Introduction

This manual main introduces the items in the aspects of performance, structure, and operation, as well as maintenance and service, etc of the 2t-3.5t forklift trucks, so that the operators are able for a correct use and maintenance.

During the user operating process, the operators and equipment management personal involved shall carefully follow the relevant regulations of this manual, for the forklift truck to maintain its good technical conditions.

Table of Contents

I. Forklift Truck Main Technical Parameters (Refer Table Diesel F/L & LPG/Gasoline F/L)

Main Technical Parameters

Diesel F/L

Parameter \ Model			**20D-7SA**	**25D-7SA**	**30D-7SA**	**35D-7SA**
+Performance Parameter	Rated Load (KG)		2000	2500	3000	3500
	Load Center (mm)		500			
	Lifting Height (mm)		3000			
	Free Lifting Height (mm)		160		165	170
	Mast Tilt Angle (Front/Rear)		6/12°			
	Lifting Speed (mm/s)	No-Load	550	550	440	350
		Full-Load	530	530	425	335
	Running Speed (km/h)	Forward	20	20	19	18
	Max Traction Force	No-Load (N)	15000		1700	
		Full-Load (N)	17000		1900	
	Gradeability	No-Load (%)	20			18
		Full-Load (%)	20			18
	Min Turning Radius R (mm)		2330	2330	2450	2510
	Min Cross Passage Width K (mm)		1940	2010	2140	2160

Main Technical Parameters

Diesel F/L Continued

Parameter \ Model			20D-7SA	25D-7SA	30D-7SA	35D-7SA
Size Parameter	Whole Length L (Without Fork) (mm)		2590	2590	2705	2790
	Whole Width W (mm)		1150		1210	
	Whole Height D(Mast Retracted) (mm)		2010		2075	2150
	Whole Height E(Mast Extended) (mm)		3990		4100	
	Wheelbase F (mm)		1600		1700	
	Wheel Base	Front Q1 (mm)	970		1000	
		Rear Q2 (mm)	980			
	Front Clearance B (mm)		475		490	510
	Rear Clearance C (mm)		515		515	580
	Fork Dimension	Length (mm)	1070			
		Width (mm)	122		125	
		Height (mm)	40		45	50
	Fork Horizontal Adjustment Quantity (mm)		250-1040		250-1100	260-1110
	Ground Clearance(in the Place of Mast) (mm)		125		140	
Self weight (kg)			3400	3700	4380	4730

Main Technical Parameters

LPG/Gasoline F/L

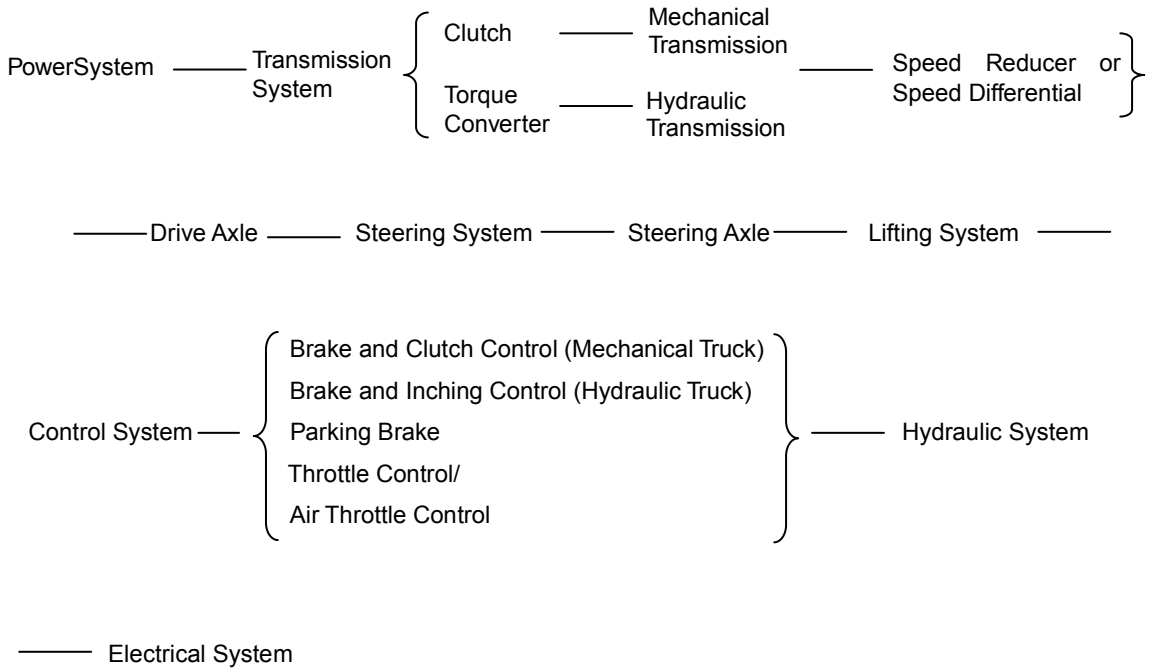
Parameter \ Model			20L-7SA	25L-7SA	30L-7SA	35L-7SA
Performance Parameter	Rated Load (kg)		2000	2500	3000	3500
	Load Center (mm)		500			
	Lifting Height (mm)		3000			
	FreeLifting Height (mm)		160		165	170
	Mast Tilt Angle (Front/Rear)		6/12°			
	Lifting Speed (mm/s)	No-Load	550	550	450	350
		Full-Load	530	530	425	335
	Running Speed (km/h)	Forward	20	20	19	18
	Max Traction Force	No-Load (N)	15000			
		Full-Load (N)	17000			
	Gradeability	No-Load (%)	20			18
		Full-Load (%)	20			18
	Min Turning Radius R (mm)		2330	2330	2450	2510
	Min. Cross Passage Width K (mm)		1940	2010	2140	2160

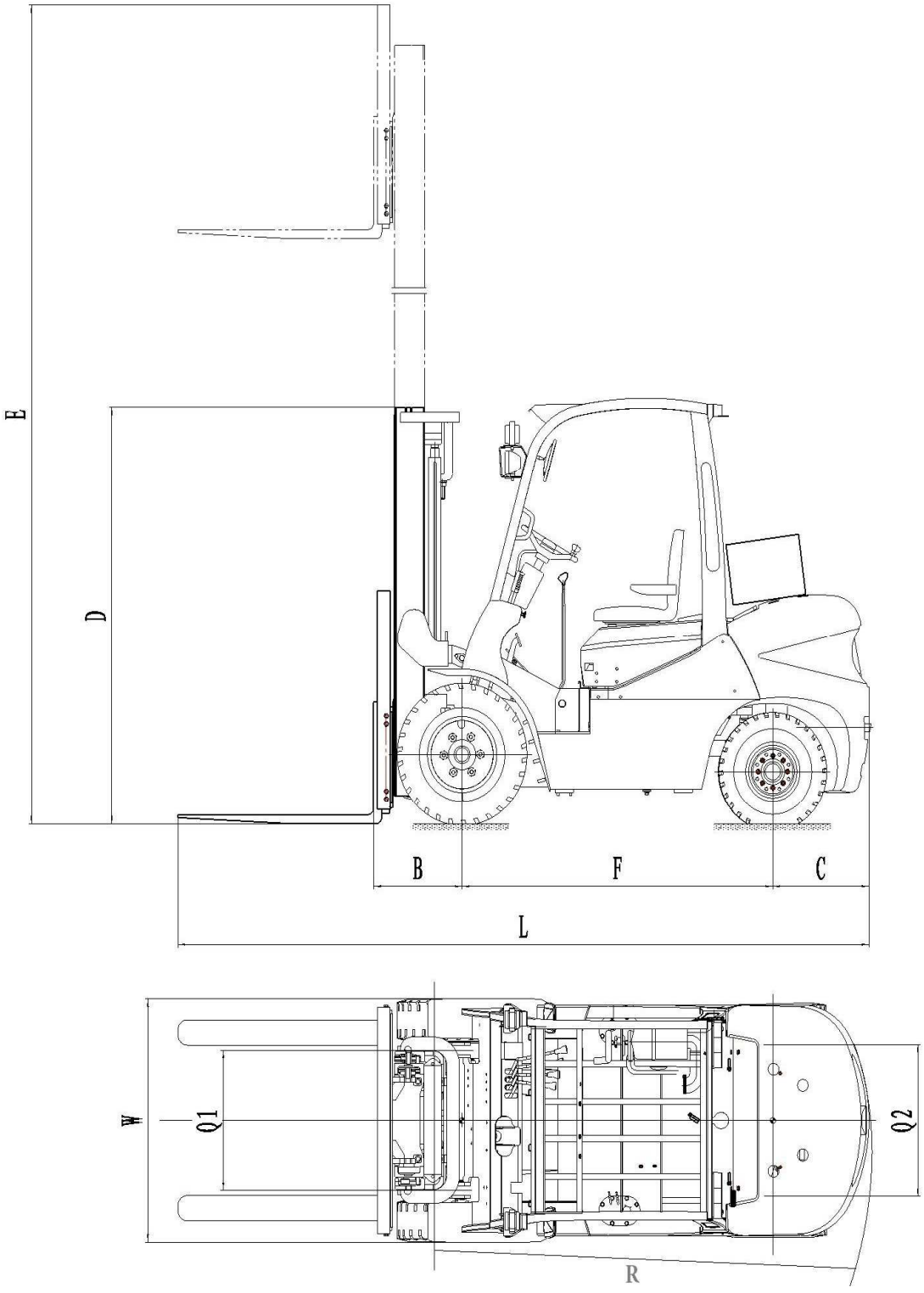
Main Technical Parameters

LPG/Gasoline F/L Continued

Parameter \ Model			20L-7SA	25L-7SA	30L-7SA	35L-7SA
Size Parameter	Whole Length L (Without Fork) (mm)		2590	2590	2705	2790
	Whole Width W (mm)		1150		1210	
	Whole Height D(Mast Retracted)(mm)		2010		2075	2150
	Whole Height E(Mast Extended) (mm)		3990		4100	
	Wheelbase F (mm)		1600		1700	
	Wheel base	Front Q1 (mm)	970		1000	
		Rear Q2 (mm)	980			
	Front Clearance B (mm)		475		490	510
	Rear Clearance C (mm)		515		515	580
	Fork Dimension	Length (mm)	1070			
		Width (mm)	122		125	
		Height (mm)	40		45	50
	Fork Horizontal Adjustment Q'ty (mm)		250-1040		250-1100	260-1110
	Ground Clearance(Mast) (mm)		125		140	
Service Weight (kg)			3320	3620	4300	4650

II. Description about Forklift Truck Main Parts





※ Outside Drawing of Forklift Truck

III. Structure, Principle, Adjustment, and Maintenance of Forklift Truck

In order for operators to use, service, and maintain the forklift truck in a better way, the items of such aspects as the structure, principle, adjustment, disassembly and assembly, maintenance, and failure removal, etc related to the forklift truck are now introduced one by one, respectively.

1. Power System

1.1 Engine Overview

Refer to Table 1 and Table 2 for the Diesel and LPG/Gasoline engines used at present for 2.0-3.5t forklift trucks.

Diesel Engine

Table 1

Main Technical Parameters			Diesel Engine
Model			Mitsubishi S4S
Type			4-Stroke, Water-Cooling, Straight-Line and Valve in Head
Cylinder	Number of Cylinders – Cylinder Diameter x Stroke (mm)		4-94×120
	Total Displacement		3.331
	Compression Ratio		22.1
Rated Power/Speed			35.3kw/22500rpm
Max Torque/Speed			182N.m/1800rpm
No-Load Min Speed (rpm)			770±20
Min Fuel Specific Consumption (g/ps.h)			265
Whole Length x Whole Width x Whole Height (mm)			781×567×717
Movement Direction			Counterclockwise as viewed from flywheel side
Firing Order			1-3-4-2
Valve Timing	Inlet Valve Open before Top Dead Center(BTDC)		30°
	Inlet Valve Close after Bottom Dead Center(ABDC)		50°
	Exhaust Valve Open before Bottom Dead Center(BBDC)		74°
	Exhaust Valve Close after Top Dead Center(ATDC)		30°
	Valve Clearance mm	Inlet Valve (Heat Engine)	0.25
		ExhaustValve(Heat Engine)	0.25
Cooling System			Forced Circulation Water Cooling
Lubricating System			Forced Circulation
Main Part	Injection Pump		Bosch A
	Fuel Filter		Catridge of Paper Element
	Engine Oil Pump		Trochoid
	Oil Rough Filter		Catridge of Paper Element
	Water Pump		Centrifugal Type
	Thermostat		Wax Pellet Type
	Generator	Voltage	12V
		Current	50A
	Starter	Voltage	12V
		Output Power	2.2kw
	Battery	Voltage	12V
		Capacity	90Ah
Referential Data		Lubricating Oil Capacity	10ℓ(Oil Pan : 9ℓ, Filter : 1ℓ)
		Cooling Water (Engine Water Jacket)	5.5ℓ

LPG/Gasoline ENGINE

Table 2

Main Technical Parameters			LPG engine
Model			Nissan K25
Type			4-Stroke, Water-Cooling, Straight-Line, and Valve in Head
Cylinder	Number of Cylinders – Cylinder Diameter x Stroke (mm)		4-89×100
	Total Displacement		2.488
	Compression Ratio		8.7
Rated Power/Speed			37.4kw/2300rpm
Max Torque/Speed			176.5N.m/1600rpm
No-Load Min Speed			850rpm
Min Fuel Specific Consumption			290g/kw.h
Whole Length x Whole Width x Whole Height			708.9×588.6×728mm
Movement Direction			In Clockwise Direction Looking from the End of Fan
Firing Order			1-3-4-2
Valve Timing	Inlet Valve Open before Top Dead Center(BTDC)		14
	Inlet Valve Close after Bottom Dead Center(ABDC)		30
	Exhaust Valve Open before Bottom Dead Center(BBDC)		32
	Exhaust Valve Close after Top Dead Center(ATDC)		12
	Valve Clearance (mm)	Inlet Valve (Heat Engine)	0.38
		Exhaust Valve(Heat Engine)	0.38
Cooling System			Forced Circulation Water Cooling
Lubricating System			Forced Lubrication
Main Part	Gasoline Pump		Membrane Type
	Air Filter		Paper Element Filter
	Engine Oil Pump		Gear Type
	Oil Rough Filter		Paper Filtration
	Water Pump		Centrifugal Type
	Thermostat		Wax Type
	Generator	Voltage	12V
		Current	50A
	Starter	Voltage	12V
		Output Power	1.2kw
	Battery	Voltage	12V
		Capacity	60Ah
Referential Data		Lubricating Oil 丨	3.5
		Cooling Water 丨	3.5

Refer to their respective engine operation and maintenance manuals for the introduction about homemade engines used for 2.0-3.5 forklift trucks. The power of engine is mainly transmitted to the transmission system from flywheel through clutch or torque converter, and as engine itself carries working oil pump, it is relatively convenient for engine to replace fan belt.

1.2 Items to be observed for Installation and Operation of LPG/Gasoline Engine

(1) Items to be observed for Installation of LPG/Gasoline Engine

Items to be Observed during Assembly of Forklift Truck		Requirement	Remarks
Cooling System	Allowed Temperature for Cooling Water	80℃ in Common Use and Max 110℃ (Outlet Water Temperature)	To prevent too heated engine
	Pressure of Heat Radiator Cover	88.3kPa(0.9kg/cm^2) in Common Use	Standard Value
	Exhaust	Exhaust shall be performed from the place of pet cock, when cooling water is injected.	
Lubricating System	Allowed Temperature	120℃ Max Oil Temperature inside Oil Pan	

(2)Items to be observed for Operation of LPG/Gasoline Engine

Items to be Observed during Operation		Requirement	Remarks
Cooling System	Air Suction Negative Pressure (Inlet Negative Pressure of Inlet Bell Mouth)	Max 6.18kPa, and below 0.98kPa in Common Use	It is required to use wire mesh air filter core, to be replaced generally after work for 1200 hours in 6 months, while it shall be replaced as soon as possible for 3-shift system or for atrocious environment, and otherwise, the cylinder and piston will be worn out, and CO black smoke will be discharged.
Exhaust System	Exhaust Pressure (Air Vent Outlet Pressure)	13.3kPa (below 100mmHg) in Common Use	Adverse impact will arise for engine power and noise, if too high.
P.T.O (Power-Take-Off) System	Oil Pump Allowable Load	6.7kg mm/3215rpm	Otherwise P.T.O. chain will extend and break and engine will stall out.
Electrical System	Battery Capacity	Standard Specification: 12V-60Ah	Generally used for -15℃～+35℃
Operating Environment	Ambient Temperature	Standard Situation: -15℃～+35℃	
	Regional Altitude	Standard Specification: Elevation below 1000m	When used at more than 1000m altitude, the mixed compensation shall be performed for gasoline engines in combination with altitudes.

(2)Fuel, Lubricating Oil Used for LPG/Gasoline Engines and Other Requirements

Item		Requirement	Remarks
Fuel		Lead-free general gasoline at 89 octane rating to be used, equivalent to Number JIS K2202-1988 2	Equivalent to Chinese Standard GB484-86RQ-90 Number gasoline, and otherwise, the rotating speed will be instable, it will fail to combust completely, if present with lead gasoline, and will cause wear to parts of gasoline engines, and give rise to environmental pollution. National Ⅲ engine use National Ⅲ or above diesel
Lubricating Oil		Application Specifications: API: Above SD Grade (Equivalent to above Chinese QD Grade) SAE: For Normal Regions: 20W Clod Zones: 10W To be replaced after use for 200 hours or 1 month	Switched to CF-4 level or above from 12th May, 2016
Anti-freezing Fluid (LLC-Long Life Coolant)		Equivalent to JIS K2234-1988, 2 Kinds LLC Concentration: Standard Zones (above -15℃) 30% Cold Zones (above -35℃) 50% To be replaced generally for every 2400 hours or 12 months, but it is changeable by taking circumstances into consideration, as operating environments and conditions are different.	Chinese anti-freezing fluids shall be referred to for implementation, and it is recommended to use long-acting antirust anti-freezing fluid (-35℃)
Remark	Fuel Filter	Authentic products to be used To be replaced for every 2400 hours or 12 months	
	Engine Oil Filter	Authentic products to be used To be replaced for every 600 hours or 3 months	
	Air Filter	Authentic products to be used To be replaced for every 1200 hours or 6 months	

Note: The period for replacement in the table indicates general situation (8 hours/day), and it shall be replaced earlier for 3-shift system or under atrocious operating conditions.

1.3 Engine Adjustment

It is required to adjust the rotating speed of engine as it produces influence over operating efficiency with both running speed and lifting speed of forklift truck, and the rotating speed of engine shall be adjusted according to the undermentioned methods, if it fails to reach the specified value.

(1) Adjusting idle speed (used for LPG/Gasoline Engine)

a) Warm up the engine until the temperature of engine cooling water reaches 85℃.

b) Mount tachometer on engine, and use the idle speed adjusting screw of carburetor to adjust the engine speed to 650r/min for 2-3.5t forklift trucks.

c) Adjust the limit screw for the minimum openness of air throttle, in the direction for engine speed to be increased.

d) Use idle speed adjusting screw of carburetor, to adjust the engine for 2-3.5t to 650r/min.

e) Repeat the steps c) and d) until a stable rotating speed of 650r/min.

(2) Adjusting the no-load maximum rotating speed (used for LPG/Gasoline Engine)

a) Warm up the engine until the temperature of engine cooling water reaches 85℃.

b) Shut down, and ensure that the accelerator pedal is pushed down to the bottom and the air throttle is fully opened.

c) Start engine, and allow air throttle to be fully opened.

d) The adjusting screw for speed limiter may be turned until the specified speed is reached, if the rotating speed of engine is higher or lower than specified value.

e) The maximum no-load rotating speed for 2-3.5t is 2800-3000r/min.

(3) Adjusting idle speed (Used for Diesel engine)

The speed of diesel engine is controlled by speed limiter of fuel injection pump, and the latter has been properly adjusted on test bed in general, while it can no longer be adjusted after engine is mounted. The steps for adjustment using test bed are given as follows (for reference):

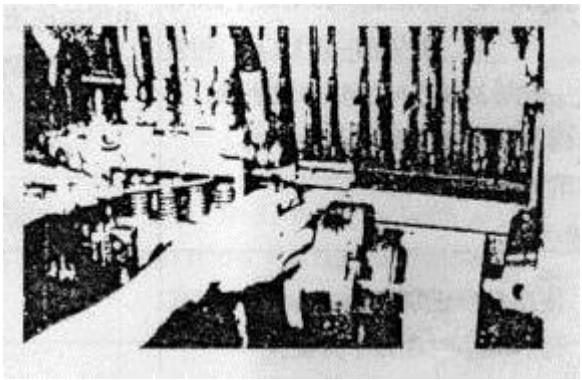


Fig 1-1

a) Control the zero adjustment of gear rack, mount the control rack for measurement device onto the end face of control rack for oil injection pump, and align the zero position of control rack for measurement device with the zero position of graduated scale.

b) Fully tilt the control rod in the direction for fuel to be increased, and ensure that the control rack extends by more than 15mm. Then fully tilt the control rod in the direction for fuel to be stopped, and ensure that the control rack on the graduated scale is less than 1mm.

c) Adjust the oil injection timing and injection speed.

d) Adjust the pressure from the minimum negative pressure.

(4) Examining whether or not air leak exists, by making use of adjusting rack to adjust the negative pressure of oil injection pump in reference to Fig 1-2

(5) Adjusting the limit of smoke by making use of adjusting screw for limit of smoke, while the operators shall pay attention that please never adjust it for imported engines, when they are basically under normal operating conditions.

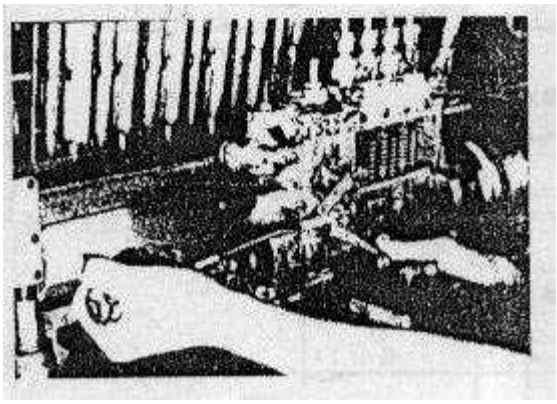
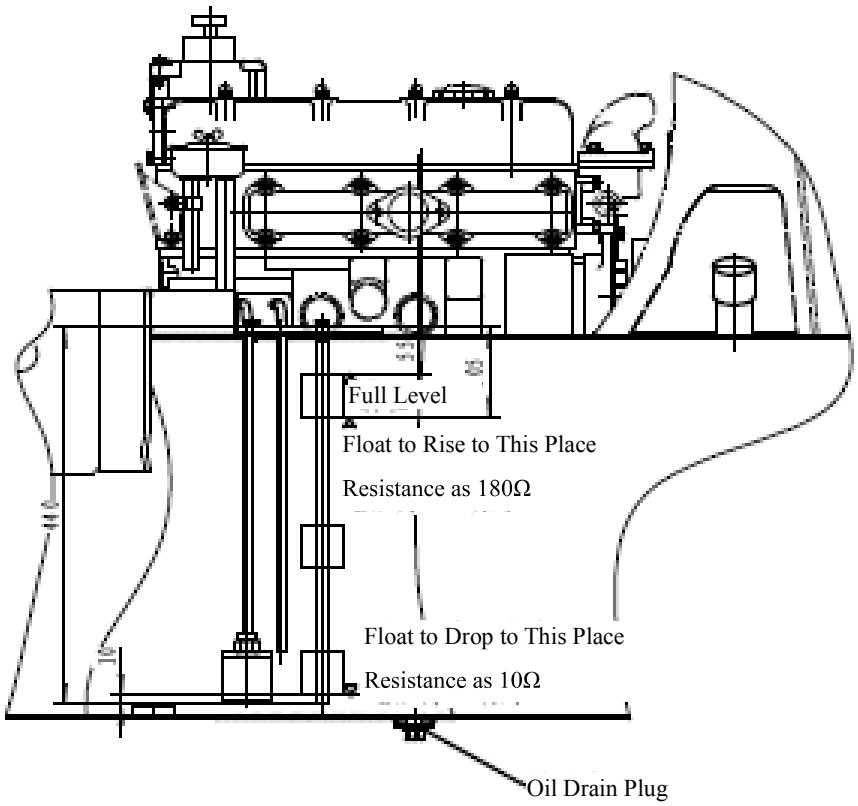


Fig 1-2

1.4 Fuel System:

Fuel system is composed of fuel tank, oil quantity sensor, and oil quantity indicator (Fig 1-3 and Fig 1-4)



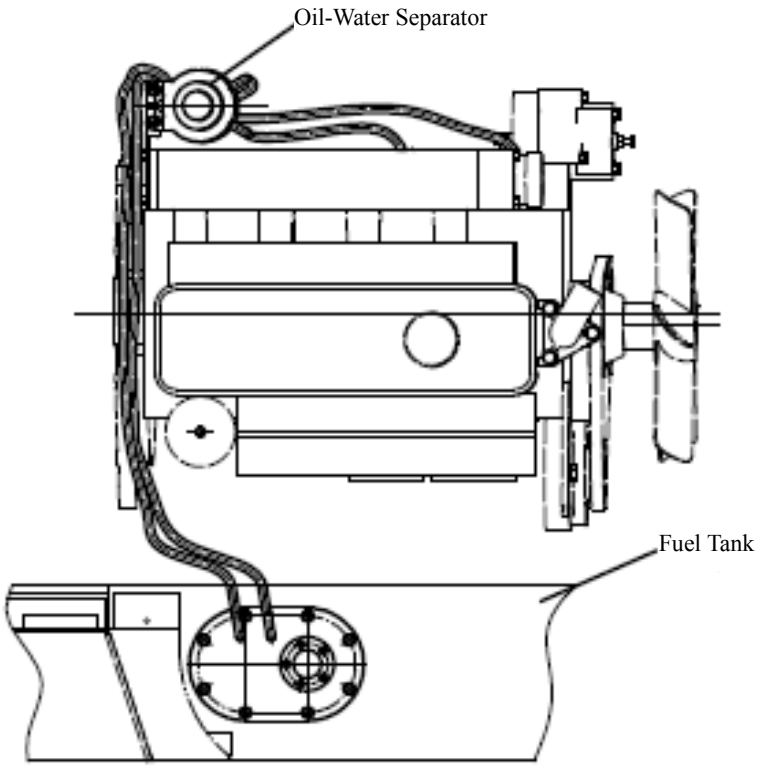


Fig 1-3 Fuel Tank (Diesel Forklift Truck)

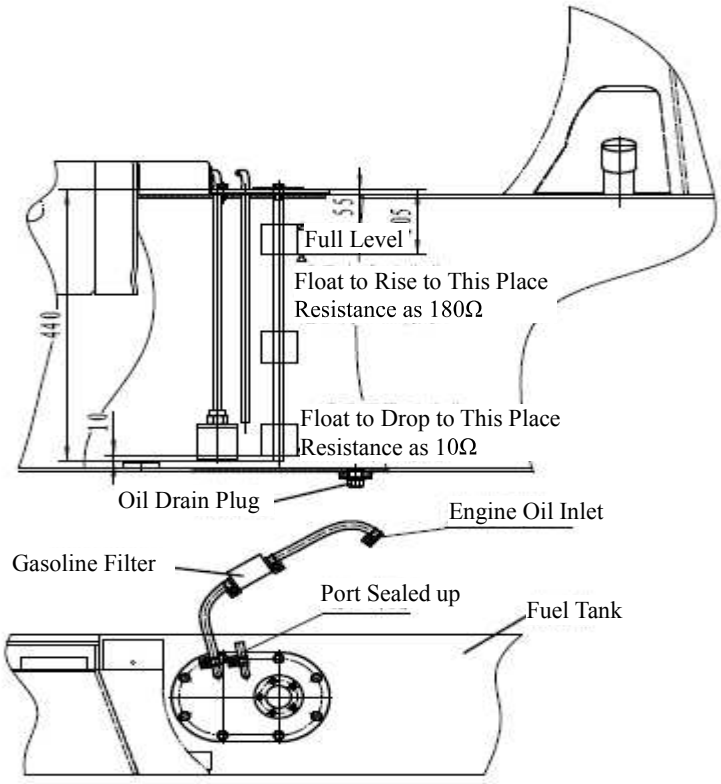


Fig 1-4 Fuel Tank (LPG/Gasoline Forklift Truck)

1.4.1 Fuel Tank

Fuel tank is an integrated welded structure connected with vehicle chassis into a whole, located on the left side of vehicle chassis. The capacity of fuel tank for 1-2.5t is 52L, 60L for 3-3.5t forklift trucks, and the fuel quantity sensor is fitted on the tank cover of fuel tank to detect the fuel level.

