Original instructions

OPERATION & SERVICE MANUAL

2-3.5T Internal Combustion Counterbalanced Forklift Truck

CPC(D)20/25/30/35
CPQ(D)20/25/30/35
CPYD 20/25/30/35

KION Baoli (Jiangsu) Forklift Co., Ltd.

PREFACE

The new type BAOLI forklift truck is of internal combustion balance weight type, which adopts advanced TCM transmission, wide vision mast system, cycloid gear type powered steering unit, and other advanced technique and equipment. So it is characterized by high performance, convenient operation, wide vision, flexible steering, reliable braking, low noise and attractive appearance. It is suitable for loading and transportation of kinds goods in goods station, port, airport, factory and store house. It is the ideal machine for realizing mechanization in loading and unloading. If the forklift truck is equipped with some attachments, its usage sphere will be wider.

This manual states 2-3.5t forklift truck's specifications, main assemblies' construction, working principle, operation and maintenance. It is necessary to read over the manual before operating or maintaining the forklift trucks. The rules and notices in this manual should be abided seriously by all of relative personnel to enable these trucks in optimized working state for long period and bring the highest efficiency.

The partial content in this manual might not correspond with the actual condition because of technical improvement. Our products are subject to improvements and changes without notice.

If there is something in the manual you do not understand, ask local dealers for advice. Suggestion and criticisms are welcome.

Thank you for your trust for Baoli forklifts, we heartily wish you have a merry heart goes all the way.

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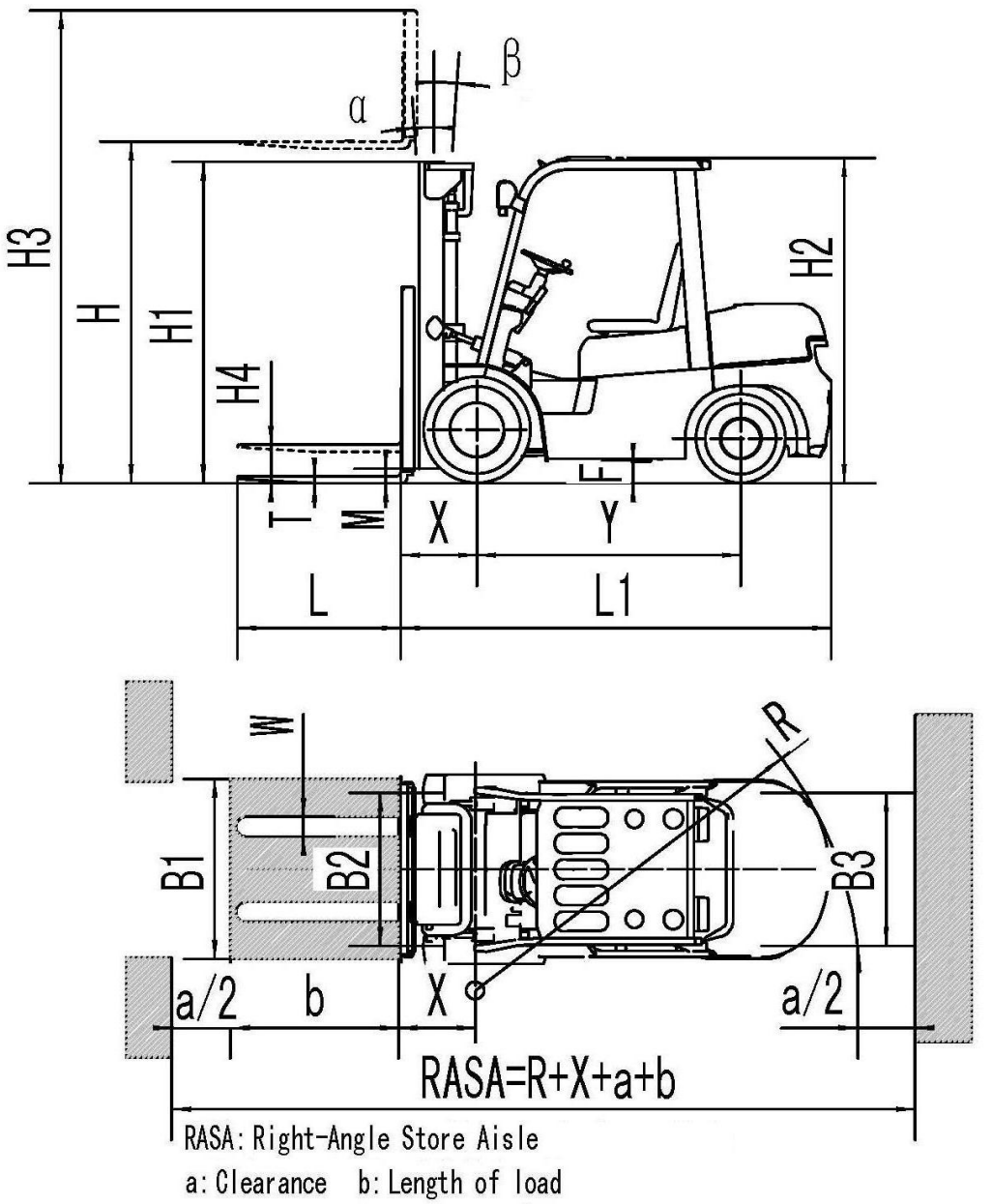
1. External view and technical parameter



External view

Technical parameter

General	Manufacturer					KION Baoli		
	Model					CPC(D)20 CPQ(Y)D20	CPC(D)25 CPQ(Y)D25	CPC(D)30 CPQ(Y)D30	CPC(D)35 CPQ(Y)D35
	Power type					Diesel / Gasoline/ LPG			
	Rated capacity				kg	2000	2500	3000	3500
	Load center				mm	500			
Dimension	Lift height			H	mm	3000			
	Free lift height			H4	mm	140		145	
	Fork size			L×W×T	mm	1070×120×40	1070×120×45	1070×125×45	1075×130×45
	Mast tilt angle			α/β	deg	6/12			
	Front overhang			X	mm	484	489	494	500
	Overall dimension	Length to fork face		L1	mm	2510	2580	2720	2775
		Overall width		B1	mm	1150		1225	
		Mast lowered height		H1	mm	2050		2080	2230
		Mast extended height		H3	mm	4040		4272	
		Overhead guard height		H2	mm	2060		2090	
	Turning radius			R	mm	2170	2240	2460	2540
Performance	Travel speed (full load/no load)	Hydraulic			km/h	17 / 19		18 / 19	
		Mechanical	Shift Ⅰ		km/h	8.5 / 9		8.8 / 9	
			Shift Ⅱ		km/h	18.5 / 19		18.5 / 20	
	Lift speed with load				mm/sec	470		430	400
	Max. grade ability				%	20			15
	Service weight				kg	3550	3880	4380	4750
Wheel & Tyre	Tyre	Front				7.00-12-12PR		28×9-15-12PR	28×9-15-14PR
		Rear				6.00-9-10PR		6.50-10-10PR	
	Tread	Front		B2	mm	970		1000	
		Rear		B3	mm	970		970	
	Wheelbase			Y	mm	1600		1700	
	Ground clearance (full load/no load)	Mast		M	mm	85/105		110/135	
		Frame		F		115/120		135/140	

2. Characteristic

The forklift truck has advantages as follows:

1. The hydraulic steering device makes steering flexible and the double ladder like steering axle makes the turning radius minor.

2. The braking system employs oil pressure brake, makes it possible to manipulate conveniently and brake reliably.

3. Employed wide-vision extension type mast, the forklift truck is high intensity. The forklift truck can be fitted with 2-stage or 3-stage full free lift mast having different lifting height, even all kinds of the attachments according to the needs of the clients.

4. Hydraulic transmission type forklift trucks are provided with a drive unit including a torque converter and a hydraulic transmission. They feature the following:

a. Hydraulic torque converter can change the speed automatically with no limitation and output torque makes the forklift truck have good performance of drawing.

b. The inching device makes it easy for the drivers to aim the fork to the cargo.

c. At work, for the forklift truck that needs starting and shifting frequently, achievement of smooth gear shifting control can raise working efficiency, simplify operation, reduce the driver’s labor intensity and reduce requirement of the driver’s operation skill.

5. The drive unit of the mechanical forklift truck consists of transmission and differential. The transmission is provided with a synchromesh mechanism. It makes the engaged gear avoid striking when shifting, lower the shift noise.

6. The forklift truck can be chosen different height mast and driver’s cab according to the operating into container or out container.

7. Specific outline adopts streamline design, wider operating vision and larger driving space. It has advantages such as low noise, vibration damping, dustproof, comfortable operation, safety and reliability.

Main system of forklift truck

No.	Name		Content
1	Power system		engine mounting, system of fuel, exhaust and cooling (inc. torque converter oil cooler)
2	Transmission system	Mechanical drive	clutch, transmission with synchromesh mechanism, differential etc.
		Hydraulic drive	torque converter, power shifted transmission, differential, gearshift etc.
3	Drive axle		axle housing, half shaft, wheel hub, brake, and front wheel etc.
4	Brake system		brake cylinder, brake unit, brake pedal etc.
5	Steering system		steering wheel, steering shaft, cycloid gear type powered steering unit and steering axle etc.
6	Hydraulic system		pump, valve, HP oil pipe, LP oil pipe, connectors etc.
7	Electric system		lamps and lanterns, battery, meter, harness etc.
8	Lifting system		mast, fork, lift bracket, load backrest, tilt cylinder, lift cylinder, lift chain, mast roller etc.

Ⅱ. Safety instruction and operation of forklift truck

It is important for drivers and managers to remember the principle of “first safety” and ensure the safety operation as the description of Operation & Service Manual. Please read this manual thoroughly. This will give you a complete understanding of Baoli forklift truck and you will operate them correctly and safely.

1. Handling a new forklift truck

The performance and service life of the forklift truck depends heavily upon the way you handle it during the break-in period. Drive with special caution while becoming familiar with a new forklift truck.

(1) Always warm up your vehicle before putting it to work irrespective of season. Don’t run engine at high rpm without load needlessly. Operate the vehicle under the light load, avoid sudden speeding and braking.

(2) Replace gear oil in the differential and reducer after the new forklift truck working for 100 hours.

(3) Renew the oil in engine oil pan, transmission, driving axle and hydraulic oil tank; check and readjust the clearance of the driving and driven gear in the reducer after the new forklift truck working for 200 hours.

2. Inspection before operation

Please pay attention to the following items in order to make the vehicle working with high efficiency and lengthen its service life.

(1) The forklift truck adopts the home or imported engine, please read the manual accompanied with the engine carefully when using and maintenance.

(2) Check the tyre inflation pressure, if doesn’t enough, charge air in time. Check the bolts of all wheels for tightness.

(3) Check the amount of oil in the working oil tank for sufficiency, the position of lubrication should be lubricated. The oil level should be at the middle position between the upper and lower scale marks of oil level meter. The contamination level of the hydraulic oil should be lower than Grade 12.

(4) Check the radiator, and add antifreeze if necessary.

(5) Check hydraulic oil and brake fluid for leakage. Check if any leak or damage

found on the oil pipes, water hoses, vent-pipes and the piping joints, pumps and valves etc.

(6) Check for all the terminals and plugs in normal state. Check the meters, lamps, switches and electric circuit if they are running properly.

(7) Check every pedal for free stroke and the levers for looseness and smooth operation. Check lifting system, actuate the lifting and tilting levers to be certain that the lift bracket moves up and down properly and the mast can be tilted smoothly. Check brake system and steering system for flexibility and reliability.

(8) Check the wheel brake: the free stroke of brake pedal is 4-8 mm, when achieving effective brake, the clearance between the front floor and the pedal should be more than 20mm.

(9) Check the parking brake: the unload forklift truck can park on 20% slope, when the parking brake is locked.

(10) Check all connectors and fasteners for looseness.

3. Start and stop of the engine

(1) Start of the engine

(a) First set the shift lever at the neutral position and the parking brake at the braking position.

(b) When starting, put the key into the start switch, turn it in the counter clockwise, preheat 15-20 seconds, and then turn it in the clockwise to “START” so the starting motor works. When your hand is away from the key, it automatically returns to “ON” by spring force. Every starting time shouldn’t morn than 15 seconds. Restarting should be after 30 seconds. As the engine doesn’t work after some times starting, should check and remove the trouble, do not keep the starting motor engaged for a long time**.**

(c) Following the start of the engine, it’s necessary to set the engine on idle running for five minutes. Full load operation can’t be started until water temperature of the engine rises above 60℃.

When the engine is on idle running, you must check water thermometer, oil manometer, ammeter, fuel measurer, and so on for the data, whether to meet the specification, and check each pedal for free stoke, braking performance for its reliability, steering operation for its flexibility, tyre pressure for its conformance to the standard. If

there is no trouble, operation may be allowed.

(2) Stop the engine

First set the engine on idle running for five minutes, so as to cool the engine gradually, and then turn off the ignition switch, so the engine is stopped to work.

Notice：

．While the engine running, does not turn the start switch to “START” position, or it will damage the starting motor.

．Do not keep the start switch at the “ON” position while the engine is shut down. This will result in battery discharge.

4. Shipping, loading and unloading, slinging and towing of forklift truck

(1) Ship the forklift truck

(a) Apply the parking brake when shipping the forklift trucks by container or freight car.

(b) Fix the mast and the balance weight with steel wire and use jacks to prevent the forklift trucks from moving in the cabin.

(c) Pay attention to the overall length, width, height when loading, unloading and shipping and conforming the regulations is necessary.

(d) Single transporting if necessary after disassembling the mast and balance weight.

(2) Load and unload the forklift truck

(a) Use the plate with enough length, width and strength.

(b) Pull the parking brake and use jacks to stop the wheel.

(c) Fasten the plate on the center of the cabin, there must be no grease on the plate.

(d) The left and right height of the plate must be equal to make the loading and unloading smooth.

(e) Don’t change the direction on the plate to prevent the danger.

(f) Reverse the forklift truck slowly when loading it on the freight car.

(3) Sling the forklift truck

(a) Only the specially trained personnel can sling the truck.

(b) Sling points should be always at the positions specified in sling nameplate.

(c) The slinging cable must be enough to hang the forklift truck.

(d) Disassembled parts of forklift truck must be slung in the appointed position.

Model	Mast (normal type)		Balance weight	
	Dimension (mm)	Slinging capacity (kg)	Dimension (mm)	Slinging capacity (kg)
2.0T	1890×1040×470	>7800	1135×543×950	>1200
2.5T	1890×1040×470	>7800	1135×628×950	>1600
3.0T	1935×1100×470	>7900	1135×720×955	>1800
3.5T	1935×1100×470	>7900	1135×796×998	>2200

Notice:

Dismantling and slinging the component shall not be performed without the approval of our company. Under special circumstances, the appointed sling position should be used. The balance weight, fork and mast of the forklift truck all have their appointed sling position. The above-mentioned data is only for a reference, which may be adjusted because of configuration or technology optimization.

(4) Towing of forklift truck

(a) The towing pin is installed below the counter weight. When towing the forklift truck, first extract the pin and fasten a steel wire, then install the pin back.

(b) When towing the forklift truck, release the hand brake lever.

(c) The towing pin only used for following situation, while the forklift truck can't move or while transporting the forklift truck.

(d) Fasten the towing steel wire at the appointed position.

(e) Don't apply capacity abruptly when towing the forklift truck.

(5) Repair the broken-down forklift truck

If the forklift truck broken-down suddenly during using, drag it away and repair in time to avoid hindering other vehicles or workers.

5. Parking and storing

(1) Safe parking

(a) Park your forklift truck on a level ground preferably in a wide area. If parking on a slope is unavoidable, pull the parking brake device and block the wheels to prevent accidental roll. The forklift truck is forbidden parking on a steep slope.

(b) Park your forklift truck in the area where designated or traffic conditions permit. If necessary, put a signpost or signal lights around the truck.

(c) Park your forklift truck on the solid ground. Avoid soft ground, deep mud or slippery surfaces.

(d) If you can not lower the forks on the ground due to break-down of the lifting system, put a warning flag to the fork end and park in the traffic conditions permitting.

(2) Storing

·**Before storing**

Before storing your forklift truck, clean it thoroughly and perform inspection using the following procedures.

(a) Wipe away grease, oil, etc. adhering to the body of the truck with waste cloth and water, if needed.

(b) While washing the body of the truck, check general condition of the truck. Especially check the truck's body for recess or damage and tyres for wear and nails or stones in the tread.

(c) Fill the oil tank up with the appointed fuel.

(d) Check for leakage of hydraulic oil, engine oil, fuel or coolant.

(e) Apply grease where needed.

(f) Check for looseness of hub nuts and cylinder piston rod joints. Check the surface of piston rod for damage.

(g) Check mast rollers to see that they rotate smoothly.

(h) Full oil into the lift cylinders by lifting the lift cylinders at the full stroke.

(i) In cold weather, don't draw off long antifreeze, if there is cooling water, run it away.

·**Daily storage**

(a) Park the forklift truck at a specified place and block the wheels.

(b) Place the shift lever in the neutral position and pull the parking brake lever.

(c) Put the key switch in “OFF” position and turn off the engine, operate the lever of the control valve several times and release the residual pressure of the cylinder or pipes.

(d) Remove the key and keep it in a secure place.

·**Long time storage**

Perform the following service and checks in addition to the “Daily storage” service:

(a) Taking the rainy season into consideration, park the truck at a higher and hard ground.

(b) Apply antirust oil to the exposed parts such as piston rods and shafts which tends to rust.

(c) Cover components which may be caught with humidity.

(d) The truck should be operated at least once a week. Fill the cooling system, if cooling water is discharged. Remove grease from the piston rods and shafts. Start the engine and warm up thoroughly. Move the truck slowly forwards and backwards. Operate the hydraulic controls several times.

(e) Avoid parking on soft grounds such as asphalted road in summer.

·**Operate the forklift truck after long time storage**

(a) Remove antirust oil from the exposed parts.

(b) Discharge the engine oil in crankshaft case of the engine, discharge the gear oil or hydraulic transmission oil in differential and gear box, after cleaning up then renew oil.

(c) Discharge foreign matter and water from the hydraulic reservoir and fuel tank.

(d) Remove the cylinder cap, the valves and the rocker shafts, check for the clearance in normal data.

(e) Add cooling fluid to specified level.

(f) Perform pre-operation checks carefully.

(g) Warm up the engine before operation.

Warning:

If at any time your forklift truck is found to be in need of repair, defective, or in any way unsafe, the condition should be reported to the supervisor, and the truck should be taken out of service until it has been restored to safe operating condition.

6. Information of safety operation

(1) The forklift truck belongs to special equipment. Only trained and authorized operator shall be permitted to operate and service the truck.

(2) Wear the safety guards, such as clothing, shoes, helmet and gloves while operating the truck.

(3) When operating the truck, observe and follow all nameplates stuck on the truck. The nameplates must be replaced if lost or damaged.

(4) Daily maintenance should be done before or after using the truck. Anytime you find that the truck is not functioning normally, operation of the truck should be halted and check or repair at once.

(5) When the distance between the gravity center of loads and the fork arms is 500mm, the max. capacity is the rated capacity. When the distance exceeds 500mm, the capacity shall be reduced according to the load chart. Overloading is strictly prohibited.

(6) Operate your forklift truck on a hard ground. Operate on other ground, the lift capacity and travel speed must be decreased. Wipe off the oil and grease from the floor.

(7) If the forklift truck is equipped with attachment, its usage sphere will be wider, but its allowable load and stability is reduced. The attachment and special device is not to be diverted to any other purpose. It's very dangerous to rebuild the attachment. Please read the additional instruction we supplied and operate the truck following it strictly.

(8) Users select "Lengthening fork" in order to carry widening loads. Pay much attention not to overload and observe the allowable load and the capacity chart stuck on the truck. Careful driving should be taken when traveling and turning.

(9) The unloaded forklift truck with attachment should be operated as a loaded truck.

(10) Connect the power and turn on the key switch, select the position of direction switch, check the truck for normal operation by turning steering wheel, depress the speed-adjusting pedal softly to keep proper acceleration.

(11) During operation, pay attention to the performance and condition of the system of machinery, hydraulic, electric and speed-adjuster etc.

(12) When operate one lever, pay attention not to shift another lever. Don't operate the lever at any position out of the driver's seat.

(13) The shift distance of control valve lever can control the speed of the lifting or descending of the goods. When the goods are lifted or descended, the initial speed

shouldn’t be too fast in either case.

(14) When tilting the mast forward or backward to the limit or lifting the fork to the maximum height, return the directional lever to neutral.

(15) The starting, turning, driving, braking and stopping of the truck should be done smoothly. When turning on the humid or slippery road, the truck should be decelerated.

(16) Because the forklift truck turns by the rear wheels, the end counterweight may swing widely when turning. Use care in narrow aisles and other workplaces.

(17) Operate the forklift truck smoothly, don’t jerk the steering wheel. Avoid sudden stop, acceleration, stop or turn. In the case of improper operation, the truck will turn over. In case of this, the driver must keep calm, don’t jump off the truck. The driver must hold tightly the control wheel with two hands; meanwhile, his body must incline in opposite direction of truck’s turning over.

(18) Turning, lateral or deflective traveling shall not be taken on a slope. It could cause overturning of the truck, it is very dangerous. On a slope, drive the truck with load forward to ascend and backward to descend. When the truck goes down on a slope, drive slowly with the brakes on. Make sure that the engine should not be shut down when traveling on a slope.

(19) The stability of the truck is influenced by the wind-force during outside operation, you must notice specially.

(20) Be careful and slow driving over a dock or temporary paving slab.

