

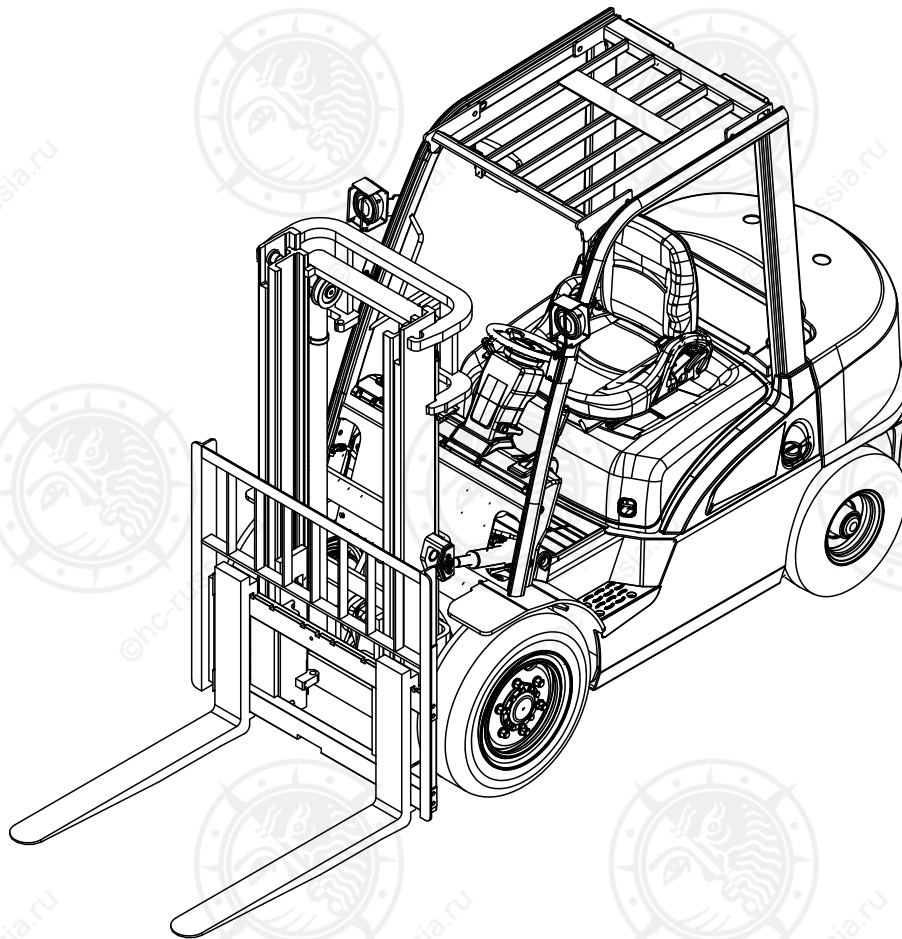


X series

**Internal Combustion Counterbalanced
Forklift Truck**

1.0t-3.8t

SERVICE MANUAL



HANGCHA GROUP CO., LTD.

02/2025

Foreword

The manual is the introduction of structure, working principle and serving of 1t-3.8t X series internal combustion counterbalance forklift truck.

For safety and performance of truck, all in charge of operation, maintenance and management must read and comprehend this manual well.

The manual also applies to container fork-lift trucks.

It is forbidden anybody without training and qualification to maintain.

Our product design will update and perform better, so the content in this manual may be not the same as the forklift you owned.

If you have any questions please keep touches with HANGCHA GROUP CO., LTD. sales department or let the agents know.

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I . Power System

1. Engine for Forklift

Engine Parameter	Electronic controlled diesel engine	
	4D27XG30-003	4D32XG30-004
Rated output kW	34	45
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	140/1000~1800	200/1500~1800
Forklift truck model	CPC10/15/18-XRG71 CPCD10/15/18-XRG71	CPC20/25/30/35/38-XRG72 CPCD20/25/30/35/38-XRG72 CPCD20/25/30/35/38-XRG72F

Engine Parameter	Electronic controlled diesel engine	
	4D27XG30-003	4D27XG40-002
Rated output kW	34	34
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	140/1000~1800	140/1000~1800
Forklift truck model	CPCD15/18-XRG71F	CPCD15/18-XRG71JF

Engine Parameter	Electronic controlled diesel engine	
	4D27XG40-201	4D32XG40-200
Rated output kW	34	36.8
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	140/1500~1800	200/1500~1800
Forklift truck model	CPC15/18-XRG91 CPCD15/18-XRG91	CPC20/25/30/35/38-XRG92 CPCD20/25/30/35/38-XRG92

Engine Parameter	Gasoline	
	GK21, GCT(NISSAN)	GK25, GCT(NISSAN)
Rated output kW	31.2	37.4
Rated rotate speed r/min	2250	2250
Max. torque N·m / Speed r/min	143.7/1600	176.5/1600
Service weight kg	158	161
Forklift truck model	CPQD10/15/18N-XRW21 CPQYD15/18-XRW21 CPQYD15/18-XRW21F CPQD15/18-XRW21B(B1) CPQYD15/18-XRW21B(B1) CPQYD20/25-XRW21	CPQD20/25/30/35-XRW22 CPQD20/25/30/35-XRW22B(B1) CPQD20/25/30/35-XRW22F CPQYD20/25/30/35-XRW22 CPQYD20/25/30/35-XRW22B(B1) CPQYD20/25/30/35-XRW22F

Engine Parameter	Gasoline	
	QSF2.8T3NA49 (Cummins)	4TNV94L-BXPHZ(YANMAR)
Rated output kW	36.5	34.6
Rated rotate speed r/min	2500	2400
Max. torque N·m / Speed r/min	186/1500	191.5~208.5 / 1500 (±100)
Service weight kg	234	260
Forklift truck model	CPCD10/15/18-XRW43 CPCD20/25/30/35-XRW43 CPCD20/25/30/35-XRW43B CPCD20/25/30/35-XRW43F	CPCD20/25/30/35-XRW56 CPCD20/25/30/35-XRW56B(B1) CPCD20/25/30/35-XRW56F

Engine Parameter	Diesel (ISUZU)
	GK-C240NKFC01
Rated output kW	45
Rated rotate speed r/min	2500
Max. torque N·m / Speed r/min	139.9/1800
Service weight kg	252
Forklift truck model	CPCD10/15/18-XRW10 CPCD20/25/30-XRW10 CPCD10/15/18-XRW10B(B1) CPCD20/25/30-XRW10B(B1) CPCD10/15/18-XRW10F CPCD20/25/30-XRW10F CPC10/15/18-XRW10 CPC20/25/30-XRW10

Engine Parameter	Electronic controlled diesel engine	
	4D27XG30-300	4D27XG30-300
Rated output kW	34	36.8
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	140/ (1600-1800)	186 / (1600-1800)
Forklift truck model	CPCD10/15/18-XRW91F	CPCD20/25/30/35-XRW92F

Engine Parameter	Diesel (ISUZU)	
	YANMAR 4TNE98	S4S-DPEU2
Rated output kW	42.1	35.3
Rated rotate speed r/min	2300	35.3kW/2250r/min
Max. torque N·m / Speed r/min	186/1700	177/1700
Forklift truck model	194	245
	CPCD20/25/30/35-XRW33 CPCD20/25/30/35-XRW33B(B1) CPCD20/25/30/35-XRW33F	CPCD20/25/30/35-XRW55 CPCD20/25/30/35-XRW55B(B1) CPCD20/25/30/35-XRW55F

Engine Parameter	Gasoline
	K25 LPG
Rated output kW	35
Rated rotate speed r/min	2400
Max. torque N·m / Speed r/min	170/1600
Forklift truck model	CPYD20/25/30/35/38-XRW52B(B1) CPYD20/25/30/35/38-XRW52F

Engine Parameter	Diesel	
	DaChai CA498-05T3-A250	DaChai CA498-06T3R-A249
Rated output kW	36	45
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	196/1800	196/1800
Forklift truck model	CPCD20/25/30/35/38-XRG59	CPCD20/25/30/35/38-XRG60

Engine Parameter	Diesel	
	XinChai 4D29X41-008	XinChai 4D29X41-007
Rated output kW	34	34
Rated rotate speed r/min	2500	2500
Max. torque N·m / Speed r/min	150/1600-1800	150/1600-1800
Forklift truck model	CPCD15/18-XRG98	CPCD15/18-XRG98F

Engine Parameter	Diesel
	XinChai 4D32X41-002
Rated output kW	36.8
Rated rotate speed r/min	2500
Max. torque N·m / Speed r/min	210/1400-1600
Forklift truck model	CPCD20/25/30/35/38-XRG92F

Engine Parameter	Diesel
	XinChai C490BPG-416
Rated output kW	40
Rated rotate speed r/min	2650
Max. torque N·m / Speed r/min	160/1800-2000
Forklift truck model	CPCD20/25/30/35/38-XRG2

Engine Parameter	Diesel
	YANMAR 4TNE92-HRJ
Rated output kW	32.8
Rated rotate speed r/min	2450
Max. torque N·m / Speed r/min	142/1600
Forklift truck model	CPCD15/18-XRW32F CPCD15/18-XRW32B CPCD15/18-XRW32B1

4D27XG30/4D32XG30 specifications, structure and maintenance methods for engine see ENGINE MAINTENANCE MANUAL.

GB20891-2014 Limits for exhaust pollutants from diesel engines of non-road mobile machinery (CHINA III)

Engine power ($P_{\max}$) (kW)	CO (g/kW·h)	HC (g/kW·h)	NO _x (g/kW·h)	HC+ NO _x (g/kW·h)	PM(particulate matter) (g/kW·h)
$37 \leq P_{\max} < 75$	5.0	—	—	4.7	0.40
$18 \leq P_{\max} < 37$	5.5	—	—	7.5	0.60

GB20891-2014 Limits for exhaust pollutants from diesel engines of non-road mobile machinery (CHINA VI)

Engine power ($P_{\max}$) (kW)	CO (g/kW·h)	HC (g/kW·h)	NO _x (g/kW·h)	HC+ NO _x (g/kW·h)	PM(particulate matter) (g/kW·h)
$56 \leq P_{\max} < 75$	5.0	0.19	3.3	—	0.025
$37 \leq P_{\max} < 56$	5.0	—	—	4.7	0.025
$18 \leq P_{\max} < 37$	5.5	—	—	7.5	0.60

2. GCT(NISSAN) K21、K25 gasoline

2.1 Specification

Specification				Gasoline	
Model				GK21	GK25
Type				Water cooled, four cycle, in-line overhead valve type	
Cylinder: No. —stroke mm				4 — 89	4 — 89
Displacement L				1.982	2.472
Direction of rotation				Clockwise cooling fan	
Firing order				1-3-4-2	
Valve clearance mm		Intake(Hot)		0.38	
		Exhaust(Hot)		0.38	
Cooling System				Water-cooled, forced circulation	
Lubrication System				Forced Lubrication	
Main component	Carburetor model			210030-41	210030-42
	Fuel pump			Film-type	
	Air clear			Paper element	
	Oil pump			Gear type	
	Oil filter			Paper element	
	Water pump			Centrifugal	
	Thermostat			Wax-pellet type	
	Standard clearance of switchboard			0. 35-0. 45	
	Spark plug		Type	FR2A-D	
			Plug gap(mm)	0.8~0.9	
	or	Type		A7T03371	
				12	
				35	
	Starter	Type		M000T65381 (Planetary gear type)	
		Voltage V		12	
		Output power kW		1.2	
	Governor	Type		Pneumatic	
		Speed control system		By controlling mix. tare amount	
		Operation of control mechanizing		By suction negative pressure	
		Max. Engine speed under no-laden		3600 r/min	
		Max. Engine speed under laden		3000 r/min	
	Battery	Type		/	
		Capacity V-A·h		12-60	
		Full charge specific gravity at 20°C		1.28	
Reference data	Engine oil capacity L			3.7	
	Coolant volume L			3.5	

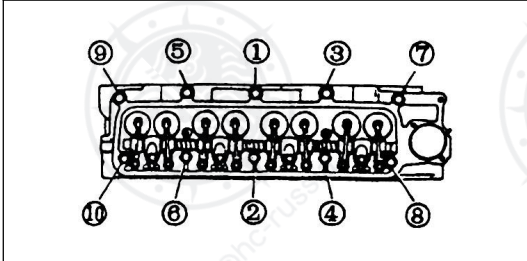
2.2 GK21/GK25 Maintenance

2.2.1 Retighten cylinder head bolts

When the engine is cold, retighten should be made in the sequence shown.

·T: 68.6 N·m

·In two steps.



2.2.2 Adjusting intake and exhaust valve clearance

1) Start engines and warm it up sufficiently.

Then turn off engine.

2) Remove valve rocker cover.

3) Rotate crankshaft.

Set No.1 cylinder in top dead center on its compression stroke and then adjust valve clearance.

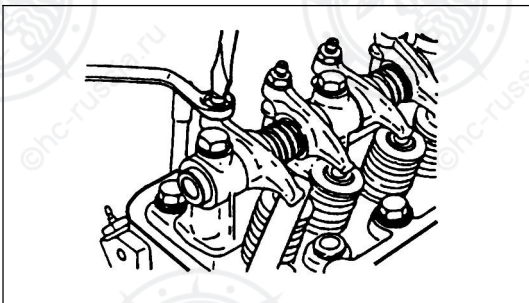
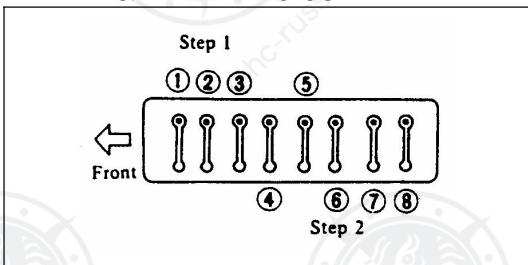
① ② ③ ⑤

Set NO.4 cylinder in top dead center on its compression stroke, and adjust valve clearance.

④ ⑥ ⑦ ⑧

Valve clearance (Hot)

Intake & exhaust: 0.38mm



2.2.3. Checking and Adjusting Fan

Belt for Tension

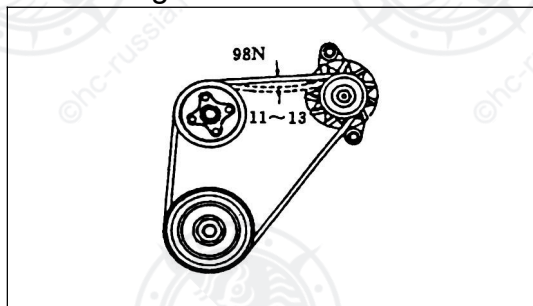
1) Visually inspect for cracks, fraying, wear or lubricity.

The belt should not touch the bottom of the pulley groove.

2) Check belt deflection by pushing midway between pulleys.

Fan belt deflection: 11mm ~ 13mm

Pushing force: 98N

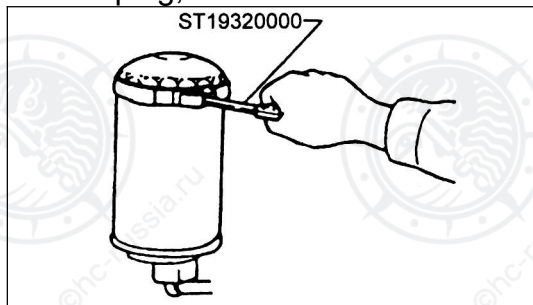


2.2.4. Changing engine oil and oil filter

1) Start engine and warm up

engine sufficiently, then stop engine.

2) Remove oil filler cap and oil pan drain plug, and allow oil to drain.



! WARNING:

Be careful not to burn yourself, as the engine oil may be hot.

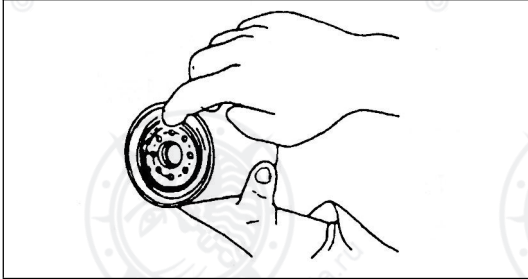
- Milky oil indicates the presence of cooling water and finds the cause, takes corrective measure.

- Oil with extremely low viscosity indicates dilution with gasoline.

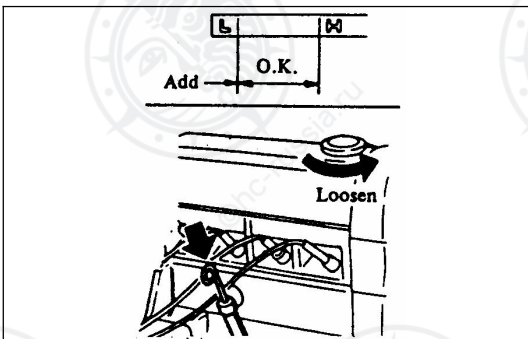
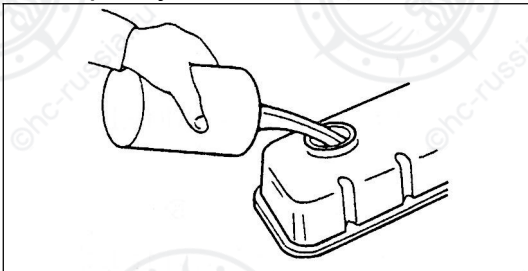
3) Clean and install oil pan drain plug with washer.

Oil pan drain plug: 29N·m ~ 39N·m

- 4) Using tool remove oil filter.
- 5) Wipe oil filter mounting surface with a clean rag.
- 6) Smear a little engine oil on rubber gasket of new oil filter.



- 7) Install new oil filter. Hand-tighten ONLY.
Don't use a wrench to tighten the filter.
- 8) Refill engine with new recommended engine oil, referring to Recommended Lubricants.
Check oil level with dipstick.
Oil capacity: 3.6 L.



- 9) Start engine, check area around drain plug and oil filter for any sign of oil leakage.
If any Leakage is evident, these parts have not been properly installed.
- 10) Warm up engine sufficiently.
Then stop engine and wait a few minutes. Check oil level. If necessary,

add engine oil.
When checking oil level, park the forklift on a level surface.

2.2.5. Changing Engine Coolant

! WARNING:

To avoid the danger of being scalded, never attempt to change the coolant when the engine is hot. When using anti-freeze coolant, mix the anti-freeze coolant with water.

2.2.6. Cleaning Radiator Outside

Clean outside of radiator with dry compressed air.

2.2.7. Checking cooling System, Hoses and Connections.

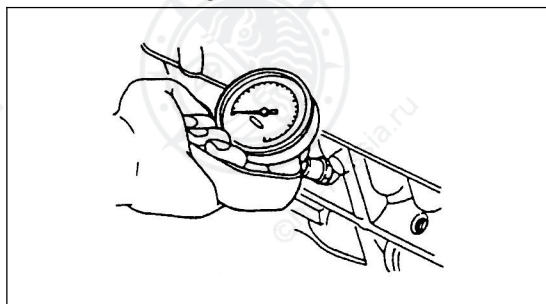
Check hoses and fittings for Lose connections or deterioration.
Retighten or replace if necessary.

2.2.8. Checking Engine Compression Pressure

- 1) Warm up engine sufficiently, then stop engine.
 - 2) Remove all spark plugs.
 - 3) Properly attach a compression tester to spark plug hole in cylinder being tested.
 - 4) Set carburetor throttle valve at fully open position.
 - 5) Crank engine and red gauge indication.
- Run engine at about 250r/min
 - Engine compression measurement should be made as quickly as possible.

Compression pressure:

K21	K25	
Standard	1.23kPa	1.27kPa



- 6).Cylinder compression in cylinders should not be less than 80% of the

highest reading.

If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the spark plug holes and retest compression.

·If adding oil helps the compression pressure, piston rings may be worn or damaged.

·If pressure stays low, valve may be sticking or seating improperly.

·If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage pass on the gasket surface.

Oil and water in combustion chambers can result from this problem.

2.2.9. Cleaning or Replacing Air Cleaning Filter (Dry paper type)

It is necessary to clean the element or replace it at the recommended interval, and more frequent maintenance should do in other dirty operating conditions.

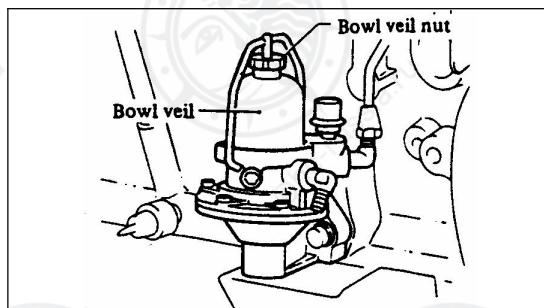


2.2.10. Cleaning or Replacing Fuel Stained Element

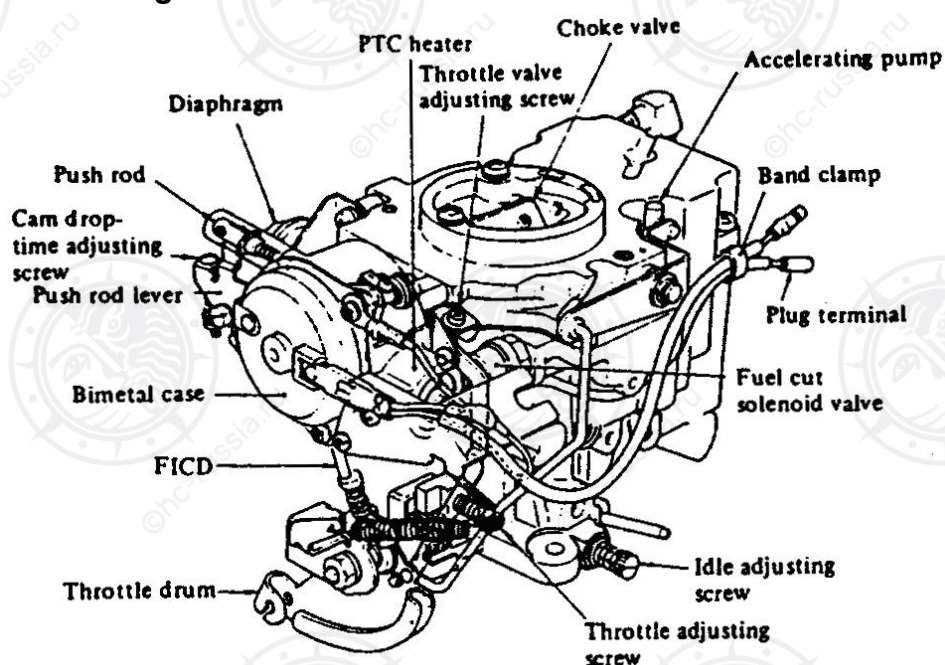
The fuel strainer element should be checked, cleaned or replaced periodically.

2.2.11. Checking Fuel lines

Check fuel lines for proper attachment, leaks, cracks, damage, loose connections, chaffing and deterioration. If necessary, replace any damaged or defective parts.



2.2.12 Checking carburetor



1) Checking Linkage And Valve

- Remove air horn. Visual check dirt and linkage of interior carburetor, visual check wear or damage of connecting parts..
- Check throttle valve shaft for wear by moving it by hand. It must not moved(no free play).
- Check operation (opening and closing) of throttle valve and choke valve.

Maintenance

- If carburetor is excessively soiled, disassemble and clean.
- If linkage is excessively worn, bent or damaged, replace with new one.
- If throttle valve shaft is excessively bent, replace with new one.

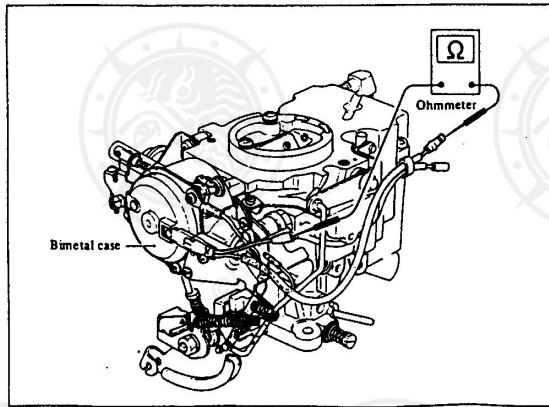
2) Checking Auto-choke Mechanism

- Visually check auto-choke mechanism for deformed linkage, etc.
- Before starting engine, depress accelerator pedal one time.
- After starting engine, ensure engine speed decreases to specified idle rpm.

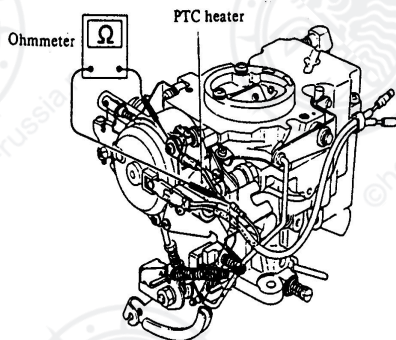
	Choke valve	Throttle valve	Cam lever and fast idle cam
Ambient temperature 20°C	Fully closed	Fast idle position	Differs with ambient temperature. During engine starts: 1 st or 2 nd ratchet position after 1 warm-up: 3 rd or 4 th ratchet position
After warm-up	Fully open	Idle position	Clearance exists

3) Checking Bimetal

- Start engine. Touch bimetal case to ensure it is hot (Simple check method)
- Using circuit tester, check bimetal for continuity. Continuity must exist.



4) Checking thermo wax



Ensure PTC heater becomes hot when engine is started. (Simple check method)

- Using circuit tester check TPC for continuity must exist.

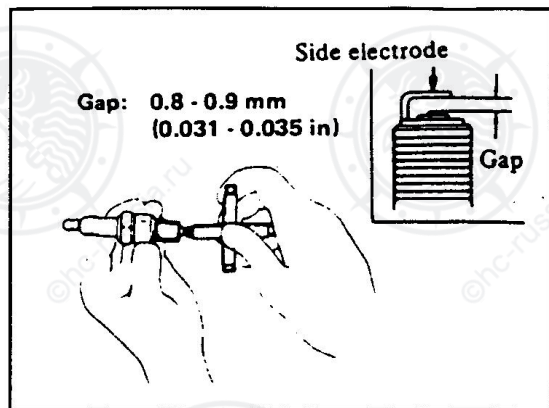
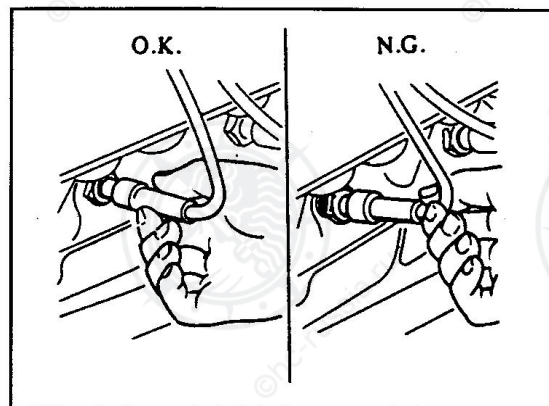
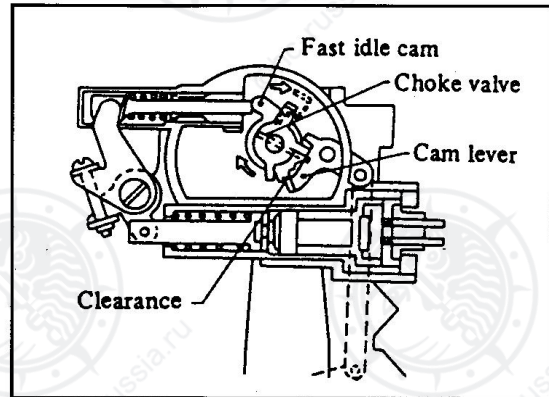
5) Choke Valve

Inspection: Ensure clearance does not exist between fast idle cam and cam lever when choke valve is closed by hand.

Adjustment: Adjust cam drop-time adjusting screw until choke valve is close completely.

Cam drop-time adjusting screw is properly adjusted at the factory before delivery. Do not attempt to

adjust it in the field unless necessary.



2.2.13 Check and replace spark plug.

- 1) Disconnect spark plug wire at boot.
- 2) Remove spark plugs with spark plug wrench.
- 3) Clean plugs in sand blast cleaner.

- 4) Inspect insulator for cracks or chips, gasket for damage or deterioration and electrode for wear or burning.

If the are excessively worn, replace with new spark plug.

- 5) Check spark plug gap.

Spark plug type: FR2A-D

T: 20 N·m~29N·m

2.2.14 Checking Distributor

1) Inspection Ignition coil

Use circuit tester, measure primary coil resistance between terminals ① and ②, and measure secondary coil resistance between terminals ① or ② and secondary terminal.

Primary coil resistance: $0.9\Omega \sim 1.2\Omega$

Secondary coil resistance: $20k\Omega \sim 29k\Omega$

2) Pickup assembly

Using circuit tester, measure pickup coil resistance.

Specifications:

$420\Omega \sim 540\Omega$

Ensure tester pointer deflects when moving standard screwdriver's blade near pickup coil's iron core.

3) Carbon contacts

If spherical surfaces of all contacts are worn, replace with new cap assembly.

4) Cap rotor

Check for cracks or damage

5) Signal rotor

Check for bends or damage.

6) Vacuum control

Using vacuum pump, apply vacuum to diaphragm. Linkage must be attracted.

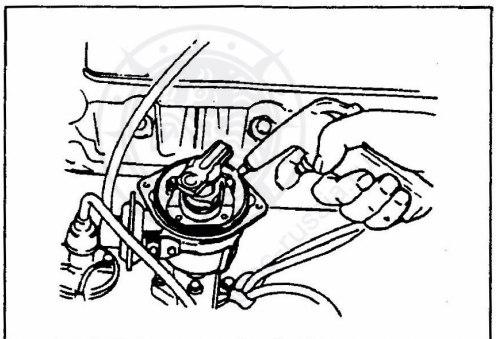
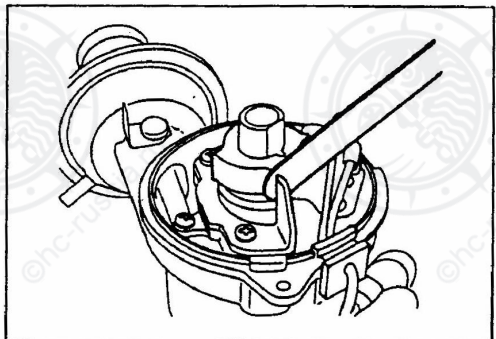
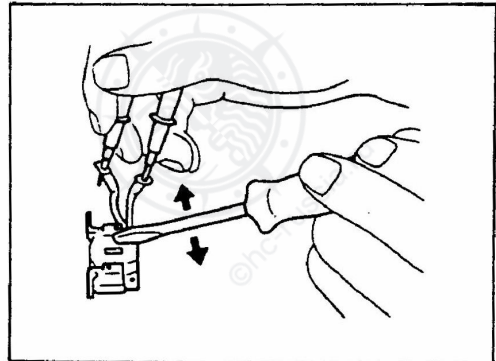
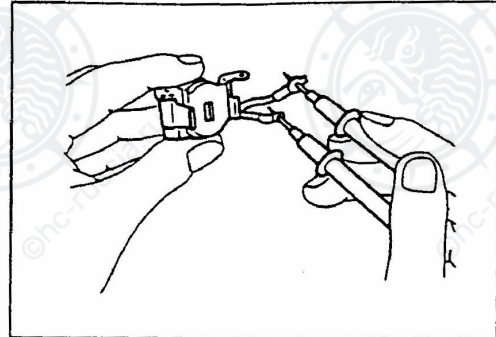
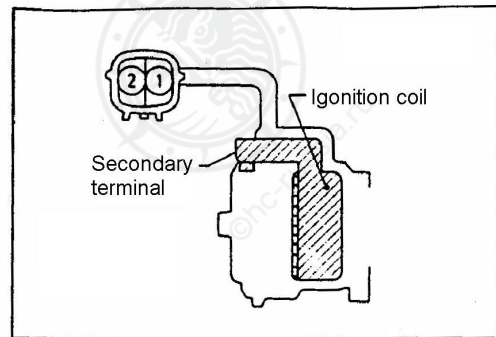
7) Inspection after reassemble

Measure air gaps between signal rotor and pickup assembly.

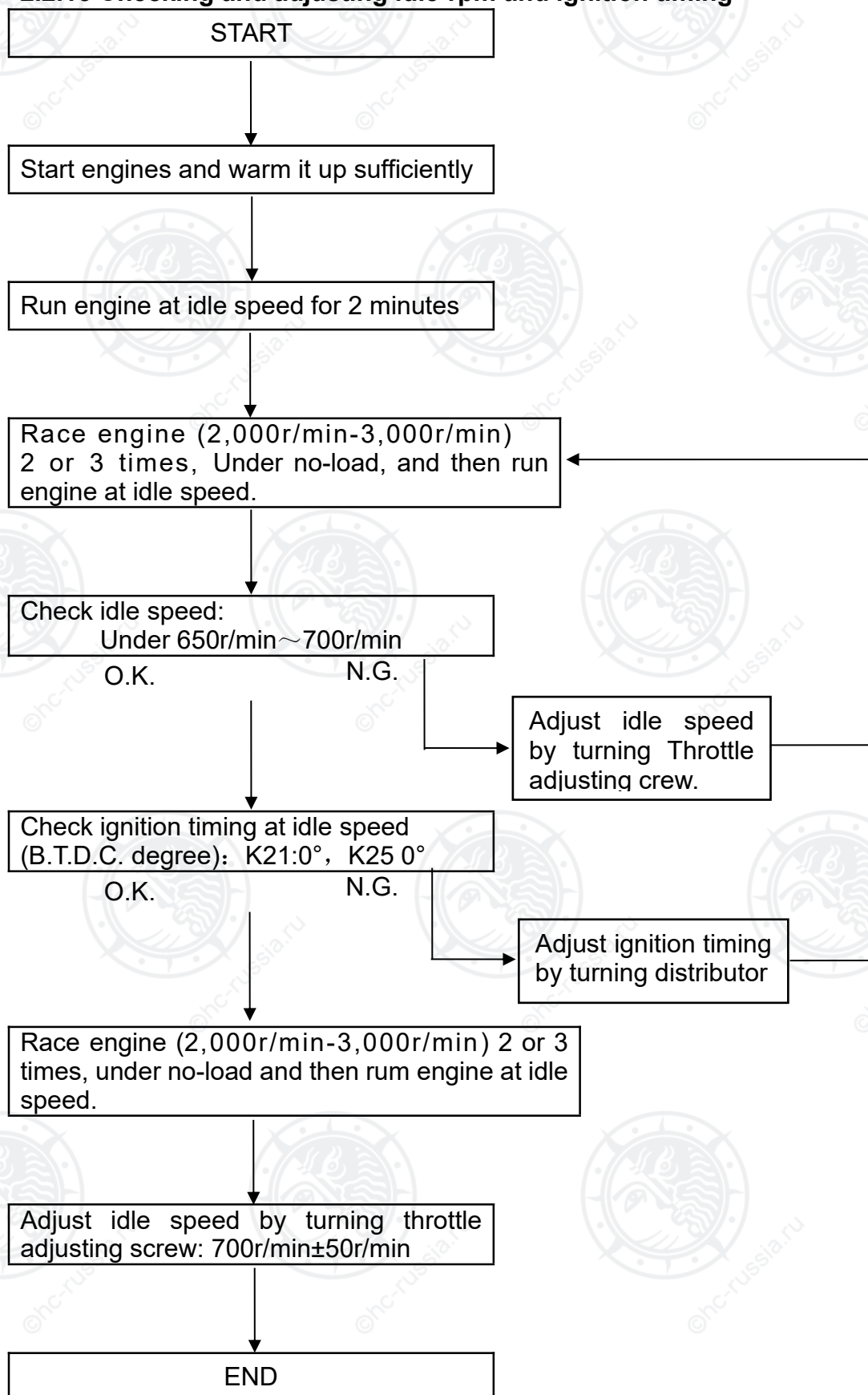
Specifications: $0.35mm \sim 0.45mm$

8) Cleaning Distributor Inside

Blow dust off inside of distributor with dry compressed air.



2.2.15 Checking and adjusting idle-rpm and ignition timing

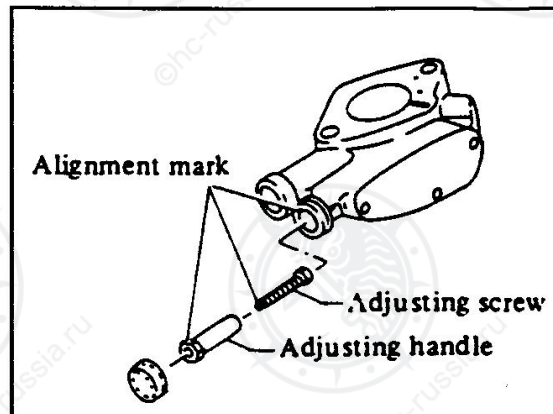


CAUTION:

- 1) Don't attempt to screw the idle adjusting screw down completely.
Doing so could cause damage to tip, which in turn will tend to cause malfunctions.
- 2) Make sure that the following parts are in good order.
 - Ignition system
 - Engine oil and coolant levels
 - Valve clearance
 - Float level at idling speedSet shift lever in "Neutral" position.

2.2.16 Adjusting Maximum Engine Speed Under No-Load

- 1) Shift F-R control lever into neutral.
- 2) Run engine and set carburetor throttle valve at fully open position. Check engine speed.
Maximum engine speed under no-load: 3600 r/min
- 3) If engine speed is not within the specified range, adjust it by turning governor-adjusting handle.



3. 4D27XG30/4D3XG30 Diesel

3.1 Specifications

item	4D27XG30	4D32XG30
type	in-line overhead valve、Water-cooled、four cycle、direct-injectionReentrant Combustion Chamb	
NO. of cylinders	four	
Cylinder bore × piston stroke mm	90×105	98×105
Piston displacement L	2.67	3.17
Firing order	1-3-4-2	
reduction ratio	17.5:1	
Rated rotate speed r/min	2500	2500
Rated power kW	36.8	45
Maximum torque N.m	168	200
Maximum torque speed r/min	1600-1800	
Full load minimum fuel consumption rate g/kW.h	≤215	
minimum idling stabilized speed r/min	700±30	
Direction of rotation (face to flywheel)	anticlockwise	
Cooling system	close、Forced water cooling	
Lubrication system	pressure、sparging	
Startup mode	electric start	
Oil volume	6L	

4. C490 Diesel engine

4.1 A498BT, C490 Main technical parameter

Parameter \ Model		A498BT	C490
Type		In-line, water cooling, four stroke, direct injection reentrant combustion chamber	
Cylinder : No. — diameter × Stroke		4, 98mm×105mm	4-90 mm×105mm
Displacement L		3.168	2.67
Compression ratio		18.5	18.5
Rated output/Rotate speed		36.8kW/2400 r/min	40 kW/2650 r/min
Max. torque/ Rotate speed		186N·m/(1600 -1800) r/min	162 N·m/(1800 -1900) r/min
Min. speed without load		750 r/min	
Min. specific fuel consumption with full load		≤225 g /kW·h	≤228 g /kW·h
Specific oil consumption		≤1.2 g /kW·h	≤1.2 g /kW·h
Direction of rotation (Face flywheel)		Counter clockwise	
Cylinder working sequence		1-3-4-2	
Type of cooling		Closed, forced water cooling	
Lubrication		Pressure, splash lubrication	
Noise dB (A)		Less than 111	Less than 112
Dimension: L×W×H mm		726×550×700.5	751×565×690 mm
Reference data	Engine oil capacity	About 6L API CD level or above	
	Valve clearance	Cold state: inlet valve 0.35mm, exhaust valve 0.45mm	
	Valve timing (calculated according to crank angle)	Refer to engine manual	

II . Clutch

Frictional Clutch Type

1. Data

Model		1t~1.8t Friction clutch type	2t~3.5t Friction clutch type
Parameters			
Type		Dry single plate	
Facing size (mm)	Outer diameter	275	275
	Inner diameter	175	175
	Thickness, locked	7.8	7.8
Surface area cm ²		352	352
Weight (approx.) kg		About 10	About 10
Operation		Foot-pedal type	

2. Inspection and Adjustment

	1~1.8t clutch	2~3.5t clutch
Height of release lever (mm)	69±1.2	69±1.2
Height clearance of release lever (mm)	Less than0.4	Less than0.4
Clearance between release bearing and release lever or plate type spring (mm)	2-2.5 (separate rod)	2-2.5 (separate rod)
Wear limit of frictional clutch (mm)	>0.3	>0.3

3. Trouble diagnoses and correction

Condition	Probable cause	Corrective action
Clutch slippage ·Difficult to recognize but the following malfunctions eventually will become evident: 5 Truck does not increase in speed. 6 When accelerator pedal is pressed, engine does not increase in speed. 7 Power fades, especially during uphill driving. 8 Increase in fuel consumption. These malfunctions are often mistaken for engine failure. If clutch slippage is not detected, however, it will lead to wear or seizure of clutch facing, clutch cover and/or flywheel. Test method 1) Fully engaged handbrake, 2) Disengaged clutch and shift to top gear. 3) Gradually increase engine speed and slowly engage clutch. ·If engine stops, clutch is in good order; ·If truck does not move forward or engine does not stop, clutch is slipping.	·Oil or dirt-coated facing ·Excessively worn clutch facing ·Damaged or weak springs ·No release bearing play ·Warped flywheel or clutch pressure plate	Clean or Replace Replace Replace Correct or Replace Replace
Poor disengagement ·Noticeable, especially when shifting into reverse, there are shifting difficulty and rattling. Test method 1) Disengage clutch and shift to low gears. 2) Then shift to neutral and increase engine speed. 3) After a short pause, again shift into reverse gear. ·If rattling sound is heard when shifted to reverse, clutch has not disengaged properly.	·Oil on clutch facing ·Insufficient pedal stroke ·Clutch disc run out or warping ·Excessive release bearing play ·Weak pressure spring	Clear or replace Adjust Replace Correct Replace
Clutch dithering	·Uneven spring pressure and different lengths of springs ·Release bearing rotates sluggishly ·The adjusting screws of release levers are not in the same plane ·Over load ·Poor contact of disc	Adjust or replace Apply grease after cleaning Adjust Load as specified Remove and adjust
Noise Unusual or clashing	·Broken release bearing /sleeve ·Loose facing rivets ·Cracked disc plate assembly	Replace Replace Replace

4. Clutch (fig.2-1)

Frictional clutch type truck is fitted with dry type single plate clutch and its operating cylinder. As shown in fig. 2-1, the friction disk assembly (2) consists of a driven plate to which pieces of disk linings made of plastics-asbestos mixture are riveted. Corrugated leaf springs are fitted between the disk lining and the driven plate. The pressure which acts on the driven plate is developed by 6 springs evenly arranged on the circumference of the pressure plate.

