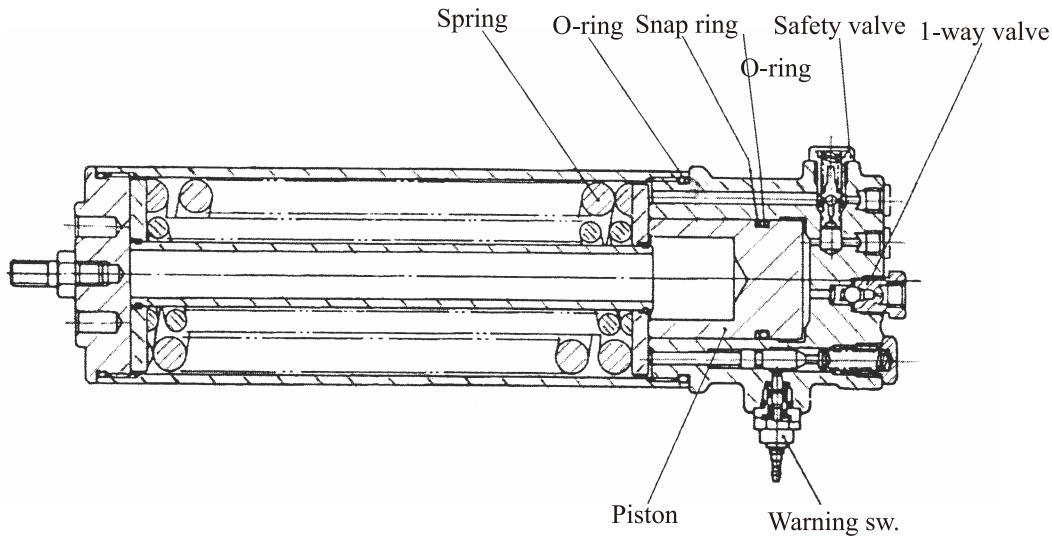


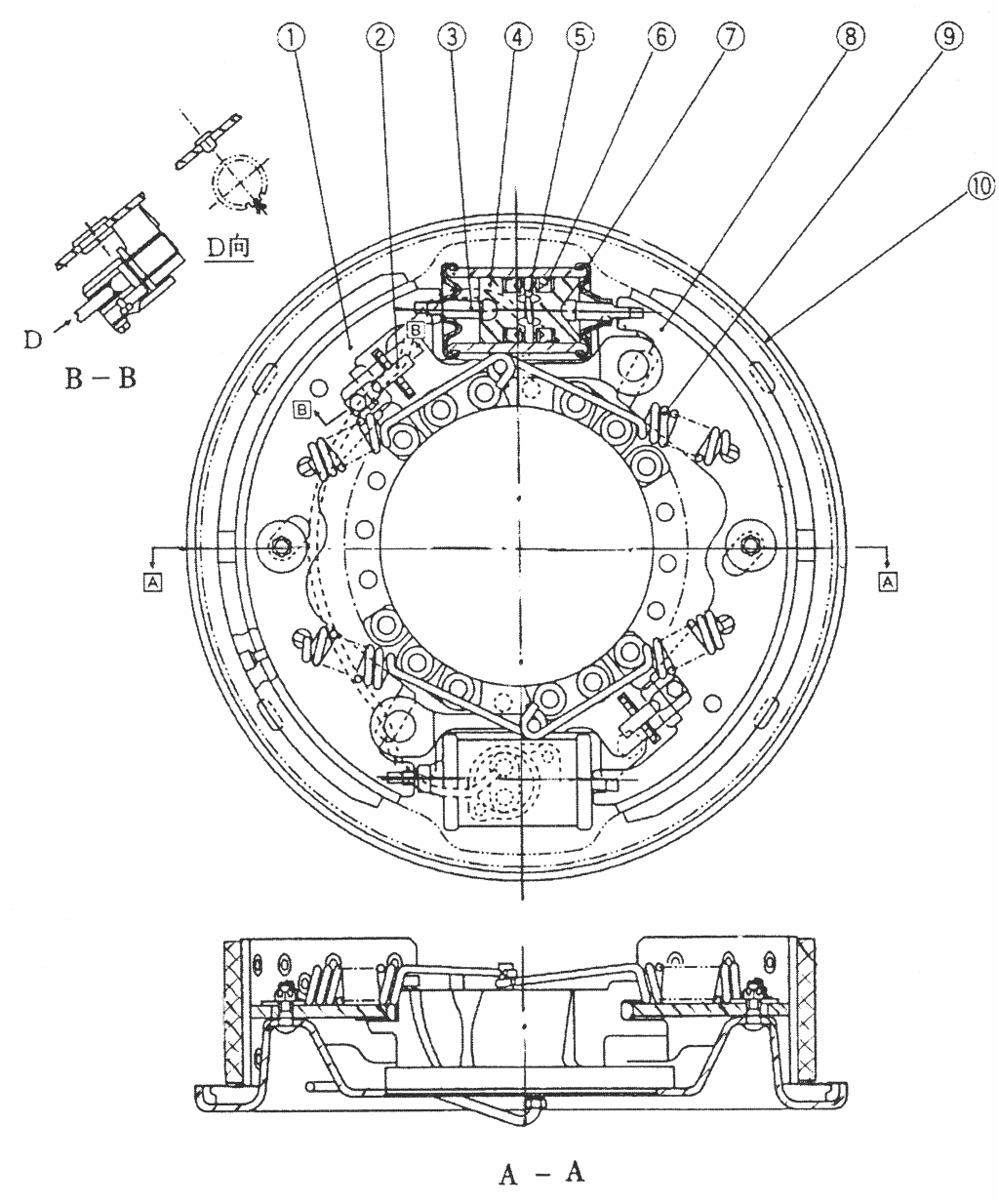
Fig.5-4 Reservior

5.3Trouble shooting and cause analysis (See Table 5.3)

Trouble and phenomenon	Analysis
No oil pressure set up in two cavities or in one of them of the main cylinder, which is reflected by: Pedal stroke becomes bigger	1. The leather ring of main cylinder wears. 2.The oil outlet pipe is damaged.
The output oil pressure is not big and pedal force becomes heavy.	1. The vacuum of booster leaks. 2.The vacuum pipe of engine leaks.
The oil storage tank often lacks oil.	1. The joint at oil cylinder leaks. 2.The leather ring of the first piston wears.
The brake pedal is low and soft.	1. There is air in the oil circuit system. 2.The clearance between push rod of booster and piston of main cylinder is too big.

5.4 Travel brake

Travel brake is an internal expanding and shoe brake. There is one symmetrically on the left and right each, which are mounted respectively in the two driving wheels. Brake is composed of a pair of braking shoes (one primary and one secondary); brake sub-pump (two for 12t truck), a clearance adjuster, three or four return springs and bottom plate of brake. A friction disc is riveted on the outside of braking shoe. Clearance adjuster is used to adjuster is used to adjust the clearance between friction disc of braking shoe and internal wall of braking drum.



1.Brake shoe
2.Adjuster
3.Push rod
4.Piston
5.Spring
6.Boot
7.Dust hood
8.Secondary shoe
9.Return spring
10.Brake floor

Fig. 5-5 Brake (12t)

5.4.1 Travel brake (12t forklift truck) (See Fig. 5-5)

There are two brake sub-pumps for travel brake of 12t forklift. The upper and lower ones contact with two ends of primary and secondary braking shoes and the clearance adjuster is next to the brake sub-pump.

When the clearance is adjusted, remove the rubber cover installed at the adjuster location on the bottom plate of the brake and the tooth of the adjuster is rotated from inside to outside with screwdriver unit the friction disc contacts with the inner wall of braking drum. Then the tooth of the adjuster is back rotated about 5 or 6 splines. (See Fig. 5-6)

12t forklift adopts dynamic braking and the material used for leather bowl of brake sub-pump is oil-resistant rubber. More attention should be paid in the replacement .

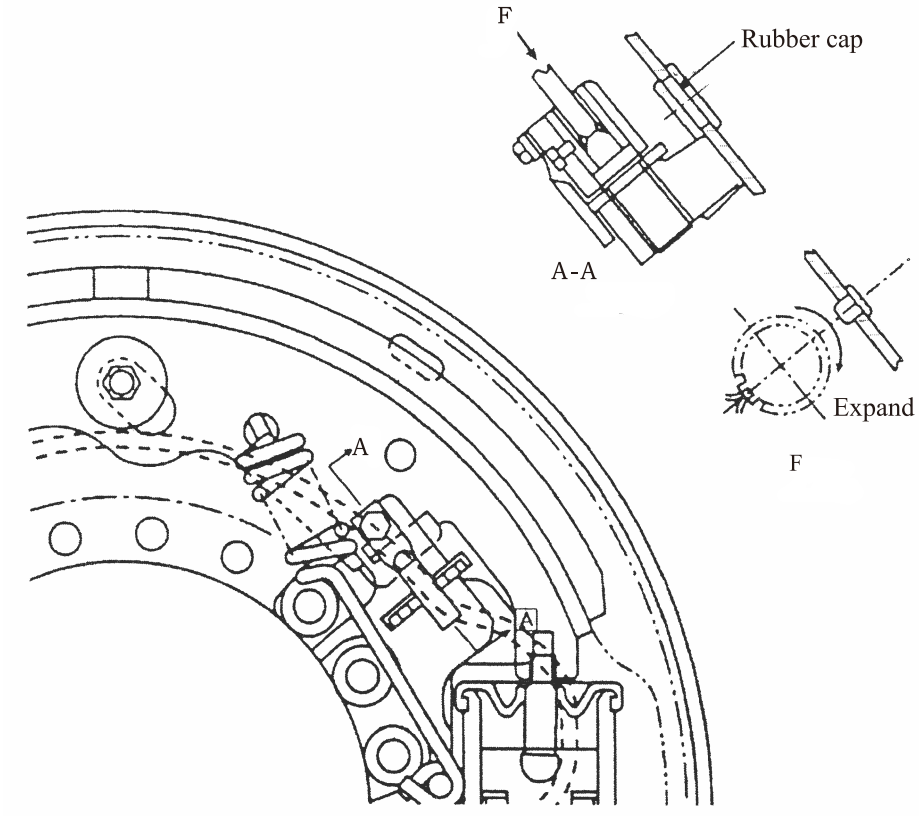


Fig. 5-6

5.5 Stop brake

Stop brake is an internal expanding and shoe type brake and is installed on output end of one intermediary shaft at the rear side of the gearbox. (See No. 9 of Fig. 3-1). For detailed structure, See Fig. 5-8.