(21) Insert forks deeply under goods. Adjust fork’s distance according to the dimension of goods. Make the loads distribute on the forks evenly to avoid tilt and slide of goods.

(22) Don’t pick the loads with single fork. Fork can not be used to pull out any embedded goods, if necessary, the pulling force should be estimated.

(23) Don’t handle unfixed or loose goods. Be careful to handle bulky goods. To prevent the collapse of stacked goods, tighten them. Forbid loading loose or little volume goods without pallet.

(24) When loading the goods, lower the forks to the floor. After the fork inserting stacked goods, the fork arms should be in contact with the goods. Drive the truck with mast tilting back for stabilizing the load. Before traveling, raise the forks for 200mm-300mm from the floor.

(25) When handling bulky loads which block your view, operate the forklift truck in reverse or have a guide.

(26) While mast’s lifting and lowering, anyone is absolutely prohibited from

standing under the lift bracket or being lifted with forks. Never permit anyone to stand or walk under upraised forks.

(27) When lifting the load, according to the weight of the load, accelerate properly and then pull the lifting lever.

(28) The load descends for the gravity, at this time, the engine must be in idle position, and the lever must be pulled slowly to prevent the load from sudden falling.

(29) When loading and unloading goods, keep the mast vertical and the truck is in braking state.

(30) Load should cling to the load backrest. Do not handle the load which exceeds height of the backrest, or else there is a danger of load's falling against operator.

(31) When travel with load, don't tilt mast forward, don't do handling. Don't brake abruptly to prevent goods from slipping off the forks.

(32) It is necessary to brake before tilting the mast forward or backward. It's also necessary to decelerate and tilt forward slowly so as to prevent the goods from slipping off the forks.

(33) Don't make a sudden braking when the truck traveling with loads.

(34) Drive the forklift truck to the stacked goods at a low speed, at the same time, pay much attention to sharp and hard objects near the goods, otherwise, the tyres will be pricked.

(35) Pay attention to pedestrian, obstacle and bumpy road when driving. Pay attention to the clearance over the forklift truck.

(36) Keep your head, hands, arms, feet and legs within the confines of the cab. Never allow other persons on the forklift truck.

(37) Tilt the mast of the high lift forklift truck as backward as possible when operating the truck. Use minimum forward and backward tilt when loading and unloading. It is dangerous to travel or turn when lifting the goods at high levels.

(38) It is noted that the goods will fall down when the forks of the truck with lifting height more than 3m lift, take the protection measures if necessary.

(39) Before the truck decelerating and stopping, don't change gear to reverse shift, so as to ensure the safe loading.

(40) When the truck stops and the engine is on idle position, the mast must be tilted backward. You shouldn't leave the truck with idling engine or hanged goods unattended.

(41) When adding fuel, make the driver leave the truck and the engine flameout. Don't ignite when checking the level of fuel tank.

(42) Don't open the radiator cap when the engine is very hot.

(43) After one day's working, the fuel tank should be added oil to prevent the humidity in the fuel tank from becoming the blob and then interfusing the fluid.

(44) When leaving, engage the hand brake, lower the forks on the ground and let the shift lever to neutral, make the engine flameout or cut down the electric supply. If parking on a slope with smaller gradient, apply the parking brake and block the wheels. The truck is forbidden parking on a slope with bigger gradient.

(45) Don't adjust the control valve and relief valve at will to prevent the damage of hydraulic system and its components because of excessive pressure passing them.

(46) Tyres should be inflated according to the pressure value specified in the nameplate of "Tyre Pressure".

(47) Check the chains periodically to make sure that good lubrication condition exists between the chain elements, the degree of tightness between left and right chain is identical. If the variation value of the chain pitch exceeds 2% standard value, it indicates that the chains have been worn excessively, replace it immediately.

(48) The overhead guard is main part which is strong enough to meet safety standard, and protect the operator from falling materials. It's very dangerous to dismantle or rebuild the overhead guard, because these conditions could lead to an accident.

(49) A load backrest shall be used as protection against back falling objects on the fork. It's very dangerous to dismantle or rebuild the load backrest, because these conditions could lead to an accident.

(50) You can't change or add other working equipments on the truck without our company's permission, or the rated capacity and safety operation will be affected.

(51) Keep safety when serving on high position.

(52) The forklift truck must be operated under the following environment: below an elevation of 1000 meters and temperature between -20℃and 40℃, relative humidity is 95%. Careful operation must observe under other adverse circumstances.

(53) Because of the danger for the people, the forklift is forbidden operating in airtight space, or you may be choked by the tail gas. The tail gas's exhausting standard shouldn't be lower than the no-load mechanical vehicle exhaust standard ruled by the nation that users are in. If in Europe nation, the adopted tail gas's exhausting index should be applied Europe StageⅢA standard.

(54) According to the Directive 2000/14/EC and based on EN12053 standard，the noise pressure level at the operator's position and the measured sound power level and the guaranteed sound power level is referred to the following table. But the noise

of the forklift truck may fluctuate due to different operation and the influence of the external environment.

(55) The driver feels the vibration of the forklift truck when operating and traveling the forklift truck.. According to ISO3691 and based on EN13059 standard. The vibration of the forklift truck fluctuates according to environment condition. In normal working condition, the vertical direction acceleration mean value from the seat to the operator by testing is in the following table. But the vibration frequency felt by the driver depends on the working condition (etc. road, operation method), so the actual vibration frequency must be determined according to environment condition when necessary.

(56) To prevent the fire, accident or other unpredictable event, prepare the fire extinguishers in advance and operate them according to the instructions.

Model	The noise pressure level at the operator's position	The measured sound power level	The guaranteed sound power level	The vertical direction acceleration mean value from the seat to the operator
	EN12053	EN12053	2000/14/EC	
CPCD20	85 dB(A)	105 dB(A)	107 dB(A)	0.76 (m/s^2)
CPCD25	86 dB(A)	104 dB(A)	107 dB(A)	0.72 (m/s^2)
CPQD20	85 dB(A)	103 dB(A)	105 dB(A)	0.86 (m/s^2)
CPQD25	85 dB(A)	103 dB(A)	105 dB(A)	0.84 (m/s^2)
CPCD30	87 dB(A)	105 dB(A)	107 dB(A)	0.91 (m/s^2)
CPCD35	86 dB(A)	104 dB(A)	107 dB(A)	0.84 (m/s^2)
CPQD30	86 dB(A)	103 dB(A)	105 dB(A)	0.85 (m/s^2)
CPQD35	87 dB(A)	104 dB(A)	105 dB(A)	0.87 (m/s^2)

7. Caution plate

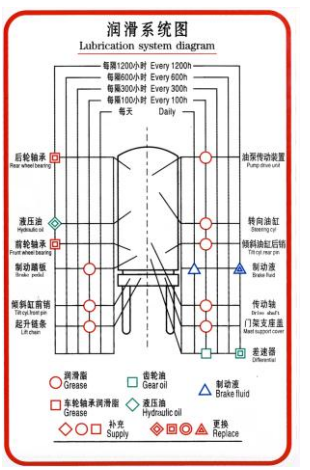
The caution plates attached on the vehicle indicates the operating method and instructions. Before driving it, please be sure to read them thoroughly. If the caution plate drops, stick it again. When maintaining, check if the caution plate is complete and the writing is legible, if necessary, please replace them.

(1) Safety mark (People are forbidden to stand on or down the fork.)

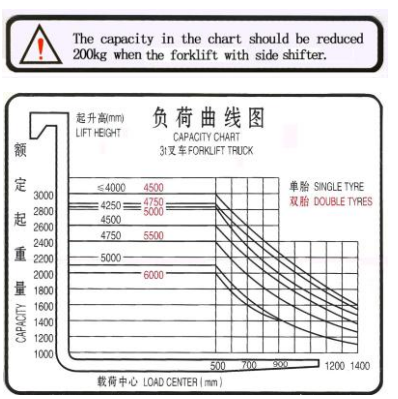
(2) General information when operating

(3) Nameplate of forklift truck

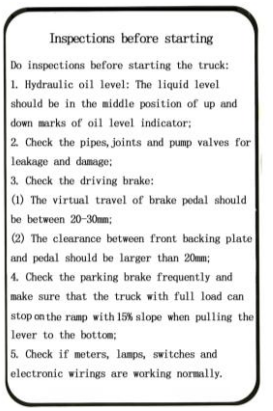
(4) Lubrication system



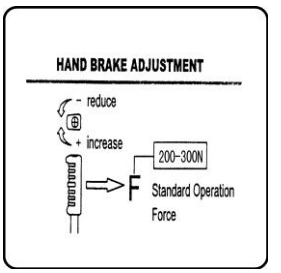
(5) Capacity chart



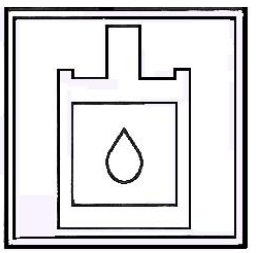
(6) Inspections before starting



(7) Adjust parking brake

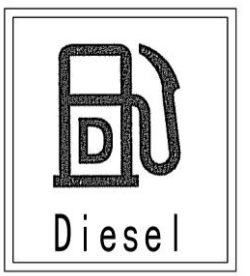


(8) Add hydraulic oil

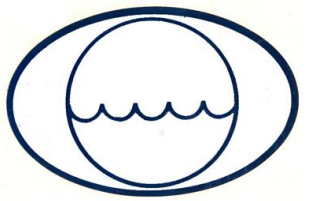


(9) Add fuel (gasoline)

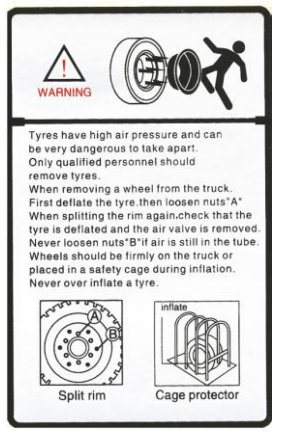
(10) Add fuel



(11) Add antifreeze

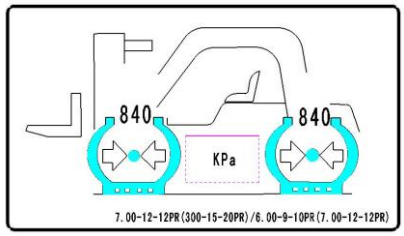


(12) Tyre safety decal (charging tyre)

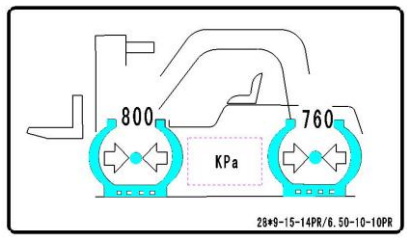


(13) Tyre pressure decal (charging tyre)

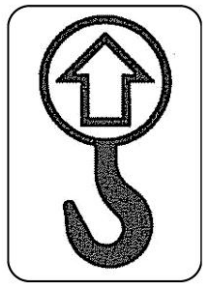
2-2.5t forklift truck



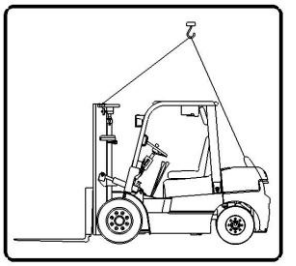
3-3.5t forklift truck



(14) Sling point indication



(15) Sling decal



(16) Forbid entering into the space behind the mast

(17) Forbid conveying person

(18) Hand caution decal

(19) Fan hurting hands

(20) Hood crushing hands

(21)Belt pulley thumb hand decal

(21) Overturn caution decal

Ⅲ. Periodic inspection and servicing

During operating the forklift truck, it is necessary to operate carefully, service and maintain periodically to make the forklift truck keep in good condition.

1. General rules on inspection and maintenance

(1) Only use genuine parts provided by our company.

(2) Only use genuine or recommended oil when replacing or adding.

(3) Clean oil fillers and grease fittings with a brush or waste cloth before adding oil or grease.

(4) Checking oil level and adding oil should be made with the truck parked on a level ground.

(5) Preventive maintenance should be done in an orderly manner and due care taken not to injure yourself.

(6) If any damage or fault is found, stop the truck and report the condition to the manager. Do not operate the truck until it has been repaired completely.

．Regular inspection

(1) Check the seal and the reliability of the hydraulic system.

(2) Check the reliability of the steering and braking system.

(3) Check the reliability of mast, driving axle and steering axle connecting with the frame.

(4) Check all wheels for tightness.

．Irregular inspection

(1) Check the reliability of each welding joints of the mast, frame and so on.

(2) Check the reliability of connecting joints of steering cylinder, joint plate and gimbals etc.

(3) Check all pipes and hoses for any leakage and breakage.

(4) Check the performance of the traveling brake and the parking brake.

Caution:

．Only trained and authorized serviceman shall be permitted to service and repair the truck.

．When checking and maintaining the forklift truck, do not use the mast or the load backrest instead of a ladder, these actions will lead to a dangerous condition unexpectedly.

2. Essentials of servicing

(1) Some critical components must be replaced according to demands periodically. Use genuine parts only.

(2) Use the same model oil only when replacing or adding.

(3) If any damage or fault is found, stop the truck and report the condition to the manager. Do not operate the truck until it has been repaired completely.

Periodic service and maintenance must be done according to the following list after using the forklift truck.

No.	Item	Contents	Period (hrs.)	Remark
1	Bearing, steering wheel	Replace grease	1000	
2	Bearing, drive wheel	Replace grease	1000	
3	Steering link lever	Replace grease	1000	
4	Parking brake lever	Add grease	200	
5	Pin, foot brake	Add grease	200	
6	Drive axle body	Replace gear oil	2400	
7	Braking oil	Add	Whenever necessary	
8	Pin, tilting cylinder	Add lubricating grease	400	
9	King pin, knuckle	Replace grease	1000	
10	Hydraulic tank and filter	Clean	1000	
11	Hydraulic oil	Replace	1000	
12	Lift chain	Replace	3000	If damaged, replace it.
13	H. P. hose	Replace	3000	
14	Switch, hydraulic motor	Clean photoelectric coupler	200	
15	Brush, traction motor	Check	1000	
16	Brush, hydraulic motor	Check	1000	
17	Brush, steering motor	Check	1000	

Notice:

When serving and checking the truck, do not use the mast or the load backrest instead of a ladder, these actions will lead to a dangerous condition unexpectedly.

3. Recommended oil, grease and coolant

Name	Brand or code		Quantity
	Domestic	Overseas	
Gasoline	90#	JISK2202/2#	60L
Diesel	Refer to diesel engine manual or select GB252-81 light diesel: Winter -10#～-35# Summer 0#	JISK2204/2# (general region) JISK2204/3# (cold region)	55L
Engine oil	Refer to engine manual or select according to GB5323-85 or working condition	SAE10W(Winter) SAE30(Summer)	
Hydraulic oil	N32# or N46#	ISOVG30	45L
Torque converter oil	6# / 8# Torque converter oil	SAE10W	20L
Gear oil	85W/90	SAE85W/90	18L
Brake fluid	DOT3 Compound brake fluid		0.6L
Lubricant grease	3# Lithium base grease (drop point 170)	JISK2220/2#	
Coolant	Water or -35℃ Long Life Coolant (FD-2)		Filled

The oil quantity listed in above table is approximation, the detailed value when operating is inspected according to the meter or corresponding gauge.

Adding oil, grease and coolant should follow relevant automobile standard. The waster of the truck must be reclaimed obeying the relevant laws and regulations. Incorrect treatment will pollute water, soil and atmosphere etc.

It is necessary to wear a helmet, safety shoes and working clothes to avoid contacting with body when adding. Once the greasy dirt adhered on the skin, wash it with clean water and soap, it is forbidden to wash with gasoline or kerosene.

4. Lubrication system

No.	Position	Point	Brand	Time (hours)			
				50	100	500	1000
1	Support of steering device	2	Lime grease		+		
2	Both end joints of steering cylinder	2	Lime grease	+			
3	Bearing of knuckle	4	Lime grease		+		
4	Bracket of foot control	1	Lime grease		+		
5	Pin of tilt cylinder	2	Lime grease	+			
6	Lever head of tilt cylinder	2	Lime grease	+			
7	Support bushing of mast	2	Lime grease		+		
8	Lift roller of fork bracket	8	Lime grease		+		

Note: About lubrication of the engine, refer to the ENGINE OPERATION MANUAL.

Ⅳ. Construction, principle, adjustment and maintenance of forklift truck

In order to keep good condition of your forklift truck, you must have an intimate understanding of the construction, principle, adjustment and maintenance of the forklift truck. When finding damage or fault with the truck, stop operating the truck and inform a professional serviceman. Use genuine parts of our company for replacement.

1. Power system

1.1 General description

Power system consists of the engine, fuel system, intake system, cooling system and exhaust system. The engine is connected with the frame by rubber cushion to avoid vibration. The engine, torque converter, transmission case, transmission shaft and drive axle are assembled into a single unit.

For the construction and adjustment of engine, please refer to the operation and maintenance manual of engine.

1.2 Engine parameter and appropriate truck model

Engine model			Rated output Kw/r.p.m	Rated torque N.m/r.p.m	No. of cylinder-Bore×stroke mm	Displacement L	Truck model
Diesel engine	Xinchang	BPG490	37/2650	148/1900	4-90×100	2.54	CPC(D) 20/25/30-X1
		BPG495	42/2650	174/1800	4-98×105	2.98	CPC(D) 30/35-X2
		BPG498	45/2500	191/1600	4-98×105	3.168	CPC(D) 30/35-X3
	ISUZU	C240PKJ	34.5/2500	139/1800	4-86×102	2.369	CPC(D) 20/25/30-W1
		4JG2PE	44.9/2450	186.3/1600	4-95.4×107	3.059	CPC(D) 25/30/35-W2
	Yanmar	4TNE92	32.8/2450	149/1600	4-92×100	2.659	CPC(D) 20/25-Y1
		4TNE98	44.3/2300	206/1700	4-98×110	3.319	CPC(D) 25/30/35-Y2
Gasoline engine	Mitsubishi	4G64 -31ZG	37/2500	161/1600	4-86.5×100	2.350	CPQ(Y)D 20/25/30-H1
	Nissan	K21	31.2/2250	143/1600	4-89×83	2.065	CPQ(Y)D 20/25-H2
		K25	37.4/2300	176/1600	4-89×100	2.488	CPQ(Y)D 20/25/30/35-H3

Parallel table for engine and forklift model which is coincidence and stuck with CE label:

Engine model			The guaranteed Sound power level LwA(dB) 2000/14/EC	Exhausting 2004/26/EC	CE CONFORMITY 2006/42/EC	Truck model
Diesel engine	ISUZU	C240PKJ	106	Stage ⅢA	yes	CPCD 20/25/30-W1
	Yanmar	4TNE92	107	Stage ⅢA	yes	CPCD 20/25-Y1
		4TNE98	107	Stage ⅢA	yes	CPCD 25/30/35-Y2
Gasoline engine	Mitsubishi	4G64 -31ZG	105		yes	CPQD 20/25/30-H1
	Nissan	K21	105		yes	CPQD 20/25-H2
		K25	105		yes	CPQD 20/25/30/35-H3

Note: The sound power level L_{WA} according to 2000/14/EC standard, the exhausting according to 2004/26/EC standard. The forklift with gasoline engine is not referred in 2004/26/EC standard presently.

1.3 Inspection and adjustment of engine

In order to keep good condition of your truck, you must carry out periodic inspection and adjustment of power system.

(1) Regularly clear the dust of air cleaner.

(2) Regularly replace oil filter and fuel filter.

(3) Check and apply the coolant periodically.

(4) Periodic inspection of throttle valve and injection pump.

(5) Check fan belt for tension and all fasteners.

Note:

Always check the exhaust gas of the engine during using the forklift truck. Especially after maintaining the engine, it's necessary to verify the discharge indicator ensure that discharge value is fit for the national standard, so as to minimum damage to the person and environment.

1.4 Fuel tank

The fuel tank is a welded construction integrated with the truck frame. It is located on the left side of the truck frame. The tank cover with a fuel sensor is located on the top surface of the tank. The fuel tank design is almost the same for the gasoline and

diesel engine type trucks. The difference is that the gasoline type is fitted with oil suction pipe and the diesel type with oil return pipe.

1.4.1 Fuel sensor

The fuel sensor is designed to convert the remaining amount of fuel electric current. See Fig1.1.

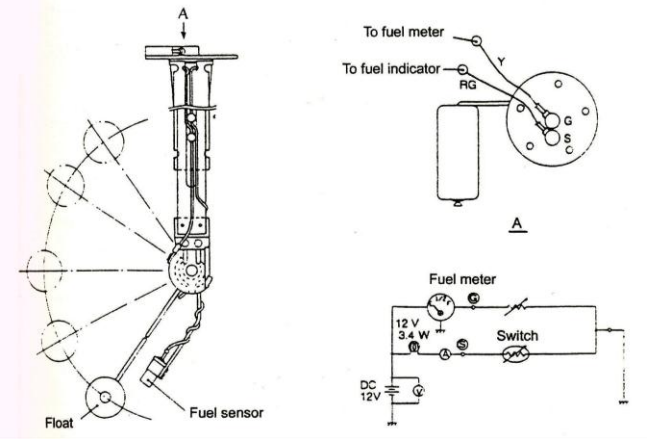


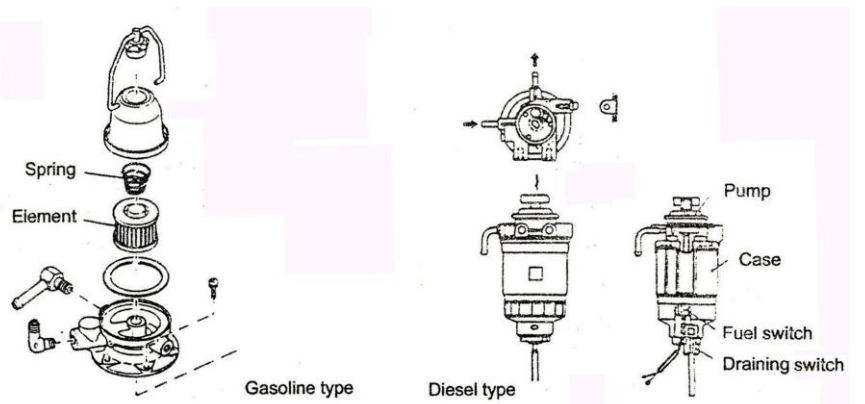
Fig1.1 Fuel sensor

1.4.2 Maintenance of the fuel system

Once every 100 hours operation, it is required to maintain the fuel system according to the methods as follows. Once every 600 hours operation, it is required to clean the fuel tank.