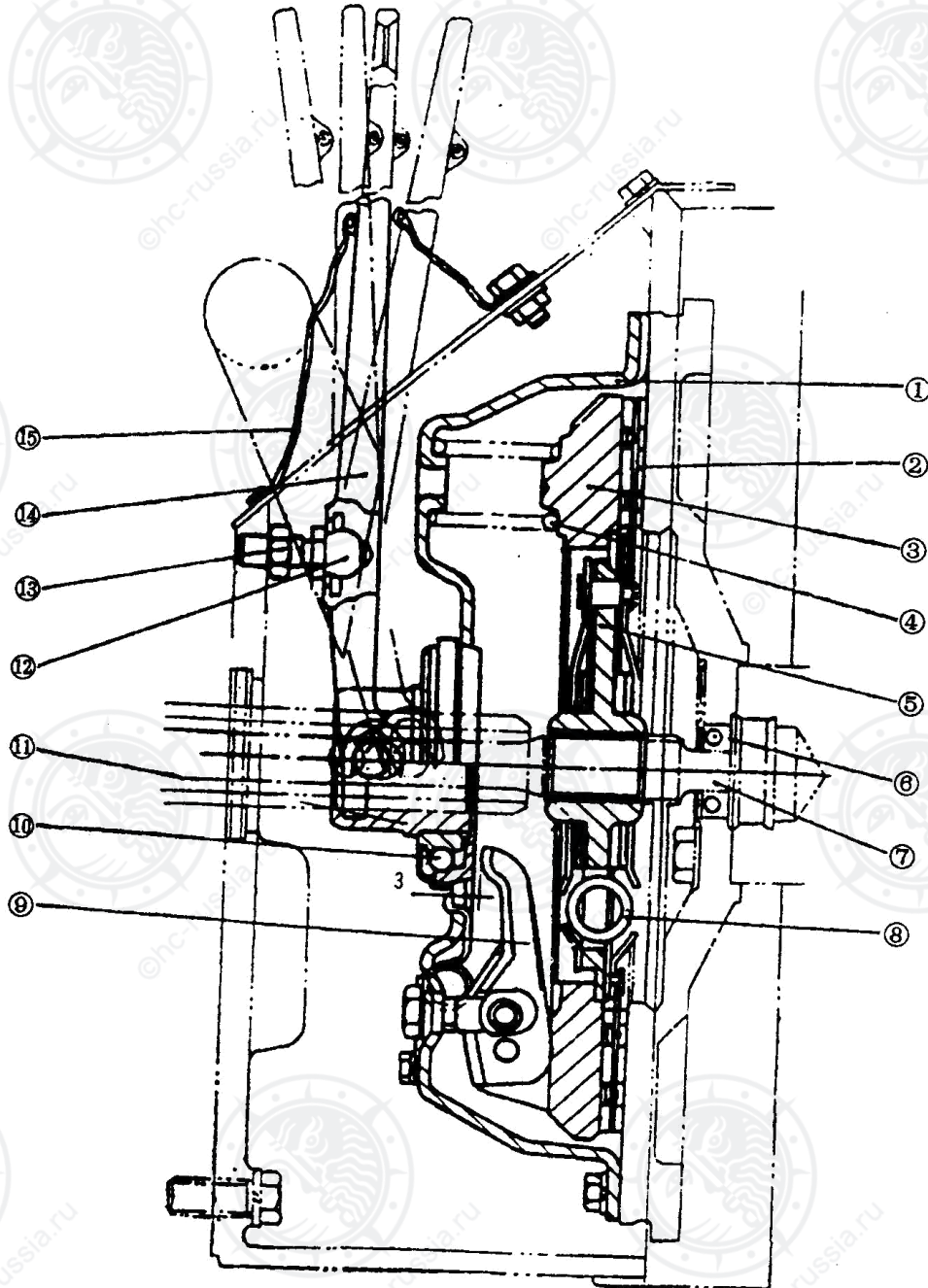


Fig. 2-1 clutch (1-3.5t mechanical truck)

- | | | | | |
|----------------------|----------------|-------------------|--------------------|-------------|
| 1. Clutch disk cover | 2. Clutch disk | 3. Pressure plate | 4. Pressure spring | 5. Disk hub |
|----------------------|----------------|-------------------|--------------------|-------------|

- | | | | | |
|----------------------|------------------|----------------|----------------|-----------|
| 6. Release bearing | 7. Main shaft | 8. Coil spring | 9. Release rod | 10. |
| Release sleeve | | | | |
| 11. Release rock pin | 12. Support bolt | 13. Nut | 14. Push rod | 15. Cover |

4.1 Inspection and adjustment

- 1) A clearance of 2-2.5mm is required between the top of release lever 9 and the end face of release bearing when the clutch is engaged. This clearance is needed to prevent release bearing and friction lining from damaging. Because the truck is constantly being accelerated and direction attention to pay to adjusting the clearance.
- 2) Check the three release levers of clutch for deviation, which is allowed less than 0.4mm. Otherwise, it should be adjusted. Tighten lock nut after adjusting.

4.2 Replacement of clutch disk

- 1) Press down the clutch pedal; and place spacers between the clutch cover and release lever engines, install 2 pull-up bolts on the clutch cover.
- 2) Turn the slide bolt (fig.3-1) to the left to bring the drive shaft into the transmission.
- 3) Remove the 6 clutch cover-mounting bolts, and take off the clutch disk.
- 4) Install a new clutch disk, with the longer spline pointing towards the transmission.
- 5) Turn the slide bolt step by step to the right and pull it out, matching the drive shaft spline with the clutch disk spline.
- 6) After making sure the drive shaft end has entered the pilot bearing, tighten the drive shaft spline with the clutch disk spline. Torque is 107~119N·m.
- 7) Install the clutch cover on the flywheel.
- 8) Press the clutch pedal and 3 remove spaces.
- 9) Adjust the clutch pedal.

III. Manual transmission、reduction gear and differential

1. Parameter

Gearbox type item		XJDS18	XJDS25	XJDS30
Gearbox weight（kg）		105	130	
Match the engine rated power（kW）		25~33	33~45	
Match engine rated speed（r/min）		2200~2650		
Match the engine maximum torque（N.m）		85~150	140~210	
Gear ratio	Forwards	F1=37.0791 F2=16.0405	F1=38.136 F2=16.498	F1=42.224 F2=18.2662
	Backwards	R1=36.5311 R1=15.8034	R1=37.573 R1=16.254	R1=41.6 R2=17.9962
Synchronizer type		Inertia lock ring		
Shift type		Manual shift		
direction of rotation（face to input terminal）		Clockwise		
Using oil type		Vehicle gear oilGL-5 85 W /90		
Capacity（L）		≈8.5（To drive the oil hole on the bridge shall prevail）		
Working oil temperature（℃）		60~80		
The highest oil temperature（℃）		120(not exceeding 5min)		
overall dimension（length×width×height）mm×mm×mm		785×460×440	851×460×490	

Remark : ·Lubricating oil should be added by the vent hole of drive axis because of communicating between axis housing and transmission case.

·Use genuine lubricating oil designated by HANGCHA.

2. Trouble diagnoses and correction

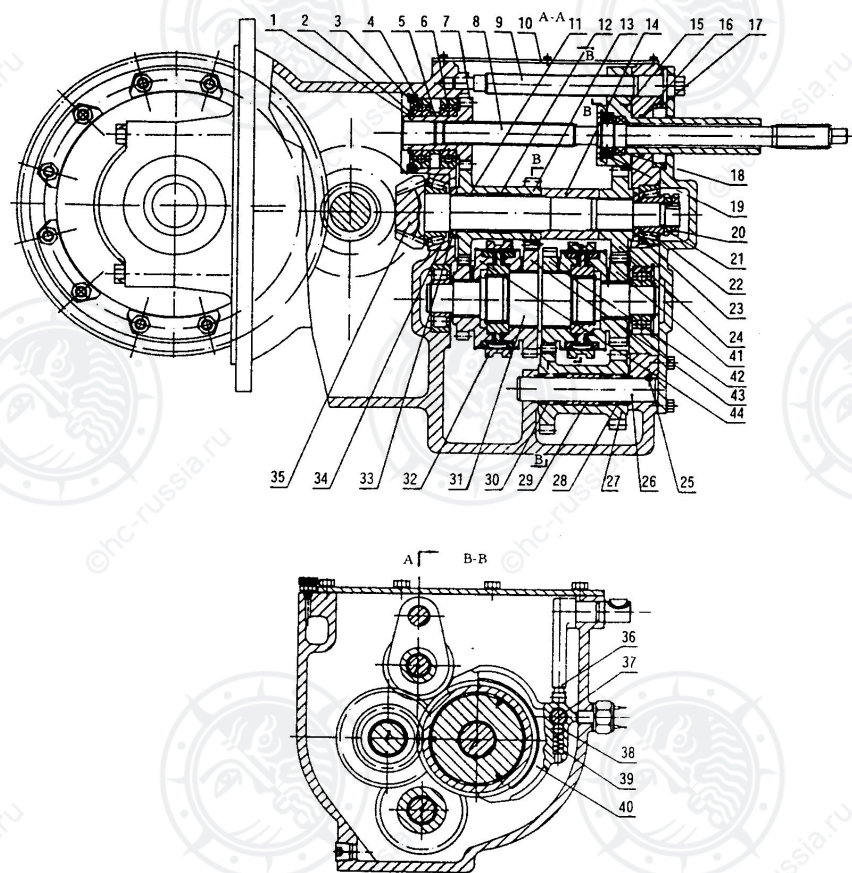
Condition	Probable cause	correct action
Great vibration	• Loose securing bolt on each fixing and connecting	tighten
Overheating of oil	·Deteriorate gear oil ·Abnormal oil level ·Dragging of moveable piece	replace fill or reduce adjust
Oil leakage	·Loose bolt of connecting face ·Broken seal ring	tighten replace
Noise	·Damaged turn gear ·Damaged bearing	replace replace

3. Summary

The manual transmission of 1-3.5t manual shift forklift consists of gearshift, reducer and differential with shifting gear, reducing speed and carrying out differential transmission. Because of its synchronizer, it makes to avoid striking between gears when shifting gear and to shift gear tenderly and smoothly and to reduce shift noise especially when shifting forward or reversibly and to prolong the gears life-span. 1-1.8t forklift adopts XJDS18 transmission, 2-2.5t forklift adopts XJDS25 and 3-3.5t forklift adopts XJDS30 transmission. The structure and principle for JDS30 transmission are introduced as follows; Those of XJDS18 and XJDS25 are the same with JDS30.

4. Gear shift

XJDS30 gear shift is mainly composed of an input shaft, an output shaft, a main shaft, an idle shaft (work in reverse). There is one or several gears with vary teeth in every shaft, There are installed two group mesh bush type synchronizer on main shaft. When shifting gear by the shift lever, the output shaft transmit the power to the drive wheels through low gear, differential and semi-axis.(as shown in Fig.3-1)



- | | | | | |
|-------------------|--------------------------|--------------------|--------------------------------|---------------------------|
| 1. Spring ring | 2. Spacer | 3. Spring washer | 4. Roll bearing | 5. |
| Spacer | 6. Roll bearing | 7. Input gear | 8. Input shaft | 9. Sliding screw |
| 10. | House cover | 11. Needle bearing | 12. Bushing | 13. Double-connected gear |
| 14. Bushing | 15. | Bearing bracket | 16. O-ring | 17. Shaft loop |
| 18.Oil seal | 19.Bearing | 20. | 21. Bearing nut | 22. Bearing |
| 23. Thrust plate | 24. Output gear | 25. | 26. Idler shaft | 27.Idler |
| 28. Bearing | 29. Bushing | 30. | 31. Main shaft | 32. Mesh bush |
| 33. Thrust washer | 34. Taper roller bearing | 35. | Output shaft | 36. Turning lever |
| 37. Shift rod | 38. Steel ball | 39. Spring | 40. Forward-reverse shift fork | 41.forward gear |
| 42. Reverse gear | 43. low gear | 44. high gear | | |

Fig. 3-1 XJDS30 manual transmission structure diagram

1) Input shaft and sliding screw

One end of the input shaft near clutch is put in the ball bearing in flywheel. Another end'spline installed with input gear (constant mesh with double-connect gear which fits on output shaft) fix up in ball bearing of transmission case , and the middle part is installed on bearing carriage through ball bearing and flexible snap ring, and bearing carriage is installed on transmission case through sliding screw. When replacing the friction disk assembly, input shaft and bearing carriage can move along shaft by turning T-thread of sliding screw so that input shaft move back inside transmission case.

2) Output shaft

Double-connect gear is fit on the output shaft through two needle gears and bush and the other end of output shaft is fit output gear with spline through bush.. The two ends of output shaft are installed by taper roller bearing and it can be adjusted side clearance of bearing with washer in the rear end .The gearwheel of double-connect gear engages with input gear and high gear while the pinion of that engage with low gear. And that output gear constant engages with forward gear and reverses idler wheel.

3) Main shaft

High gear, low gear, reverse gear and forward gear are all installed on main shaft. Because they constant engage with double-connect gear, reverse idler wheel and output gear separately, it can carry through to shift gear or change direction by operating synchromesh on main shaft.

The gearshift of XJDS18 manual transmission is the same with that of XJDS30 manual transmission except gear of output shaft.

4) Idler shaft

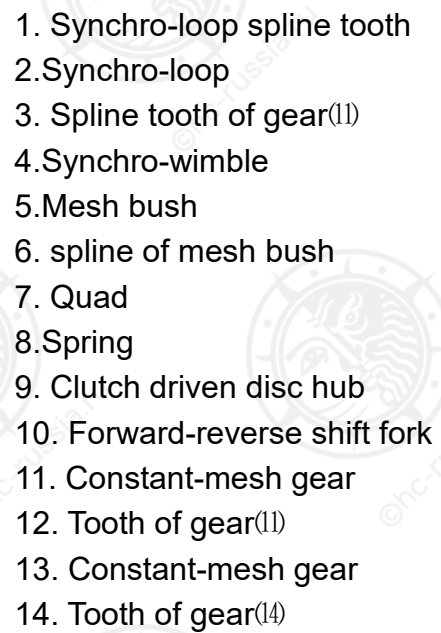
Idler shaft is fixed on the transmission case which rear end uses ball for locking. Idler wheel is installed on idler shaft with needle bearing, which constant engage with reverse gear and output gear separately.

5) Turning lever and shifting yoke

Two turning levers 36 are applied to shift between high gear and low gear and between forward and reverse direction. Fork 40 is supported on shifting lever 37 and Ball 38 is locked inside the groove of shifting lever through spring 39 in order to fix shifting position.

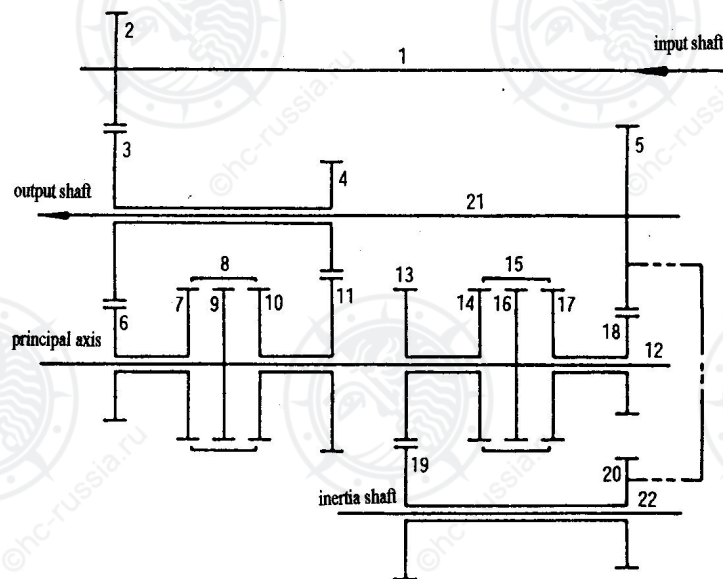
6) synchromesh

Sliding type synchromesh is mainly composed of synchro-wimble, synchro-loop, quad and mesh bush. It can fulfill conversion operations between low speed and high speed, forward and reverse direction through synchromesh. As shown in Fig.3-2.



1. Synchro-wimble: gear 11 or 13 has a wimble(synchro-wimble) and involute spline, which links separately with synchro-loop(piece 2) and mesh bush (piece 5) through friction face of the wimble and spline.
2. Synchro-loop: Synchro-loop has a bore wimble which friction face links with synchro-wimble and it also has three grooves which set equally along circle and which suit with splines of mesh bush and synchro-loop in order to press to synchro-loop through spline 6 of mesh bush.
3. Quad: Assemble the middle bulge of three quads in spline of mesh bush 5, which two ends implant corresponding three grooves of synchro-loop. Quad is pressed to the top of spline 6 through two springs 8 while outwards spring force makes spline tooth of synchro-loop usually in the middle position.

27



1. Drive shaft 2. Input gear 3. Double-connected gear 4. Double-connected gear 5. Output gear
6. High gear 7. Synchro-wimble 8. Mesh bush 9. Clutch driven plate hub 10. Synchro-wimble
11. low gear 12. Main shaft 13. Reverse gear 14. Synchro-wimble
15. Mesh bush
16. Clutch driven plate hub 17. Synchro-wimble 18. Forward gear 19. Reverse gear
20. Reverse gear 21. Output shaft 22. Idler shaft

Fig.3-3 Manual transmission drive diagram

Neutral position (neutral)

Power from input shaft 1 transfers to high gear 6 and low gear 11 through meshing input gear 2 and double-connect gear 3. But the shift mesh bush which controls speed and direction is in neutral, and main shaft output gear and output shaft cannot rotate so that power cannot output.

Shift position — When shift gear lever, yoke drive mesh bush to move so that each gear mesh through synchromesh. Power transmission procedure is as follows: input shaft→input gear→double connect gear→high or low gear→synchromesh→main shaft→synchromesh→reverse gear or forward gear→output gear→output shaft

Forward 1st speed power transmission procedure:

1→2→3→4→11→10→8→9→12→16→15→17→18→5→21

Forward 2nd speed power transmission procedure:

1→2→3→6→7→8→9→12→16→15→17→18→5→21

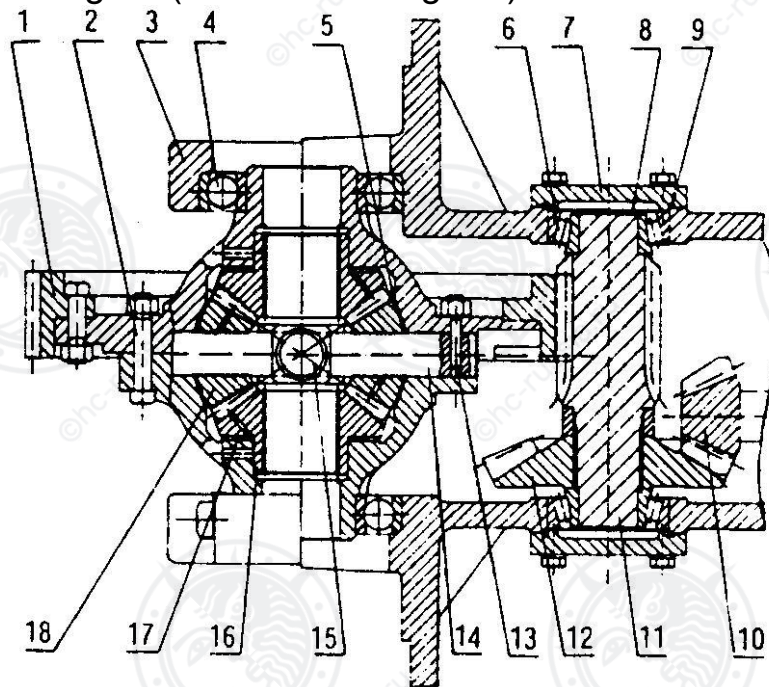
Reverse 1st speed power transmission procedure:

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

Reverse 2nd speed power transmission procedure:

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

5. Reduction gear (as shown in Fig.3-4)



1. Gear ring 2. Bolt 3. Bearing holder 4. Ball bearing 5. Thrust washer 6. Taper roller bearing
 7. Bearing cover 8. gasket 9. "O"ring 10. Output shaft 11. Pinion 12. Helical bevel gear
 13. Column pin 14. Gear shaft I 15. Gear shaft II 16. Semi-axle gear 17. Gasket 18. Planetary gear

Fig.3-4 Reduction gear ,Differential

Reduction gear is in the front of transmission, which reduces the speed of output shaft of transmission and increase the torque from output shaft to differential; reduction gear is mainly composed by a small helical bevel gear on the output shaft, a big helical bevel gear and a small gear shaft, the big helical bevel gear is fixed in a small gear shaft through spline, two ends of small gear shaft are all holden by taper roller bearing and adjusted gap by shim.

6. Differential (as shown in Fig.3-4)

Differential is installed on front hull by bearing holder through ball bearing on both ends, which front end connect with axle carriage. Differential carriage is divided into left and right half, which is composed of two semi-axle gears and four planetary gears. Thrust ring is put between differential carriage and gears in order to have a clearance between pairs of gears. Planetary gear is holden by gear shaft I,II. Gear shaft I is secured to differential carriage

by columnar pin, and gear loop 1 is secured to differential carriage byream bolt .

The power from transmission transmits to wheel through semi-axle gear and semi-axle when it is reduced to come into differential driving by differential.

7. Replace for yoke (as shown in Fig.3-1)

- ① Remove first the bolts securing shaft arm to back end side shift lever 37;
- ② Pull out shaft arm slightly;
- ③ Remove cover fixing bolts and cover;
- ④ Make quickly gear shift, from forward to reverse or from reverse to forward, to separate shift lever front end from transmission housing;
- ⑤ Pull out shaft arm;
- ⑥ Remove spring snap ring on outer end of turning lever 36;
- ⑦ Gently beat turning lever nob, and remove turning lever.

Caution: Don't beat too heavily, forbid striking.

- ⑧ Remove yoke 40 together with shift lever 36. Take down yoke from shift lever.

Caution:

- This time should recognize the shift position of yoke.
- Keeping spring 39 and steel ball 38 inside yoke hole.

8. Reassemble yoke

Caution:

- Reassemble in clean site to prevent dust and impurity from entering into case.
- Check each part for wearing, replace if any worn.
- Always replace seal thing and "o" ring.

- ① Install spring and steel ball in yoke hole, set yoke into shift lever and get well by beat gently.

Caution:

- The position of yoke should be that before removing.
- The steel ball on yoke should drop in corresponding groove of shift lever.

- ② Make yoke meet groove of mesh bush well, meanwhile install yoke together with shift lever in case.
- ③ Assemble shaft arm. please notice the position of shift lever.
- ④ Before tightening lock bolt on the end of shaft arm, please tighten two fixing bolt in the range of 28.4 N·m ~44N·m
- ⑤ After insert front end of shift lever into case, tighten lock bolt in the range of

7.8 N·m ~17.6 N·m and then tighten lock nut in the range of 13.7 N·m ~23.5 N·m.

⑥ Install turning lever together with “o” ring into case and lock with spring snap ring.

⑦ Install gasket of case cover together with cover into case, and tighten each bolt symmetrically, equally and in turn in the range of 20.6 N·m ~34.3 N·m.

9. Remove transmission assemble

Removal of transmission is according to following procedures:

9.1 Remove differential (as shown in Fig.3-4)

- 1) Take down bolts securing bearing seat of differential.
- 2) Take down the section of differential from transmission.
- 3) Loose and take down bolt 2 and column 13, detach differential left hull from right hull.
- 4) Take respectively down thrust washer 5, gear 14, planetary gear 18, semi-axle gear 16, washer 17, gear shaft 15 etc..

Caution: Be sure to lay adjust shim dividually and not to be mixed up.

9.2 Remove reduction gear (as shown in Fig.3-4)

- 1) Loose and take down the fixing bolts of two ends of bearing cover 7.
- 2) Gently tap the front of pinion 11 near helical bevel gear.
- 3) Take down bearing 6, pinion 11, helical bevel gear 12.

Caution: Be sure location of adjust shim 8, and adjust shim of both ends should be lay dividually and not be mixed up.

9.3 Remove gear shift (as shown in Fig.3-1)

9.3.1 Unscrew sliding screw 9; take down “o” ring 16.

9.3.2 Take down snap ring 3 using in bore on case with caliper, and take down input gear 7 from case.

9.3.3 Take down snap ring using in bore from bearing holder 15, gently beat right end of input shaft in order to detach it from bearing holder 15. Take down input shaft 8 and then take down bearing holder from case.

1) Remove yoke

The procedure of removing yoke is as shown in 6.

9.3.5 Remove input shaft

2 Loose nut 20, 21, gently beat the right end of output shaft 35.

3 Take down output shaft and all parts on it.

9.3.6 Remove main shaft

1. Remove snap ring using in shaft in the right of main shaft 31.

2. Remove bearing holding ring using two thread hole of bearing holding ring 41.

3. Take down main shaft components, and take down all parts on the

main shaft. Snap ring using in shaft may be removed with caliper.
Caution: Be sure location of adjust shim.

9.3.7 Idler

- 1) Gently tap the left of idler shaft.
- 2) Take down idler shaft from case, and take down all parts on it.

9.4 Assembly

Assemble in the reverse order of removal, but be sure:

- a. Prevent each fixing connecting face and gear tooth surface from knocking to be damaged.
- b. Apply working faces of parts such as bearing, gear, seal ring and relatively movement parts with a little gear oil to prevent them from coming into being instant dry friction while early running.
- c. Each part should be assembled correctly.
- d. Each part should be running smoothly to prevent it from getting stuck.
- e. Be sure to tighten firmly each joint bolt.

IV. XYQXD Hydraulic transmission and torque converter

1.Data

Models		XYQXD18	XYQXD25	XYQXD30
power rating KW		24—33	33—40	
rated speed r/min		2300—2600	2250—2650	
Transmission ratio	Forwards	19.2065	15.3652	17.4972
	Backwards	19.2065	15.3652	17.4972
Main oil pressure Mpa		1.1—1.4		
Inlet Pressure of torque Converter Mpa		0.5—0.7		
Electrical device (V·DC/W)		12V·DC/26W		
Hydrodynamic torque converter	Models	YJH265		
	Diameter of circulating chamber D(mm)	265		
	Max. torque converter ratio K_0	3 ± 0.15		
	Max efficiency $\eta_{\max}$	>0.79		
	Zero speed operating conditions Nominal torque N.m	33.5 ± 1.7		
	Nominal torque of pump wheel with maximum efficiency N.m	31 ± 1.6		
direction of rotation (face to input terminal)		Clockwise		
Using oil type		No.6		
Working oil temperature℃		70—95		
The highest oil temperature℃		120(not exceeding 5min)		
overall dimension (length×width×height) mm× mm× mm		740x470x450		830x470x450
Mass (kg)		160	165	185

2. Summary

XYQXD18, XYQXD25, XYQXD30 model hydrodynamic transmission gear box consists

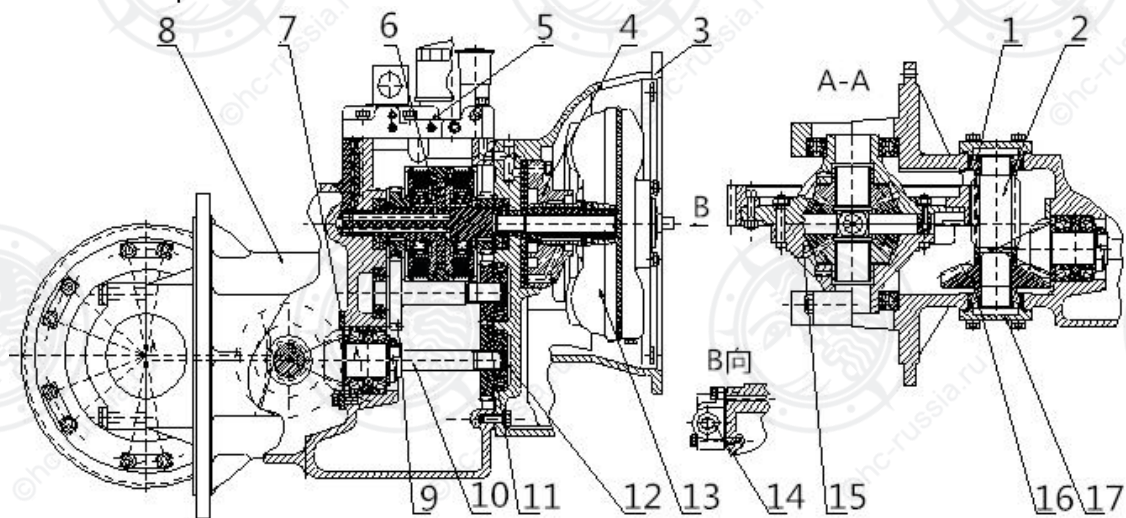
of hydrodynamic torque converter and power shift which has two shifts(forward/reverse).

It has virtues as follows:

Hydrodynamic transmission gear-box has automatic adaptability for hydrodynamic transmission output, it can change it's output torque and rotation speed according to the external load;

It can absorb and remove the impact liberation that the engine and external load brings to the transmission system;

Inching valve can make the truck to move a little when the engine in either low speed or high speed, make the operation easy 、 convenient, steady starting, reduce the labor intension of operators.



- | | | |
|-------------------------------|--------------------------------------|---|
| 1 tooth shape shaft | 2 tapered roller bearing | 3 shell subassembly of torque converter |
| 4 oil-supply pump | 5 assembly of case and control valve | 6 assembly of clutch |
| 7 support flake | | |
| 8 shell body | 9 idler shaft | 10 output shaft |
| | 11 idler wheel | 12 output gear |
| 13 hydraulic torque converter | 14 assembly of inching valve | 15 assembly of differential |
| 16 screw bevel gear | 17 Bearing cover | |

3. Working principles

3.1 Hydrodynamic transmission gear-box power transmit

Gear-box transmission sketch, see fig. 4-2, torque converter is driven by engine through a elastic plate 1, it rotates the impeller wheel 4, in this way, the fluid flows at high speed into the turbine wheel 2 and rotates the turbine wheel. Stator wheel make the torque converter effective, through turbine shaft 5, it transmit the torque to input shaft assembly 11. When at forward gear ratio, reverse clutch at idle motion, transmit order is that 11→7→20→19→12→13, drives the differential 15 to output the torque. When at reverse gear ration, onward clutch at idle motion, transmit order is that

11→10→18→21→20→19→17→12→13, drives the differential 15 to output the torque. Onward and reverse clutch are controlled by shift control valve. Oil pump 6 is inner-mesh gear pump, it is driven by engine through impeller wheel, oil pump supply the oil for the system, after hydrodynamic torque converter works, the oil flows into the radiator , then into gear-box-lubrication clutch disc、bearings and gears.

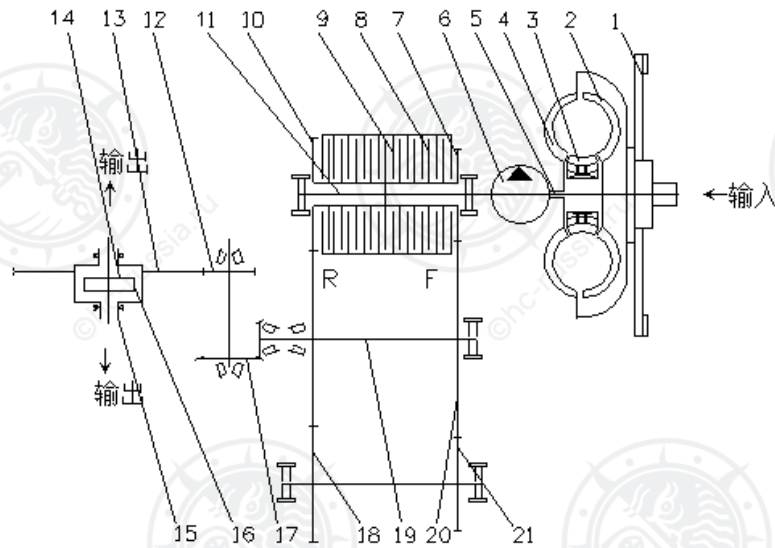


Fig. 4-2 hydrodynamic transmission gear box sketch

- | | | | |
|-------------------------|--------------------------|-----------------------------|------------------|
| 1 elastic plate | 2 turbine wheel | 3 stator wheel | 4 impeller wheel |
| 5 turbine shaft | 6 oil pump | 7 gear(forward gear ratio) | |
| 8 clutch disc | 9 septa | 10 gear(reverse gear ratio) | |
| 11 input shaft assembly | | 12 gear shaft | 13 gear ring |
| 14 half-axle gear | 15 differential assembly | | 16 planet gear |
| 17 helical bevel gear | | 18 idler shaft | 19 output shaft |
| 20 output gear | 21 idler wheel | | |

3.2 hydraulic oil pipe system (see fig 4-3)

After the engine starts, oil-supply pump absorbs the oil from the tank (on the bottom of gear-box) through the oil strainer, the oil flows into the control valve, then separate itself into two parts, the one part for hydrodynamic power clutch, the others for the torque converter.

The oil for hydrodynamic power clutch flows into main-pressure valve (pressure at 1.1MPa ~1.4MPa), then separate itself into two parts, the one part into inching valve and electromagnetic directional valve, the others into overflow valve (pressure at 0.5MPa ~0.7MPa) and supply for the blade wheel of torque converter. The oil, from the torque converter, is cooled when passing through the radiator, then it lubricates the hydrodynamic power clutch, at last, the oil comes back into the tank.

When at idle motion, the oil route, from the electromagnetic directional valve to clutch, is closed. At this time , the main-pressure valve is opened, the

oil absolutely flows into the torque converter through the overflow valve,
when the reversing switch located in the forward or backward position, electromagnetic directional valve not work, the oil route, from the slide valve to onward clutch or the reverse clutch, is connected to make the clutch do its work respectively;

when the one clutch works, the other clutch's disc and septa are separated, the cooling oil lubricate it and take the heat away; when the inching pedal works through operating the inching valve, some or a majority of oil, from the clutch, comes back into the tank through the inching valve lever, at this time, the oil circle of the torque converter is the same as at the idle motion.

Hydrodynamic power transmission gear-box oil route principle diagram see fig.4-3.F represent Forward gears,R represent Reverse gear.

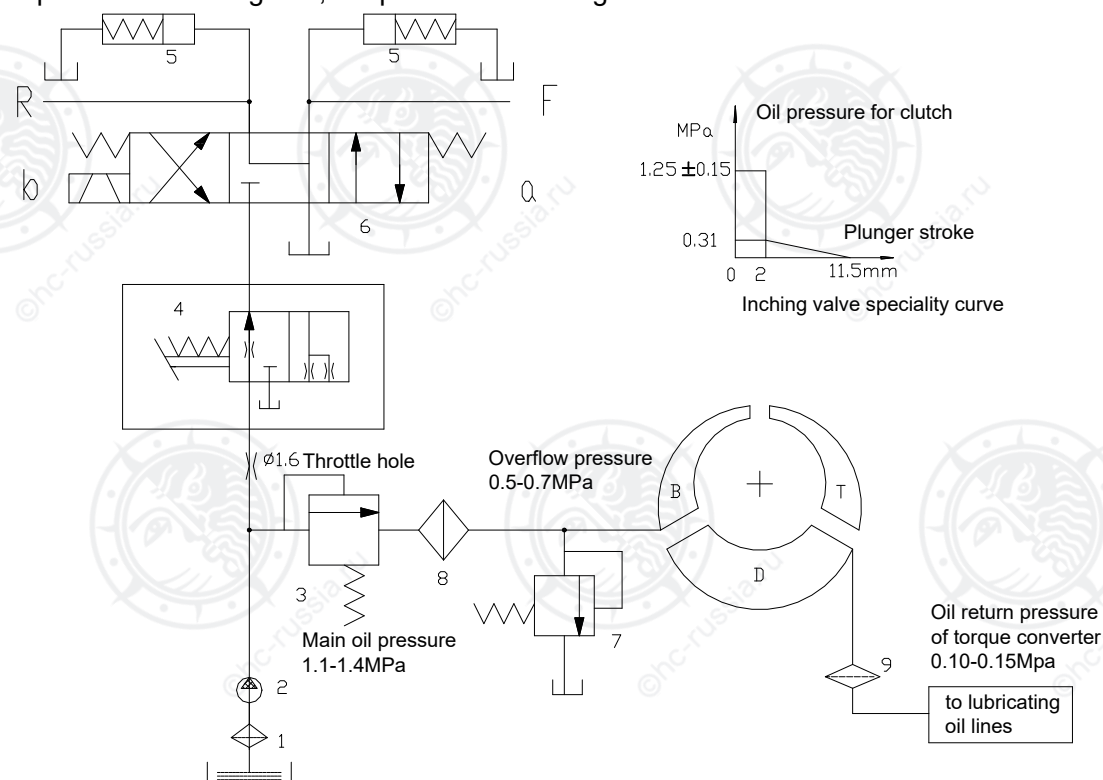


Fig.4-3 oil route hydrodynamic power transmission gear box

- | | | |
|-----------------|------------------|------------------------------------|
| 1 oil strainer | 2 oil pump | 3 main-adjustment-pressure valve |
| 4 inching valve | 5 buffer valve | 6electromagnetic directional valve |
| 8 oil strainer | 9 cooling device | 7 relief valve |

4. Torque converter (see Fig.4-4)

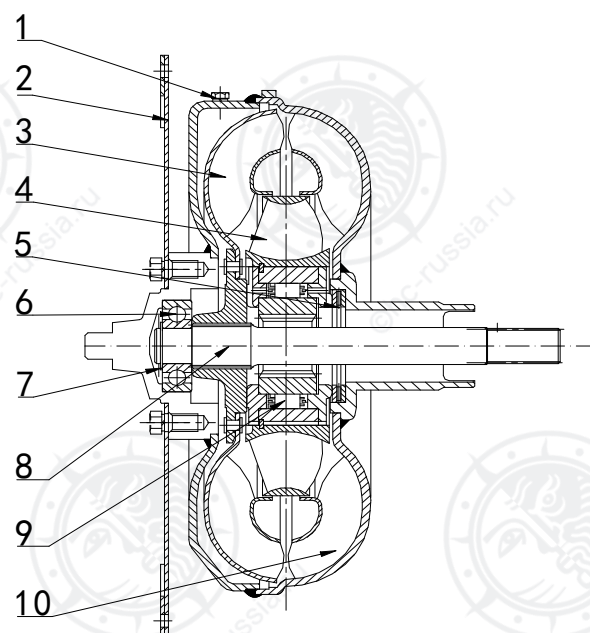
Torque converter consists of impeller wheel、turbine wheel、stator wheel.

Impeller wheel is driven by input shaft, the fluid impacts blades of the

turbine wheel along with blades of the impeller wheel by the effect of centrifugal effect (mechanical energy is converted into fluid kinetic energy), transmit the torque to output shaft, fluid, flows out of the turbine, change it's direction by the effect of the stator wheel, so a part of the fluid comes back to the impeller wheel at a definite angle. At this time, there has a conversed-effect torque to drive the stator wheel, so as to make the output torque increased than the input torque, when the rotation speed is increasing and near the input rotation speed, the fluid's flow angle begins to decrease; the torque of the input shaft decreases. At last, the fluid flows into blades of the stator wheel on the conversed direction, make the original conversed torque have a conversed effect, hence, the output torque is less than the input torque, for preventing this to happen, the clutch in the stator can rotate freely when above things happens.

This kind of the converted torque mode can ensure high-efficiency、 steady operation.