The operation of stop brake is shown in Fig. 5-7. When the forklift is under the standard loading state and stop brake is made on the slope, the manual operating force should be not bigger than 300N. The pulling force is adjusted according to the direction shown in the Fig and B is the force measurement point.

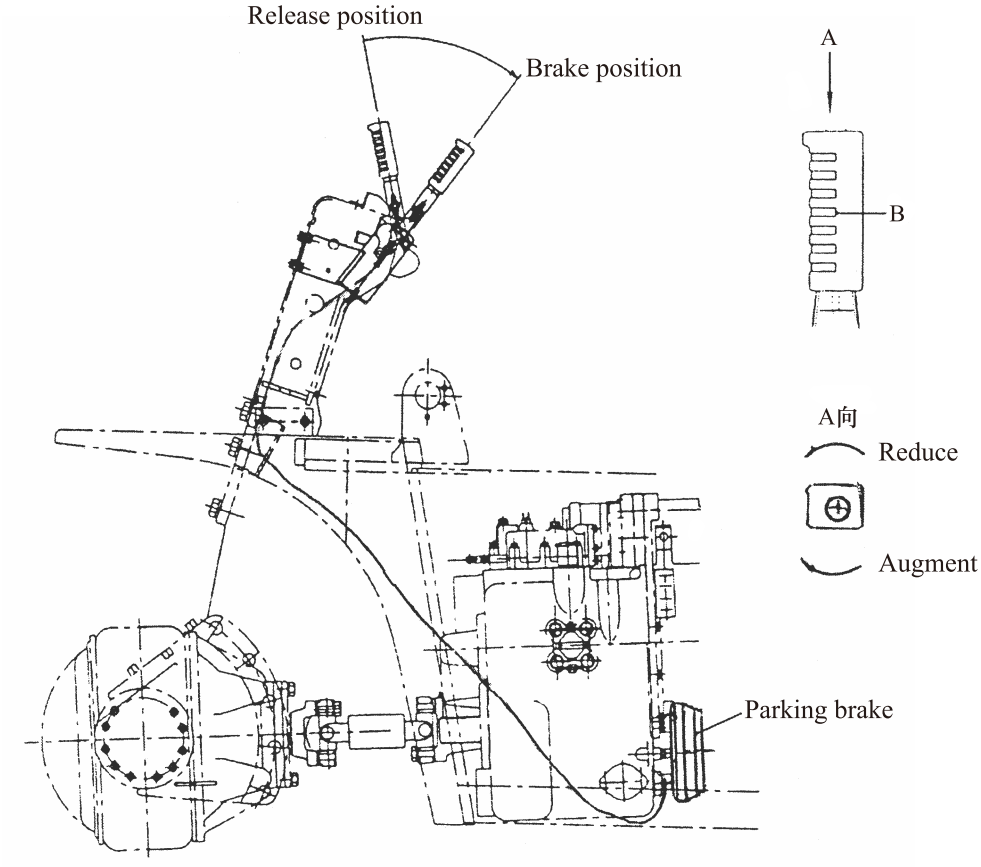
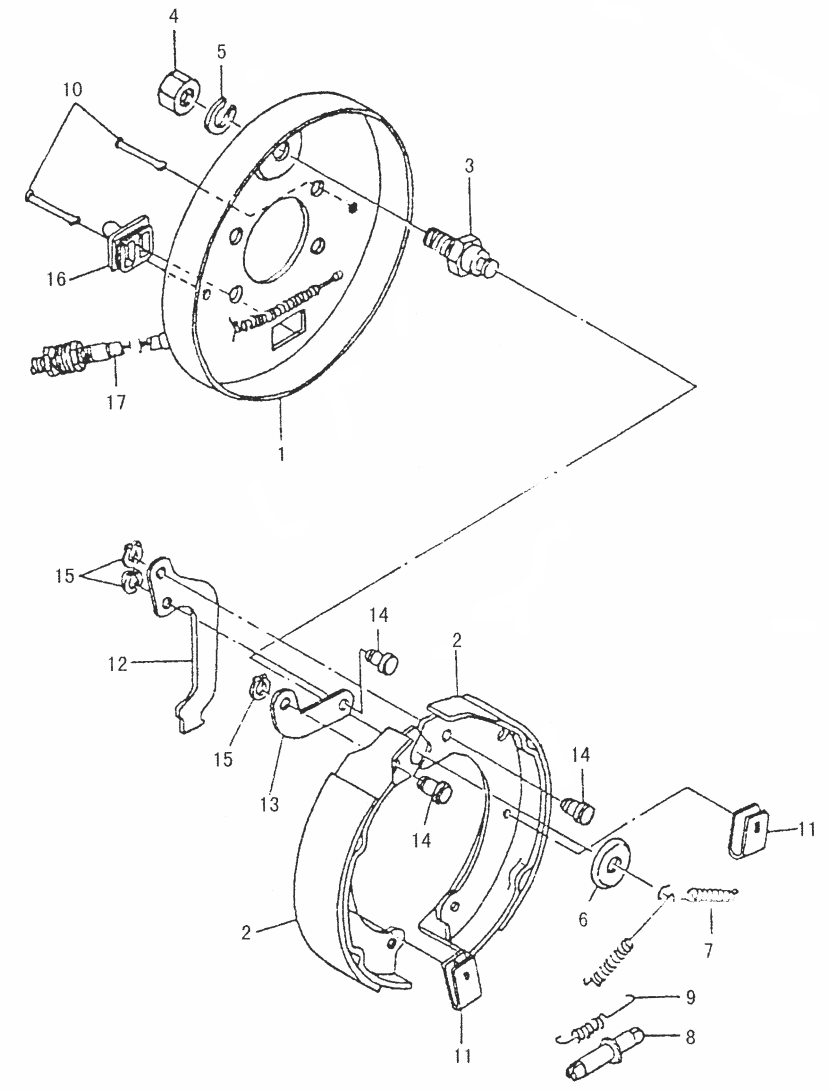


Fig.5-7 Parking brake unit



1.Floor	7.Return spring	13.Support plate
2.Brake shoe	8.Adjuster	14.Pin
3.Securing bolt	9.Adjuster spring	15.U-ring
4.Nut	10.Pin	16.Plug
5.Washer, lock	11.Spring seat	17.Parking brake cable
6.Washer	12.Lever	

Fig.5-8 Parking brake

5.6 Troubleshooting Guide (See Table 5-4).

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

Item		12t
Type		Rear wheel steering powered
Dia. of steering handwheel mm		360
Steering unit	Type	BZZ series powered steering unit
	Delivery rate ml/min	280
	Rated pressure Mpa	16
Steering cylinder	Bore	Landscape, double function
	Dia. of cyl./Dia. of piston rod mm	Φ115/Φ85
	Stroke mm	2×260
Flow-drvider	Setting pressure Mpa	12.3
	Rated flow ml/min	27
Steering axle	Type	Center pin supported, landscape cylinder
	Steering angle: Inner/ Outer wheel	79°/50°
	Rear wheel: tread mm	1700
	King pin: interval mm	1500
Gimbal swivel radius mm		Φ12
Steering wheel	Tire	9.00-20
	Rim	7.0-20
	Inflation pressure Kpa	760

Steering system consists of a steering handwheel, a steering column, gimbal assembly, steering unit, steering axle and steering cylinder. Steering control unit see fig. 6-1.

The steering shaft connects the steering unit with a gimbal, the steering handwheel turns with the steering shaft and steering column, realizes hydraulic steering. The steering column supporting steering shaft changes some tilt angle forward and backward, to adjust to a proper position, so as to satisfy the driver's need.

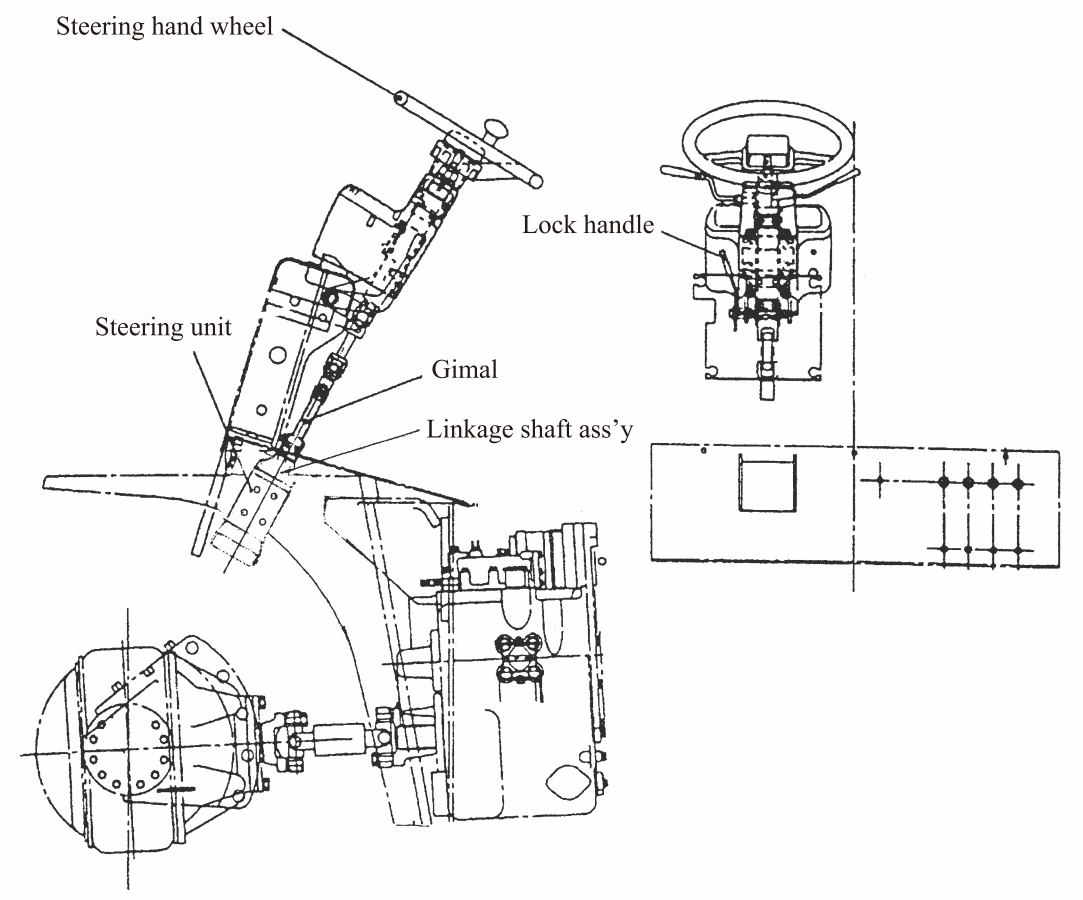


Fig.6-1 Steering control unit

6.1 Steering unit

The steering unit is a full-hydraulic steering unit, and can transmit the pressure oil from the flow-divider to steering cylinder through the oil pipe by metering. The oil volume changes as the rotation angle of the handwheel. When the engine goes out and the oil pump can not supply oil, the steering shall bu does by manpower.