1.4.2 Fuel Quantity Sensor

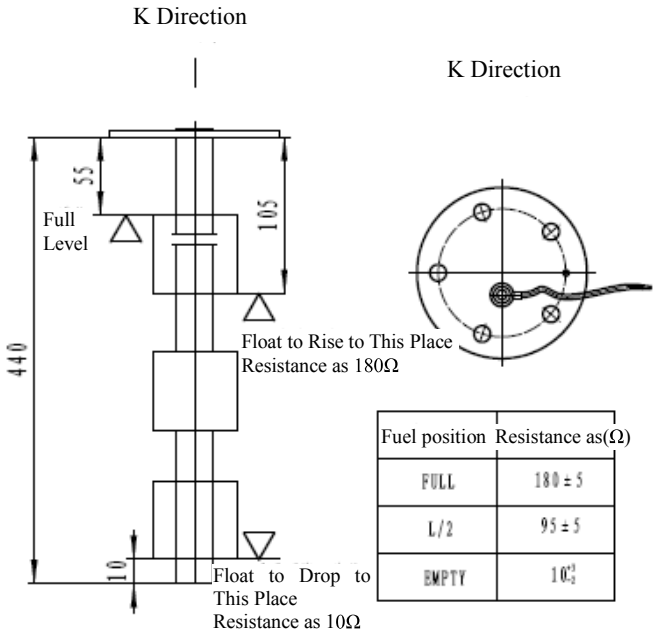


Fig 1-5 Fuel Quantity Sensor

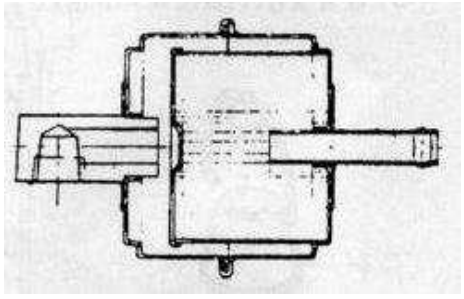


Fig 1-6 LPG/Gasoline Filter
(Specially Available for LPG/Gasoline Engines)

The fuel quantity sensor is used to convert the remaining fuel quantity in fuel tank into voltage, and refer to Fig 1-5. The value of resistance will change, when float moves upward and downward, by making use of alloy steel wire to be fabricated into slide resistance connected with float, and the storage fuel quantity inside fuel tank can be read out from the instrument panel through electromagnetic fuel gauge.

1.4.3 Maintenance of Fuel System

The fuel system is to be maintained and serviced once for every work of 100 hours with the following method, and the fuel tank shall be cleaned once for every work of 600 hours.

(1) Fuel Filter

Fuel filter is used for remove dust and impurity in fuel, and this fuel filter is located between the fuel tank and the LPG/Gasoline pump (LPG/Gasoline engine) or oil delivery pump and oil injection pump (diesel engine).

Service of fuel filter for LPG/Gasoline engine: (including the two items of A) and B))

A) Fuel Filter I for LPG/Gasoline engine is in a through or cylindrical type and it shall be replaced periodically (namely replacement by years). (Refer to Fig 1-6). It is peculiar, with one grade of fuel filtration increased.

B) Fuel filter for LPG/Gasoline engine (Refer to Fig 1-7.)

a) Take off the oil drain plug (Refer to Fig 1-7) and drain the fuel in gas cup completely.

b) Loosen Nut 1, and detach Filter Core 4.

c) Clean or replace the filter core.

d) After reassembly is completed, start engine for Fuel to be filled into the gas cup of filter. Examine whether or not gas leak exists, and Parts 8 and 5 seal rings may be replaced if leak exists.

(2) Service of Diesel Engine fuel filter

This filter is in cylindrical type, not detachable generally, and it shall be replaced in complete set if required.

a) For every work of 100 hours, dismount the cylindrical shell using special tools, and take out the filter core.

b) For every work of 600 hours, the entire filter shall be replaced.

c) It is required to pay attention to examining as to whether or not fuel leak exists after reassembly.

d) Pay attention to examining the working status of Part 1 overflow valve.

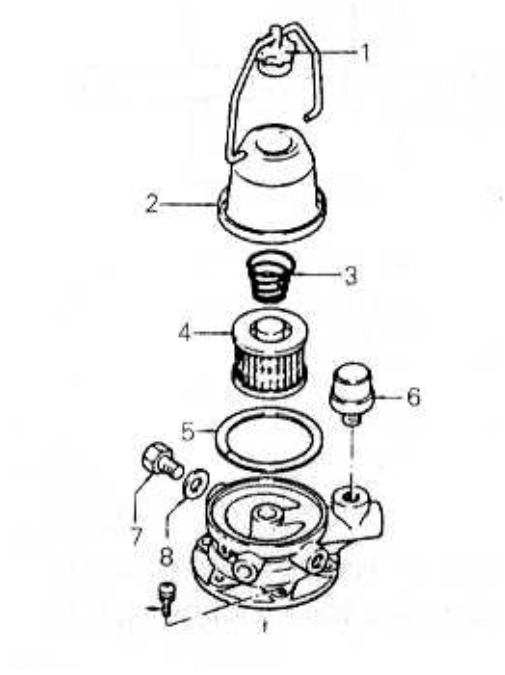


Fig 1-7

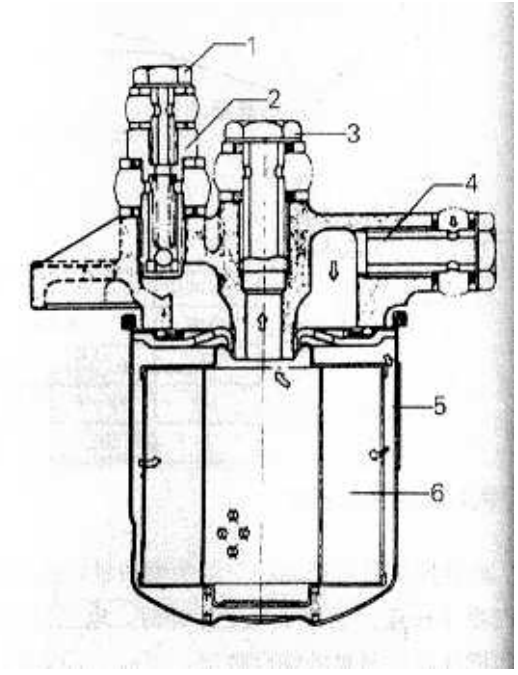


Fig 1-8

(3)Fuel-Water Separator (Sediment Bowl)

As VE oil injection pump is lubricated with fuel internally, water content in fuel must be separated, and therefore sediment bowl is used. If indicator light of fuel-water separator turns on, water shall be drained. (Fig 1-9)

a) Water Drain

Loosen off the fuel drain plug and allow fuel drain plug to drain water manually. Then tighten the fuel drain pump and start the pump for multiple times. It shall be ensured that not fuel leak exists, engine is started, and warning light is turned off. Firmly tighten the fuel drain plug

b) Air Exhaust

Loosen off the air exhaust plug (overflow valve) of oil injection pump, and press the main pump until no air emits. It shall be ensured that no fuel leak exists.

(4) Cleaning of Fuel Tank

The fuel tank is to be cleaned once for every work of 600 hours, and attention shall be paid to fire control for forklift trucks using gasoline engine during cleaning.

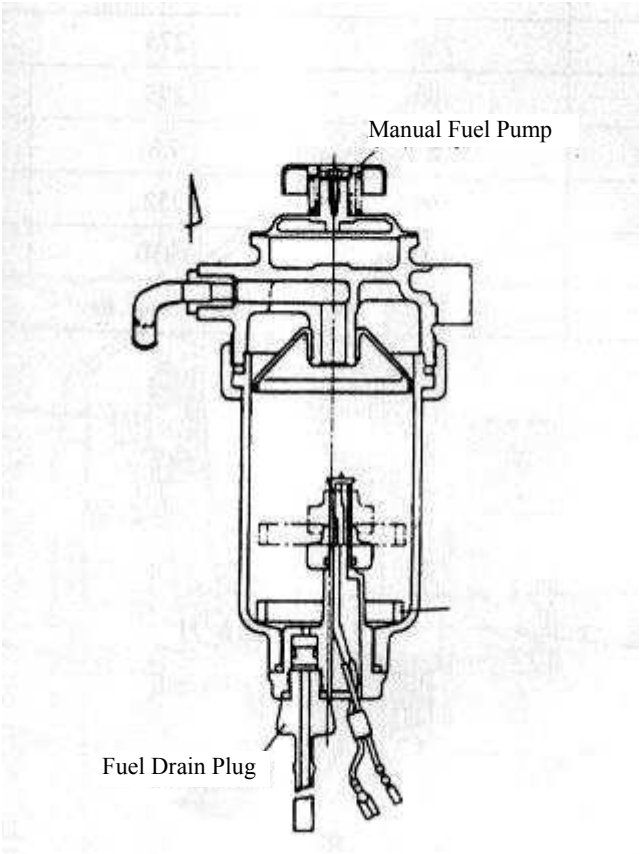


Fig 1-9

2. Clutch and Its Pedal

Parameter \ Truck Model		20/25/30/35L-7SA	20/25/30/35D-7SA
Type		Single Disk Dry Type	
Size of Brake Shoe (mm)	Outer Diameter	275	275
	Inner Diameter	175	180
	Thickness when Compacted	7.8	8.4
Surface Area (cm^2)		352	340
Weight (kg)		About 10	About 10
Operation		Foot Pedal Type	

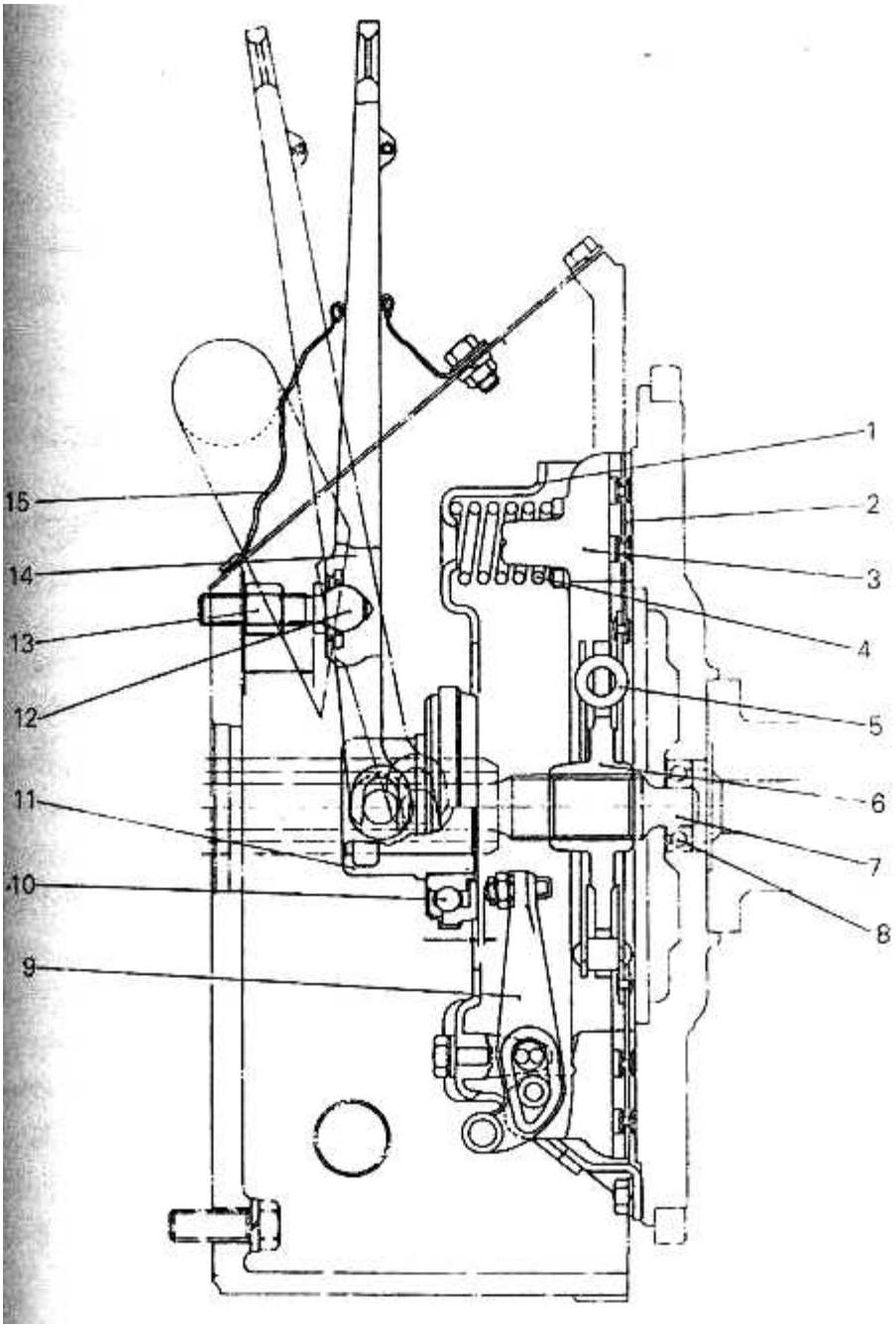


Fig 2-1 Clutch (Used for 2-3.5t LPG/Gasoline Forklift Trucks)

1. Pressure Plate Shell
2. Clutch Brake Shoe
3. Pressure Disc
4. Pressure Spring
5. Damping Disc Spring
6. Disc Hub
7. Driving Shaft
8. Bearing
9. Declutching Lever
10. Clutch Release Bearing
11. Disengaging Bearing Sleeve
12. Support Bolt
13. Nut
14. Release Fork
15. Cover

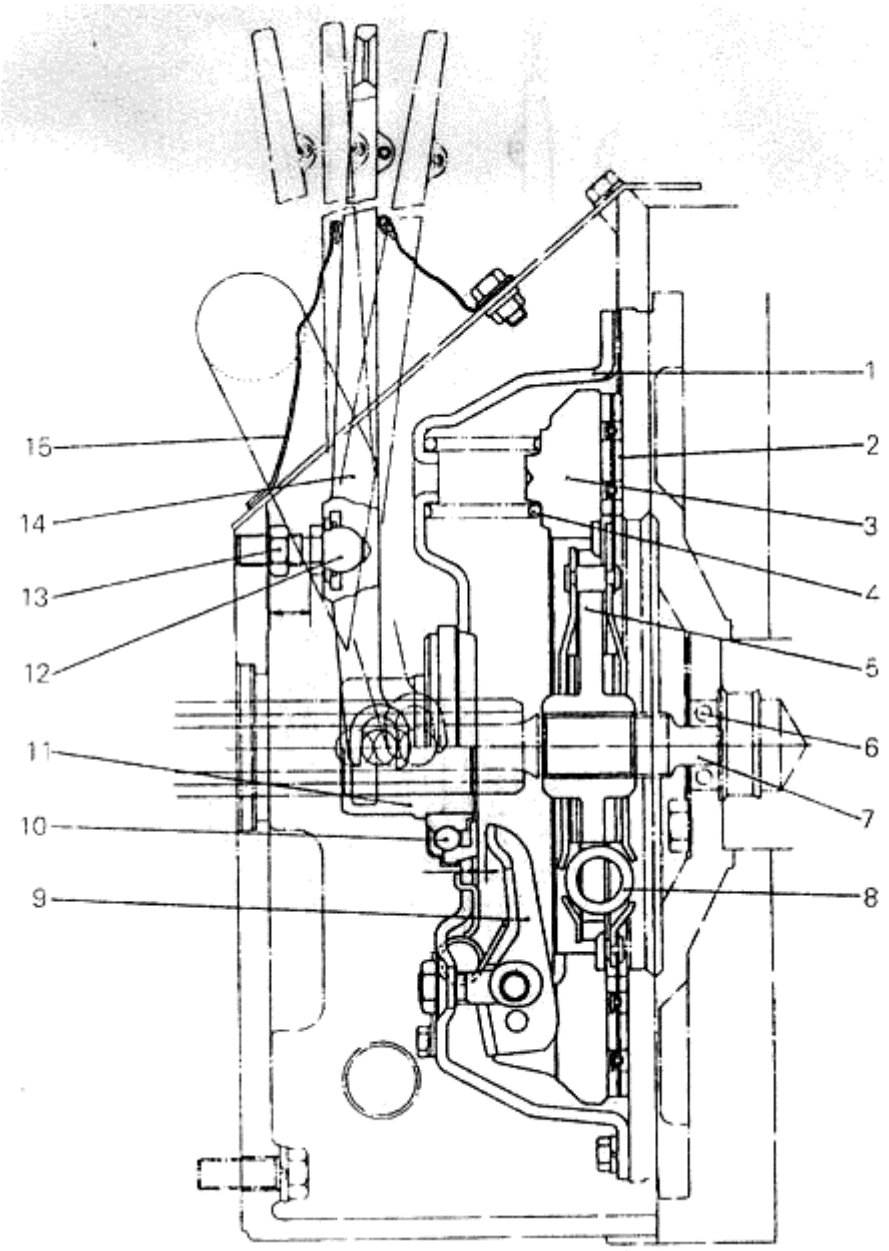


Fig 2-2 Clutch (Used for 2-3.5t Diesel Forklift Trucks)

1. Clutch	5. Disc Hub	9. Declutching Lever	13. Nut
2. Clutch Brake Shoe	6. Bearing	10.Clutch Release Bearing	14. Release Fork
3. Pressure Plate	7. Driving Shaft	11. Disengaging Bearing Sleeve	15. Cover
4. Pressure Spring	8. Damping Disc Spring	12. Lock Nut	

2.1 Overview

Clutch is mainly composed of pressure plate assembly, brake shoe assembly, and release fork. Pressure plate is fixed using bolts on the flywheel of engine. Slight hole is mounted on clutch housing. The clutch pedal allows the normally engaged brake shoe and flywheel to disengage from each other using release fork through link.

The clutches used for LPG/Gasoline forklift trucks and diesel forklift trucks are respectively indicated in Figs 2-1, 2-2.

2.2 Method for Replacement of Brake Shoe Assembly

2.2.1 Push down the clutch pedal, and use three spacer sleeves between the shell of pressure plate and the release fork to disengage the brake shoe.

2.2.2 Turn the slide screw stem on the upper end of transmission case counterclockwise (Refer to the Fig 3-1 to be followed) for the driving shaft to retreat into the transmission case.

2.2.3 Take off the 6 bolts for the shell of pressure plate, for it to de released from flywheel, and then immediately take out the old brake shoe assembly.

2.2.4 It is required to pay attention to the disc hub of brake shoe, when new brake shoe assembly is to be fitted in (Refer to Part 6 in Fig 2-1 and Part 5 in and 2-2) and the end with relatively long extension of spline sleeve shall face the side of transmission case.

2.2.5 Turn the slide screw stem clockwise, and pull out the driving shaft gradually, for it to be inserted into the spline hole of disc hub for brake shoe.

2.2.6 Once it is determined that the driving shaft has entered into the middle bearing of flywheel, it is then to lock up the slide screw stem, with a tightening torque as 107-119N.m (10.9-12.1kgm).

2.2.7 Mount the shell of pressure plate on flywheel.

2.2.8 Step on the clutch pedal, and take off the three spacer sleeves.

2.2.9 Adjust the stroke of clutch pedal (Refer to Fig 2-1).

2.3 Clutch Pedal

Clutch pedal and brake pedal are mounted on the same bracket, and fixed on the drive device.

2.4 Adjustment for Stroke of Clutch Pedal (Refer to Fig 2-1.)

2.4.1 Loosen the limit bolt for clutch pedal.

2.4.2 Use limit bolt (a) to adjust the height of pedal to: 113mm for 2-3.5t LPG/Gasoline forklift trucks and 111mm for diesel forklift trucks, with an idle stroke as 3 - 40mm.

2.4.3 Remove the tension spring on one end of clutch pedal, and loosen the nut (b).

2.4.4 Push down the clutch pedal by about 3-40mm, and at this point, pull forward the release fork. When hand feels resistance, tighten the spherical nut (b) until it gets into contact with release fork, and tighten up the nut (c).

2.4.5 Mount the pedal tension spring properly.

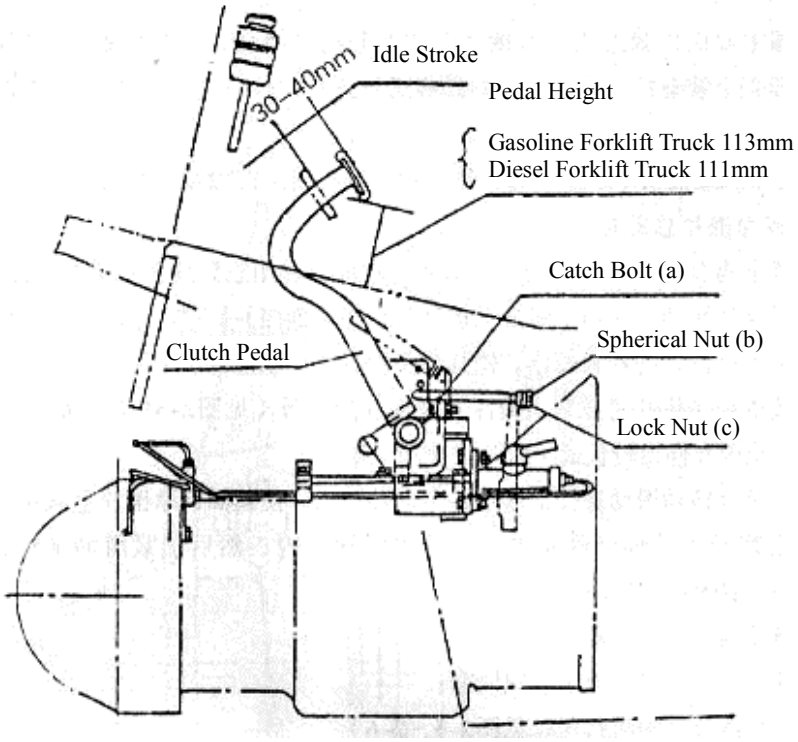


Fig 2-3 Clutch Pedal (2t-3.5t)

3. Hydraulic Transmission Case and Torque Converter

Torque Converter		
Type		Three-Element, Single-Stage, and Two-Phase Type
Torque Ratio		3
Adjusting Pressure		0.5-0.68MPa
Oil Feed Pump		
Type		Internal-Meshing Gear Type
Flow Rate		27 l/min(2000rpm,1.5MPa)
Hydraulic Transmission Case		
Type		Power Gear Shift
Speed Ratio	Forward	1.35
	Backward	1.35
Hydraulic Clutch		
Brake Shoe Outer Diameter × Inner Diameter × Thickness		125×81×2.7mm
Brake Shoe Frictional Surface Area		71cm^2
Adjusting Pressure		1.1-1.4MPa
Weight		165kg
Oil Capacity		7 L
Type of Oils Used		6# Hydraulic Transmission Oil

3.1 Overview

The hydraulic transmission forklift truck is mounted with the driving device composed of torque converter and power gear-shift transmission case (Refer to Fig 3-1), typical of undermentioned advantages:

(1) Inching valve is able to allow the forklift truck to be able for inching operations both at high speed and low speed of engine.

(2) The hydraulic clutch is equipped with four pairs of paper brake shoes and steel plates that have been specially treated, which has improved the resistance to wear of its friction pair.

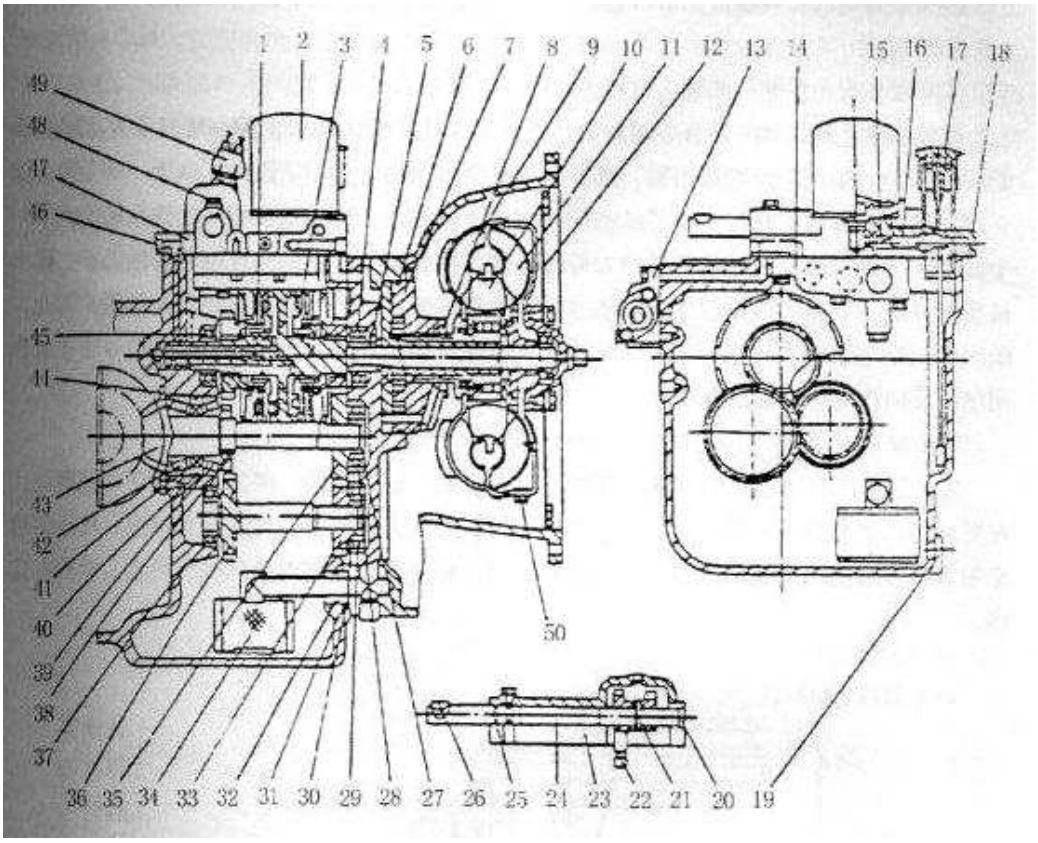


Fig 3-1 Hydraulic Transmission Device

1. Forward Clutch
2. Oil Filter (II)
3. Backward Clutch
4. Single Row Radial Ball Bearing
5. Seal Ring (A)
6. O-Ring
7. Oil Feed Pump Assembly
8. Oil Seal
9. Pump Impeller
10. Guide Wheel
11. Turbine
12. Elastic Plate Assembly
13. Inching Valve Assembly
14. ControlValve Assembly
15. Piston
16. Spring
17. Oil Filler Port Cap
18. Safety Valve Cover
19. Hexagonal Socket Head Plug
20. Plug
21. Elastic Cylindrical Pin
22. Transmission Arm
23. Shell Cover
24. Transmission Arm Shaft
25. O-Ring
26. Woodruff Key
27. Hole Elastic Snap Ring
28. Single Row Radial Ball Bearing
29. Single Row Radial Ball Bearing
30. O-Ring
31. Retainer Ring
32. O-Ring
33. Idler Wheel
34. Oil Filer I
35. Output Gear
36. Idler Wheel Shaft
37. Single Row Radial Ball Bearing
38. Bearing Nut
39. Single Row Tapered Roller Bearing
40. O-Ring
41. Oil Seal
42. Single Row Tapered Roller Bearing
43. Output Shaft
44. Supporting Plate
45. Single Row Radial Ball Bearing
46. Hexagonal Socket Head Plug
47. Shell Cover
48. Fixed Bolt
49. Reversing Light Switch

(3) The one-way over running clutch mounted in torque converter has changed the power transmission efficiency.

(4) Relatively satisfactory filter is available in the oil circuit of torque converter, which has enhanced the service life of the torque converter.

3.2 Torque Converter

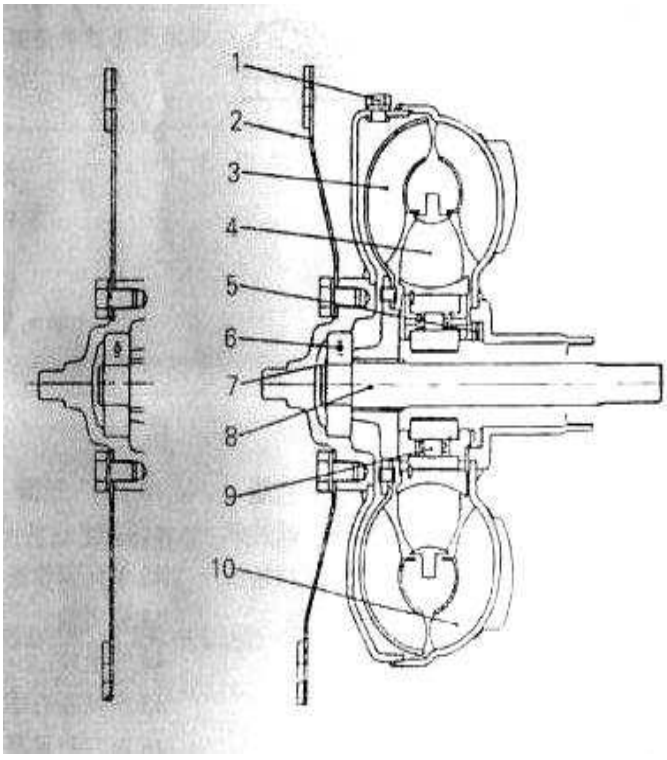
Torque converter is mainly composed of three elements including pump impeller, turbine, and guide pulley.

Pump impeller is driven by input shaft. The liquid is vigorously sprayed onto the blades of turbine along the the pump impeller blades under the action of centrifugal force (at this point the mechanical energy is transformed into kinetic energy.), for torque to be transmitted to output shaft. The liquid leaving from the turbine changes the direction under the effect of guide pulley, thus for a part of liquid to flow back to the pump impeller at certain angle, to generate a reactive torque to push the guide pulley at this point, so as to allow the output torque to have a value larger by one reactive torque compared with input torque. Finally, the liquid flows into the blades of guide pulley in a reverse direction, for the original reactive torque to act reversely. On this account, the torque of output shaft is smaller than that of the input shaft. To prevent such situation, the overrunning clutch mounted inside the guide pulley allows the guide pulley to be able for free rotation, when reactive torque acts reversely.