The torque converter in the transmission device connects to the fly wheel of the engine through the elastic plate; it goes with the rotation of the engine. The inner torque converter is full of the oil, driving gears connects to the impeller wheel by using the spline, so as to drive the oil-supply pump, supply oil for the torque converter and hydrodynamic power gear box. The turbine wheel connects to the turbine shaft by using the spline, transmits the power to the gearbox through the turbine shaft.



- | | | | | |
|--------------|-----------------|-----------------|----------------|------------------------|
| 1.drain plug | 2.elastic plate | 3.turbine wheel | 4.stator wheel | 5.bearing, thrust ball |
| 6.bearing, | 7.snap ring | 8.turbine | 9.one-way | 10.impeller wheel |

ball

shaft

clutch

5. Hydrodynamic clutch (Refer to fig.4-5)

5.1. Summary

YQX38 clutch assembly is used in 2.0t-3.8t and its structure drawing refers to fig.4-5. Clutch assembly is mainly composed of input shaft 9, forward gear 4, piston 2, clutch housing 22, disc 19, septa 18, backhaul spring 5, reverse gear 6 and sealing ring 8 etc. Left and right clutches are wet multi-disc hydraulic clutches, both equipped with interphase-installed five septa and discs, clutch housing is welded together with input shaft, and pressure oil is distributed to forward or backward clutch through control valve, thus realizes the forward and backward gear shifting. Piston ring 6 and input shaft O-ring 3 ensure the clutch work is in sealed. No oil pressure enters the clutch when in neutral, piston returns with the backhaul spring forces, thus separates the septa from the disc. When gear shifting, oil pressure works on the piston to combine the septa with the disc, and then transfers the torque converter power to forward gear or reverse gear by the friction.

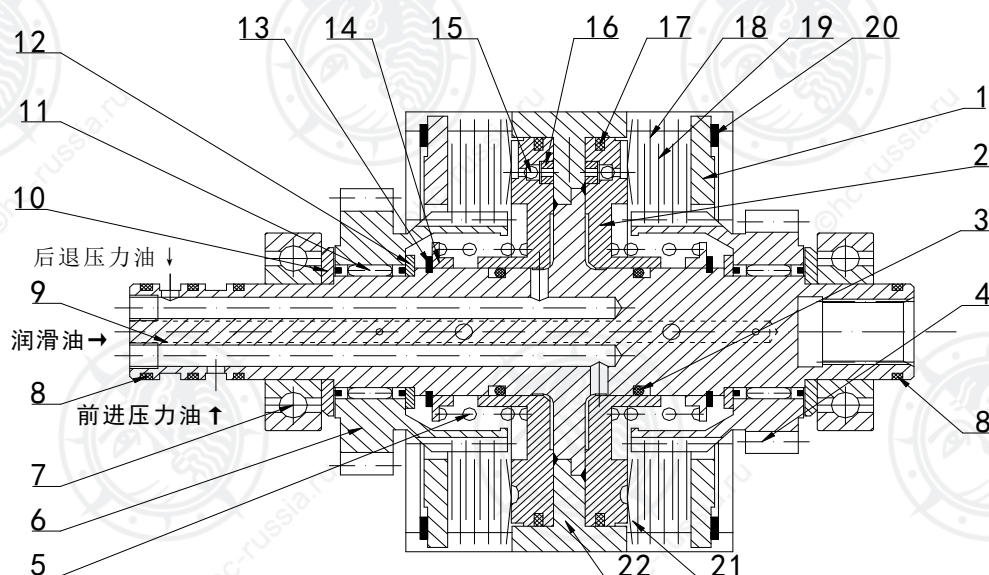


Fig 4-5 2.0t-3.8t hydrodynamic power clutch

1 plate	2 piston	3 O-ring	4 forward-gear -ratio gear
5 backhaul spring		6 reverse gear	7 bearing
	9 input shaft assembly	10 restrain ring (A)	11 needle
bearing	12 restrain ring(A)	13 elastic snap ring for shaft	14 spring
seat	15 steel ball	16 plug	17 ring (A)
19 disc	20 clip ring	21.Butterfly plate	18 septa
		22. Input shaft	

YQX18 clutch is used in 1.0t-1.8t, and its structure drawing refers to Fig. 4-6. YQX18-1000 clutch assembly structure is similar to YQX30-1000 clutch assembly, but the difference is that the YQX18-1000 left and right clutches equipped with interphase -installed four septa, four discs and one butterfly plate.

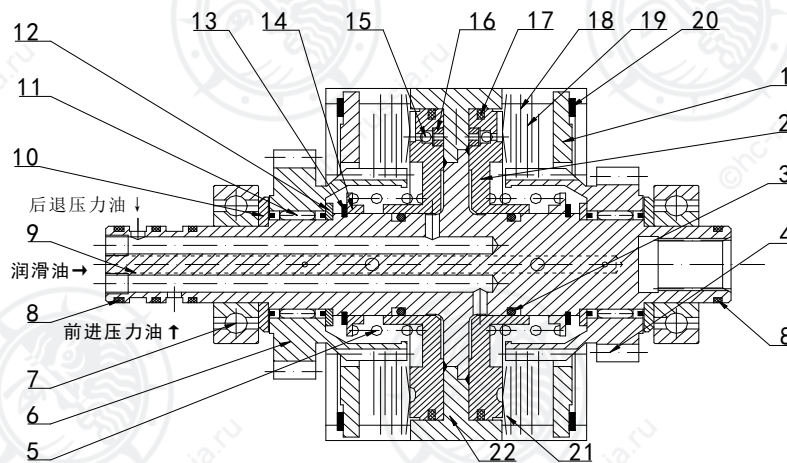


Fig 4-6 1.0t-1.8t hydrodynamic power clutch

1 plate	2 piston	3 O-ring	4 forward-gear -ratio gear
5 backhaul spring	6 reverse gear	7 bearing	8 ring (A)
bearing	9 input shaft assembly	10 restrain ring (A)	11 needle
seat	12 restrain ring(A)	13 elastic snap ring for shaft	14 spring
19 disc	15 steel ball	16 plug	17 ring (A)
	20 clip ring	21. Butterfly plate	22. Input shaft

5.2 Disassembly and assembly

- ① Take off the bearings 7 on the left and right sides;
- ② Separately take off the forward-gear-ratio gear 4、reverse-gear-ratio gear 6、disc 19、septa 18;
- ③ Separately compress the spring 5, take off the snap ring 13, remove the piston 2 and spring 5.

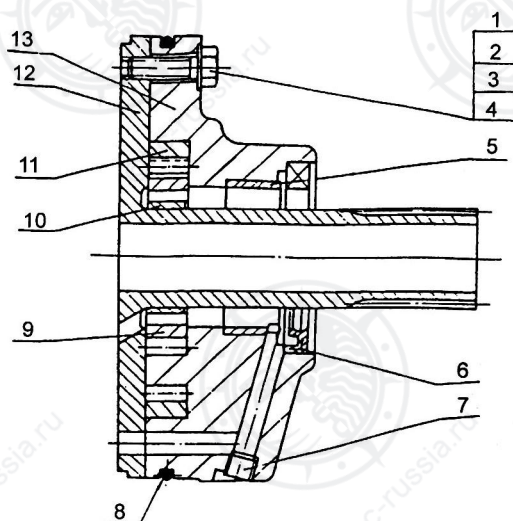
Assembling procedures is contrary to those of disassembly.

NOTE:

- Flush the piston cavity of the input shaft assembly、oil route, clean the other parts except the disc.
- Replace the ring(A)、(B) if it is damaged.
- Replace the snap ring.
- Replace the disc if it is overly abraded or bend.
- Restrained ring(A)、(B) should face to gears.
- After assembled, rotate the gears, it should be freely rather than locked.

6. Oil-supply pump (Refer to fig.4-6)

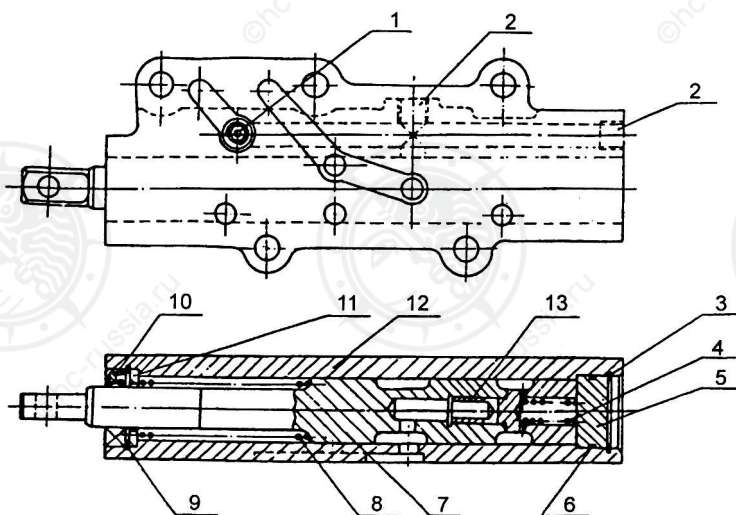
Oil-supply pump is installed on the torque converter body. Driving gear 9 is connected to the impeller wheel, driven by engine, it mesh with the driven gear 11 and supply oil for the torque converter、hydrodynamic gear box.



- | | | | |
|-----------------|--------------|-----------------|----------------|
| 1 straight pin | 2 bolt M8×35 | 3 bolt M8×25 | 4 ring |
| 5 sleeve | 6 oil seal | 7 threaded plug | 8 o-ring |
| 9 driving gear | 10 sleeve | 11 driven gear | 12 stator seal |
| 13 pump housing | | | |

Fig. 4-6 oil-supply pump

7. Inching valve



1 threaded plug	2 threaded plug	3 elastic snap for hole	4 spring
5 plug	6 o-ring	7 inching valve lever	8 spring
9 elastic snap for hole	10 oil seal	11 block	12 inching valve body
			13 inching-slide valve

Fig. 4-7 inching valve

Inching valve is installed outside the gear box. Inching valve lever 7 is connected to the inching pedal lever, when put foot down, inching valve lever moves to the right side, so it reduces the oil pressure for clutch, make the

truck inching moving by slide the clutch disc.

8. Case and control valve

YQXD30-4000 Case and control valve see fig.4-9. Consist of Solenoid valve1、 turbine wheel、 stator wheel.Case and control valve is installed inside the shell of gear box. There are a Solenoid valve 1 and an overflow valve 4 installed on the shell body case, keep the oil pressure for torque converter between 0.5MPa ~0.7MPa, prevent the air erode.

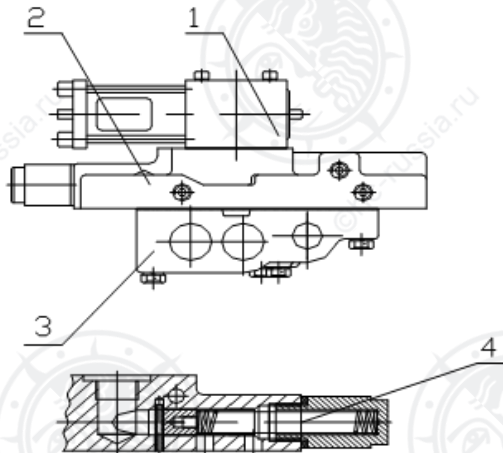


fig.4-9 Case and control valve

1.Solenoid valve 2.Shell body cover 3. Control valve Assembly 4.Coverflow valve

XQXD30-4100Control valve Assembly see fig.4-10.Consist of main pressure valve1、 Reverse buffer valve2、 forward buffer valve3。 the oil pressure for controlling the hydrodynamic clutch is at 1.1MPa ~1.4MPa,, a part of the oil through the inching valve to enter the manoeuvring valve to achieve shift; The other part of the oil into the relief valve, adjust the oil pressure in the range of 0.5Mpa—0.7 Mpa , then enter the torque converter.Buffer valve is used to reduce the impactof clutch engagement and separation.

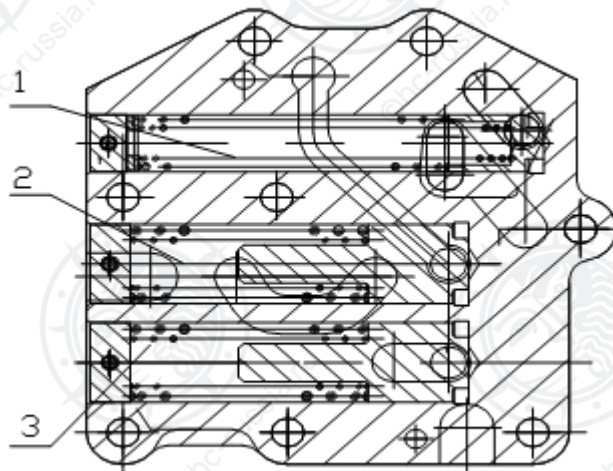


fig.4-9 control valve

1.Main pressure valve 2.Reverse buffer valve 3.Forward buffer valve

9. Gear-box shell body

Gear box body plays the same role as tank besides used for installs the input and output shaft, the oil strainer I (150) in the bottom of it, filtrate the oil flowing to the oil-supply pump, pipe oil strainerII 、 oil-add cover and oil leveler on the top of the shell-body cover.

10. Reduction transmission and differentials

2.0t-3.8t differential assembly structure refers to fig.4-11, and is supported on the gearbox housing through ball bearing 8 on both ends. Differential assembly installs with two half axle gears 9 and four planetary gears 10, planetary gear is supported by cross gear shaft 2, and cross gear shaft 2 is fixed on the left and right differential carrier 3 and 7. Thrust washer 1, washer 11 are installed between differential carrier and planetary gear and half axle gear. Differential carrier is in right and left splits, left differential carrier 7 and right differential carrier 3 are connected through bolts 4, gear ring 5 is fixed on right differential carrier 3 by bolt 4.

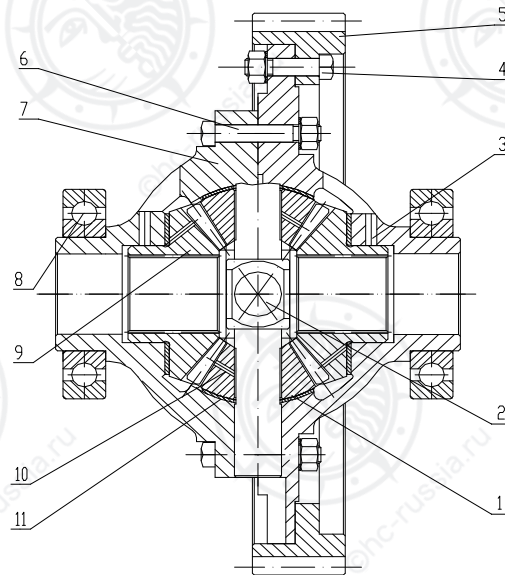


Fig.4-11 2.0t-3.8t Differential assembly structure drawing

1-Thrust washer 2-Cross gear shaft 3-Right differential carrier 4-Bolt
5-Gear ring 6-Bolt 7-Left differential carrier 8-Bearing 9-Half axle gear
10-Planetary gear 11-Washer

1.0t-1.8t differential assembly structure refers to fig.4-12, and is supported on the gearbox housing through ball bearing 6 on both ends. Differential assembly installs with two half axle gears 7 and four planetary gears 9, planetary gear is supported by cross gear shaft 2, and cross gear shaft 2 is fixed on the left and right differential carrier 3 and 5. Thrust washer 1, washer 8 are installed between differential carrier and planetary gear and half axle gear. Differential carrier is in right and left splits, left differential carrier 5,

right differential carrier 3 and gear ring 4 are connected through bolts 10.

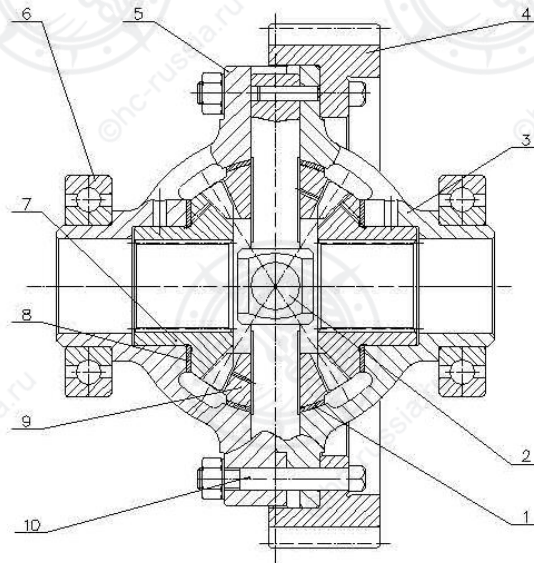


Fig.4-12 1.0t-1.8t Differential assembly structure drawing

1- Thrust washer 2- Cross gear shaft 3- Right differential carrier 4- Gear ring
5- Left differential carrier 6- Bearing 7- Half axle gear 8- Washer 9- Planetary gear
10-Bolt

11. Notice about installation and usage

- 1). Before installation, first clean oil of oil seal on surface of hydraulic gearbox, to avoid leaking when working, no disassemble freely hydraulic gearbox.
- 2). To avoid affecting precision of installation and usage must prevent every installation surfaces, torque converter and out gear knocking.
- 3). Guarantee no more than 0.15mm runout for installation hole of engine flywheel, no more than 0.1mm for flywheel end surface, no more than 0.2mm for installation end surface of flywheel, no more than or equal to $\Phi 0.1$ mm for location position of 2 location pins on installation surface.
- 4). Truck control mechanism must guarantee correct stroke of inching valve lever, and secure location. Inching valve lever can return its initial location when operator loosens pedal. Inching valve characteristic graph, see Fig.2, inching valve lever can move together with brake pedal, must guarantee cut off the oil to clutch before braking, and the stroke of inching valve lever is equal to or more than 14mm (less than 22mm), when shifting, close inching valve first, and then shift.
- 5). When hoisting, keep level, ensure gearbox and reduction gearbox calm, and avoid torque converter sliding out.
- 6). Prohibit changing oil system of the gearbox. To ensure gearbox work regularly, lubricate well, the circular oil of gearbox can not be used for other purpose, and the oil should accord with required trademark.
- 7). Keep work oil clean and no other impurity, replace new oil after 50 hours usage for new truck, and after every 1000 hours, or reuse after long depositing.

8). Fill in work oil, run at neutral shift for 5 minutes, then check oil height, and the height should be within the specified range.

9). New hydraulic gearbox should breaking in 50 hours after it is installed, and the load is no more than 70% in breaking in process, note oil temperature, oil pressure and bolts loosen or not usually, replace new oil after breaking in.

item	Cause and solutions
Insufficient power and over high oil temperature	1. Friction plate jam or wear. Check whether the friction plate is glued, uneven contact or bow and twist. 2. Torque converter oil supply shortage. Check whether the pump is worn and the oil level is in the normal position. 3. Bearing failure. Replace bearing. 4. Check whether the lubricant passage way is blocked. 5. Torque converter one-way wheel jam.
Oil leak	1. Gasket jam. Change Gasket. 2. Rubber Parts preburning or breakdown. Change parts. 3. parts damaged with cracks. change.
clutch pressure low and overswing	1. Low oil level. Check oil level, the oil added to the normal level. 2. input elastic plate loosen or distort. 3. Replace sealing ring. 4. Oil pump wear. Replace oil pump. 5. inching valve stem is reset.

V. XYQXF Hydraulic transmission and torque converter

1.Date

Project			Models	XYQXF18	XYQXF25	XYQXF35A
Match engine rating			(kW)	30~37	34~45	
Match engine rated speed			(r/min)	2250~2700		
Transmission ratio	Forwards	Transmission case	1.5641	1.5641	1.5641	
		Main reducer	9.1034	10.2083	11.1235	
		Total speed ratio	14.2387	15.9668	17.3983	
	Backwards	Transmission case	1.5641	1.5641	1.5641	
		Main reducer	9.1034	10.2083	11.1235	
		Total speed ratio	14.2387	15.9668	17.3983	
Main oil pressure			(MPa)	0.9~1.2		
Inlet pressure			(MPa)	0.5~0.7		
Electrical installation				12V·DC/26W		
Hydraulic torque converter	Model		YJH265E	YJH265G		
	Effective diameter mm		265			
	Torque converter coefficient		≥2.9			
	Maximum efficiency		>0.79			
	Nominal moment N·m		31.5	43		
	Nominal moment(Maximum efficiency) N·m		≥30			
Rotation direction of input shaft (for input)			Clockwise			
Grade of working fluid			6#Hydraulic transmission oil			
Capacity (L)			8.4L			
Working oil temperature (℃)			70~95			
Maximum working oil temperature (℃)			120 (No more than 5min)			
Dimension (L × w × h) mm			820×530×500			
Net weight kg			166			

2.Summary

XYQXF18/25/35A floating hydraulic transmission is composed of hydraulic transmission, airfoil coupling and main reducer.

Hydraulic transmission is composed of hydraulic torque converter and hydraulic shift transmission.

The torque converter used in the hydraulic transmission is a single-stage, two-phase and three wheel integrated torque converter. The hydraulic torque converter makes the hydraulic transmission have the automatic adaptability of hydraulic transmission output, which can change its output torque and speed with the change of external load, and can absorb and eliminate the impact and vibration from the engine and external load on the transmission system.

Hydraulic shift transmission is a power shift transmission with front and back gears. The shift mode is electromagnetic control power shift, and it is equipped with micro valve and buffer valve, which makes the operation simple, convenient and stable, and greatly reduces the labor intensity of the operator.

The main reducer consists of a two-stage reducer and a differential assembly. The two-stage reducer is composed of a pair of cylindrical gears (one-stage reducer) and a pair of spiral bevel gears (two-stage reducer), which is simple in structure and easy to maintain.

The differential assembly is composed of four planetary gears and two half shaft gears. The half shaft is driven by the half shaft gear to drive the tire and realize the power output.

The hydraulic transmission is connected with the main reducer through the airfoil coupling, and the power of the engine is transmitted to the wheels through the hydraulic transmission → airfoil coupling → main reducer, so as to realize the flexible transmission.

The hydraulic transmission and the engine are supported on the frame and the bridge through the cushion, which can effectively reduce the damage of the vehicle vibration to the engine and the transmission, protect the transmission and the engine, and reduce the impact of the vibration when the engine is running on the whole vehicle, so as to improve the driving comfort of the whole vehicle.

3.Working principle and internal structure

3.1 Working principle

3.1.1、Transmission principle

The transmission diagram of the hydraulic transmission gearbox is shown in Figure 5-1. The hydraulic torque converter is driven by the engine through the elastic coupling plate 1, which drives the pump wheel 4 to rotate, so that the liquid flow flows into the turbine 2 at high speed along its blade direction, and drives the turbine to rotate. The guide wheel 3 causes the torque converter to change torque and transmit torque to the input shaft assembly 10 of the hydraulic transmission through the turbine shaft 5.

When the forward gear is engaged, the reverse clutch idles, and the transmission sequence is part 10 → Part 7 → Part 12 → Part 11 → Part 14 → Part 15 → Part 16 → Part 17 → Part 18 → Part 19, driving the output of differential 20.

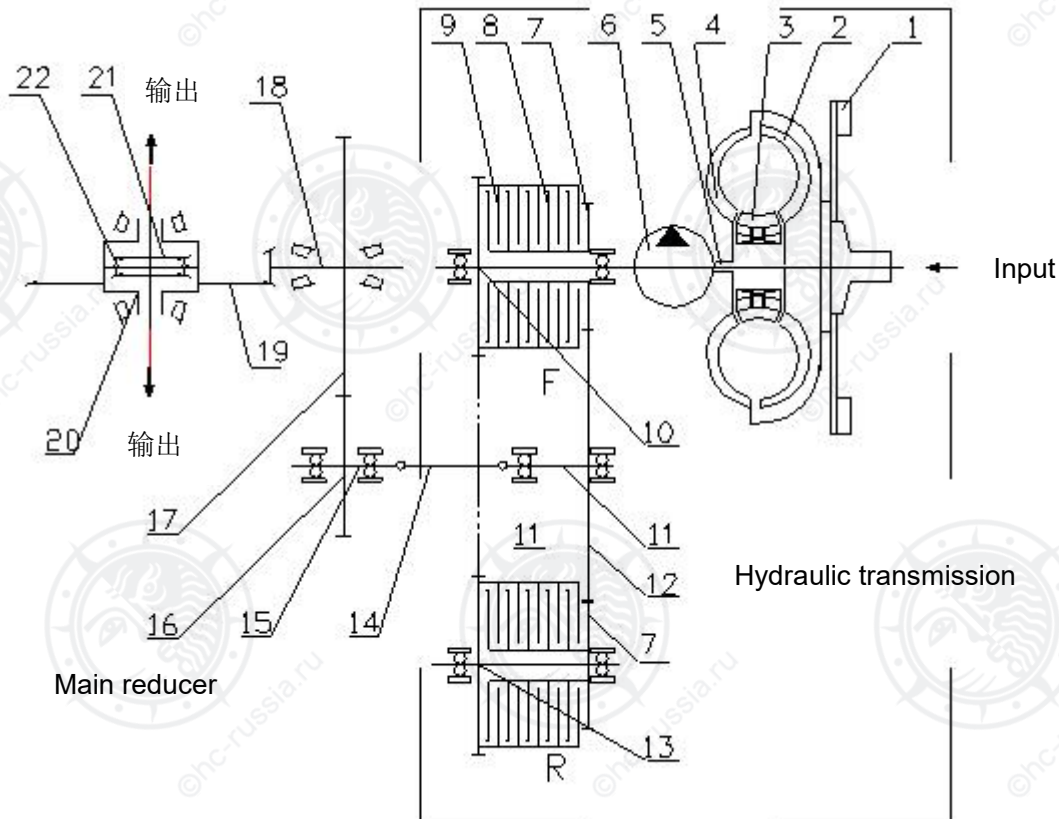


Fig 5-1 XYQXF18/25/35 Transmission diagram of hydraulic transmission

- | | | |
|-------------------------------|------------------------------|--|
| 1.Elastic connection plate | 2. Turbine | 3. Guide wheel |
| 4. Pump wheel | 5. Turbine shaft | 6. Oil pump |
| 8. Friction plate | 9. Spacer | 7. Clutch gear |
| 11. Output flange | 12. Output gear | 10. Input shaft assembly (forward clutch) |
| 14.Universal coupling | 15. Input flange | 13. Intermediate shaft assembly (reverse clutch) |
| 18. Driving spiral bevel gear | 16. Driving gear | 17. Driven gear |
| 20. Differential | 19. Driven spiral bevel gear | 21. Half shaft gear |
| | | Planetary gear |

When the reverse gear is engaged, the forward clutch idles, and the transmission sequence is part 10 → Part 13 → Part 7 → Part 11 → Part 14 → Part 15 → Part 16 → Part 17 → Part 18 → Part 19, which drives the output of differential 20.

The forward and reverse clutches are controlled by an electromagnetic power shift control valve. The oil pump 6 is an internal gear pump, which is directly driven by the engine through the pump wheel. The oil pump provides pressure oil to the system. After the hydraulic torque converter works, the oil enters the radiator on the vehicle, and then enters the gearbox to lubricate the friction plate, bearing and gear.

3.1.2、Hydraulic principle

The oil circuit schematic diagram of XYQXF18/25/35 hydraulic transmission is shown in Figure 5-2, in which F represents forward gear and R represents backward gear.

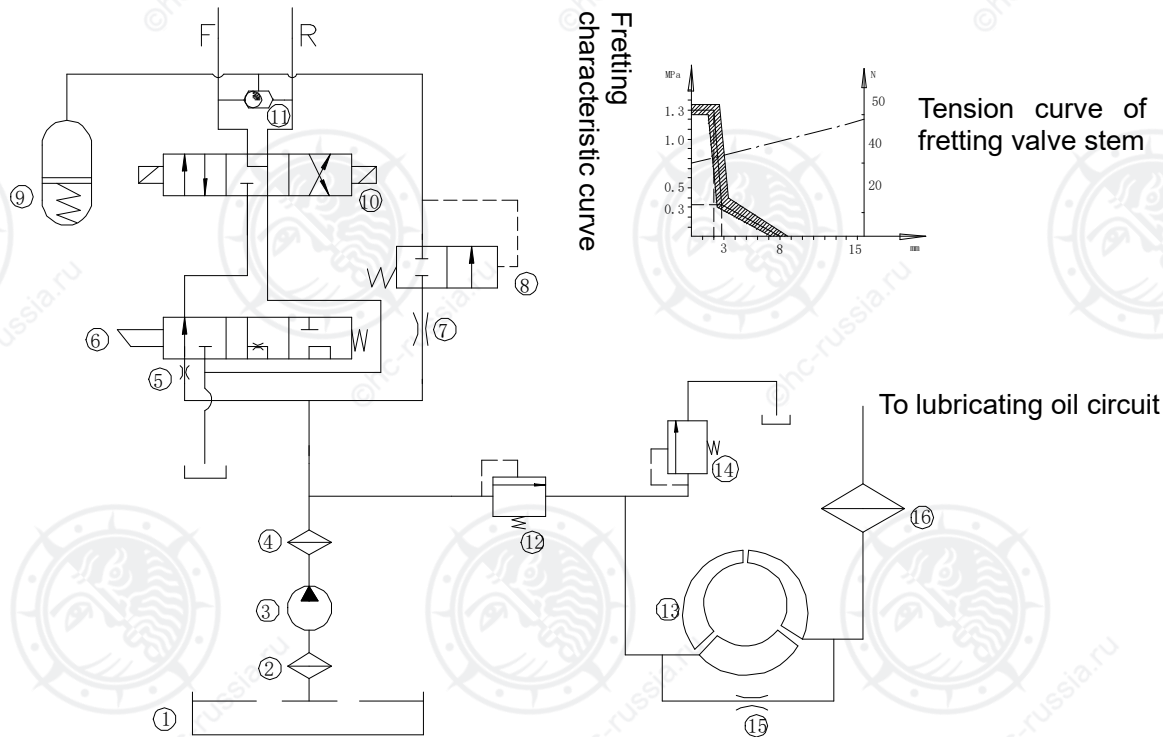


Fig 5-2 Oil circuit schematic diagram of XYQXF18/25/35 hydraulic transmission

- | | | | |
|-----------------------------|--------------------------------------|---------------------------|-----------------|
| 1.Oil tank | 2.Coarse filter | 3.Oil supply pump | 4.Fine filter |
| 5.φ 1.3 orifice | 6.Micro valve | 7.φ 1.4 compensation hole | |
| 8.Compensation on-off | 10.Electromagnetic directional valve | 9.Accumulator | |
| | 11.Shuttle valve | 13.Torque converter | 14.Relief valve |
| 15.φ 3 pressure relief hole | | 16. Car cooler | |

After the engine starts, the supply pump 3 draws oil from the transmission oil tank 1 through the primary filter 2. After the oil passes through the fine filter 4, it enters the main pressure valve 12 and the oil is divided into two parts. A part of the oil passes through the torque converter relief valve 14 and then enters the torque converter 13. After the torque converter runs, it enters the vehicle cooler 16 and enters the transmission lubricating oil circuit after cooling. There is a φ 3 pressure relief hole between the inlet and outlet of the

torque converter to ensure that the pressure of the torque converter is too high instantaneously during the cold start of the vehicle, and the lubricating oil quantity of the whole vehicle can be ensured when the torque converter relief valve is opened.

The other part enters the micro valve 6 through the orifice 5. When the micro pedal is not pressed, the oil flows through the micro valve and enters the electromagnetic directional valve 10. According to the electric signal given by the combination switch of the whole vehicle, the electromagnetic directional valve controls the oil flow to the R, F or neutral position (the oil flows directly into the oil tank in neutral position). When the micro pedal is pressed, the oil directly enters the oil tank from the micro valve, and the clutch pressure oil is cut off.

When the vehicle is in forward gear, shuttle valve 11 will move backward, and the oil port will disconnect the oil circuit between accumulator 9 and backward gear, so as to connect the oil circuit between forward gear and accumulator. It can effectively slow down the rising speed of clutch pressure and reduce the impact. When the clutch pressure reaches a certain value, the compensation on-off valve 8 is opened, and the pressure oil enters the clutch through the compensation hole 7, the clutch can reach the working pressure more quickly and improve the vehicle reaction speed. The accumulator and compensation on-off valve constitute the buffer valve. On the contrary, when the vehicle is put into reverse gear, the accumulator is connected with the oil circuit of reverse gear, which plays a buffer role.

3.2 Structure introduction

3.2.1、Structure introduction

The structural diagram of XYQXF18/25/35 hydraulic transmission is shown in Figure 5-3. The power of the engine is input to the input shaft assembly 8 of the transmission by the torque converter turbine through the spline connection through the torque converter 6.

The gearbox is mainly composed of input shaft assembly 8, intermediate shaft assembly 5, output gear 2, output flange 1, electromagnetic directional control valve assembly 9, oil supply pump assembly 7 and other main parts. The forward or backward clutch is controlled by the electromagnetic reversing control valve to realize reversing, and the power is transmitted to the universal coupling through the output gear and output flange.

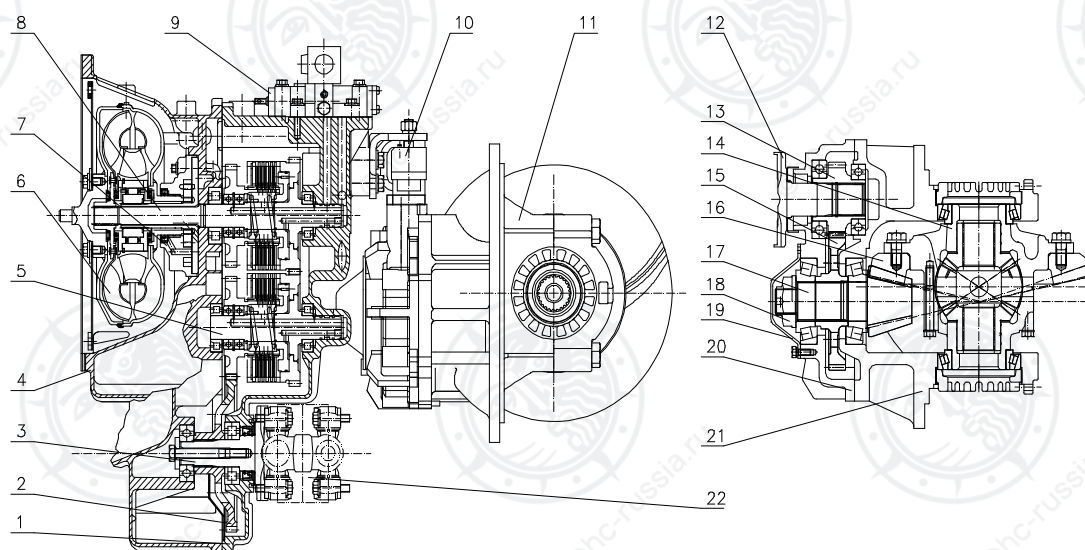


Fig 5-3 Structural diagram of XYQXF18/25/35hydraulic transmission

- | | | |
|-------------------------------------|-------------------------------|-----------------------|
| 1.Housing assembly | 2.Output gear | 3.Output flange |
| 4.Torque converter housing assembly | 5.Intermediate shaft assembly | |
| 6.Torque converter assembly | 7.Oil pump assy | 8.Input shaft assy |
| 9. Solenoid control valve assembly | 10. Bracket | 11.Reducer assy |
| 12.Input flange | 13.Driving gear | 14.Differential assy |
| 15.Driven gear | | |
| 16.Driven spiral bevel gear | 17.Driving spiral bevel gear | |
| 18.Lock nut | 19.End cover | 20.Differential cover |
| 21.Differential seat | | |
| 22.Universal coupling assembly | | |

The reducer is mainly composed of input flange 12, driving gear 13, driven gear 15, driving spiral bevel gear 17, driven spiral bevel gear 16 and differential assembly 14. The power from the gearbox is transmitted to the input flange by the universal coupling 22. After two-stage deceleration, the differential drive is generated by the differential and transmitted to the wheel through the half shaft gear and the half shaft.

At the same time, the gearbox and reducer itself also play the role of fuel tank. The transmission and the reduction box are fixedly connected by a damping bracket 10.

3.2.2、Hydraulic torque converter

The torque converter used in XYQX18/25/35 hydraulic transmission is welding type, which cannot be disassembled. See Figure 5-4 for the structural diagram of the torque converter.

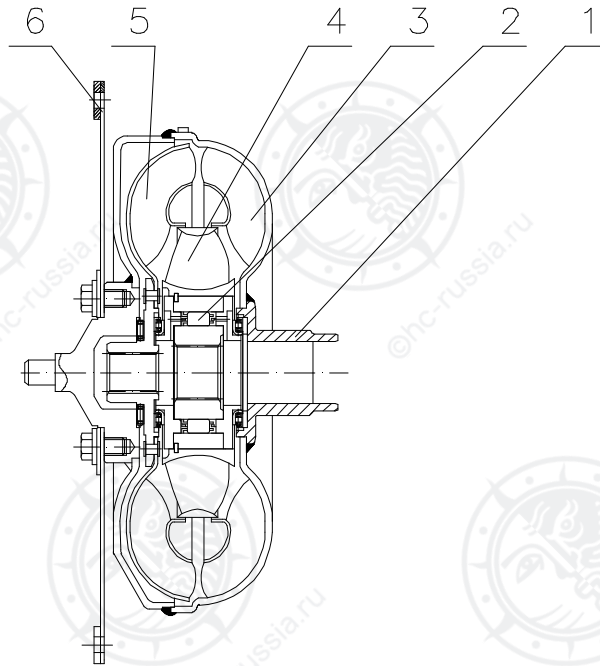


Fig 5-4 Structural diagram of hydraulic torque converter

- | | | | |
|------------|------------------------------|---------------|----------------|
| 1. Clutch | 2. One way clutch | 3. Pump wheel | 4. Guide wheel |
| 5. Turbine | 6 - elastic connecting plate | | |

The torque converter is mainly composed of pump wheel, turbine, guide wheel and elastic connecting plate. The elastic plate 6 is directly connected to the engine flywheel. The pump wheel 3 converts the mechanical energy of the engine into the kinetic energy of the working oil through the elastic plate, and makes the liquid flow flow into the turbine 5 at high speed along the direction of the blade, which drives the turbine to rotate, and the torque and speed are transmitted to the gearbox by the turbine shaft. The liquid flows out of the turbine and into the guide wheel 4. When the torque converter is under a large load, the turbine is affected by the load, and is in the torque conversion stage of low speed and high torque, the guide wheel is wedged by the one-way clutch 2 and cannot rotate, and the torque of the liquid flow acting on the guide wheel is reversed on the turbine, so that the torque on the turbine is equal to the sum of the torque of the pump wheel and the guide wheel, so the output torque is greater than the input torque, resulting in automatic torque conversion. When the ratio of rotor speed to pump speed is greater than a certain value, the guide wheel will be disengaged and rotate freely, and the torque conversion will be terminated, which is a coupled state.

When the engine starts, the speed of the pump wheel is synchronized with that of the engine, and the pump wheel drives the gearbox to supply the oil pump through the clutch to provide pressure oil for the system.

3.2.3、 Oil supply pump assembly

The structural diagram of XYQXF35-3000 oil supply pump assembly is shown in Figure 5-5. The oil supply pump assembly is mainly composed of driving gear 1, guide wheel seat 2, passive gear 3, pump body 4 and other parts. The oil supply pump assembly is installed on the torque converter housing. The guide wheel seat 2 is connected with the torque converter guide wheel through splines. The pump body 4 is a casting with high-pressure cavity and low-pressure cavity. The driving gear 1 is connected with the torque converter pump wheel, which is driven by the engine and drives the passive gear 3 to rotate to form internal gear. The pump supplies oil to the system.