Full-hydraulic steering system see Fig. 6-2. Full hydraulic redirector see Fig. 6-3

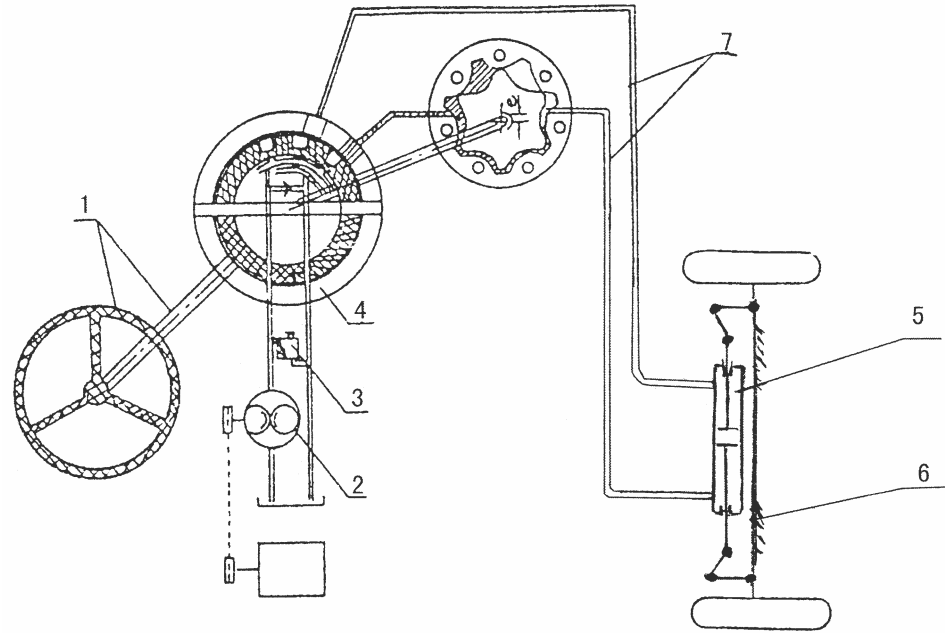


Fig.6-2 Full-hydraulic steering system

1.Handwheel and steering shaft
2.Pump
3.Flow-divider
4.Powered steering unit
5.Steering cylinder
6.Steering axle
7.Hose

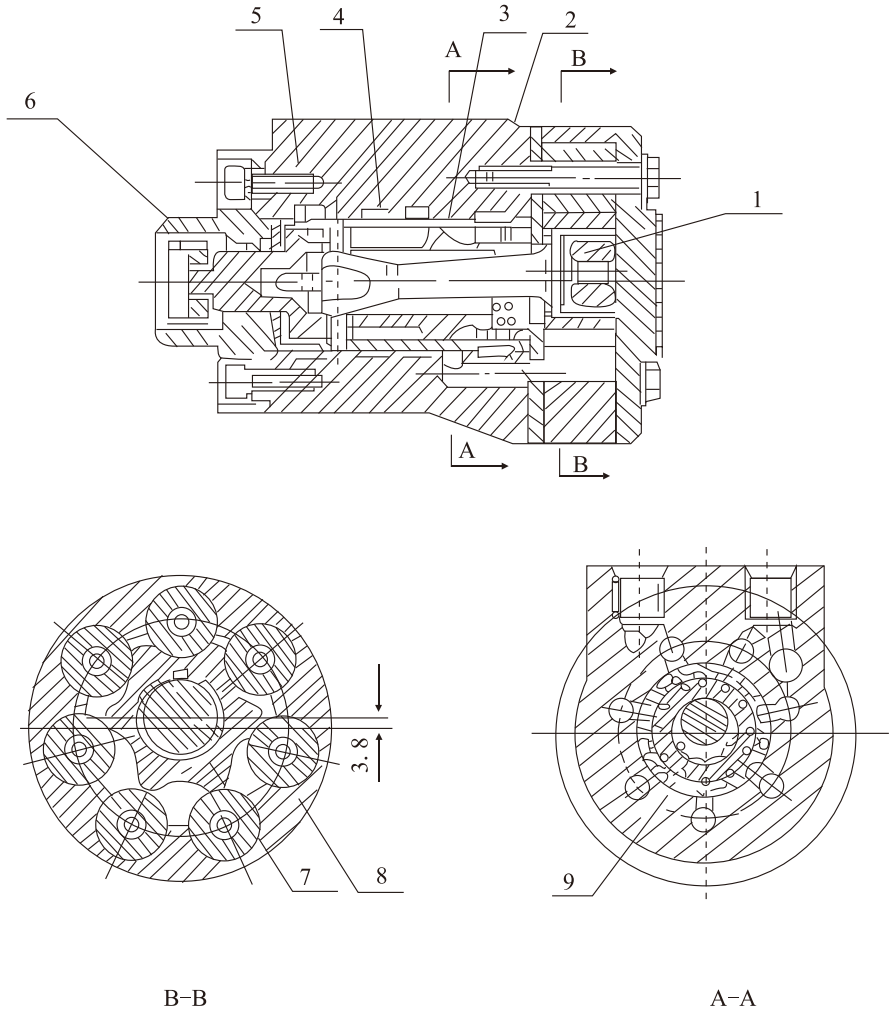


Fig. 6-3 Full hydraulic redirector

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

6.2 Checking after mounting on the machine

(1) Check the arrangement of hydraulic pipeline and turning direction of the truck for correctness.

(2) Check the forces necessary to turn the steering handwheel to right and left unit it can't be turned any more to see if they are identical each other and check the operation of the steering handwheel for smoothness during above operation.

(3) After mounting on the machine, jack up the rear wheels, run the engine idly, and steer the steering wheel several times to discharge air from the piping and power steering system. Let down the rear wheels, steer the steering wheel several times to check for abnormal sound. If abnormal sound is not heard, this indicates that air has been completely discharged. Then set the engine in idling state to raise oil temperature.

(4) Measurement of steering power

Stop the machine on a flat dry paved rod, and apply its parking brake. Attach a spring balancer to the steering wheel rim to measure the steering power. The steering power must be less than approx. 150N.

(5) To measure hydraulic pressure, use the pressure gauge (15-20MPa), stop valve and hoses connected as shown in fig. 6-4.

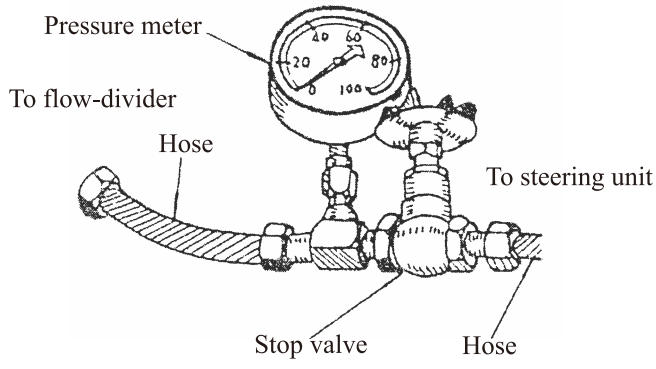


Fig.6-4 Measure pressure

Disconnect the hose which has been connected from the flow valve to the power steering, connect the hose with the stop valve to the power steering side, and run the engine idly.

When the steering wheel is kept in free state, the hydraulic pressure is about 0.5 to 2MPa. If the hydraulic pressure exceeds this valve, check for clogging of the control valve and piping. If no abnormality is found, raise the rotational speed of engine up to about 1500rpm, and slowly close the stop valve, paying attention to pressure rise.

The limit pressure of relief valve has been set to 12MPa. Therefore, when the stop valve is completely closed, the pressure gauge indicates its setting pressure.

If the hydraulic pressure exceeds 12MPa, this indicates that the relief valve malfunctions. If the hydraulic pressure is too low, this indicates that the oil pump malfunctions or the relief valve spring has been broken. In this case be careful not to keep the stop valve closed for more than 15 seconds.

Caution: The pump supplies the hydraulic oil to actuate the power cylinder. Its work must be considered from two different aspects, namely pressure and flow rate.

Pressure is designated to give thrust to the cylinder whereas flow rate relates to the kinetic speed of the cylinder.

Therefore, even when the hydraulic pressure is normal, say 12MPa, the power steering cannot work normally if flow rate is insufficient. This results in heavy steering. Since the flow valve and relief valve have been properly adjusted according to capacity and use conditions of the power steering, it is necessary put the match mark in the set position or measure the distance to the screw head if disassembly of valve is needed.

6.3 Troubleshooting Guide

Problem	Possible cause	Remedy
Steering wheel is caught when repidly turned	Flow control valve spool stuck	Disassemble, repair or replace
	Flow control valve spool worn	Replace as assembly
Oil pressure does not rise	Relief valve stuck open	Replace as assembly
Oil pressure higher than relief set pressure	Relief valve stuck closed	Replace as assembly
Noisy relief valve	Relief valve vibrating	Replace as assembly
Too high oil temperature	Relief valve stuck closed	Replace as assembly
Hard steering operation while idling	Relief valve stuck open	Replace as assembly
	Flow control valve spool stuck	Disassemble, repair or replace
	Flow control valve spool worn	Replace as assembly
Varying steering force	Relief valve vibrating	Replace as assembly
	Flow control valve spool stuck	
	Flow control valve spool worn	Replace as assembly
Hard steering operation	Relief valve stuck open	Replace as assembly
	Flow control valve spool stuck	Disassemble, repair or replace
	Flow control valve spool worn	Replace as assembly

6.4 Steering axle

12t forklift entirely adopts transverse steering oil cylinder. The front and rear of the center are supported by two supporting axle through sleeve on the steering axle base, the later is fixed on the forklift frame. The two supporting axle can sway a certain angle to the right and left. The main structure is presented in the Fig. 6-5.