This kind of torque conversion method is able to ensure a high-efficient and steady operation.

The part of the torque converter for the transmission device is connected with the flywheel of engine through elastic plate, and turns along with the rotation of engine, with oil for torque converter to be filled up inside the torque converter. The driving gear is connected with pump impeller using two claws, to actuate oil feed pump, to feed the oil to the torque converted and the hydraulic shifting transmission case. The turbine is connected onto the turbine shaft using spline, and the power is transmitted to power gear-shift transmission case through turbine shaft.

1. Air Displacement
2. Elastic Plate
3. Turbine
4. Guide Pulley
5. Thrust Bearing
6. Ball Bearing
7. Retainer Ring
8. Turbo Shaft
9. One-way Clutch
10. Pump Impeller



C240 Diesel Engine LPG/Gasoline Engine

Fig 3-2 Torque Converter

3.3 Hydraulic Clutch (Fig 3-3)

Wet multi-disk hydraulic clutch is mounted on the input shift of hydraulic transmission case, to distribute pressure oil to forward or backward clutch through control valve, to achieve forward and backward gear shift. All the gears in transmission case are normally engaged gears. Each clutch is composed of alternately assembled four spacers (Part 24) and four brake shoes (Part 25) as well as one piston. Both internal circle and external circle are fitted with seal rings, to ensure the sealing performance during work of piston. The piston does not act at neutral gear, and the spacer and the brake shoe are under the separate status. During gear shifting operation, oil pressure acts on the piston, the spacer and the brake shoe are mutually compacted, for form an adapter depending on friction force, so as to transmit the power from torque converted to the driving gear (forward gear 4 or reversing gear 13).

The power transmission procedure from torque converter to hydraulic transmission case is as follows:

Turbine ⟶ Input Shaft Assembly⟶ Spacer ⟶ Brake Shoe ⟶ Forward Gear or Reversing Gear ⟶ Output Shaft

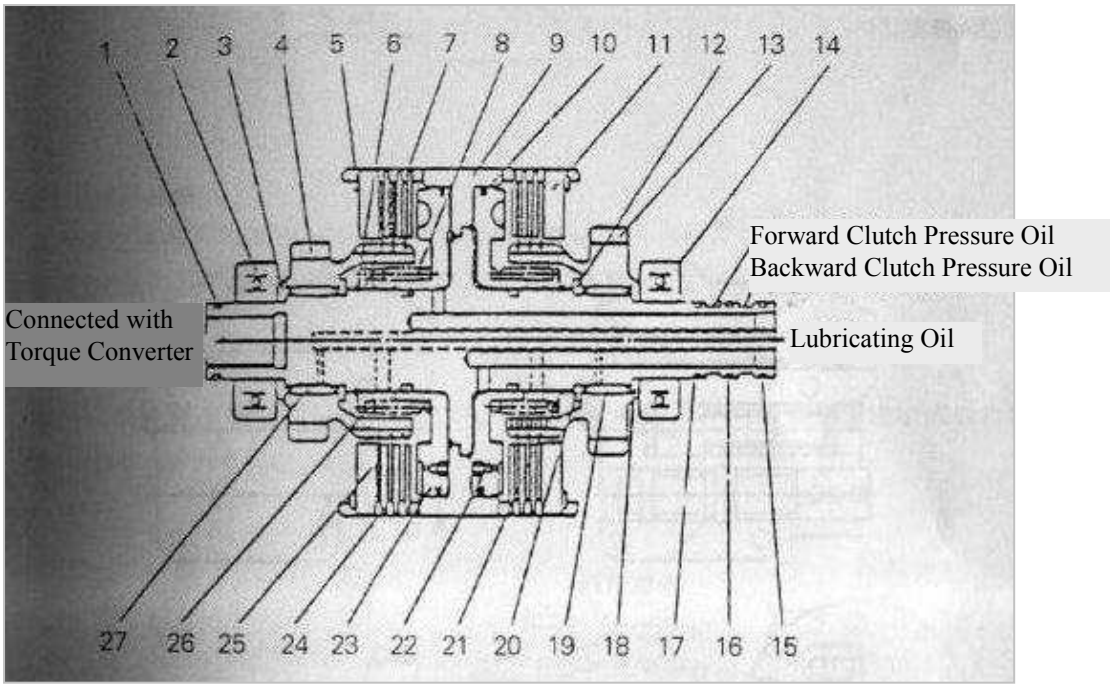


Fig 3-3 Hydraulic Clutch

1. Seal Ring (A)	8. O-Ring	15. Seal Ring (A)	22. Check Ball
2. Bearing	9. Input Shaft Assembly	16. Seal Ring (A)	23. Piston Assembly
3. Thrust Collar (B)	10. Seal Ring (B)	17. Seal Ring (A)	24. Spacer
4. Forward Gear	11. End Plate	18. Thrust Collar (B)	25. Brake Shoe
5. Snap Ring	12. Shaft Collar (A)	19. Needle Roller Bearing	26. Return Spring
6. Elastic Collar	13. Reverse Gear	20. Shaft Collar (A)	27. Needle Roller Bearing
7. Spring Seat	14. Bearing	21. Elastic collar	

3.4 Control Valve, Safety Valve, and Inching Valve

3.4.1 Control valve is mounted on the inner side of transmission case cover, and the control valve includes three parts such as control spool valve, constant pressure valve, and adjusting valve. (Fig 3-4)

3.4.2 Constant Pressure Valve: It is used to control the oil pressure of hydraulic clutch between 1.1 - 1.4MPa, and send the oil content through it to overflow valve to be transmitted to torque converter.

3.4.3 Adjuster: It is located between inching valve and control spool valve. When control spool valve is fully opened, this valve will work, to reduce the impact of clutch during engagement.

3.4.4 Overflow Valve: The overflow valve connected together with transmission case allows the oil pressure of torque converter to maintain between 0.5-0.7MPa.

3.4.5 Inching Valve: Inching valve is installed on the outer side of transmission case. The winding shaft of valve is connected onto the link for inching pedal. This winding shaft will move rightwards, when inching pedal is pushed down, which has reduced the oil pressure of hydraulic clutch for a short time, for the forklift truck to achieve the inching effect (Fig 3-5).

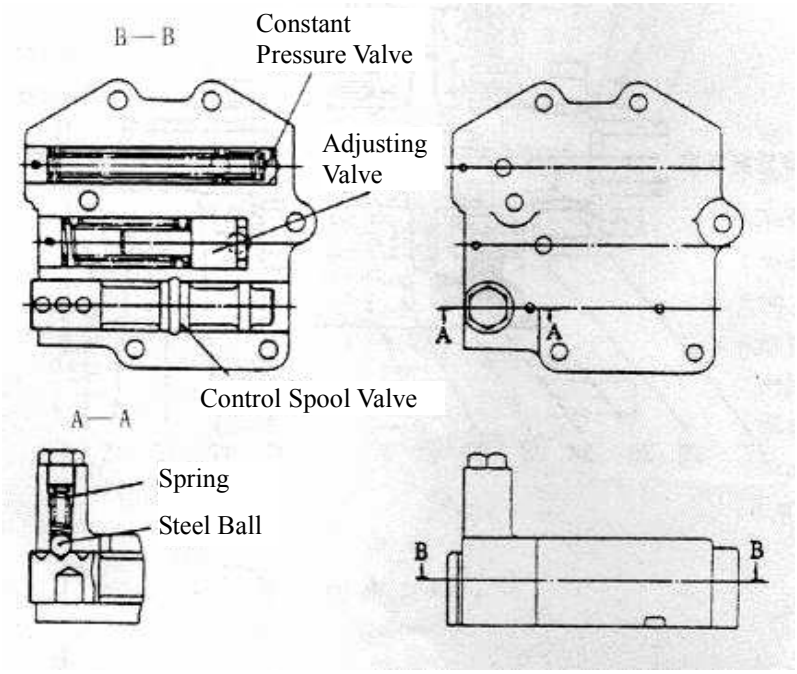


Fig 3-4 Control Valve

1. Spring Collar
2. O-Ring
3. Inching Valve Stem
4. Elastic Collar
5. Spring
6. Valve Core
7. Winding Shaft
8. Valve Body
9. Spring
10. O-Ring
11. Cover
12. Oil Seal

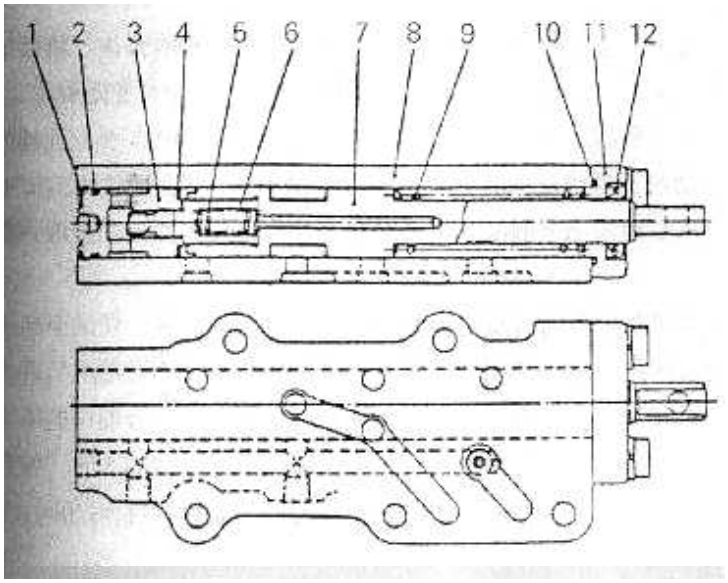


Fig 3-5 Inching Valve

3.5 Transmission Case

Except for installation of input shaft, output shaft, and other mechanisms, the transmission itself also plays the function of oil tank. An oil filter I (of 150 mesh screen) is available on the bottom part of the case to filter the oil sucked into oil feed pump, while the pipe line filter II, oil filler cap, and oil tappet are mounted in the upper part of case cover.

3.6 Oil Feed Pump

Oil fee pump is installed between the torque converter and the input shaft, to feed oil to torque converter and hydraulic transmission case, by actuating one pair of gear pumps composed of internal engaged gears through pump impeller.

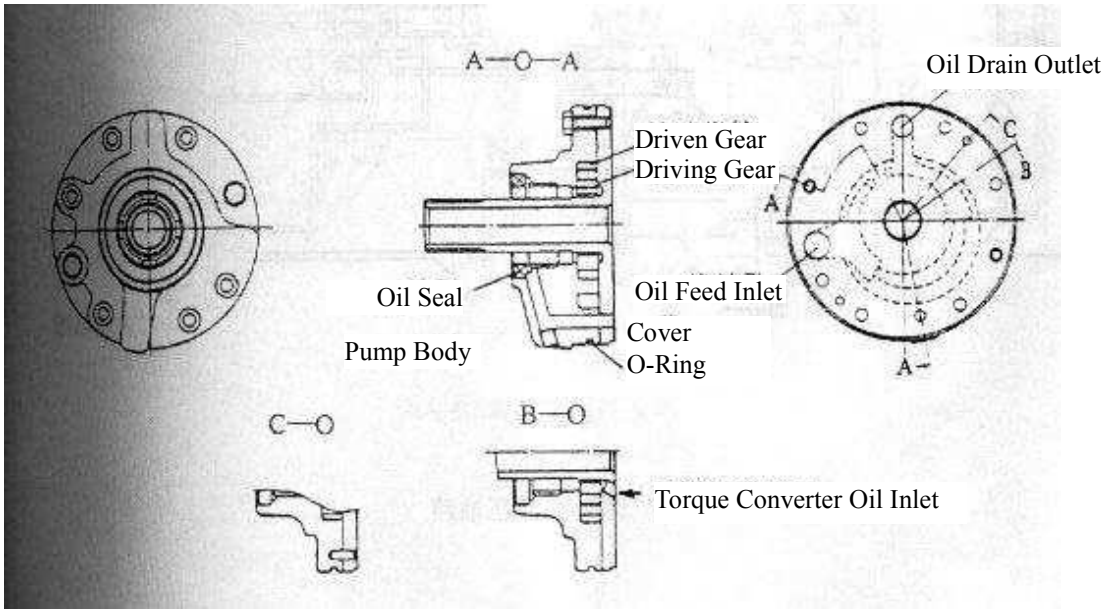


Fig 3-6 Oil Feed Pump

3.7 Hydraulic Oil Circuit (Hydraulic Transmission) Fig 3-7

After engine is started, the oil feed pump sucks out oil from the oil tank (namely the bottom of transmission case) through oil filler that flows through control valve, and the pressure oil is divided into two parts in valve, one part to be fed and used by hydraulic clutch, and the other part to be fed to torque converter.

The oil necessary for operation of hydraulic clutch flows into the constant pressure valve (the pressure of this valve to be adjusted to 1.1-1.4MPa). The oil from the constant pressure valve further flows to inching valve and control spool valve on one hand, and is fed into the impeller of torque converter on another (pressure to be adjusted to 0.5-0.5MPa). The oil from torque converter is cooled down through oil heat radiator, then lubricates the hydraulic clutch, and returns to oil tank afterwards.

At the time of neutral gear, the oil circuit from control spool valve to clutch is closed. At this point, the constant pressure valve is turned on, for all the oil to pass the overflow valve transmitted to torque converter. When control spool valve is at forward or backward position, the oil circuit from spool valve to forward or backward clutch is connected for respective clutches to take separate actions. When one clutch is taking action, the spacer and the brake shoe of another clutch are under separate status, and lubricated by cooling oil and with heat taken away. When inching pedal operates inching valve, one part or most of oil into clutch is drained to oil tank through inching valve lever, and at this point the circulation for the oil circuit of torque converter is the same as it is at the neutral gear.

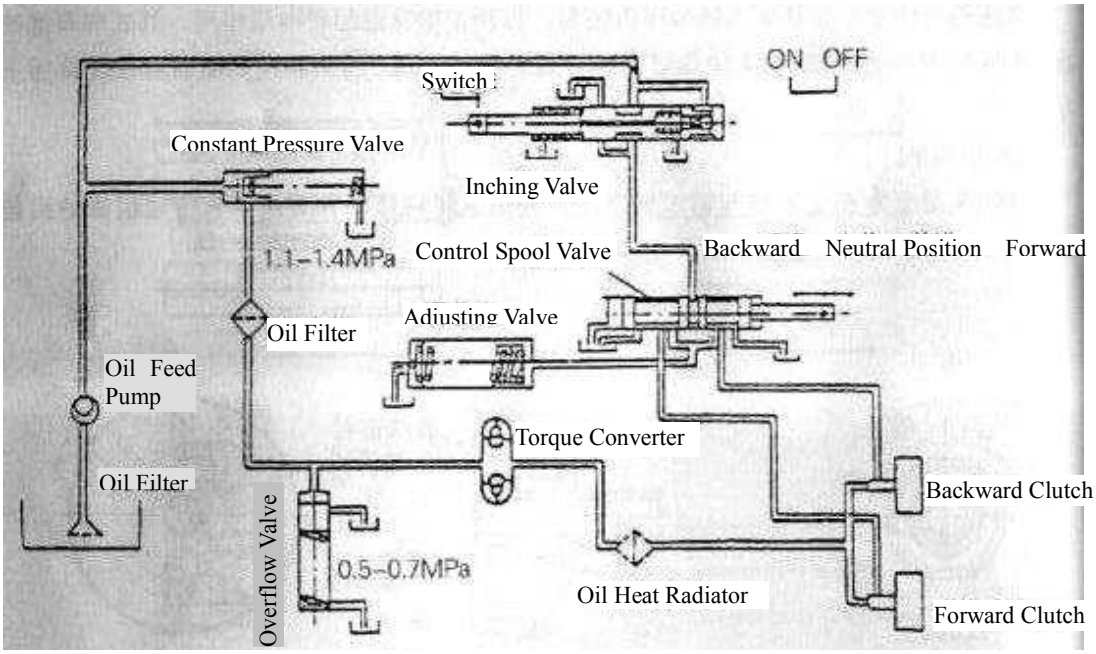


Fig 3-7 Hydraulic Oil Circuit

3.8 Speed Reducer and Speed Differential (Fig 3-8)

The part of speed reducer is located on the front part of transmission case. This mechanism has reduced the rotating speed of output shaft from transmission case and increased the torque transmitted from the output shaft, and then sends this torque to the speed differential. The speed reducer is mainly composed of the small spiral bevel gear on the output shaft, one large spiral bevel gear, and one small gear shaft. The large spiral bevel gear is mounted on the small gear shaft through spline, while the two ends of small gear shaft are both supported with tapered roller bearing, and filled with gasket to adjust the side clearance.

Speed differential is mounted on the front half shell using bearing seat through ball bearings on the two ends, and the front end is connected with axle shell. The shell of speed differential is made into a type of left and right parts, with two half shaft gears and four planetary gears. The thrust washer is mounted between the shell of speed differential and gear and it is allowed for a clearance to be retained between respective gear pairs. The planetary gears are supported using gear shafts I and II, while gear shaft I is fastened onto the body of speed differential using cylindrical pink, and gear ring I is fixed onto the shell of speed differential using articulated bolts.

The power from transmission is generated into differential speed by speed differential through speed reduction transmitted onto the wheels through half shaft gear and half shaft.

3.9 Traction of Forklift Truck to be repaired

Attention shall be paid after the hydraulic transmission forklift track is damaged, and when traction by other vehicles is required:

（1） The half shaft shall be taken off from the front wheel.

（2） The gear-shift lever shall be placed at neutral position.

3.10 Oil Port Joint Positions (Refer to 3-8)

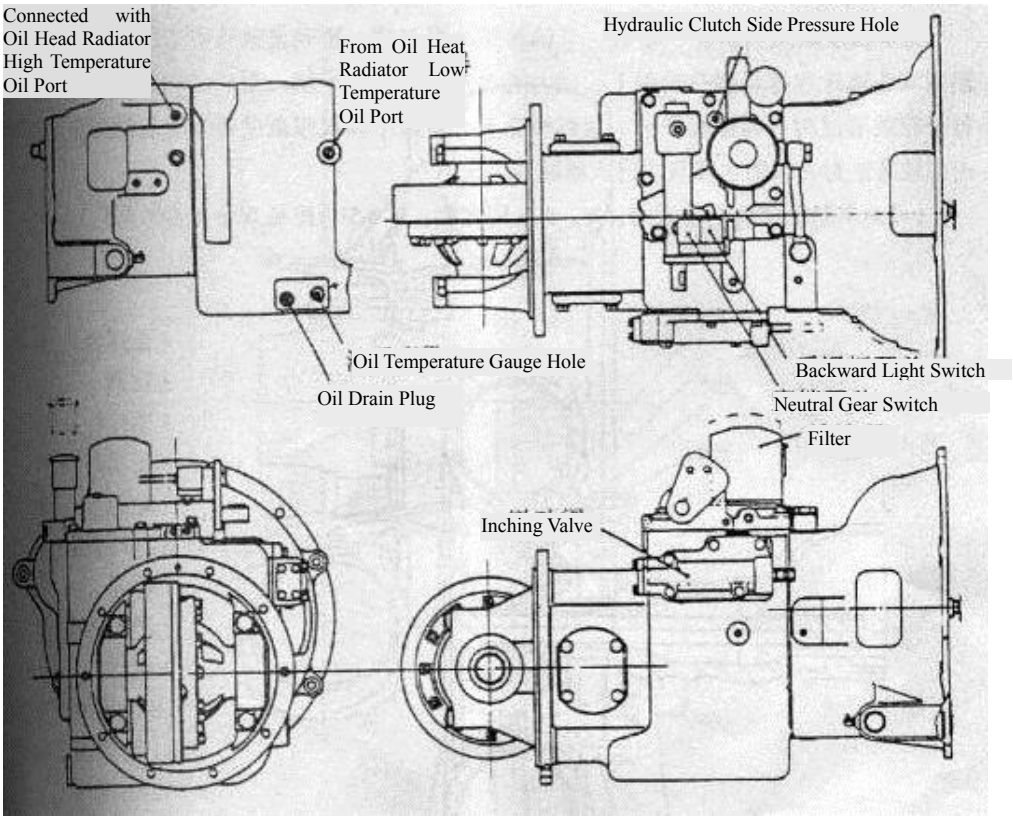


Fig 3-8 Speed Reducer and Speed Differential

4. Drive Axle

4.1 Overview

Type	Front Wheel Drive, Axle Body Fixed with Vehicle Chassis, and Fully Floating Type			
Forklift Truck Tonnage	2t and 2.5t		3t and 3.5t	
	Single Tyre	Double Tyre	Single Tyre	Double Tyre
Tyre Size	2×7.00-12-12 PR	4×7.00-12-12 PR	2×28×9-15-14 PR	4×28×9-15-14 PR
Rim Size	5.00S-12	5.00S-12	7.00T-15	7.00T-15
Tire Pressure	860 MPa		970 MPa	

Drive axel is mainly composed of axle housing, wheel hub, half shaft, and brake. The axle housing is in an integrated cast structure. The tire is prized on wheel hub through wheel rim using stub bolt and nut. The power is transmitted to half shaft through speed differential, and finally the front wheel is actuated by wheel hub for rotation. Each wheel hub is mounted on axle housing through two tapered roller bearings, so the half shaft only bears the torque transmitted by wheel hut. Oil seal is fitted inside the wheel hub, to prevent entry of water and dust, or oil leak.

1-2.5t the wheel rim for single tire is in partial type, with wide tire used for 3t and 4t, while 2-4t forklift trucks may be equipped with double tire (Refer to Fig 4-2.).

1. Conical Nut
2. Wheel Rim
3. Bolt Stud
4. Brake Drum
5. Wheel Hub
6. Brake Cylinder
7. Axle Housing
8. Oil Seal Retainer Ring
9. Oil Seal
10. Tapered Roller Bearing
11. Tapered Roller Bearing
12. Round Nut
13. Half Shaft

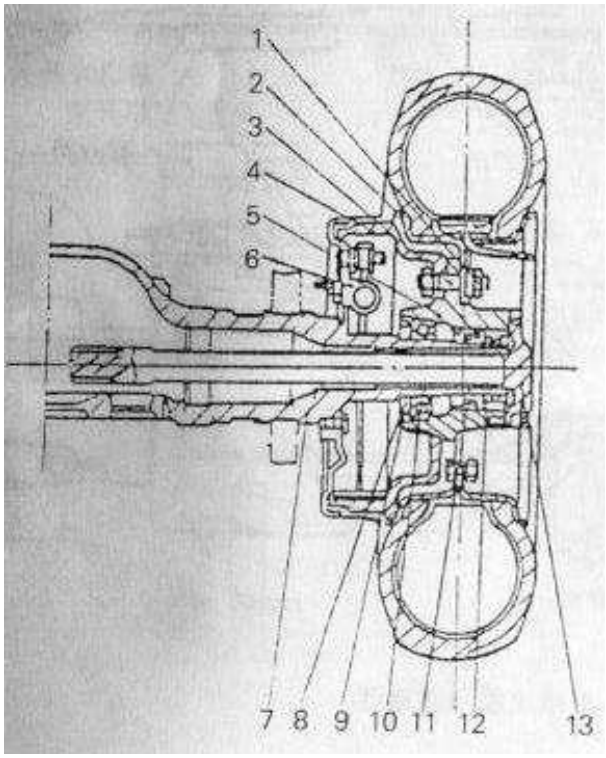


Fig 4-1 Drive Axle

4.2 Maintenance of Drive Axle

The wheel hut of drive axle shall be reassembled according to the following procedure:

（1）Coat lubricating grease on the tapered roller bearing.

（2）When the lock nuts for tapered roller bearing inside the wheel hub is tightened, attention shall be paid that the rotating torque of wheel hub is 9.8-29.4N.m(1-3kg.m) after tightening (or return by about 1/8 circles after tightening, for wheel hub to be able to rotate freely).

（3）Tighten the half shaft mounting nut and its torque is 96-111N.m(9.8-11.3kg.m).

（4）Tighten the wheel mounting nut and its torque is 470-550N.m for 2-3.5t.

（5）Tighten the brake drum mounting nut and its torque is 206-225N for 2-3.5t.

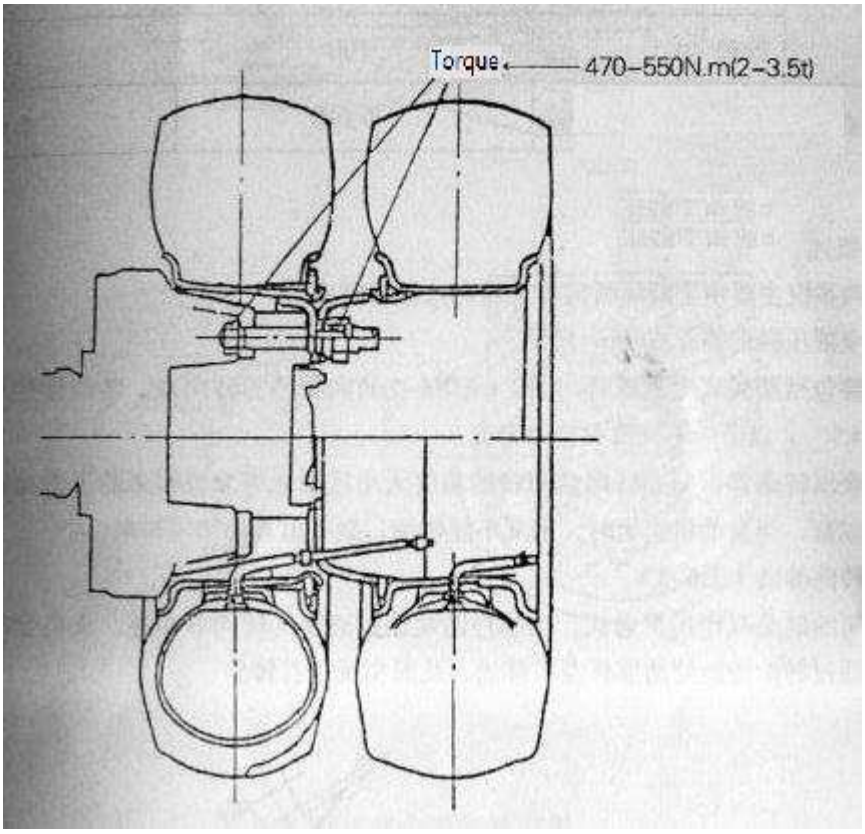


Fig 4-2

5. Steering System

Type of Steering System		Rear Wheel Steering with Power Steering
Power Steering		
Forklift Truck Tonnage		2t, 2.5t, 3t, 3.5t
Cycloid Full Hydraulic Steering Gear		BZZ1-E125BA
Steering Cylinder	Cylinder Diameter mm	Φ70
	Diameter of Piston Rod mm	Φ50
	Stroke mm	198
Diameter of Steering Wheel mm		Φ300

5.1 Overview

Steering system is mainly composed of fully hydraulic steering gear, and steering cylinder.

(1)Fully Hydraulic Steering Gear Assembly (Fig 5-1)

It mainly includes cycloid fully hydraulic gear, (Refer to Fig 5-2), steering column, and steering wheel. The steering column and the steering wheel are able for forward and backward rotation by 4.5˚, to adapt to driver's different needs.

Fully hydraulic steering gear is able to transmit the pressure oil from bypass valve to steering cylinder through pipeline according to the size measurement for the rotation of steering wheel. When engine is turned off, oil pump cannot feed oil, and then steering may be achieved manually.

(2)Steering Cylinder (Fig 5-3)

Steering cylinder is in dual-action through type. The two ends of piston rod are connected with steering knuckle through link. Pressure oil from fully hydraulic steering gear enables the piston rod to move leftward or rightward through steering cylinder, thus to achieve leftward or rightward steering.