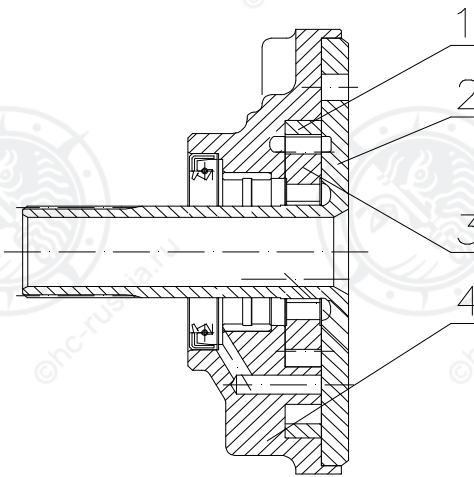


Fig 5-5 Structural diagram of xyqxf35-3000 oil pump assembly

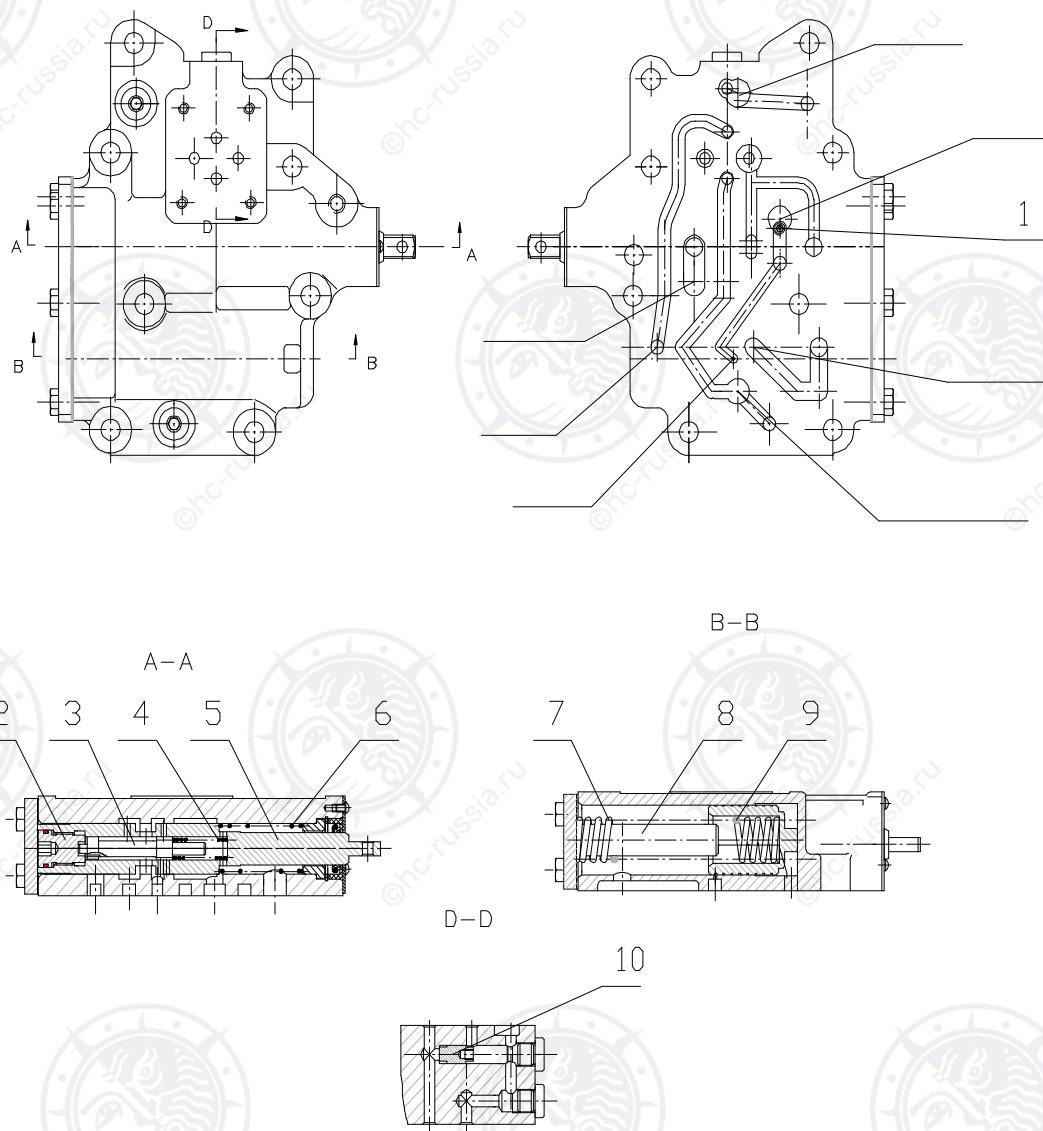
1. Driving gear 2. Guide wheel seat 3. Driven gear 4. Pump body

3.2.4、 Control valve assembly

The oil port location of XYQXF35-4100 control valve is shown in Figure 5-6. XYQXF35-4100 control valve is a comprehensive integrated valve block with high integration, compact space structure and reasonable layout. It is mainly composed of micro valve, buffer valve and shuttle valve.

The structure of the micro valve is shown in A-A. the micro valve is mainly used to cut off the oil inlet of the clutch. The fretting valve rod is connected to the connecting rod of the fretting pedal. When the fretting pedal is depressed, the fretting valve rod moves outward. When the fretting valve rod moves outward by 2mm, the fretting valve rod moves outward by 2mm, The clutch begins to depressurize, and when the clutch pressure drops to a certain pressure, the friction plate slips, which makes the vehicle achieve fretting effect; when the fretting valve rod moves 8 mm outward, the clutch pressure drops to 0, the clutch friction plate and the spacer can not be combined, and the vehicle stops moving; when the fretting valve rod moves 12 mm outward, the travel of the

fretting valve rod stops.



- | | | | |
|---------------------|------------------|----------------------|------------------|
| 1.Damping plug | 2.Plug | 3.Control valve core | 4.Control spring |
| 5. Micro valve core | 6. Return spring | 7.Buffer spring | 8.Limit post |
| 9.Buffer spool | 10.Shuttle spool | | |

Fig 5-6 XYQXF35-4100 control valve assembly

The structural diagram of buffer valve is shown in B-B. the buffer valve is used to reduce the impact produced in the process of clutch combination and separation.

The shuttle valve structure diagram is shown in d-d. according to the control of the solenoid valve, the shuttle valve can introduce the oil of the buffer valve into the forward clutch or reverse clutch to make the buffer valve play a buffer role.

3.2.5、 Main pressure valve, relief valve

See Figure 5-7 for the structural diagram of the main pressure regulating valve assembly. The main pressure regulating valve controls the clutch oil pressure in the range of 1.1mpa-1.5mpa. A part of the oil flows into the electromagnetic directional control valve to realize the shift; a part of the oil flows into the relief valve.

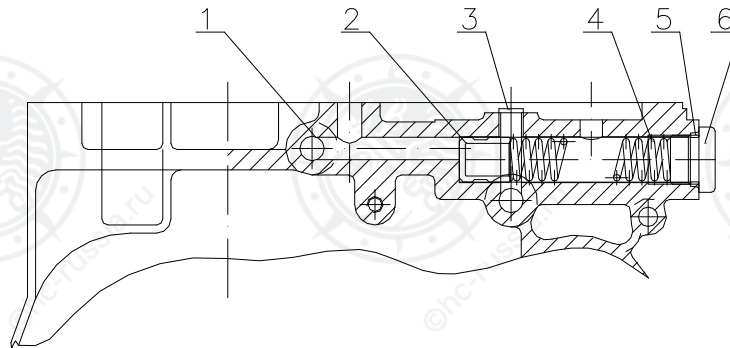


Fig 5-7 structural diagram of main pressure regulating valve

- | | | | |
|----------------|---------------|--------------|---|
| 1.Valve body | 2.Valve cor | 3.Screw plug | 4.Main pressure regulating valve spring |
| 5.Sealing ring | 6. Screw plug | | |

The structural diagram of relief valve assembly is shown in Figure 5-8. Relief valve is also known as torque converter safety valve. The relief valve controls the oil pressure within the range of 0.3mpa-0.7mpa to flow into the torque converter.

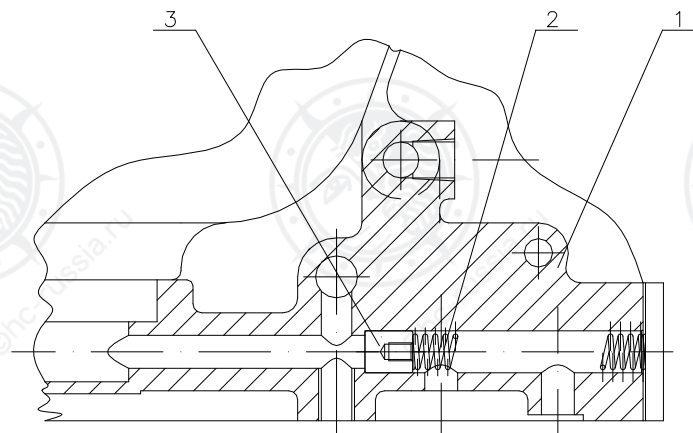


Fig 5-8 Structural diagram of relief valve

- | | | |
|--------------|----------|--------------|
| 1.Valve body | 2.Spring | 3.Valve core |
|--------------|----------|--------------|

3.2.6、Clutch

The wet multi plate hydraulic clutch is installed on the input shaft and intermediate shaft of the hydraulic transmission, and the pressure oil is distributed to the forward or backward clutch through the control valve to realize the forward and backward shift. All gears in the gearbox are constant mesh gears.

Each clutch of the clutch assembly is composed of five spacer plates 18, five friction plates 19, a backing plate 14, a butterfly plate 21 and a piston 2, which are assembled alternately.

The outer circle of the piston is equipped with piston ring 17, and the input shaft is equipped with O-ring 3, so as to ensure the sealing of the piston when it works. In neutral position, the piston does not move, and the spacer and friction plate are separated. When shifting, the oil pressure acts on the piston, the spacer and the friction plate to compress each other, and the power from the torque converter is transmitted to the clutch gear by the friction force.

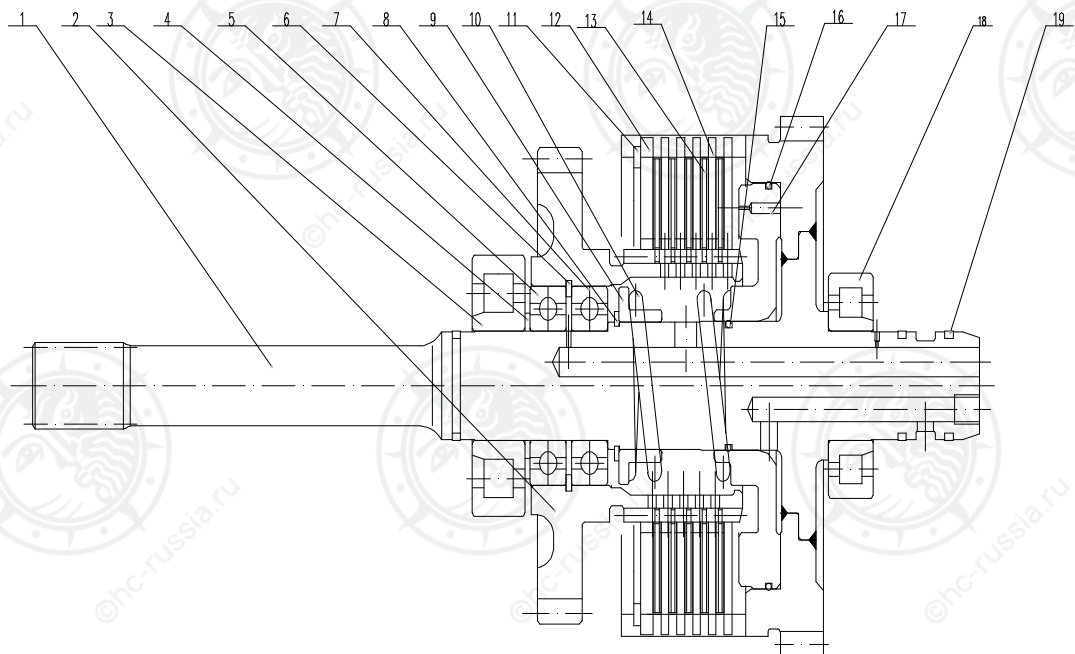


Fig 5-9 YQXF35-1000 input shaft/YQXF35-5000 intermediate shaft clutch assembly

- | | | | |
|----------------------|------------------|--------------------|----------------------------|
| 1.Input shaft assy | 2.Clutch gear | 3.Bearing | 4.Spacer |
| 5.Bearing | 6.Retaining ring | 7.Retaining rin | 8.Spring seat |
| 9.Spring | 10.Clip | 11.End plate | 12.Internal friction plate |
| 13.External friction | 14.Base plate | 15.Sealing ring | 16.Piston ring |
| 17.Piston | 18.Sealing ring | 19.Butterfly piece | |

3.2.7. Reducer assembly

The structural diagram of the reducer assembly is shown in Figure 10. It is composed of a pair of cylindrical gears and a pair of spiral bevel gears. The two-stage reducer and differential are combined to form the reducer assembly. The reducer assembly is equipped with input flange 1, driving gear 2, driven gear 4, driving spiral bevel gear 7, driven spiral bevel gear 8, differential seat assembly 9, differential cover 8, two axle gears 11, four planetary gears 14, cross shaft 12 and differential housing assembly 3. Thrust washer 15 and washer 10 are installed between differential housing, planetary gear and half shaft gear.

The power from the gearbox is transmitted to the reducer through the input flange, and then through the secondary reduction, the differential drive is generated by the differential, which is transmitted to the wheel through the half shaft gear and the half shaft.

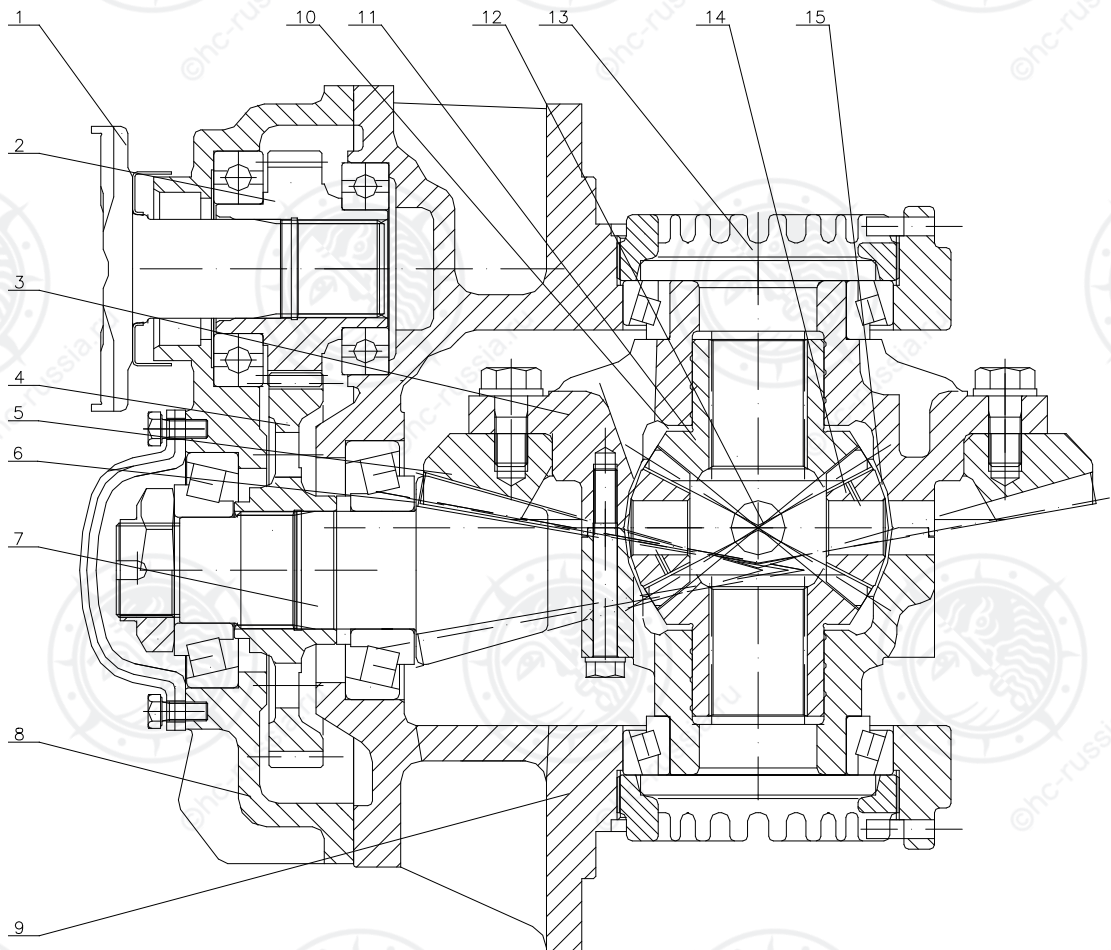


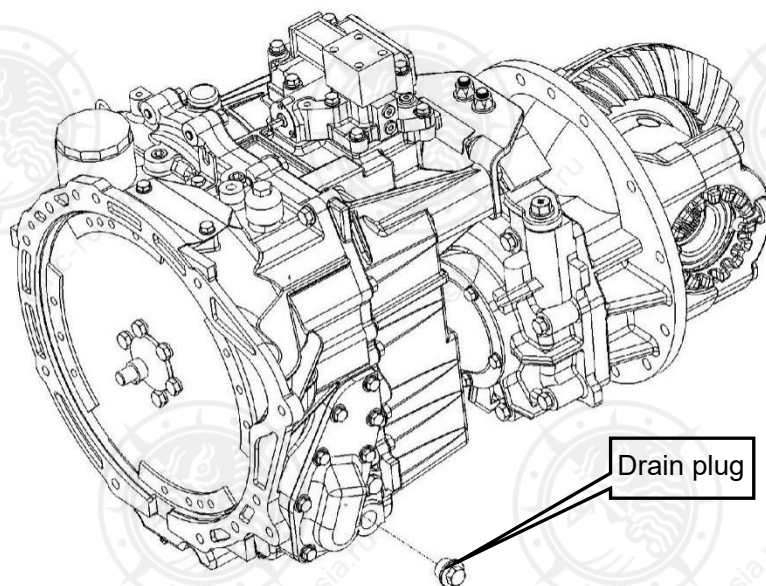
Fig 5-10 Structural diagram of reducer assembly

1-input flange	2-driving gear	3-differential housing assembly
4-driven gear	5-driven spiral bevel gear	6-adjusting pad
7-driving spiral bevel gear	8-differential cover	9-differential seat
10-washer	11-axle gear	12-cross shaft
14-planetary gear	15-thrust washer	13-adjusting nut

4. Maintenance and adjustment

4.1. Oil level check (engine idle speed check)

Stop the vehicle on a level road, inject oil, run in neutral for 2 minutes, and then check the oil level of the oil dipstick. The oil level should be within the specified range of the oil dipstick. If it does not meet the requirements, refuel or open the drain plug to drain oil. The position of oil drain plug is shown in the figure below:

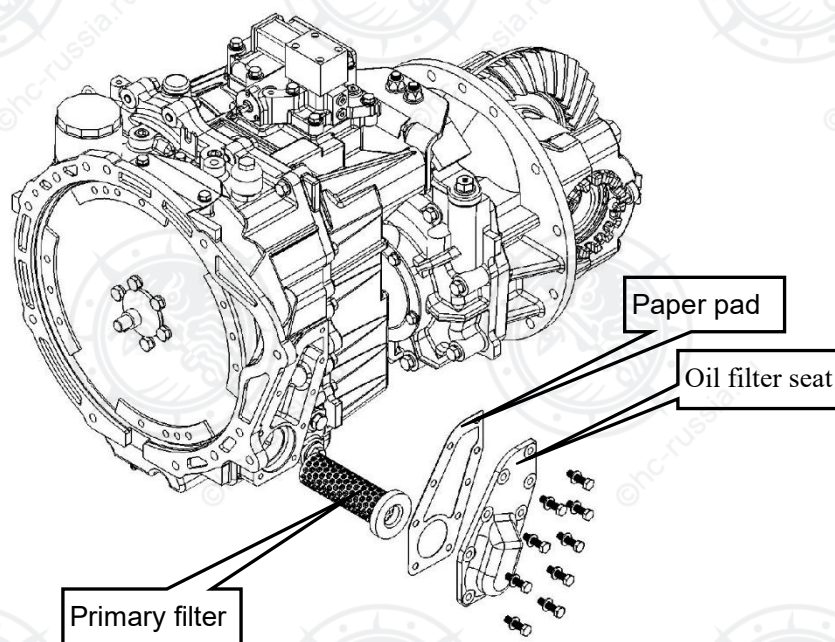


4.2. Change oil, check and clean filter screen

4.2.1. start the engine, run it for about ten minutes and stop it.

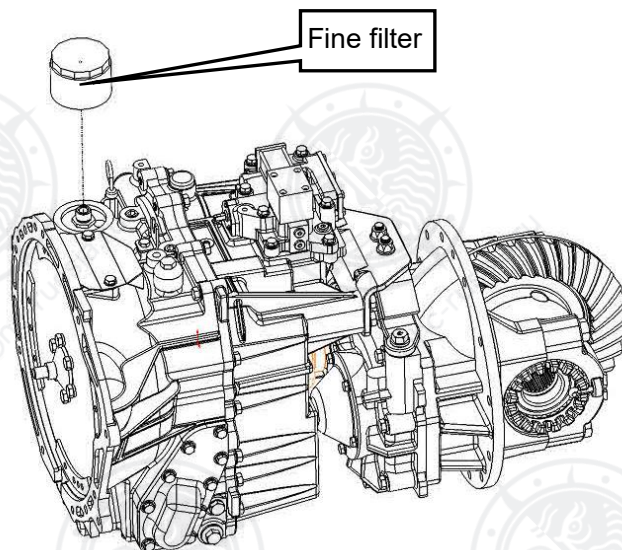
4.2.2. remove the drain plug to drain the oil. After draining the oil, tighten the oil drain plug.

4.2.3. remove the fixing bolts, remove the oil filter seat, remove the primary filter and clean the primary filter with cleaning agent. (Note: if the paper pad is damaged during disassembly, clean the paper pad left on the joint surface and replace it with a new one).



4.2.4. After cleaning, blow dry compressed gas from the inside to the outside of the primary filter, and install when it is completely dry. Note: if any damage is found on the primary filter, a new primary filter is required.

4.2.5. Remove the fine filter and replace it.



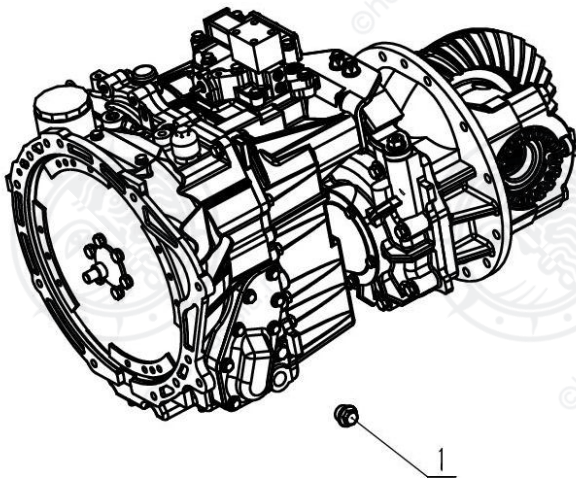
4.2.6. Refuel (according to the above 1).

4.2.7. After 100 hours of use of the new machine, the fine filter shall be replaced and the coarse filter shall be cleaned; after 500 hours of use, the fine filter shall be replaced and the coarse filter shall be cleaned; after 2000 hours of use, the coarse filter shall be replaced.

5.Disassembly and assembly

1、Gearbox disassembly and assembly

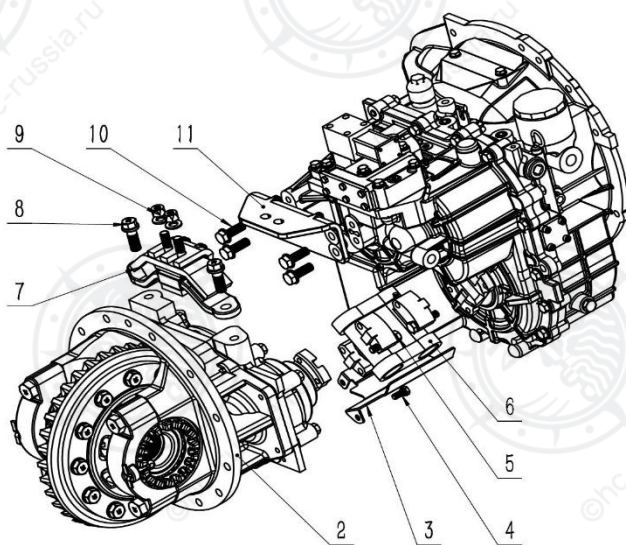
1.



Before disassembling the gearbox, drain the residual oil in the gearbox, and replace the O-ring at the drain plug. After drain the residual oil, screw the drain plug 1 back to the gearbox.

Parts description	Characteristic requirements	Tooling and tools
1-Oil drain plug + O-ring	A.tightening torque 35-40N·m	10mm inner hexagon wrench

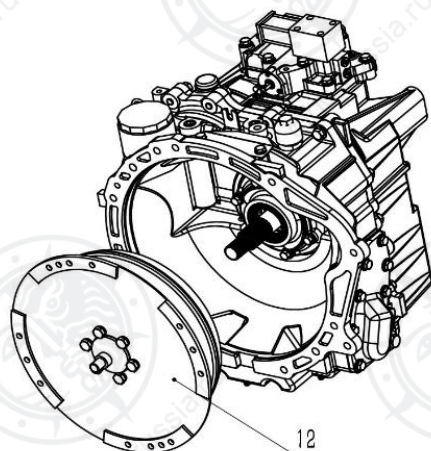
2.



Remove the bolt 4, remove the dust cover, remove the bolt 5, and then remove the coupling 6. Then remove the lock nut 9 and bolt 8, remove the cushion 7, separate the main reducer assembly 2 from the transmission, and finally remove the bolt 10 and the bracket 11.

Parts description	Characteristic requirements	Tooling and tools
2-Final drive assembly		
3-Dust cover		
4-Bolt + spring pad (2 pieces)	a、tightening torque 22-30N·m	13mm outer hexagon socket
5-Bolt + spring pad (8 pieces)	a、tightening torque 70-80N·m	16mm outer hexagon socket
6-Coupling		
7-Cushion		
8-Bolt (2 pieces)	a、tightening torque 160-180N·m	19mm outer hexagon socket
9-Nut + flat pad (2 pieces)	a、tightening torque 95-105N·m	19mm outer hexagon socket
10-Bolt + spring pad (4 pieces)	a、tightening torque 95-105N·m	19mm outer hexagon socket
11-Bracket		

3.

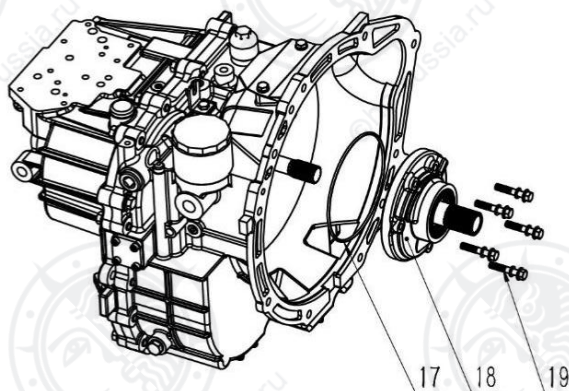


Remove torque converter assembly 12.

Parts description	Characteristic requirements	Tooling and tools
12-Torque converter assembly	During installation, push in while rotating	

4.		Remove the solenoid valve 13. Pay attention to the four O-rings at the bottom of the solenoid valve. Remove the mounting bolt 14, remove the control valve assembly 15 and the paper pad 16. If the paper pad is damaged during installation, replace the paper pad. At the same time, clean up the residual paper pad on the control valve surface and box surface, and prevent the paper pad debris from entering the control valve and box hole.
Parts description	Characteristic requirements	Tooling and tools
13-Solenoid directional valve	a、 Tightening torque 8-10N·m	4mm hexagon wrench
14-Bolt + spring washer (8)	a、 Tightening torque 22-30N·m b、 Diagonal tightening is required during installation	13mm outer hexagon socket
15-Control valve		
16-Paper pad	a、 Vulnerable parts (to be replaced during disassembly)	

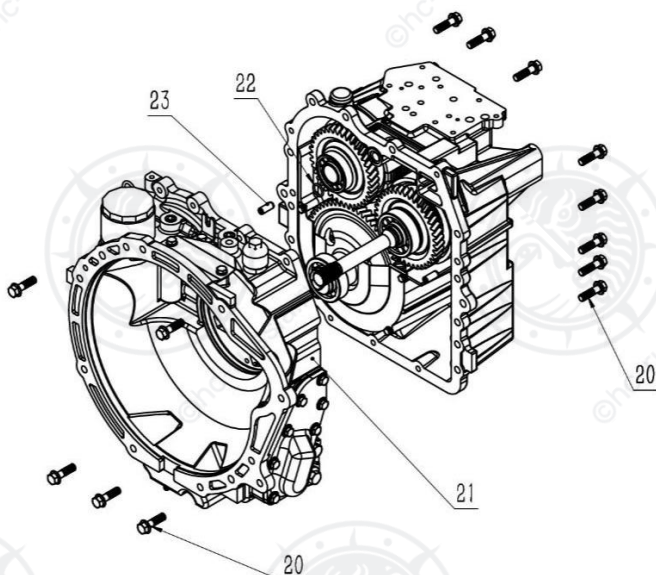
5.



Remove the fixing bolt 19, take out the oil supply pump 18 and remove the O-ring 17. Note that since the O-ring here is a plane seal, the O-ring must be replaced during installation, and the O-ring is not allowed to be reused.

Parts description	Characteristic requirements	Tooling and tools
17-O-ring	a、Vulnerable parts (to be replaced during disassembly)	
18-Oil pump assembly		
19-Bolt + copper pad (5 pieces)	a、Tightening torque N·m	12mm Outer hexagon sleeve
	b、Diagonal tightening is required during installation	

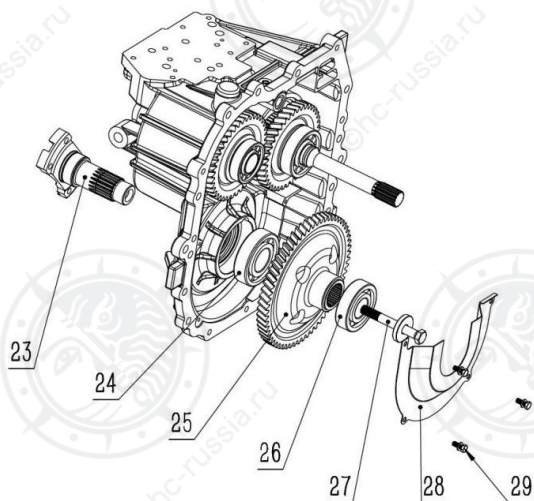
6.



Remove the bolt 20 and take down the torque converter housing assembly 21. During installation, clean up the residual sealant on the joint surface of the torque converter housing and the transmission housing. At the same time, apply a little anaerobic adhesive plane glue on the joint surface during installation. Finally, remove dowel 23 and O-ring 22. Note that as the O-ring here is a plane seal, the O-ring must be replaced during installation, and the O-ring is not allowed to be reused.

Parts description	Characteristic requirements	Tooling and tools
20-Bolt (18)	a、Tightening torque N·m	15mm Outer hexagon sleeve
21-torque converter housing assy		
22-Cylindrical locating pin		
23-O-ring	a、Vulnerable parts (to be replaced during disassembly)	

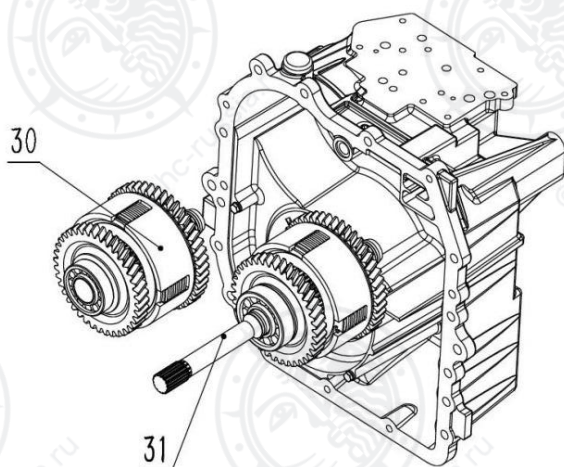
7.



Remove the bolt 29, remove the oil shield, remove the bolt 27, and then remove the output flange 23. Remove the bearing 26, output gear 25 and bearing 24 in turn.

Parts description	Characteristic requirements	Tooling and tools
23-Output flange assembly		
24-Deep groove ball bearing		
25-Output gear		
26-Deep groove ball bearing		
27-Bolt + washer	A.Tightening torque 100-120N·m	18mm Outer hexagon sleeve
28-Oil shield		
29-bolt + spring washer (4 pieces)	A.Tightening torque 13-16N·m	10mm Outer hexagon sleeve

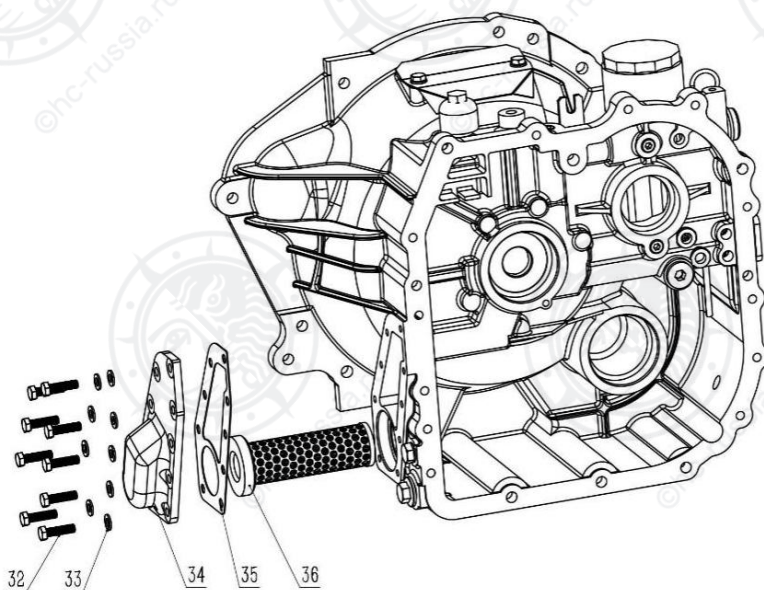
8.



Remove input clutch assembly 31 and reverse clutch assembly 30.

Parts description	Characteristic requirements	Tooling and tools
30-Reverse clutch assembly		
31-input (forward) clutch assy		

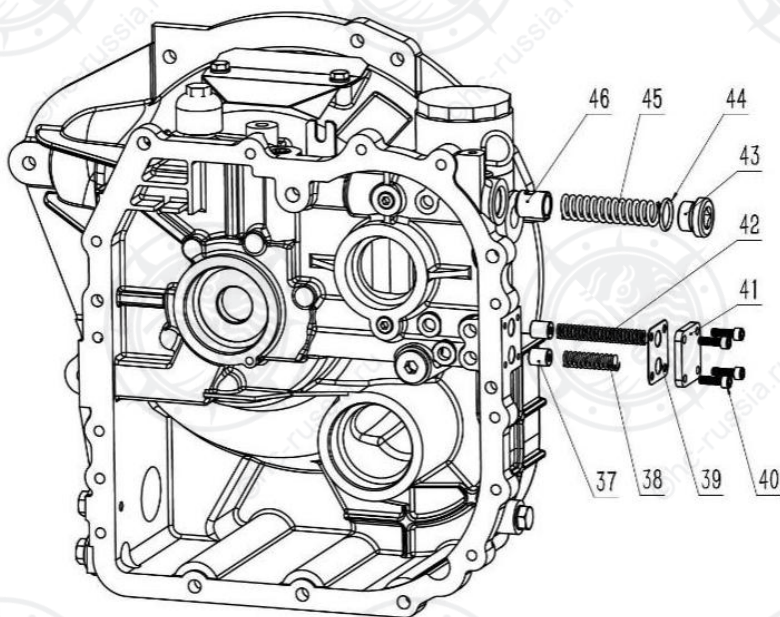
9.



Remove the bolt 32 and spring pad 33, remove the oil filter seat 34 and paper pad 35, and remove the primary filter 36. If the paper pad is damaged during installation, the paper pad shall be replaced, and the residual paper pad on the oil filter seat and shell surface shall be cleaned during installation.

Parts description	Characteristic requirements	Tooling and tools
32-Bolt	a、 Tightening torque 20-26N·m	13mm outer hexagon socket
33-Elastic pad		
34-Oil filter seat		
35-Paper pad	a、 Vulnerable parts (to be replaced during disassembly)	
36-Primary filter	a、 Vulnerable parts (to be replaced during disassembly)	
	b、 Clean every 500 hours and replace every 2000 hours	

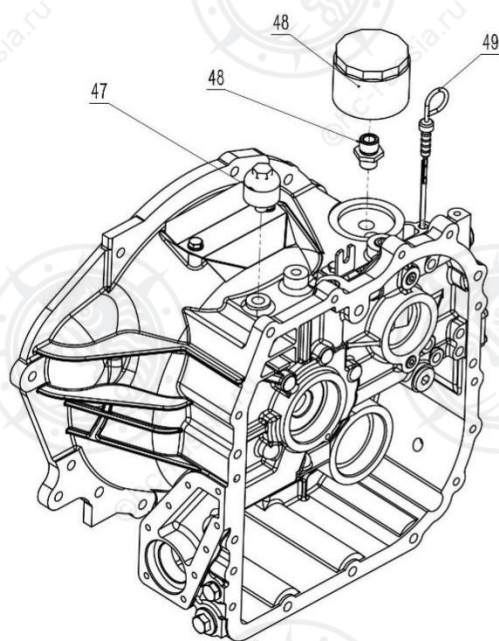
10.



Remove the hexagon socket bolt 40, the cover plate 41, the paper pad 39, the springs 38, 42 and the piston 37. If the paper pad is damaged during installation, the paper pad shall be replaced, and the residual paper pad on the cover plate and shell surface shall be cleaned during installation. Remove the main pressure valve plug 43, remove the spring 45 and piston 46, and replace the O-ring 44 during installation.

Parts description	Characteristic requirements	Tooling and tools
37-Piston (2 pieces)		
38-Spring of lubricating oil safety valve		
39-Paper pad	a、Vulnerable parts (to be replaced during disassembly)	
40-Socket head screw (4)	a Tightening torque 9-11N·m	5mm inner hexagon spanner
41-Cover plate		
42-Torque converter relief valve spring		
43-Main pressure valve plug	a、 Tightening torque 65-80N·m	12.7mm Square sleeve
44-O-ring	a、Vulnerable parts (to be replaced during disassembly)	
45-Main pressure valve spring		
46-Main pressure valve piston		

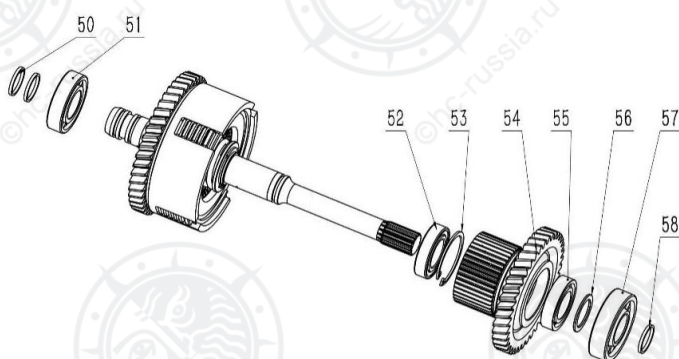
11.



Use the filter wrench to remove the fine filter 48 and the pipe joint, and remove the oil dipstick 49 and the air cap assembly 47.

Parts description		Characteristic requirements	Tooling and tools
47-Cap assembly			
48-	Coupling		Filter wrench
	Fine filter	a、Vulnerable parts (to be replaced during disassembly)	
		b、Replace every 500 hours	
		c、Tightening torque 35-40N·m	
49-Oil dipstick			

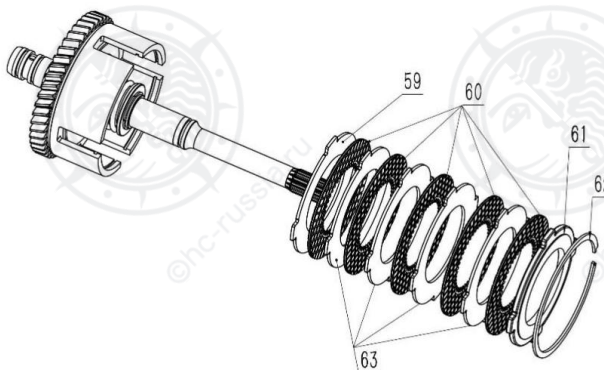
12.



Remove the sealing rings 50 and 58, remove the bearings 51 and 57, remove the retaining ring 56, and then remove the bearing 55, clutch gear 54, hole retaining ring 53 and bearing 52 in turn.

Parts description	Characteristic requirements	Tooling and tools
50 (58) -Seal ring (3 pieces)	a、Vulnerable parts (to be replaced during disassembly)	
51-Bearing		
52-Bearing		
53-Elastic ring for hole		
54-Clutch gear		
55-Bearing		
56-Circlip for shaft		
57-Bearing		

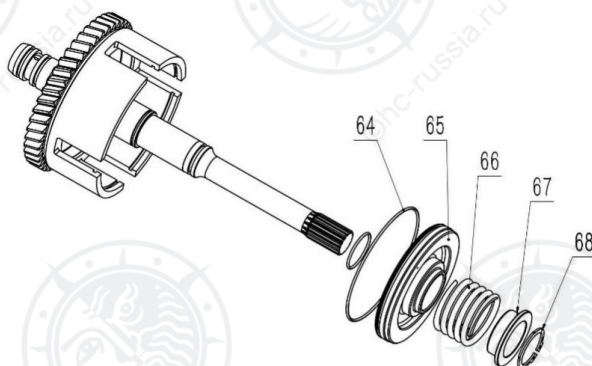
13.



After removing the retaining ring 62, take down the lower end plate 61, the inner friction plate 60 and the outer friction plate.