Steering axle is mainly made up of steering axle body, left and right steering knuckle assembly, connecting rod assembly, wheel, wheel hub and steering oil cylinder.

6.4.1 Steering axle body

Steering axle body is a steering plate welding structure. On its two ends there are upper and lower bosses (holes) that connect the left and right steering knuckle assembly with the axle body by using the steering stub.

6.4.2 Left and right steering knuckle assembly

Left and right steering knuckle assembly is supported on the wheel hub through two thrust bearings and the wheel is mounted on the wheel hub. Oil seal is provided on the wheel hub in order to prevent grease from overflowing. The plane thrust bearing is mounted between the steering knuckle and the upper and lower bosses of steering axle body, under which a gasket can be used to regulate the rotation clearance. In the inner hole of upper and lower bosses, the steering stub is mounted and is supported by the upper and lower needle bearings, under which the oil seal is used. An oil nozzle is mounted on the upper extreme cover in order to lubricate all the bearings through the inner hole of stub. Users should fill in the grease on time. The locking pin is used for between the steering stubs of steering knuckle assembly.

6.4.3 Wheel hub

Wheel hub is spherical iron.

6.4.4 Steering ram (oil cylinder)

The steering ram horizontally set in the middle of the axle body is of double-action type. The piston rods on two ends are connected with connecting bar assembly; the other end of the later can propel the steering knuckle arm to make the wheel change direction. On the two ends of the oil cylinder are pilot sleeves and the steel-backed bearing, baffle plate, sealing ring and anti-dust ring are installed in the inner holes of the sleeve, while contact with piston rod. Outside the sleeve are the supporting ring and O-shaped ring, while contact with the inner wall of the cylinder. The oil cylinder of the structure, refer to Fig. 6-6.

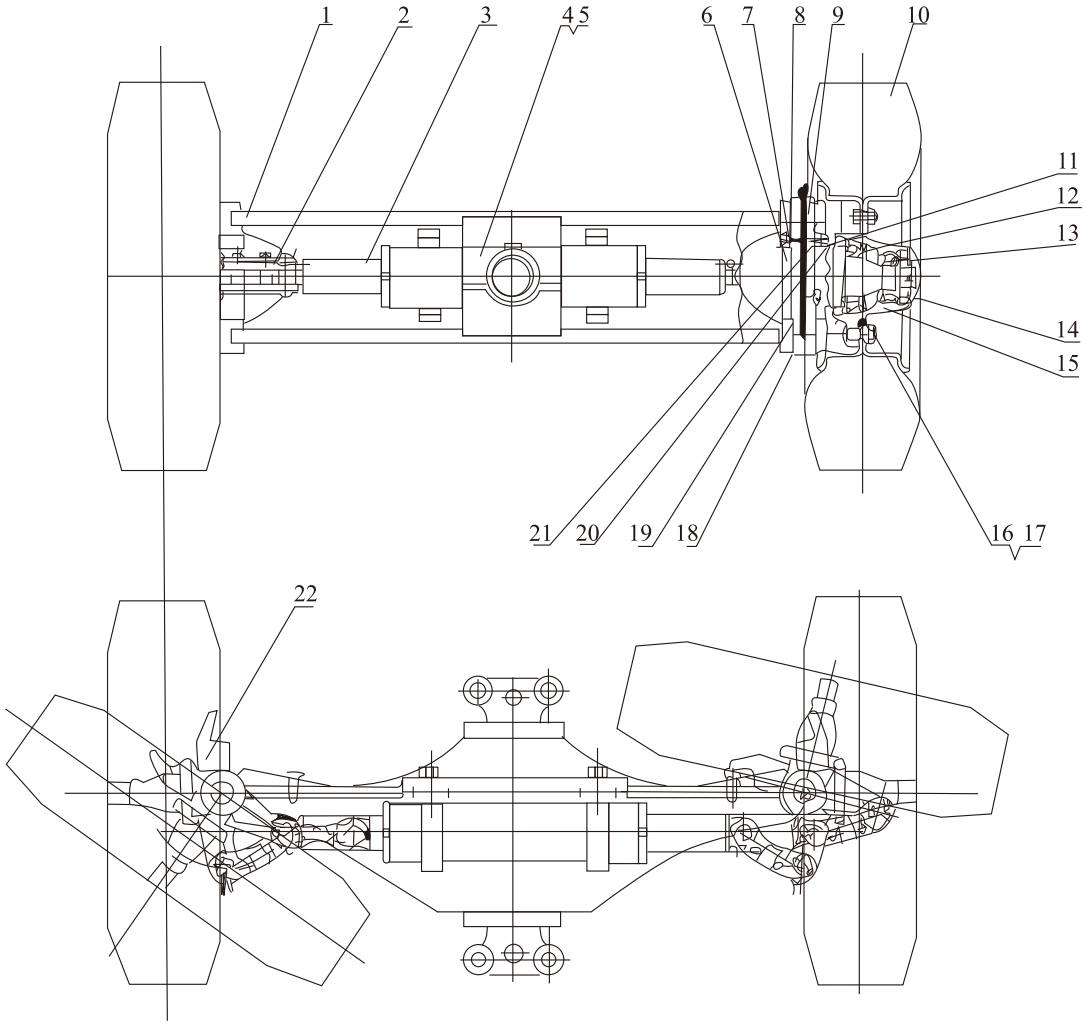


Fig. 6-5 Steering axle

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

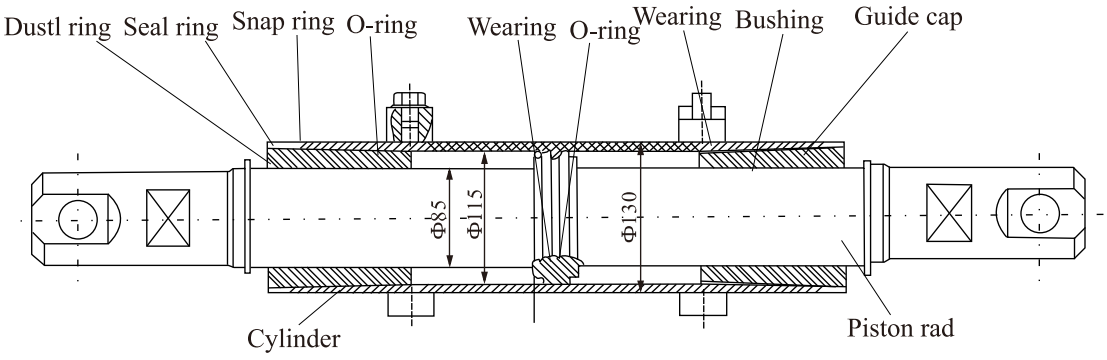


Fig. 6-6 Steering cylinder

7.Hydraulic system

			12t
			Power brake
Oil pump	Drive type		Transmission P.T.O.
	Rated pressure		25MPa
	Front pump NO.		A90B4-20100
	Rear pump NO.		A50B4-20200
Control valve	Type		Two-spool sliding type(with relief valve and tilt-lock valve)
	Setting pressure		20MPa
	Part NO.	Two-throw	A120A4-30000*2
		Three-throw	A120A4-30000*3
		Four-throw	A120A4-30000*4
		Five-throw	A120A4-30000*5

7.1 General Description

The hydraulic system mainly consists of main pump, control valve, high & low pressure oil pipes and joints. The main pump is a gear type and installed on the top of the transmission. The pump is filled to a gear to which the charging pump is also fitted. As the engine runs, the main pump is driven to draw up oil from the tank and send it to the control valve. The control valve, provided with a relief valve to keep the circuit pressure within the specified one, controls the cylinders by changing over the oil passages inside the valve body with the spools.

7.2 Main Pump

The main pump consists primarily of a drive gear, driven gear and pump body which contains the two gears and other components. The drive gear is in mesh with the driven gear.

7.3 Control valve (See Fig. 7-1)

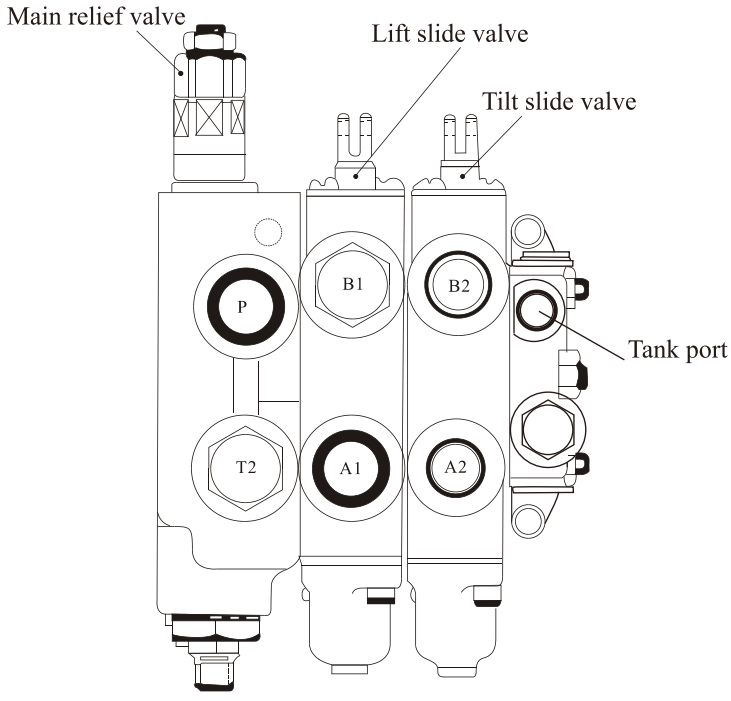


Fig. 7-1 Control valve

The control valve is a sectional type consisting of the inlet section, plunger section and outlet section which are assembled with three bolts.

At the inlet section is a cartridge type relief valve to set the oil pressure in the circuit. The plunger section controls the hydraulic cylinders by changing over the flow of oil from the relief valve with plungers. The tilt cylinder plunger section is equipped with a tilt lock valve. Oil

sealed with O-ring , and the oil passage at the high pressure side is given a check valve.

7.4 Operation of control valve

(1) Neutral position (See Fig. 7-2)

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.