(1) Fuel filter

The fuel filter is used to clean the fuel applying to the engine. It is installed in the fuel pump (for gasoline engine) or on the fuel tank (for diesel engine). The fuel filter used in diesel engine can also separate water from fuel.



▲ Gasoline engine

(a) Once every 300 hours operation, replace the filter wholly.

(b) Loosen the circle wheel and remove the cap.

(c) Loosen the nut and take the filter element out.

(d) Clean or replace the filter element.

(e) After reassembly of filter, start the engine to feed gasoline into filter bowl and check for leaks.

▲ Diesel engine

(a) Once every 600 hours operation, it is required to replace the filter assembly.

(b) Apply several drops of fuel to the around of the new filter's seal before installation, it should be screwed 2/3 circles again when the filter's seal touches the body of engine.

(c) When the warning lamp is on, drain all the water by loosing the draining switch.

Note: Turn off the draining switch after draining water.

(2) The cleaning of fuel tank

Once every 600 hours operation, the fuel tank should be cleaned. As for the gasoline forklift truck, it is required to take care of fire when cleaning.

1.5 Precautions of cooling system

(1) During using the forklift truck, if the temperature of the radiator or coolant is too high, don't open the cap of the radiator immediately. To find the reason for boiling, use extreme care when removing the cap, the sudden release of pressure can cause a steam flash which would cause a serious personal injury. Lower the running speed of the engine to moderate speed, after the cooling system cooled then turn to idle speed, loosen cap slowly to allow steam to escape, the cap can be removed. After that, make sure the cap is tightened securely.

(2) Check the radiator coolant reservoir fluid level. It should between FULL and LOW mark. Add the same type coolant to specified level if necessary. The coolant can be used all the year round.

(3) Put the coolant on a safe place and mark "Dangerous Matter" for its toxicity. If swallowed by accident, take the emergency first aid and consult a physician immediately.

(4) According to variety working condition, periodic wiping away the dirt adhering to the surface of the radiator with detergent, compressed air or high pressure water (pressure less than 4kg/cm^2) is necessary.

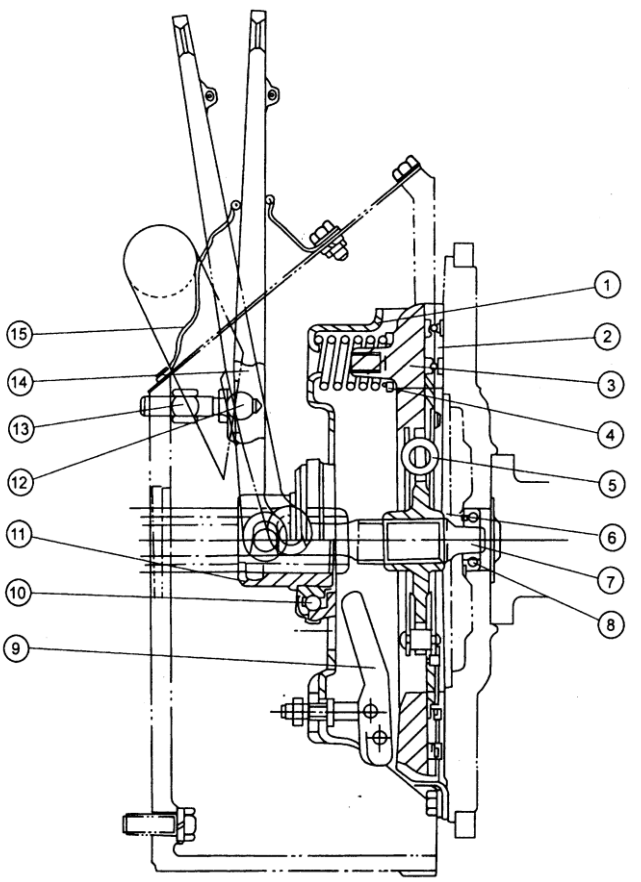
2. Mechanical drive system

2.1 Clutch

Type	Dry single plate type
Operation	Foot-pedal type
Friction piece outer diameter	275mm
Friction piece inner diameter	175mm
Friction piece thickness	8.9±0.3mm
Surface area	354cm^2
Weight	12.5kg

2.1.1 General description

The clutch consists primarily of clutch housing, friction pieces, jib and pressure plate assy. It transmits or cuts off the power from the engine to the gear box. The structure of clutch is referred to Fig2.1.



1. Housing
2. Clutch friction piece
3. Pressure plate
4. Pressure spring
5. Spring
6. Hub
7. Shaft
8. Bearing
9. Release lever
10. Release bearing
11. Release bearing sleeve
12. Bolt
13. Nut
14. Separating fork
15. Cover

Fig2.1 Clutch

2.1.2 Maintenance

A. Adjustment of clutch pedal

(1) Remove the floor board.

(2) Loose the lock-nut of the stopper bolt.

(3) Turn the stopper bolt left and right to adjust the height of the clutch pedal.

(4) Screw the lock nut tightly and fit the floor board.

B. Replacement of friction pieces

(1) Remove the clutch cover.

(2) Press the clutch pedal and move out the pressure plate with liftout bolt. (See Fig 2.2)

(3) Turn the slide bolt left to let the drive shaft go into the transmission.

(4) Disassemble the stopped bolt of the clutch cover, remove the friction pieces.

(5) Install the new friction pieces with the longer spline boss pointing toward the transmission.

Note: Make sure that the spline couple of drive shaft has corresponded with the spline.

(6) The tighten torque of the slide bolt: 10.9-12.1kg.m.

(7) Install the clutch housing on the flywheel.

(8) Press the clutch pedal and remove the liftout bolt.

(9) Check the free stroke of clutch pedal and adjust it if necessary. (Free stroke: 10mm)

(10) The distance between the release lever and clutch bearing seat should be 3mm.

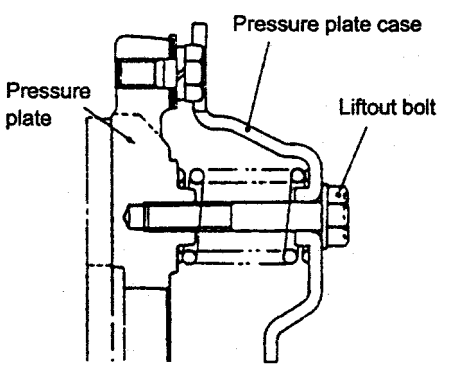


Fig2.2 Liftout bolt

2.2 Mechanical drive unit

Transmission	Type		Manual-shift, slide type synchromesh mechanism
	Shift No.		FWD 2 BWD 2
	Gear Ratio	FWD 1st/2nd	3.253/1.407
		BWD 1st/2nd	3.204/1.386
Reducer	Reduction gear		Spiral bevel gear
	Reduction ratio		2.1
Differential	Reduction gear		Spur gear
	Reduction ratio		6.182
	Differential gear		Bevel gear
Oil amount			8 L
Weight (without oil)			165kg

2.2.1 General description

The drive unit of clutch type truck consists of transmission and differential.

The transmission is provided with a synchromesh mechanism. (See Fig2.3)

2.2.2 Reducer and differential

The reducer located in the front of the transmission is used to reduce the speed and increase the torque from the output shaft of the transmission and transfer them to the differential. It consists primarily of a small spiral bevel gear assembled on the output shaft and a pinion shaft splinted with a big spiral bevel gear. Both ends of the pinion shaft are supported by tapered roller bearing. Several shims are installed between the case and bearing covers to adjust the clearances between them.

The differential is housed in the front portion of the differential the front end of which is connected with the axle housing. The differential case is of splitting type. The differential includes two halfshaft gears and four planer gears. The thrust washers are installed between the differential case and each gear, which makes the clearance among gear pairs is proper. The planet gears are supported by planet gear shaft Ⅰ and Ⅱ. The gear shaft Ⅰ and ring gear 1 are fixed to the differential case respectively with column pin and hinged bolt.

The power from the transmission is transmitted through the reduction gear, differential, halfshaft gear and halfshaft to driving wheels.

The structure of the reducer and differential is referred to Fig2.4.

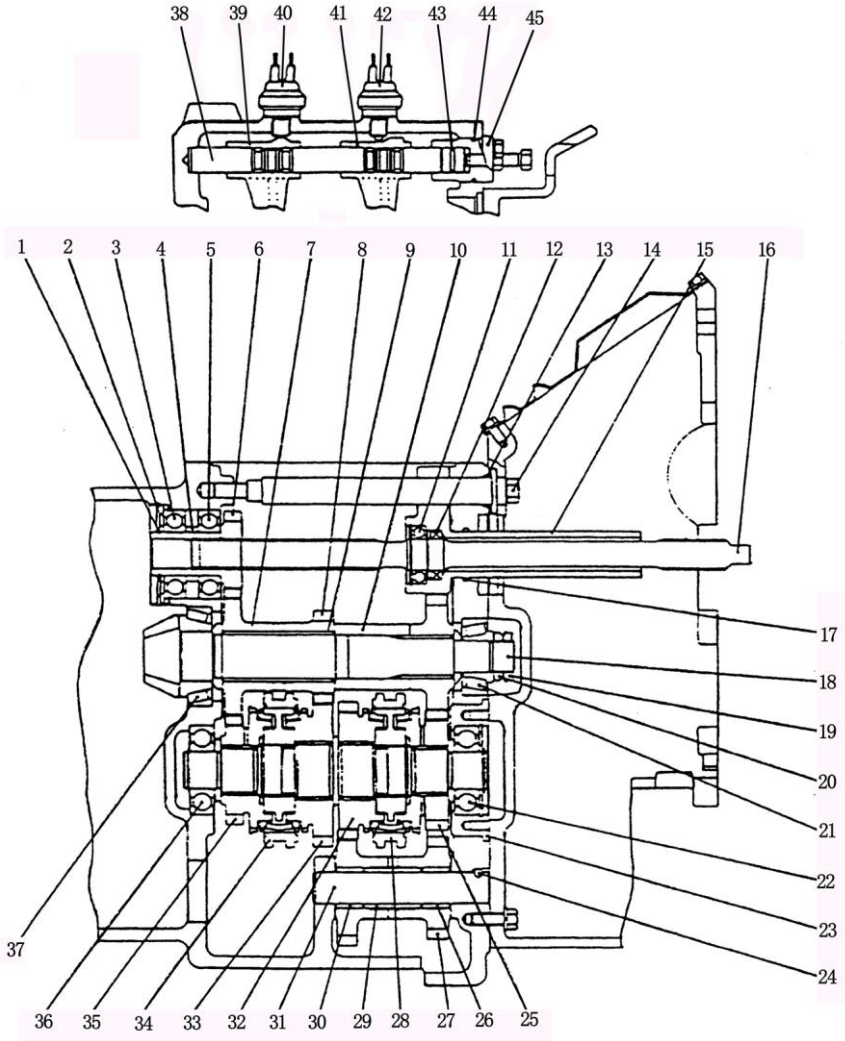


Fig 2.3 Transmission

1. Snap ring
2. Snap ring
3. Ball bearing
4. Spacer
5. Ball bearing
6. Drive gear
7. Needle bearing
8. Combined
9. Needle bearing
10. Spacer
11. Ball bearing
12. Oil seal
13. O-ring seal
14. Slide bolt
15. Retainer, bearing
16. Drive shaft
17. O-ring seal
18. Drive gear
19. Lock nut
20. Adjusting nut
21. Tapered roller bearing
22. Ball bearing
23. Retainer, bearing
24. Ball, steel
25. Forward gear
26. Needle bearing
27. Reverse gear
28. Clutch hub
29. Spacer
30. Needle bearing
31. Shaft
32. Backward gear
33. Gear, low speed
34. Clutch hub
35. Gear, high speed
36. Ball bearing
37. Tapered roller bearing
38. Shift lever
39. Shift fork
40. Switch, neutral
41. Shift fork
42. Switch, reverse lamp
43. O-ring seal
44. O-ring seal
45 Collar

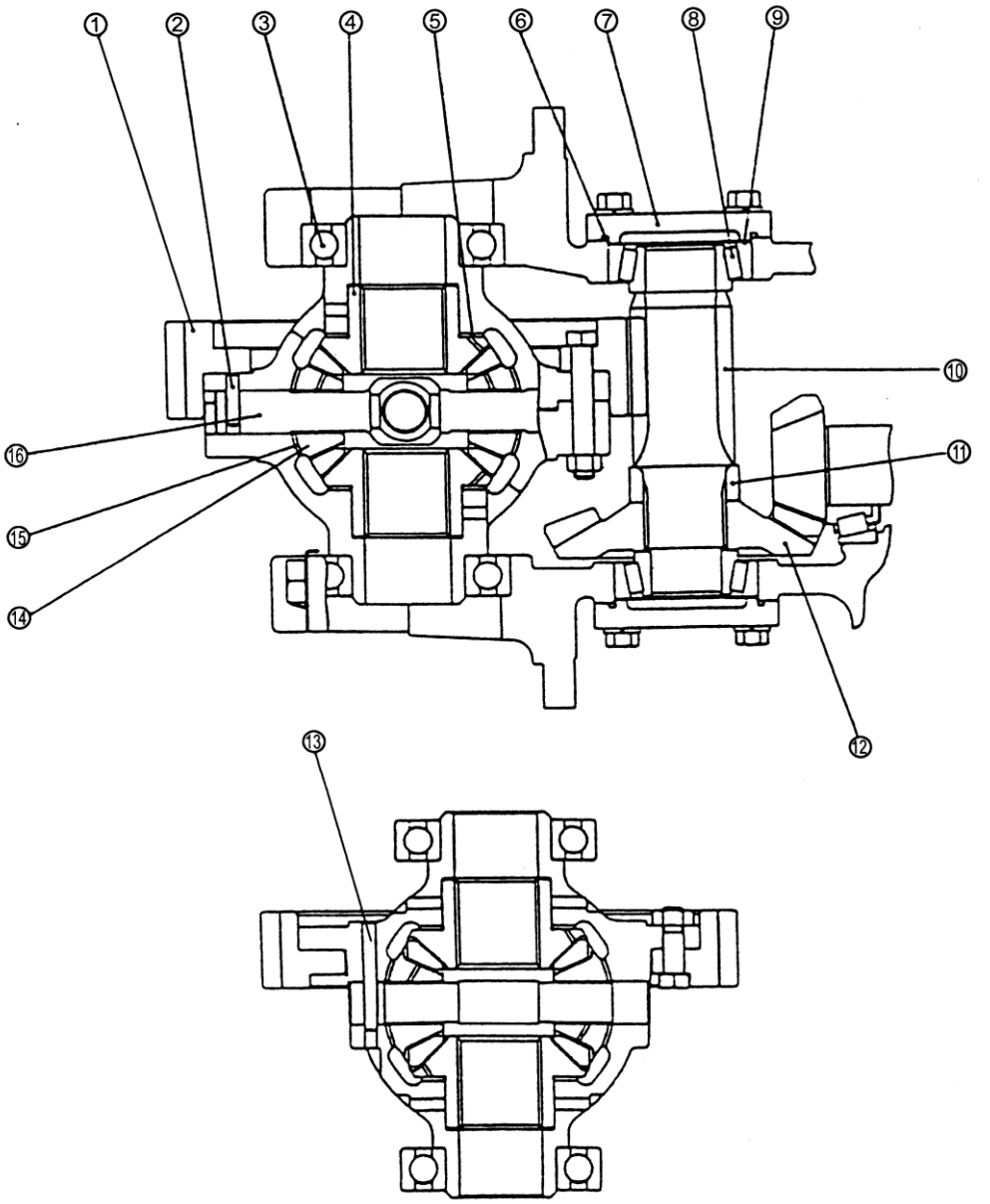


Fig 2.4 Reducer and differential

1. Gear ring	5. Shim	9. Adjusting shim	13. Column pin
2. Pin	6. O-ring seal	10. Gear	14. Planet gear
3. Ball bearing	7. Bearing cover	11. Spacer	15. Shim
4. Side gear	8. Tapered roller bearing	12. Pinion shaft	16. Gear shaft

3. Hydraulic drive unit

Torque converter	Type	Three elements, single stage, two phases
	Torque ratio	3
	Set pressure	0.5～0.68 MPa
Charging pump	Type	Inner-mesh gear pump
	Flow rate	27 L/min(2000rpm,1.5MPa)
Hydraulic transmission	Type	Power shifted
	Speed ration (FWD/BWD)	1.35/1.35
Hydraulic clutch	Friction piece: O.D.×I.D.×T.	Φ125×Φ80×2.7 (mm)
	Friction area	71cm^2
	Set pressure	1.1～1.4 MPa
Weight		165kg
Oil amount		7 L
Oil type		6# or 8# Torque converter oil

3.1 General description (Fig3.1)

The hydraulic transmission case used in the hydraulic drive type truck is consisted of a torque converter and a power gear-shifting transmission.

(1) With an inching valve, the inching operation can be done under the condition that the engine runs at both high and low speed.

(2) Each of two hydraulic clutches is provided with three pairs of steel plates and high quality friction pieces specially-treated, so as to improve the durability of friction surface.

(3) One-way clutches in the torque converter are used to increase the efficiency for power transmission.

(4) High quality oil filters is helpful to prolong the life of the torque converter.

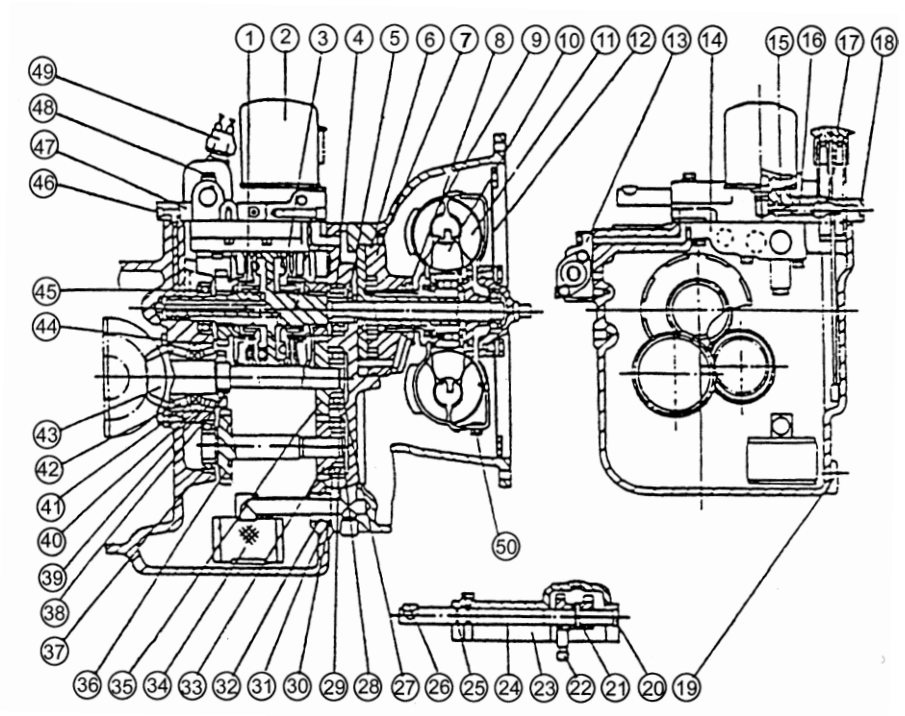


Fig3.1 Hydraulic drive unit

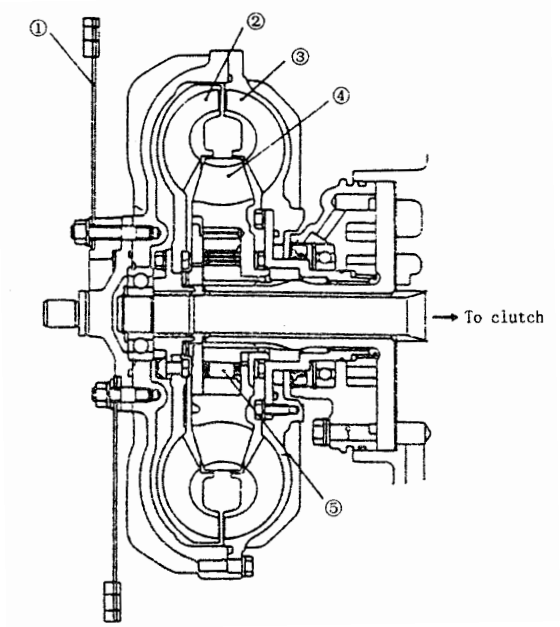
1. Forward clutch
2. Oil filter
3. Backward clutch
4. Single-row radial ball bearing
5. Seal ring
6. O-ring
7. Charging pump
8. Oil seal
9. Impeller
10. Guide wheel
11. Turbine
12. Spring plate
13. Inching valve
14. Control valve
15. Piston
16. Spring
17. Oil inlet cover
18. Safety valve cover
19. Inner-hexagon plug
20. Plug
21. Spring pin
22. Shift arm
23. Transmission case cover
24. Shift shaft
25. O-ring
26. Haft-round key
27. Clip ring for hole
28. Single-row radial ball bearing
29. Single-row radial ball bearing
30. O-ring
31. Snap ring
32. O-ring
33. Idler
34. Oil filter
35. Output gear
36. Idler 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 piece
45. Single-row radial ball bearing
46. Inner-hexagon plug
47. Cover
48. Bolt
49. Switch, reverse lamp
50. Drain plug

3.2 Torque converter (Fig 3.2)

The torque converter mainly consists of an impeller, a turbine and a guide wheel.