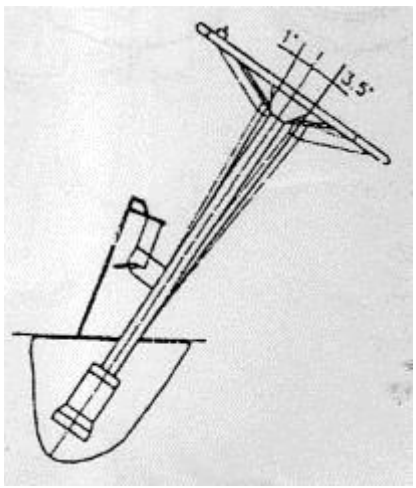


Fig 5-1

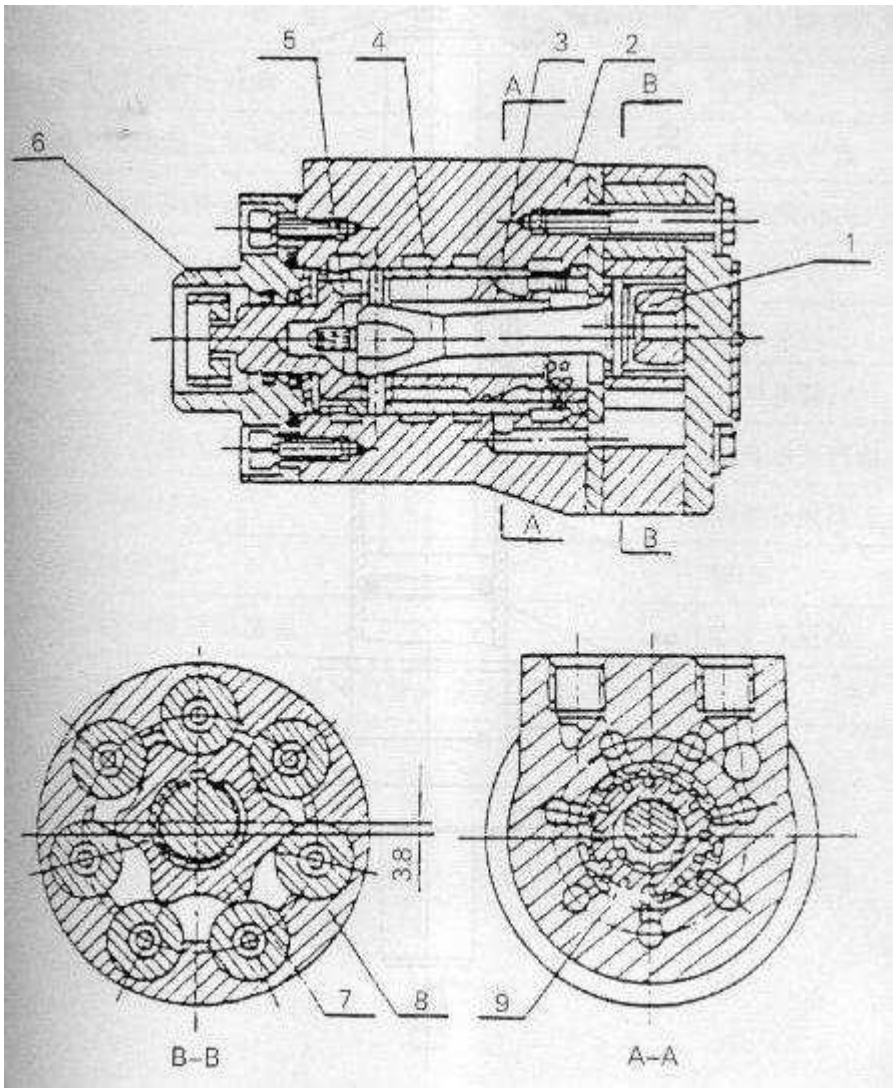


Fig 5-2 Cycloid Fully Hydraulic Steering Gear

1. Limit Post
2. Valve Body
3. Valve Core
4. Universal Driving Shaft
5. Leaf Spring
6. Connecting Block
7. Rotor
8. Stator
9. Valve Sleeve

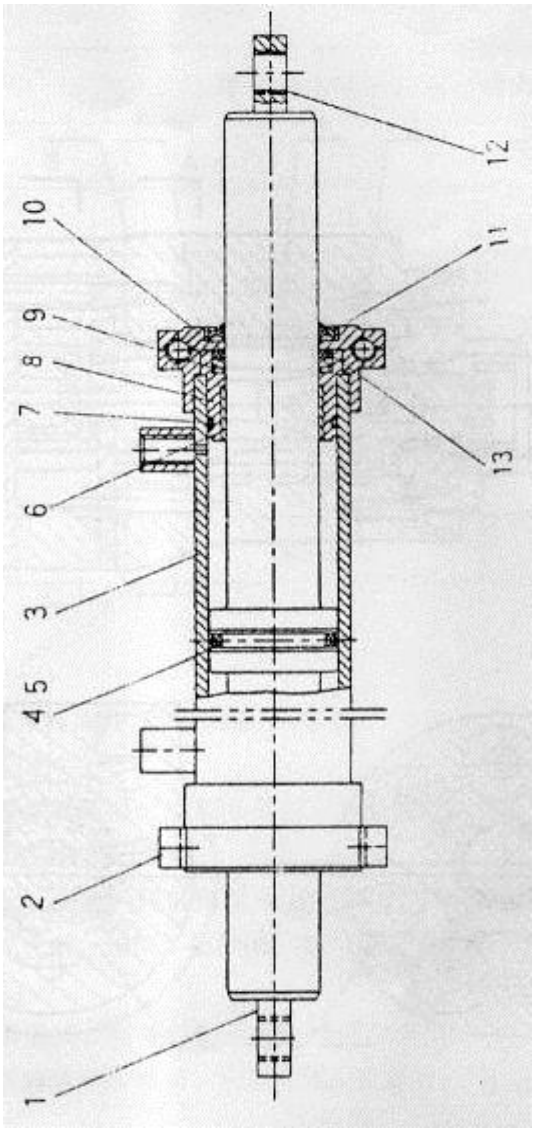


Fig 5-3 Steering Cylinder

1. Piston Body	6. Shaft Sleeve	11. Dust Ring
2. Cylinder Cover	7. O-Ring	12. Lining
3. Cylinder Body	8. Shaft Sleeve	13. Block Film
4. O-Ring	9. YX Seal Ring	
5. Wear Ring	10. Gasket	

5.2 Examination after Reassembly of Steering System

(1) Turn the steering wheel leftward and rightward thoroughly to see whether or not left and right force application are uniform, and whether or not rotation is steady.

(2) Examine whether or not oil pressure pipeline is correctly arranged, and whether or not the left and right steering are reversely assembled.

(3) Jack up the rear wheels, and slowly turn the steering wheel leftward and rightward. Repeat it for several times, and remove the air in the hydraulic pipeline and the cylinder.

5.3 Failure Removal for Steering System

Problem	Analysis Cause of Generation	Removal Method
Steering Wheel Fixed	Oil pump damaged or out of action	To be replaced
	Bypass valve blocked or damaged	To be cleaned or replaced
	Rubber hose joint damaged or pipeline blocked.	To be replaced or cleaned
Steering Operation Toilsome	Bypass valve pressure too low	Pressure to be adjusted
	Air present in oil circuit	Air to be removed
	Reset of steering gear out of operation, and positioning leaf spring broken or elasticity insufficient.	Leaf spring to be replaced
	Excessive internal leak of steering cylinder	Sealing of piston to be examined
Forklift Truck Serpentine or Swinging	Excessive steering flow	Flow of bypass valve to be adjusted
Abnormal Noise	Oil tank level low	Oil to be added
	Suction pipe or oil filter blocked	To be cleaned or replaced
Oil Leak	Sealing of steering cylinder guide sleeve damaged or pipe line or joint damaged.	To be replaced

6. Cross Cylinder Drive Axle

Tonnage		2t, 2.5t, 3t, 3.5t,
Type of Axle Body		Supported with Central Supporting Shaft
Steering Angle	Inner Side Wheel	78°
	Outer Side Wheel	54°
King Pin	Center Distance of King Pin	810mm
	Sidewise Inclination Angle	0°
Wheel Camber Angle		1°

Wheel

Tonnage	2-2.5t	3-3.5t
Tyre	2×6.00-9-10 PR	2×6.50-10-10 PR
Wheel Rim	4.00E-9	5.00F-10
Charging Pressure	860KPa	790KPa
Total Weight	About 155kg	

6.1 Overview

Steering axle is in a type of welded structure of a box cross section (Fig 6-1), and it is composed of steering axle body, steering cylinder, link, and steering wheel. Slider-crank mechanism is applied to steering trapezium. The steering knuckle is actuated by cylinder piston rod through link for rotation, for steering wheel to deflect, thus to achieve steering. Steering axle is prized on the tail bracket in the rear part of truck frame using bolts through bearing seas via forward and backward pin shafts, for the axle body is able to swing round the pin shaft. One left and right steering knuckle is available respectively on left and right of steering axle. The rear wheel hub is mounted on the shaft of steering knuckle using two tapered roller bearings. The wheel is prized on the wheel hub through wheel rim. Oil seal is fitted on the inner side of bearing, for lubricating grease to be retained inside the wheel hub and the steering knuckle.

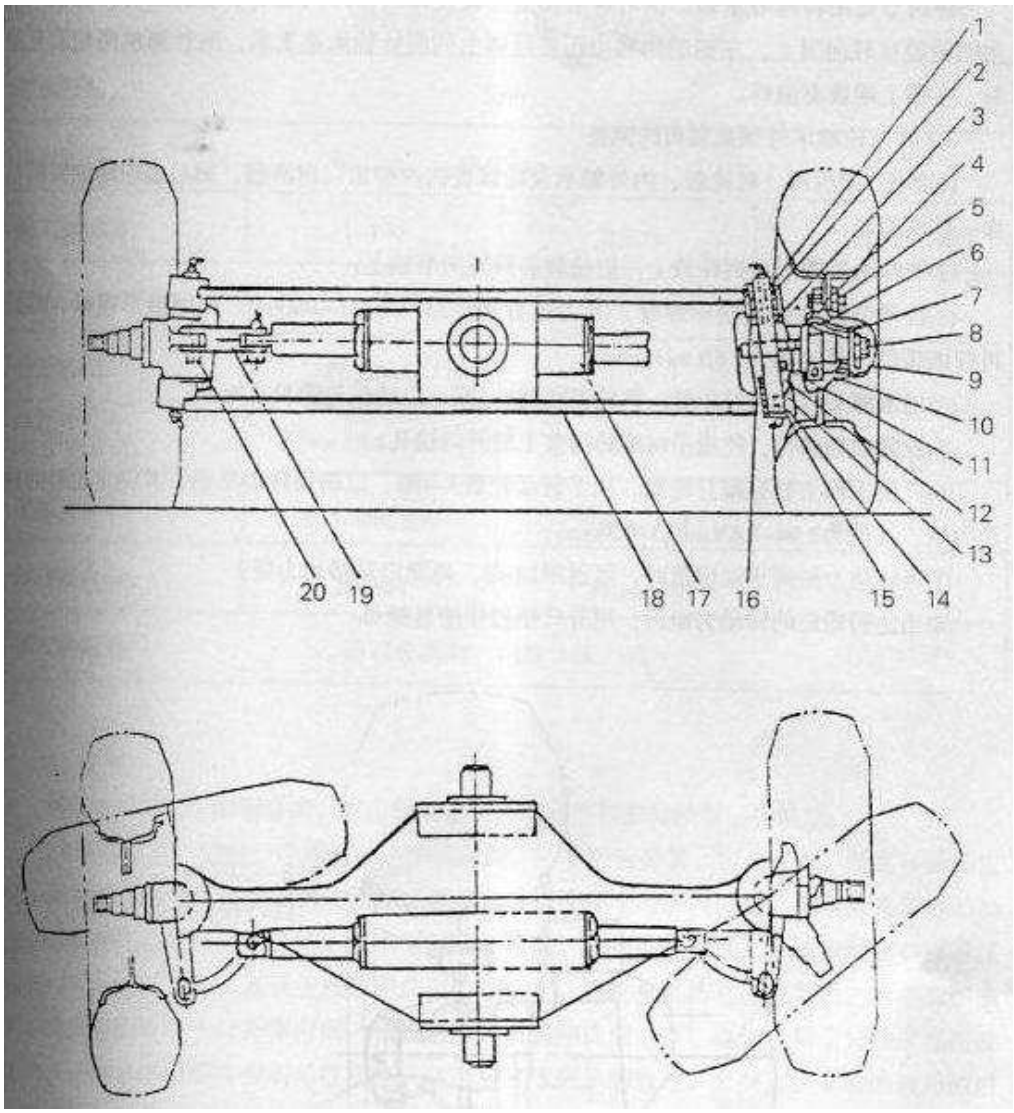


Fig 6-1 Steering Axle

1. Oil Seal
2. Needle Roller Bearing
3. Thrust Bearing
4. Oil Seal
5. Wheel Hub Nut
6. Tapered Roller Bearing
7. Tapered Roller Bearing
8. Lock Nut
9. Wheel Hub Cover
10. Steering Wheel Hub
11. Lock Pin
12. Adjusting Washer
13. Needle Roller Bearing
14. Oil Seal
15. Steering Knuckle King Pin
16. Steering Knuckle
17. Steering Cylinder
18. Steering Axle Body
19. Link
20. Pin Shaft

6.2 Steering Knuckle and Steering King Pin

Steering knuckle is mounted between the upper and lower shaft sleeves on the two ends of steering axle body using steering knuckle king pin, thrust bearing, and gasket. The middle part of king pin is locked on steering knuckle using lock pin, while the two ends of king pin are supported by needle roller bearings pressed on the axle body. Oil seals are mounted on the two ends of needle roller bearings, and oil cup is fitted on the king pin.

6.3 Adjustment for Pre-tightened Load of Steering Wheel Bearing

(1) As indicated in Fig 6-2, the internal cavities of internal and external bearings as well as wheel hub cover are added with lubricating grease, and at the same time some lubricating grease shall also be coated on the lip of oil seal.

(2) Fix the bearing outer ring onto the wheel hub, and mount the wheel hub onto the shaft of steering knuckle.

(3) Mount the flat washer and tighten the slot nut, and its torque is 06-235N.m(21-24kgm). Loosen the slot nut and then tighten this nut, with its torque as 9.8N.m(1kgm).

(4) Knock at the wheel hub gently using wood hammer, turn the wheel hub manually by 3-4 circles, to ensure a steady rotation, and measure the rotating torque, with its value as 2.94-7.8N.m(0.3-0.8kgm).

(7) When rotating torque is higher than the specified value, it may be returned by 1/6 circles, and then measure its rotating torque.

(8) Lock up the slot nut using cotter pin, when specified rotating torque is reached.

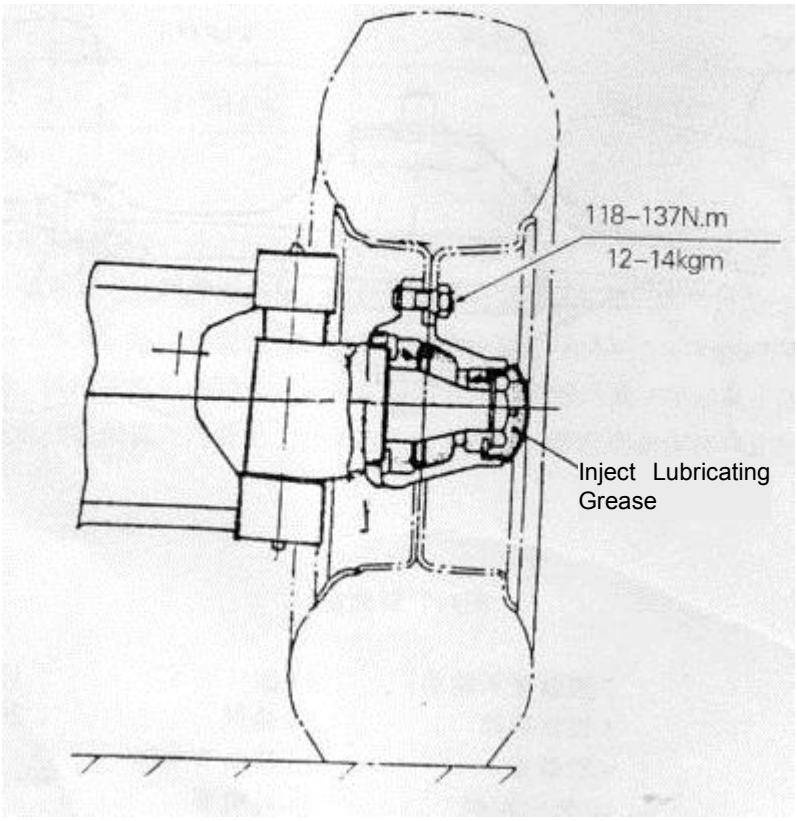


Fig 6-2 Adjustment for Pre-tightened Load

7. Brake System

Type	Front Twin Wheel Brake, Internal Expansion, Hydraulic	
Pedal Lever Ratio	5.66	
Master Cylinder Diameter	19.05mm	
Wheel Brake	2-2.5t	3-3.5t
Type	Dual Servo Type with Parking Brake	
Wheel Cylinder Diameter	28.58	
Size of Brake Shoe (L X W X T)	324×60×7mm	348×76×8mm
Area of Brake Shoe	194.4 cm^2×4	264 cm^2×4
Inner Diameter of Brake Drum	310mm	314mm
Parking Brake	Front Twin Wheel Brake, Internal Expansion, and Hydraulic Type	

7.1 Overview

Brake system is in a front double-wheel brake type, and it is composed of brake master cylinder, brake, and brake pedal mechanism.

7.2 Brake master cylinder includes one valve seat, one one-way valve, and one return spring, as well as rubber cup, piston, and auxiliary rubber cup. The end part is fixed using thrust washer and stop steel wire, while and external part is protected through rubber dust cap. The master cylinder piston acts through push rod through operating brake pedal. When brake pedal is pushed down, the push rod pushes forward the piston, and the brake fluid in the cylinder body flows back to oil tank through return oil port, until the main rubber cup blocks the return oil hole. After main rubber cup has pushed the return oil port, the brake fluid in front cavity of master cylinder is compressed and opens the one-way valve, thus to flow to the wheel cylinder through bypass pipeline. In this way, the pistons of respective wheel cylinders extend outwards, for the friction plate of brake shoe and the brake drum to get into contact with each other, to achieve the effect of deceleration or brake. At this point, the rear cavity of piston is supplemented with the brake fluid from return oil port and oil inlet port. When brake pedal is loosened, the piston is pressed by return spring, and at the same time the brake fluid in respective brake cylinders are likewise compressed by return spring of brake shoe, for brake fluid to return to the master cylinder (the front cavity of piston) through one-way valve. The piston will return to original place, the brake fluid in master cylinder will flow back to oil tank through return oil port, and the pressure of one-way valve is adjusted to certain proportion to the remaining pressure in brake cylinders, so that the rubber cup of wheel cylinder is correctly placed to prevent oil leak, and to eliminate the effect of choke that may possibly arise during emergency brake.

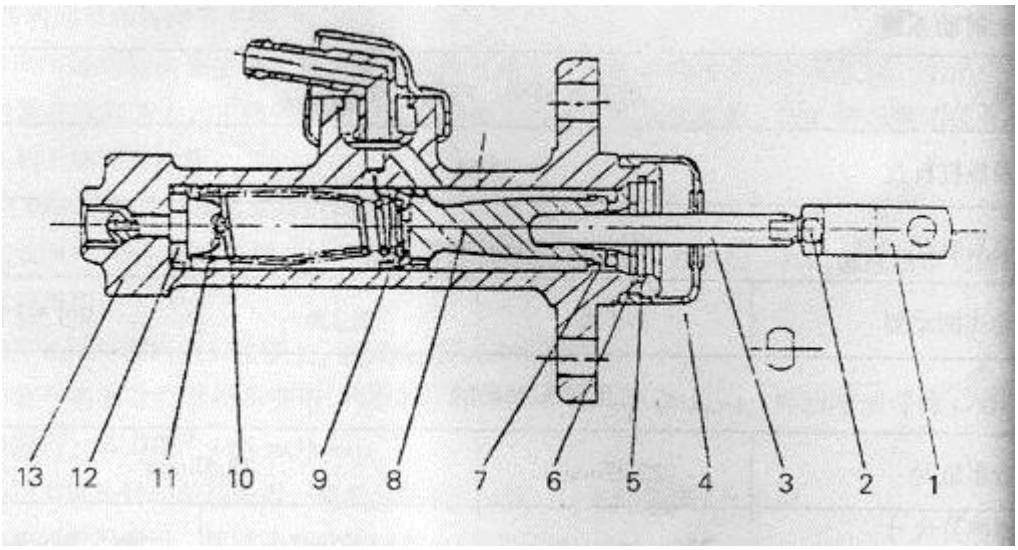


Fig 7-1 Brake Master Cylinder

1. Clevis
2. Lock Nut
3. Push Rod
4. Dust Cap
5. Stop Steel Wire
6. Stop Washer
7. Auxiliary Cup
8. Piston
9. Main Cup
10. Spring
11. One-way Valve
12. Valve Seat
13. Pump Body

7.3 Wheel Brake

Wheel brake is in an internal expansion and hydraulic type, and it is composed of brake shoe, spring, wheel cylinder, adjuster, and bottom plate. The two brakes are respectively mounted on the two ends of front axle. One end of brake shoe is connected with support pin, while the other end is connected with clearance adjuster, and bears down onto the bottom plate by spring and tension spring pull rod. Lever L H Brake is mounted on primary brake shoe, while adjustment pull rod for automatic clearance adjuster is fitted on secondary brake shoe. Refer to Fig 7-2, Fig 7-3.

1. Spring
2. Rubber Cup
3. Piston
4. Cylinder Body
5. Piston Top Rod
6. Return Spring
7. Top Rod
8. Return Spring
9. Adjusting Lever
10. Auxiliary Brake Shoe
11. Clearance Adjuster
12. Spring
13. Brake Steel Cable Assembly
14. Pressure Spring Cap
15. Pin, shoe hold
16. Lever L H Brake
17. Hand Brake Push Rod
18. Brake Cylinder Assembly
19. Return Spring
20. Primary Brake Shoe

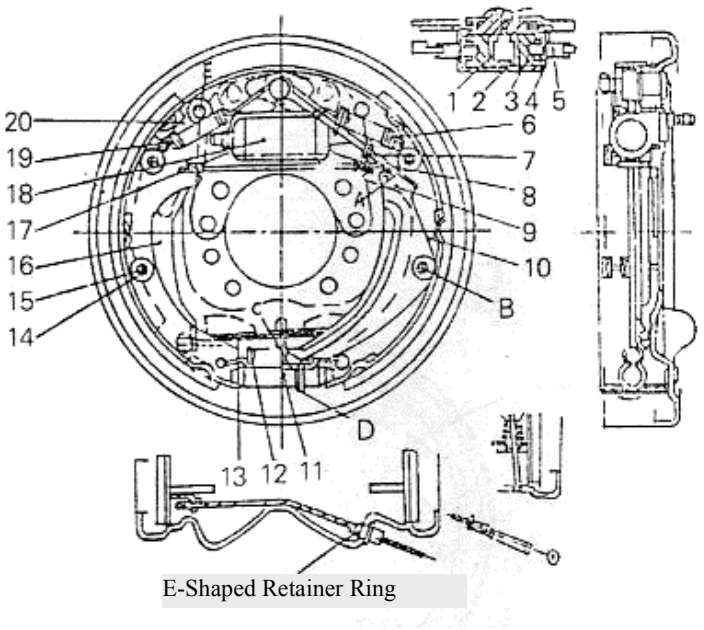


Fig 7-2 2t and 2.5t Wheel Brakes

1. Brake Cylinder Assembly
2. Spring
3. Rubber Cup
4. Piston
5. Wheel Cylinder Shield
6. Piston Top Rod
7. Brake Shoe Return Spring
8. Brake Shoe
9. Spring
10. Hand Brake Push Rod
11. Spring Stay Wire Device
12. Brake Shoe
13. Washer cup
14. Pin, shoe hold
15. Pressure Spring
16. Spring
17. Ratchet
18. Spring
19. Clearance Adjuster Assembly
20. Pin
21. Bottom Plate
22. Brake Shoe Return Spring
23. Lever L H Brake
24. Brake Steel Cable Assembly

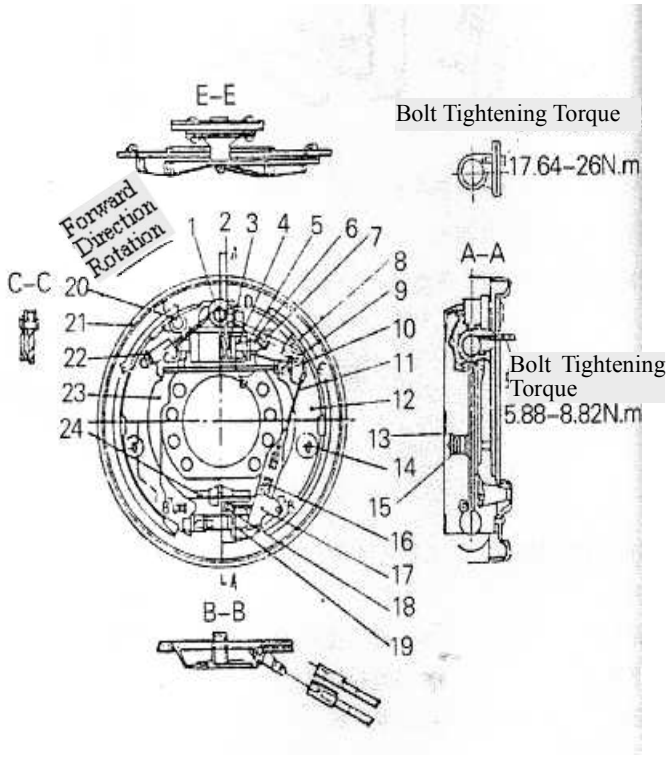


Fig 7-3 3t and 3.5t Wheel Brakes

The brake action in forward movement is as follows (as indicated in Fig 7-4). Through operating brake wheel cylinder, the primary brake shoe and the secondary brake shoe are effected by two forces of equal size but reverse directions, respectively, for brake shoe and brake drum to get into contact with each other, while the primary brake shoe is pressed onto the adjuster with support of friction force between brake shoe and brake drum, thereby for clearance adjuster to generate a larger force used to operate the wheel cylinder to push the secondary brake shoe, and to force the upper end of secondary brake shoe to bear down on the support pin, thus to get a relatively large brake force. In another connection, the reversing brake action is performed in reverse direction, but the brake force is the same as that during forward movement.

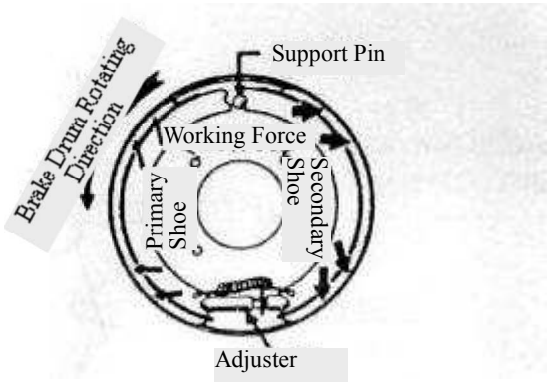


Fig 7-4 Brake Actions during Forward Running Process

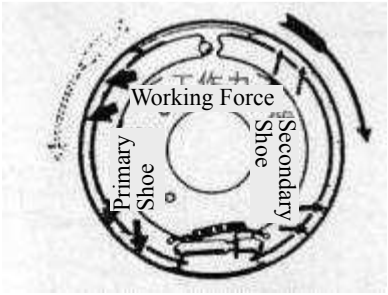


Fig 7-5 Brake Actions during Reversing Process

7.4 Automatic Clearance Regulator (with 2t brake mainly described, and the action principle of 1-4t brakes is the same as that of 2t)

The automatic clearance adjuster is able to automatically maintain the clearance between brake shoe and brake drum between 0.4-0.45mm (0.25-0.4mm for 3, 3.5). However this adjuster only acts during reversing brake. During reverse movement, the brake shoe will disengage once the brake pedal is pushed down, thereby, the secondary and the primarily brake shoes will begin to get into contact with brake drum for rotation together, until the upper end of primarily brake shoe begins to get into contact with support pin. Meanwhile when secondary brake shoe is released from the support pin, the A part of adjusting lever (Refer to Fig 7-2.) is relatively in tension, thus for adjusting lever to rotate around the B part, for C part to lower, and the D part of adjuster to rotate leftward, so as to achieve the objective of automatic adjustment. When brake pedal is further pushed down, the pressure applied to both ends of adjust is larger, which has increased the resistance to thread rotation, for the force of adjusting lever to be unable to actuate rotation of part B.

7.5 Parking Brake

Parking brake is in mechanical, internal expansion type and built-in on wheel brake, and it shares the brake shoe and the brake drum with foot brake. When the handle of parking brake is pulled, the brake handle actuates the manual pull rod through brake cable (Refer to Fig 7-2 E), and this cable pushes the manual brake push rod rightwards with the support of pin that plays the function of rotating shaft, for the brake shoe to step towards the brake drum.

7.6 Adjustment of Brake Pedal (Mechanical Forklift Truck) (Refer to Fig 7-7.)

(1)Adjust short the push rod.

(2)Adjust the catch bolt, for the heights of pedals for 2-4t diesel forklift truck and LPG/Gasoline forklift truck to be respectively 111mm and 113mm.

(3)Push down the brake pedal by 30-40mmt, and adjust long the push rod until the front end of push rod begins to contact the piston of master cylinder.

(4)Screw down the lock nuts for push rod.