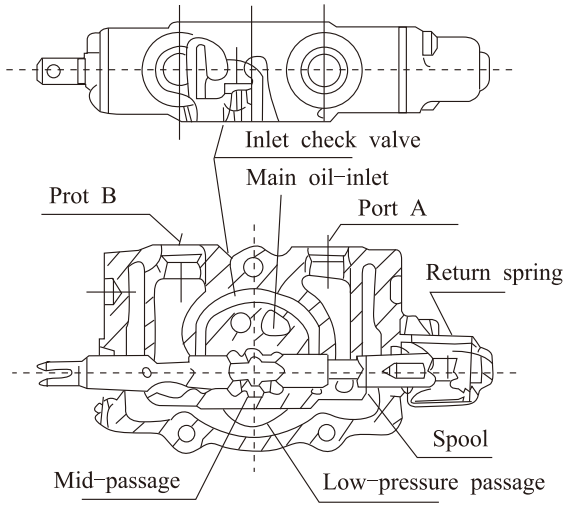


Fig. 7-2

(2) Pushing-in of spool (See Fig. 7-3)

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. 7-4)

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

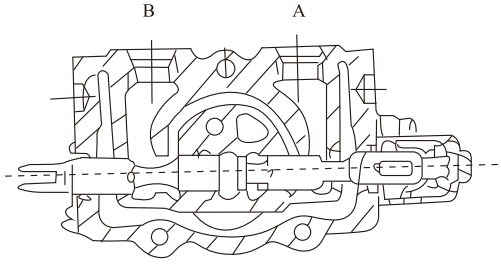


Fig. 7-3

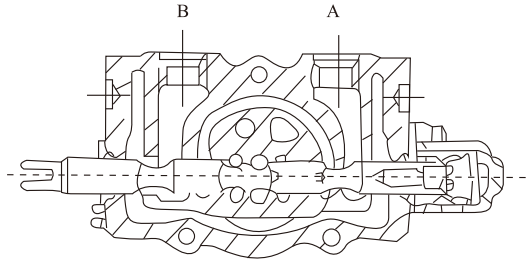


Fig. 7-4

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. 7-5)

(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. 7-6)

(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. 7-7)

(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. 7-8)

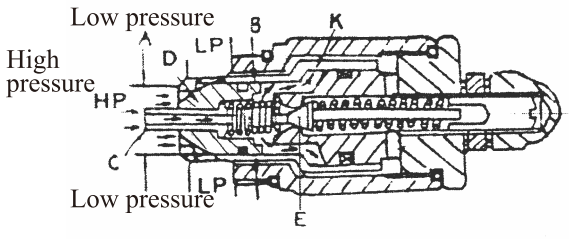


Fig. 7-5

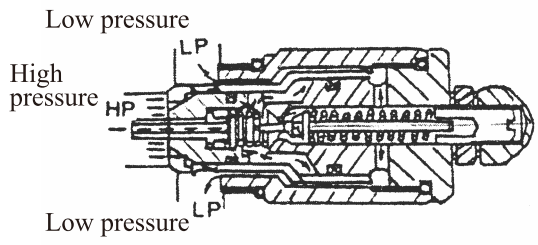


Fig. 7-6

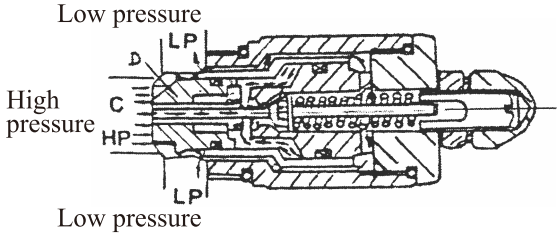


Fig. 7-7

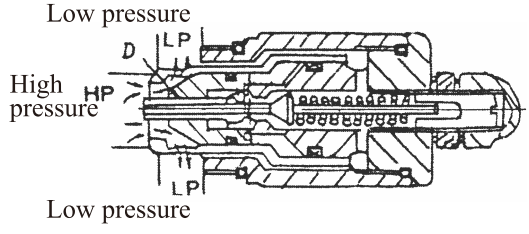


Fig. 7-8

7.6 Operation tilt lock valve

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

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

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

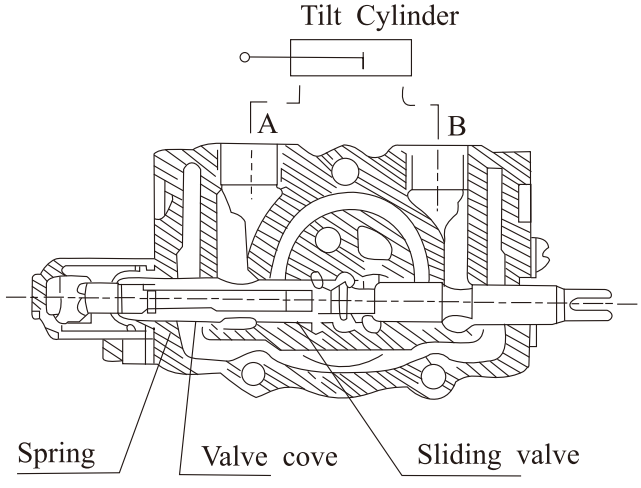


Fig. 7-9 Tilt lock valve

7.7 Operation of the multi-control valve

The control valve is operated with the valve levers. All valve levers are assembled together with a shaft and the shaft is assembled on the front guard with the bracket. The valve levers operate the control valve with the joins. (See Fig. 7-10)

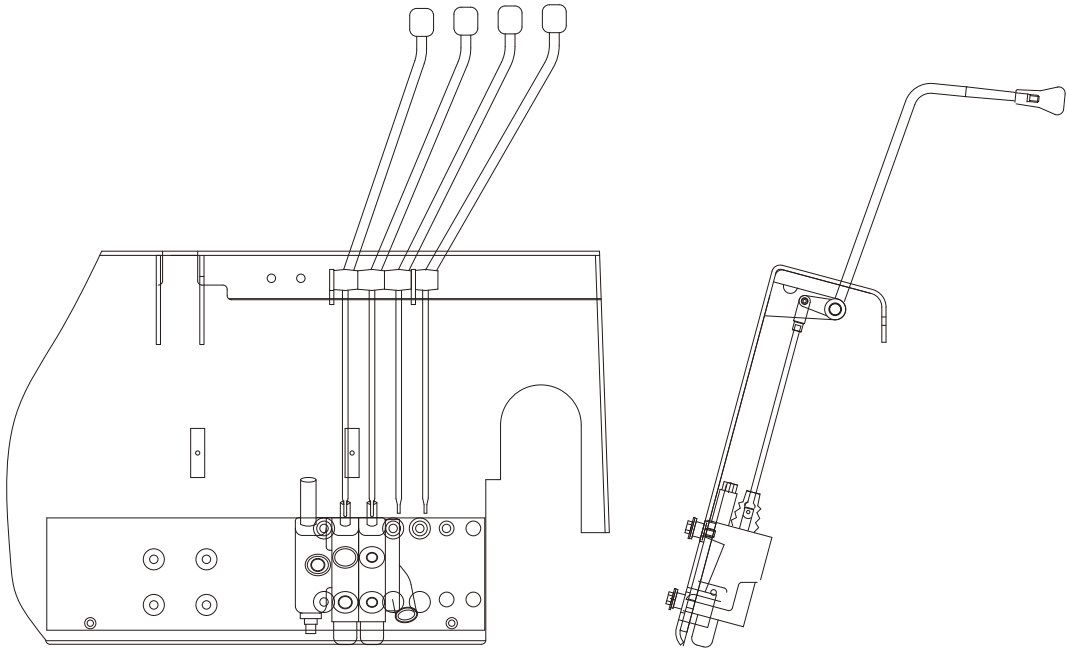


Fig. 7-10 Operation of the multi-control valve

7.8 The hydraulic oil tank

The hydraulic oil tank does not suck oil and filter the dust as the component of frame on the right tank.（See Fig. 7-11）

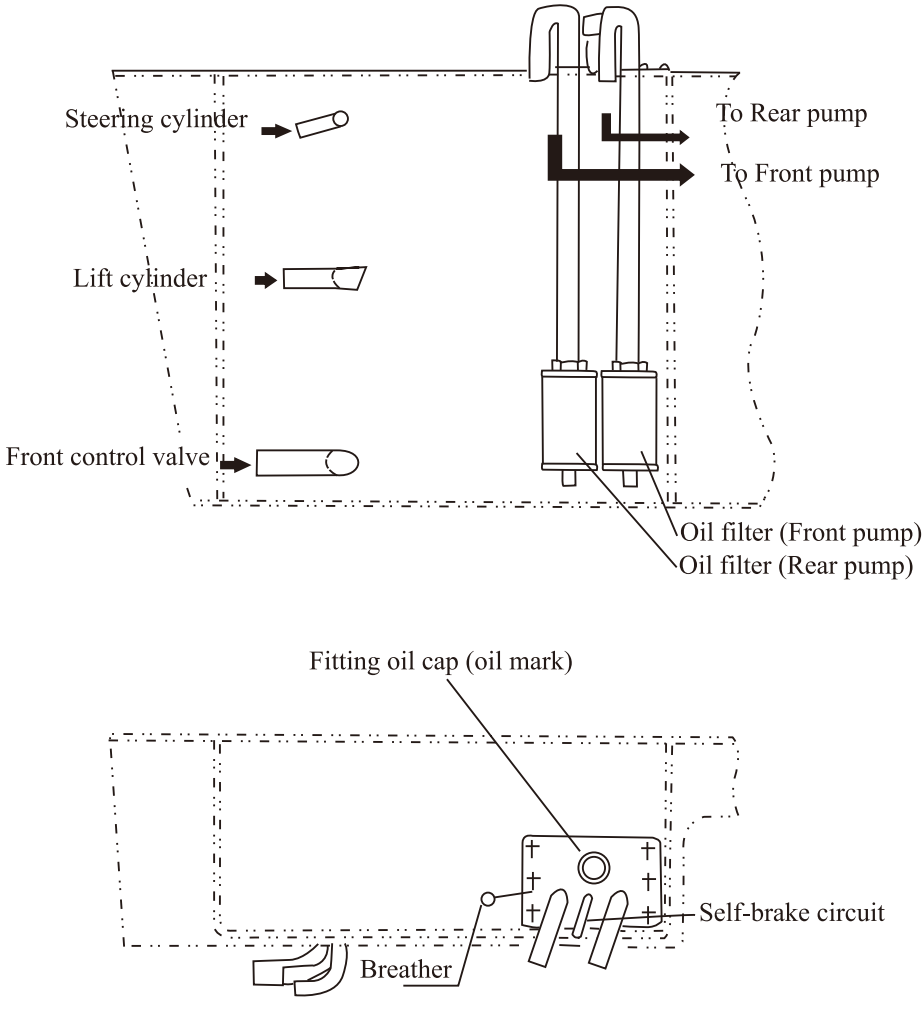


Fig. 7-11 Oil tank

7.9 Hydraulic circulation system (Main circuit)

The hydraulic system sketch see following:

The hydraulic circulation system of 12 ton forklift trucks see fig. 7-13.