The liquid, from the impeller driven by an input shaft, is jetted along its leaves to leaves of the turbine to transmit the torque to the output shaft (Mechanical energy is changed into kinetic one). And the flowing direction of the liquid from the turbine wheel is changed by the idler pulley to cause partial liquid return the impeller at an angle and produce so large reaction torque driving the idler pulley that the value of output torque is more than that of input torque by the value of the reaction torque. When the turbine speed keeps on increasing up to speed of the impeller, the change rate of the flow angle slows down and the value of the output torque keeps on decreasing until the liquid flows into the leaves of the idler pulley in opposite direction. When original reaction torque acts in the opposite direction, the torque value of the output shaft is less than that of the input shaft. To prevent this, a one-way clutch is fitted in the idler pulley, causing the idler pulley freely rotate on this case. The way of torque-converting can be used to ensure efficient and smooth work of the torque converter.

The torque converter, filled up with the torque converter oil, in the drive unit is driven by an engine through a spring plate and flywheel on the engine. A charging pump is driven by a driving gear which is supplied by the pump. The power is transmitted to the transmission through a turbine shaft spliced to the turbine.



1. Spring plate
2. Turbine
3. Impeller
4. Idler pulley
5. One-way clutch

Fig3.2 Torque converter

3.3 Hydraulic circuit (See Fig3.3)

After the engine is started, the charging pump inhales the oil from the oil tank. The pressure oil from the pump serves two parts for hydraulic clutches and torque converter.

The oil necessary to operate the hydraulic clutches is divided into two circuits through the pressure valve (set pressure of 1.1-1.4MPa): one circuit flowing to the torque converter via. a relief valve (set pressure of 0.5-0.7MPa) and another to the inching valve and the slide valve. The oil out of the torque converter is cooled by an oil radiator and used to lubricate the hydraulic clutches and finally returns to the oil tank.

In the neutral, the circuit from the slide valve to the clutches is intermitted, and the pressure valve is opened to let the oil only flow into the torque converter. When the slide valve lies at its forward or backward position, the circuit form the slide valve to either the forward clutch or the backward clutch is closed accordingly, thus causing corresponding clutch come to work. When a clutch is at work, another must stop working, i.e. its spacers and friction pieces must be disengaged each other and be lubricated and cooled. When the inching valve is operated through stressing the inching pedal, apart or most of the oil in the clutches flows into the oil tank through the inching valve rod. The oil circulation for the torque converter then is the same as that in the neutral.

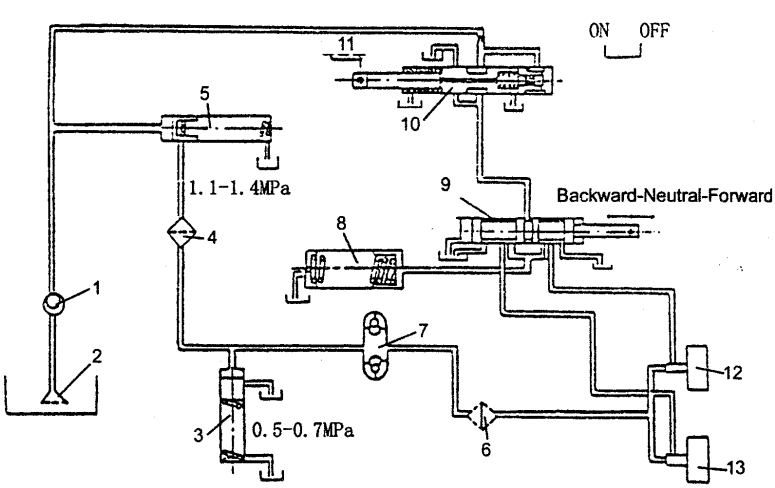


Fig3.3 Hydraulic circuit

1. Charging pump
2. Oil filter
3. Relief valve
4. Oil filter
5. Pressure valve
6. Oil radiator
7. Torque converter
8. Adjusting valve
9. Slide valve
10. Inching valve
11. Switch
12. Backward clutch
13. Forward clutch

3.4 Towing disabled truck

Pay attention to the following items when the forklift truck to be repaired is towed by other truck:

(1) Remove the drive shaft between the transmission case and differential. (only for the truck with drive shaft)

(2) The half shaft should be took off from the front wheel.

(3) Shift lever should be placed in the neutral.

The lubrication can't be achieved if the charging pump is out of work. Disassemble the drive shaft for there is adherence performance if the transmission of drive wheels is transferred to the gear and clutch.

3.5 Troubleshoot

(1) Insufficient power

Parts	Problem	Possible cause and remedy
Torque converter	A. Too low oil pressure	
	1. Lower oil level	Check oil level and add oil
	2. Air entering in resulting from loose connections	Check connection or oil pipe. Retighten each connection or replace seal.
	3. Blocked oil filter	Check, clean or replace.
	4. Oil can not be pumped out	Check and replace
	5. Deformed spring of relief valve	Check tension of spring
	6. Seal ring or O-ring seal damaged	Check and replace
	B. Fly wheel damaged	Check oil, if have dirt, replace it.
Gear Box	A .Unsuitable oil or air bubble in oil	Check oil
	1. Air entering in resulting from loose connections	Check connection or oil pipe. Retighten each connection or replace seal.
	2. Too low oil pressure or air bubble in oil	Measure and adjust pressure
	B. Slipped clutch	
	1. Oil pressure lower	Measure and adjust pressure
	2. Seal ring damaged	Check and replace
	3. Piston ring of the clutch damaged	Check and replace
	4. Worn friction piece or deformed steel piece	Replace
	C. Incorrect position between inching rod and shift rod	Check and adjust
Engine	Insufficient engine power	Adjust or repair engine

(2) Higher oil temperature

Parts	Problem	Possible cause and remedy
Torque converter	1. Lower oil level	Check oil level and add oil
	2. Blocked oil filter	Check, clean or replace.
	3. Fly wheel bump against other arts	Check oil, if have dirt, replace it.
	4. Air entering in resulting from loose connections	Check connection or oil pipe. Retighten each connection or replace seal.
	5. Water mixed into oil	Check and replace oil
	6. Lower oil flow	Check pipe and replace
	7. Worn bearing	Check and replace
Gear box	1. Slipped clutch	Replace friction piece of clutch
	2. Worn bearing	Check and replace

(3) Noisy gear box

Parts	Problem	Possible cause and remedy
Torque converter	1. Elasticity plate is broken	Check noise and replace elasticity plate
	2. Damaged or worn bearing	Check or replace
	3. Gear is broken	Check or replace
	4. Spline is worn	Check or replace
	5. Noisy main pump	Check or replace
	6. Loosen bolt	Check, tighten or replace.
Gear box	1. Bearing is worn	Check or replace
	2. Gear is broken	Check or replace
	3. Spline is worn	Check or replace
	4. Loosen bolt	Check, tighten or replace.

(4) Too low transmission efficiency

Parts	Problem	Possible cause and remedy
Torque converter	1. Elasticity plate is broken	Check noise and replace
	2. Lower oil amount	Check oil level and add oil
	3. Ineffective driving system of oil pump	Check and replace
	4. Shaft is broken	Check and replace
	5. Too low oil pressure	Check oil pump for suction pipe
Gear box	1. Lower oil amount	Check oil level and add oil
	2. Seal ring is worn	Check and replace
	3. Slipped clutch	Check oil pressure of the clutch
	4. Shaft is broken	Check and replace
	5. Clutch cap is broken	Check and replace
	6. Retainer ring of clutch cap is broken	Check and replace
	7. Foreign matter mixed in oil tank	Check, clean or replace.
	8. Spline of shaft is worn	Check and replace

(5) Oil leakage

Parts	Problem	Possible cause and remedy
Torque converter or gear box	1. Worn seal ring	Check and replace seal ring
	2. Incorrect connection of case	Check, tighten or replace.
	3. Loose connector and oil pipe	Check, tighten or replace.
	4. Loose drain plug	Check, tighten or replace.
	5. Oil spray from vent hole	Check connector, air hole or replace pipe.
	6. Much oil	Check oil level and drain surplus oil

4. Drive system

Type	Front wheel drive, axle body and frame fastened together, fully floating type		
Forklift truck	2t, 2.5t	3t	3.5t
	Single tyre (2)	Double tyres (4)	
Tyre size	7.00-12-12PR	28×9-15-12PR	28×9-15-14PR
Rim size	5.00S-12D	7.00WFB-15	7.00WFB-15
Tyre pressure	0.84MPa	0.80MPa	

Notice: For the difference of manufacturers' standard, please charge the tyre according to the pressure specification of actual tyres.

4.1 General description

The drive axle mainly consists of the housing, the wheel hub, the half shaft and the brake unit. (See Fig4.1) The housing is an integral casting body. The tyre with the rim is fixed to the hub with studs and nuts. The power is transmitted to the half shaft through the differential and drives the front wheels through the hubs. Each hub is fixed on the axle housing with two tapered roller bearings, so that the half shafts bear only torque transmitted to the hubs. There are oil seals to prevent water and dust from entering and oil leakage inside the hub.

4.2 Procedure for hubs remounted

(1) Fill the chamber of wheel hub with 1/3-2/3 cubage lithium base grease (about 100 cc), then fit the hub on the shaft. (Fig 4.2)

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

(3) Put the spring balance up on the bolt to measure the hubs' starting torque. When the starting torque arrives to the specified value, lock the nuts slowly.

Starting torque: 5 to 15 kg.m (Fig4.3)

(4) Install the lock plates and lock nuts, after that pull the lock plates up to lock the bolts.

(5) Wheel assembly (Fig4.4)

Install the inner rim and gasket inside the outer rim and assemble the outer rim

and inner rim. Pay attention to the following points:

(a) Put the air valve rod in the notch of the rim and make it face outside.

(b) Make the tops of the rim mounting bolts face outside.

(c) Don't stand near the tyre when inflating air.

(d) When the tyre pressure reaches 98KPa (1kgf/cm^2), knock the tyre lightly to make the inner tyre and gasket into the rim.

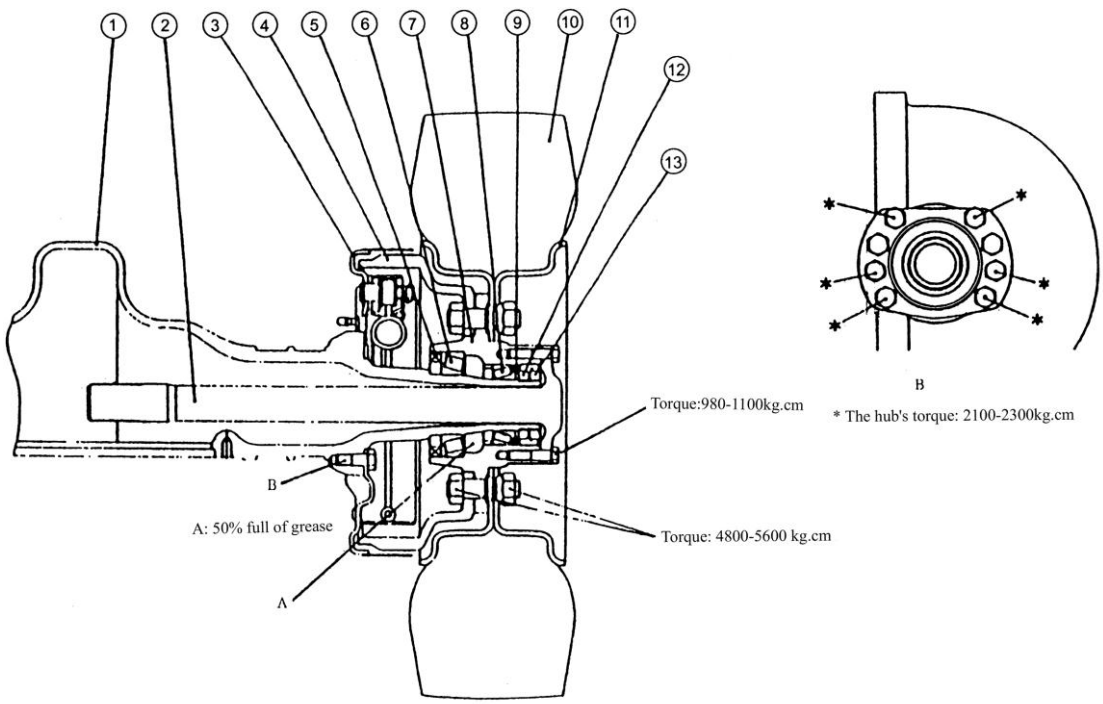


Fig4.1 Drive axle

1.	Housing	6.	Tapered roller bearing	11.	Rim
2.	Half-shaft	7.	Wheel hub	12.	Adjusting nut
3.	Wheel brake	8.	Tapered roller bearing	13.	Lock nut
4.	Brake drum	9.	Oil seal		
5.	Oil seal	10.	Tyre		

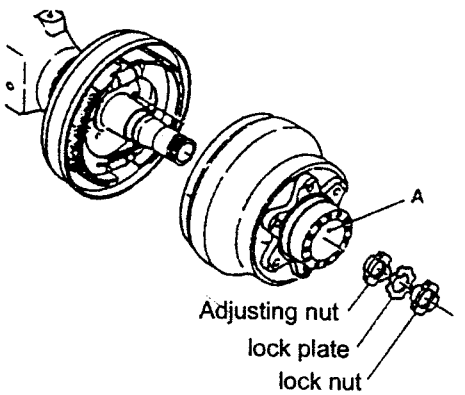


Fig4.2 Add grease

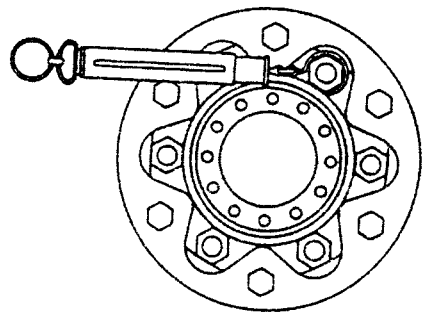
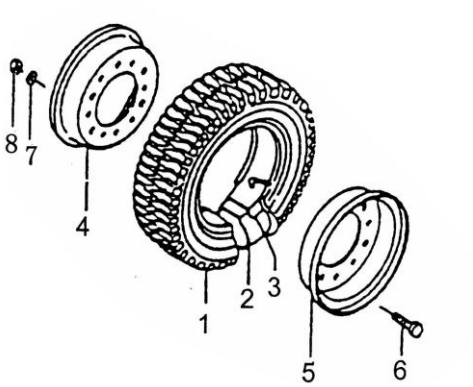
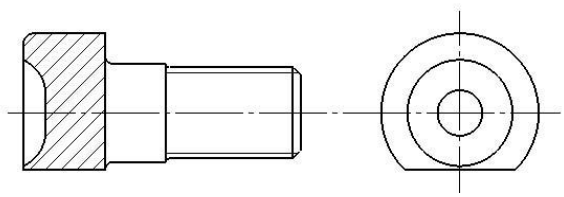


Fig4.3 Measure starting torque





Structure of rim bolt

Fig4.4 Wheel assembly

1.Tyre	4.Inner rim	7.Spring washer
2.Air valve core	5.Outer rim	8.Nut, rim
3.Bushing	6.Rim bolt	

4.3 Troubleshoot

Problem	Probable cause	Remedy
Oil leaks from the reducer case	Connecting bolt of reducer is loose or worn shim	Tighten or replace
	Blocked air hole	Clean or replace
	Worn, damaged or broken oil seal	Replace
Noisy differential	Worn, damaged or broken oil seal	Replace
	Worn or damaged bearing	Replace
	Misadjusted gear clearance	Adjust
	Interference fit of spline connecting with half shaft gear and half shaft	Replace parts
	Insufficient gear oil	Add oil

5. Brake system

Type of brake system	Front two-wheel braking, internal expansion, hydraulic type	
Pedal ratio	5.66	
Master cylinder bore	19.05mm	
Wheel brake	2t, 2.5t	3t, 3.5t
Type	Duo-servo type with parking brake	
Operating cylinder bore	28.58mm	
Size, friction pieces (L×W×T)	324×60×7 (mm)	348×76×8 (mm)
Area, friction pieces	194.4cm^2×4	264cm^2×4
Inner diameter of brake drum	310mm	314mm
Parking brake	Front two-wheel braking, internal expansion, hydraulic type	

5.1 General description

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

5.2 Master cylinder

The cylinder contains valve seat, check valve, return spring, primary cup, piston and secondary cup, which are all kept in place with a stop washer and a stop wire. The exterior of the cylinder is protected from dust by means of a rubber dust cover. The piston is actuated through the push rod by operation of the brake pedal. As the brake pedal is pressed, the push rod pushes the piston downward. The brake fluid in the cylinder flows back to the reserve tank through the return port until primary cup blocks up the return port. After the primary cup passes through the return port, the brake fluid in the lower cavity of the cylinder is pressurized and opens the check valve, flowing through the brake pipeline to the operating cylinder. Thus, each operating cylinder piston is forced outwards. This brings the friction pieces on the brake shoes come into contact with the brake drum and slows or stops the truck. Meanwhile, the cavity behind the piston is filled with brake fluid led through the return port and inlet port. When the brake pedal is released, the piston is forced back by the return spring.

At the same time, the brake fluid in each operating cylinder is pressurized by the return spring, returning into the master cylinder through the check valve. With the piston in its original position, the brake fluid in the master cylinder flows into the reserve tank through the return port. The brake fluid in the brake pipelines and operating master has a residual pressure proportioned to the set pressure of the check valve, which makes each operating cylinder piston cup securely seated to prevent oil leakage and eliminates a possibility of air locking when the truck is sharply braked. See Fig5.1.

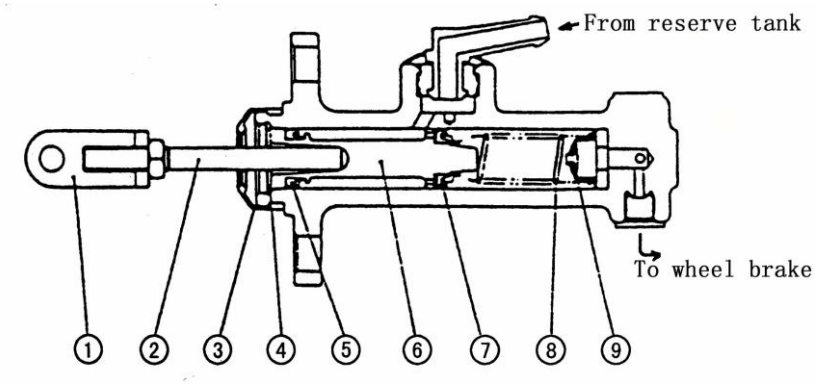


Fig5.1 Master cylinder

1. Link rod
2. Push rod
3. Dust cover
4. Snap ring
5. Secondary cup
6. Piston
7. Primary cup
8. Spring
9. Check valve

5.3 Wheel brake

The wheel brake is the internal expansion hydraulic type consisting of brake shoes, spring, operating cylinder, adjuster and backing plates. Two wheel brakes are provided on each end of the front axle. The brake shoe, one end of it being connected to the anchor pin and the other to the adjuster, is stressed on the backing plate by the spring and spring pull rod. The primary brake shoe is provided with the parking pull rod while the secondary brake shoe with the adjusting lever of the clearance self-adjuster. The structure of wheel brake refers to Fig5.2.

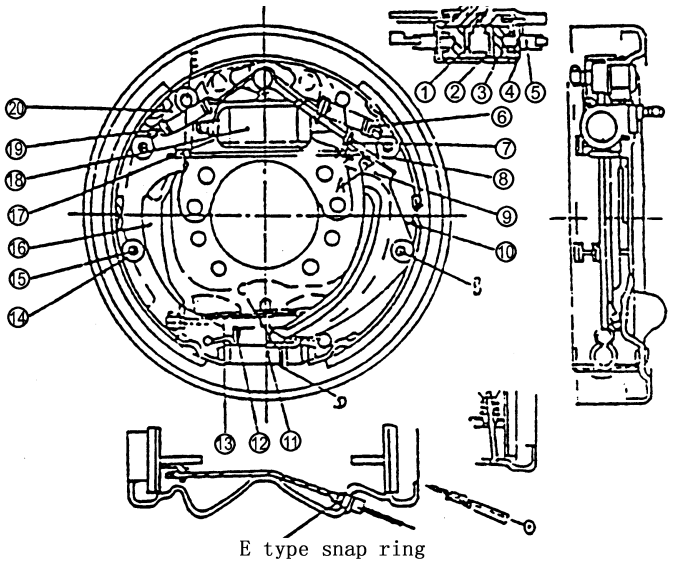


Fig5.2 Wheel brake

1.	Spring	8.	Return spring	15.	Spring pull rod
2.	Cup	9.	Adjusting lever	16.	Parking pull rod
3.	Piston	10.	Secondary brake shoe	17.	Parking push rod
4.	Cylinder body	11.	Clearance adjuster	18.	Operating cylinder
5.	Push rod, piston	12.	Spring	19.	Return spring
6.	Return spring	13.	Parking cable assy	20.	Primary brake unit
7.	Push rod	14.	Spring cover		

▲Clearance self-adjuster

The clearance self-adjuster actuates only when the truck in reverse travel is braked. The secondary brake shoe comes into contact with the brake drum and rotates together. As a result of this, the parking pull rod turns right around the point A so that the point B of the rod raises. After release the brake pedal, the parking pull rod turns left with the spring force so that the point B of the rod lowers. (Fig5.3)

As the clearance between the friction pieces and the brake drum increases, the rotating vertical distance of the pawl by point B increases, too. When the clearance is more than 0.4mm, the adjuster is dialed a tooth and the adjusting lever becomes longer, so that the clearance decreases.