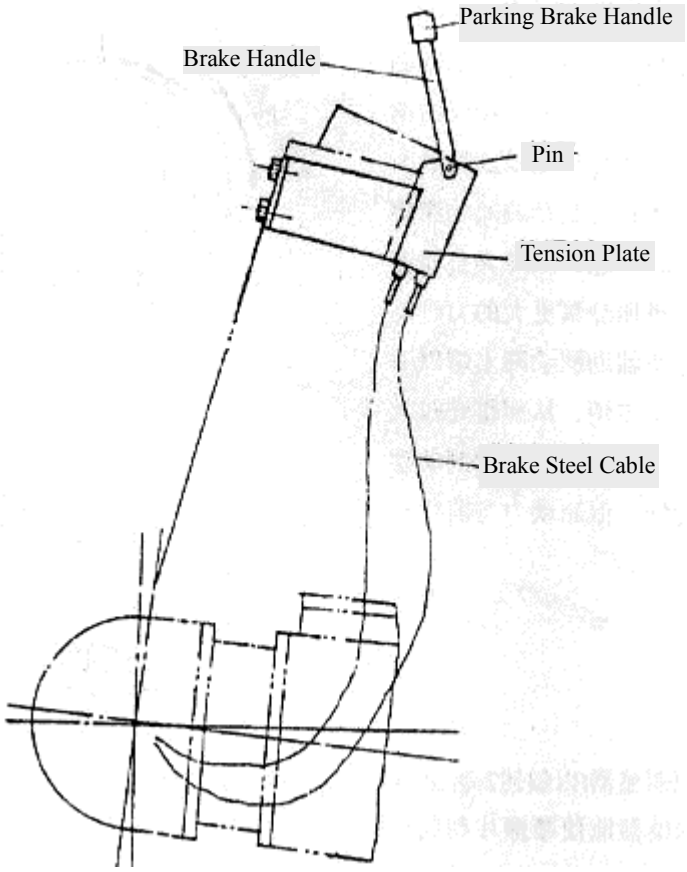


Fig 7-6 Parking Brake Device

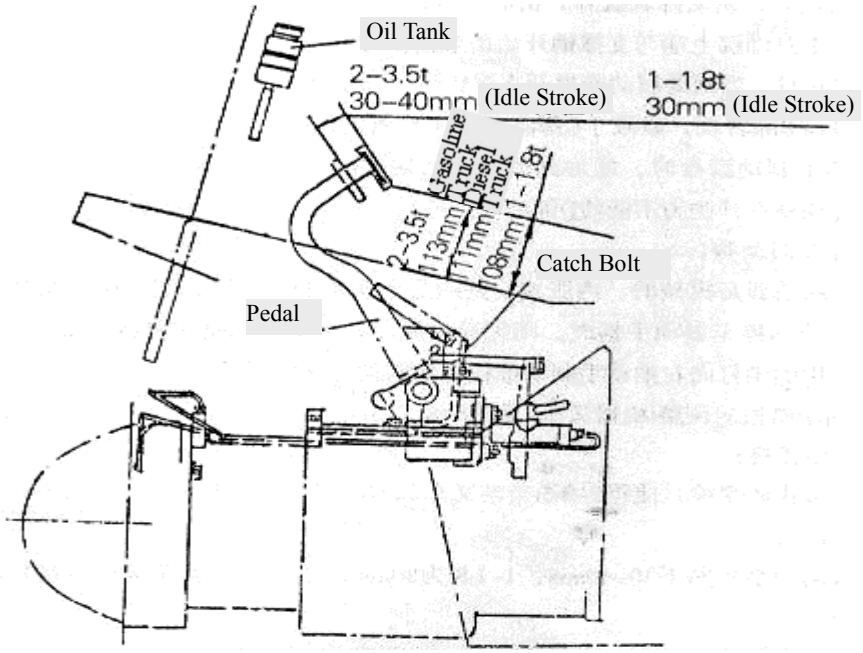


Fig 7-7 Adjustment of Brake Pedal (Mechanical Type)

7.7 Adjustment of Brake Pedal (Hydraulic Forklift Truck)

(1)Loosen the push rod and the interlock bolt.

(2)Adjust the catch bolt, for the heights of pedals for 2-3.5t diesel forklift truck and LPG/Gasoline truck to be respectively 111mm and 113mm.

(3)Adjust the screw stem, for the left pedal (inching pedal) to get a 2-10mm idle stroke.

(4)Push down the right pedal for 2-4t forklift truck by 60mm and adjust the length of screw stem until the front end of push rod begins to contact the piston of master cylinder. Then tighten the lock nut.

(5)Adjust the interlock bolt, until the head of bolt begins to contact the connecting shaft, and lock it up.

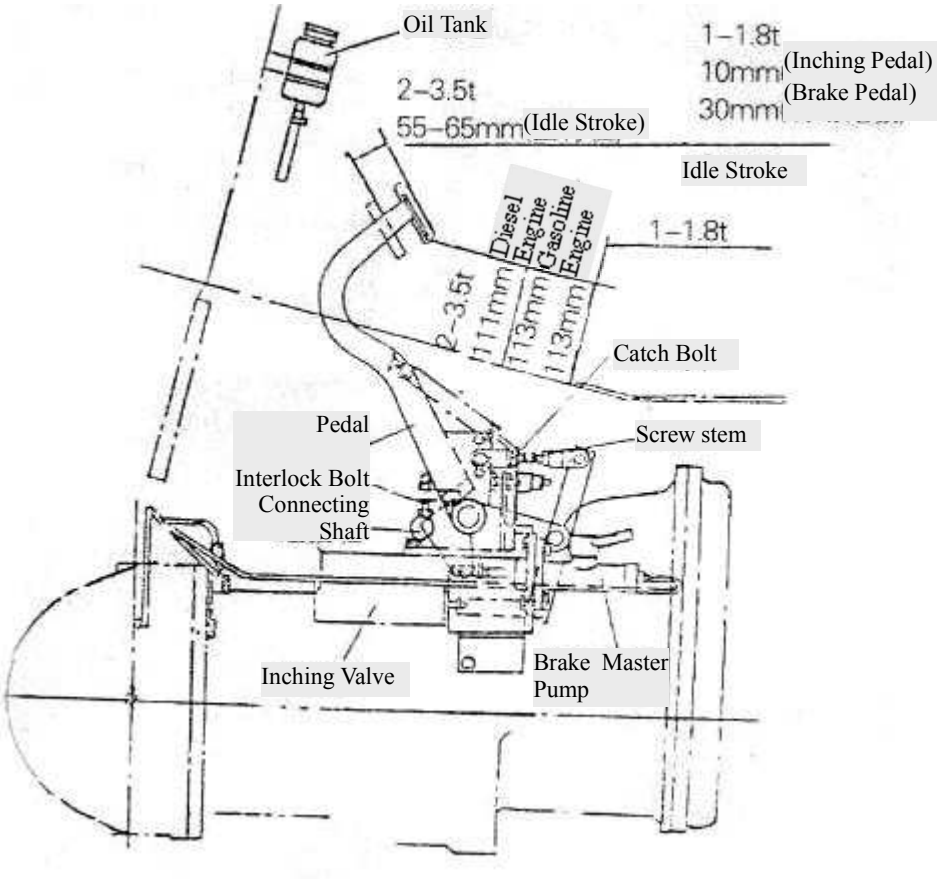


Fig 7-8 Adjustment of Brake Pedal (Hydraulic Trucks)

7.8 Maintenance

This section covers brake disassembly, reassembly, and adjustment (with mainly 2t brake described, while the brakes for 3t are similar. Attention: The following ones with are only the part drawings for 3t brake.).

7.8.1 Disassembly of Wheel Brake

(1)Remove the fixed spring of secondary brake shoe, and take off the adjusting lever, top lever, and the top lever return spring (Fig 7-9).

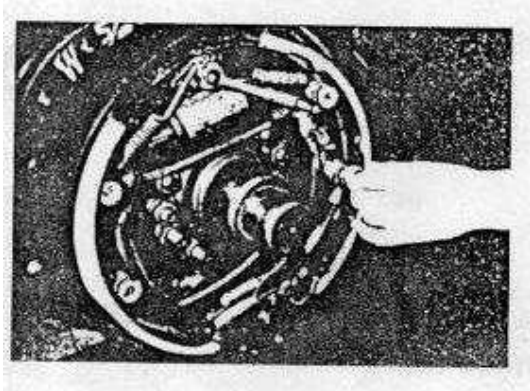


Fig 7-9

(2) Remove the return springs for the two brake shoes. (Fig 7-10)

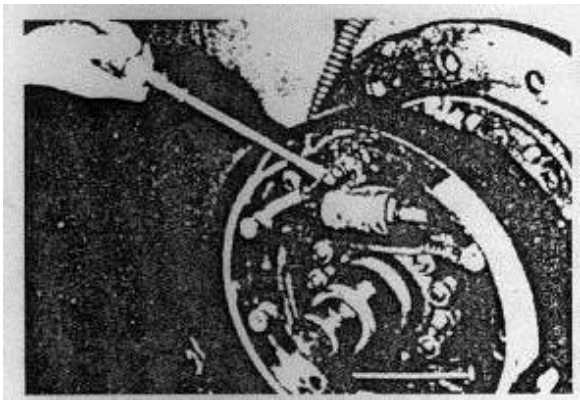


Fig 7-10

(3) Remove the other three fixed springs. (Fig 7-11)

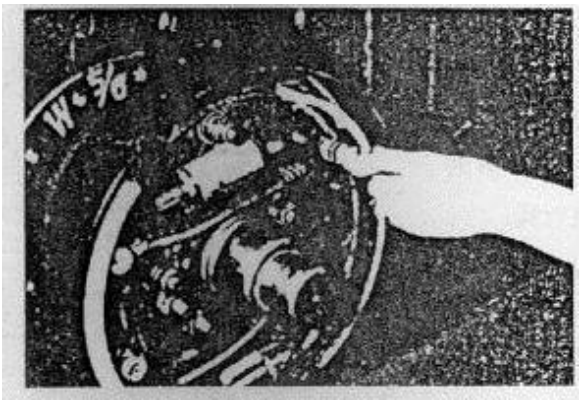


Fig 7-11

(4) Detach the primary brake shoe and the secondary brake shoe, and at the same time remove the spring for adjuster. (Fig 7-12)

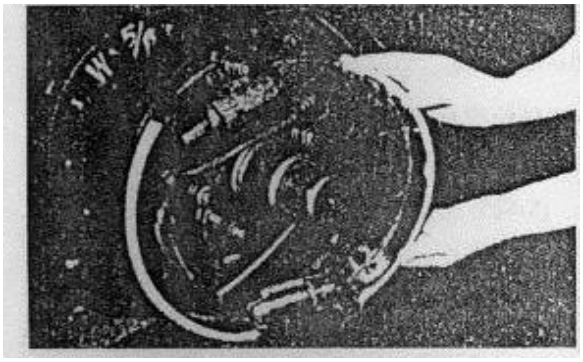


Fig 7-12

(5) Demount the brake oil pip on the wheel Cylinder, then remove the mounting bolts for wheel cylinder, and separate the wheel cylinder from the bottom plate. (Fig 7-13)

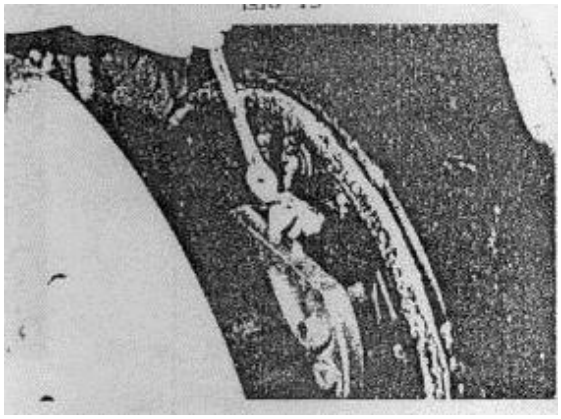


Fig 7-13

(6) Remove the E-shaped retainer ring that fastens the brake cable onto the bottom plate, then remove the mounting bolts on bottom plate, and detach the bottom plate from the axle. (Fig 7-14)

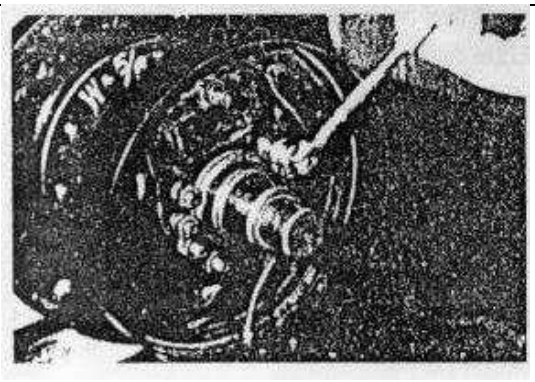


Fig 7-14

(7) Remove the shield for wheel cylinder, and push out all the parts inside the cylinder. (Fig 7-15).

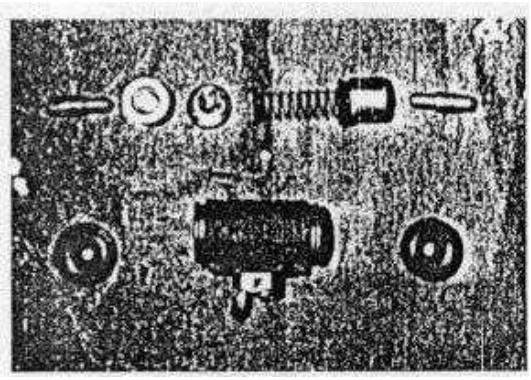


Fig 7-15

7.8.2 Examination of Wheel Brake

Examine all the parts as to whether or not any of them is worn or damaged, and it shall be repaired or replace, if incompliant.

(1)Examine whether or not the inner surface of wheel cylinder body and the surface of piston column are rusted, and then measure the clearance between piston and cylinder body.

Specified Value: 0.065mm-0.150mm(2-3.5t Forklift Truck)； Maximum Value: 0.15

(2)Visually check whether or not the pump rubber cup is damaged or distorted, and replace it if incompliant.

Outer Diameter of Rubber Cup: $\Phi 30.1_{-0.2}$(2-3.5t)

The standard value for interference of rubber cup is 1.52, and the minimum value is 0.42 (2-3.5t).

(3)Examine the free length of wheel cylinder spring, and replace it is improper.

It is specified that the free lengths of wheel cylinder springs for 3t, and 3.5t forklift trucks as well as 2t forklift truck are respectively 58mm and 60mm.

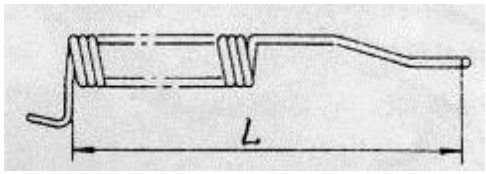
(4)Examine the thickness of brake shoe, and replace it if it is found to be excessively worn out.

Specified Thickness: 7.2mm (2t)　8.0mm (3t, 3.5t)

Minimum Thickness: 2.0mm (2t)　1.0mm (3t, 3.5t)

5) Examine the status of inner surface of brake drum, and it shall be rehabilitated or replaced, if it is found to be excessively worn out.

Standard Value: 310mm (2t, 2.5t), 314mm(3t, 3.5t)



Maximum Value after Rehabilitation: 312mm (2t, 2.5t), 316mm (3t, 3.5t)

Fig 7-16

(6) Measure the free length and installation load of return spring for brake shoe (Fig 7-16). Refer to Part 6 of Fig 7-2, and Part 7 of Fig 7-3.)

Free Length: L= 106mm (2t, 2.5t), L=115.1mm (3t,3.5t)

Installation Length: 116mm (2t, 2.5t), 122mm (3, 3.5t)

Installation Load: 246N (2t, 2.5t), 225N (3t, 3.5t)

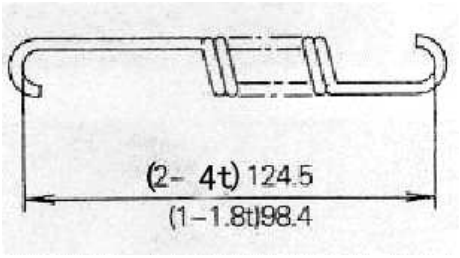


Fig 7-17

(7) Measure the free length and installation load of return spring for top rod (Fig 7-17). (Refer to Part 8 of Fig 7-2 and Part 9 of Fig 7-3)

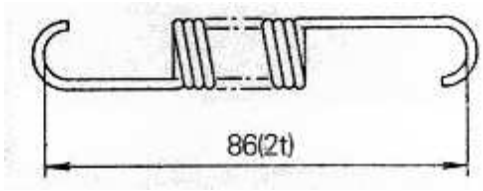


Fig 7-18

Free Length	124.5mm
Installation Length	130mm
Installation Load	245N
Forklift Truck Tonnage	2-3.5t

(8) Measure the free length and installation load of adjuster spring (Fig 7-18 and Fig 7-19).

Free Length: 86mm (2t, 2.5t) 121mm (3t, 3.5t)

Installation Length: 97mm (2t, 2.5t) 137mm (3t, 3.5t)

Installation Load: 153N (2t, 2.5t) 71.5N (3t, 3.5t)

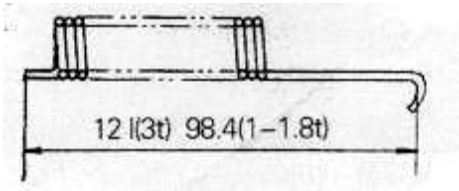


Fig 7-19

(9) Measure free length and installation load of ratchet spring (Fig 7-20). Installation Load: 14.7N (3t, 3.5t)

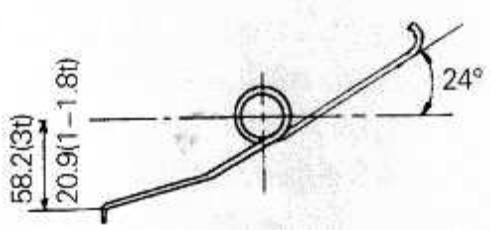


Fig 7-20

(10) Examine whether or not the adjusting mechanism is damaged, how the operating status is, and also examine whether or not the contact of adjusting lever is out of order, and replace it when necessary.

7.8.3 Reassembly of Wheel Brake

(1) Firstly dip the wheel cylinder rubber cup and the piston with brake fluid, and then assemble spring, rubber cup, piston, and shield in turn.

(2) Mount the wheel cylinder on bottom plate.

Attention: Ensure that respective parts are all at the correct position during installation, and the bolt tightening torques are 14.7-19.6N.m (2t), 17.6 - 26.5N.m(3t and 3.5t).

(3) Mount the bottom plate onto the front axle. Bolt Tightening Torque: 120-140N.m

(4) Add #2 calcium base lubricating grease at a, b, c, d respective lubricating pints as indicated in Fig 7-21 and Fig 7-22, and be careful not to allow this grease to be adhibited on brake shoe.

(a) Support Face of Bottom Plate (b) Support Pin of Lever L H Brake

(c) Support Pin (d) Adjuster Thread and Other Rotating Parts

(e) Contact Face of Brake Shoe and Washer, Cup

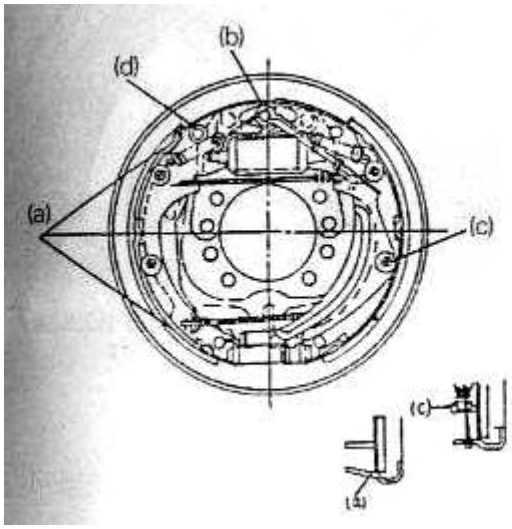


Fig 7-21. 2t, 2.5t Forklift Truck

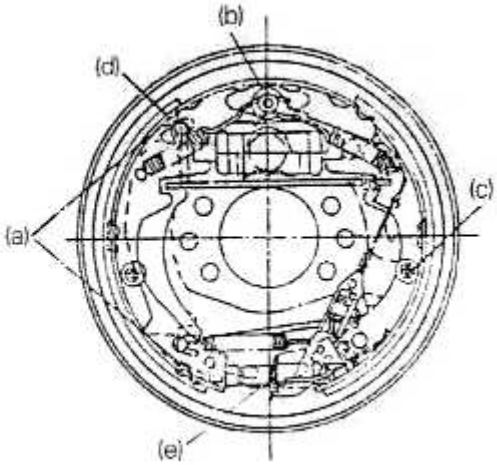
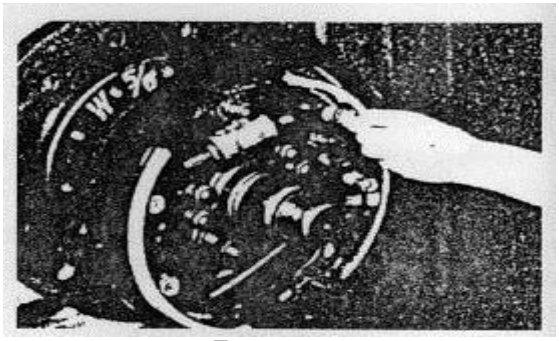


Fig 7-22. 3t, 3.5t Forklift Trucks

(5) Mount the brake cable assembly onto the bottom plate using E-shaped retainer ring.

(6) Mount the brake shoe onto the bottom plate using fixing spring, but the bottom part of secondary brake shoe shall be mounted with fixing spring after the washer, cup and the adjusting lever have been properly installed, to ensure that the pressure seat is fitted in the holes of brake shoe and adjusting lever (Fig 7-23).



F
Fig 7-23

(7) Mount the compressed spring onto the hand brake push rod, and then install the push rod onto the brake shoe.

(8) Mount the guide plate of brake shoe onto the support pin, and then install the return spring of brake shoe (Fig 7-24).

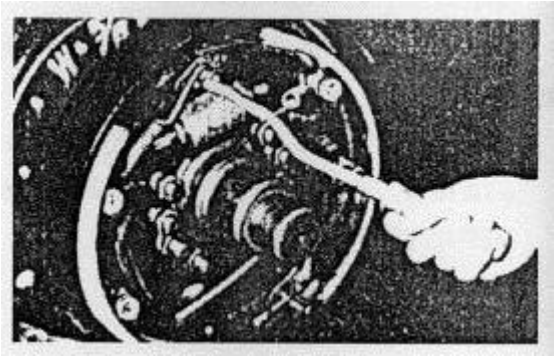


Fig 7-24

(9) Install adjuster, adjuster spring, top rod, and return spring for top rod (Fig 7-25).

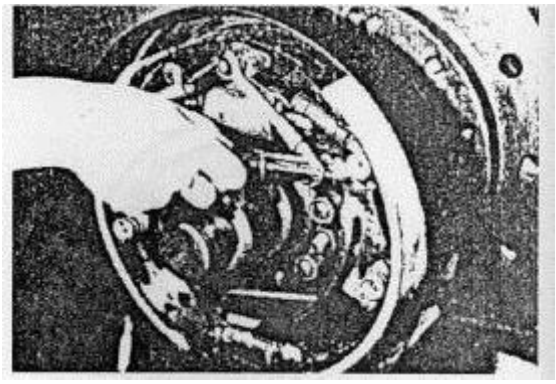


Fig 7-25

Pay attention to the following respective items:

a) Adjuster Threat Direction and Its Installation Direction (In 2t, 2.5t forklift truck, right-hand threat is used for left brake, while the left-hand thread is used for right brake. In 3t and 3.5t forklift trucks, left-hand thread is used for left brake, while right-hand thread is used for right brake.)

b) Adjuster Spring Direction (It is not allowed for the tooth part of adjuster to contact the spring.

c) Top Rod Return Spring Direction (At the end of support pin, the spring hook shall be fixed on the opposite side of top rod.)

d) Top rod and top rod return spring shall be fixed inside the sloth of support pin.

e) Make sure that the lower end of adjusting lever shall be in contact with the tooth part of adjuster.

(10) Connect the brake oil pip onto the wheel cylinder.

(11) Measure the inner diameter of brake drum, and adjust the adjuster for the differences between the inner diameter of brake drum and the friction plate of brake shoe to be: 0.8-0.9mm (2t, 2.5t) , 0.5-0.8mm (3t, 3.5t).

7.9 Operating Test on Automatic Clearance Regulator

(1) Firstly allow the diameter of brake shoe to approach the installation size, and pull the adjusting lever with hand in the direction as indicated by the arrow in Fig 7-26 for adjust to rotate. When hand is released, the adjusting lever returns to its original place, while the gear of adjuster will not rotate.

Attention: Even if when hand is released, and the adjuster gear and the adjusting lever return together, the adjuster is still able for normal work after being assembled.

(2) In the case when adjusting lever is pulled, and the adjuster cannot do the abovementioned action, the following items shall be examined:

a) Mount the adjusting lever, the top rod, the top rod spring, and the washer, cup firmly.

b) Examine whether or not the relationship in arrangement between adjusting lever and adjusting gear is correct. Refer to Fig 7-26 (2t, 2.5t), Fig 7-27 (3t, 3.5t), and replace the parts if not satisfactory. In addition, examine whether or not lever and gear are in contact with each other.

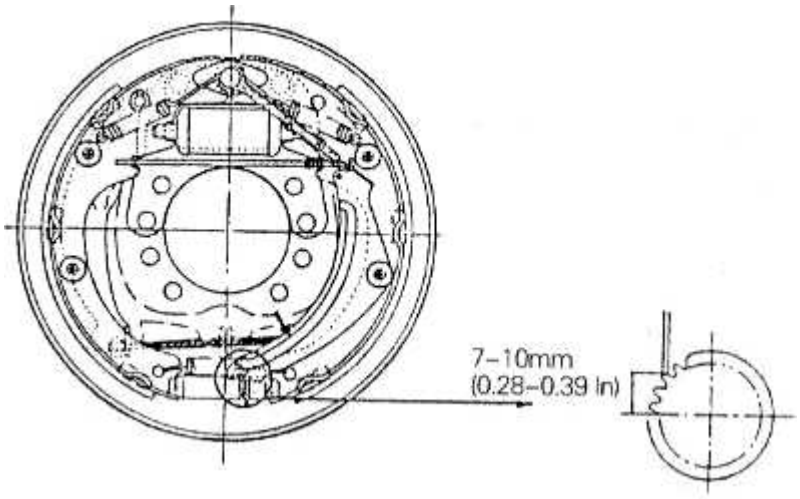


Fig 7-26

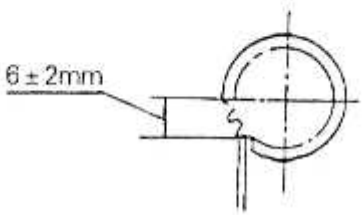


Fig 7-27

c) Examine whether or not the return spring of top rod and the spring for adjuster are damaged, and then examine the rotating status of adjuster gear and whether or not its engaged part is excessively worn out or damaged.

7.10 Failure Removal for Wheel Brake

Problem	Analysis for Cause of Generation	Removal Method
Brake under Poor Condition	1. Oil leak with brake system 2. Clearance of brake shoe not properly adjusted 3. Brake too hot 4. Contact between brake drum and brake shoe under poor condition 5. Impurity attached on brake shoe 6. Impurity blended into brake fluid 7. Brake pedal (inching valve) improperly adjusted	To be repaired Adjuster to be adjusted Examine whether or not skidding exists To be readjusted To be repaired or replaced Brake fluid to be examined To be adjusted
Noise Present with Brake	1. Surface of brake shoe hardened or impurity attached on it 2. Bottom plate distorted or bolt loosened 3. Brake shoe distorted or installation incorrect 4. Brake shoe worn 5. Bearing of wheel loosened	To be repaired or replaced To be repaired or replaced To be repaired or replaced To be replaced To be repaired
Brake Un-uniform	1. Oil stain present on surface of brake shoe 2. Clearance of brake shoe not properly adjusted 3. Wheel cylinder out of operation 4. Brake shoe return spring damaged 5. Brake drum deflected	To be repaired or replaced Adjuster to be adjusted To be repaired or replaced To be replaced To be repaired or replaced
Brake Weak	1. Oil leak with brake system 2. Clearance of brake shoe not properly adjusted 3. Air blended into brake system 4. Adjustment of brake pedal incorrect	To be repaired or replaced Adjuster to be adjusted Air to be bled To be readjusted

8. Hydraulic System

Forklift Truck Tonnage			2t-3.5t	
Equipped Engine			NISSAN K25	MITSUBISHI S4S-455
Main Pump	Model		SGP1A28.2D2H9-R330C	SGP1A28.2D2H1-L707D
	Type		Gear Type	
	Driving		Driving with Engine Power Output Gear	
	Loaded Displacement		78 L/min [2650rpm/1715N(175kg/cm^2)]	57L/min [2260 rpm]
	No-load Displacement		79 L/min [2650rpm/196N(20kg/cm^2)]	63L/min [2385 rpm]
Multi-way Valve	Model		CBD3 Haihong brand	
	Type		Double Spool Valve, with Overflow Valve, Bypass Valve, and Inclined Autolocking Valve	
	Adjusting Pressure		17.5MPa	
	Bypass Valve	Pressure	10 MPa	
		Flow Rate	11 l/min	
Lift Cylinder	Type		Single Act Piston Type, with Shutoff Valve and Speed Limiting Valve	
	Cylinder Inner Diameter		2-2.5t: Φ50mm 3t: Φ56mm 3.5t: Φ63mm	
	Stroke		1495mm (At 2nd-grade Standard Mast at 3m Lifting Height (Varying along with Type of Mast and Lifting Height))	
Tilt Cylinder	Type		Double Act	
	Cylinder Inner Diameter		2-2.5t: Φ70mm 3-3.5t: Φ80mm	
	Piston Rod Outer Diameter		2-2.5t: Φ32mm 3-3.5t: Φ35mm	
	Stroke		2-2.5t: 122mm 3-3.5t: 141mm	

Note: When forklift idle for a long time, please do lubrication maintenance no more than every 10 days: upgrade the cylinder to the top 2-3 times.

8.1 Overview

Hydraulic system is composed of main oil pump, multi-way valve, lift cylinder, tilt cylinder, and oil pipe line, as well as the direct transmission oil pump of engine power-take-off (P.T.O).

8.2 Main Oil Pump

The main oil pump is a gear pump, mainly composed of pump body, pump cover, one pair of gears, bearing, and seal ring. Load balanced bearing and special lubricating method are applied to main oil pump, for the end face of gear to gain the minimum clearance.

As pump body and pump cover are light and firm, as they are made of alloy aluminum. The two shafts respectively provided for driving gear and driven gear are separately installed on the bearing of pump body. These bearings are made of special material, to bear the radial load of gear shaft on one hand, and to serve as the baffle seat for the end face of gear on another.