Parts description	Characteristic requirements	Tooling and tools
59(63)-outer friction plate (5 pieces)	a、Vulnerable parts (to be replaced during disassembly)	
60-Internal friction plate (5 pieces)	a、Vulnerable parts (to be replaced during disassembly)	
61-End plate	The clearance between end plate and retaining ring should be 1.55-1.75mm	Feeler gauge
62-Elastic ring for hole		

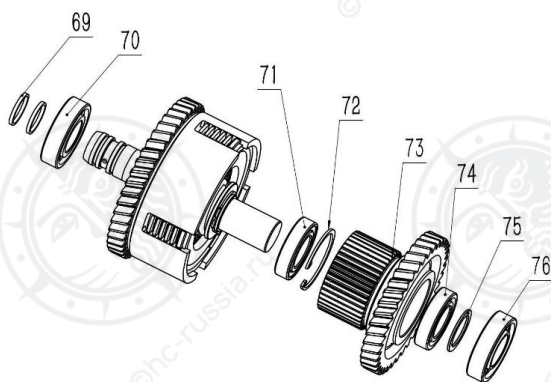
14.



Remove the shaft retaining ring 68, remove the spring seat 67, return spring 66, and remove the piston 65 and O-ring 64.

Parts description		Characteristic requirements	Tooling and tools
64-	O-ring	a、Vulnerable parts (to be replaced during disassembly)	
	O-ring	a、Vulnerable parts (to be replaced during disassembly)	
65-Piston			
66-Return spring			
67-Spring seat			
68-Elastic ring for shaft			

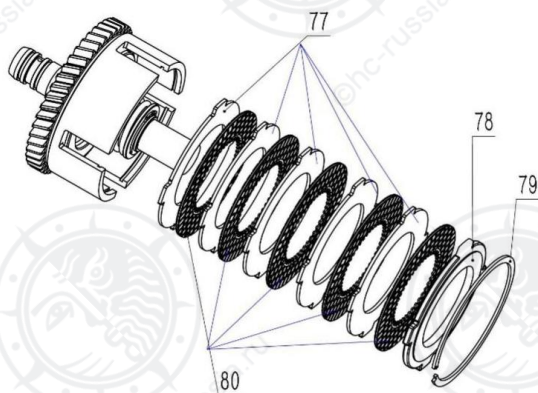
15.



Remove the seal ring 69, remove the bearings 70 and 76, remove the retaining ring 75, and then remove the bearing 74, clutch gear 73, hole retaining ring 72 and bearing 71 in turn.

Parts description		Characteristic requirements	Tooling and tools
69-Sealing ring (2 pieces)		a、Vulnerable parts (to be replaced during disassembly)	
70 (76) -Bearing (2 pieces)			
71-Bearing			
72-Circlip for shaft			
73-Clutch gear			
74-Bearing			
75-Circlip for shaft			

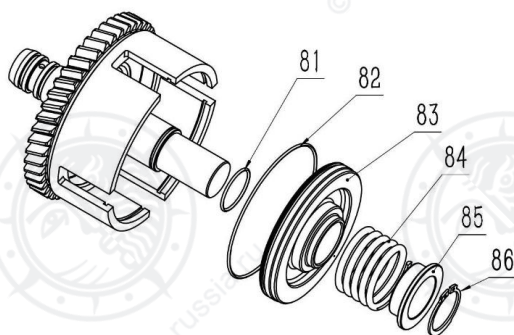
16.



After removing the retaining ring 79, remove the lower end plate 78, the inner friction plate 80 and the outer friction plate 77 in turn

Parts description	Characteristic requirements	Tooling and tools
77-external friction plate (5 pieces)	a、Vulnerable parts (to be replaced during disassembly)	
78-end plate	The clearance between end plate and retaining ring should be 1.55-1.75mm	Feeler gauge
79-Elastic ring for hole		
80-Internal friction plate (5 pieces)	a、Vulnerable parts (to be replaced during disassembly)	

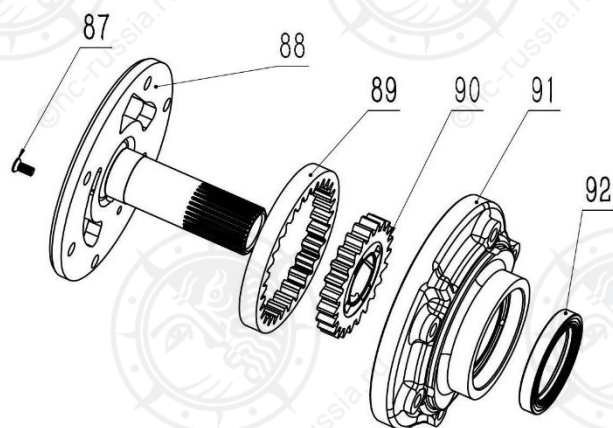
17.



Remove the shaft retaining ring 86, remove the spring seat 65, return spring 84, and remove the piston 83 and O-rings 82 and 81.

Parts description	Characteristic requirements	Tooling and tools
81-O-ring	a、Vulnerable parts (to be replaced during disassembly)	
82-O-ring	a、Vulnerable parts (to be replaced during disassembly)	
83-Piston		
84-Return spring		
85-Spring seat		
86-Elastic ring for shaft		

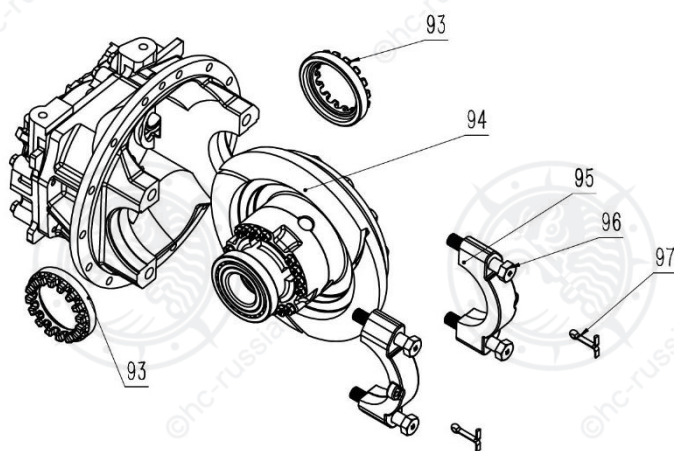
18.



After removing the screw 87, remove the pump body assembly 91, oil pump driving gear assembly 90, oil pump inner ring gear 89 and oil seal 92.

Parts description	Characteristic requirements	Tooling and tools
87-Screw	a、 The end face of the screw after installation shall not be higher than the end face of the guide wheel seat	Cross screwdriver
88-Guide wheel seat		
89-Oil pump inner gear ring	After installation, the end face of the oil pump gear is 0.04-0.055mm lower than the end face of the pump body	Lever dial indicator
90-Oil pump driving gear assy		
91-Pump body assembly		
92-Oil seal	a、 Vulnerable parts (to be replaced during disassembly)	

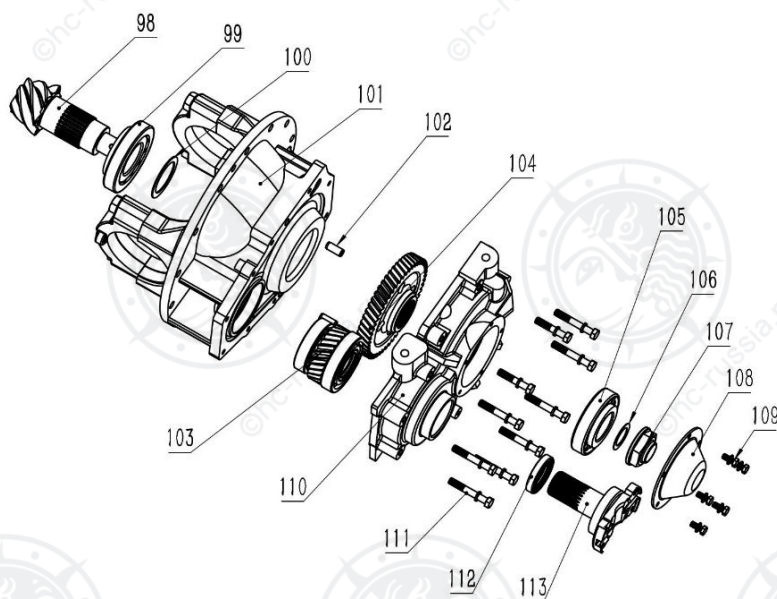
19.



Remove the split pin 97, remove the bolt 96, and then remove the bearing seat 95. When removing and installing, pay attention to that the left and right bearing seats are not interchangeable. Remove adjusting nut 93 and differential assembly 94.

Parts description	Characteristic requirements	Tooling and tools
93-Adjusting nut	a、 After the adjustment nut is installed, the clearance of spiral bevel gear shall be controlled within 0.26-0.34mm	Lever dial indicator
	a、 After the adjustment nut is installed, the rotation torque at the input flange 113 should be controlled at 5-6 N · M	Torque wrench with Watch
94-Differential assembly		
95-Bearing block (2 pieces)	a、 Left and right are not interchangeable	
96-Bolt (4 pieces)	a、 Tightening torque 325-380N·m	27mm Outer hexagon socket
97-Split pin (2 pieces)		

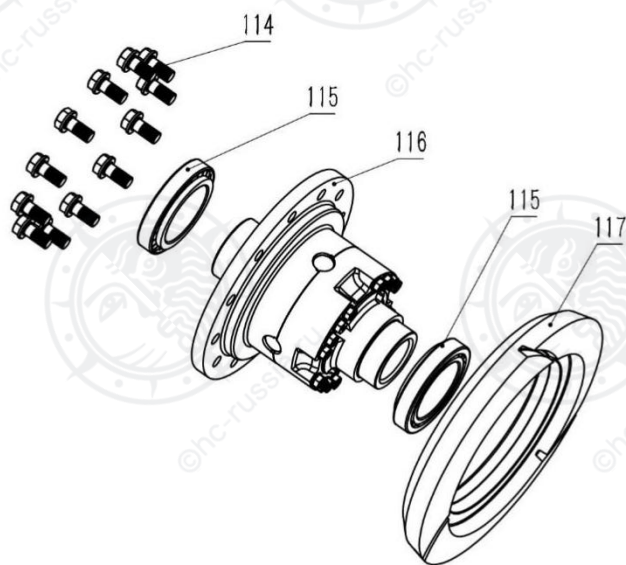
20.



Remove the bolt 109, remove the end cover of driven shaft, and apply plane sealant on the joint surface during installation; chisel the notch on the lock nut 107, remove the lock nut, remove the adjusting pad 106 and bearing 105; remove the input flange 113, remove the bolt 111, and remove the differential cover 110, and apply plane sealant on the joint surface during installation. Remove the driving gear assembly 103, the driven gear 104, and the cylindrical pin 102. Remove the conical roller bearing 100, bevel gear bearing 99.

Parts description	Characteristic requirements	Tooling and tools
98-Driving spiral bevel gear		
99-Bearing		
100-Adjustment pad	After the adjustment pad is installed, the tooth surface contact area of the driving spiral bevel gear should be in the middle of the gear, and the area should be $\geq 60\%$	Inspection of Huangdan powder
101-Differential seat assembly		
102-Cylindrical pin (2)		
103-Driving gear assembly		
104-Driven gear		
105-Bearing		
106-Adjustment pad	a、 After the adjustment pad is installed, the rotation torque at the input flange 113 should be controlled at $4-5 \text{ N} \cdot \text{m}$	Torque wrench with Watch
107-Lock nut	Tightening torque $323-363 \text{ N} \cdot \text{m}$ b、 After tightening, use a chisel to flatten and lock the notch on the shaft	55mm outer hexagon socket
108-Driven shaft end cover		
109-Bolt+ pad (5)	a、 Tightening torque $27-34 \text{ N} \cdot \text{m}$	13mm hexagon socket
110-Differential cover		
111-Bolt+ pad (10)	a、 Tightening torque $60-75 \text{ N} \cdot \text{m}$	16mm hexagon socket
112-oil seal	a、 Vulnerable parts (to be replaced during disassembly)	
113-Flange as-input		

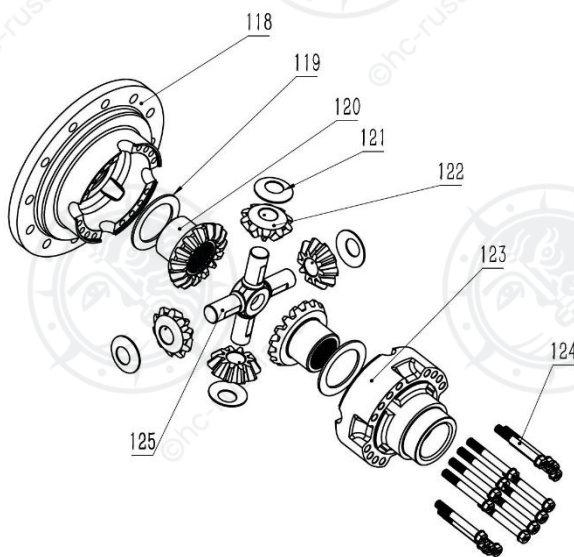
21.



Remove the bolt 114, the driven spiral bevel gear 117 and the tapered roller bearing 115 at both ends.

Parts description	Characteristic requirements	Tooling and tools
114-Bolt (12 pieces)	Tightening torque 180-210N·m	22mm outer hexagon sleeve
115-Bearing (2 pieces)		
116-Differential assembly		
117-Driven spiral bevel gear		

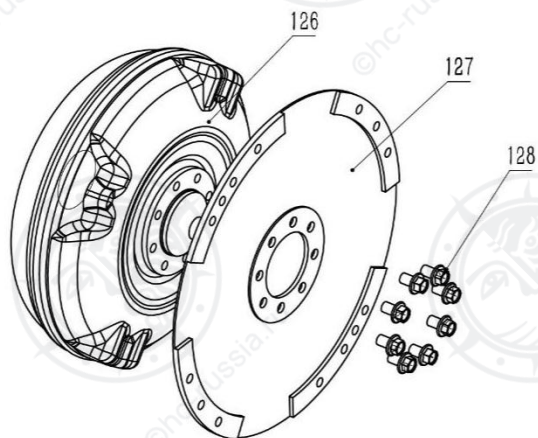
22.



Remove the bolts 124, open the left and right half housings 118 and 123 of the differential, and take out the internal thrust washer 119, half shaft gear 120, planetary gear 122, washer 121 and cross shaft 125.

Parts description	Characteristic requirements	Tooling and tools
118-Differential left half housing	The replacement should be matched with Part 123	
119-Washer (2 pieces)	The clearance between the two parts after installation is required to be 0.3-0.45mm	
120-Half shaft gear (2 pieces)		
121-Washer (4 pieces)		
122-Planetary gear (4 pieces)		
123-Differential right half housing	The replacement should be matched with part 118	
124-Bolt (16 pieces)	Tightening torque 75-100N·m	14mm outer hexagon sleeve
125-Cross shaft		

23.



Remove the bolts 128 and remove the elastic plate assembly 127.

Parts description	Characteristic requirements	Tooling and tools
126-Torque converter assy		
127-Washer		
128-Bolt (8 pieces)	a、Tightening torque 50-59N·m	13mm external hexagon wrench

2、Matters needing attention

2.1、The sequence of disassembly and assembly of transmission is basically opposite.

2.2、When disassembling and assembling the gearbox, it should be handled with care to prevent the parts from being damaged. After disassembling, the parts should be placed in order. The parts to be reassembled should be cleaned with kerosene and dried with dry high-pressure air before assembly.

2.3、The adjusting gaskets in the gearbox shall be installed back to the original place according to the quantity during disassembly, and shall not be increased, decreased or replaced at will.

2.4、The disassembly process should be operated in strict accordance with the above instructions. Blind disassembly and barbaric operation are strictly prohibited.

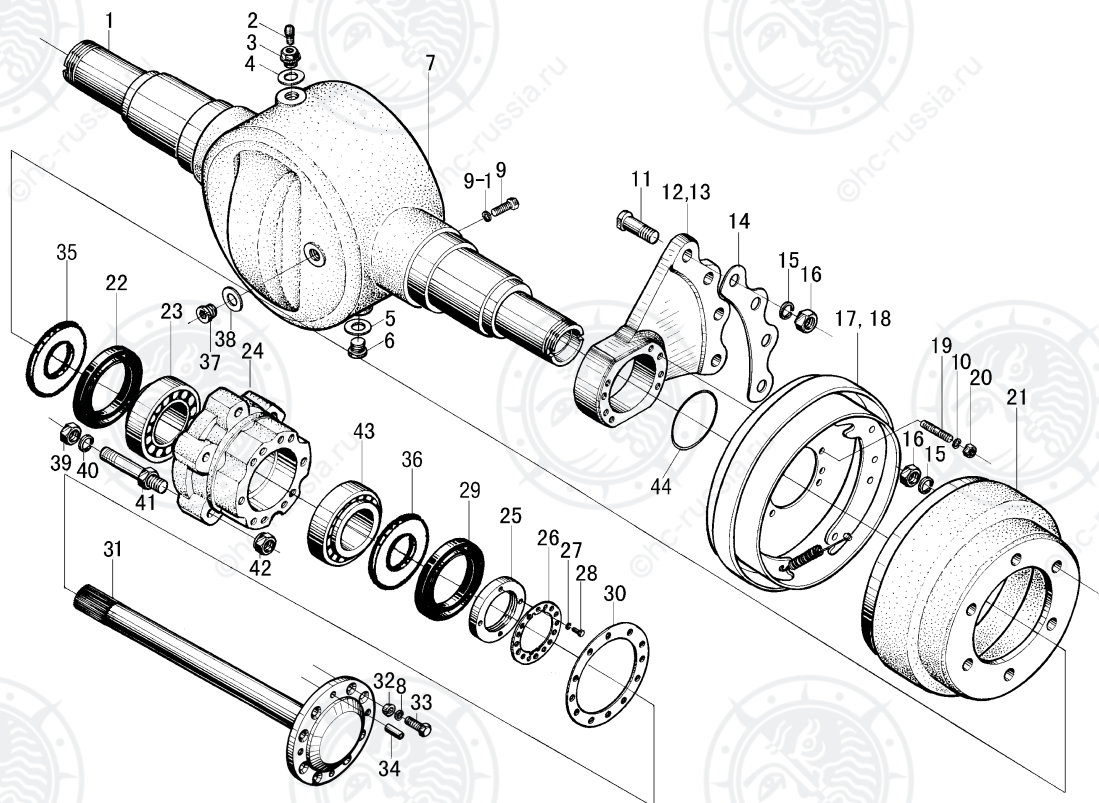
VI. Driving axle

1. Date

Driving axle type	Full floating, axle and truck body direct install, front wheel driving
Tire pressure	790kPa 1.0t-1.8t
	860kPa 2.0t-2.5t
	830kPa 3.0t-3.8t
Wheel hub rotation starting torque at hub blot N	10~29
Axial play of wheel bearing mm	< 0.08

2. Trouble diagnoses and corrections

condition	Probable cause	Corrective action
Abnormal noises	·loose driving axle and body connecting blots. ·loose wheel nut ·worn or damaged wheel hub bearing. ·wheel hub bearing not properly adjusted. ·worn axle shaft spliner. ·insufficient lubrication	Tighten. Tighten. Replace. Adjust. Replace. Lubricate.
Unstable driving	·loose wheel nut. ·deformed wheel. ·worn or damaged wheel hub bearing. ·loose driving axle and body connecting blots. ·wheel hub bearing not properly adjusted. ·improper tire pressure.	Tighten. Replace. Replace. Tighten. Adjust. Adjust.
Oil leakage	·worn or damaged axle shaft oil seal. ·final drive improperly installed. ·loose drain plug.	Replace Replace gasket. Tighten.

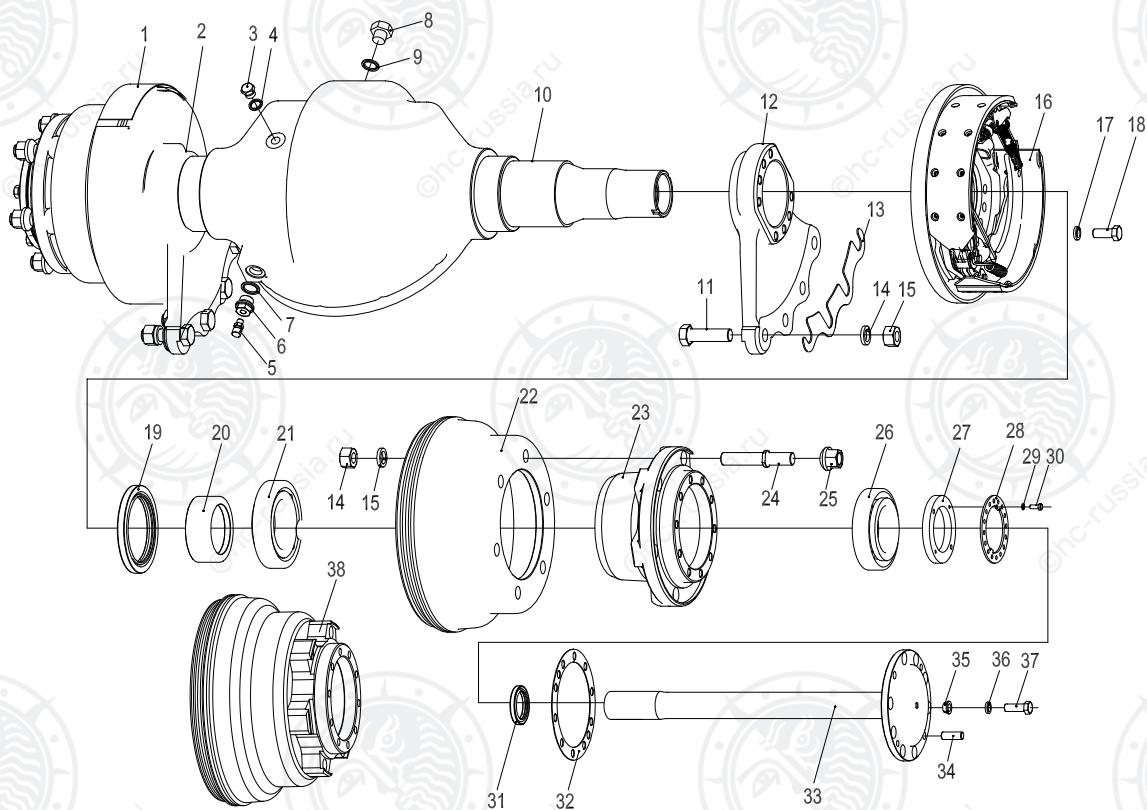


1.0-1.8t Drive axle

1.Plug	2.Vented plug	3.Plug	4.Washer 22	5.Washer 20	6.Plug
7.Axle	8.Washer 10	9.Bolt	10.Washer 12	11.Bolt	12.Plate
13.Plate	14.Plate	15.Washer 18	16.Nut	17.Left brake	18.Right brake
19.Bolt	20.Nut M12×1.5	21.Brake drum	22.Oil seal	23.Bearing	24.Hub
25.Lock nut	26.Locking shim	27.Washer 6	28.Bolt M6×12	29.Oil seal	30.Gasket
31.Half shaft	32.Clamp split-ring	33.Bolt	34.Pin 10×30	35.Snap block	36.Snap block
37.Plug	38.Washer 16	39.Nut M16×1.5	40.Washer 16	41.Bolt	42.Nut
43.Bearing3312	44.O-ring 75×3.1				

Tighten torque: N.m

	1.5t-1.8t	Remark
Support plate fixed nut (part 11)	260-347	Conical surface on wheel hub nut needn't lubricate grease
Brake drum fixed nut (part 16)	260-347	
Bolt, Brake plate assy (part 19)	106-158	
Wheel hub nut (part 39)	157-176	
Half shaft bolt (part 33)	65-78	



2.0-3.8t Drive axle

- | | | | | | |
|---------------|-----------------|------------------|------------------|----------------------|-----------------|
| 1. Left brake | 2. Left Plate | 3. Plug M16×1.5 | 4. Washer 16 | 5. Vented plug | 6. Plug |
| 7. Washer 22 | 8. Plug | 9. Washer 20 | 10. Axle | 11. Bolt | 12. Right Plate |
| 13. Plate | 14. Washer 20 | 15. Nut M20×1.5 | 16. Right brake | 17. Washer 14 | 18. Bolt |
| 19. Oil seal | 20. Oil Seat | 21. Bearing 7816 | 22. Brake drum | 23. Hub | 24. Bolt, Hub |
| 25. Nut, Hub | 26. Bearing 781 | 27. Lock nut | 28. Locking shim | 29. Washer 6 | 30. Bolt M6×12 |
| 31. Oil seal | 32. Gasket | 33. Half shaft | 34. Pin D12×35 | 35. Clamp split-ring | 36. Washer 12 |
| 37. Bolt | 38. Hub | | | | |

Tighten torque: N.m

	2.0t-3.8t	Remark
Support plate fixed nut (part 11)	324-373	Conical surface on wheel hub nut needn't lubricate grease
Brake drum fixed nut (part 15)	324-373	
Bolt, Brake plate assy (part 18)	90-210	
Wheel hub nut (part 25)	363-490	
Half shaft bolt (part 37)	90-110	

3. Assembly and disassembly of driving axle

WARNING

Be careful when removal and installation driving axle as it is heavy.

Raise front end of forklift truck and support frame with wooden blocks.

- 1) Remove mast assemblies.
- 2) Slightly raise axle with a hoist and place wooden blocks under differential gear carrier and transmission case.
- 3) After placing a pan under axle case, loose oil plug, drain oil from axle case.
- 4) Disconnect brake nuts from left and right cylinders.(see fig.5-1)。

CAUTION: plug brake tube openings to prevent oil from flowing out.

- 5) Disconnect brake cable at hand brake lever.
- 6) Remove front wheels.
- 7) Remove axle shaft.
- 8) Support driving axle with wire ropes and lifting device.
- 9) Remove bolts securing axle mounting bracket to frame.(see fig.5-2).
- 10) Remove nuts securing axle case to differential gear carrier.(see fig.5-3).
- 11) Remove driving axle assemble.

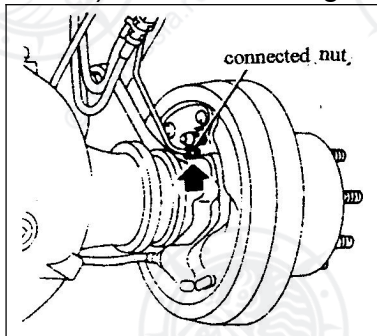


Fig.5-1

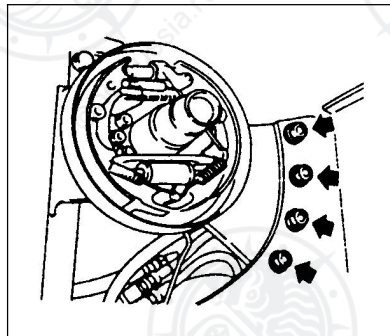


Fig.5-2

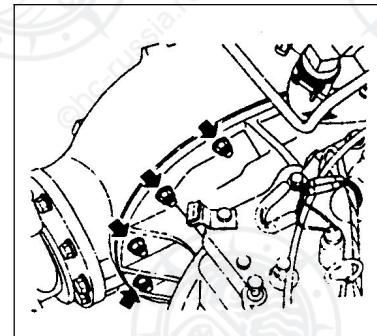


Fig.5-3

- 13) Remove brake drum, remove wheel hub.
- 14) Remove axle mounting bracket and brake component from axle tube.
- 15) Remove oil seal from axle tube.
- 16) To install driving axle assemble in the reverse order of removal. Observe the following:
 - ① When installing axle mounting bracket and brake component, apply a coat of calcium grease to axle tube.
 - ② Apply 1/3 ~ 2/3 of volume of calcium grease to wheel hub, then install them on axle tube.
 - ③ Install oil seal with its part number facing to the inside of forklift truck.
 - ④ Attach seal tape (PVC, white) to drain plug then installed after cleaned it.
 - ⑤ Replenish axle case with gear oil. Tighten vent plug after clearing.

TonModels	1.0t-1.8t	2.0t-2.5t	3.0t-3.5t	Remark
	4.5L	5.4L	10.3L	
Fill in drive axle (L)				
Gear Oil: GL-5 85W/90	4.5L	5.4L	10.3L	Mechanical forklift truck
	2.6L	2.7L	6.5L	Hydraulic Transmission Forklift truck

Vent plug should clear instantly to prevent pressure inside of wheel hub from rising.

4. Axle shaft and wheel hub

Remove

- 1) Raise the front end of forklift truck and support frame with wooden blocks.
- 2) Remove front wheel and axle shaft.
- 3) Remove lock nuts, lock washers, snap ring, felt ring, adjusting nut. Use special tools.
- 4) Remove brake drum(refer to Fig.5-4);

If brake drum is difficult to remove: a. Remove adjusting hole plug. Then with flat-blade screwdriver extend adjusting hole, turn adjusting ratchet wheel by 10 notches. To contract brake shoe lining(refer to Fig.5-5). b. evenly tapping on brake drum with brass bar or wooden mallet.

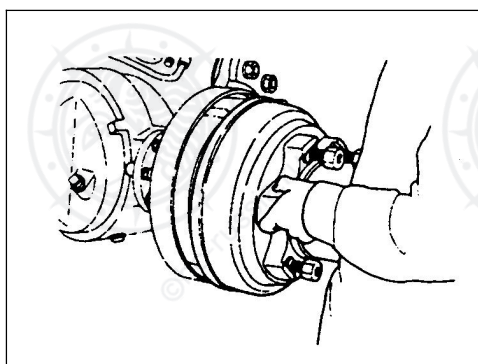


Fig.5-4

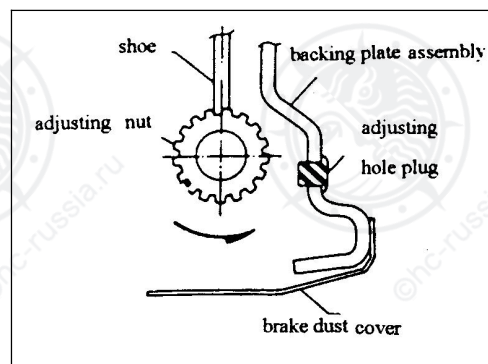


Fig.5-5

- 5) Remove wheel hub, be careful not to drop bearing inner race.
- 6) Remove oil seal and inner bearing as an assembly by evenly tapping on periphery of seal with a wooden mallet and brass bar.
- 7) Remove bearing outer race from wheel hub by evenly tapping on its periphery with a wooden mallet.

CAUTION: Be careful not to damage oil seal and outer race.

Inspection

Stepped wear or cracks on axle shaft splines	replace
Seized, scratched, noisy or rusted bearing or improper rotation of rollers	Replace
Cracked or damage wheel hub	Replace
Damaged oil seal felt ring.	replace

Installation

Install reverse order of removal.

5. Bearing adjusting

- 1) Lubricate on taper roller bearing.
- 2) Tighten roller bearing lock nut in wheel hub until wheel hub can no longer be rotated with one hand.
- 3) From that position, turn back lock nut approx. 60°.
- 4) Turn back wheel hub two or three rotations so that bearing settles down.
- 5) Again tighten lock nut until it can no longer be rotated with one hand; then turn back approx. 60°.
- 6) Install snap ring and settles down felt ring, install lock washer so as to set its hole in the pin of snap ring. Screw lock nut.
- 7) Turn wheel hub back and forth two or three rotations to see if rotation starting torque is within specifications. Rotation starting force: 10N~29N (refer to Fig.5-6);
- 8) Measure axial play of wheel hub to see if it is within specification. Axial play is less than 0.10mm (refer to Fig.5-7).

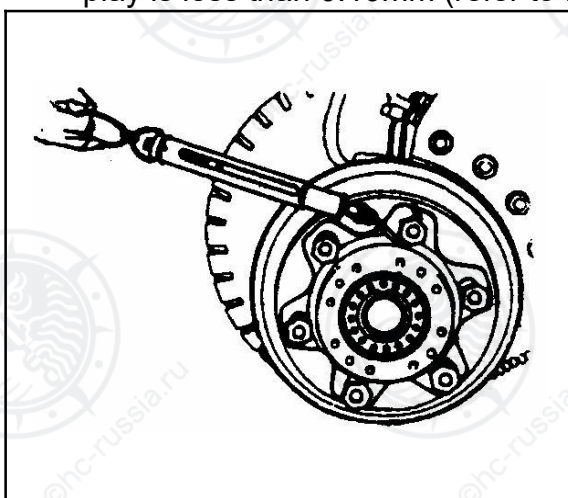


Fig.5-6

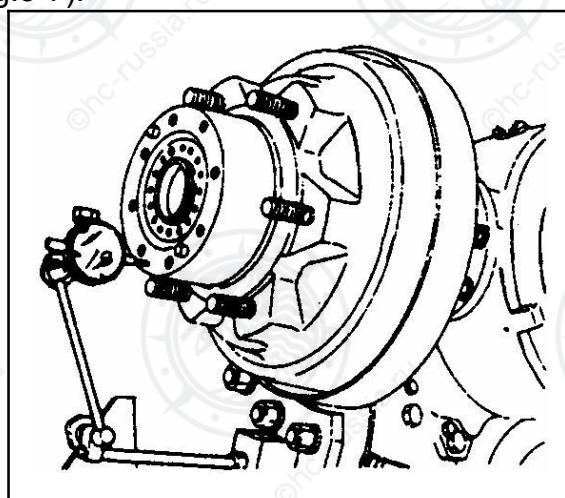


Fig.5-7

VII. Steering axle

1. General specifications

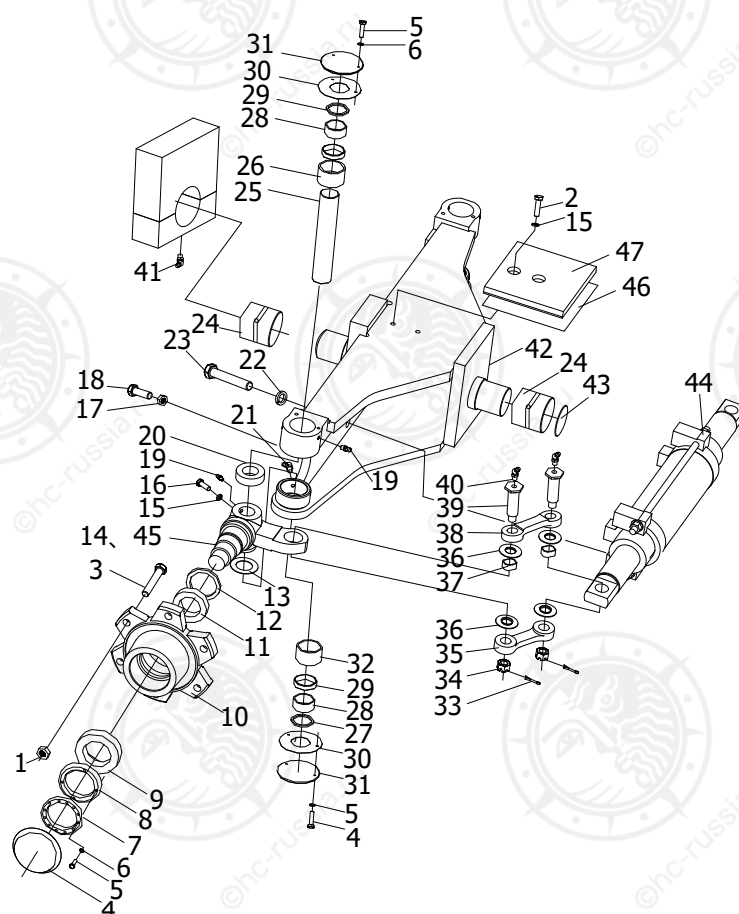
Axle body type	Center-pivoted, turn around type		
Turning angle	Inside turning angle	1-1.8t	81.5°
		2-3.8t	77.2°
	Outside turning angle	1-1.8t	57.5°
		2-3.8t	56°
Tyre pressure	1000kPa 1.0t-1.8t 860kPa 2.0t-2.5t 790kPa 3.0t-3.8t		

Axle centre	
Vertical play(mm)	0~0.5
Adjusting shim for end shaft of axle	0.5,1.0,1.6
wheel hub bearing	
Pre-tighten	Tighten steering spindle nut until drive wheel hub no longer rotates with one hand. Then loose 1/8~1/6 rotations. Or wheel hub bolt force is 10~29.8N
Axial play(mm)	Less than 0.10

2. Trouble diagnoses corrections

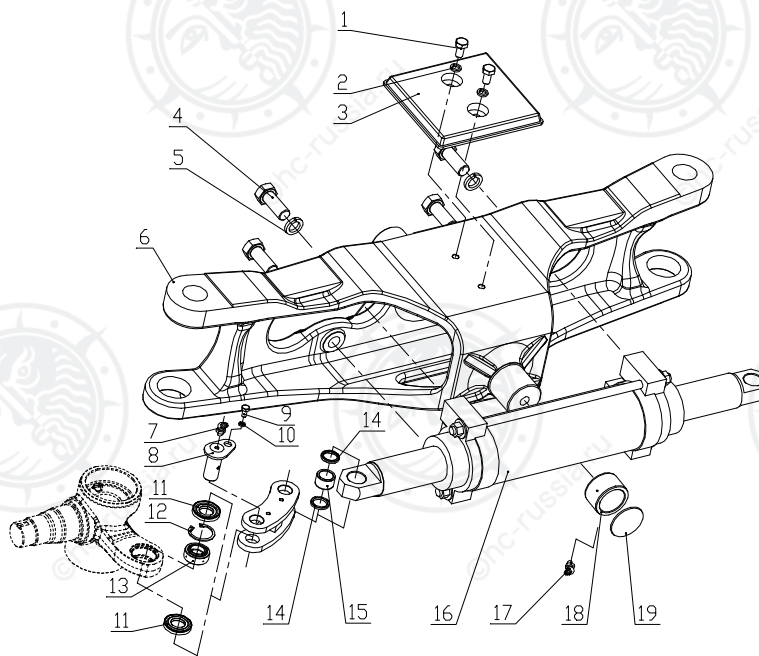
condition	Probable cause	Corrective action
Unstable driving	·loose wheel nut ·wheel bearing out of adjustment ·improperly adjusted shims. ·faulty steering system.	tighten adjust adjust refer to turning system section
Noises	·insufficient lubrication ·loose bolts and nut ·improperly adjusting shim for axle end Shaft. ·damaged joint bearing at two ends of rod.	Apply calcium grease tighten adjust replace

3. Structure



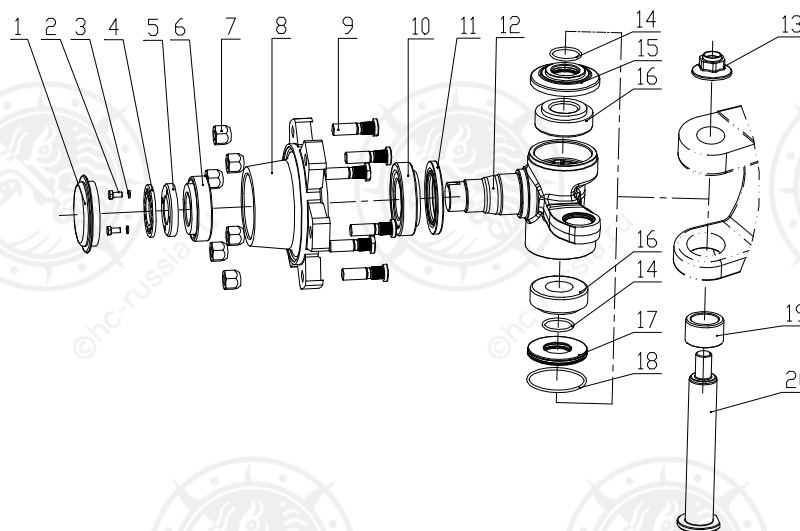
1.0t-1.8t Steering axle

1.Nut	2.Bolt	3.Bolt	4.End cover	5.Bolt M6×12	6.Washer 6
7.Washer	8.Lock nut	9.Bearing30305	10.Steering hub	11.Bearing30208	12.Oil seal
13.Adjust shim	14.Left steering knuckle	15.Washer 10	16.Screw	17.Nut	18.Bolt
19.Grease nipple	20.Bearing	21.Grease nipple	22.Washer 16	23.Bolt	24.Bush
25.Pin	26.Bush I	27.Rubber seal ring	28.Bearing	29.Oil seal II	30.Gasket
31.End cover	32.Bush I	33.Pin 3.2×40	34.Nut M14×1.5	35.Tie-rod bar	36.Washer
37.Bush II	38.Tie-rod bar	39.Pin shaft	40.Grease nipple	41.Grease nipple	42.Steering axle body, Welding
43.Adjust shim	44.Steering cylinder	45.Right steering knuckle	46.Gasket	47.Damper	



2.0t-3.5t Steering axle

- | | | | | | |
|-----------------|--------------|--------------|----------------------|-------------------|------------------|
| 1.Bolt | 2.Washer 10 | 3. Damper | 4.Bolt | 5.Washer 18 | 6.axle body |
| 7.Grease nipple | 8. Pin shaft | 9.Bolt M6×12 | 10.Washer 6 | 11.Dustproof ring | 12.Snap ring-B35 |
| 13.Bearing | 14.Oil seal | 15.Bush II | 16.Steering cylinder | 17.Grease nipple | 18.Bush |
| 19.Adjust shim | | | | | |



2.0t-3.5t Steering axle

- | | | | | | |
|-------------|-----------------|--------------|------------------|-------------|------------------------|
| 1.End cover | 2.Bolt M6×12 | 3. Washer 6 | 4.Washer | 5.Lock nut | 6.Bearing322083DC |
| 7.Nut | 8. Steering hub | 9.Bolt | 10.Bearing32103D | 11.Oil seal | 12. steering knuckle C |
| 13.Lock nut | 14.O-ring | 15.dust boot | 16..Bearing | 17.Washer | 18.O-ring |
| 19.Spacer | 20.Pin | | | | |

4. Steering axle Assembly and disassembly

Remove wheel hub

- 1) Jack up and support forklift truck body with wooden blocks.
- 2) Remove tire.
- 3) Remove hubcap.
- 4) Remove steering spindle nut.
- 5) Pull off hub assemblies.
- 6) Remove bearing inner race.

caution: a. Not to drop bearing inner race. b. Be careful not to damage oil seal.