Clearance adjusting range: Within 0.4 to 0.45mm.

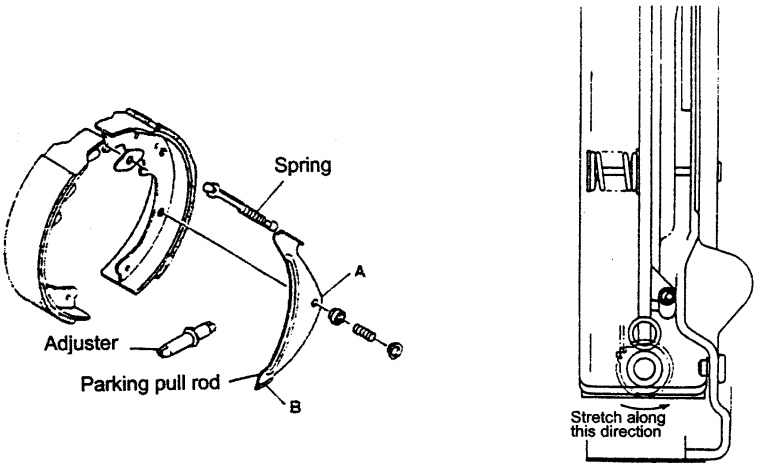


Fig5.3 Clearance self-adjuster

5.4 Parking brake lever (Fig5.4)

The parking brake lever is of a cam type. The brake force can be adjusted with the screw in the adjuster which is on the end of the brake lever.

Brake force adjustment:

When you turn the adjuster clockwise, the force increases, otherwise, when you turn the adjuster counterclockwise, the force decreases.

Pull force: 20 to 30kg.

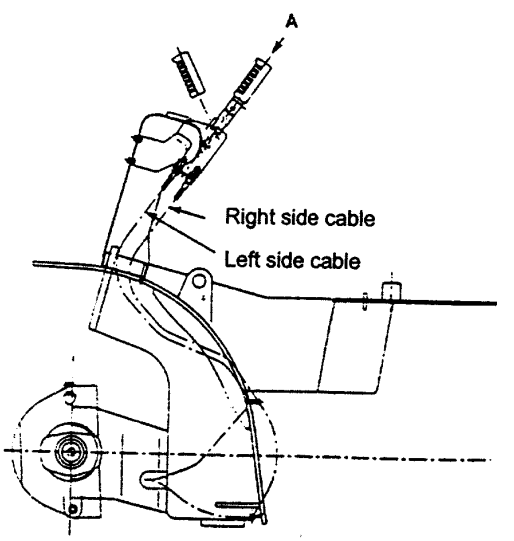


Fig5.4 Parking brake lever

5.5 Inspection of wheel brake

Inspect all parts to make sure if there're any worn or damaged parts. If necessary, repair or replace with new one.

(1) Check the operating cylinder body's inner surface and the piston periphery surface for rusting. Then, measure the clearance between the piston and cylinder body:

Specified clearance: 0.03 to 0.10 mm

Maximum clearance: 0.15mm

(2) Visually check the piston cup of the operating cylinder for damage or deformation. If necessary, replace it.

(3) Check the operating cylinder spring for free length. If necessary, replace it.

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

Unit: mm

	2t, 2.5t	3t, 3.5t
Standard thickness	7.2	8
Max. thickness	5.0	6

(5) Check the inner surface of brake drum for damage and excessively worn. If necessary, repair or replace it.

Unit: mm

	2t, 2.5t	3t, 3.5t
Standard dimension	310	314
Max. dimension	312	316

(6) Measure the free length and the load of the brake shoe return spring.

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

5.6 Troubleshoot

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

6. Steering system

			2t, 2.5t	3t	3.5t
Steering system			Rear wheel powered steering		
Type of steering unit			Cycloid gear type powered steering unit		
Model of steering unit			BZZ1-100 (sealed by taper ring)		
Steering cylinder	Type		Double-action piston type		
	Cylinder bore	mm	Φ70		
	Diameter of piston rod	mm	Φ50		
	Stroke	mm	160		
Rated pressure		Mpa	7	9	10.5
Diameter of handwheel		mm	Φ380		
Pressure of steering wheel		Mpa	0.84	0.76	

6.1 General description

The steering system principally consists of hand wheel, steering shaft and steering unit. The steering shaft is connected with the steering unit, while the connecting shaft is connected with the hand wheel. The steering column can be tilted forward or backward to suitable position. (See Fig.6.1)

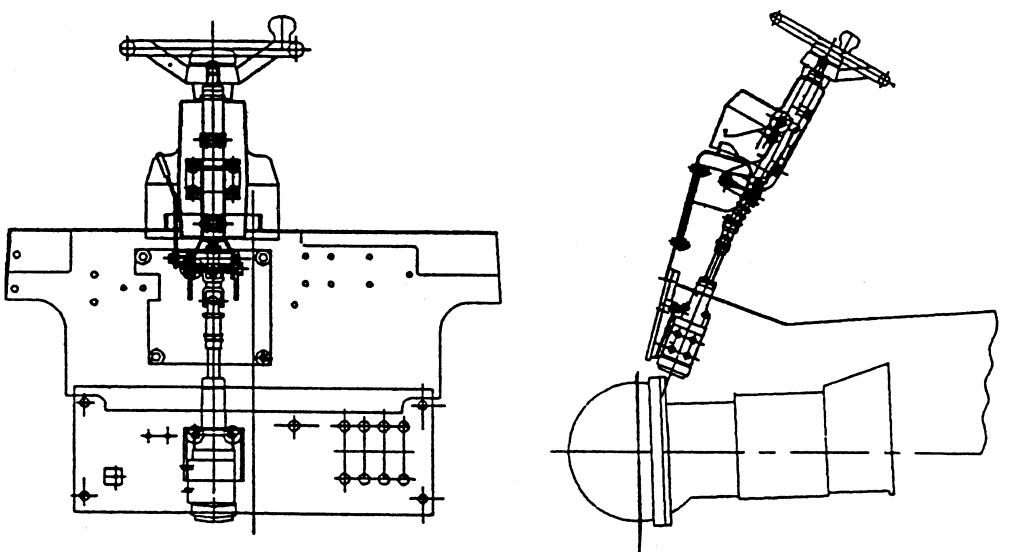
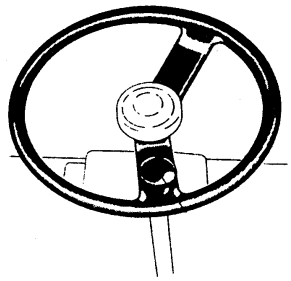


Fig6.1 Steering operation device

6.2 Hand wheel



Hand wheel is operated in normal way, that is to say, when turning the hand wheel right, the truck will turn right. When turning the hand wheel left, the truck will turn left. The rear wheels of the forklift truck are steering wheels, which make the tail section of the truck swing out when turning. The turning method can be mastered easily through practice.

6.3 Cycloid gear type powered steering unit

The powered steering unit (Fig6.2) can transmit the pressure oil from the flow divider by pipes to the steering cylinder in terms of the rotating angle of the handwheel. The engine stops running, the oil pump will not work, in this case a man-powered steering shou

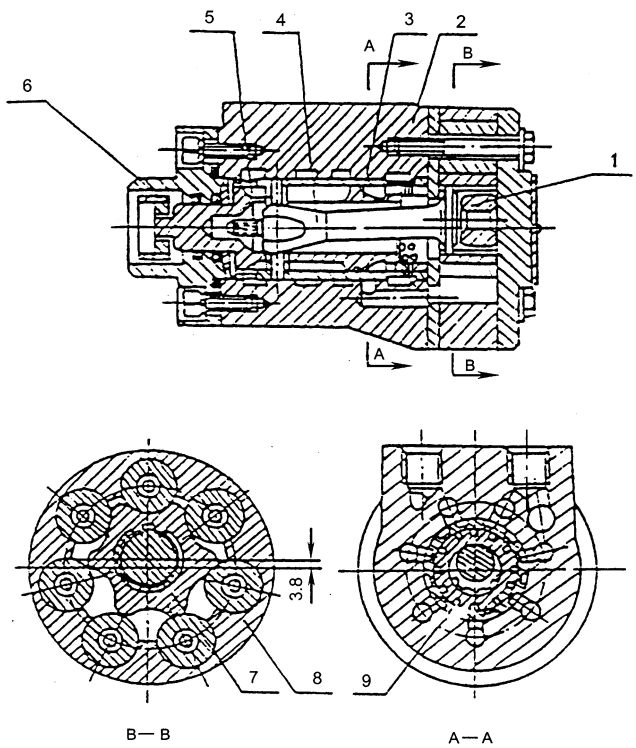


Fig6.2 Cycloid gear type powered steering unit

1. Spacing sleeve
2. Valve body
3. Valve core
4. Interlock shaft
5. Spring piece
6. Joint sleeve
7. Rotor
8. Stator
9. Valve sleeve

6.4 Inspection after reassembling the steering system

(1) Check the force when turning the steering handwheel to right and left until it can't be turned any more to see if they are identical each other and check the operation if the steering handwheel for smoothness during above operation.

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

(3) Lift up the rear wheels and slowly turn the handwheel over several times to exhaust the air in the hydraulic pipelines and the cylinder.

6.5 Troubleshoot of steering system

Problem	Analysis of trouble	Remedy
Fail to turn handwheel	Oil pump damaged	Replace
	Flow-divider blocked or damaged	Clean or replace
	Hose or joint damaged or pipeline blocked	Clean or replace
Difficult to turn handwheel	Too low oil pressure from flow-divider	Adjust pressure
	Air in steering oil circuit	Exhaust air
	Steering unit fail to reposition due to spring piece damaged or insufficient elasticity	Replace spring piece
	Excessive inner-leakage in steering cylinder	Check piston seals
Truck's naking or moving with oscillation	Excessive flow rate for steering	Adjust flow divider for flow rate
	Spring damaged or elasticity insufficient	Replace
Excessive noise	Too low oil level in oil tank	Refill oil
	Suction pipeline or oil filter blocked	Clean or replace
Oil leakage	Seals of guide sleeve, pipeline or joint damaged	Replace

6.6 Steering axle

The steering axle is of section-boxed welded construction type (Fig6.3). It includes axle body, steering cylinder, tie rod, steering knuckles and steering wheels. The steering axle is of cranks and slider mechanism. The cylinder piston rod pushes the knuckle steering through tie rod, causing wheel's deflection and truck's steering. The steering axle is bolted to the rear frame by the buffer.

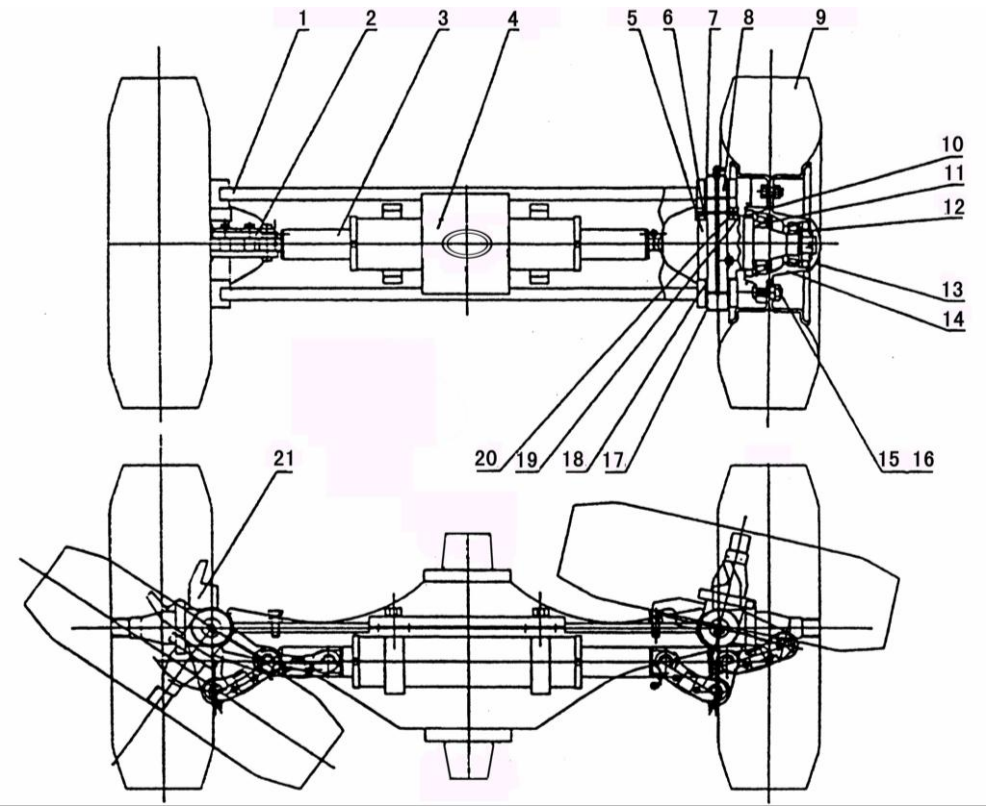


Fig6.3 Steering axle assy

1. Axle body
2. Tie rod
3. Steering cylinder
4. Support, rear axle
5. Knuckle assy, R.H.
6. Thrust bearing
7. Needle bearing
8. King pin
9. Tyre
10. Oil seal
11. Tapered roller bearing
12. Tapered roller bearing
13. Hub cover
14. Hub
15. Hub bolt
16. Hub nut
17. Oil seal
18. O-ring
19. Bushing
20. Dust sleeve
21. Knuckle assy, L.H.

6.6.1 Steering cylinder (Fig6.4)

The steering cylinder is of double-action piston type. The seal unit consists of the supporting ring and O-ring, Yx-ring seal is adopted between the cylinder cover and the piston rod. The cylinder is fitted on the steering axle through two sides cylinder covers.

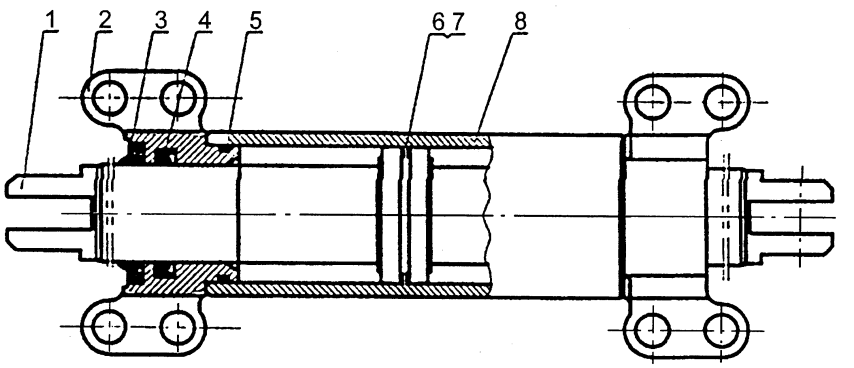


Fig6.4 Steering cylinder

1. Piston rod assy
2. Cylinder cover
3. Dust ring
4. Yx-ring
5. O-ring
6. O-ring
7. Supporting ring
8. Cylinder body

6.6.2 Rear wheel bearing pre-load adjustment

(1) As shown in Fig6.5, fill up the chamber formed by wheel hubs, wheel hub bearing and wheel hub covers with lubricating grease. Coat the lips of the oil seals with lubricating grease.

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

(3) Fit a flat washer and tighten a castle nut with torque of 206～235N.m and loosen it and then tighten it again with torque of 9.8N.m.

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

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

(6) Again slightly knock at the hub with a wooden hammer and in this time, rotate manually the hub for 3～4 turns to ensure its smooth rotation with a specified torque of 2.94～7.8N.m.

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

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

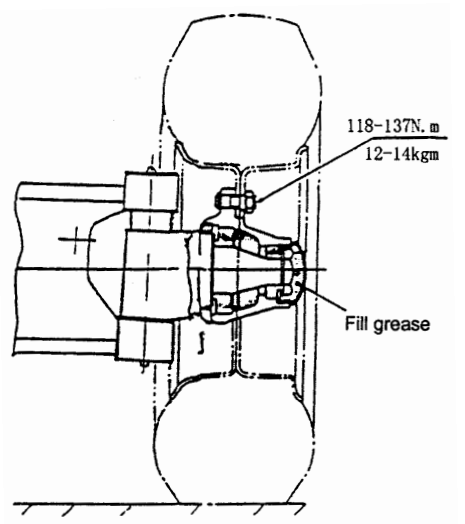


Fig6.5 Pre-load adjustment

7. Hydraulic system

Hydraulic oil pump	Type	Gear pump
	Displacement	31.5 ml/r
Control valve	Type	Two-pool type with relief valve, flow divider and tilt self-locking valve
	Setting pressure	17.5MPa
	Dividing pressure	7 MPa (2, 2.5t) / 9 MPa (3t) / 10.5 Mpa (3.5t)
	Flow rate	11L/min (2t, 2.5t) 13L/min (3t, 3.5t)
Lift cylinder	Type	Single-action piston type, with cut-off valve
	Bore diameter	Φ56
	Stroke	1495mm (Only for 3m lift height)
Tilt cylinder	Type	Double-action piston type
	Bore diameter	Φ70
	Stroke	167mm
Hydraulic oil amount		42L

7.1 General description

The hydraulic system consists of hydraulic pump, control valve, lift cylinder, tilt cylinder, and oil pipe-lines etc. The oil tank is installed on the right side of the forklift truck.

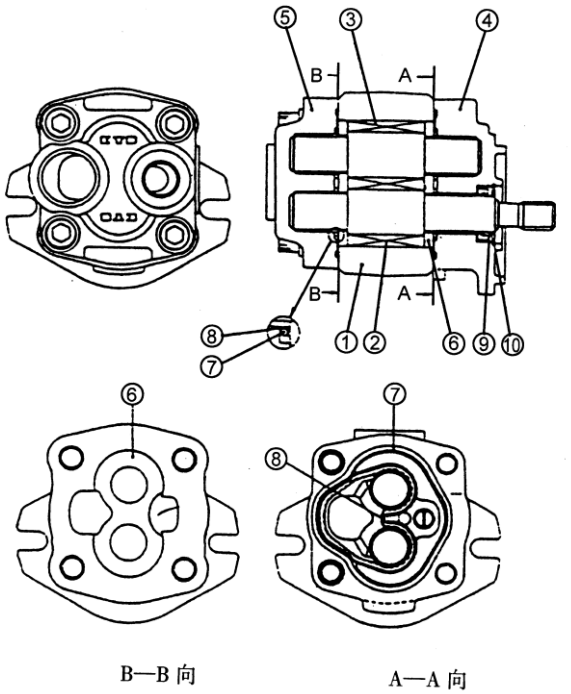
7.2 Hydraulic oil pump (Fig7.1)

The hydraulic oil pump is a gear pump. It is drived directly by the power takeoff device of the engine. The oil in the oil tank flows to the control valve through the main pump.

The hydraulic oil pump consists of pump body, a pair of gears, lining plate and snap rings. The pressure-balance method makes the lining plate press on the side face of gear owing to outleting oil between the lining plate and pump body. This pump uses pressure-balance type bearings and a special lubrication method so as to minimum the gear clearance.

7.3 Control valve & flow divider (Fig7.2)

The control valve (2 spool type) consists of four valve housings, two spool valves, one relief valve and one flow divider. Four valve housings are assembled together with three stud bolts and nuts. The tilt spool valve consists of a tilt self-locking valve.



1. Pump body
2. Driving gear
3. Driven gear
4. Front cover
5. Rear cover
6. Lining plate
7. Seal ring
8. Ring
9. Oil seal
10. Snap ring

Fig7.1 Hydraulic oil pump

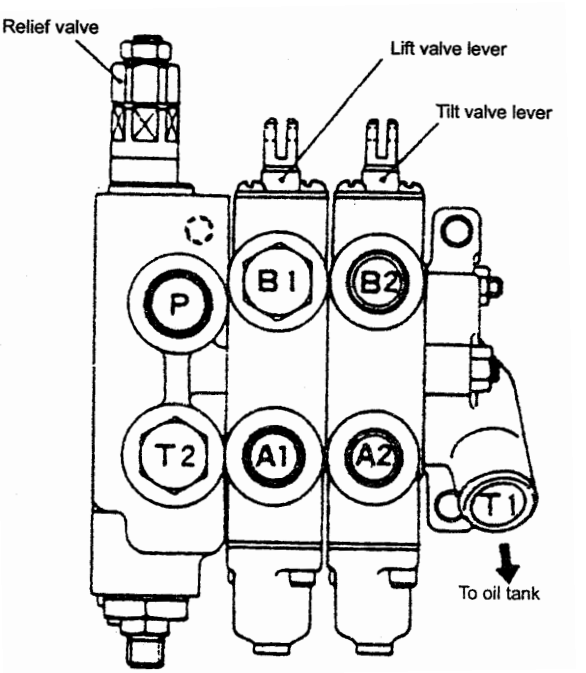


Fig7.2 Control valve

Relief valve and flow divider (see Fig7.3)

The relief valve consists of main valve A and proceeding valve B. When the spool of the control valve is operated, chamber Q linked with the operating cylinder is filled with high pressure oil. The high pressure oil affects proceeding valve B through throttle hole D and E. If the system pressure is higher than the setting pressure, the proceeding valve B will be opened to make the pressure in F chamber lower and thus causes the main valve A to move right, then the oil in chamber Q may directly flow to low-pressure passage G and reduce chamber Q pressure. In this way, the system pressure may keep unvaried. The setting pressure may be adjusted by the adjusting screw H.