On the side of drive shaft, one oil seal is pressed and fitted on the pump body, to ensure the sealing property. The sealing between pump body and cover is ensured with seal ring in special shape mounted.

8.3 Multi-way Valve and Bypass Valve (Fig 8-1)

The 2-disk multi-way valve consists of four-plate valve body, two spool valves, one safety overflow valve, and one bypass valve. The four-plate valve body is assembled using three stub bolts and nuts, and the inclined spool valves are mounted with inclined autolocking valve.

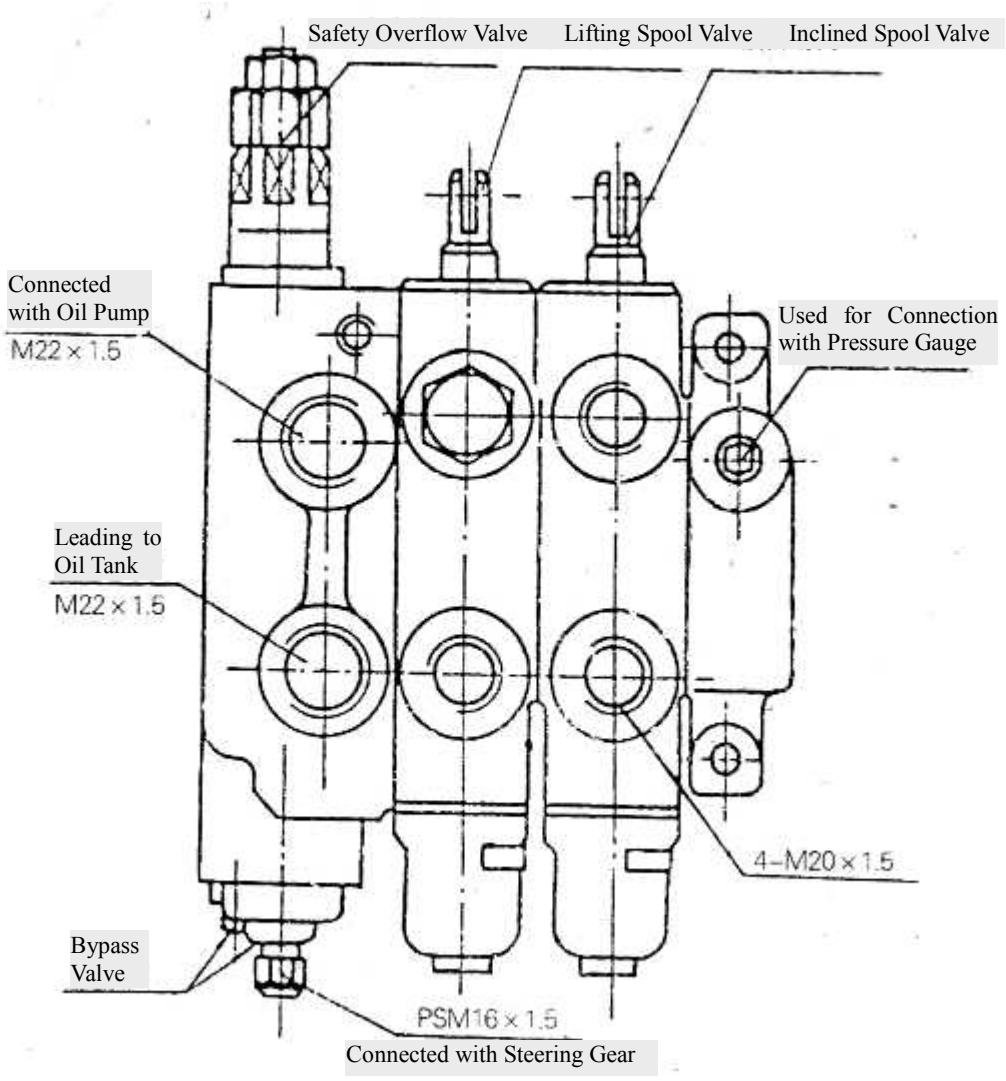


Fig 8-1 Multi-way Valve

8.3.1 Operation of Spool Valve (Taking inclined Spool Valve as example)
(1)Neutral Position (Fig 8-2)

At this point the High-pressure oil drained from oil pump returns to oil tank through neutral position.

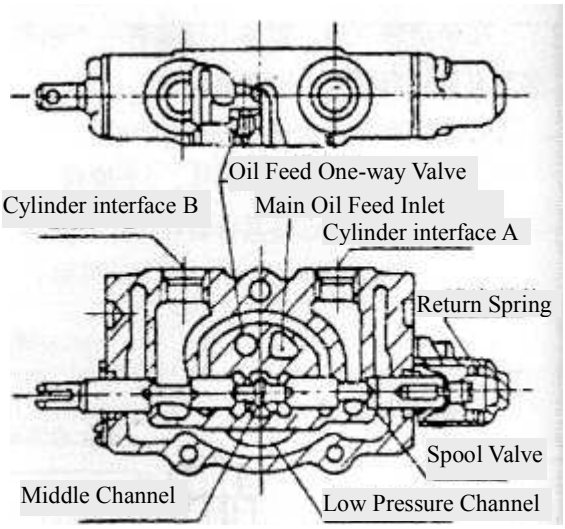


Fig 8-2

(2)Push-in Spool Valve (Fig 8-3):

At this point middle channel is closed the oil from oil inlet port opens the one-way valve and flows to the interface B of cylinder, while the oil from cylinder interface A flows to oil tank through low-pressure channel. By virtue of return spring, it may allow the spool valve to return to neutral position.

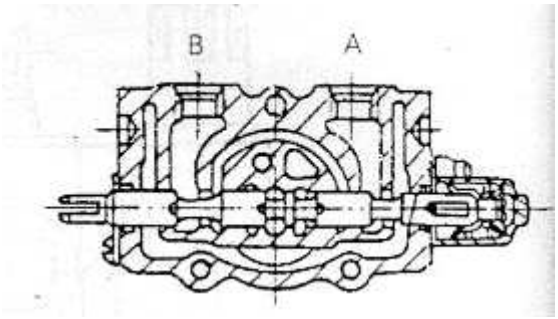


Fig 8-3

(3)Pull-out Spool Valve (Fig 8-4)

At this point when neutral position is closed, the oil from the oil inlet port opens the one-way valve and flows to the cylinder interface A, while the oil from cylinder interface B flows to the oil tank through low-pressure channel.By virtue of return spring, it may allow the spool valve to return to neutral position.

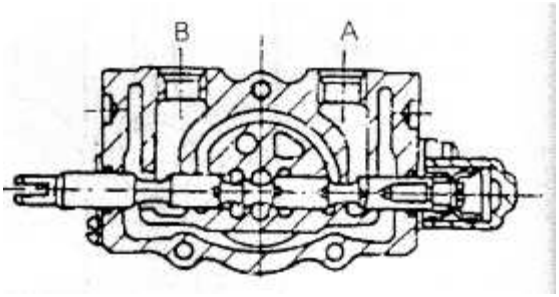


Fig 8-4

8.3.2 Main Safety Overflow Valve and Bypass Safety Valve (Fig 8-5)

The main safety overflow valve is composed of the two parts including main valve A and pilot valve B. When multi-way valve is reserved, the high-pressure oils in cavity C and working mechanisms (such as lift cylinder and tilt cylinder) are connected, the pressure oil acts on the pilot valve B, through the fixed throttle holes D and E. When system pressure is larger than the system regulated pressure, the pilot valve B is opens, for the pressure in cavity F to drop. The valve core of the entire main valve A moves rightwards, for the pressure oil to be directly connected with low-pressure channel G, for cavity C to be relieved, in order to ensure the stability of system pressure. Adjusting screw H may be used to adjust the stable pressure value of the system.

The bypass safety valve is in a relatively simple structure, as a direct-acting type of overflow, to get a stable pressure value for steering system by making use of the principle for direct balance of liquid pressure with spring force. When operating wheel is operated, the oil cavity M is connected with high-pressure oil circuit. When system pressure is larger than spring pressure, the valve core N moves rightwards, and pressure oil is connected with low-pressure oil circuit through cavity T, for cavity M to be relieved, in order to ensure the stability for the pressure of steering system. Adjusting screw K may be

used to adjust the stable pressure value of the system.

L valve is a balanced spool valve, and the spool valve L moves leftwards and rightwards through continuous change in flow and pressure to change the openness in the two places of R and S, to ensure that the flows to working cavity Q and outlet PS to fully hydraulic steering gear are automatically balanced, and to be passed by steadily according to proportion. a, b, and c are the fixed throttle holes.

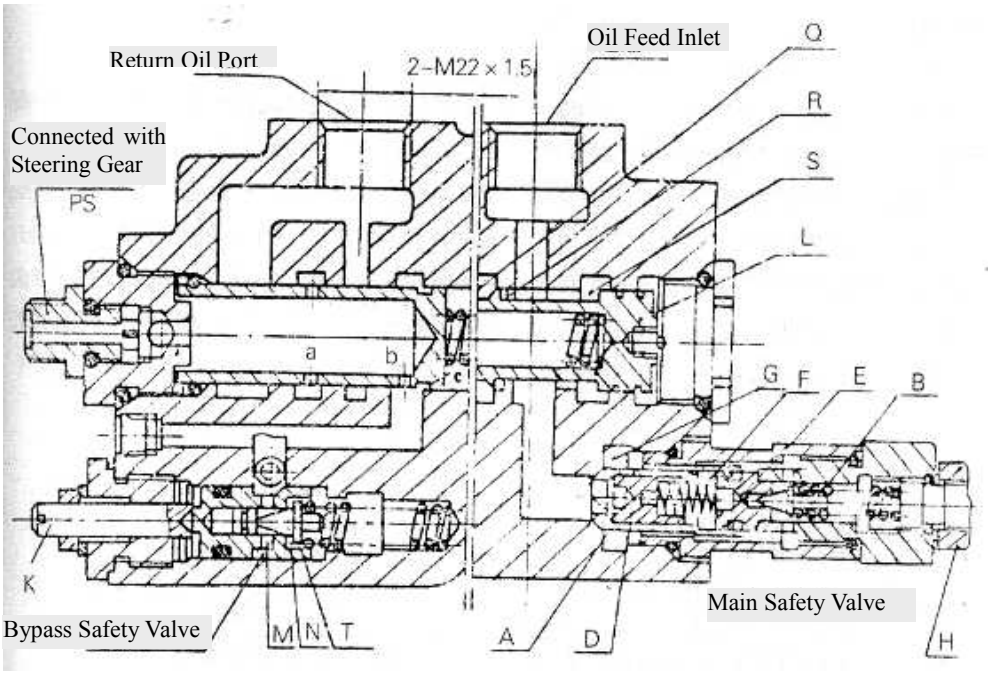


Fig 8-5

8.3.3 Action of Inclined Autolock Valve

The inclined spool valve is mounted with autolock valve, mainly used to prevent vibration possibly arisen from internal negative pressure of tilting cylinder, and avoid severe aftereffect caused by misoperation. For general conventional structure, the inclined spool valve can still be operated for it to tip forward after engine is turned off. However, when this tilt autolock valve is used, it cannot make the mast tip forward, even if the valve is operate with a big push, in the case when engine is turned off.

Refer to Fig 8-6 for its structure.

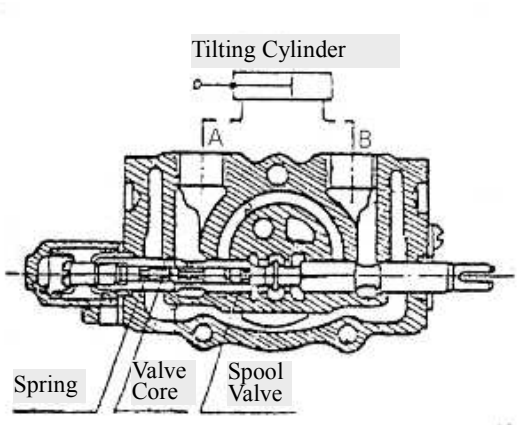


Fig 8-6

The interfaces “A” and “B” of valve body are respectively connected to the front and rear cavities of piston for tilting cylinder. When spool valve is pulled out, the high-pressure oil (P) enters into interface “A”, while the oil in the rear cavity returns from “B” to oil tank (T), and at this point the mast is under the back-tip status.

When inclined spool valve is pushed, the high-pressure oil enters into interface “B”, to allow the autolock valve in spool valve to act by virtue of high-pressure oil, while “A” is connected with low pressure. When engine turns off or stop rotation, there is no high-pressure oil for autolock inside the spool valve to act, hence the interface “A” cannot be connected with low pressure, the mast will not tip forward, and negative pressure can neither be formed in tilt cylinder.

8.4 Oil Circuit of Hydraulic System (Main Oil Circuit) (Fig 8-7)

The high-pressure oil from the main oil pump reaches the multi-way pump, divided into two parts via multi-way valve and through the bypass valve therein: One part for high-pressure oil to be divided into lift cylinder or tilt cylinder, and the other part is divided at an invariable flow rate into steering gear, to control the steering cylinder. When lift and tilt two spool valves are at the neutral position, the high-pressure oil returns to oil tank directly through channel. When lift spool valve is pulled, the high-pressure oil passes through the throttle valve, and then pushes the piston rod upwards from downward of lift cylinder piston. When lift spool valve is pushed, the lower part of lift cylinder piston is connected with low pressure, for piston rod to drop depending on self weight and cargo weight. AT this point the oil flowing out from lift cylinder passes through the throttle valve for the dropping speed to be controlled. When tilt spool valve is operated, the high-pressure oil may flow into the front cavity of tilt cylinder, while the other side is connected with low pressure, for the door frame to achieve the back tip or front tip action.

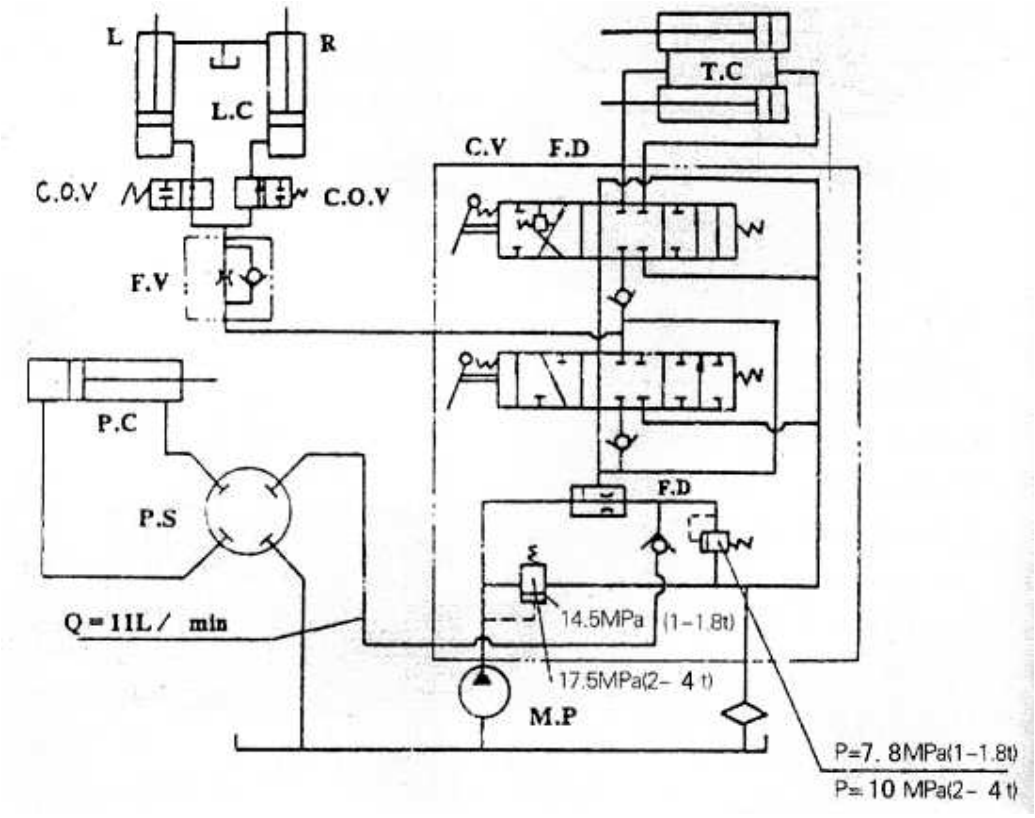


Fig 8-7 Oil Circuit of Hydraulic System

8.5 Lifting Cylinder (Fig 8-8)

Two single-acting lifting cylinders are fixed on the rear side of channel steel for the outside mast, and the bottom part of cylinder is fixed on the bracket of lift cylinder on the outside mast using pins and bolts, while the top part of cylinder (namely the top part of piston rod) is connected with active beam. The piston strokes for the two cylinders shall be adjusted to be consistent, for the two cylinders to lift synchronously, and the parts 28 and 29 may be adjusted to achieve the synchronization, if they are still not synchronized.

The lifting cylinder is mainly composed of cylinder body, piston, piston rod, cylinder cover, cylinder bottom and sealing parts. One oil port is available in the lower part of cylinder body, while one return oil pipe is mounted in the upper part of cylinder body for a small amount of leaked oil above the piston to return to oil tank. The piston is fastened onto the piston rod using slot nut and cotter pine, and one YX seal ring, retainer ring and wear ring are fitted on the outer edge of piston. This piston moves along the inner surface of cylinder body under the action of high-pressure oil. Shaft sleeve and dust ring pressed and matched are mounted in the inner hold of cylinder cover, and this shaft sleeve supports the piston rod, while the dust ring is able for cylinder body to resist dust. The stroke of piston may be adjusted by making use of cylinder cover.

When the lift spool valve of multi-way valve is pulled backwards, the high-pressure oil enters through the bottom part of lift cylinder, to push the piston and the piston rod, for fork and inside mast to lift by virtue of lift chain. When lift spool valve is pushed forward, the piston of lift cylinder drops under the effect of piston rod, bracket, fork and cargo weight, for the oil under the piston to flow out. The oil drained out from lift cylinder is controlled by throttle valve, and returns to oil tank through multi-way valve.

1. Active Beam
2. Dust Ring
3. Shaft Cap
4. Cylinder Cover
5. O-Ring
6. Piston Rod
7. Cylinder Body
8. O-Ring
9. Piston
10. Wear Ring
11. Retainer Ring
12. Yx Seal Ring
13. Nut
14. Cotter Pin
15. Bolt
16. Pin
17. Spool Valve
18. Spring
19. Joint
20. O-Ring
21. Hosting Chain
22. Plug
23. Screw
24. Retainer Ring
25. Sheave
26. Plug
27. Chuck Plate
28. Bolt
29. Screw Plug

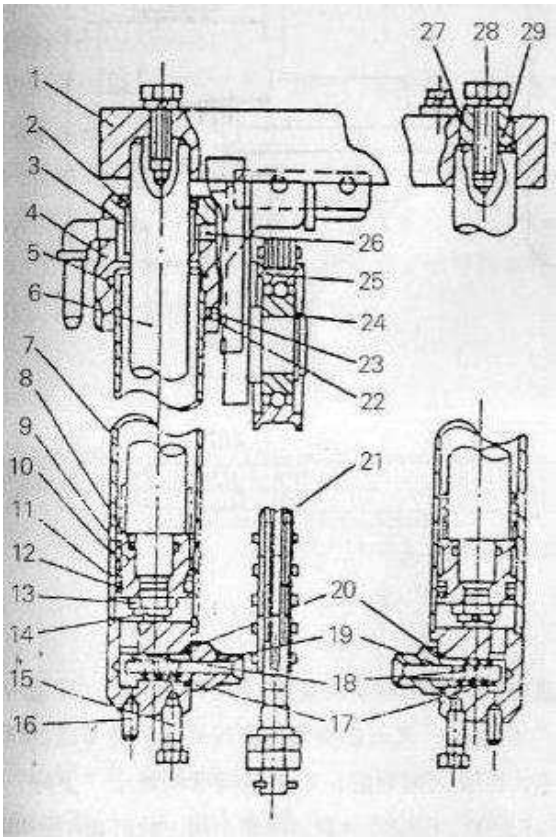
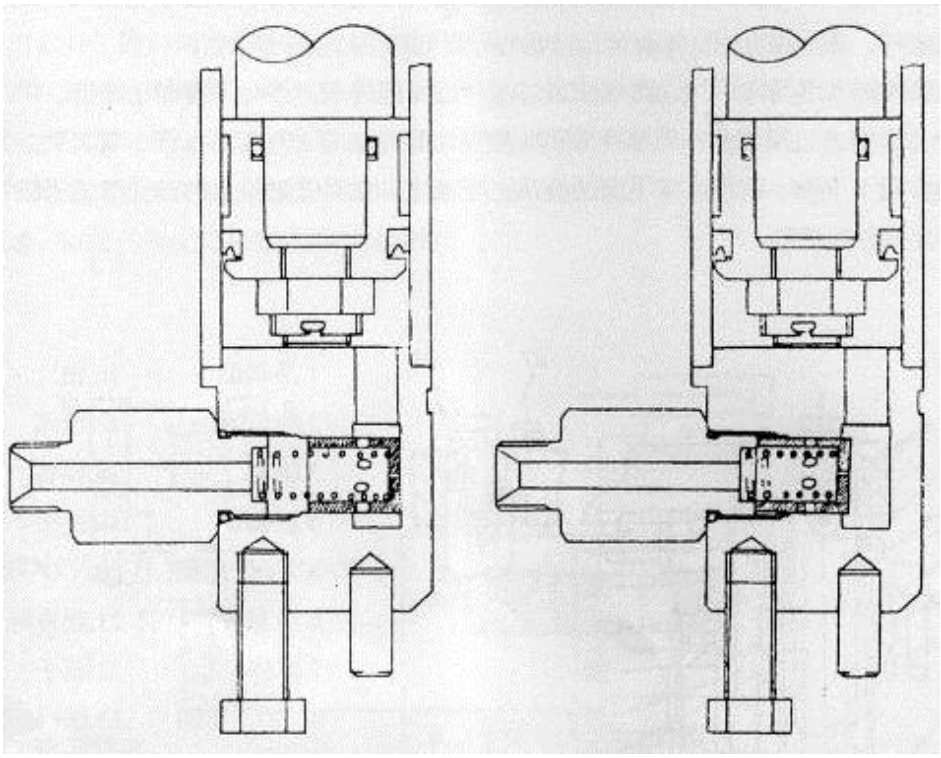


Fig 8-8

There is one shut-off valve on the bottom of lift cylinder (Refer to Fig 8-9), to prevent cargo from abrupt drop, when high-pressure rubber hose is suddenly cracked. The oil from lift cylinder passes through the spool valve of shut-off valve, and the oil holes around the spool valve allow the two rubber hoes to generate pressure difference. When this pressure difference is smaller than the spring force, the spool valve will not act. If the high-pressure rubber hose is cracked, a very huge pressure difference is formed, for the spool valve to move and block up its surrounding oil holes, only to allow a small amount of oil to flow through the pores on the end part of spool valve, for fork to slowly drop.

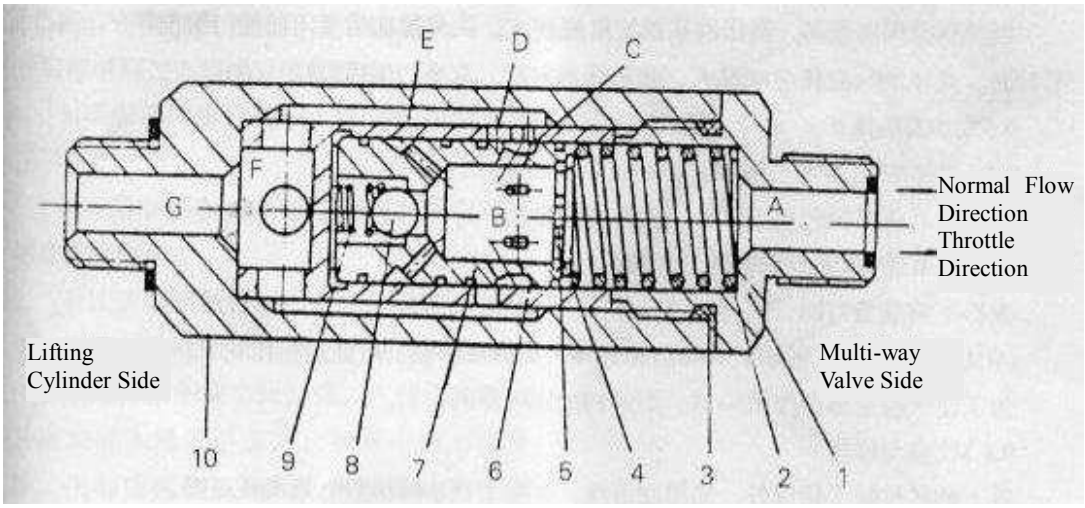


When Normal When Disconnected

Fig 8-9

8.6 Limiting Valve

Speed limiting valve (namely throttle valve) is mounted in the oil circuit of lift cylinder, to restrain the dropping speed when fork carries a heavy load, and its structure is indicated as in Fig 8-10. When spool valve of multi-way valve is at the “Lift” position, the high-pressure oil from multi-way valve passes through cavities A and B as well as holes C, D, E, and F, and cavity G under the condition when it is not throttled, and then flows into the lift cylinder. When spool valve of multi-way valve is at the “Drop” position, the oil from lift cylinder passes cavity G, oil holes F, E, D, and C, as well as cavities B and A thought the entire valve. AT this point, pressure difference is generated between cavity A and cavity B, and opens the ball valve (Part 8). When pressure difference exceeds the spring force of spring 2, the valve core 7 moves rightwards, for the flow quantity of oil to drop for diminish of D and C holes, which has also reduced the flow quantity through the throttle hole.



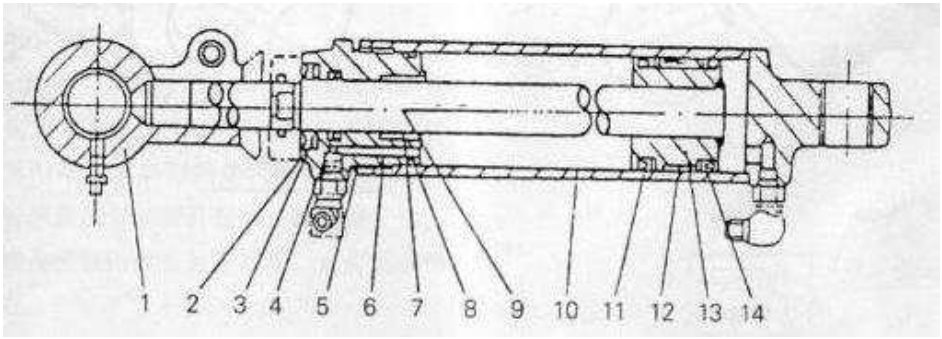
1. Joint
2. Spring
3. O-Ring
4. Retainer Ring
5. Throttle Plate
6. Valve Sleeve
7. Valve Core
8. Nylon Ball
9. Spring
10. Valve Body

Fig 8-10 Limiting Valve

8.7 Tilting Cylinder (Fig 8-11)

Tilting cylinder is in a double-acting type, mounted on the two sides of mast. Its end of piston rod is connected with mast, and the bottom of tilt cylinder is connected with truck frame using pins.

The tilting cylinder assembly comprises of piston, piston rod, cylinder body, cylinder bottom, guide sleeve, and sealing parts. Welded structure is applied to piston and piston rod. One wear ring and two Yx seal rings are mounted on the outer edge of piston, while Yx seal ring, retainer ring, and dust ring are fitted in the inner hold of guide sleeve, pressed and matched with shaft sleeve. This shaft sleeve supports the piston rod, while the seal ring, retainer ring, and dust ring are able to prevent oil leak and dust, screwed onto the cylinder body together with O-ring.



1. Clevis
2. Dust Ring
3. Baffle Ring
4. Yx Seal Ring
5. O-Ring
6. Guide Sleeve
7. Bearing
8. O-Ring
9. Piston Rod
10. Cylinder Body
11. Yx Seal Ring
12. Wear Ring
13. Piston
14. Yx Seal Ring

Fig 8-11 Tilting Cylinder

When tilt spool valve is pushed forward, the high-pressure oil enters from the bottom of cylinder, thus to push forward the piston for mast to tip forward by 6°, and when spool valve is pulled backwards, the high-pressure oil enters from the front end of cylinder body, to push backward the piston, until the mast tips backwards by 12°.

8.8 Maintenance of Main Oil Pump

8.8.1 Disassembly (Refer to Fig 8-18 and 8-19 for Imported Main Oil Pump in combination.)

(1) Clamp the pump gently on the vice stand after cleaning, and firstly remove the bolt 12.

(2) Detach pump cover 1 and seal rings 8, 9, 10, and 11.

(3) Remove the front-end cover 7, and 8, 9, 10, and 11.

(4) Demount bearings 3 and 4, as well as gears 5 and 6 from pump body 2, and bearings may be dismounted through pressing the gears, if it is difficult to disassemble them.

It is the best to make arrangement according to the sequences in Fig 8-18 and Fig 8-19, in order to facilitate examination.

8.8.2 Examination and Repair

The parts that have been disassembled, except rubber, shall be cleaned firstly with oil, and examined, repaired, or replaces according to following steps.

(1) Examination of Pump Body

High-efficiency gear pump is designed into that the crest of gear rotates along the inner surface of pump body through slight press and touch, and the trace of scratch will be generated around the inner surface of the crest and the pump body. Under normal situation, its trace shall not exceed a length 1/3 of the inner edge of the pump body, and if it reaches 1/2 length, it indicates that the bearing and gear shaft are severely worn out. In Fig 8-12, when size X exceeds 39.180mm, or the trace of scratch on inner edge exceeds one half, it is required to replace the pump body.