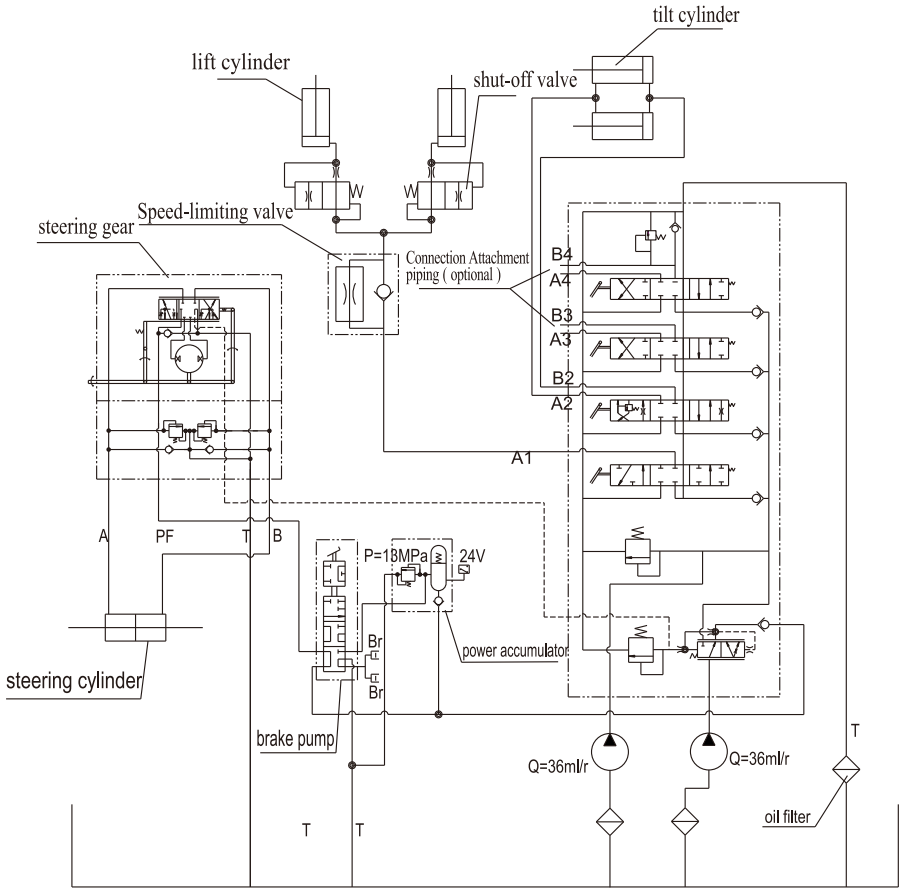


Fig.7-12 Steering hydraulic schematic diagram of priority

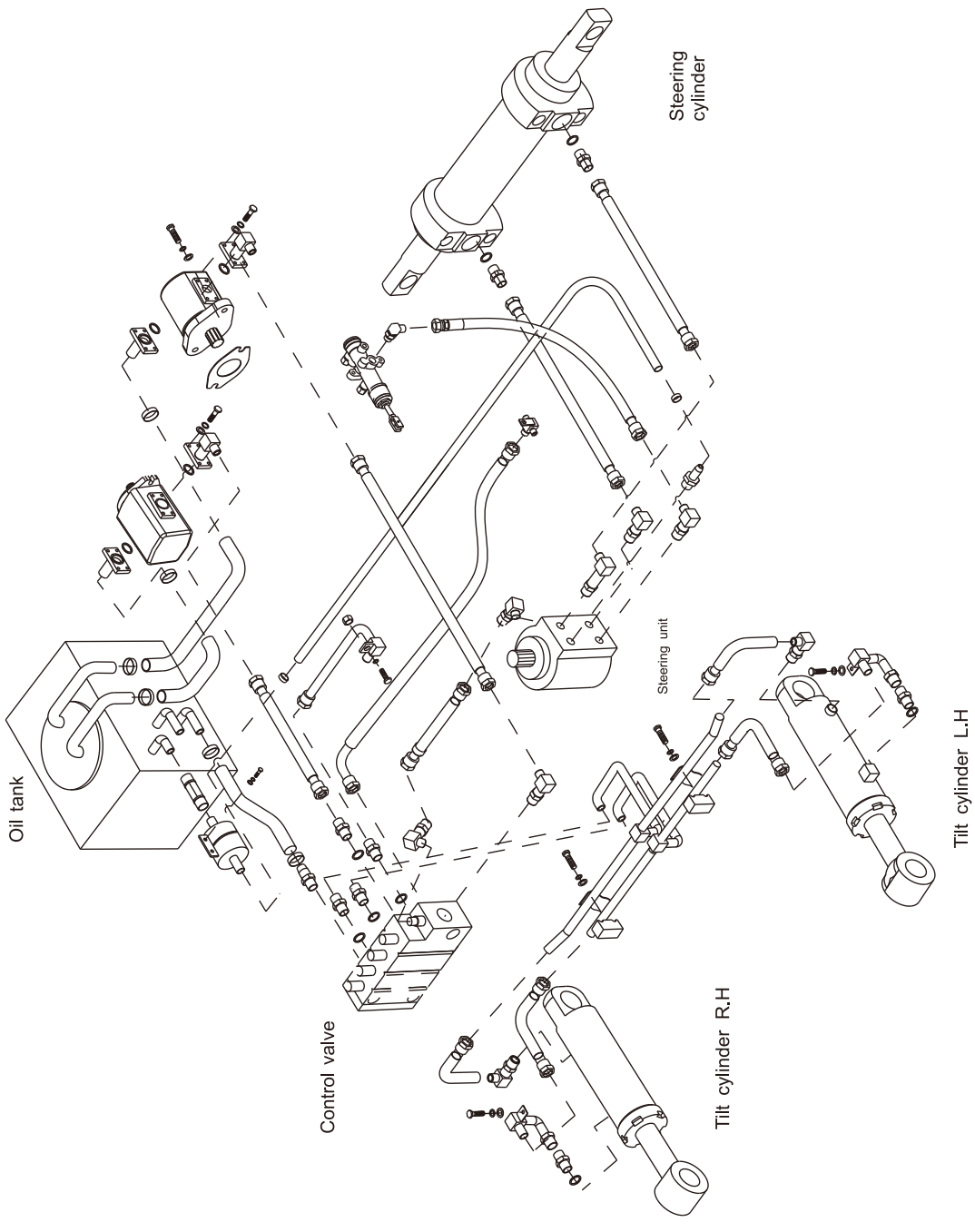


Fig. 7-13 Hydraulic circuit (for 12t truck)

The hydraulic circulation system of the main circuit is complicated with the hydraulic circuit for power steering. The hydraulic piping is of O-ring fitting type with excellent sealing performance, providing secure oil tightness.

The hydraulic oil sent from the rear main pump flows directly to the control valve, while the hydraulic oil sent from the front main pump is divided by the flow divider valve in two portions for steering and load handling operation.

The hydraulic oil for load handling flows into the control valve and mingles with the hydraulic oil from the rear main pump. With the control valve in neutral position, the oil returns to the oil tanks, passing through the valve.

When the lift lever is pulled, the hydraulic oil from the control valve flows through the flow regulator valve and reaches the lower part of the lift cylinder piston to push up the piston rod. When the lift lever is pushed, the circuit between the lower part of the lift cylinder piston and the oil tank is opened, and the piston begins to descend due to the weight of the piston rod, lift bracket, forks, etc. In this case, the oil returning to the control valve is regulated by the flow regulator. When the tilt lever is operated, the hydraulic oil from the main pump reaches one side of the piston to push it. The oil pushed by the piston returns to the tank through the control valve.

7.10 Maintenance

7.10.1 Disassembly of control valve

Dismount the control valve from the machine and clean exterior of it.

(1) Remove the fitting bolts and separate the control valve into each section. Don't lose the check valves and spring arranger at the joint sections.

(2) Remove the screws at the plunger head side and the bolts with hex. Groove at the cap side, and remove the wiper, O-ring and seal plate from the valve housing together with plunger.

(3) Put the plunger on the vice and remove the cap screw. And then remove the spring and spring seals. On the plunger provided with a tilt lock, remove also the spring and poppet in the plunger.

7.10.2 Reassembly of control valve

Using mineral oil, clean all the disassembled parts. Check them for burrs or nicks, and replace as necessary. The valve housing and plunger, and the plunger and poppet are assembled by wrapping. If replacement is needed, replace as assembly.

(1) Fasten the plunger with vice, and install the poppet and spring in the plunger, observing the direction of poppet.

(2) Install the O-ring, wiper, seal plate, spring seal, spring and spring seat in this order to the plunger end side, and tighten them with cap screw to the torque of 25 to 32N.m.

(3) Insert the assembles plunger into the valve housing and fit the cap by the bolt with hex

groove.(Tightening torque: 9 to 11 N.m)

(4) Fasten the O-ring and wiper to the plunger head side and tighten the seal plate with screw to the torque of 4.6 to 5.8 N.m.

(5) After assembling, install the check valve, spring and O-ring in each section and tighten them to the specified torques with three bolts.(one bolts: 103N.m; the others:66N.m)

8. Lift Cylinder & Tilt Cylinder

The main specification See Table 8.1.