The construction of the flow divider is simple. It is of direct overflow type, and ensures the constant pressure of the power steering system by balancing the oil pressure with fixed spring force. When turning, chamber M gets through with the high pressure passage. If the oil pressure is higher than the spring force, the valve core N moves right, causing the high pressure oil to flow directly to the low-pressure passage via. Chamber T and keeping the pressure of the power steering system unvaried. The setting pressure is adjusted by adjusting the screw K.

Valve L is a balance spool valve, and may move right or left according to the variety of the oil flow and pressure passing through it to change the opening of chamber R and S and ensures the oil flow to working chamber Q and to power steering port PS keeps in balance condition and is smoothly divided in certain proportion. Hole a is a fixed throttle hole.

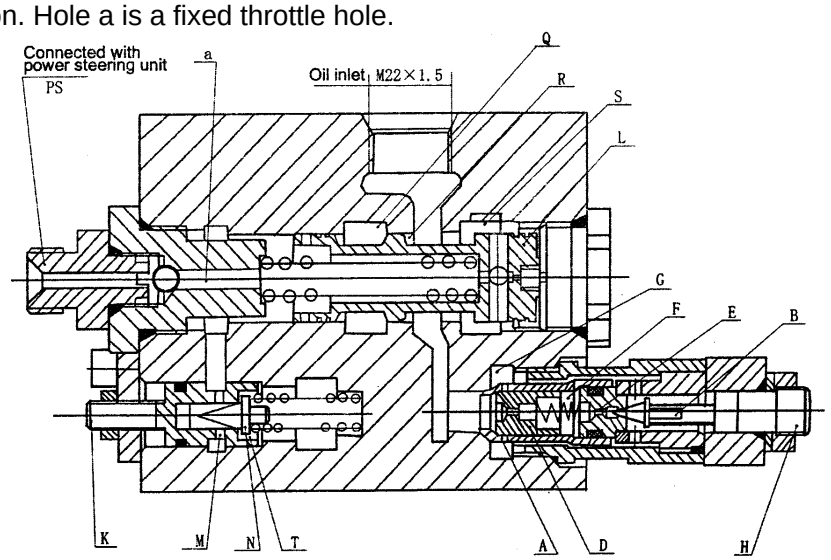


Fig7.3 Relief valve and flow divider

▲Setting pressure of the relief valve (Fig7.4)

The pressure of the relief valve has been set before delivery. Don't adjust the pressure at will, for it will bring danger for system and safety. If the oil pressure is different with standard value, according to the measure method specified in JB/T3300, specialized servicemen adjust the pressure as follows:

(a) Screw out the measured hole plug from the inlet port of control valve and install the oil-pressure gauge (20MPa) on it.

(b) Operate the tilt lever, measure the pressure when the stroke is to the bottom.

(c) When the oil pressure mismatches with the specified value, loosen the lock nut of the relief value, screw the adjusting screw left and right to achieve the specified value. Turn the screw left when pressure is high, and turn right when it is low.

(d) After having adjusted, tighten up the lock nut.

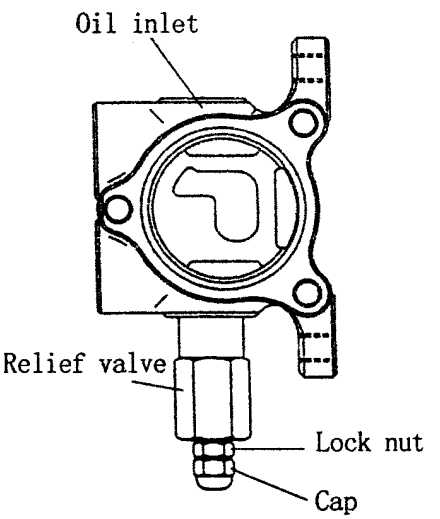
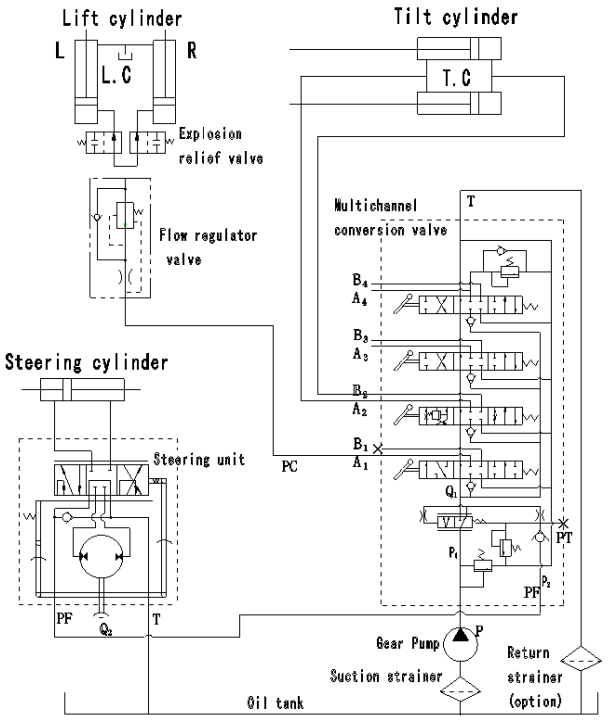


Fig7.4 Setting pressure of the relief valve

7.4 Hydraulic oil circuit (Fig7.5)

The oil from the hydraulic pump comes to the control valve first and there is divided by the flow divider into two parts, one being sent to lift cylinder or tilt cylinder, and another to the power steering unit in constant flow rate to operate the steering cylinder. With the spools of the lift and tilt spool valves in neutral position, the oil from the pump directly returns to the tank through the passage in the control valve. When the lift spool is pulled, the oil from the pump flows through the flow regulator valve and reaches the lower part of the lift cylinder to push the piston up. When push the lift spool, the circuit between the lower part of the lift cylinder and the oil tank is connected and the piston begins to descend due to the weight of the load and all of lifting parts. In this case, the oil flow returning to the control valve is regulated by the flow regulator valve and the fork descent speed is controlled. When the tilt lever is operated, the high pressure oil reaches the front or rear chamber of the cylinder and pushes the piston forward or backward. The oil pushed out by the piston returns to the oil tank through the control valve and the mast then tilts forward or backward.



Ton	t	2-3	3.5
Flow,control valve Q1	L/min	65	65
Flow,steering unit Q2	L/min	13	13
Primary pressure, hydraulic system P1	Mpa	17.5	19
Steering pressure P2	Mpa	9	10.5

Fig7.5 Hydraulic oil

7.5 Lift cylinder (Fig7.6)

The lift cylinder is of single-action piston type. It consists of cylinder body, piston rod, piston and cylinder head etc. The bottom of the cylinder is connected with the cylinder supporter of the outer mast by bolts and pins, while its top (i.e. piston rod head) is connected with the upper beam of the outer mast.

The piston, fastened to the piston rod with spring wire is fitted with oil seals and wearing on its outer periphery.

At the bottom of the lift cylinder there is a cut-off valve, which operates when the high-pressure hose bursts for any reason to prevent the load form dropping from abruptly.

Bushing and oil seal assembled on the cylinder head is used for support the piston and prevent dirt from entering.

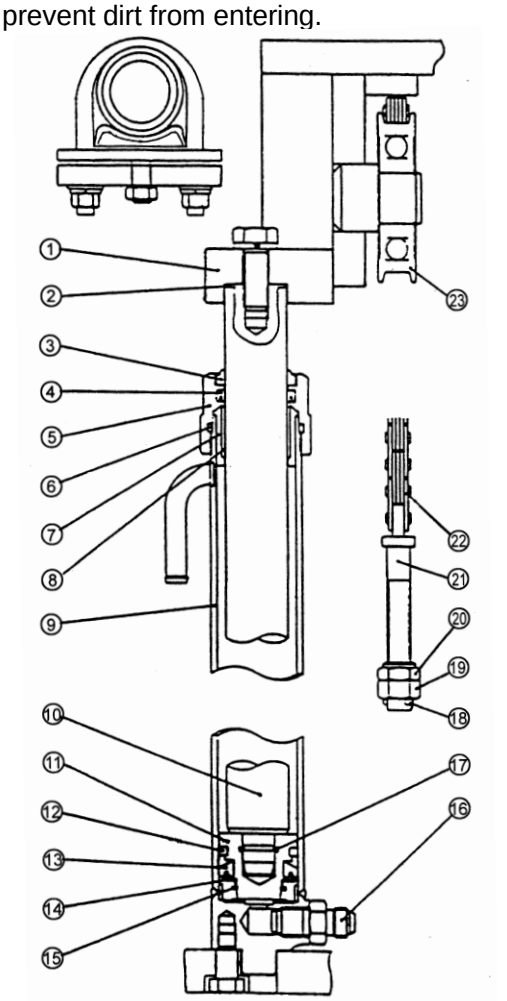


Fig7.6 Lift cylinder

1. Upper beam
2. Shim
3. Dust ring
4. Oil seal
5. Guide sleeve
6. O-ring
7. Cylinder head
8. Bushing
9. Cylinder body
10. Piston rod
11. Piston
12. Oil seal, piston
13. Oil seal
14. Ring
15. Snap ring
16. Cut-off valve
17. Spring lock ring
18. Cotter pin
19. Nut, lock
20. Adjust nut
21. Joint
22. Chain
23. Sheave

7.6 Flow regulator valve (Fig7.7)

The flow regulator valve, located in the lift cylinder circuit to limiting the descending speed of loaded forks, has the construction as shown in Fig7.7. When the lift spool valve is placed in the “lift” position, the oil from the control valve flows through the oil chambers A and B, oil holes C, D, E and F, and the chamber G to the lift cylinder without any regulation. When the lift spool valve is placed in the “down” position, the oil flows in the reverse position. When the oil passes the throttle plate (5) and a pressure difference overcomes the force of the spring (2) and moves the valve core (7) right, thus the oil flow being decreased by narrowing of the hole D and C, and reduces the oil flow passing through the throttle plate (5).

The flow regulator valve controls the goods descending speed and serves as a safety device, prevent the danger for suddenly descending if the rubber hose ruptures between the control valve and the lift cylinder.

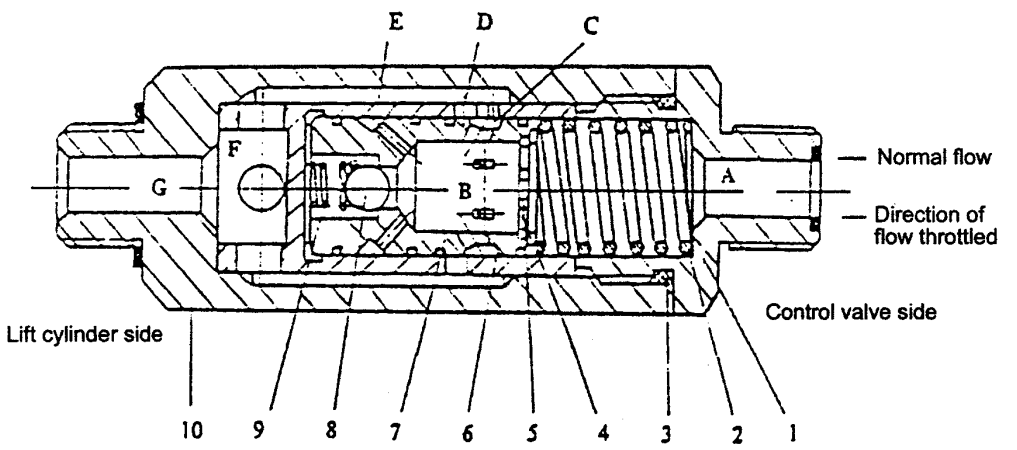


Fig7.7 Flow regulator valve

1. Joint
2. Spring
3. O-ring
4. Snap ring
5. Throttle plate
6. Valve sleeve
7. Valve core
8. Ball
9. Spring
10. Valve body

7.7 Tilt cylinder (Fig7.8)

The tilt cylinder is of double-acting type. Each truck has two cylinders which are installed on two sides of the mast, their cylinder base are connected with frame with pins while their piston rod ends are connected with the outer mast channels.

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

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

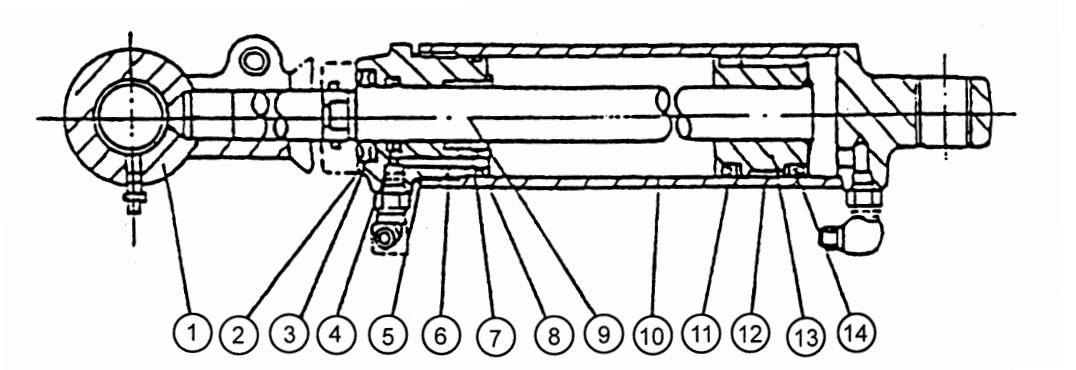


Fig7.8 Tilt cylinder

1. Joint
2. Dust ring
3. Snap ring
4. Yx-ring
5. O-ring
6. Guide sleeve
7. Bearing
8. O-ring
9. Piston rod
10. Cylinder body
11. Yx-ring
12. Retainer ring
13. Piston
14. Yx-ring

7.8 Hydraulic pipe-line

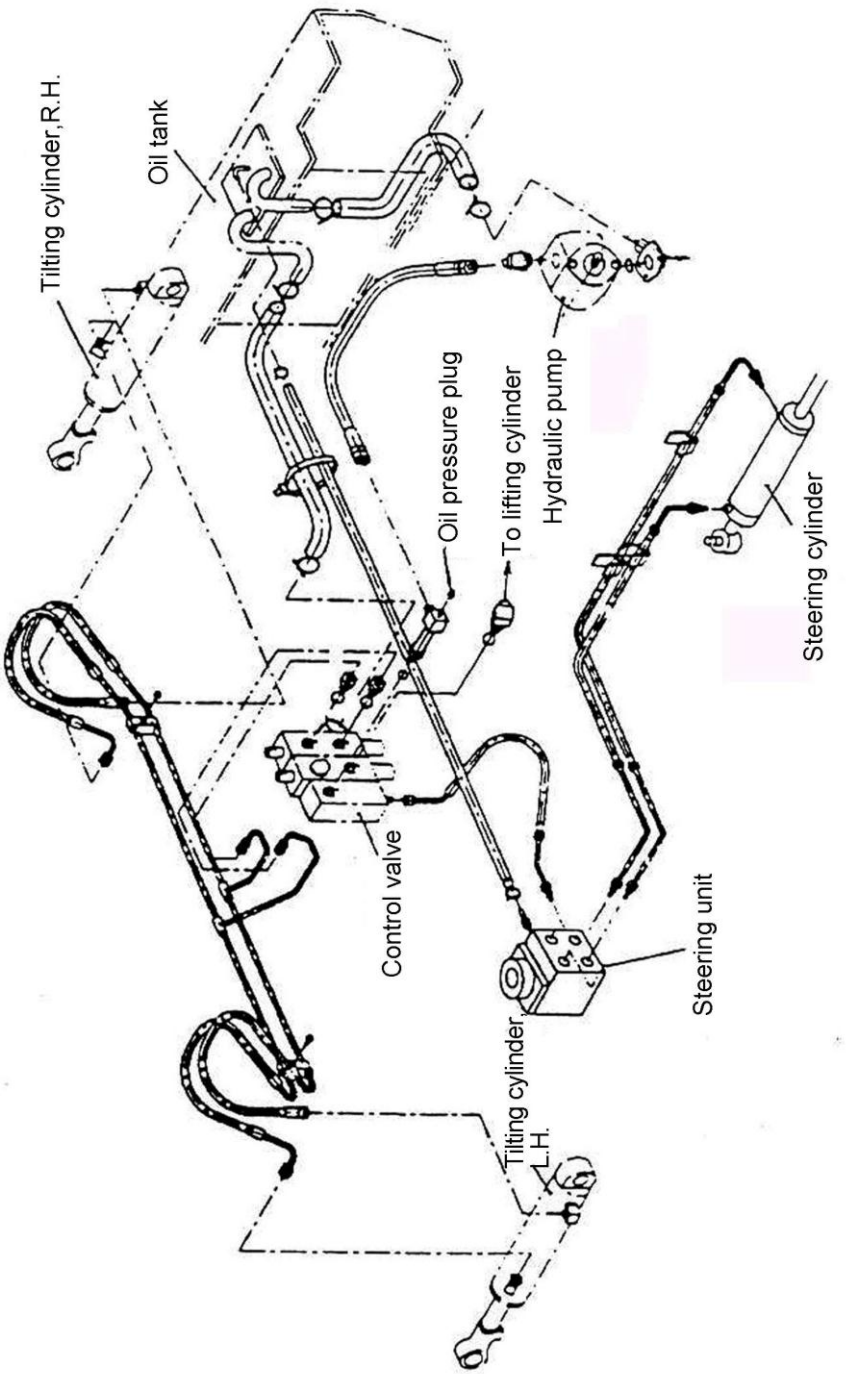


Fig7.9 Hydraulic pipe-line

7.9 Troubleshoot

If the hydraulic system occurs trouble, find out the possible cause according to the following tables and repair it.

(1) Control valve

Problem	Possible cause	Remedy
Lower oil pressure and lower oil amount of the steering oil circuit	Spool is held up	Disassemble and clean, renew oil
	Slide surface broke down	Replace spool
	Spring is broken	Replace spring
	Oil hole is blocked	Disassemble and clean
	Misadjusted relief valve	Adjust relief valve
Lower oil pressure of the lifting oil circuit	Spool is held up	Disassemble and clean
	Oil hole is blocked	Disassemble and clean
Vibrate and the oil pressure rises too slowly	Spool is held up	Disassemble and clean
	Exhaust is inadequate	Exhaust fully
The oil pressure of the steering oil circuit is more than the specified value	Spool is held up	Disassemble and clean
	Oil hole is blocked	Disassemble and clean
Lower oil amount	Misadjusted relief valve	Adjust
Noisy control valve	Misadjusted relief valve	Adjust
	Slide surface worn	Replace relief valve
Oil leakage (outside)	O-ring seal broken down	Replace O-ring seal
Lower adjusting pressure	Spring is worsen	Replace spring
	Valve seat surface is worsen	Adjust or replace relief valve
Oil leakage (inside)	Valve seat surface is worsen	Correct valve seat surface
Higher adjusting pressure	Valve is held up	Disassemble and clean

(2) Hydraulic oil pump

Problem	Possible cause	Remedy
Oil can not be pumped out	Lower oil level in oil tank	Add oil up to specified oil level
	Blocked pipe-line or oil filter	Clean or replace oil if necessary
Oil pump can not be pressurized	Lining plate broken down	Replace
	Wearing broken down	
	Seal ring, bushing or snap ring broken down	
	Misadjusted relief valve	Adjust pressure to specified value
	Air entering into the pump	Retighten loose connections for suction pipe
		Add oil into oil tank
		Replace oil seal
Noisy oil pump	Worn suction pipe or blocked oil filter	Correct pipe or repair filter
	Air entering in resulting from loose suction connections	Retighten the connection
	Too high oil stickiness	Use oil with proper stickiness
	Air bubble in oil	Find out cause and correct them
Oil leakage	Oil seal or seal ring in pump broken down	Replace
	Pump broken down	Replace

8. Lifting system

The lifting system is the type of lifting and descending vertically with the two-stage rollers. It consists of the inner mast, the outer mast and the lift bracket.