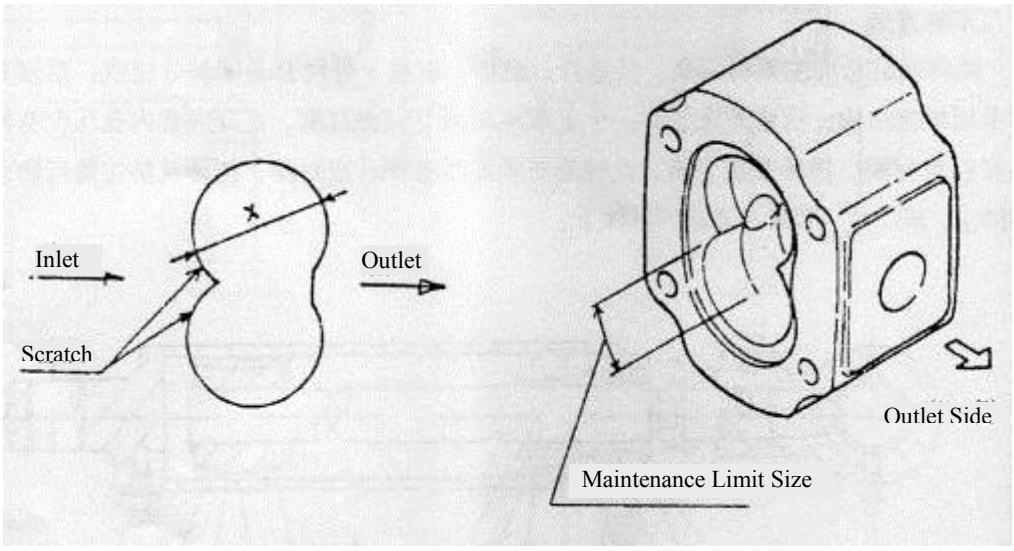


Fig 8-12

(2) Examination of Bearing (Fig 8-13 and Fig 8-14)

The ideal situation is to require that the inner surface of bearing is not coarse, and the contact surface with brightness is shown at the position about 1/2 at the inlet side. The bearing shall be replaced, if any of the undermentioned cases occurs.

a) The trace of contact appears on the entire slide inner surface, and a feeling of obvious coarseness exists when it is scraped with finger nail.
b) Crack appears around the end face, and a severe coarseness is felt when it is scraped with finger nail.

c) The bonding trace with other extraneous substance appears on the internal slide surface and the end face.

Most cases of abovementioned failures are aroused by un-cleaned hydraulic oil. At this point the whole oil circuit may be cleaned or the oil may be replaced. Some individual cases are attributed to overloaded safety valve, air corrosion, or too high temperature, or too low viscosity. In the case when the abovementioned failures occur, leading to coarseness or severe wear on the gear shaft or the end face of gear, the gear and bearing shall be replaced. The limit size for bearing maintenance is:

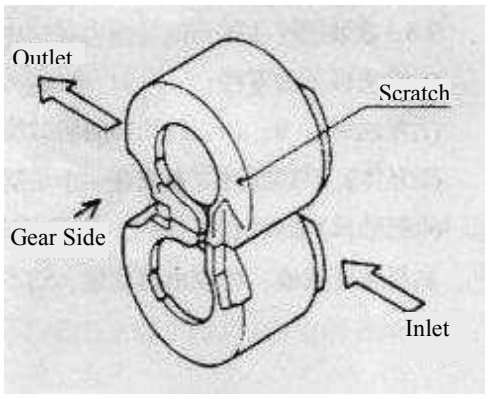


Fig 8-13

Inner Diameter - 19.123mm (Fig 8-14)
Total Length - 26.411mm

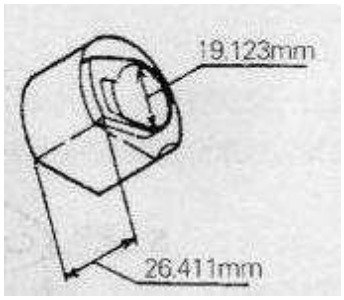


Fig 8-14

(3)Examination of Gear

So long as clean hydraulic oil is used, generally speaking, gear shaft and gear end face will not be damaged. In the case when a coar seness to a certain degree is felt when it is scraped with finger nail on the end face of bearing and gear, or crack occurs on the gear end face, or severe un-uniform wear is present on the gear end face, the gear shall be replaced at this point. When gear surface is worn or discolored, it indicates that failure has also occurred with bearing or pump body, and it shall be examined. The limit size for the axial diameter of gear shaft is 18.935mm (as indicated in Fig 8-15).

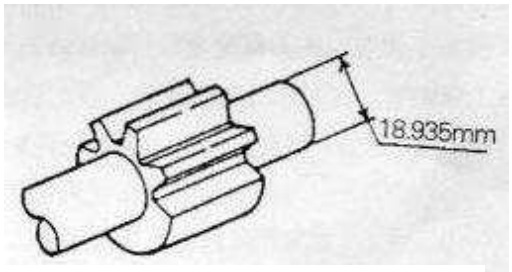


Fig 8-15

(4)Examination of Oil Seal

a) Oil Seal 14: (Refer to Figs 8-18 and 8-19) Oil seal 14 is a combination seal, and the lip at inner side of the pump shaft plays the sealing function, while the lip at the outer side is mainly for dust resistance (as in Fig 8-16). It is mainly required to examine whether or not crack, wear, or distortion exists with oil seal, and it is also required to examine whether or not the elasticity of rubber is enough, and it shall be replaced once it is out of order.

b) Seal Rings 8 and 9;

Seal ring 8 for pump body and seal ring 9 for bearing shall be replaced with new ones, when pump body is reassembled.

c) Seal Rings 10 and 11: Examine whether or not they are worn and damaged.

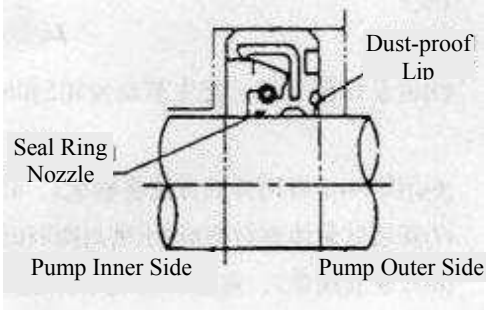


Fig 8-16

8.8.3 Reassembly (Fig 8-17)

(1) Clean the disassembled parts.

(2) Coat a thin layer of clean grease on the lips of oil seals 8, 9, 10, 11, and 14.

(3) Place the pump body 2 and the pump cover 1 on a flat stand, and coat the inner surface of pump body with clean hydraulic oil.

(4) Put bearings 3 and 4 into the pump body, and pay attention not to misplace their mutual positions. Place the bearing at correct position, and it may be taken out for reassembly, in the case of difficulty. It is never allowed to knock it gently or press it in forcibly.

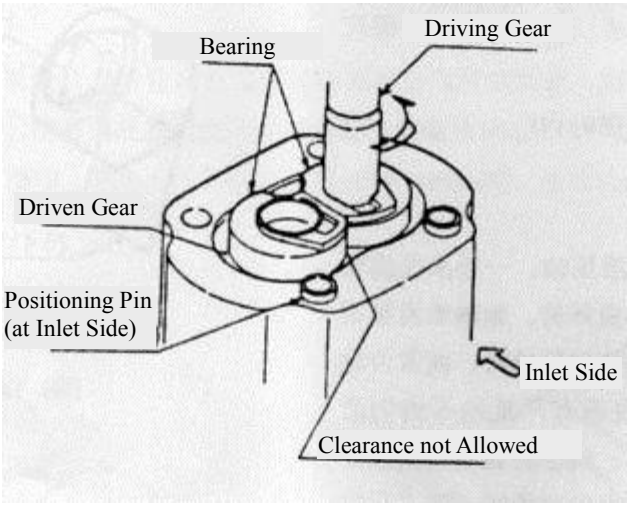


Fig 8-17

(5) Turn over the pump body, put the driving and driven gears 5 and 6 into the pump body, and allow the engaged teeth to be at the same engagement positions prior to disassembly.

(6) Mount the bearings 3 and 4 on one side of the front end cover using the same method as in Step (4).

(7) Mount the seal ring for pump body 8, the seal ring for bearing 9, and seal rings 10 and 11, and pay attention not to allow the seal rings to be overlaid in the middle.

(8) Assemble the front end cover 7, and in this case, wrap the band around the end of driving gear, to avoid damage of oil ring lip, and don't forget removing such band after the front end cover is mounted.

(9) When pump body is turned over to mount end cover, pay attention to prevent the slide of seal rings installed during step (7).

(10) Mount seal rings 8, 9, 10, and 11, with the same method as in step (7).

(11) Put on the end cover 1.

(12) Mount spring washer 13 and bolt 12, and tighten the bolt with a torque of $47^{+0.25}_{0}$ N.m ($4.7^{+0.26}_{0.}$ kgm).

Examine the gear pump as to whether or not it is assembled completely and properly. Place the driving shaft into the vice stand, the turn this pump, and the rotation of this pump shall be quite light. It is required to reexamine the pump, in the case when it is difficult to rotate.

Before this pump is assembled onto the machine, it is required to examine for a second time whether or not the assembly of the hydraulic pump is correct, and whether or not the rotating direction is correct.

Attention shall be paid to the following items when the pump is assembled:

a) Examine whether or not the lower part based on centerline is damaged or present with dust.

b) Examine whether or not the flange face of pipeline is damaged or present with dirt.

Mount O-ring, after the abovementioned has been examined.

8.8.4 Test Run

Operation shall be carried out after assembly. Observe whether or not the pump has the specified performance after reassembly, and do running-in. It is required for test run to be performed when pump is assembled on forklift truck, and test run shall be conducted according to the following method. If pump is blocked or its internal part is excessively worn out, oil shall be replaced and filter shall be replaced or cleaned.

(1) Install pressure gauge on high-pressure pipeline near the pump.

(2) Place the control valve at neutral gear, for pump to run at a speed of 500-1000rpm. As this valve is at neutral gear, the reading of pressure gauge shall be slightly lower than 1MPa (10kg/cm), and keep the pump running for 10 minutes under such status.

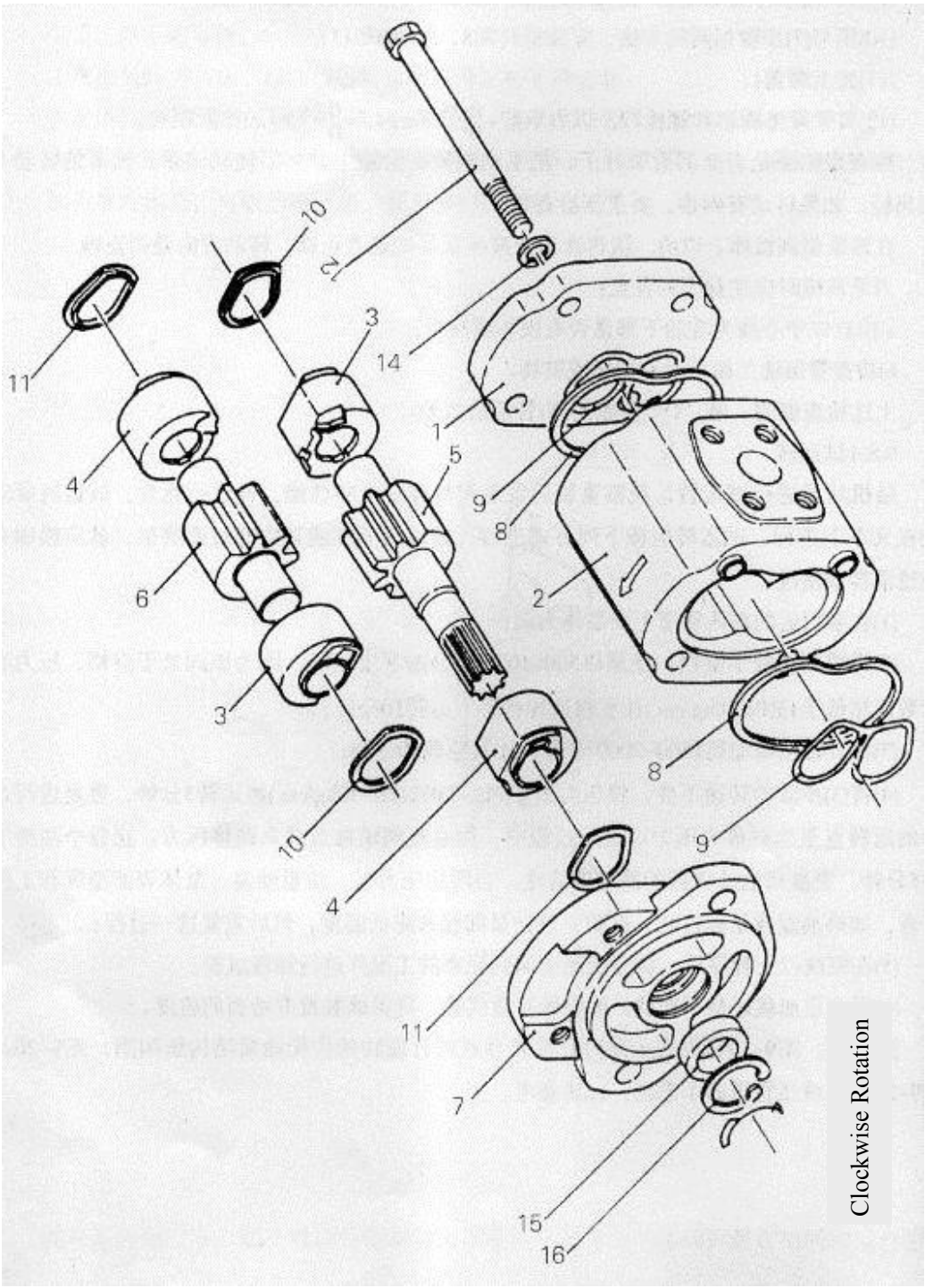
(3) Increase its rotating speed to 1500-2000rpm, and allow it to be idle for 10 minutes.

(4) Keep the rotating speed at Step (3) unchanged, increase the pressure to 2-3MPa (20-30kg/cm) for a further operation for 5 minutes, and repeat such operation until maximum pressure is reached. During this process, use overflow valve to increase load so as to adjust pressure. Allow each oil circuit to work for 5 minutes, and replace or clean the filter core of return oil filter. When pressure is boosted, attention shall be paid to oil temperature, as well as the surface temperature and working sound of pump body. IF oil temperature or pump temperature is too high, the pump shall be unloaded immediately to lower the temperature, and then this process is to be repeated.

(5) After the above procedure is completed, readjust the overflow valve to the original working condition and perform unloading test.

(6) No matter it is loading or not loaded, unloading test shall be made in either cases to ensure that this device has a proper speed.

Fig 8-18 and Fig 8-19 respectively indicate the lateral views for structure of gear oil pump in clockwise and counterclockwise rotations, and Fig 8-20 represents the schematic diagram of hydraulic pipeline, for your information.



1. End Cover 2. Pump Body 3. Bearing 4. Bearing 5. Driving Gear 6. Driven Gear
7. Front End Cover 8. Seal Ring 9. Seal Ring 10. Seal Ring 11. Seal Ring 12.Bolt
13. Lock Washer 14. Oil Seal 15. Locking Collar

Fig 8-18 Clockwise Rotation of Gear Pump
(2t-3.5t LPG Forklift Trucks)

1. End Cover
2. Pump Body
3. Bearing
4. Bearing
5. Driving Gear
6. Driven Gear
7. Front End Cover
8. Seal Ring
9. Seal Ring
10. Seal Ring
11. Seal Ring
12. Bolt
13. Lock Washer
14. Oil Seal
15. Locking Collar

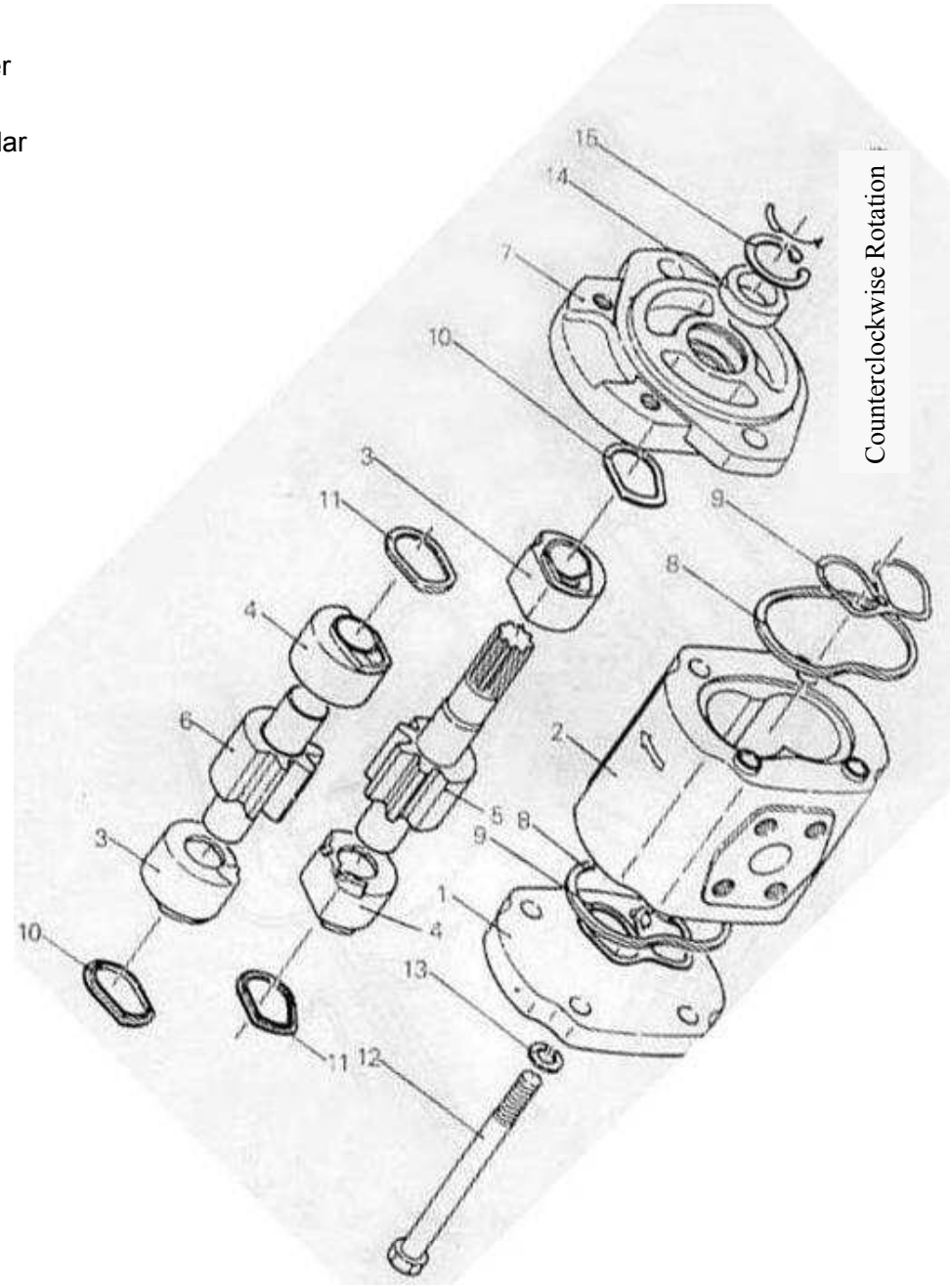


Fig 8-19 Counterclockwise Rotation of Gear Pump
(2-3.5t Diesel Forklift Truck)

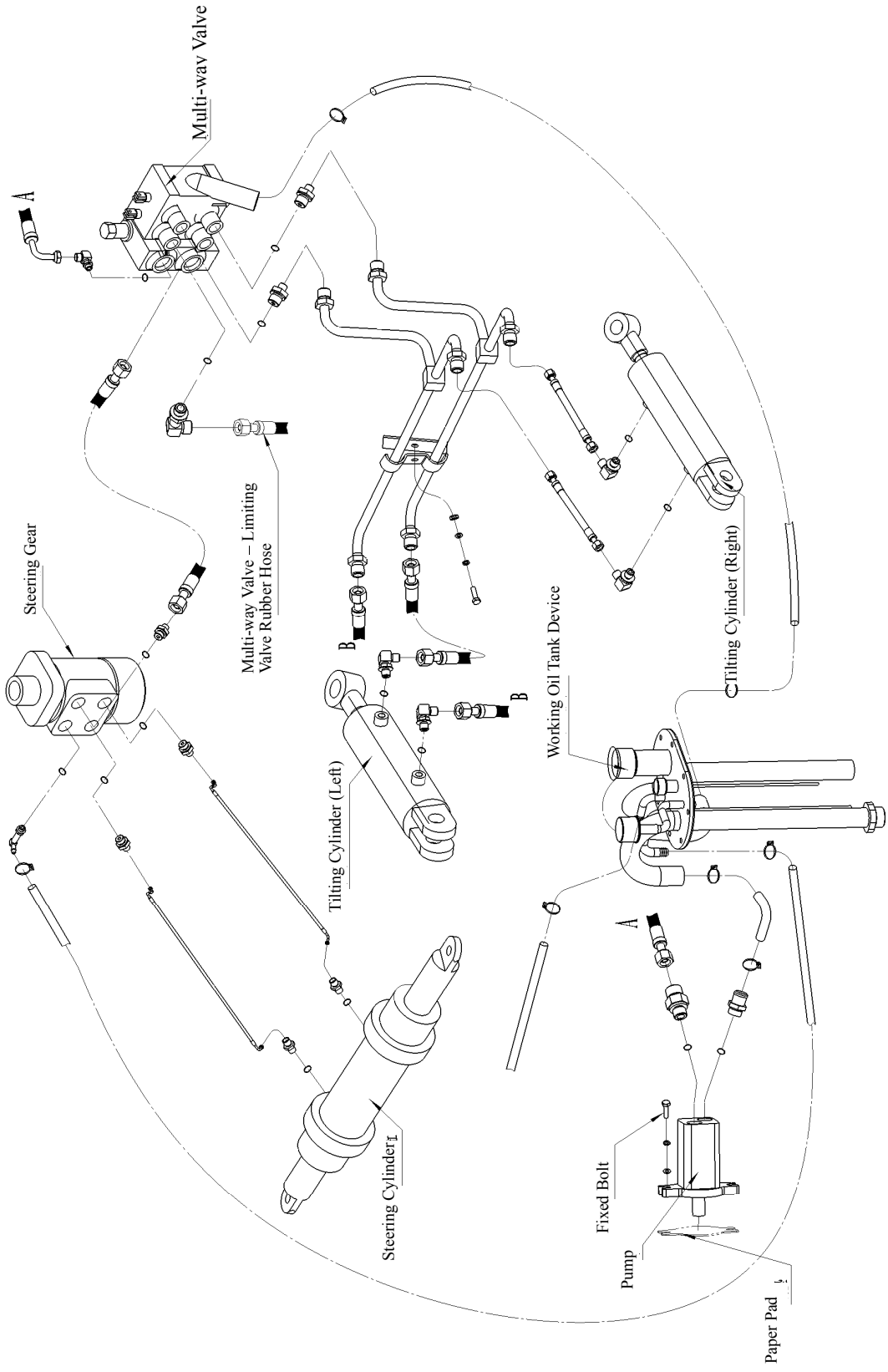


Fig 8-20 Schematic Drawing of Hydraulic Pipeline
(Diesel and LPG/Gasoline Forklift Trucks)

8.8.5 Failure Removal

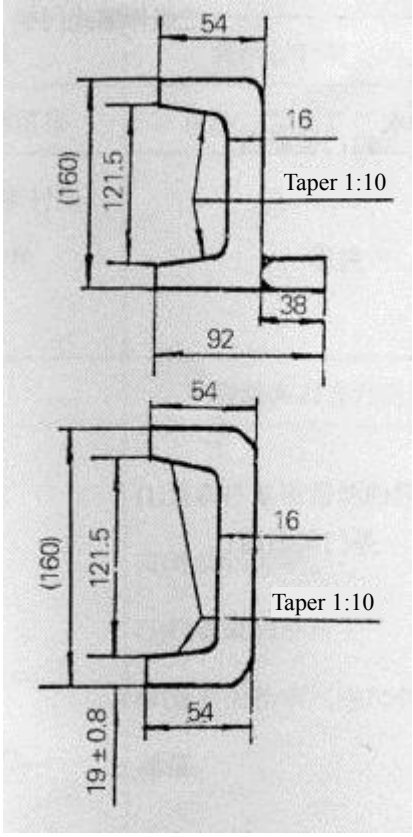
Problem	Possible Cause	Removal Method
Oil of Oil Pump Staying away	Oil level in oil tank to the low end	Oil to be filled to the specified oil level
	Oil suction side pipeline or filter blocked	To be cleaned, and oil to be replaced if it is dirty
Failure of Gear Pump for Supercharge	Bearings 3 and 4 worn, and bearing seal ring 9 or filler seal rings 10 and 11 at fault	To be replaced
	Overflow valve misadjusted	Pressure to be raised based by virtue of pressure gauge
	Air blended into pump	(1) Loosene3d joint at suction pipe side to be re-tightened (2) Oil to be added into oil tank (3) Oil seal of pump to b e examined (4) Pump to be started only until there is no more air bubble in oil tank
Noise of Gear Pump Loud	Oil suction side hose twisted, or cavity aroused by blockage of oil filter	Oil filter to be cleaned and hose to be adjusted
	Air sucked inside due to loosening of oil suction side joint	Each joint to be re-tightened
	Cavity aroused due to excessive viscosity	(1) Oil of proper viscosity to be used (2) Work to be started only when oil temperature is normal
	Non-concentric	To be concentric
	Air bubble present in hydraulic oil	Cause for generation of air bubble to be examined and to be repaired
Oil Leak with Pump	(1) Oil seal and seal ring 8 of pump at fault (2) Sliding face worn (for internal leak to be increased)	To be replaced

9. Lifting System

2t-3.5t Type Roller type, “J”-shaped inside mast, “C”-shaped mast with free lifting, two-stage telescopic mast

End Face of
Inside Mast:

End Face of
Outside Mast:



Rollers:

- Main Roller I
- Roller 2
- Limit Roller
- Side Roller Group I
- Side Roller Group II
- Side Roller Group
- Lifting Chain (ISO)

- Fork Mast Lifting System
- Fork Mast Adjusting Device
- Weight (Lifting Height at 3m)

9.1 Overview

Lifting system is a two-stage rolling telescopic mast, with the outside mast typical of a “C” shaped end face, and the inside mast in a “J” shaped end face. The fork and the bracket comply with the international standard, with a free lift of about 300mm during operation.

9.2 Inside and Outside Masts

The mast assembly is composed of inside and outside masts. The lower part of the outside mast is connected with drive axle, with weight mainly supported on axle housing. The bracket of tilt cylinder on the outer side in the middle of outside mast is connected with piston rod of tilt cylinder. The mast is able to tip forward for 6° and backward for 12° through operating the inclined spool valve of multi-way valve. The inside and outside masts are welded parts, to bear the longitudinal and traverse loads through rollers and side rollers, and to allow the inside mast to rise and fall steadily.

9.3 Bracket

The bracket is also in a structure of welded part, to allow the bracket to move upward and downward steadily along the inner edges of the channel steel for the inside mast and to bear the longitudinal and traverse loads through rollers and side rollers with clearance adjustable. There are three groups of main rollers (Roller I) and two groups of side rollers on each side of the bracket for 2-4t forklift trucks, and when the fork rises to the maximum height, one pair of main rollers on left and right on top will extend to the upper edge of the inside mast.

The fork is locked inside the groove on the bracket using lock pins, and the spacing of fork may be adjusted on the left or right manual. International standard (ISO) is applied to fork and bracket, to facilitate common use and interchange.

9.4 Adjustment of Lifting System

(1) Drop the fork to the ground, and adjust the lift chain, to ensure that the distance between the lower roller center of bracket and the lower edge of inside mast is 15-20mm.

(2) Tip back the mast and adjust the tensioning force of lift chain, for the tensioning degrees of lift chain at places b to be equivalent (Fig 9-1).

(3) The strokes of left and right lift cylinders shall be equivalent, and their strokes may be adjusted using cylinder cover 4 (Refer to Fig 8-8.).

(4) Adjust the error of position for the height of left and right lift cylinders by making use of the adjusting bolt on the upper end of right lift cylinder as indicated in Fig 9-2.

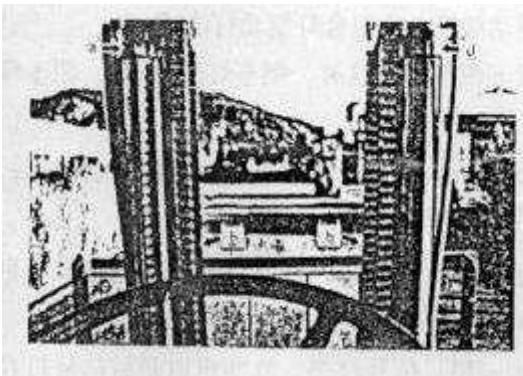


Fig 9-1

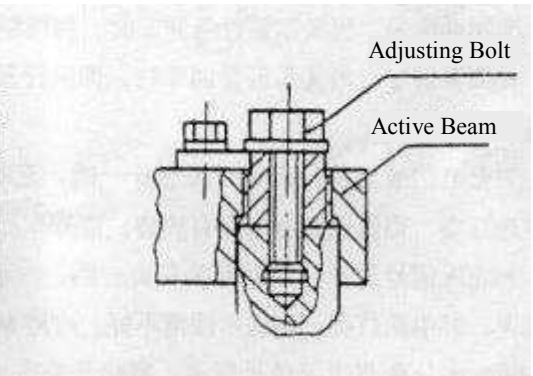


Fig 9-2

10. Electrical System

10.1 Overview

The electrical system is a negative earthed signal-wire circuit. The electrical equipment is mainly composed of following several systems:

(1) Charging System

It consists of engine, battery, charging indicator signal light, etc, belonging to a power supply for power equipment used for forklift trucks, with a voltage: 12V.