5. Kingpin and steering spindle.

- 1) Remove rod.
- 2) Loose lock bolts.(see fig.6-2);
- 3) Remove grease nipples on kingpin.
- 4) Remove kingpin.

caution: Hold kingpin to prevent it from dropping. (See fig.6-3).

- 5) Take off spindle, thrust bearing and shim.

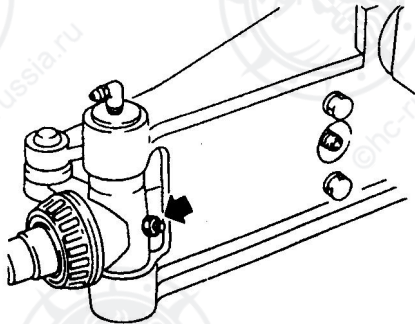


Fig. 6-2

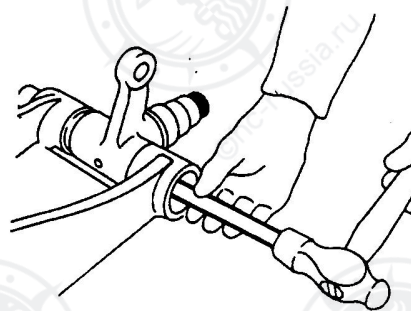


Fig. 6-3

INSPECTION:

- 1). Replace spindle if cracked.
- 2). Replace bearing if its rollers or roller surfaces are rusted or nicked.
- 3). Replace steel sleeve if it distortion, out of round, cracked.
- 4). Replace thrust bearing and dust cap if them damaged.

Installation

To install, reverse the order of removal. Careful observes the following.

- 1) Always insert kingpin from lower side.
- 2) Install thrust bearing, set the tighten-ring below the support and loosen-ring. Pack all grease between dust proof inside, loosen-ring, and tighten-ring.
- 3) Adjust axial play to specification with shims. Axial plays less than 0.15mm.
- 4) The character of seal tape faces outside. Apple grease to roller of roller bearing, also apply grease between lip and groove of seal tape.
- 5) Pack all grease nipples with a sufficient of grease.

6. Wheel bearing adjustment

- 1) Slowly rotate hub. Tighten steering spindle nut until it can no longer be rotated with one hand.
- 2) From that position, turn back steering spindle nut $1/6 \sim 1/4$ rotation. Measure hub bolt force is 10N~30N.
- 3) Make sure that hub rotates smoothly and that its axial play is within specification. Axial play is less than 0.10mm.

7. Steering cylinder

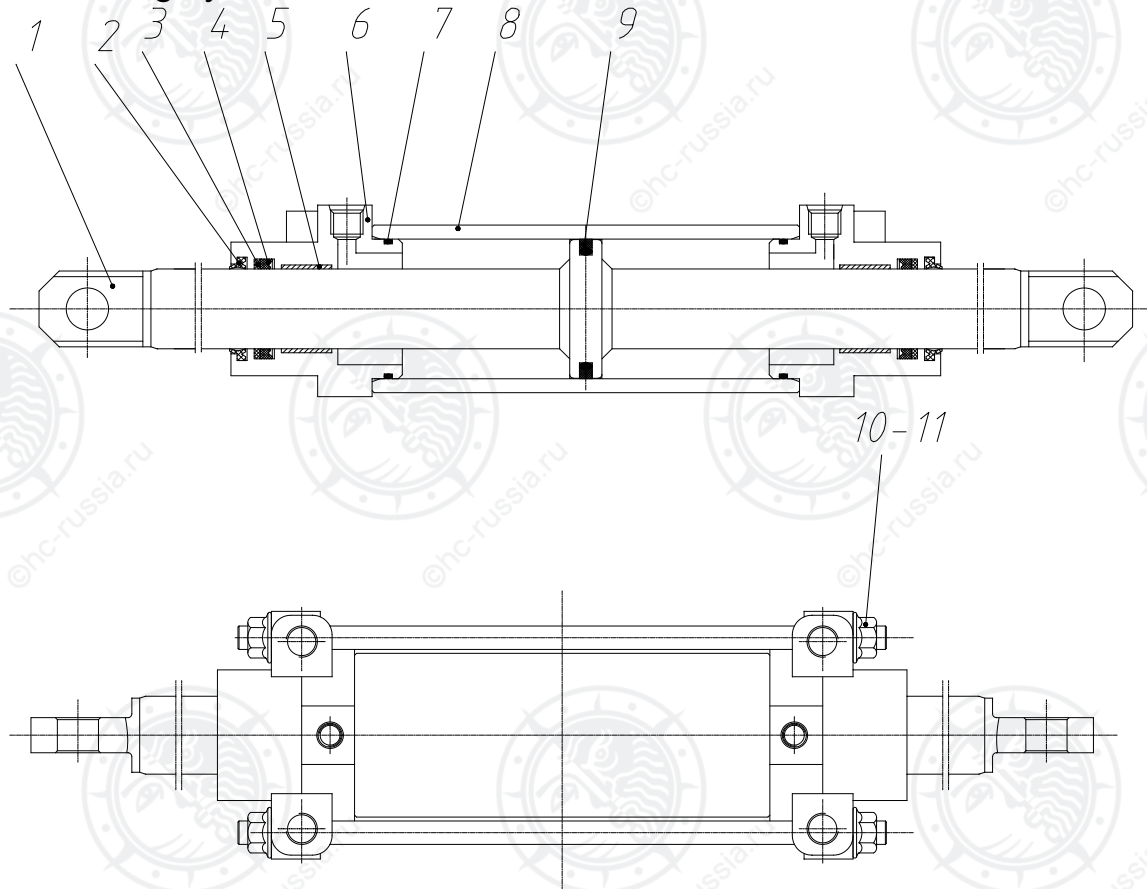


Fig. 6-4

- | | | | | |
|-----------------|------------------|-------------------|--------------------|---------------------|
| 1. Piston rod | 2. LBH dust ring | 3. Protect ring | 4. ISI gasket ring | 5. Compound bushing |
| 6. Guide sleeve | 7. O-ring | 8. Steel cylinder | 9. Glyd ring | 10. Screw |
| | | | | 11. Nut |

Disassemble:

- 1) Loose nut 10, remove bolt 11;
- 2) Remove guide sleeve 6 at left and right side;
- 3) Remove LBH dust ring 2, protect ring 3, LSI gasket ring, compound bushing 5, O-ring 8 in turn;
- 4) Remove piston rod, remove glyd ring 9;
- 5) Inspecting: if any component is damaged, please replace.

To install, reverse the order of removal.

Careful observes the following:

- 6) Lubricate every component with clean hydraulic oil.
- 7) Prevent dust , oil dirty entering cylinder.
- 8) Prevent causing woolly grain at cylinder port , inlet and outlet.
- 9) ISI seal lip direct to inside, LBH dust proof port direct to outside.
- 10) Pay attention to avoiding scratch O-ring at outside circle when installing.
- 11) Carefully center, push guide sleeve into cylinder, pay attention to avoid scratch O-ring at outside and inside circle when installing.
- 12) Please wipe the same trademark hydraulic oil to lubricate between gasket ring.

VIII. Steering system

1. Data

Steering system type		Change direction rear wheel with power steering	
		2t、2.5t、3t、3.5t、3.8t	1.0t、1.5t、1.8t
cycloidal rotor full hydrostatic power steering gear	Model	532-1323	532-1322
	Displacement ml/r	123	100
	Type of connection	Inner spline	Inner spline
	Features	Open center ,low torque	Open center ,low torque
Steering cylinder	Cylinder diameter mm	Φ80	Φ70
	Piston diameter mm	Φ50	Φ40
	stroke mm	188	166
Wheel diameter mm		Φ360	Φ300

2. Trouble diagnoses

condition	Probable cause	Corrective action
Failure to rotate steering wheel	Damaged or trouble of oil pump	replace
	Divide valve is clogged or damaged.	Clean or replace
	Damaged hose or connector, block lines	Replace or clean
High effort for steering	Divide valve pressure too low.	Adjust pressure.
	Air in oil lines.	Remove air
	The steering fails to turn to its natural position, broken lock spring or insufficient spring pressure	Replace spring flat
	Too much internal leakage in steering cylinder.	Check piston for sealing
Track travel zigzag or wobbly	Too much oil flow to steering cylinder.	Adjust divide value.
normal noise	Oil is not sufficient in oil tank.	Add oil.
	Suction piping or filter clogged.	Clean or replace
leakage	Damaged sealing of oriented bush of steering cylinder or hose or connector.	replace

3. Summarize

Steering system is composed of full hydrostatic power steering gear and steering cylinder.

3.1 Full hydrostatic power steering gear assemble(refer to Fig.8-1)

Full hydrostatic power steering gear assemble include cyclical full hydrostatic power steering gear, column and steering wheel. Column and steering wheel can be adjust 6°back or forth to fit all driver.

When engine stops running, rotate steering wheel with 1kg force slightly, after leaving hands, steering wheel should be return 10° auto backing boardically.

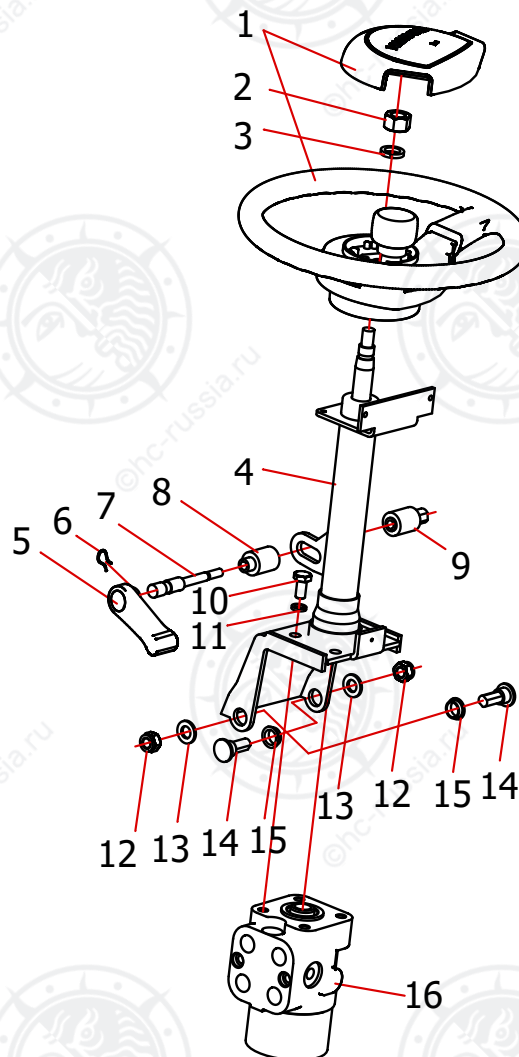


Fig. 7-1 steering wheel

- | | | | | | |
|------------------------|------------------|-------------------|-------------------------|----------------|---------------|
| 1. Steering wheel assy | 2. Nut | 3. Washer 16 | 4. Steering pipe device | 5. Lock Handle | 6. Snap ring |
| 7. Lock shaft | 8. Lock sleeve I | 9. Lock sleeve II | 10. Bolt M10×20 | 11. Washer 10 | 12. Washer 12 |
| 13. Washer 12 | 14. Bolt | 15. Spacer | 16. Orbitrol | | |

3.2 Full hydrostatic power steering gear

3.2.1 cycloidal rotor full hydrostatic power steering gear (refer to Fig.7-2-1)

When power steering ,pressure oil flows from valve disk and valve sleeve pair , then drive rotary to rotate followed as steering wheel, and drive oil entering into left or right cavity of cylinder, and drive steering tire to turn by piston rod .

When the engine stops running, the pump does not supply oil, and the steering action will be realized manually by turning the steering wheel to move valve spool, valve guide, coupling block , and to actuate he rotor to feed oil into steering cylinder, in this case, rotor and stator act as a hand pump, making manual steering possible.

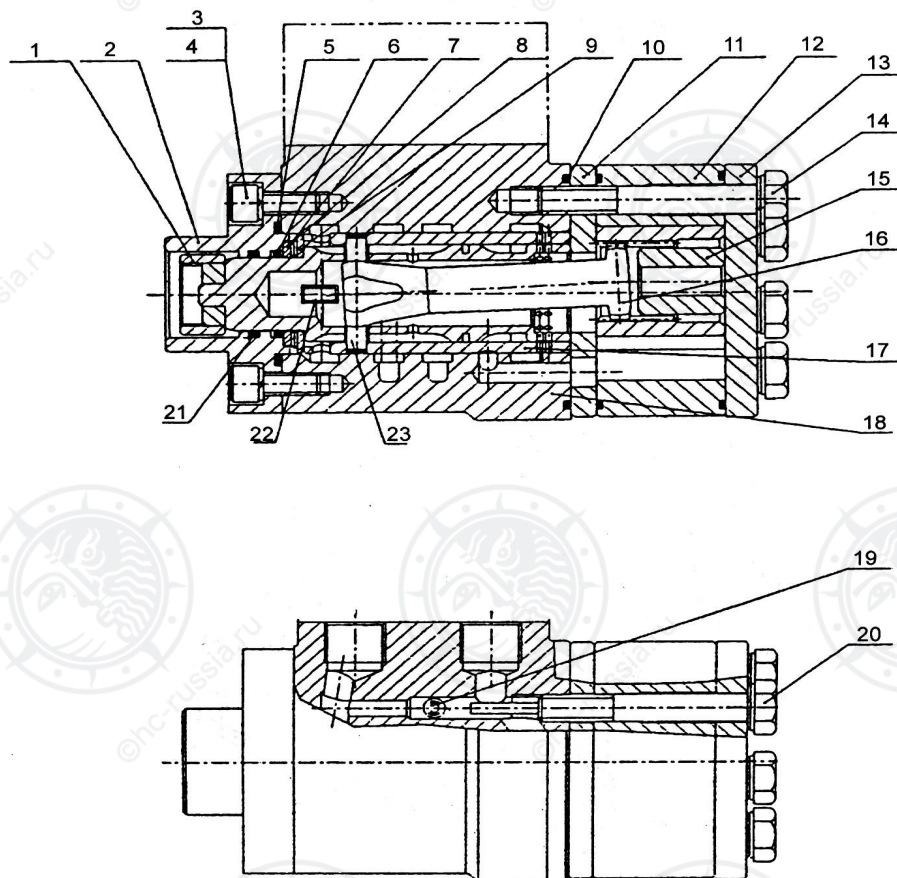


Fig. 7-2-1 cycloidal rotor full hydrostatic power steering gear

- | | | |
|--|----------------------------------|------------------------|
| 4. Connected block (inner spline connection ,none) | 2. Front cover | 3. Screw |
| 4. Spring | 5. O-ring | 6. X-ring |
| 7. Stop ring | 8. Thrust bearing | 9. Slip ring |
| 10. O-ring | 11. diaphragm | 12. Rotary-stator pari |
| 13. Rear cover | 14. Bolt | 15. Stop block |
| 16. Couple axle | 17. Valve disk valve sleeve pair | 18. Shell |
| 19. Steel ball | 20. Stop bolt | |

3.2.2 Load sensing type hydraulic steering gear (refer to Fig.7-2-2)

This hydraulic steering gear is load sensing type. There is a LS mouth in the steering gear connected to priority valve that makes steering load pressure signal transmit to priority valve through oil pipe, which controls the oil quantity supplied to the steering gear. In the load sensing type steering system, whatever load pressure or steering wheel speed, it can prioritize corresponding flow according to oil line requirement, and guarantees the steering reliable, sensitive and light.

Besides the needed oil pump output flow to the steering system, the rest one is supplied to working oil line, thus eliminates power loss from over oil supply to steering oil line, and improves system efficiency.

When the power steering is working, pressure oil flows into rotor and stator pair through valve element and valve pocket pair, and to drive rotor to rotate along with steering wheel, and push oil into left and right chamber of steering cylinder, and piston rod pushes steering tires to steer.

When the engine stops running, the pump does not supply oil, and the steering action will be realized manually by turning the steering wheel to move valve element, valve pocket, coupling, and to actuate the rotor to feed oil into steering cylinder, in this case, rotor and stator act as a oil pump.

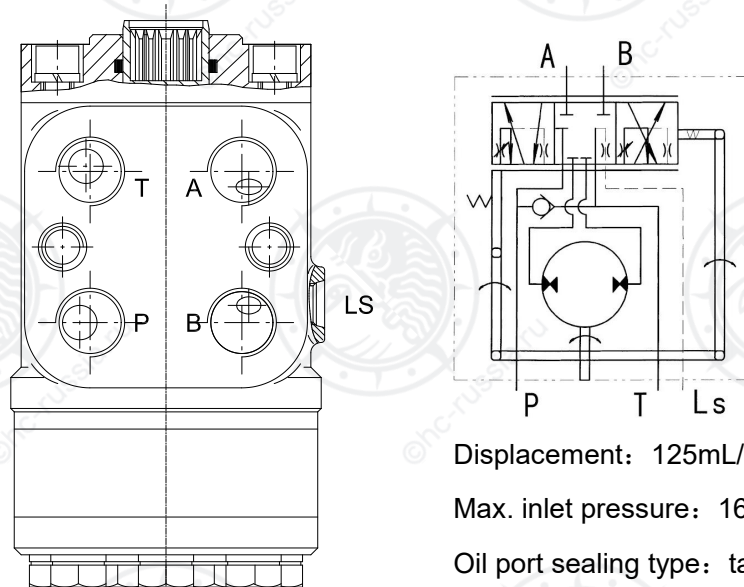


Fig.7-2-2 Hydraulic steering gear schematic diagram

3.3 Steering cylinder

Steering cylinder is of double-acting piston type. The two end of piston is connected with steering spindle through rod. The pressure oil from full hydrostatic power steering gear makes piston rod to move left and right so as to turn truck lift and right.

Structure and maintenance, please see front part drive axle.

4. Install steering system

Careful observe the following:

- 3) Hydraulic tie-in, blots and piping must be cleaned while installing.
- 4) Check oil lines arrangement for properness, whether it is reverse order of steering direction or not, refer to steering system .
- 5) Steer wheel to end left and right to make sure whether it is equably of steering force and smooth of steering.
- 6) Jack up rear wheel and steer slowing wheel left and right and repeat it. Bleed air of hydraulic lines and cylinder.

When engine stops running, rotate steering wheel with 1kg force slightly, after leaving hands, steering wheel should be return 10° autobacking boardically.

IX. Brake system

1. Trouble and diagnoses and corrections

condition	Probable cause	Corrective action
Insufficient brake force	·Oil leakage in brake lines. ·Air in brake lines. ·Water or oil on linings. ·Uneven wear or contact of brake linings. ·Improper functioning of master cylinder or wheel cylinder. ·Clogged oil lines.	Correct and replenish. Bleed air. Clean or replace. Grind or replace. Correct or replace. Clean.
Unequal braking (forklift truck veers to one side)	·Uneven tire pressure. ·Brake out of adjustment. ·Water or oil on brake linings. ·Foreign particles in brake drum. ·Deteriorated lining surface. ·Improper contact of linings. ·Worn lining. ·Worn, warped, rusted or damaged brake drums. ·Improper operation of wheel cylinder. ·Improper sliding shoes. ·Loose back plate blots. ·Warped back plates. ·Improperly adjusted wheel bearing. ·Clogged oil lines.	Adjust. Adjust. Clean or replace. Clean. Grind or replace. Grind or correct. Replace. Correct or replace. Correct or replace. Adjust. Tighten or replace. Replace. Adjust or replace. Clean.
Brake dragging	·No free play of brake pedal. ·Improper shoe sliding. ·Improper operation of wheel cylinder. ·Faulty piston cup. ·Weak or broken return springs. ·Clogged master cylinder returns port. ·Clogged oil lines. ·Wheel bearing out of adjusting.	Adjust. Adjust. Adjust or replace. Replace. Replace. Clean. Clean. Adjust or replace.
Brake noise.	·Lining surface harden or foreign particles on it. ·Warped back plates or loosed blots. ·Brake shoes warped or improper install. ·Worn linings. ·Loose wheel bearing.	Repair or replace. Repair or replace. Repair or replace. Replace. Repair.

2. Summary

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

2.1 master cylinder

The 2t-3.8t master cylinder contains a valve seat, check valve, return spring, primary cup, piston and secondary cup, which are kept in place with stop washer and 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. First, as the brake pedal, the push rod pushes the piston forwards. The brake fluid in the cylinder flows back to the reserve tank through the return port until the primary cup blocks up the return port. After the primary cup passes the return port, the brake fluid in the cylinder is pressurized and opens the check valve, flowing through the brake lines to the wheel cylinder. Thus, each wheel cylinder piston is forced outwards. This brings the brake shoes into contact with the wheel drum and slows or stops the lift truck.. Meanwhile, the cavity caused behind the piston is filled with brake fluid led through the return port and inlet port to lubricate the piston. When the brake pedal is released, the piston is forced back by the return spring. At the same time, the brake fluid in each wheel cylinder is pressurized by the force of the brake shoe return spring, thus returning into the master through the check valve. With the piston in its original position, the fluid in the cylinder flows into the reserve tank through the return port. The brake fluid in the brake lines and wheel cylinders has a residual pressure proportioned (about 0.04MPa) to the set pressure of the check valve, which makes each wheel cylinder piston cup securely seated to prevent oil leakage and eliminates of vapor lock developing when the lift truck is sharply braked.

Brake principle of brake master cylinder of 1t-1.8t forklift is similar.

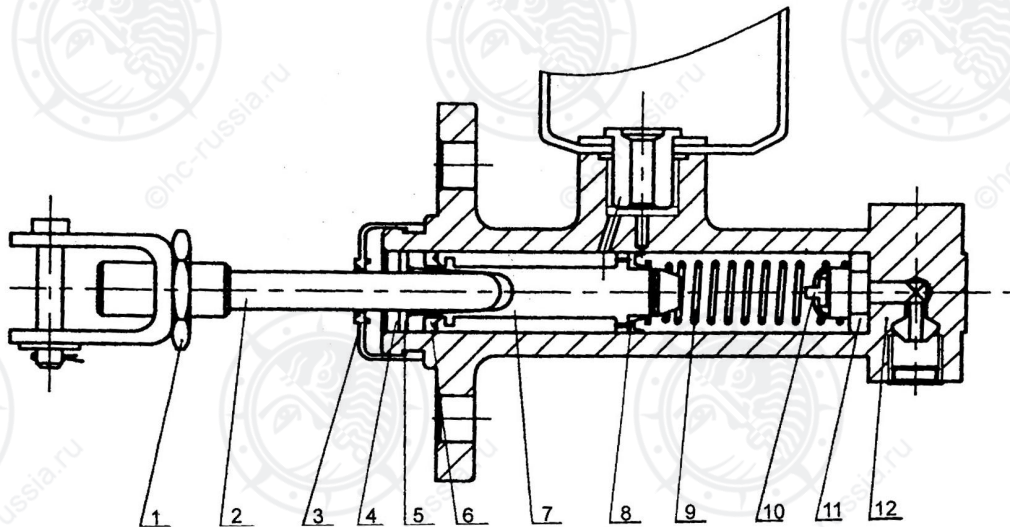


Fig. 8-1 Master cylinder

- | | | | | | |
|-------------|-------------|---------------|---------------------|----------------|-------------------|
| 1. Lock nut | 2. Rod | 3. Duct cover | 4. Light spring | 5. Gasket ring | 6. Primary cup |
| 7. Piston | 8. main cup | 9. Spring | 10. Raffinate valve | 11. Valve seat | 12. Cylinder body |

2.2 Brake

1t-1.8t ,3t-3.8t forklift right hand structure, please see fig. 9-2, 2t-2.5t structure of forklift hand brake is similar to 3t-3.5t.

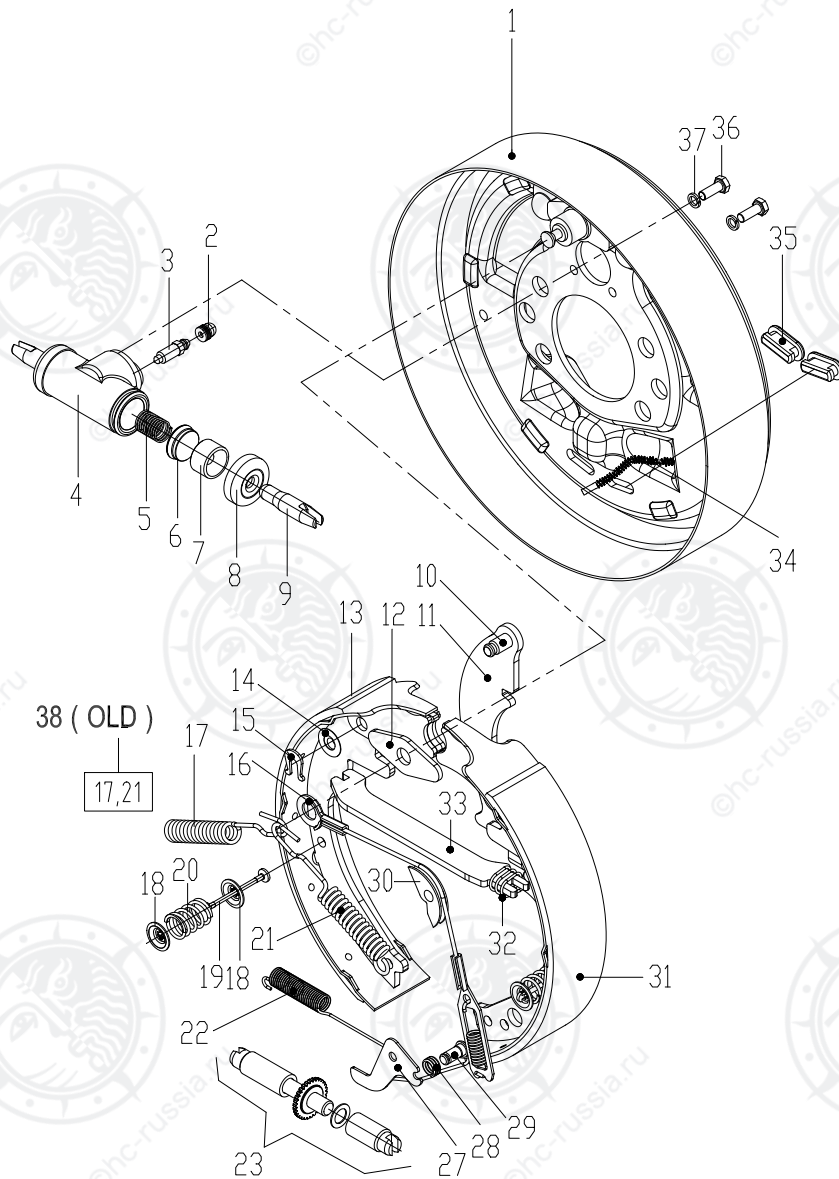


Fig. 8-2 1t~1.8t,3t~3.5t forklift truck right brake

1.Brake assy	2. Cap bleader	3. Screw,Bleader	4.Cylinder
5.Spring	6.Cup	7. Piston	8.Boots
9.Link,Conneeding	10.Pin	11.Brake lever	12.Plate,Shoe guide
13.Brake shoe	14.Elastic gasket	15. Retainer	16. Spring&fitting assy
17.Spring shoe	18. Cup,Shoe hold hown	19.Pin,Shoe hold down	20.Spring,Shoe hold down
21.Spring shoe, Rear left	22.Spring	23.Adjuster	27.Lever
28.Spring	29.Spring Pin	30.Guide,cable	31.Brake shoe
32.Spring, push rod	33.Push rod, Hand brake	34.Cable,Control	35.Plug,Rubber
36.Bolt M6×16	37.Washer 6	38.Spring shoe	

2.3 Replace brake shoe:

- 1) Place the forklift truck on level concrete.
- 2) Start engine and raise carriage about 100mm.
- 3) Place chocks behind rear wheels to prevent movement of forklift truck.
- 4) Loosen wheel nuts two or three turns each.
- 5) Tilt mast fully backward, and place a wooden block under each side of outer mast.



WARNING:

Do not allow wooden blocks to touch front tires.

- 6) Tilt mast forward until front tires are raised from surface.
- 7) Support forklift truck by putting additional wooden blocks under each side of front-end frame.
- 8) Stop engine.
- 9) Remove wheel tire nuts and brake drum. Remove half-shaft, lock nut, and washer.
- 10) Remove wheel hub and brake drum.
- 11) Replace brake shoes with new ones.
- 12) Install brake drum.
- 13) Adjust shoe to drum clearance: rotate wheel counterclockwise and at the time press down brake pedal several times.
- 14) Take out every padding block: take out according to reverse procedures when inserting.
- 15) Make sure no person or obstacle is around forklift, then operate forklift in reverse at 2km/h to 3km/h, set foot on brake pedal 2~3 times.

16)

2.4 Hand brake device

The hand brake device adopts a hand-pulling soft brake wire cable device. It makes use of auto-assist pressure linings type brake together with foot brake. Only when parking truck, use the hand brake. If it occurs for foot brake malfunction, use hand brake to stop the truck.

Make sure that drive system is working normally before adjusting hand brake.

- 1) Adjust nut B to make the length L is 15.5mm, and then lock nut A
- 2) Adjust nut A to adjust hand brake pull force, the pull force of point P in Q direction is in the range of 15kg~20kg when locking hand lever.
- 3) When the handle is locked, ensure that the E is not tilted. (The difference between S1 and S2 is less than 2mm); (Details refer to the view V)。
- 4) When the hand brake pull rod is in the locked position, the support of the brake cable can not be tilted. If there is a tilt phenomenon, then re adjust the length of the L.
- 5) Make sure hand brake device work normally.

Notice: wipe lithium lubricating grease on guide rail C, and do it usually.

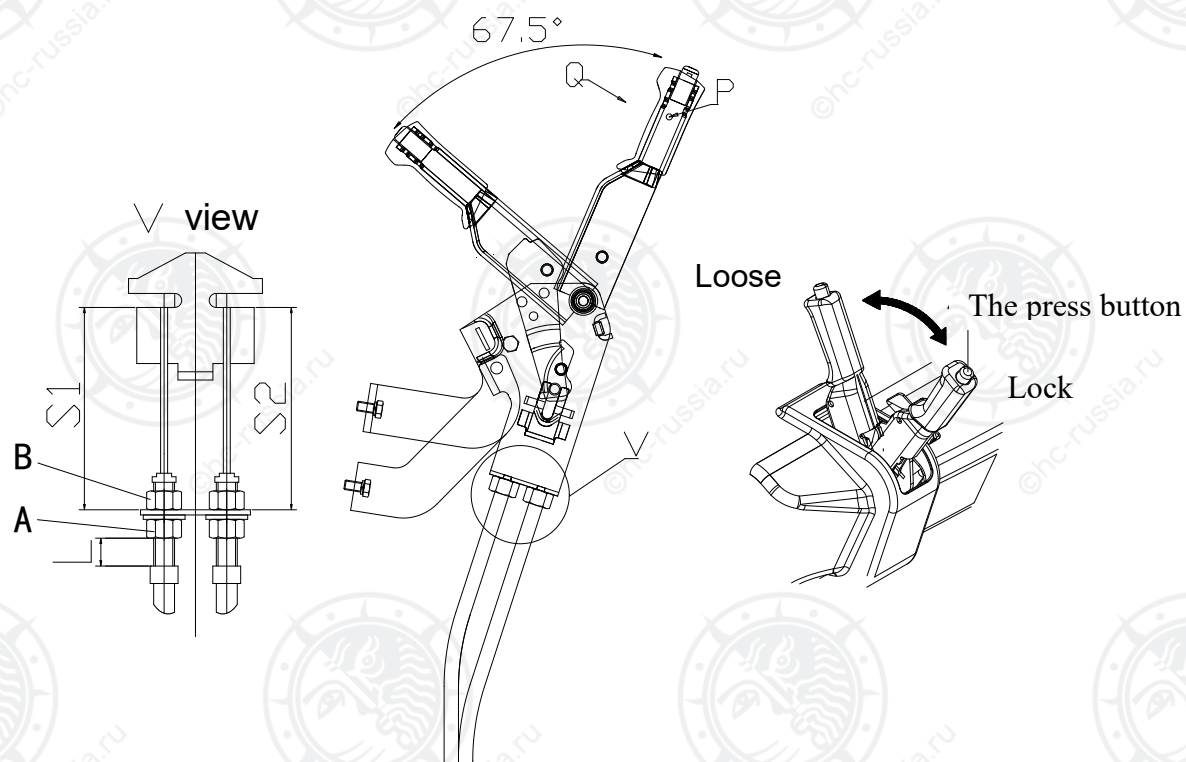


Fig. 8-3 hand brake

3 . Brake schematic

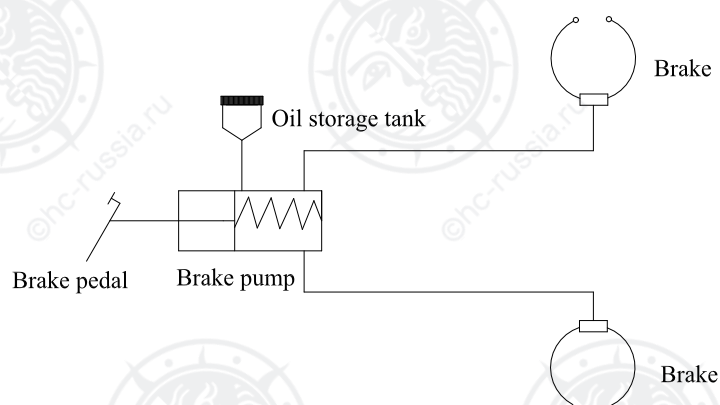


Fig. 8-4 Brake schematic

X.Hydraulic system

1. Data

Main pump

1t-1.8t

type	gear
driving	Engine power take off type: gear
displacement(ml/r)	25
speed(r/min)	500~3000, 400~3500, 500~3000
Output pressure (Rated/Max.)MPa	20/25

2t-3.8t

2t -3.8t

type	gear
driving	Engine power take off type: gear
displacement(ml/r)	26.5, 28.2, 30, 34
speed(r/min)	400~3500
Output pressure (Rated/Max.)MPa	20/25

Control valve

1t-1.8t

Nominal pressure	20MPa
Rated flow	65L/min
Main relief valve setting pressure	1.0t: 13MPa, 1.5t: 15.5MPa, 1.8t: 18.5MPa
Steering relief valve setting pressure	8.8±0.25 MPa
Overload valve setting pressure	16±0.25 MPa
Single stable shunt valve	12 L/min ~14L/min

2t-3.8t

Nominal pressure	20MPa
Rated flow	65L/min
Main relief valve setting pressure	18.5±0.25 MPa
Steering relief valve setting pressure	8.8±0.25 MPa
Overload valve setting pressure	16±0.25 MPa
Single stable shunt valve	12 L/min ~14L/min

2. Trouble diagnoses and corrections

Main pump

trouble	Probable cause	Corrective action
No oil from oil pump	Low oil level in tank.	Add oil to specified level.
	Clogged suction pipe or strainer.	Clean oil line and tank. If oil is dirty, change.
Low discharge pressure on oil pump.	Worn bearing, damaged backup ring and O-ring.	Replace faulty parts.
	Maladjusted relief valve.	Readjust to specified pressure using pressure gauge.

trouble	Probable cause	Corrective action
	Air in oil pump.	Retighten suction side pipe. Add oil in oil tank. Check pumps oil seal. Do not operate pump until bubbles in tank disappear.
Noisy oil pump	Cavitation due to crushed suction hose or clogged strainer.	Adjust or replace crushed hose and clean strainer.
	Air being sucked from loose suction side joint.	Retighten each joint.
	Cavitation due to too high oil viscosity.	·replace with new oil having proper viscosity for temperature at which pump is to be operate. ·to operate when oil temperature is normal.
	Bubbles in hydraulic oil.	Determine cause of bubbles and remedy.
Oil leaking from oil pump	Faulty oil seal on pump, faulty O-ring or worn sliding surfaces on pump.	Replace faulty parts.

Control valve

Trouble	Probable cause	Corrective action
Pressure of relief valve is not steady or too low.	Loose of pressure-adjust screw.	Readjusted and retighten.
	Distorted or damaged pressure-adjust spring.	Replace.
	Worn or blocked relief valve core.	Replace or clean.
	Pump abated.	Examine and repair pump.
Fork tilt forward when control lever is used while engine is off.	Worn or damaged tilt lock valve.	Replace valve core and tilt lock valve as an assembly.
	Broken tilt locks spring.	Replace spring.
	Damaged tilt valve plunger O-ring.	Replace O-ring.
Mast is unstable when tilting forward.	Malfunctioning tilt relief valve.	Replace tilt relief valve assembly.
Lowering	Valve body and spool valve is	Replace spool valve with

distance of mast is big when spool valve is in the centre.	worn and clearance between them is too great.	specified clearance.
	Spool valve is not in centre.	Keep being in the centre.
	Cylinder seal abated.	Examine and repair cylinder.
	Taper valve is worn or blocked by dirt.	Replace or clean taper valve.
Spool valve is not return neutral position.	Damaged or distorted reposition-spring.	Replace spring.
	Dirt exist between valve body and spool valve.	Clean.
	Blocked control device.	Adjusted.
	Not coaxial parts at reposition	Reinstall., be coaxial
Leakage	Damaged O-ring.	Replace.
	Faulty seal of joint.	Check and retighten.
	Loose seal plate.	Clean seal plate and retighten bolts.
	Loosed lock-nut of relief valve and connect-nut between plate and plate.	Tighten.

3. Main pump

3.1 W21 main pump

1-1.8t **W21** main pump is a gear type consisting of a pump body, pump cover, a pair of gear, bearing and seal ring. This pump uses pressure-balance type bearing and a special lubrication method so as to get the minimum clearance of the gear flank.

Since the pump body and cover are made of aluminum alloy, they are light and rigid. The drive gear and driven gear are integrated with their respective shafts, which are held against the pump body with bearing. The bearing, made of special material, serves both as bearing for each shaft and as side plates for the gear flank.

At the drive shaft side, an oil seal is press-fitted into the pump body to provide oil tightness performance. Oil tightness between pump body and pump cover is secured with a packing of a special shape.

Main pump maintenance remove (refer to Fig.9-1)

f. Hold the pump in a vice lightly and remove blot 12.

- g. Remove pumps cover 1 and remove seals 8, 9, 10 and 11.
- h. Remove forward end-cover 7, 8, 9, 10 and 11.
- i. Remove bearing 3, 4 and gear 5, 6 from pump body 2. If remove bearing difficult, you can press gear.
- j. For the convenience of correct reassemble, it is to put the disassembled parts as shown in Figs.9-1.

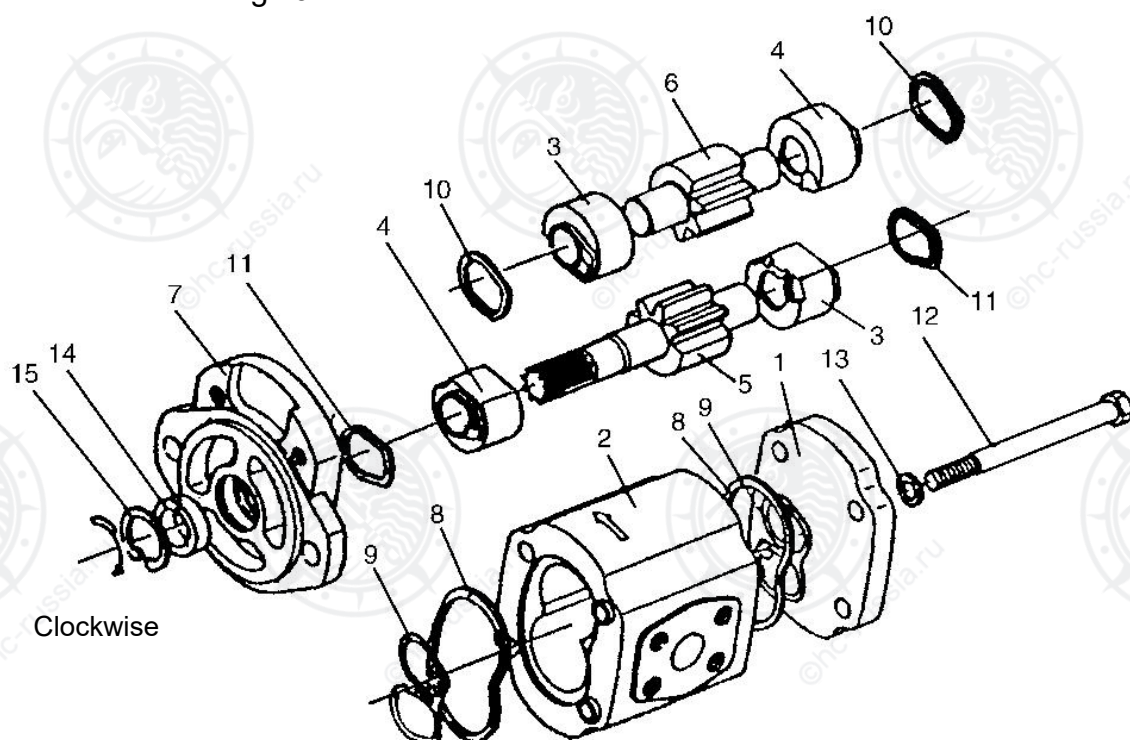


Fig. 9-1 clockwise gear pump

1. End cover	2. Gear plate	3. Bearing	4. Bearing	5. Driving gear
6. Driven gear	7. Front end cover	8. Seal ring	9. Seal ring	10. Seal ring
11. Seal ring	12. Bolt	13. Lock washer	14. Oil seal	15. Snap ring

3.2 2t-3.8t main pump

2t-3.8t hydraulic system adopts CBHZG model gear pump. Gear pump CBHZG is an external gear pump with axial interval self-compensation and radial hydraulic balance. By using special structure, low noise comparing with those in symmetry. backing boarderials used in the parts effectively improve the performance and make it reliable, i.g, DU sleeve in bearing, double metal backing boarderial of side plate, AL. alloy die casting of front and rear cover, extruding AL. alloy of middle section, etc.