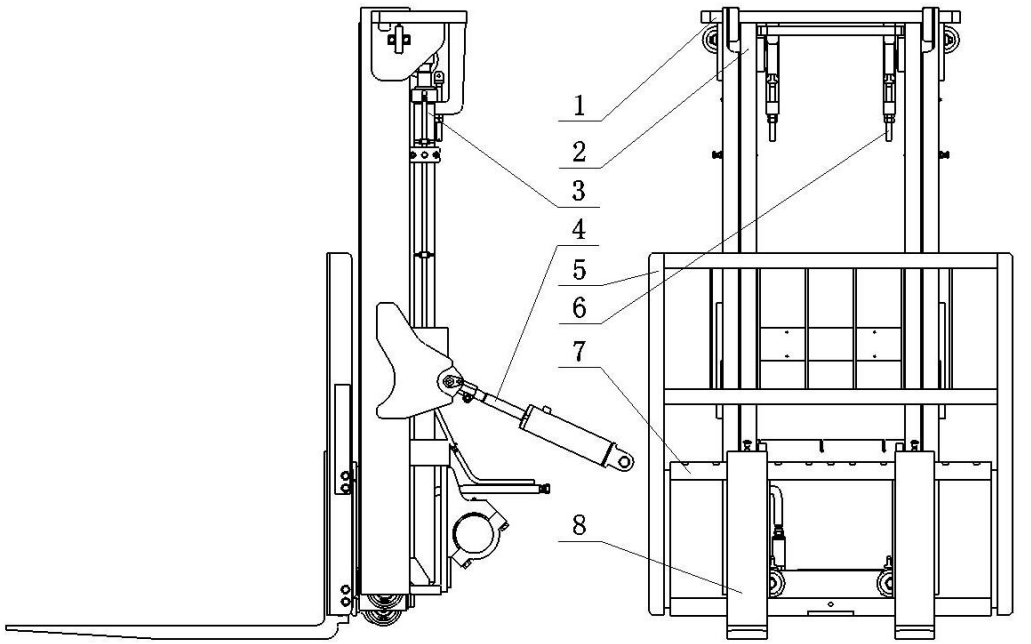


Fig8.1 Mast

1.Outer mast	4.Tilt cylinder	7.Carriage
2.Inner mast	5.Load backrest	8.Fork
3.Lift cylinder	6.Lift chain	

8.1 Inner and outer mast

The inner and outer masts are welded parts. The bottom of outer mast is connected with the drive axle through supporting. At the outside middle of outer mast, it is connected with the frame by the tilt cylinder. The mast can be tilt forward and backward by operating the tilt cylinder. The outer mast is made of C-shaped channel and main rollers and side rollers are assembled on the upper part of it. The inner mast is made of J-shaped channel and there are main rollers and side rollers at the bottom of it.

Notice: Please pay more regard to safety when maintaining the main rollers and side rollers on the upper of outer mast.

8.2 Lift bracket

The lift bracket moves up and down smoothly along the channel of the inner mast by the main rollers. The main rollers mounted on the main roller shafts and blocked by snap rings. The main roller shafts are welded on the lift bracket. The side rollers fitted on the lift bracket with bolts. They roll along the flank plate of the inner mast and rolling clearance can be adjusted with shims. The main rollers sustain the longitudinal loads and the side rollers sustain the transverse loads.

8.3 Fork

The fork is fastened on the lift bracket upper beam groove with pins, the fork clearance can be adjusted with hands. The forks and lift brackets are manufactured according to the international standard.

The fork pin fastens the fork on the definite position. When adjusting the clearance of the fork, pull the fork pin turn 1/4 circle, the fork clearance must be adjusted according to the loaded goods.

8.4 Roller position (Fig8.2)

There are two kinds of rollers, main roller and side roller. They are separately mounted on the outer mast, inner mast and lift bracket. The main rollers sustain the loads from front and rear direction and the side rollers sustain the side loads, this will make the inner mast and lift bracket move freely.

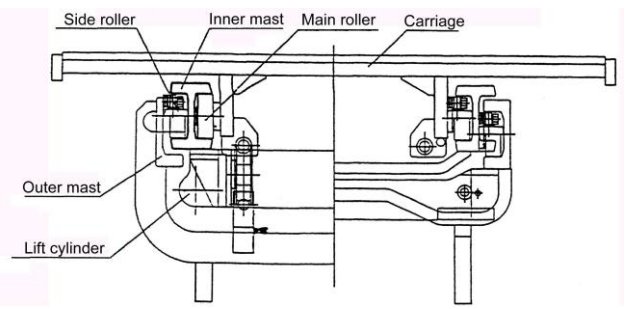


Fig8.2 Roller position

Notice:

(a) Adjust the side roller clearance for 0.5mm.

(b) Apply lubricating grease on the surface of main roller and interface of mast.

8.5 Maintenance and adjustment

8.5.1 Adjustment of lift cylinder (Fig8.3)

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

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

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

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

(4) Adjust the tightness of lift chains.

Notice: Please pay more regard to safety when adjusting the lift cylinder at an elevated height.

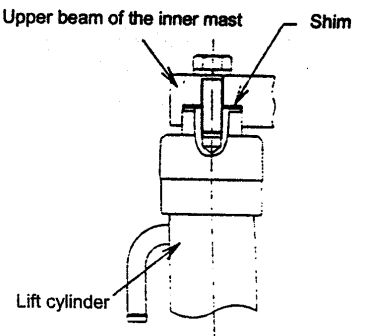


Fig8.3 Adjustment of lift cylinder

8.5.2 Adjustment of lift bracket

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

(2) Lower the forks on the ground, adjust the nut for the end nipple of the upper chain and make a distance A between the main roller and the lift bracket.

Capacity	A mm
2t~2.5t	24~29
3t~3.5t	19~24

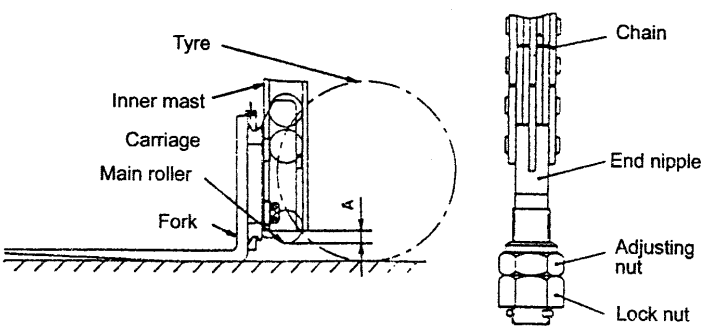


Fig8.4

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

8.5.3 Replace rollers of the lift bracket

(1) Place a pallet on the forks and let the truck parking on the horizontal ground.

(2) Make the forks and the pallet down to the ground.

(3) Disassemble the end nipple of the upper chain and take the chain down from the sheave.

(4) Lift the inner mast (See Fig8.5 ①).

(5) Make the truck back-up if the lift bracket is fully separated from the outer mast. (See Fig8.5 ②)

(6) Replace the main rollers.

·Disassemble all the snap rings and take out the main rollers with a drawing tool except the adjusting shims.

·Ensure the new rollers have the same types as the replaced rollers. Install the new rollers inside the lift bracket and fasten them with snap rings.

8.5.4 Replace rollers (Fig8.6)

(1) Use the same way as 8.5 to disassemble the lift bracket from the inner mast.

(2) Let the truck parking on the horizontal ground and wedge up the front wheels for 250mm to 300mm.

(3) Apply the parking brake and wedge up the rear wheels.

(4) Disassemble the bolts which fasten the lift cylinder and the inner mast. Hang up the inner mast not to loose the shims of the piston rod heads.

(5) Disassemble the connecting bolts for the lift cylinder and the bottom of the outer mast. Disassemble the lift cylinders and the oil pipes between the two cylinders without loosen the oil pipe joints.

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

(7) Replace the main rollers.

·Disassemble the upper main rollers with a drawing tool, don't loose the adjust

shims.

·Install the new rollers and the shims disassembled before.

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

(9) Reassemble the lift cylinder and the lift bracket.

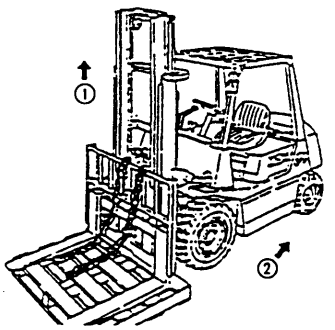


Fig8.5

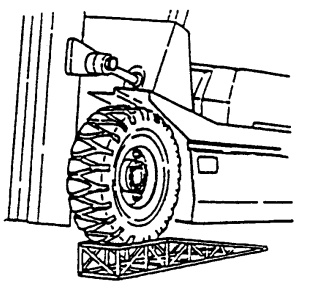


Fig8.6

9. Electrical system

9.1 General description

The electric system for this forklift truck is single wire system with minus earth. It mainly consists of the following systems:

(1) Charge system

This system contains generator, battery, charging indicator, etc. It supplies current for all the electric appliances.

Voltage: 12V (DC)

(2) Starting system

This system mainly consists of automatic pre-heating unit (only diesel engine), key switch, starting protection circuit, starting motor, etc. The function of this system is starting the engine.

(3) Instruments

It mainly consists of hour meter, fuel meter, water temperature meter and indicator lamps. They are all performance checking instruments for the forklift truck.

The instrument panel adopts Curtis internal-combustion engine meter core. The fuel meter and water temperature meter are ten solid state bars of multicolor LED display. The hour meter in the BAOLI instrument panel is solid state digital display with back lamp.

Notice for operation of instrument:

a. Working circumstance: Elevation is lower than 1200 meters, working temperature -25℃～+40℃, relative humidity is not larger than 95%.

b. Forbid wetting the meter. When washing the truck, don’t let water into the meter, if it happens, clean it with dry cloth.

c. Don’t pull the plug of the meter and harness for the connection.

d. Forbid impacting or scratching the meter strongly.

e. When the meter works abnormally, contact with our company for maintenance.

(4) Lighting and signal device

They include all kinds of lightings, signal lamps, horns and buzzers, etc.

Headlamp: 55W

Front combination lamp (turning/signal): 21W/5W

Rear combination lamp (turning /signal/backing): 21W (red)/5W (red)/10W (white)

Warning lamp (optional): 21W

9.2 Brief explanation for operation

(1) Starting

There is a starting protection circuit in the control box for the forklift truck. You have to shift the direction switch in neutral before you start the engine. Otherwise, you can not start the engine.

Turn the key switch clockwise to the first “on” position, the instrument circuit and the firing circuit is ready for work. For diesel engine, the automatic pre-heater begins to work and the pre-heating indicator lights. The pre-heating indicator automatically stops lighting after 3.5 seconds and the pre-heater automatically stop working after 13.5 seconds. The pre-heating time is controlled by a time relay.

Turn the key switch clockwise to the second “on” position (starting position), then start the engine.

After engine starting, push the direction switch forward (that is forward gearshift), then pedal accelerator, the forklift truck runs faster and you can begin to begin to work. When pull the direction switch backward (that is in reverse gearshift), the backing lamp is on and the buzzer sounds.

(2) Lamp switch

Pull the lamp switch to the first “on” position, the front lamps and rear lamps are on. Pull the lamp switch to the second “on” position, the headlamps are on while the front lamps and rear lamps keep on.

(3) Turning signal

Pull the turning switch backward, the left turning lamps flash. Push the turning switch forward, the right turning lamps flash.

(4) Brake signal

When you pedal brake, the brake lamps (red) in the rear combination lamps are on.

(5) Backing signal

When you need to reverse the forklift truck, pull the direction switch backward and the transmission is in reverse gear. Then the backing lamps (white) in the rear

combination lamps are on and the buzzer sounds.

(6) Charging signal

Before you start the engine, put the key switch to the first “on” position and the charging lamp is on. After engine starting, the charging lamp is automatically off. If the charging lamp becomes on while the engine is working, it means something is wrong with the charging circuit and you must stop working and check the charging circuit as soon as possible.

(7) Oil pressure signal

Before you start the engine, put the key switch to the first “on” position and the oil pressure alarm lamp is on. After engine starting, the oil pressure alarm lamp is automatically off. If this lamp becomes on while the engine is working, it indicates low lubricating oil pressure and you must stop working and check the lubricating system as soon as possible.

(8) Water separator signal

Before you start the engine, put the key switch to the first “on” position and the water separator alarm lamp is on. After engine starting, the water separator alarm lamp is automatically off. If this lamp becomes on while the engine is working, it means too much water has been accumulated in the water separator. You should push the handle in the water separator to get rid of the water. After eliminating the water, this lamp becomes off.

(9) Fuel meter

It indicates how much fuel is left in the fuel tank. If it displays fewer than two bars, it means little fuel is left in the fuel tank and the buzzer sounds. You should replenish the fuel tank as soon as possible.

(10) Water temperature meter

It indicates the temperature of the coolant for the engine.

(11) Hour meter

It indicates the temperature of the coolant for the engine.

9.3 Precautions when using the battery

(1) Avoid the short circuit, spark and smoking for the battery may cause combustible gas which has danger of explosion.

(2) The electrolyte is dilute sulfuric acid which is dangerous when touching the skin or eyes. If it is on the skin, wash it with water immediately. If in the eyes, please go to hospital at once after cleaning the eyes with water.

(3) Dealing with the waste and worn batteries according to relevant laws and regulations.

9.4 Harness

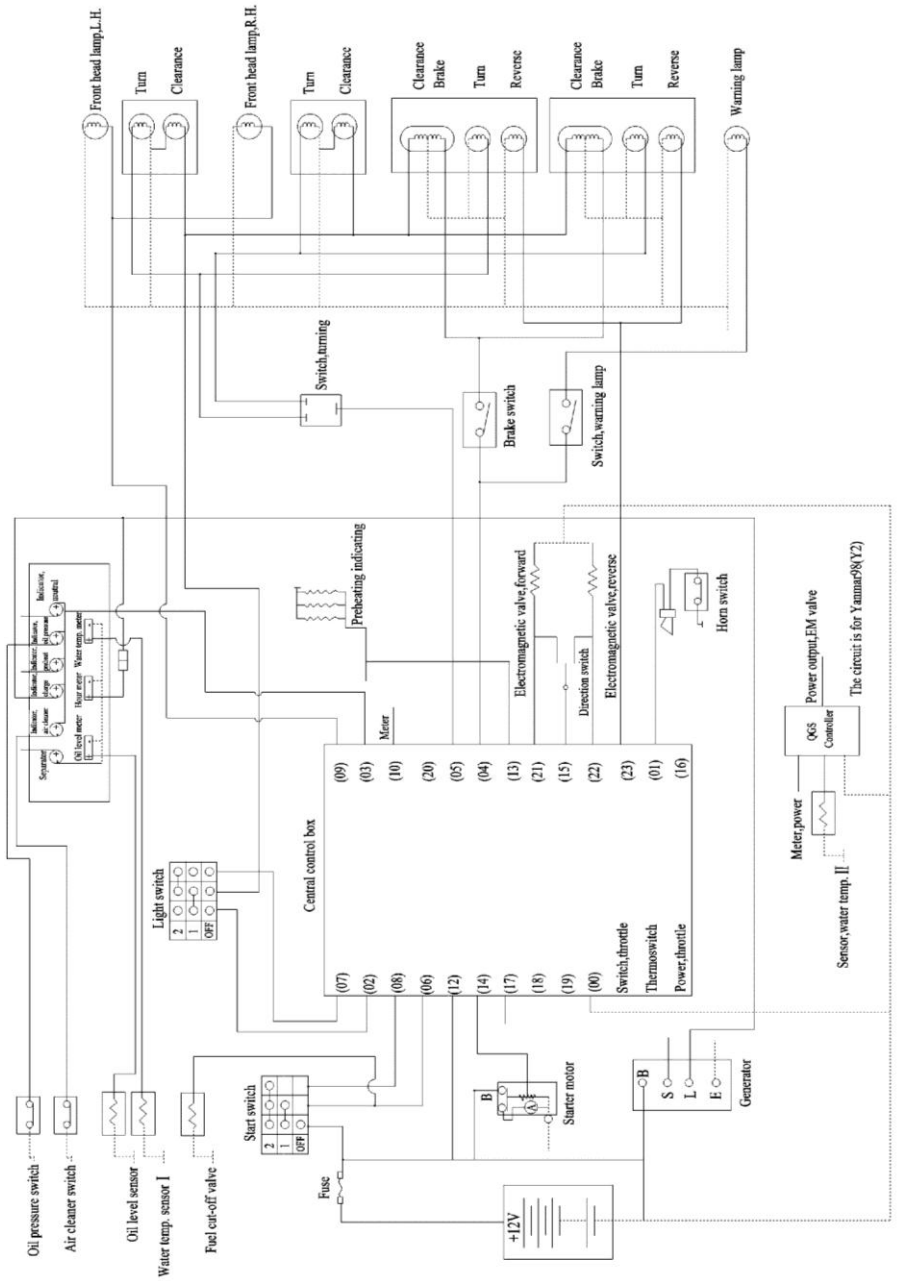
The allowable loading current value of low-voltage wires cross-section is as follows:

Section (mm^2)	1.0	1.5	2.5	3.0	4.0	5.0	6.0
Current (A)	11	14	20	22	25	25	35

Attached diagram:

See the principle diagram of electrical system in Fig9.1, the diagram of harness in Fig9.2.

The principle diagram of electrical system and diagram of harness is representative circuit diagram, they are only for a reference, please refer to the corresponding Parts Manual for the specific models.



Central control box

00 Power(-)

01 Power, horn

02 Power, lamp

03 Power, meter

04 Power, switch

05 Switch, turning lamp

06 Power, ignition switch

07 Switch, light

08 Switch, start

09 Power, headlamp

10 Preheating indicating

12 Main power

13 Preheating fuse

14 Starter

15 Optional power 1

16 Optional power 2

17 Indicating, neutral

18 Generator N

19 Generator F

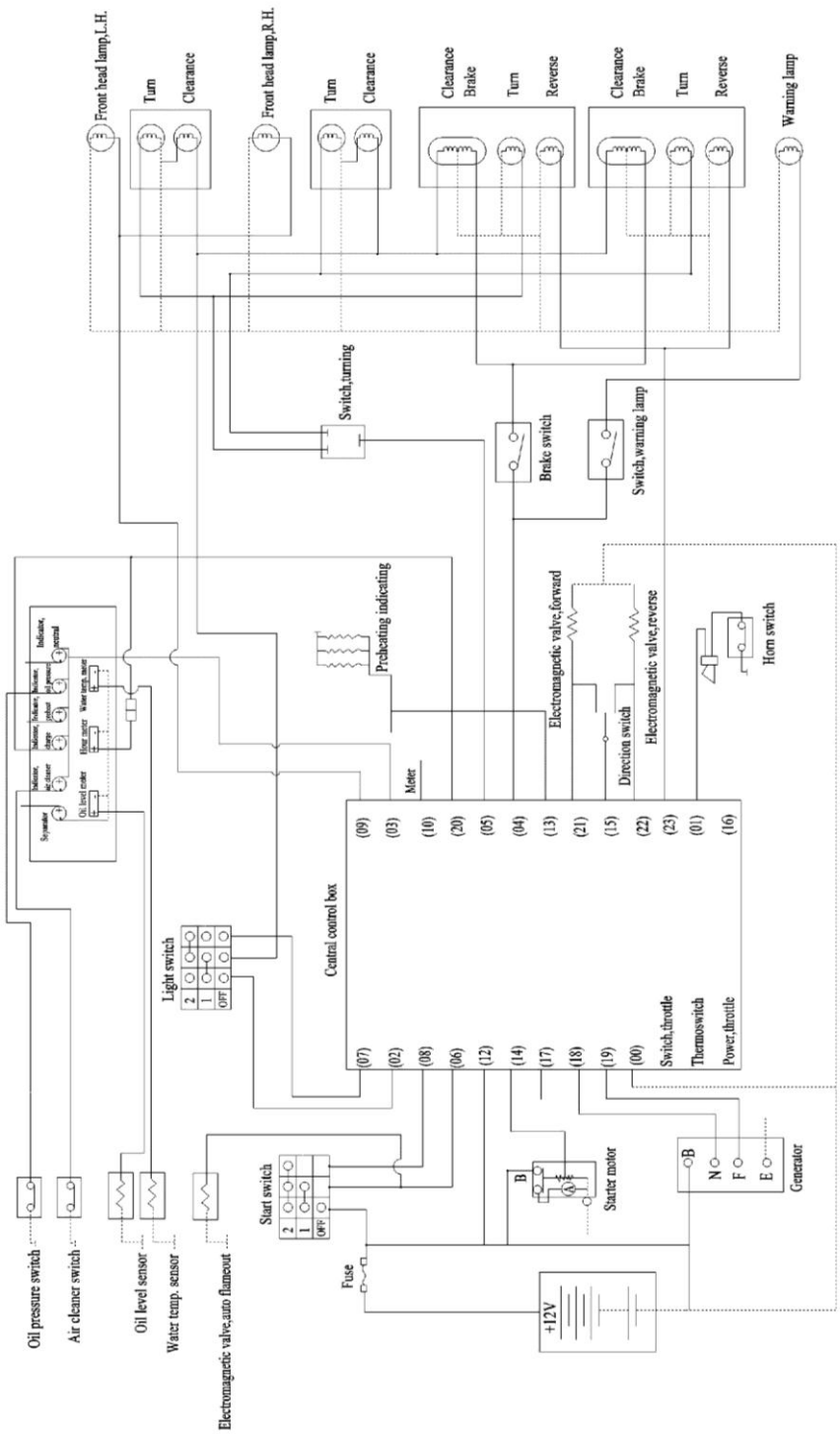
20 Charging indicating

21 Switch, forward

22 Switch, reverse

23 Lamp, reverse

Fig9.1-1 Principle diagram of electrical system (ISUZU engine)