(2) Starting System

It is mainly composed of starter, and start switch, and its purpose is to start engine.

(3) Ignition System (LPG/Gasoline Forklift Truck)

It mainly comprises of distribution block, ignition wire, and spark plug, etc, used for ignite burning mixture in LPG/Gasoline engine.

(4) Instruments

They cover hour meter, oil gage, and water temperature gauge, etc, are the monitoring equipment on the forklift truck.

(5) Lighting and Signal Equipment

It includes various lighting, and signal lights, as well as horn, and buzzer, etc.

Front Headlight: 55W

Front Combination Light (Steering/Width Light): 10W

Rear Combination Light (Width/Brake/Reversing/Steering): 5W/21W/21W/10W

10.2 Operating Brief Description

(1) Preheating Start Switch: Right-hand turn to 1st gear, the instrument and ignition power is connected, to automatically start preheating for the diesel engine. The preheating indicator light turns on, and preheating will be completed after it has lasted for 12 seconds. It may be turned to the 2nd gear to start engine.

Attention: Place the transmission case lever must be placed on zero gear before it can be started for hydraulic forklift truck, and otherwise, the zero-gear switch will be in open circuit, and the starter fails to be started.

(2) Light Switch: Turn to the 1st gear, the front and rear width lights turn on, and turn to the 2nd gear, for the front headlight to turn on.

(3) Left-hand Turn Signal: Pull backward the switch for turn signal light, the left-hand turn signal light of the front combination headlight flashes and turns on.

(4) Right-hand Turn Signal: Push forward the switch for turn signal light, the right-hand turn signal light of the front combination light flashes and turns on.

(5) Brake Signal: When it is required to forklift truck to brake, push down the brake pedal with foot, the brake light (red) of the rear combination light turns on

(6) Reversing Signal: When it is required for forklift truck to reverse, place the control rod at the reversing gear, and at this point, the reversing light (white) turns on, and the reversing buzzer will hoot immediately.

(7) Charging Signal Display: Right-hand turn of start switch to the 1st gear, the charging indicator light turns on, and it will automatically turn off at once after engine is started.

(8) Oil Pressure Signal Display: Right-hand turn of the start switch to 1st gear, the engine oil pressure indicator light turns on, and it will automatically turn off after engine is started. If the light turns on in running process, it then indicates that lubrication is not under satisfactory condition, and it shall be parked for examination.

(9) Oil-Water Separator Indicator Signal Display: Right-hand turn of start switch to the 1st gear, the signal light will turn on, and it will automatically turn off after engine is started. If the light turns on in running process, it then indicates that water is accumulated in fuel-water separator. Press the compression bar on oil-water separator for water to be then drained out, and the signal light will turn off after water is drained (only used for diesel engine trucks).

(10) Fuel Gauge: Indicating the storage volume of fuel in fuel tank.

(11) Water Temperature Gauge: Indicating the temperature of engine cooling water. The white area on the scale plate is 60-80℃, the green area is 80-110℃ (normal working temperature of engine), and the red area is 110-145℃. When pointer is pointed to the red area, the forklift truck shall be stopped for use, to be launched into work again when pointer returns to green area.

(12) Hour Meter: Cumulative total working hours of engine

10.3 For the engine control section, please read the engine manual

10.4 Battery

This series forklift with Xunqi battery, in the use of maintenance should note the following:

(1) When installing and maintaining, do not touch the conductor of the battery, which can cause serious burns.

(2) When charge the battery, the positive and negative can not be reversed, otherwise it will cause high temperature, burning, smoke or explosion.

(3) When do the battery maintenance, please wear goggles, rubber gloves, rubber shoes.

(4) The battery will produce flammable gas, there is a risk of explosion, it should avoid short circuit and spark production, strictly prohibited fireworks.

(5) Prohibit the removal of the battery, the battery electrolyte is dilute sulfuric acid, when contact with the skin, please immediately rinse with water, get the eyes rinse with water and see doctor in time.

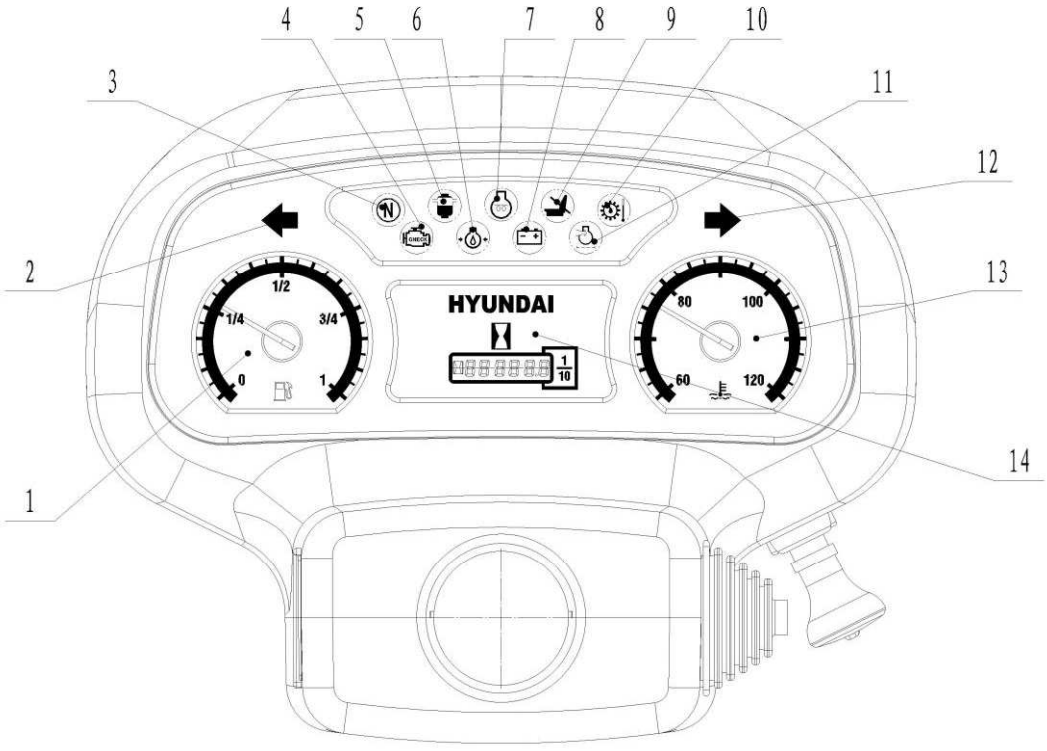


Fig 10.1 Combination display（National III display comes with fault indicator）

1. Fuel gauge 2. Left turn indicator light 3. Neutral indicator 4. ECU failure(not use)

5. Sediment indicator light 6. E/G oil pressure alert light 7. Pre-heat indicator light

8. Battery Charging light 9. Seat belt light 10. T/M oil temp gauge 11. Air filter indicator light

12. Right turn indicator light 13. Water Temperature gauge 14. Houre meter

IV. Drive, Operation, and Routine Maintenance of Forklift Truck

The forklift drivers and management personnel must bear in mind “Safety First”, and perform safety operation and standard operation according to the forklift truck operation and maintenance manual as well as driver manual.

1. Conveyance of Forklift Truck

Attention must be paid to following items when container or motor vehicle is used to convey forklift trucks:

(1) Trigger the parking brake.

(2) It is required to fasten properly the front part and the rear part of the mast and the counter weight using steel wire, and to wedge up properly the corresponding positions of front and rear wheels using wedge blocks.

(3) Hoist according to the “Lift Label Plate” of forklift truck during lifting operation.

2. Storage of Forklift Truck

(1) Drain the fuel completely. (Cooling water is not to be drained if it is the antirust and anti-freezing fluid.)

(2) Coat antirust oil on the surface of un-painted parts, and coat lubricating oil on the lift chain.

(3) Drop the door to the lowest position.

(4) Trigger the parking brake.

(5) Fill the front and rear wheels properly using wedge blocks.

3. Preparation prior to Operation

(1) Avoid examining fuel, oil leak, and oil level as well as examining electrical instrument in the place with open fire, and avoid adding fuel during operation.

(2) Examine air pressure of tyres.

(3) The handle for forward and reversing gear shall be placed at the middle position (the position of part).

(4) Don’t smoke when fuel system is work and when battery is examined.

(5) Examine the status of respective handles and pedals.

(6) Get well prepared prior to start.

(7) Loosen the parking brake.

(8) Perform the test actions for lift and drop, forward and backward tip of mast as well as steering and brake of forklift truck.

(9) The degree for contamination of hydraulic oil is larger than Grade 12, and the NAS1638 “Requirement for Cleanliness of Parts with Hydraulic System” is to be followed as test standard.

4. Operation of Forklift Truck

(1) The forklift truck shall be driven by drivers who have been trained and hold driving license.

(2) The operators shall wear shoes, helmet, clothes, and gloves usable for safety protection during operation.

(3) Examine respective controls and warning devices before truck is driven, and it is required to operate the truck after repair in the case when any damage or defect is found.

(4) Load shall not exceed the specified values during conveyance. Fork must be completely inserted under the cargo, and cargo shall be uniformly placed on the fork. It is not allowed to pick up cargo using single fork tip.

(5) Smoothly perform start, turning, driving, brake, and stop. Slow down at turning, on wet or smooth pavements.

(6) It is required to place cargo as low as possible, and to keep the mast tilt backwards, when cargo is load for driving.

(7) It is required to be careful during driving on a ramp. It is required to drive forward during upgrade and drive reversely during downgrade, when the truck is driven on a ramp larger than 1/10. Turning shall be avoided by all means, and please never perform loading-unloading operation when forklift truck is running downgrade.

(8) It is required to pay attention to passengers, obstacles, and low-lying pavements, and pay attention to the clearance above the forklift truck, during driving.

(9) It is not allowed for anyone to stand on fork and it is not allowed for anyone to be carried on truck.

(10) It is not allowed for anyone to stand under the fork, or to walk under the fork.

(11) It is not allowed to control the truck and spreaders at any position other than the driver seat.

(12) It is required to pay attention to the fall of cargo from above, for any high lift forklift trucks with a lifting height larger than 3m, and protective measures must be taken, when necessary.

(13) Try as much as possible to tip backward the mast for high-lift forklift trucks during work, and it is required to perform front or back tip within the minimum range during loading-unloading operation.

(14) It is required to take a doubled care, and to drive slowly, during running on dock or on temporary planks.

(15) Driver shall not stay on the truck, when fuel is added, and the engine shall be turned off. Ignition is to be avoided when battery or level of oil tank is examined.

(16) The forklift trucks with spreaders shall be operated as loaded forklift trucks during empty-load operation.

(17) Don’t convey unfixed or loosely stacked cargo, and take care when cargo of relatively large size is conveyed.

(18) Drop the fork onto the ground, and put the handle for gear position to neutral gear, and turn off the engine or disconnect the power supply when driver leaves the truck. Pull the parking brake device properly when truck is parked on a ramp, while wedge blocks must be used to fill up the wheels when the truck is to be parked there for a long time.

(19) It is not allowed to open water tank cover carelessly, under the condition when engine is very hot.

(20) The pressures of multi-way valve and safety valve have been properly adjusted before delivery of forklift truck from factory, and users shall not adjust them at discretion during use, to avoid damage of entire hydraulic system and hydraulic components due to excessively high adjustment.

(21) The value of air pressure specified on the label plate of “Tire Air Pressure” shall be followed for tyre air charge.

(22) The maximum noise outside the forklift truck is not to be larger than 89dB (A), and JB/T3300 shall be followed as test method.

5. Notices for application of Cooling System

(1) When forklift truck is being used, in the case when radiator is overheated or temperature of coolant is excessively high, try as much as possible not to open the radiator cover immediately. Examine the liquid level, in order to find the overheating cause. When cover has to be opened, it is required to drop engine to medium speed. Turn the radiator cover slowly and loosen off the cover after waiting for a while, to avoid scald of operator by splash of coolant.

Make sure to screw the radiator cover properly in place, when it is tightened up, and otherwise it is difficult to build up a specified pressure system.

(2) Regarding the radiator with coolant used as cleaning water, the water in radiator shall be drained out, only when truck is parked in cold weather and risk exists for water to be frozen. The radiator shall be detached, after it has worked for a period of time, and shall be cleaned in the boiled soda solution, to remove the scale or sediment formed on respective inner surfaces of radiator.

(3) Regarding radiator with long-acting antirust and anti-freezing fluid used for coolant, it is strictly prohibited to randomly add water and anti-freezing fluid of different models. The antirust and anti-freezing fluid of the same model shall be supplemented after anti-freezing fluid is leaked or evaporated.

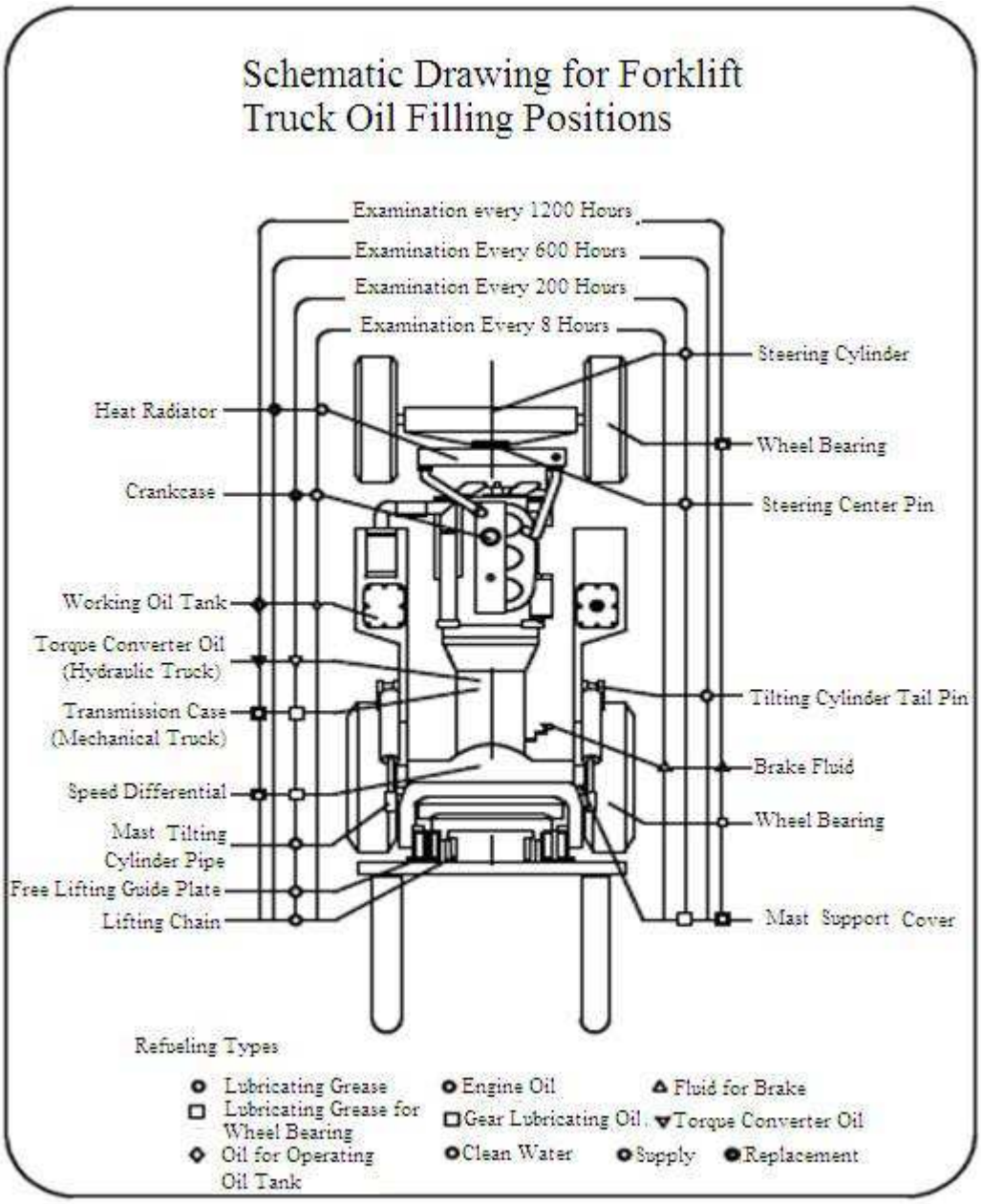
Anti-freezing fluid is generally used both in winter and summer, not changed for four seasons. It shall be drained out for filtration and purification treatment after use for one year in general, to be then further used.

(4) According to different work conditions, the smudge on the outer surface of radiator shall be periodically cleaned and removed, either to be soak cleaned using detergent, or to be flushed using compressed air or high-pressure water (pressure not larger than 4kg/cm).

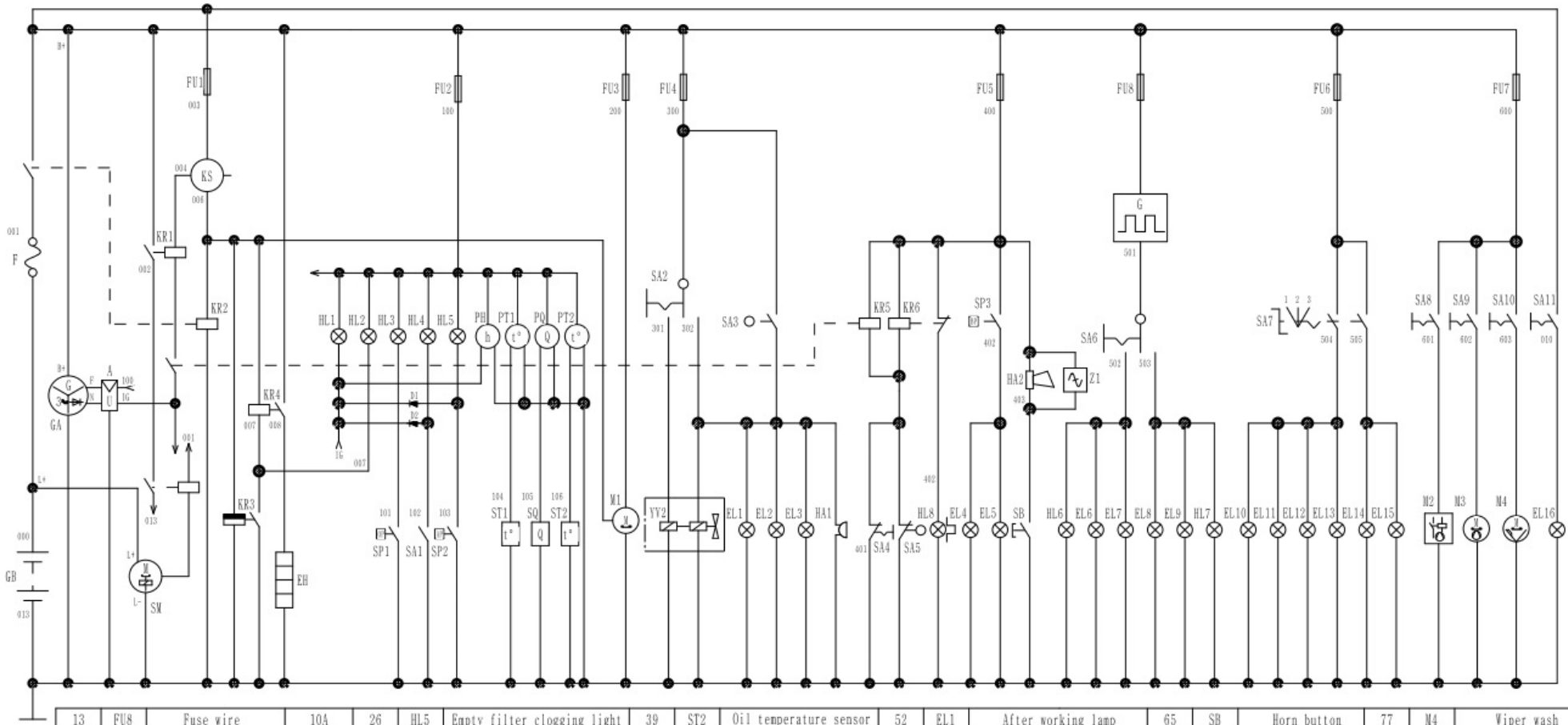
6. Oils Used for Forklift Truck

* Refer to followed Operator's manual page 78.

7. Lubricating System Table

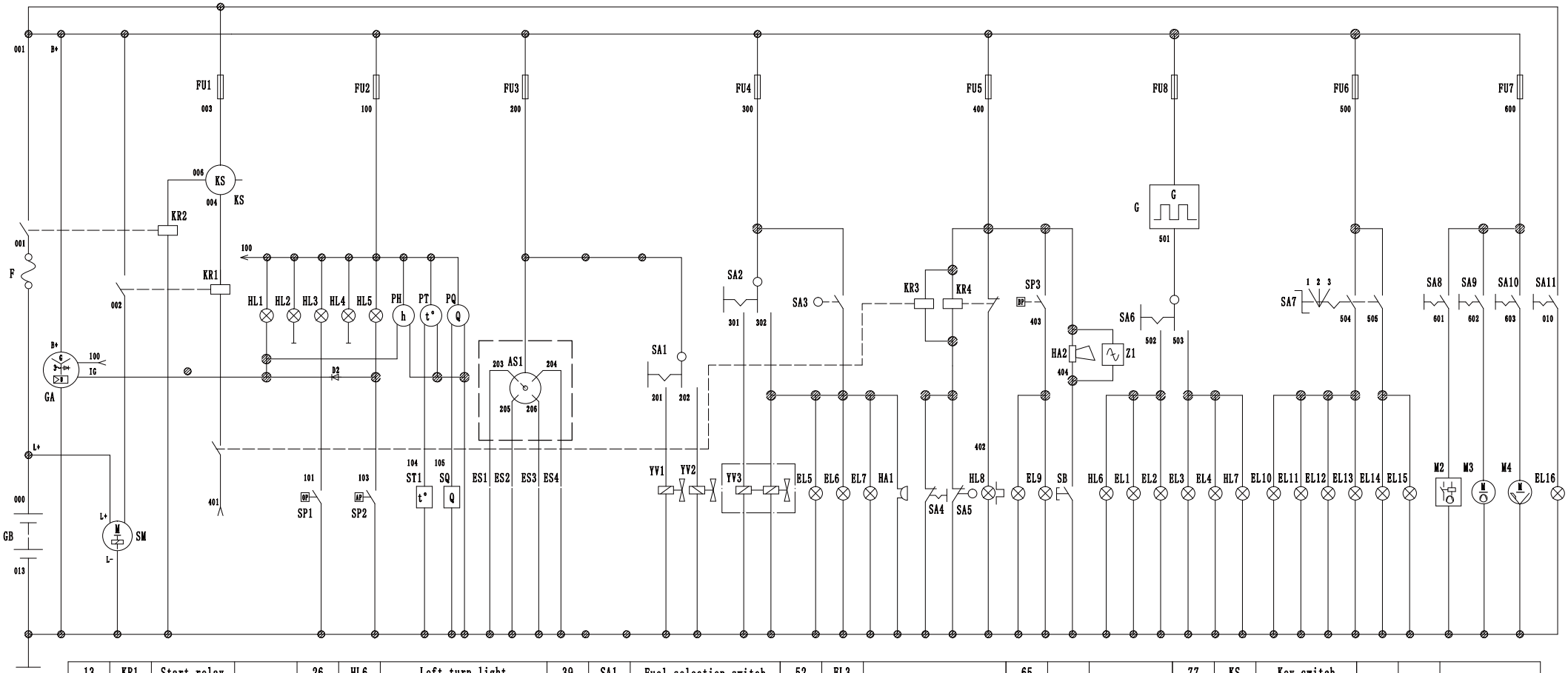


Power	Start	Ignition and preheating	Instrument	Valve block control	Sound signal and lighting	Bridge apparatus



Number	Code	Designation	Parameter	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation
13	FU8	Fuse wire	10A	26	HL5	Empty filter clogging light	39	ST2	Oil temperature sensor	52	EL1	After working lamp	65	SB	Horn button	77	M4	Wiper wash
12	FU7	Fuse wire	30A	25	HL4	Oil-water separation light	38	SQ	Oil measurement sensor	51	YV2	Direction valve	64	EL13	Width lamp	76	M3	Air fan
11	FU6	Fuse wire	30A	24	HL3	Oil pressure alarm light	37	ST1	Water temperature sensor	50	SA11	Reading light switch	63	EL12		75	M2	Air conditioner
10	FU5	Fuse wire	15A	23	HL2	Preheat the lamp	36	SP3	Brake switch	49	SA10	Wiper switch	62	EL11		75	M1	Stalled motor
9	FU4	Fuse wire	15A	22	HL1	Charge lamp	35	SP2	Air pressure switch	48	SA9	Electric fan switch	61	EL10		74	HA2	Horn
8	FU3	Fuse wire	15A	21	EH	Heater plug	34	SP1	Oil pressure switch	47	SA8	Air conditioner switch	60	EL9	Right turn light	73	HA1	Reverse buzzer
7	FU2	Fuse wire	15A	20	KR6	Running lights relay	33	PT2	Oil temperature gauge	46	SA7	Light switch	59	EL8		72	G	Flasher
6	FU1	Fuse wire	10A	19	KR5	Neutral relay	32	PQ	Oil measurement gauge	45	SA6	Turn signal switch	58	EL7	Left turn light	71	Z1	Horn filter
5	SM	Start engine	12V	18	KR4	Preheating relay	31	PT1	Water temperature gauge	44	SA5	Neutral switch 2	57	EL6		70	D2	Diode
4	F	Fusible wire	50A	17	KR3	Timer relay	30	PH	Hourmeter	43	SA4	Neutral switch 1	56	EL5	Stop lamp	69	D1	
3	A	Electronic regulator	14V	16	KR2	Main relay	29	HL8	Running lights	42	SA3	Reversing switch	55	EL4		68	EL16	Reading light
2	GA	Alternator	14V · 50A	15	KR1	Start relay	28	HL7	Right turn light	41	SA2	Direction switch	54	EL3	Backup light	67	EL15	Headlamp
1	GB	Battery	12V · 90AH	14	KS	Key switch	27	HL6	Left turn light	40	SA1	Oil-water separation switch	53	EL2		66	EL14	

Power	Lgnition and Start	Instrument	Engine appliance	Direction control	Sound signal and lighting	Bridge apparatus



13	KR1	Start relay		26	HL6	Left turn light	39	SA1	Fuel selection switch	52	EL3	Backup light	65			77	KS	Key switch			
12	FU8	Fuse wire	10A	25	HL5	Empty filter clogging light	38	ST2	Oil temperature sensor	51	EL2		64	EL15	Headlamp	76	M3	Wiper wash			
11	FU7	Fuse wire	30A	24	HL4	Oil-water separation light	37	SQ	Oil measurement sensor	50	EL1	After working lamp	63	EL14		75	M3	Air fan			
10	FU6	Fuse wire	30A	23	HL3	Oil pressure alarm light	36	ST1	Water temperature sensor	49	SA11	Reading light switch	62	EL13	Width lamp	75	M2	Air conditioner			
9	FU5	Fuse wire	15A	22	HL1	Charge lamp	35	SP3	Brake switch	48	SA10	Wiper switch	61	EL12		74	M1	Fuel pump			
8	FU4	Fuse wire	15A	21	ES4	Ignition plug	34	SP2	Air pressure switch	47	SA9	Electric fan switch	60	EL11		73	SB	Horn button			
7	FU3	Fuse wire	15A	20	ES3		33	SP1	Oil pressure sensor	46	SA8	Air conditioner switch	59	EL10		72	HA2	Horn			
6	FU2	Fuse wire	15A	19	ES2		32	PT2	Oil temperature gauge	45	SA7	Light switch	58	EL9	Right turn light	71	HA1	Reverse buzzer			
5	FU1	Fuse wire	10A	18	ES1		31	PQ	Oil measurement gauge	44	SA6	Turn signal switch	57	EL8		70	G	Flasher			
4	SM	Start engine	12V	17	AS1	Distributor block	30	PT1	Water temperature gauge	43	SA5	Neutral switch 2	56	EL7	Left turn light	69	Z1	Horn filter	81	HL2	Preheat the lamp
3	F	Fusible wire	50A	16	KR4	Running lights relay	29	PH	Hourmeter	42	SA4	Neutral switch 1	55	EL6		68	D2	Diode	80	YV3	Direction valve
2	GA	Alternator	14V◦40A	15	KR3	Neutral relay	28	HL8	Running lights	41	SA3	Reversing switch	54	EL5	Stop lamp	67	D1		79	YV2	Fuel valve
1	GB	Battery	12V◦60AH	14	KR2	Main relay	27	HL7	Right turn light	40	SA2	Direction switch	53	EL4		66	EL16	Reading light	78	YV1	Gasoline valve
Number	Code	Designation	Parameter	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation	Number	Code	Designation