CHBZG left rotation see fig. 9-2, right rotation see fig. 9-3. The difference of counter-clockwise and clockwise pump is 3 shape backing plate. The direction of them is different.

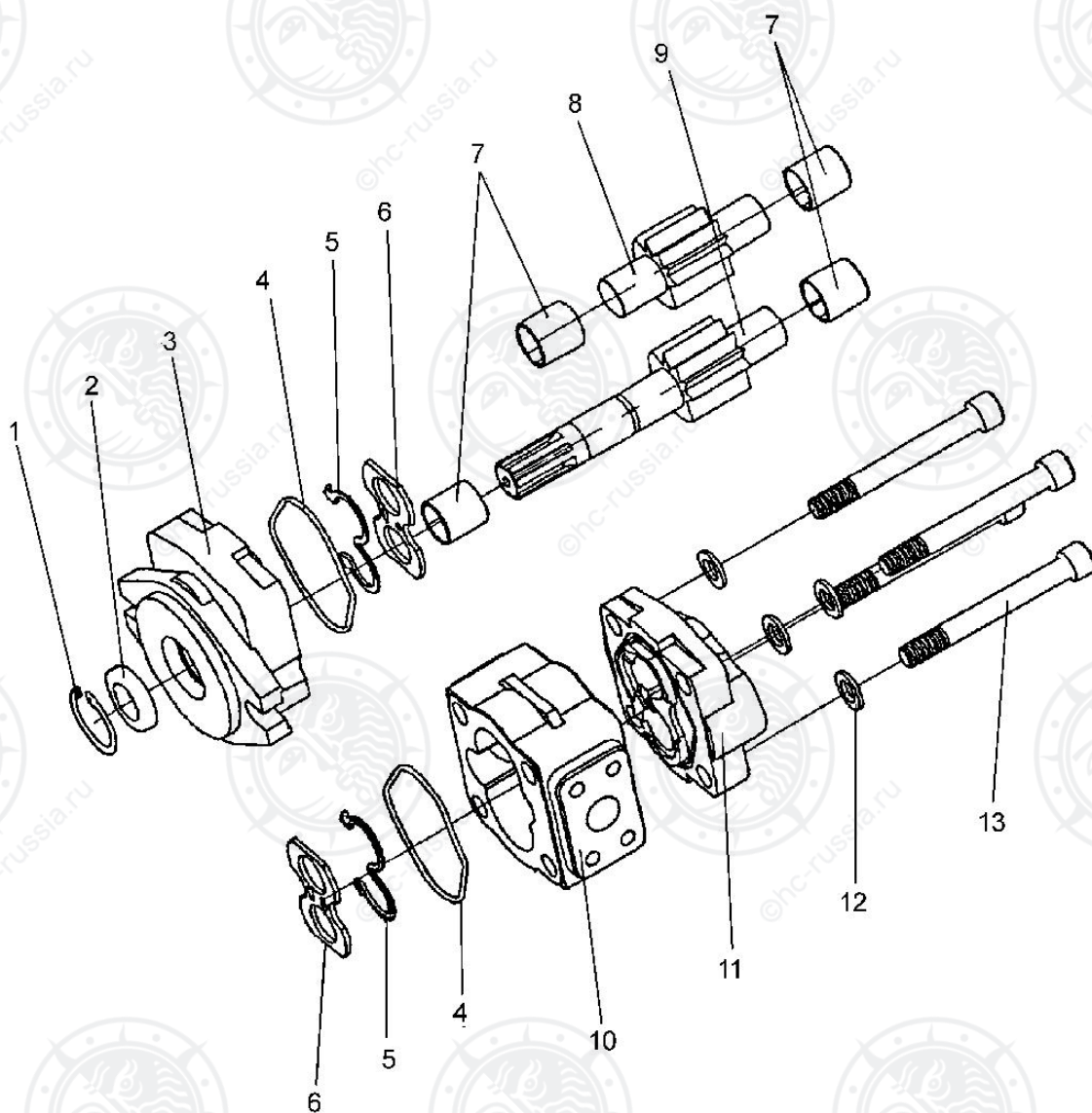


Fig. 9-2CBHZG counterclockWise rotation gear pump (left)

- | | | | |
|--------------------------|-------------------|--------------------|----------------|
| 1. Snap ring | 2. Oil seal | 3. Mounting flange | 4. Seal plate |
| 5. 3 shape backing plate | 6. Pressure plate | 7. Bush | 8. Driven gear |
| 9. Drive gear | 10. Gear plate | 11. End cover | |
| 12. Washer | 13. Mounting bolt | | |

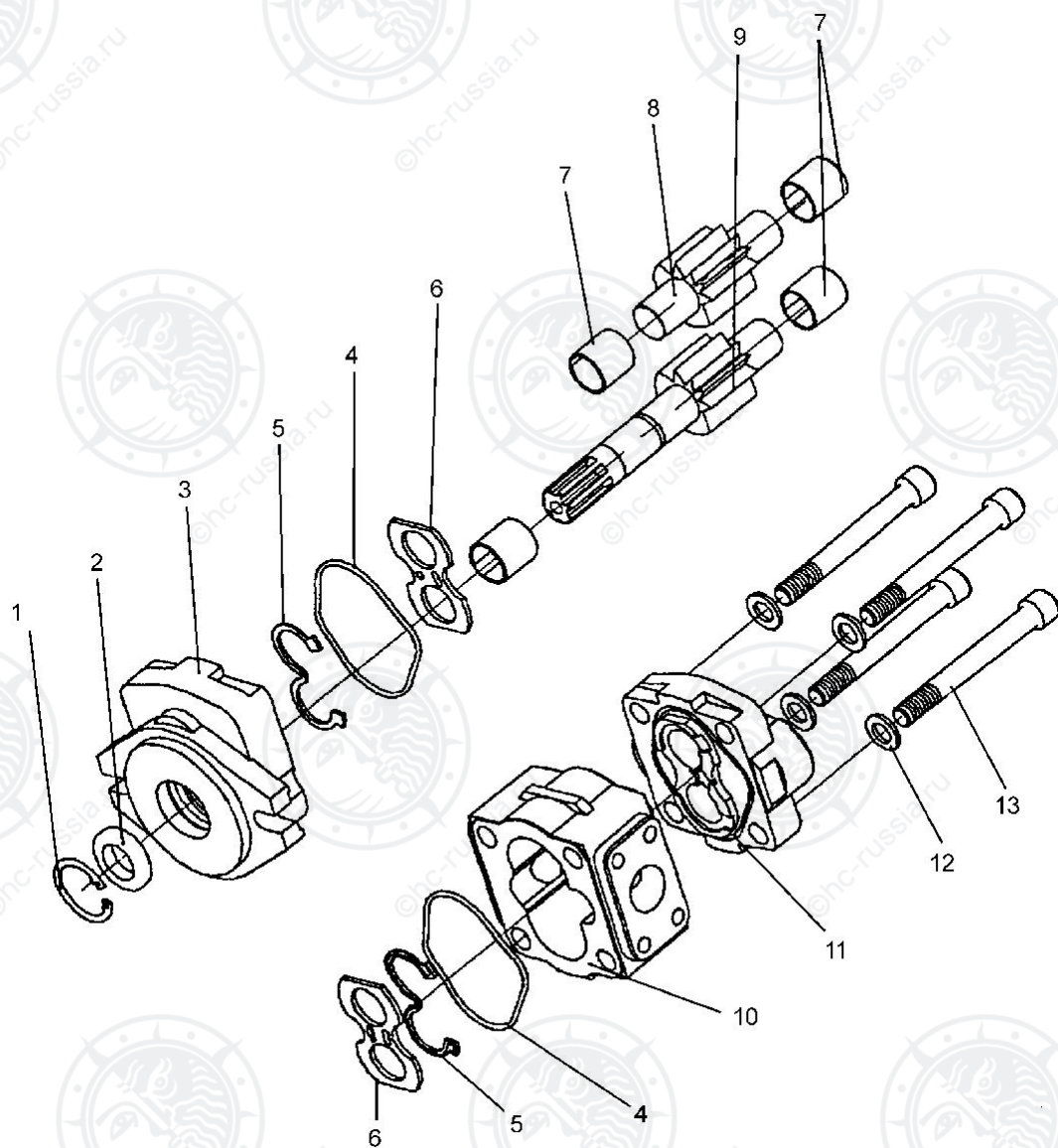


Fig. 9-3CBHZG clockwise (Right) rotation gear pump

- | | | | |
|--------------------------|-------------------|--------------------|----------------|
| 1. Snap ring | 2. Oil seal | 3. Mounting flange | 4. Seal plate |
| 5. 3 shape backing plate | 6. Pressure plate | 7. Bush | 8. Driven gear |
| 9. Drive gear | 10. Gear plate | 11. End cover | |
| 12. Washer | 13. Mounting bolt | | |

4. Control valve

Two pieces type control valve consists of four pieces of valve body, two plungers, a relief valve and a divided valve. Four pieces of valve body are assembled with three bolts and nuts. Tilting plunger is fitted by tilting lock-self valve. According to requirement of work device, it is capable to add combined lock valve and rotating valve.

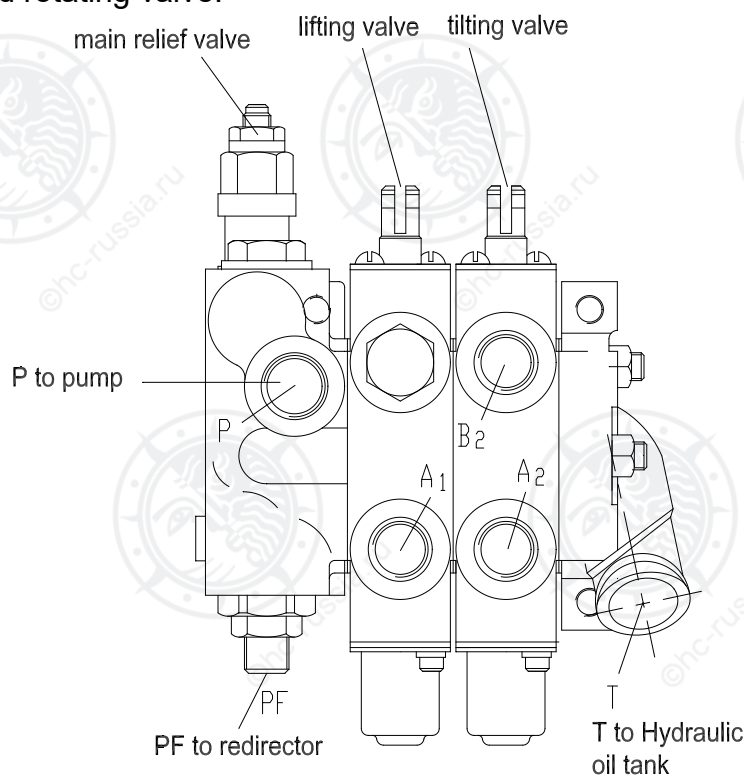


Fig.9-4-1 Control valve for 1t~3.5t forklift truck(for cycloidal rotor full hydrostatic power steering gear)

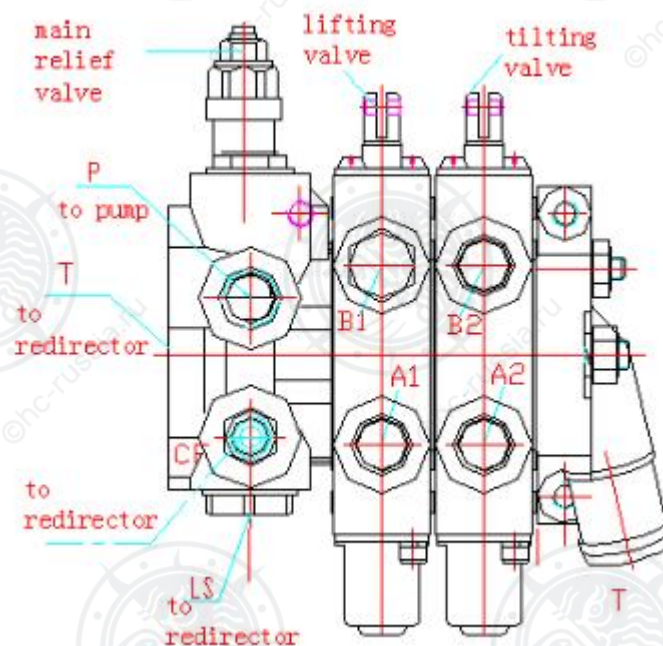


Fig.9-4-1 Control valve for 1t~3.5t forklift truck(Load sensing type hydraulic steering gear)

4.1 Main relief valve and flow dividing valve

Main relief overflow valve is consisting of main valve A and guide valve B. When shifting of control valve, C house connects with high pressure oil of working mechanism (lifting cylinder, tilting cylinder). By fixing throttle hole D and E, pressure oil acts on guide valve B. When oil pressure of lines is higher than setting pressure of oil lines, guide valve B opens to low oil pressure of F house and main valve spool A moves right to connect pressure oil to low pressure lines G and C house unload. To ensure stability of oil pressure of lines, adjusting screw H can adjust stable pressure valve of whole lines.

The structure of dividing valve is simple which is straight-move type overflow. Using the principle that liquid pressure balance with spring pressure to decide stable pressure value of steering system. When operating steering wheel, house M connects with high pressure oil lines. In that case, when line pressure is higher than spring pressure, valve spool N move right and pressure oil connects with lower pressure line by T house to unload M house. To ensure stability of steering system, adjusting screw K can adjusting stable value of whole system.

L valve is balance spool, by constant changing of flow volume and oil pressure, spool L moves left and right so as to not alter the opening of R A and S to ensure flow volume between entering working house Q and exit PS and

full hydrostatic power steering gear balances automatically and divide liquid stable pro rata. A, b and c are fixing throttle hole.

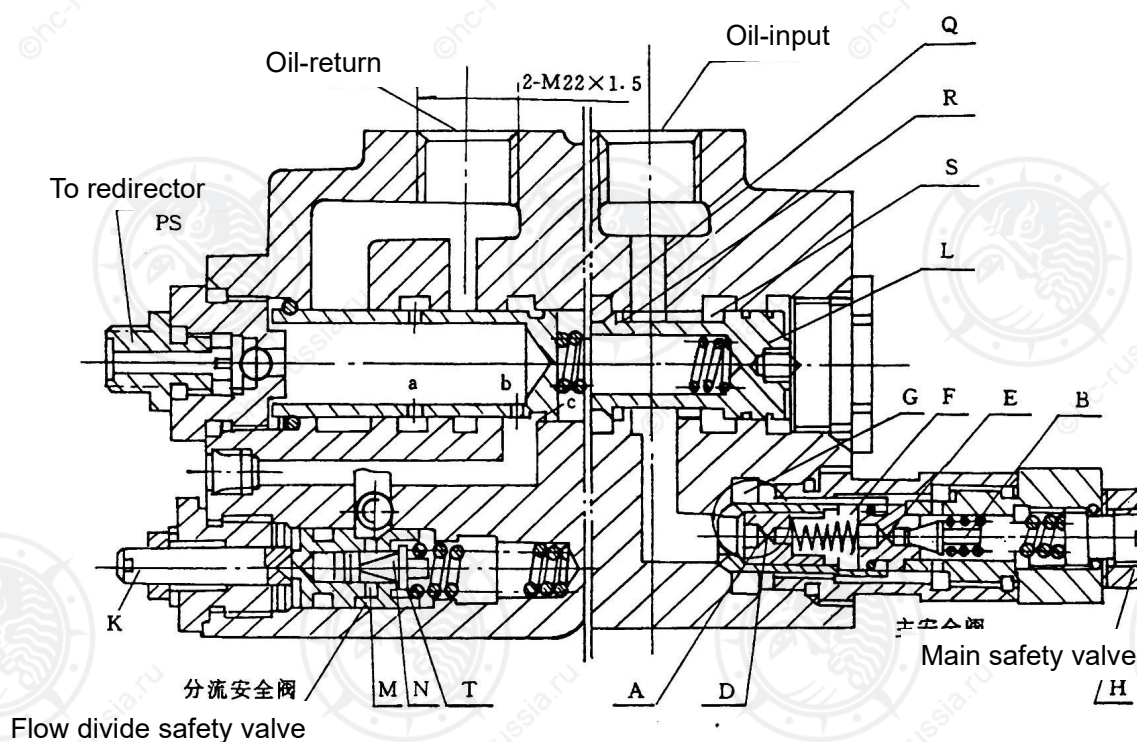
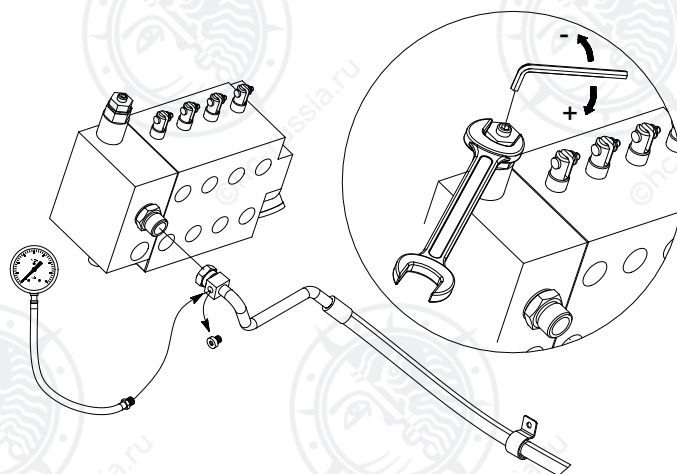


Fig. 9-5

4.2 Adjusting the pressure of the main relieve safety valve

The main relieve valve has been adjusted before leaving the factory, it is not allowed to adjust at will in general condition. Adjusting way is as follows:

- (1) Park the truck on solid and smooth road, place in neutral, pull up the hand brake handle, tilt the mast backwards to the end, and drop the fork to the ground. The engine stops.
- (2) Open front soleplate, release the pressure mouth bolt of oil inlet pipeline in the multi-way valve, and put in clean place. If hydraulic oil outflows, please protect the environment.



(3) Connect the pressure gauge. Notice: a. Specification of gauge should be larger than 20Mpa. b. taper thread at pressure mouth matches: Rc1/8R1/8; c. tightening torque is 20N•m-22N•m.

(4) Start the engine, place the mast in vertical, and the fork is 300mm from the ground.

(5) Read out the indication in the pressure gauge, and judge is the main safety valve of multi-way valve is in normal scope.

1.0t: 13MPa, 1.5t:15MPa, 1.8t:18.5MPa, 2.0t~3.8t:18.5MPa±0.25 MPa

(6) If the pressure is not in the normal scope, please release the main safety valve lock nut, and adjust adjusting bolt.

If the indication is smaller than the normal scope, inner hexagon spanner the adjusting bolt in clockwise (+) to increase main safety valve pressure.

If the indication is larger than normal scope, inner hexagon spanner the adjusting bolt in counterclockwise (-) to decrease main safety valve pressure.

(7) Stable the pressure in normal scope for 30's.

(8) Release pressure gauge, install the bolt, and the tightening torque is 20N•m-22N•m.

Drop the mast to the ground and tilt backward to end.

(9) Retighten the tightening nut, and fix it on the front soleplate.

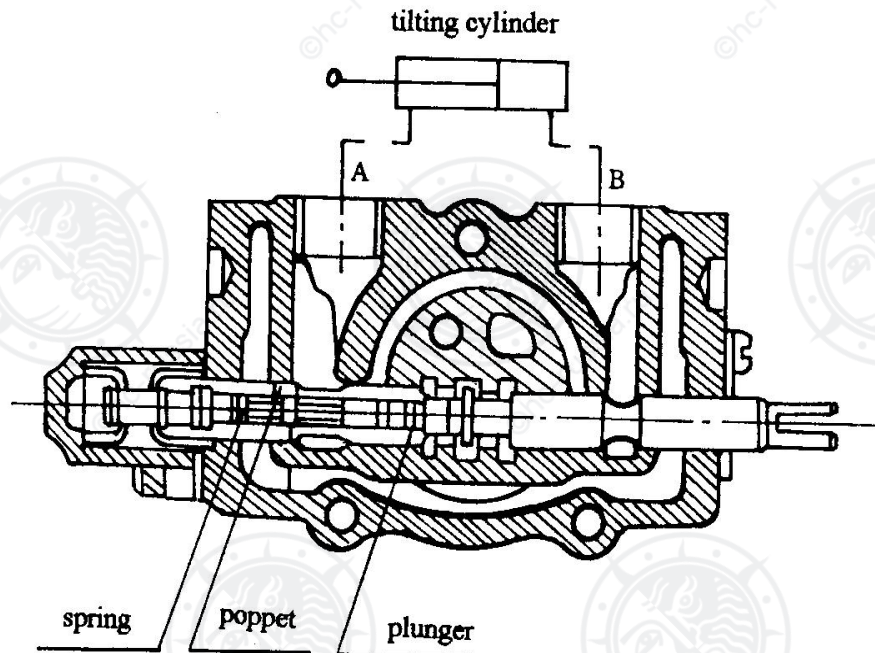
4.3 Operation of tilt lock valve

Tilting lock valve is fitted by lock-self valve to prevent vibration owing to back pressure inside tilt cylinder and avoid casualty because of miss-operation. According to common structure, it can operate tilt spool to tilt forward after engine is off, but using the tilt lock valve, when engine is off, it cannot tilt mast forward even push the lever of operation valve, the structure is shown as Fig. 9-6.

Connector of valve body: "A", "B" connects separately with frond and rear house of tilt cylinder piston. When pulling out spool, high pressure oil (P) enters connector "A", oil in rear house returns to oil tank (T), in this time mast is in tilting backward.

When pulling tilting spool, high pressure oil enters connector "B", by high pressure oil, lock valve in spool works to make "A" to connect with low

pressure. When engine is off or stop, lock valve in spool cannot work without high pressure oil, so that connector “A” can not connect low pressure line and mast cannot tilt forward, also there is not back pressure in tilt cylinder.



5. Hydraulic piping

5.1 Cycloidal rotor full hydrostatic power steering gear

The high pressure oil from main pump goes to control valve and divide it to two parts by priority valve inside control valve: one of them preferentially goes to steering gear control steering cylinder, excess part goes to lifting cylinder or tilting cylinder. When lifting and tilting spool is in neutral, high pressure oil return oil tank directly from pass way. When pulling lifting spool, high pressure oil goes by throttle valve and then push piston rod under lifting cylinder piston. When pushing lifting spool, it is that bottom of lifting cylinder piston connects with low pressure line and then piston rod drops by deadweight and weight of cargo. In this time, oil from lifting cylinder goes by unidirectional speed limiting valve so as to control the falling speed. When operating tilting spool, high pressure oil goes to front house of tilting cylinder and another connects with low pressure line so as to make mast tilt forward or backward.

The cut off valve is used under right lifting cylinder, its function is to prevent goods falling suddenly when oil pipe is busting.

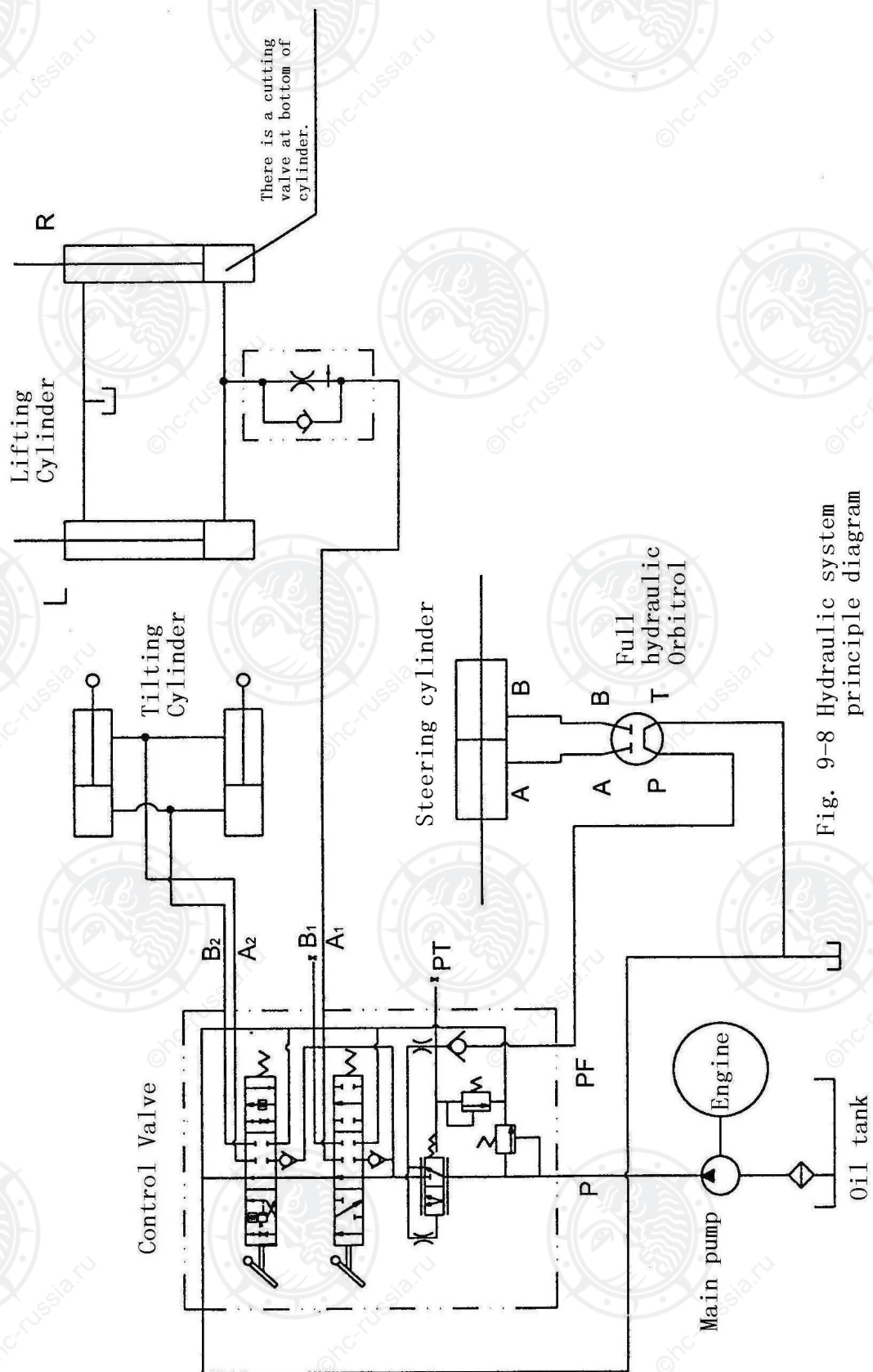


Fig. 9-8 Hydraulic system principle diagram

Fig. 9-7-1 Schematic figure of hydraulic system

5.2 The high pressure oil from main pump goes to control valve and divide it to two parts by priority valve inside control valve: one of them preferentially goes to steering gear control steering cylinder, excess part goes to lifting cylinder or tilting cylinder. When lifting and tilting spool is in neutral, high pressure oil return oil tank directly from pass way. When pulling lifting spool, high pressure oil goes by throttle valve and then push piston rod under lifting cylinder piston. When pushing lifting spool, it is that bottom of lifting cylinder piston connects with low pressure line and then piston rod drops by deadweight and weight of cargo. In this time, oil from lifting cylinder goes by unidirectional speed limiting valve so as to control the falling speed. When operating tilting spool, high pressure oil goes to front house of tilting cylinder and another connects with low pressure line so as to make mast tilt forward or backward.

The cut off valve is used under right lifting cylinder, its function is to prevent goods falling suddenly when oil pipe is busting.

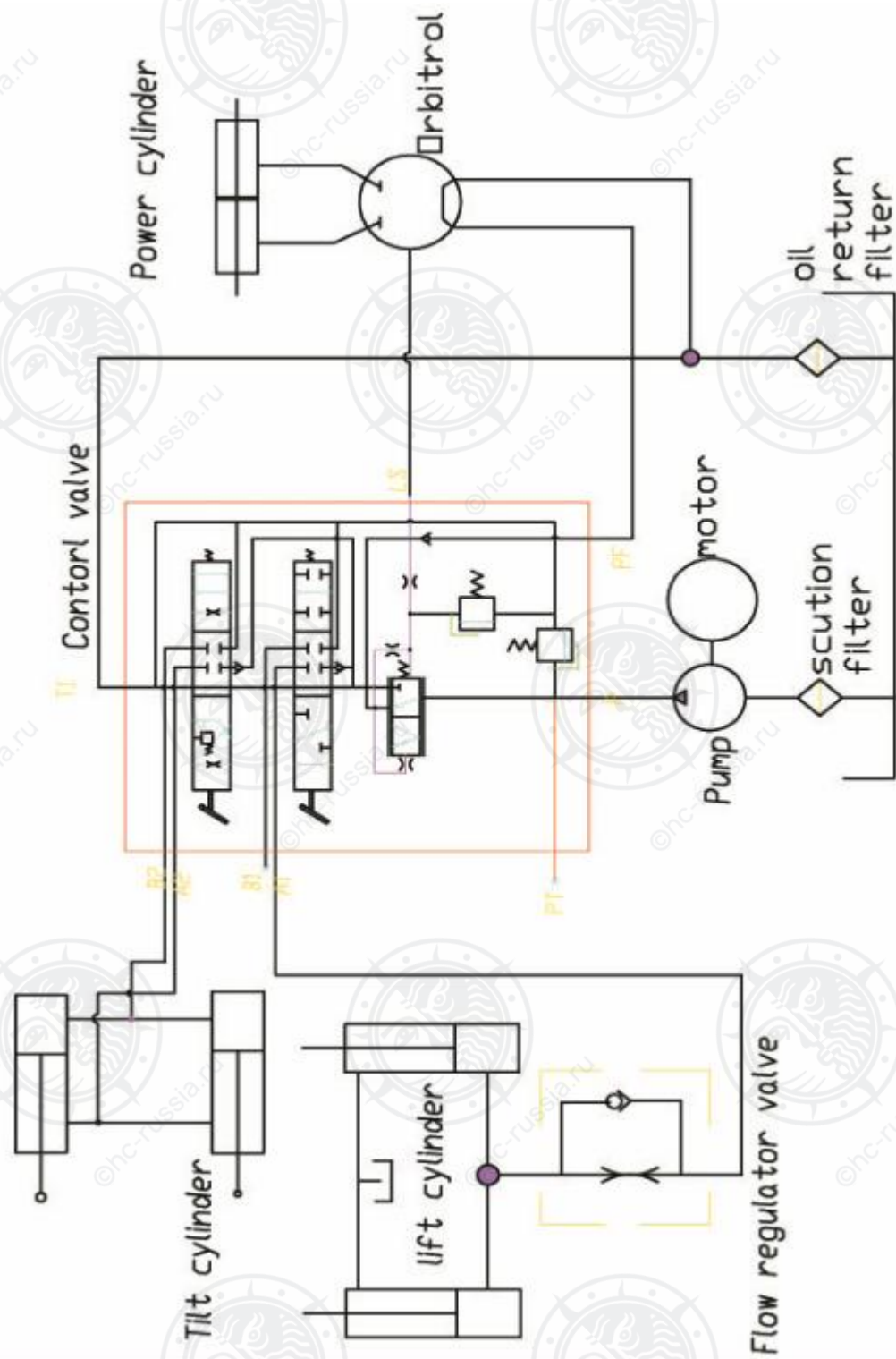


Fig. 9-7-2 Schematic figure of hydraulic system

XI. Lifting system

1. Assemble debugging data

Debugging data

Double mast and triple mast

Mast type		Standard type and lifting height of >2~4 meter	Lifting height >4~5 meter, TRIPLEX MAST 4 meter	Lifting height > 5~6 meter
Mast tilt angle	Forward	6°	6°	3°
	Backward	12°	6°	6°
Fork carriage roller		Complex roller assy, Side roller assy, Cross roller assy		

Inspection and adjustment

Place	Assembly clearance (mm)	Repair clearance(mm)
Mast to lift roller	0.1~0.8	0.2~1
Shims	0.5,1.0,2.0	
Mast to back up metal	0.1~0.8	0.2~1
Shims	0.5,1.0	
Inner mast to carriage side roller	0.1~0.6	0.2~1
Shims	0.5,1.0	
Lift chain deflection	25~30 mm	

Tightening torque

Place	Model or Lifting capacity	N·m
Lift chain lock nut	1-1.8t	193-257(M16)
	2~3.8t	245-314(M20)
Mast support cap blot	1-1.8t	124-165(M14)
	2~3.8t	176-216(M18)
Tilt cylinder lock nut	1-1.8t	89-118(M14)
	2~3.5t	
Lift cylinder bolt(top)	1-1.8t	76-107(M12)
	2~3.8t	
Lift cylinder bolt(bottom)	1-1.8t	22-30(M8)
	2~3.5t	
Lift cylinder fixing bolt(cylinder light bolt)	1-1.8t	76-107(M12)
	2~3.8t	

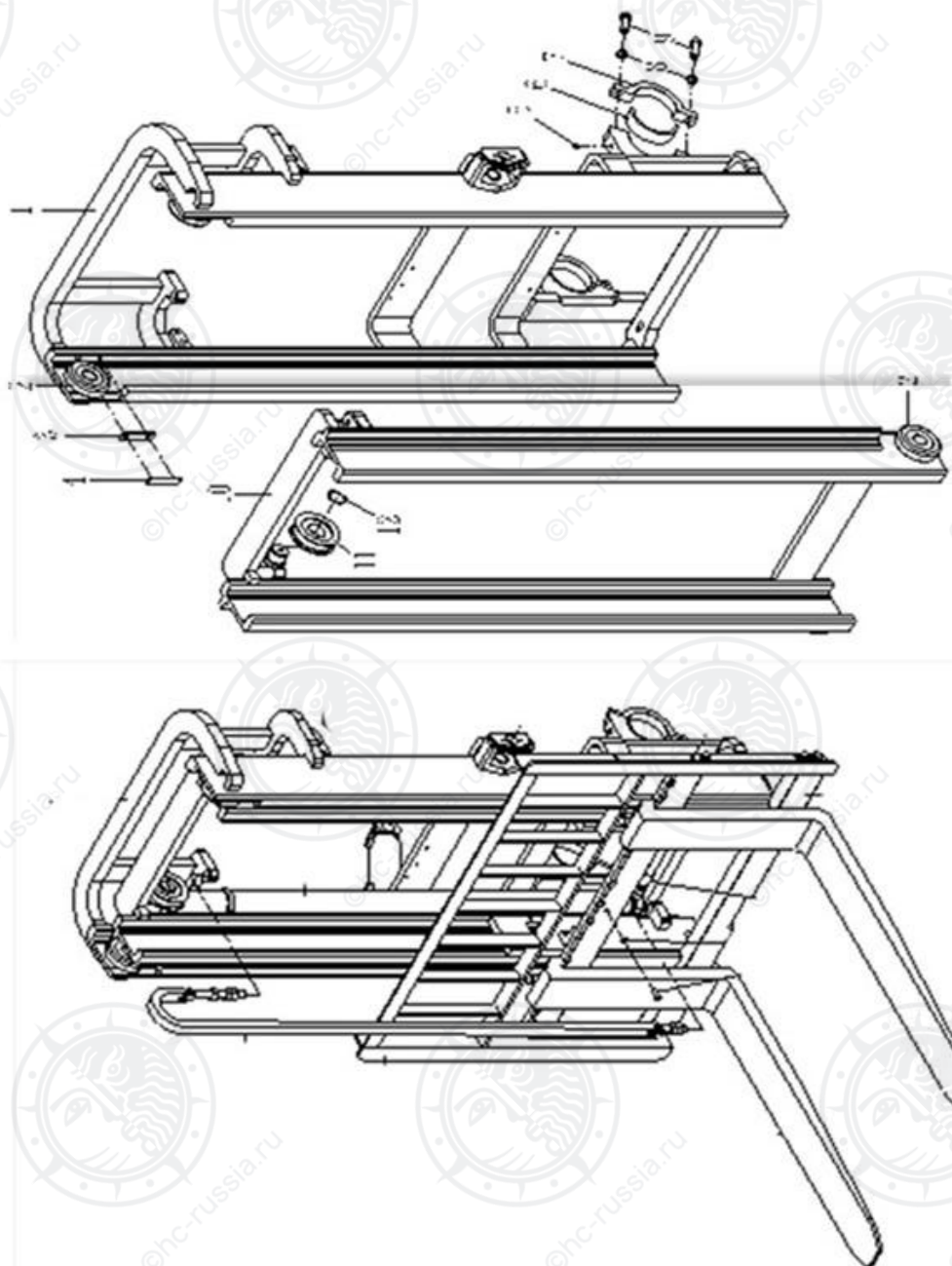
Basic model mast weight

Model(truck)	1t	1.5 t	1.8t	2t	2.5t	3t	3.5t-3.8t
Weight(mast) kg	531	531	540	575	644	721	820

2. Trouble diagnoses and corrections

Condition	Probable cause	Corrective action
Fork arm carrier or mast tilt by itself.	1.Tilt cylinder and ring abraded excessively	Replace piston ring tilt cylinder.
	2. The hydraulic control valve spring is inoperative.	Replace it.
The fork arms carrier moves up and down sluggishly.	1. Caused by piston jamming or bent piston rod.	Replace the faulty parts.
	2. Too much dirt is accumulated in the cylinder.	Strip it down and clean.
Forks are lifted or lowered non-smoothly.	1. Carriage bracket assembly out of adjustment.	Adjust clearance with thrust metal and carriage side roller.
	2. Insufficient clearance between inner and outer masts or rollers and mast.	Adjust clearance with rollers.
	3. Biting foreign backing boarderials between moving part.	Remove foreign backing boarderials.
	4. Insufficient lubrication.	Apply grease on contact surfaces of sliding parts.(butter)
	5. Bent carriage bracket assembly.	Repair or replace.
Forks are lifted unevenly	1. Lift chains out of adjustable.	Adjust lift chains.
Lift roller does not rotate	1. Grease stiffened or dirt accumulated on lift roller and mast sliding surfaces.	Clean and lubricate lift rollers.
	2. Improperly adjusted lift roller.	Adjust.
Excessive mast noise	1. Insufficient lubrication.	Lubricate.
	2. Improperly adjusted lift roller, side roller and back-up metal.	Adjust.

Condition	Probable cause	Corrective action
Insufficient lift power or no lift movement.	1. Excessive wear occurs between the oil pump body and gears, causing too much clearance.	Replace the worn parts or the oil pump.
	2. The lifting jack piston Yx-ring has worn, resulting in excessive inner leaks.	Replace Yx-ring.
	3. Springs of the multiple control valve and its relief valve are inoperative oil leaks.	Replace.
	4.Excessive wear occurs of the hydraulic control valve, resulting in excessive oil leaks.	Replace.
	5. Oil leaks occur between the hydraulic control valve sections.	Dismantle for regrinding the joint surfaces and reassemble the valve.
	6. Leakage occurs in the hydraulic pipe.	Tighten the joint nuts and inspect the seal for damage.
	7. The hydraulic oil temperature is too high. Oil viscosity is too low and the rate is insufficient.	Change the wrong hydraulic oil or stop operation for reducing the oil temperature. Find out the reasons for high oil temperature and eliminate the trouble.
	8. The load carried is beyond the designed capacity.	Observe the lifting capacity limit.



XR30M300-000000-000 Lifting Mast assembly

(T) Tightening torque See foregoing table

3. Summary

The lifting system is composed of inner and outer mast, fork arm carrier, fork arm, load backrest, chain, roller, lifting jack, and tilt cylinder, etc. Oil line system, hydraulic pressure system and it compose fork lift truck work equipment. This equipment is performing framework of load and unload. Commonly common masts have simple mast, Double mast and Triple mast class mast framework type. Fork lift truck what is made in our company

backing boardch Double high visibility mast, Double full free lift mast (including container mast), Triple full free lift mast, mast framework adopted is CL model juxtaposition roller type.