Central control box

00 Power(-)

01 Power, horn

02 Power, lamp

03 Power, meter

04 Power, switch

05 Switch, turning lamp

06 Power, ignition switch

07 Switch, light

08 Switch, start

09 Power, headlamp

10 Preheating indicating

12 Main power

13 Preheating fuse

14 Starter

15 Optional power 1

16 Optional power 2

17 Indicating, neutral

18 Generator N

19 Generator F

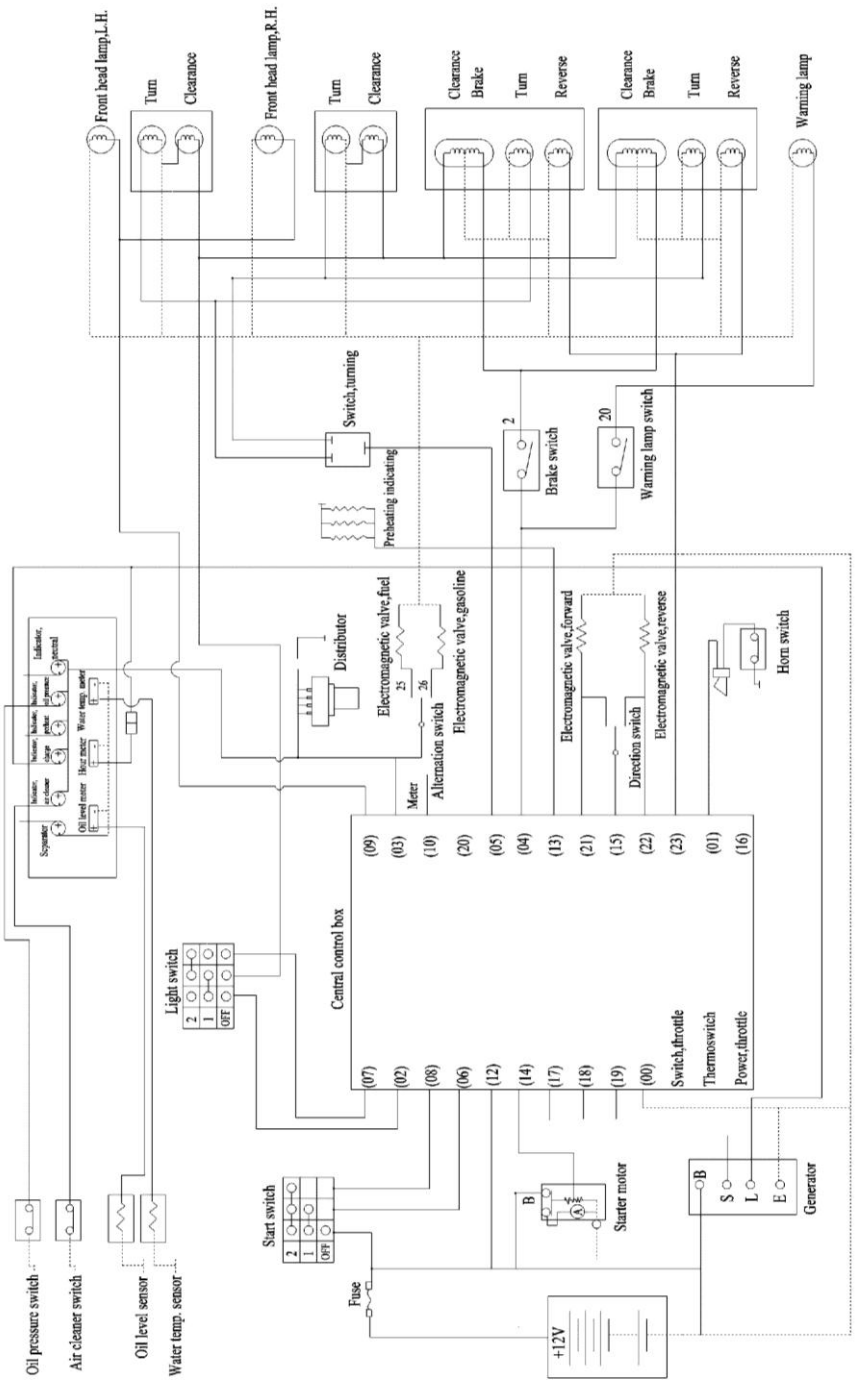
20 Charging indicating

21 Switch, forward

22 Switch, reverse

23 Lamp, reverse

Fig9.1-2 Principle diagram of electrical system (Xinchang engine)



Central control box

00 Power(-)

01 Power, horn

02 Power, lamp

03 Power, meter

04 Power, switch

05 Switch, turning lamp

06 Power, ignition switch

07 Switch, light

08 Switch, start

09 Power, headlamp

10 Preheating indicating

12 Main power

13 Preheating fuse

14 Starter

15 Optional power 1

16 Optional power 2

17 Indicating, neutral

18 Generator N

19 Generator F

20 Charging indicating

21 Switch, forward

22 Switch, reverse

23 Lamp, reverse

Fig9.1-3 Principle diagram of electrical system (Mitsubishi gasoline engine)

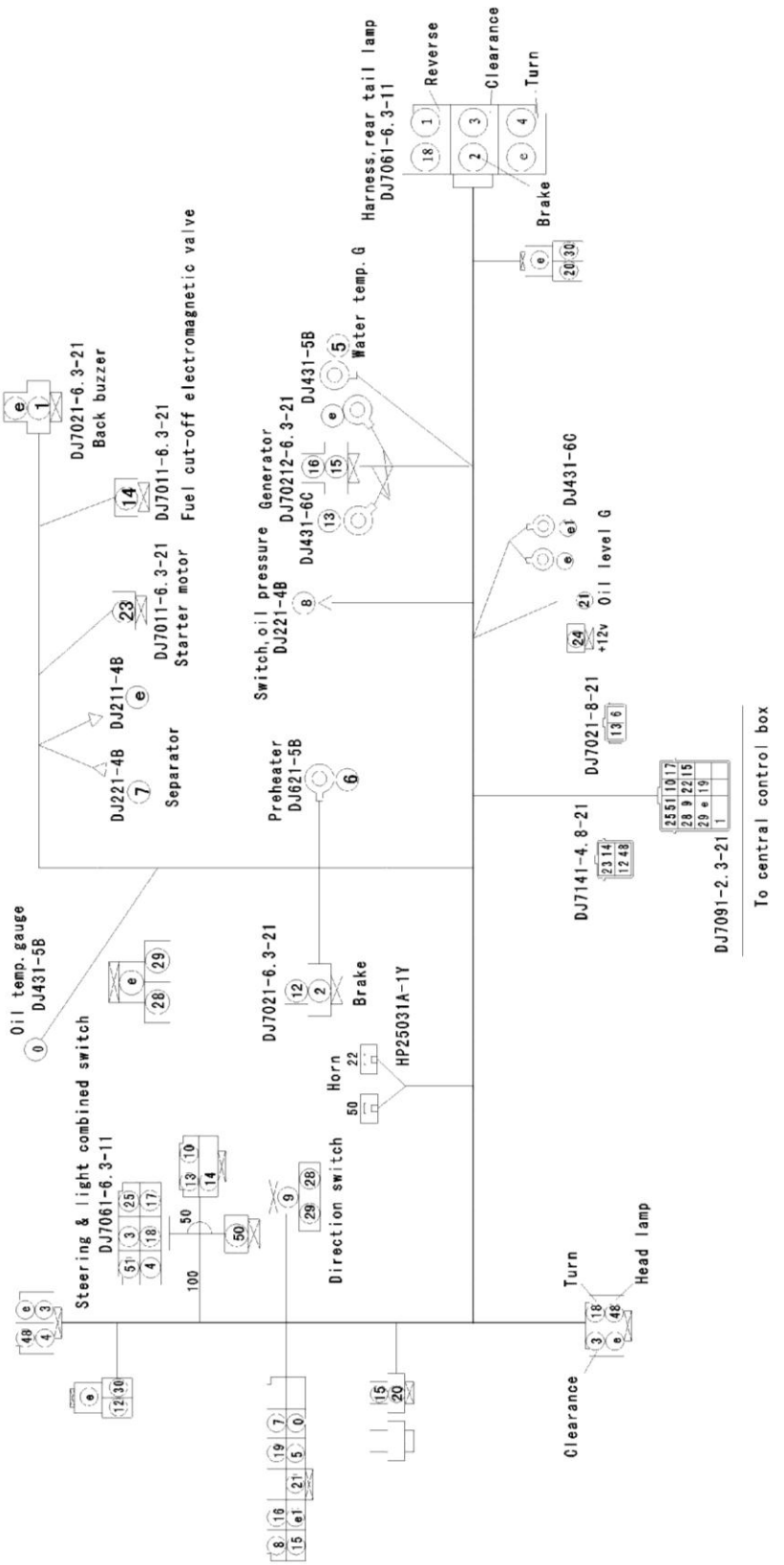


Fig9.2-1 Diagram of harness (ISUZU 4JG2 engine)

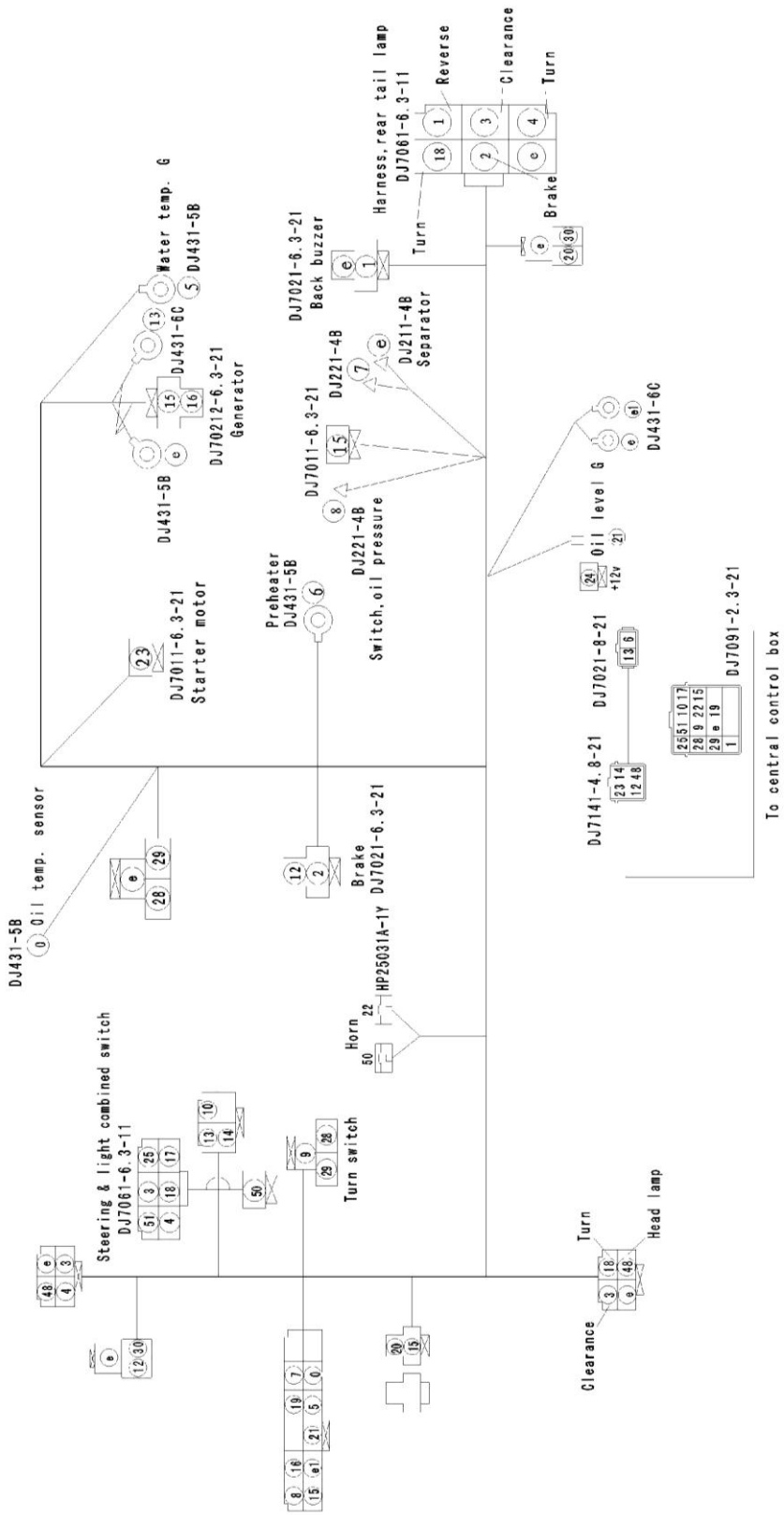


Fig9.2-2 Diagram of harness (ISUZU engine electron shift)

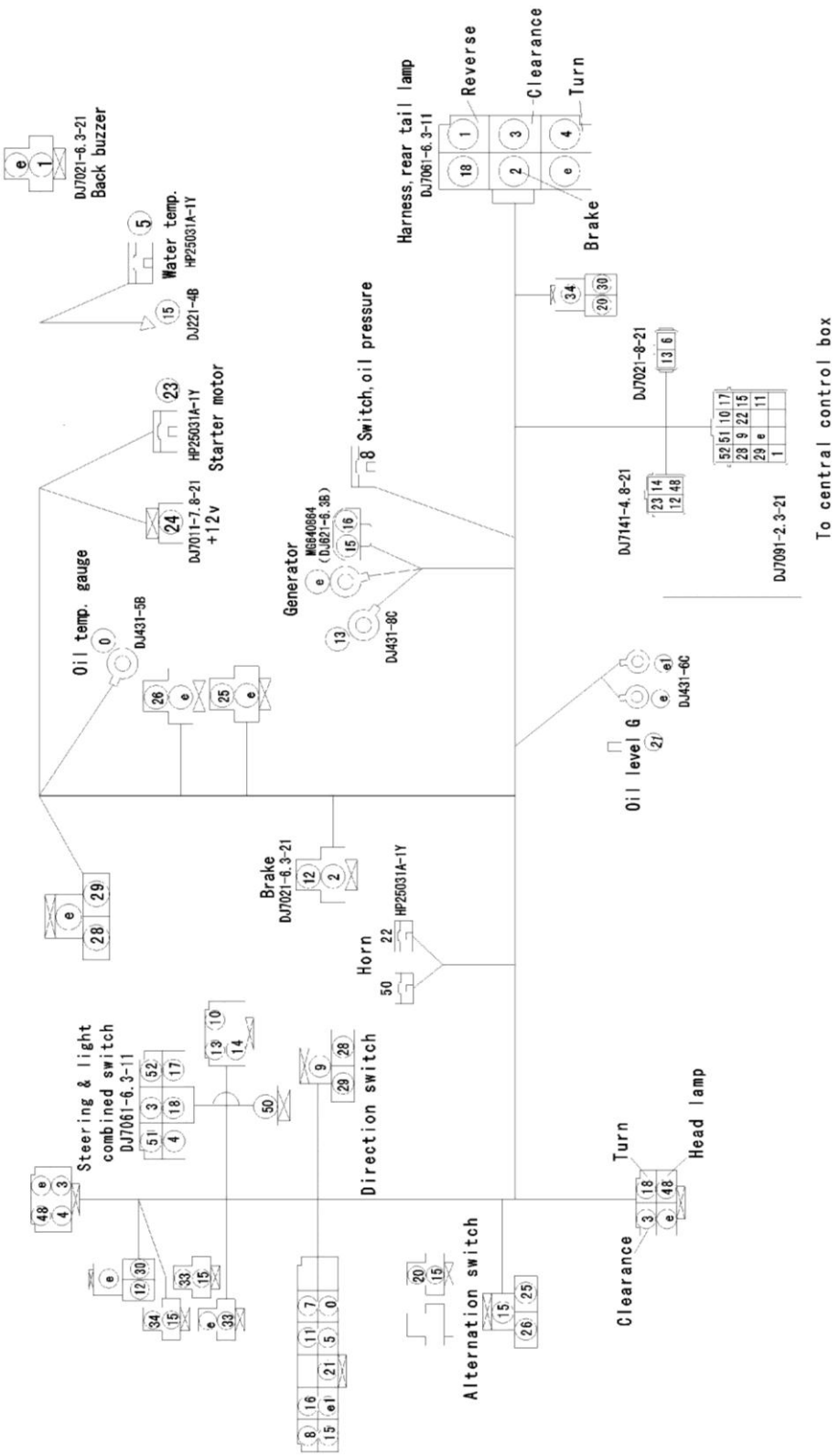


Fig9.2-3 Diagram of harness (Mitsubishi engine electron shift)

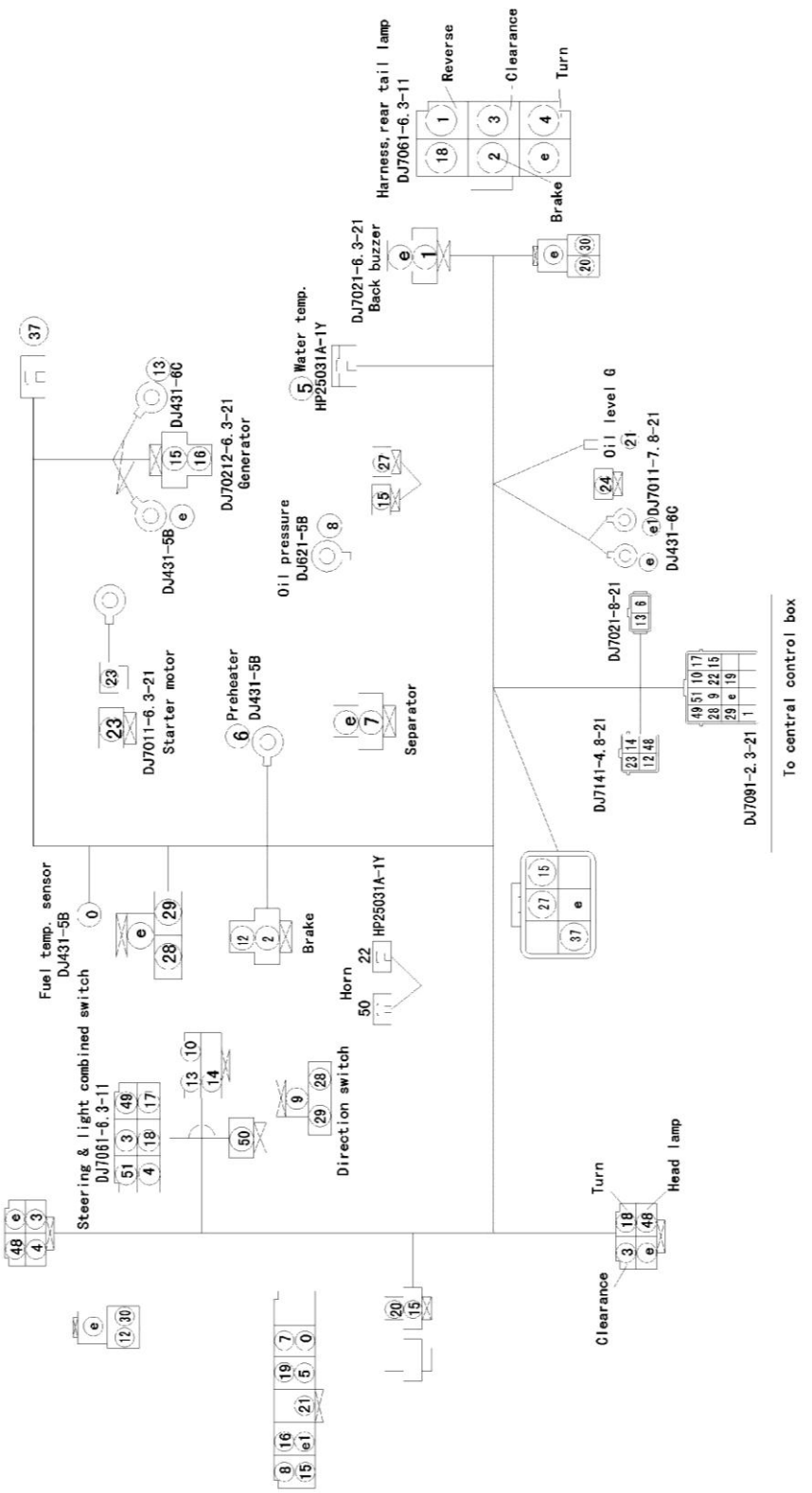


Fig9.2-4 Diagram of Yanmar harness (electron shift)

Product improve suggestion sheet (feedback)

Product name			
Serial No.		Product lot number	
Date of delivery		Start use date	
Use company			

Suggestion content:

To improve our forklift trucks, absorb your valuable suggestion, please send to us suggestion content.

NOTE

EC DECLARATION OF CONFORMITY

MANUFACTURE

Name: KION Baoli(Jiangsu) Forklift CO., LTD.

Address: No.8 Xinzhou Road, Economic Development Zone, Jingjiang ,Jiangsu, China

Post: 214500 ,Jiangsu, China

THE TECHNICAL DOCUMENTATION WAS COMPILED BY:

Name: Wu,Yun-Cheng

Address: Hoppengarten 19,Germany

Post: 40489 Duesseldorf,Germany

HEREBY DECLARES THAT THE PRODUCT DESCRIBED BELOW:

Description: Industrial truck – Counterbalanced Lift truck

Model:

Serial number: Net engine power: kW

Manufacturing year:

COMPLIES WITH THE PROVISIONS OF THE FOLLOWING EUROPEAN DIRECTIVES:

2006/42/EC Machinery Directive

2004/108/EC EMC Directive

97/68/EC Engine pollutant emission Directive

2000/14/EC & 2005/88/EC Noise Directive

Equipment according to the definition given by Annex I, item 36 of Noise Directive.

Conformity assessment procedure followed: Annex V of Noise Directive 2000/14/EC

Holder of the technical documentation

Name: KION Baoli(Jiangsu) Forklift CO., LTD.

Measured sound power level: dB Guaranteed sound power level: dB

COMPLIES WITH THE PROVISIONS OF THE FOLLOWING HARMONIZED STANDARDS:

EN 1726-1：1998+A1：2003	Safety of industrial trucks — Self-propelled trucks up to andincluding 10 000 kg capacity and industrialtractors with a drawbarpull up to and including20 000 N
Annex I of Machinery Directive 2006/42/EC	Essential health and safety requirements relating to the design andconstruction of machinery

Done at: Jingjiang ,Jiangsu, China

On : _____

Name of the signatory: 陈斌/ChenBin

Title: Director of Quality Assurance

Signature: _____

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Edition: ME02-02 : 2009