Table 8.1

			12t
Lift cylinder	Type		Single-acting piston type
	Cylinder bore	mm	Φ105
	O.D. of piston rod		Φ70
	Stroke		1495
Tilt cylinder	Type		Double-acting piston type
	Cylinder bore	mm	Φ115
	O.D. of piston rod		Φ50
	Stroke		242

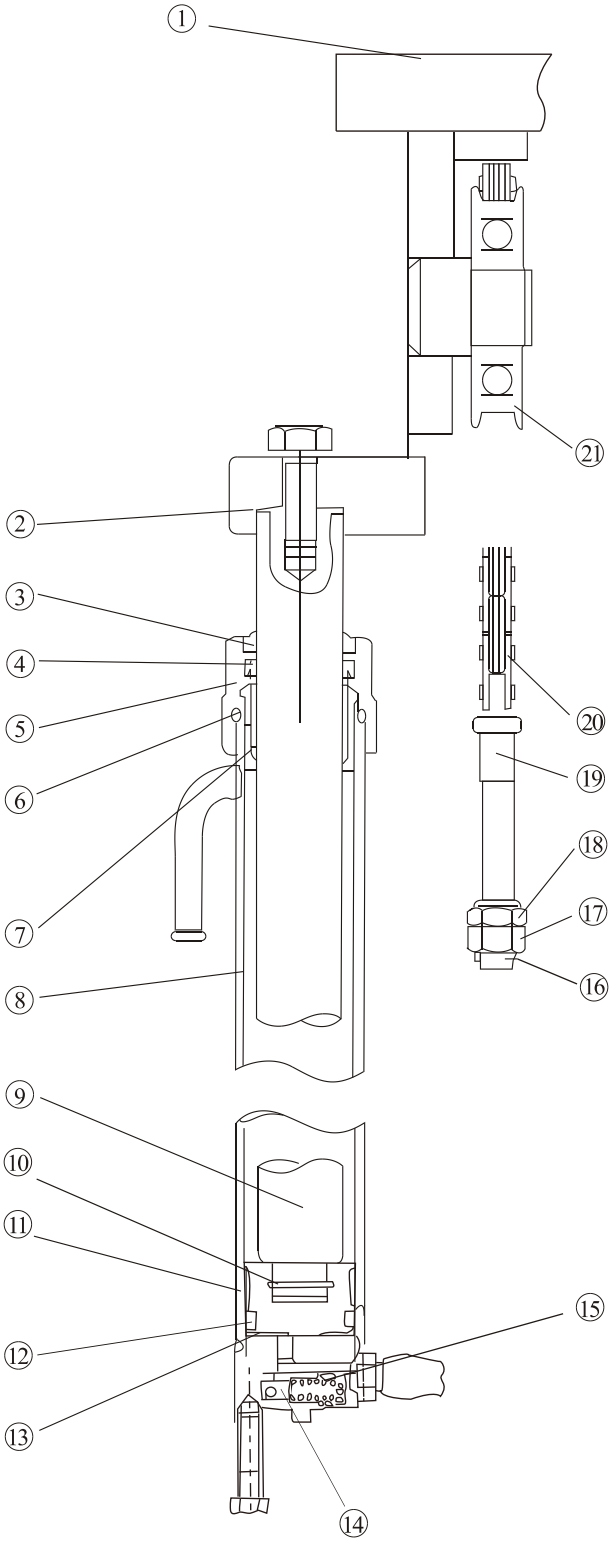
8.1 Lift Cylinder

The two lift cylinders of single acting type are used and located behind each outer mast frame. The bottoms of the cylinders are sustained by the mast support of the outer mast frame. The bottoms of the cylinders are sustained by the mast support of the outer mast while the tops of them, or the piston rod ends are inserted into the one body construction piston head.

The lift cylinder assembly consists primarily of a cylinder body, piston rod and cylinder cap. At the lower part of the cylinder body is arranged an inlet for high-pressure oil, and at the upper part there is an outlet for low-pressure oil above the piston packing, to which a return pipe is connected. The piston is fastened to the piston rod with castle nut and cotter pin together with an O-ring. A wear ring, parking and back-up ring are attached to the outside periphery of the piston which is moved along the inner surface of the cylinder by high-pressure oil. An oil seal and hushing are installed on the cylinder cap which is screwed into the cylinder body. The bushing supports the piston rod, and oil seal prevents dust from entering the cylinder. The upper

end the piston rod is locked with piston head set bolts.

When the lift lever is tilted backward, high oil pressure is sent into the lift cylinders through their inlets to push up the piston rods and the piston rods and the piston head, causing the forks to rise through chains. The height from the from the ground to the fork position at which the inner mast frame connecting member begins to be lifted is called “Free Lift” range. Within this range, the mast height does not vary. With the lift lever tilted forward, the pistons of the lift cylinders descend by the weights of the piston rods, lift bracket, finger bar and forks, causing oil under the piston to flow out of the cylinders. The oil discharger from the cylinders is regulated by flow regulator and returns through the oil discharged from the cylinder is regulator and returns through the control valve to the oil tank.



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

Fig. 8-1 Lifting Cylinder(12t truck)

8.2 cut-off valve

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

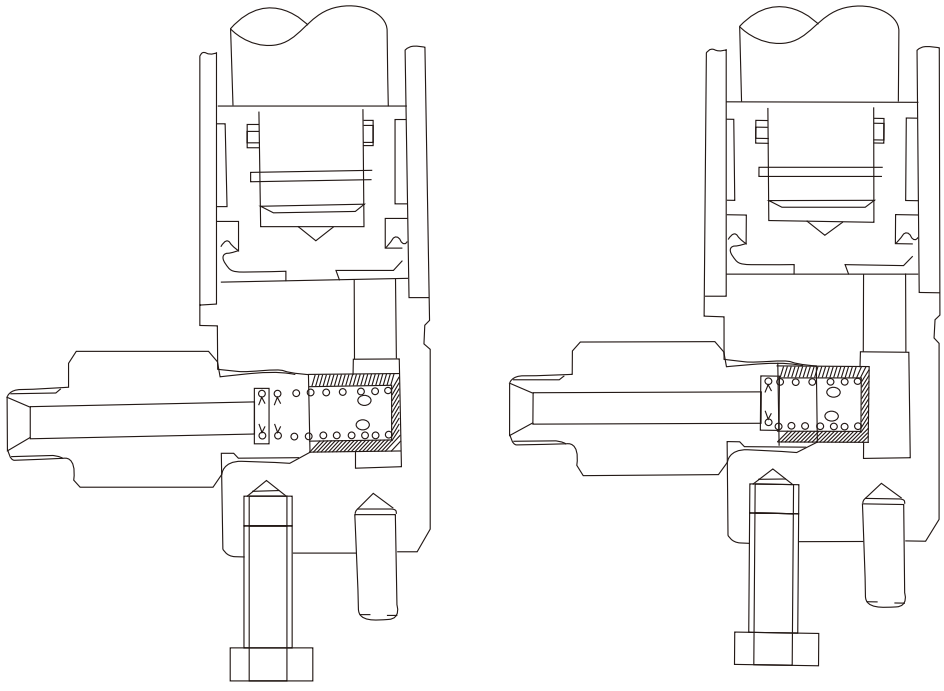


Fig. 8-2 cut-off valve

8.3 Flow regulator

The flow regulator valve is located between the control valve and the high pressure ports of the twp lift cylinders, near the left cylinder (See Fig. 8-3). The structure of the flow regulator valve as shown in Fig. 8-4. No.3 in Fig. 8-4 is coil spring for 12 ton forklift trucks.

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. 8-4. 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.

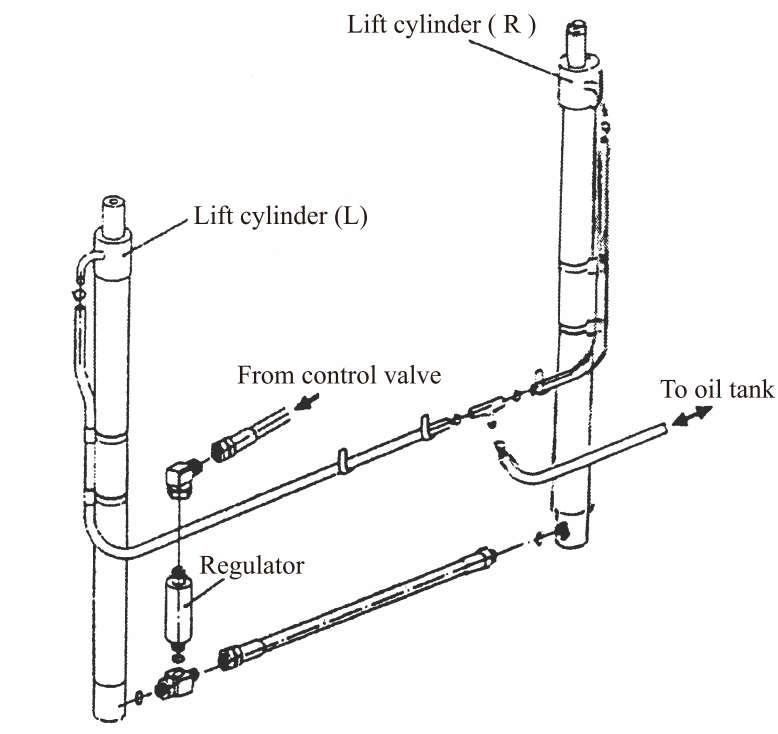
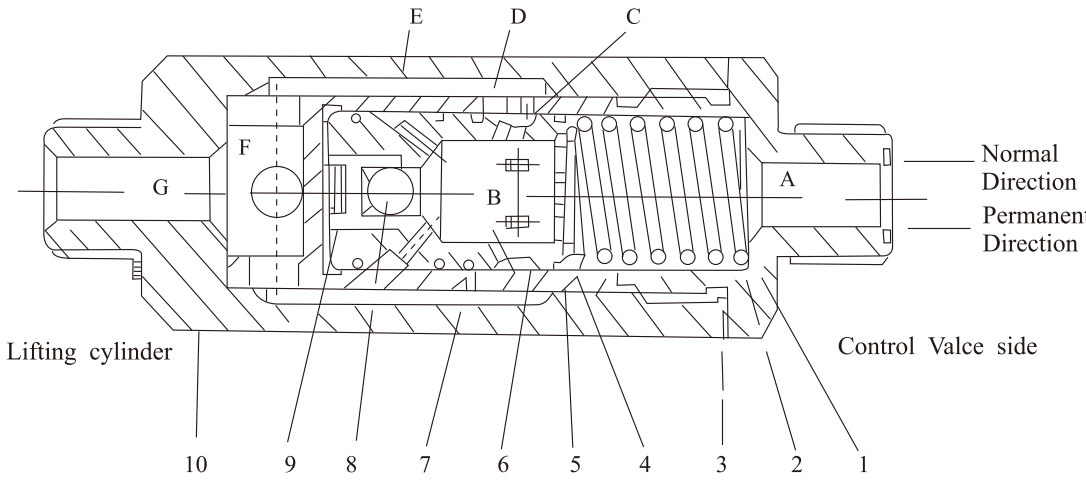


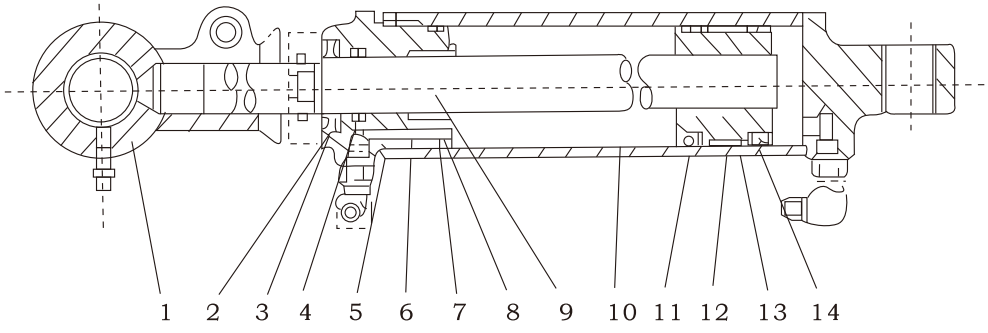
Fig. 8-3 Regulator mounting position



1. tie-in
2. spring
3. "O" seal ring
4. check ring
5. throttle plate
6. valve sleeve
7. valve core
8. nylon ball
9. spring
10. valve body

Fig. 8-4 Flow regulator valve(12t truck)

8.4 Tilt cylinder



1. earring
2. dustproof ring
3. check ring
4. YX seal ring
5. "O" ring
6. guide sleeve
7. bearing
8. "O" ring
9. piston rod
10. cylinder body
11. Yx ring seal
12. back ring
13. piston
14. Yx seal ring

Fig. 8-5 Tilt cylinder

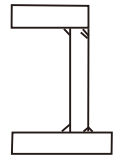
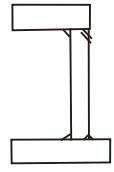
The tilt cylinder is of double-acting type. Each truck has two tilt cylinders that are installed on each side of the frame with pin while their piston rod ends are connected with the outer mast.

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

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

9.Hoist system

The main specifications see table 9.1.

			12t
Type			Rolling type, welded mast with free lift, 2-stage telescopic mast
Cross section of inner mast			
Cross section of outer mast			
Max. Lift Height(S.T.D)			3000mm
Forward /Backward tilt (S.T.D)			6° /12°
Rollers	O.D. of end rollers	mm	Φ183.5
	O.D. of side rollers	mm	Φ82
	O.D. of retaining (on bracket)	mm	Φ119
Lift chain			LH2844,4×4 P=44.5
Fork lifting method			Hydraulic
Mast tilting method			Hydraulic
Fork spacing adjustment			Manual

9.1 General

The hoist system is of the twp-stage, rolling telescopic mast type. The inner mast frames have J-shaped section. The outer mast frames have J-shaped section of 12 ton forklift truckss.

9.2 Outer & inner mast

The mast assembly is of the free lift range-contained two stage telescopic type consisting of the inner and outer mast, and is sustained by mast supports. The mast supports are welded to the bottom of the outer mast, being extended from the axle housing. The outer masts are provided with brackets for lock pins of tilt cylinder connecting hardware. The mast is tilted by operation of the tilt cylinders, forward 6° and backward 12° .

The inner mast is composed of right and left mast frames which are connected with each other by upper and lower connecting members. At the upper inside of each outer mast frame an end roller is installed on the end roller shaft welded to the frame, with a snap ring. In addition, the outer mast frames are fitted with side rollers to sustain the inner mast frames. At the lower outside of each inner mast frame an end roller is installed on the end roller shaft with snap ring, which is welded to the inner mast. Under the end rollers other side rollers are located to sustain transverse load. With the aid of these rollers, the inner mast can smoothly operates.

9.3 Lift bracket and the backrest

At the lift brackets, end rollers that roll along the inside of he inner mast frames are installed on the end roller shafts with snap rings. The end roller shafts are welded to the lift brackets. The side rollers that roll along on the inside of the inner mast frames are bolt fitted, being shim adjusted. To prevent the tolling of the finger bar, two retaining rollers are used, which roll along on the outside of inner mast frames. The lingitudinal load is sustained by the end rollers of which the upper ones emerge from the mast top when the forks reaches the maximum lift height. The transverse load is sustained by upper retaining rollers and lower side rollers. As we mentioned above, the mast assembly and lift brackets are designed with rigidity and smooth operation in mind. Furthermore, the finger bar and lift brackets are made into body construction using high tension steel to improve the durability. This meets the ISO Standards.

The two forks installed on the finger bar are made of special alloy steel which has been subjected to heat treatment.

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 .

9.4 Adjustment of hoist system

9.4.1 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.

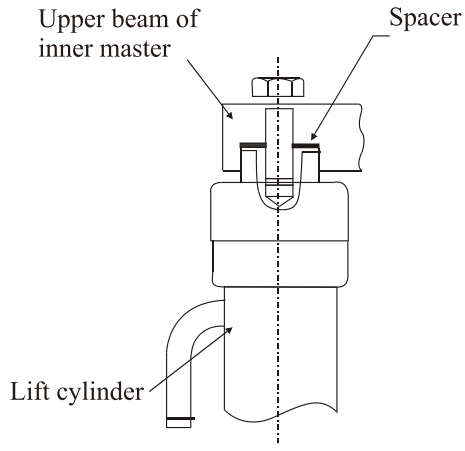


Fig.9-1

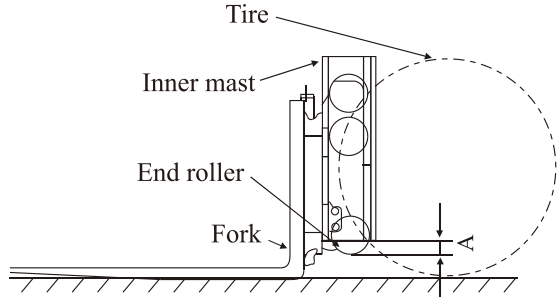


Fig.9-2

9.4.2 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.

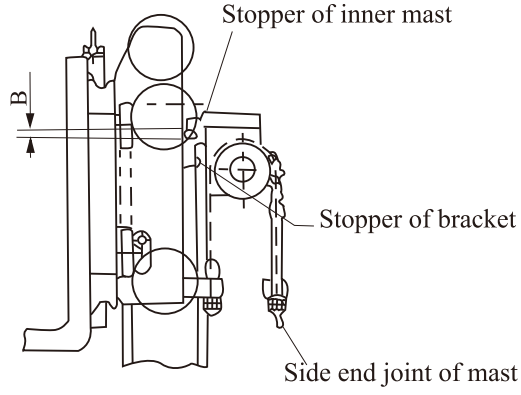


Fig.9-3

(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 .

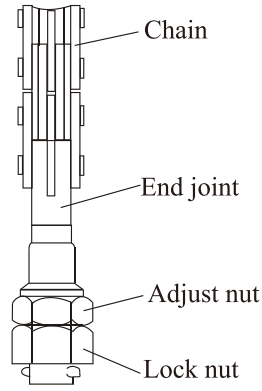


Fig.9-4

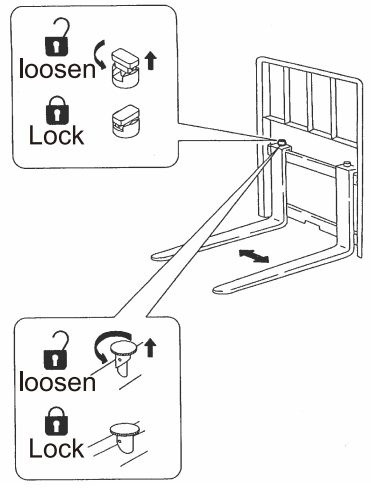
9.4.3 Fork and its width adjustment

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.

9.5 The position of roller

Roller disposal there are three kinds of rollers in the hoist system ., main roller , side roller group , side roller . They are separately mounted on the outer mast , inner mast and carriage . Roller disposal of the trucks of 12t are almost similar . The main rollers sustain the loads from front and rear direction , and generally can not be adjusted . The side rollers sustain the side loads . Usual can adjust clearance in right and left side-direction with shims , so as to outer mast , inner mast and bracket can move freely up and down .

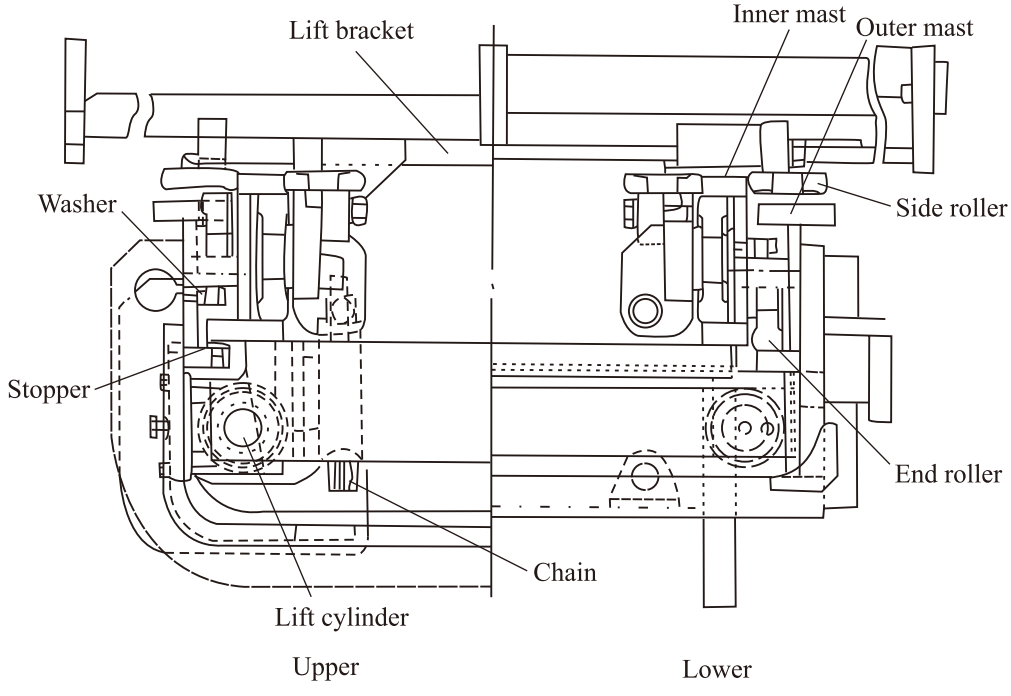


Fig.9-5 Roller lay (for 12t truck)

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.

Maintenance records

Name	Date	Inspection parts	Lubrication patrs	Replacement parts	Remarl

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