3.1 Simplex mast

Simplex mast is composed of outer mast which can't lift and inner mast which can lift. Lifting jack bottom is fixed on outer mast below cross beam, oriented with screw. Piston rod extremity is joined with upper cross beam of inner mast; cylinder body is fixed on outer mast fixation board with U-bolt. Commonly free lift range is 155mm~170mm, which is difference with different tonnage. Two lifting jacks (fig.10-5 is right) are laid out back of outer mast to realize high visibility; two lifting jacks are laid outside of outer mast.

Forks are hung on the fork carriage by means of hooks, with longitudinal roller set, composite roller set (ie, side-force slider set in the middle of the longitudinal roller side) and side roller set (1-1.5t forklifts lack one and use longitudinal roller group) on the fork carriage. Longitudinal roller set is installed on the top of the outer mast and bottom of the inner mast. Composite roller set is used on the top of the outer master for 1-1.8t forklifts.

Pressure oil from hydraulic control valve is entered into lifting jack by unidirectional speed limiting valve, forced piston and piston rod rising, thereby forced inner mast rising. At the same time one end of lifting chain on inner mast is fixed on outer mast, the other is joined with fork arm carrier. Fork arm carrier and fork arm is rising with inner mast rising to realize aim of lifting goods.

It is basis model that our company offers forklift truck which lift 3 meter high. It is especial model that our company offers forklift truck which lift height else (2~6 m).

3.2 Double full free lift mast (including container mast)

Double full free lift mast (Fig10-2) is also composed of inner mast, outer mast, fork arm carrier, and etc, is also belong to high visibility mast. It is different from common standard type mast that two postpose long lifting jacks are both pole stopper type cylinder. One piston rod is hollow, hole of piston rod is dypassed for hydraulic pressure oil flowing into free lifting jack. End of piston rod in two long lifting jacks is joined with upper branch of inner mast. Besides, short lifting jack who is installed middle of inner mast is named as free lifting jack. Free lifting jack is also pole stopper type cylinder.

Fork arm can rising or falling when height go beyond 1050mm, because inner mast don't rising when free lifting jack rising or falling. There are different specifications in this series of height, 2.0m,2.5m, 2.7 m, 3 m, 3.3m,3.6,3.7, 4 m and etc. Free lifting height is commonly about 1050~2050mm.

When lowest height of mast $\geq 2190\text{mm}$, lift height is 3m, full free lift height

is about 1270mm. It can work inside container, mast which include side-shift is named container fork lift truck mast (see Fig.10-3). Side shift cylinder of container fork lift truck mast can be side shifting only when goods don't placed appropriate position. In another condition, side cylinder should set center.

Structure of left and right lifting cylinder of more than or equal to 3 t, see fig.10-6, fig.10-7;

Structure of left and right lifting cylinder of less than or equal to 2.5 t, see fig.10-6, fig.10-8.

3.3 Triple full free lift mast

Triple full free lift mast (fig.10-4) is composed of outer mast, middle mast, and inner mast, middle mast and inner mast can flex. There are different specifications in this series of height, 4m, 4.3m, 4.5m, 4.7m, 4.8m, 5m, 5.5m, 6m, 6.5m, 7m, etc. It is different from double full free mast that mostly it includes middle mast, and its two postpose long lifting jacks are both piston type cylinder

(fig.10-5), and its oil system rather complex than oil system of double full free mast. Free lift cylinder structure see fig.10-6.

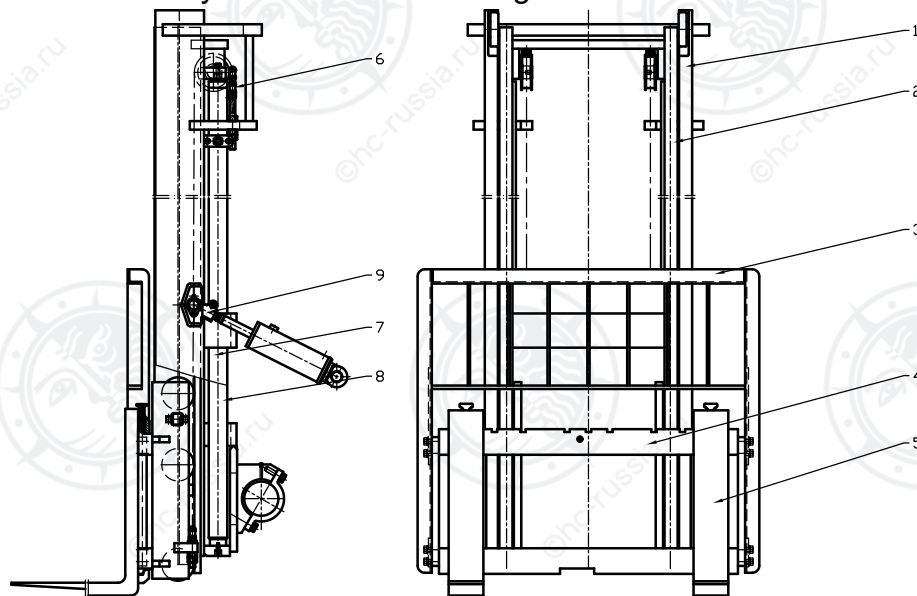


Fig. 10-1 Double stage wide view mast

- | | | | |
|---------------------|---------------|-------------------------|--------------------------|
| 1. Outer mast | 2. Inner mast | 3. Load-backrest | 4. Fork arm carrier |
| 5. Fork arms | 6.Chain | 7.Left lifting cylinder | 8.Right lifting cylinder |
| 9. Tilting cylinder | | | |

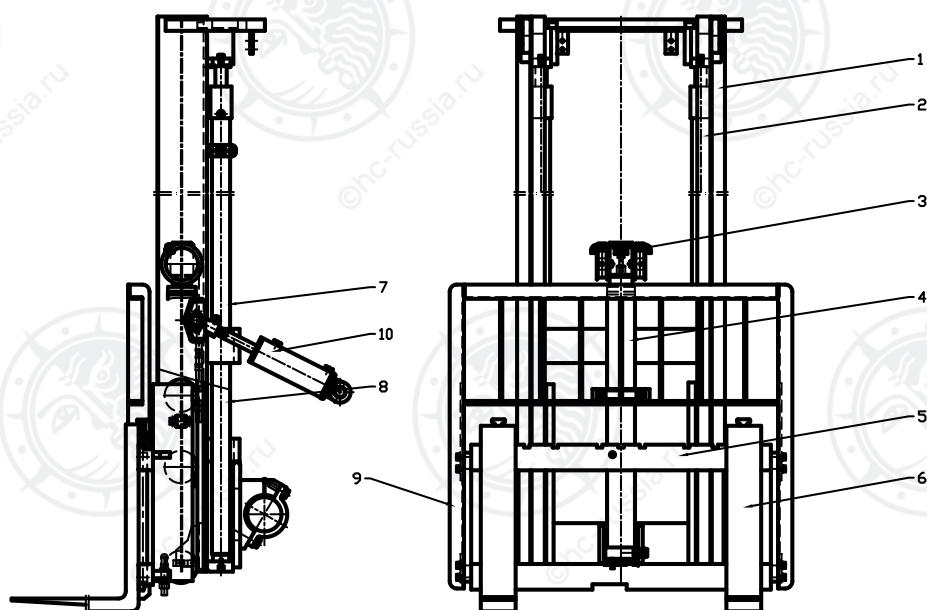


Fig.10-2 Double grade full free lifting mast

- 1.Outer mast 2. Inner mast 3. Chain 4. Free lifting cylinder 5. Fork arm carrier
6. Fork arms 7.Left lifting cylinder 8.Right lifting cylinder 9. Load-backrest
10. Tilting cylinder

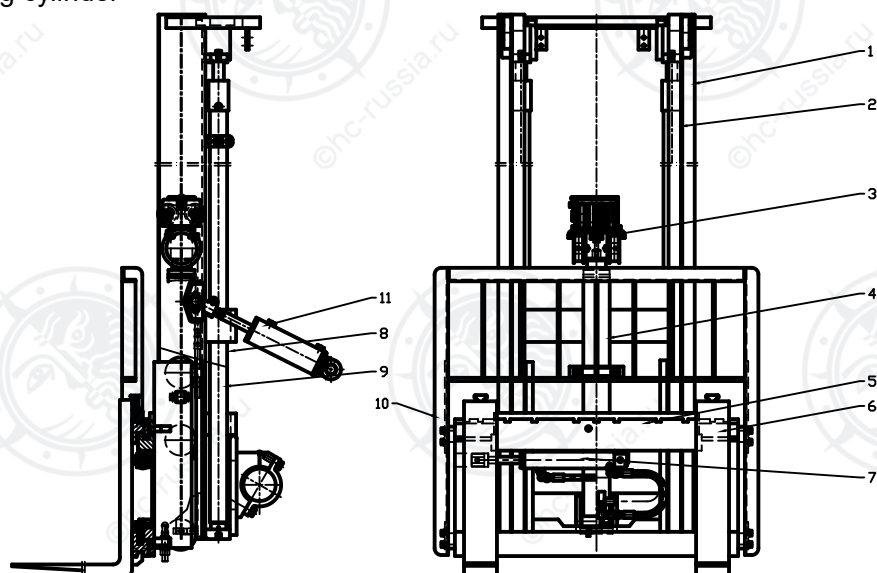


Fig.10-3 Containers forklift mast

- 1.Outer mast 2. Inner mast 3. Chain 4. Free lifting cylinder 5. Fork arm carrier
6. Fork arms 7. Side move cylinder 8.Left lifting cylinder 9.Right lifting cylinder
10. Load-backrest 11. Tilting cylinder

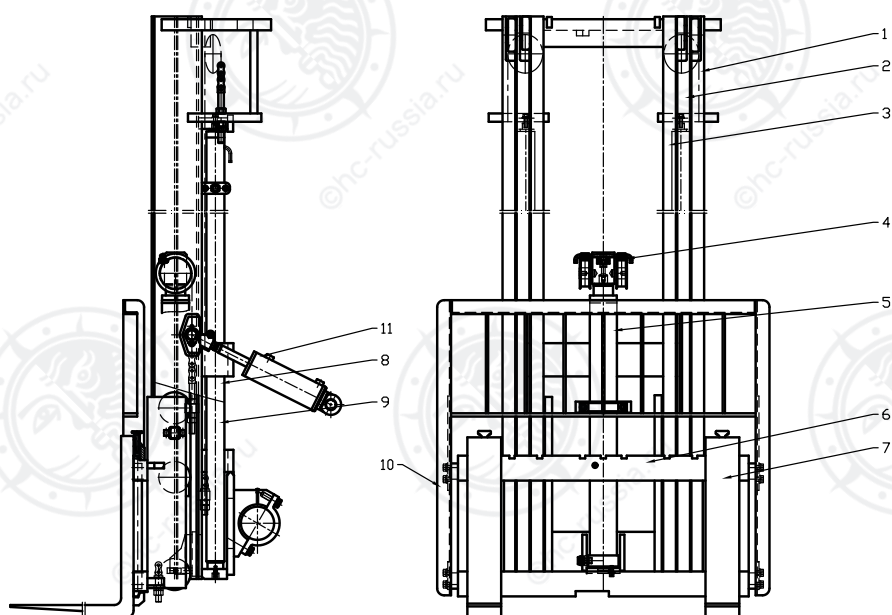


Fig.10-4 3 grade full free lifting mast

- 1.Outer mast 2. Middle mast 3. Inner mast 4. Front cylinder chain 5. Free lifting cylinder
 6. Fork arm carrier 7. Fork arms 8. Chain 9.Left lifting cylinder
 10.Right lifting cylinder 11. Load-backrest 12. Tilting cylinder

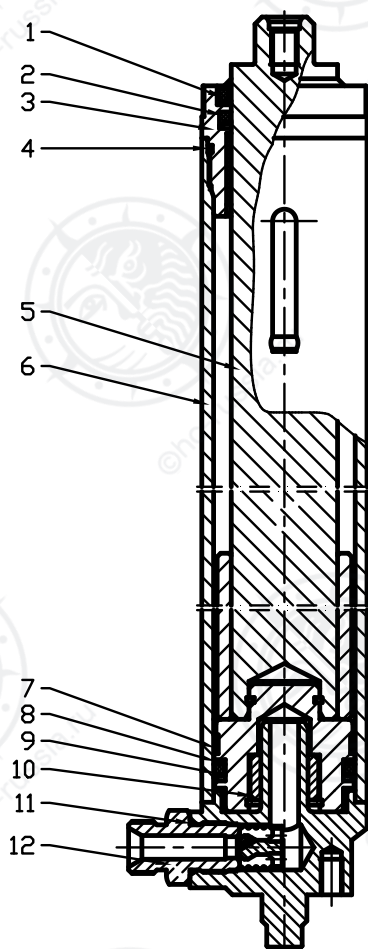


Fig.10-5 Lifting cylinder
(Used in fig.10-1, 10-4)

- | | | |
|--|-----------------|-----------------|
| 1. Dustproof ring | 3. Protect ring | 3. Gasket ring |
| 4. Guide sleeve | 5. O-ring | 6. Piston rod |
| 7. Cylinder cover | 8. Support ring | 9. Protect ring |
| 10. Gasket ring | | |
| 11. O-ring (Lift cylinder,Right) | | |
| 12. safety valve (Lift cylinder,Right) | | |

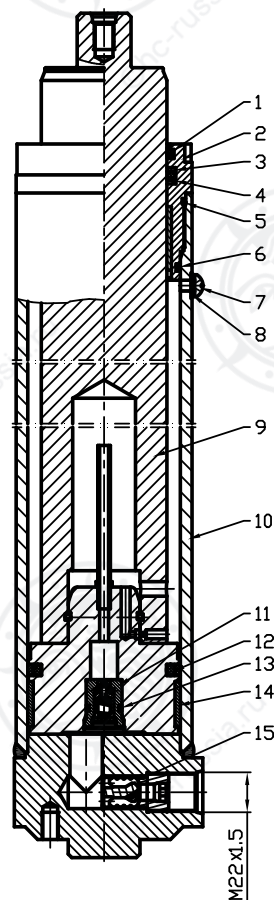


Fig. 10-6 Free lifting cylinder
(Used in fig. 10-2,10-3,10-4)

- | | | |
|--------------------|-------------------|------------------|
| 1. Dustproof ring | 2. Cylinder cover | 3. Protect ring |
| 4. Gasket ring | 5. O-ring | 6. O-ring |
| 7. Screw | 8. washer | 9. Piston rod |
| 10. Cylinder cover | 11. check valve | 12. Glyd-ring |
| 13. O-ring | 14. Support ring | 15. safety valve |

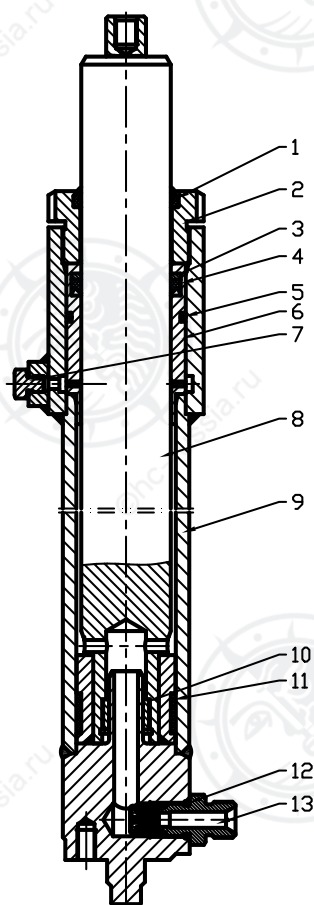


Fig.10-7 Lifting cylinder (3.0t-3.8t)
(Used in fig.10-2, 10-3)

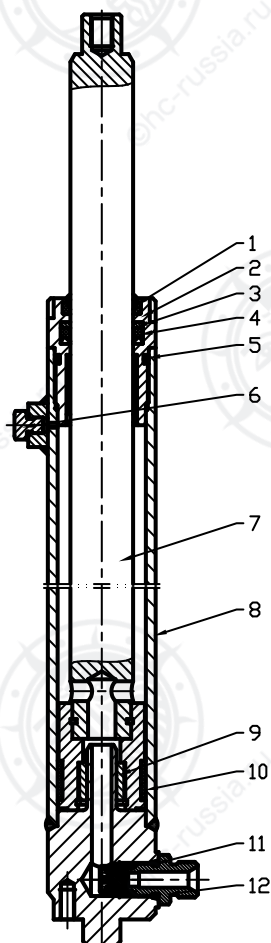


Fig.10-8 Lifting cylinder (1.0t-2.5t)
(Used in fig.10-2, 10-3)

- | | | |
|--|-------------------|-----------------|
| 1. Dustproof ring | 2. Cylinder cover | 3. Protect ring |
| 4. Gasket ring | 5. O-ring | 6. Guide sleeve |
| 7. plug screw | 8. Piston rod | 9. Cylinder |
| 10. Sleeve | 11. Support ring | |
| 12. O-ring (Lift cylinder,Right) | | |
| 13. safety valve (Lift cylinder,Right) | | |

- | | | |
|--|-------------------|-----------------|
| 1. Dustproof ring | 2. Cylinder cover | 3. Protect ring |
| 4. Gasket ring | 5. O-ring | 6. plug screw |
| 7. Piston rod | 8. Cylinder | 9. Sleeve |
| 10. Support ring | | |
| 11. O-ring (Lift cylinder,Right) | | |
| 12. safety valve (Lift cylinder,Right) | | |

4. Removal and adjustment

WARNING

Be careful when removing and installing the forks, carriage and mast as they are heavy.

4.1 Remove forks and mast assembly

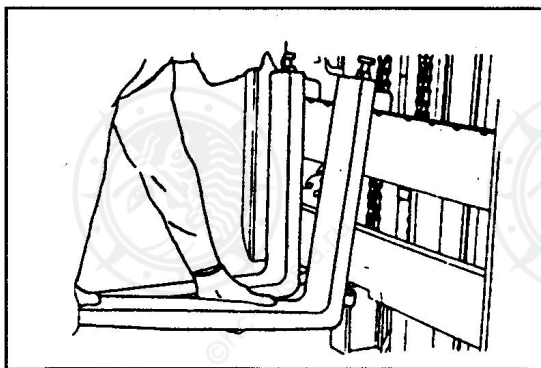
1) Unlock fork lock pins by pulling them and move forks to cutout portion in the middle of carriage bracket assembly.

2) Pull lower portion of fork to remove its lower jaw and lift it out.

WARNING

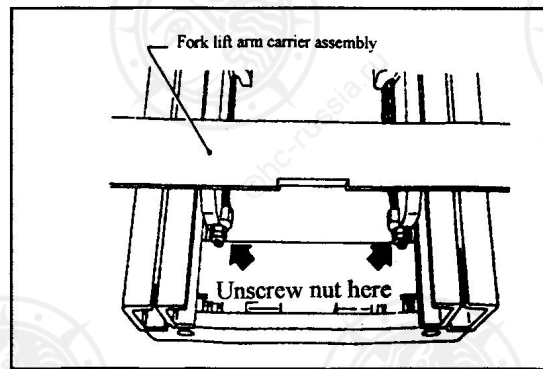
a. Keep hands and feet away from forks when removing and installing forks carefully, keep feet and hands clear.

b. Do not remove forks from the end of the fork bar. Severe injury can result if the fork is dropped.



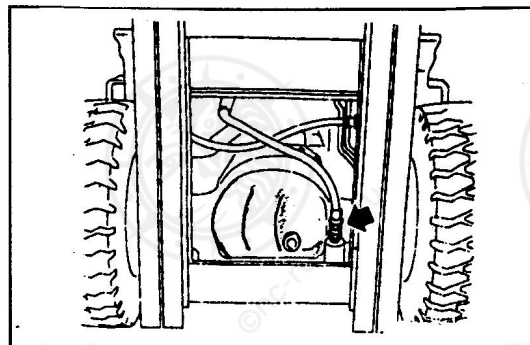
1) Attach wire ropes to carriage bracket assembly and lift carriage bracket assembly up with a lifting device.

2) Remove chain attaching nuts, and detach chains from carriage bracket assembly.

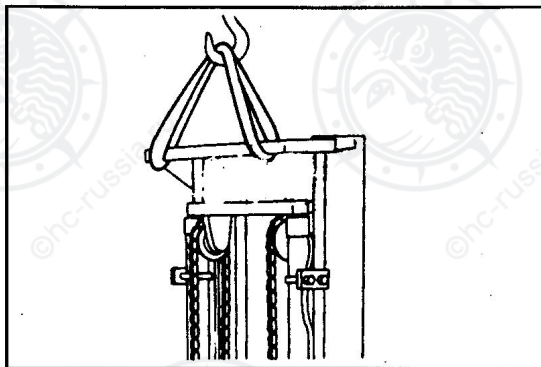


3) Remove carriage bracket assembly from inner mast.

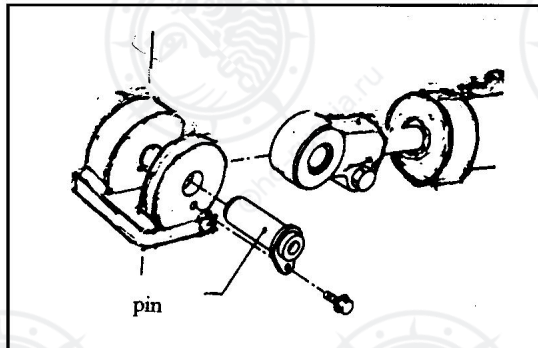
4) Detach high pressure hose, lift hose and low pressure hose.



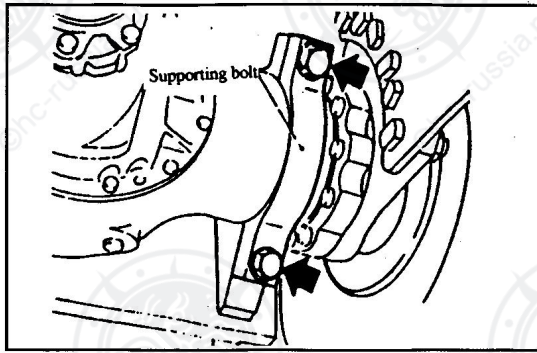
5) Support mast assembly with wire ropes.



6) Pull out tilt cylinder pivot pin.



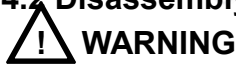
7) Remove mast support caps.



8) Remove mast assembly.

9) To install mast assembly, reverse order of removal.

4.2 Disassembly

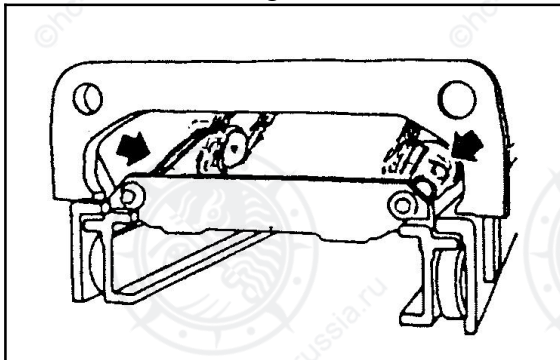


WARNING

Be careful when disassembling the masts as they are heavy.

Remove lifting jack

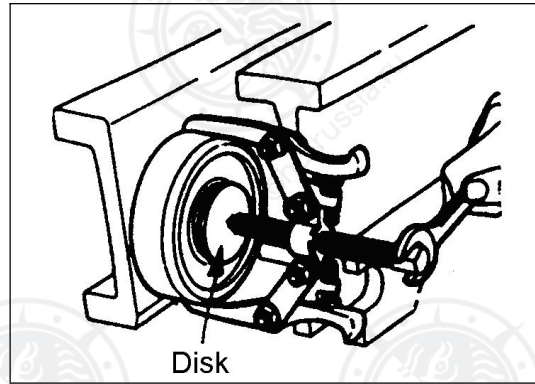
1) Place mast flat on ground. Remove lifting jack attaching bolts-bolts and tighten screw.



2) Slide inner mast, then remove lifting cylinders.

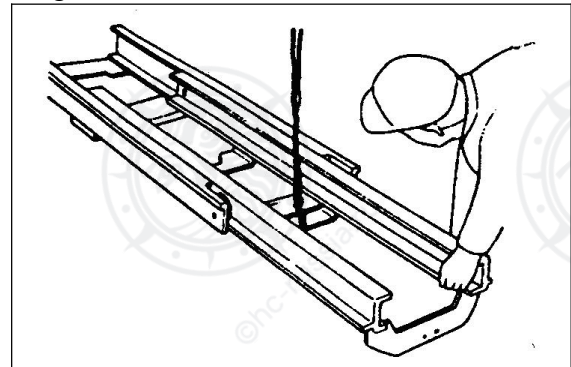
Remove roller

1) Slide inner mast out until rollers are exposed and remove little rollers with bearing puller. Can be directly with the hand (wearing gloves) to remove the longitudinal roller, adjust the gasket.



Remove inner mast

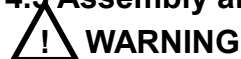
Attach wire rope to middle of inner mast and slide it out with a lifting device.



INSPECTION

- 1) Check lift rollers, roller shafts, and associated parts for wear or damage.
- 2) Replace damaged parts as required.

4.3 Assembly and adjustment

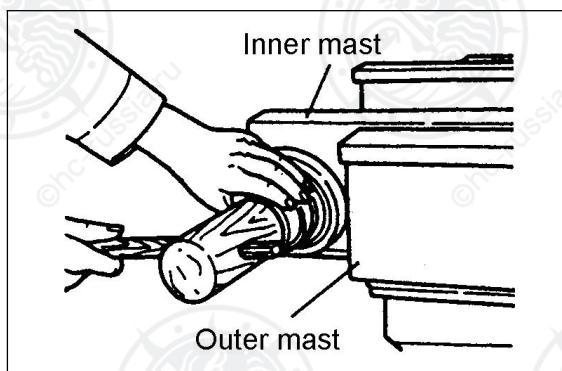


WARNING

Be careful when assembling the masts as they are heavy.

Lift roller

Slide inner mast into outer mast and securely attach lift rollers.

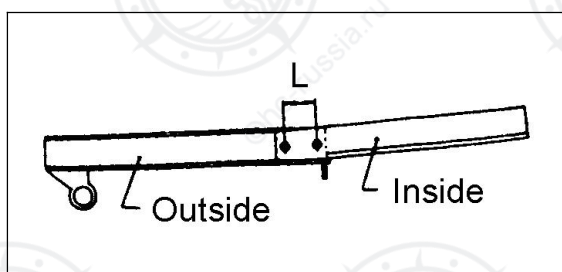


Lift roller-to-mast clearance adjustment

1) Set roller pitch of inner and outer masts to "L" dimension. Then proceed with the following adjustment.

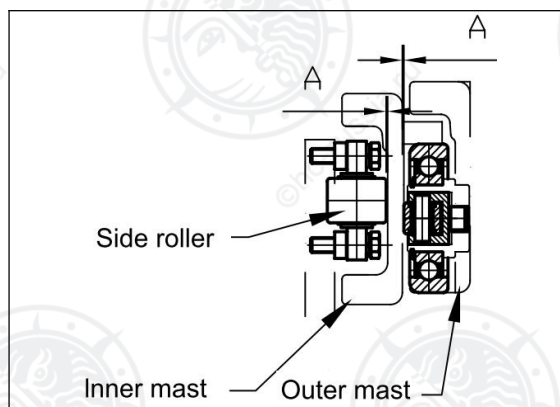
Dimension "L" unit: mm

Model or tonnage Max.lift height (mm)	III grade 3 t	II grade 2t~2.5t
2500~3300	341	306
3600	391	356
4000	441	406
4500	441	406

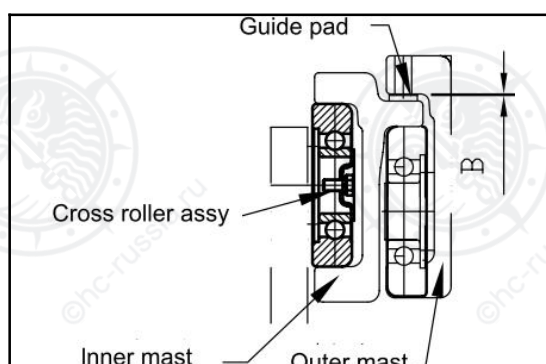
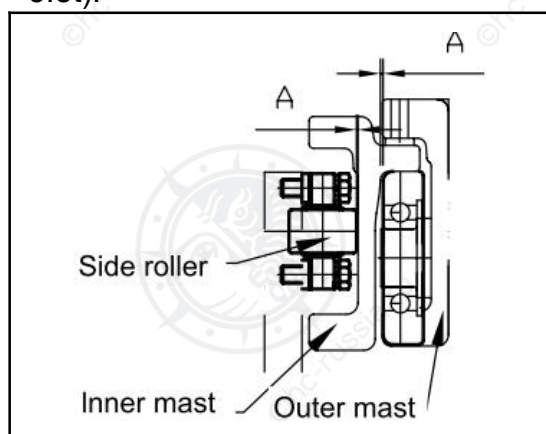


2) Adjustable range "A" with shims:

a. Dimension: 0.1mm ~ 0.6mm. (≤ 1.8 t)



Dimension: 0.1mm ~ 0.6mm (2.0t ~ 3.8t).



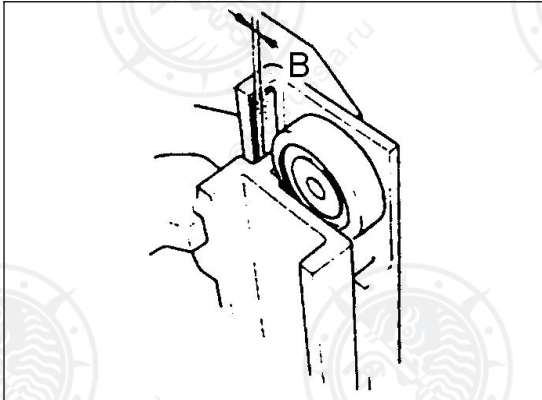
3) It is suitable that clearance of roller and outer mast is about 0.8mm ~ 1mm. Clearance can't adjustable. Replace it if roller wear too much.

4) Apply lubrication (butter) to interface of inner mast and outer mast, interface of roller and mast. To prevent sand from entering, it is

decided whether to apply lubrication or not in the area where sand blown by wind heavily.

Clearance of back up metal and mast steel

Adjust clearance "B" to 0.1mm ~ 0.8mm with shims, which may not use. Thickness of shim is 0.5mm or 1mm.



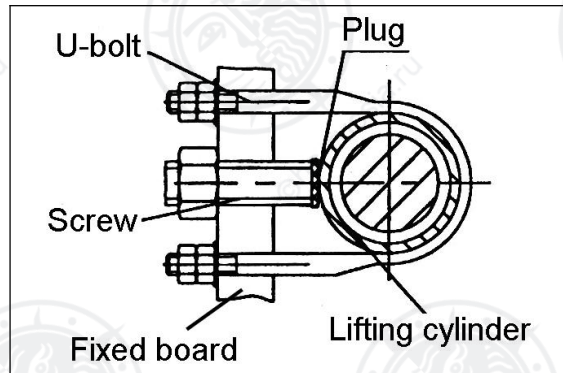
Apply a coat of grease to back-up metals. Install mast and lifting jack on forklift truck. Connect circle tube and high-pressure tube.

4.4 Left and right cylinder height adjustment.

1) Install left and right lifting jack on mast, pin must be installed into orientation hole of outer mast lower cross beam.

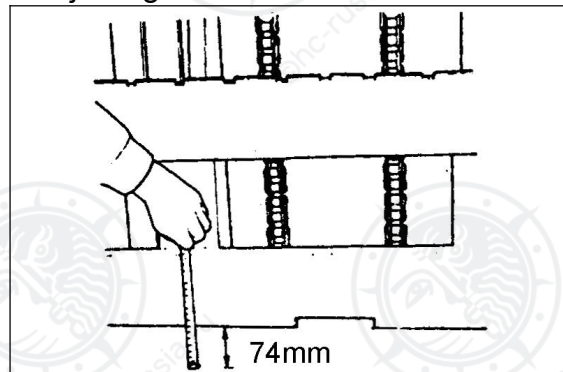
2) Install upper of piston rod on inner mast. Inner mast lay evenly in the direction of left, right, upper and lower. If it is not even, please adjust by putting washer between hole of cylinder support and upper end of piston rod.

3) Installs U-bolt onto cylinder, hand-tighten nuts and lock it with two tighten nuts. Screws down tighten bolt and nuts to avoiding loosening.



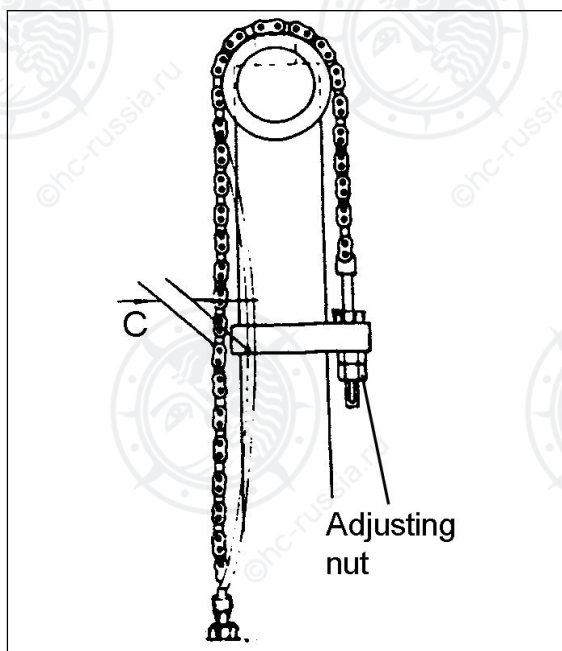
4.5 Lifting chain adjustment

Installs fork arm carrier on inner mast, and install lifting chain, then install two nuts on end of every side. With mast set straight up, lower carriage completely. Temporarily adjust clearance of carriage to 74mm-76mm above ground. If necessary, adjust with chain adjusting nut.



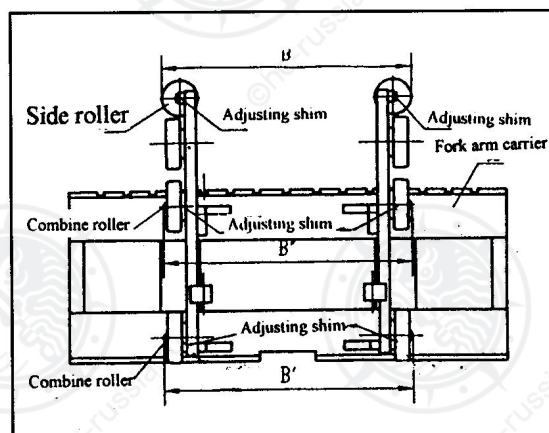
To adjust tension of lift chain, lower lifting jack until fork is on the ground, and adjust chain adjusting nut (three every side) so that dimension C will be as listed below when the middle portion of chain is pressed by a finger.

Dimension C: 25mm~30 mm



$$A-B' = 0.8\text{mm} \sim 1.5\text{mm}$$

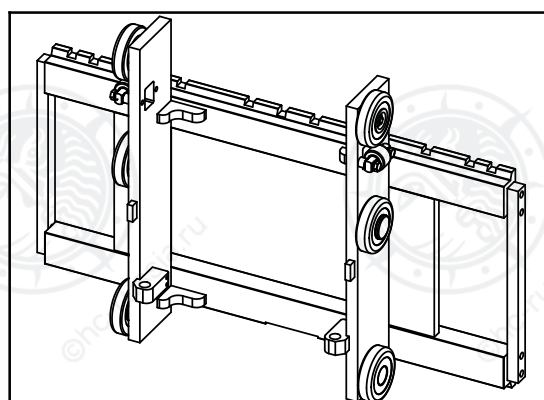
$$A'-B'' = 0.1\text{mm} \sim 0.8\text{mm}$$



Shims

0.5 mm 1 mm

- Number of shims must be the same on the right and left sides, when using shims.
- After clearance adjustment, push carriage assembly to see if it operates properly.



4.6 Clearance of fork arm carrier assembly and rollers adjustment

1) Measure the distance A between the two channels of the inner mast. Collect the value on the top, central part, central beam of the inner mast(cross) and the bottom respectively. Mark $A' = A - 7$

1) 2) Measure the space from left and right side B, B', B'' of rollers on fork carriage, composite rolling slider and lift roller respectively.

2) 3) Calculate the difference values between A and B, A and B', A and B'' respectively. Each difference value is the clearance between the roller and inner mast channel.

3) Evenly adjust the washers of each side roller, composite roller and lift roller on left and right. Adjust the clearance to the following range.

$$A-B = 0.1\text{mm} \sim 0.8\text{mm}$$

5. Disassembly and installation of lifting jack

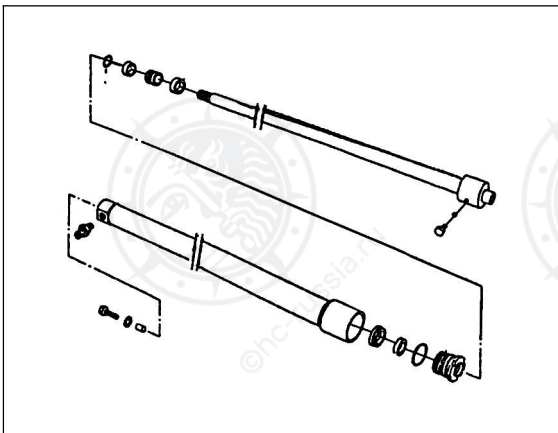
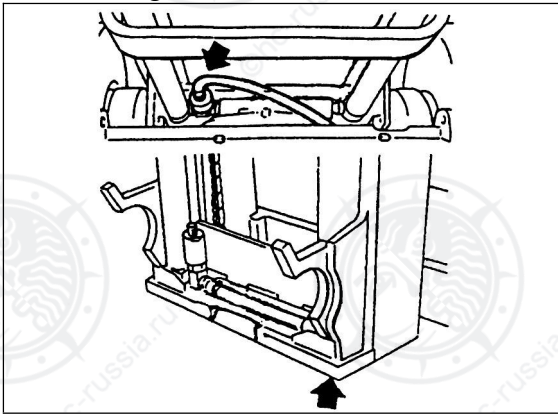


Keep body away from equipment

- Turn out engine, then make lifting jack falling into lowest condition that lower of piston rod is touched bottom of cylinder body so as to oil flowing back tank

completely.

- 2) Unscrew piston rod and bolt.
- 3) Disconnect circle oil pipe, remove high pressure tubes.
- 4) Remove U-bolt of outer mast fixation board and tighten skew of other side.
- 5) Remove chain of outer mast.
- 6) Attach wire rope to inner mast and remove left and right lifting jack with a lifting device.



5.1 Disassembly

Rated capacity is less than 2.5 t

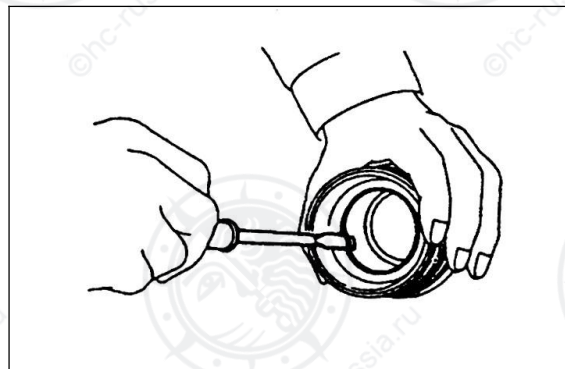
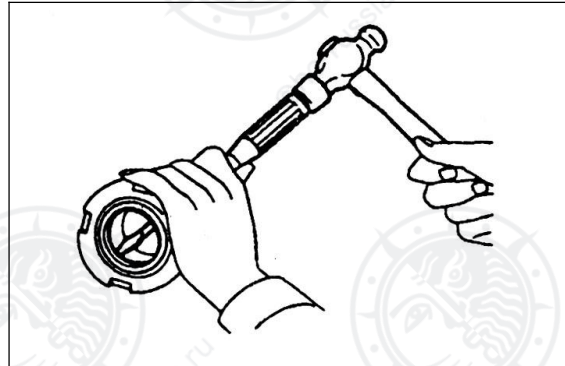
Remove cylinder head and guiding bush

Rated capacity is more than 3 t

Removes tighten skew and nylon stopper, then remove cylinder head.

- 1) Remove dust gasket ring.

- 2) Remove Y-ring with screwdriver.



CAUTION : Please not use dust gasket ring removed, O-ring, Y-ring again, must replace.

- 3) Draw out piston rod , remove Y-ring on end of piston.

5.2 Install and replace faulty parts.

- 1) Cleanup parts with clean oil before installation.
- 2) Then cleanup guiding bush and piston with hydraulic pressure oil the same as oil box trademark.
- 3) Dust or dunghill doesn't drop into lifting jack.
- 4) The order of installation is reverse the order of disassembly.
- 5) Install Y-ring on piston.
- 6) Install piston rod assembly into clean cylinder body.

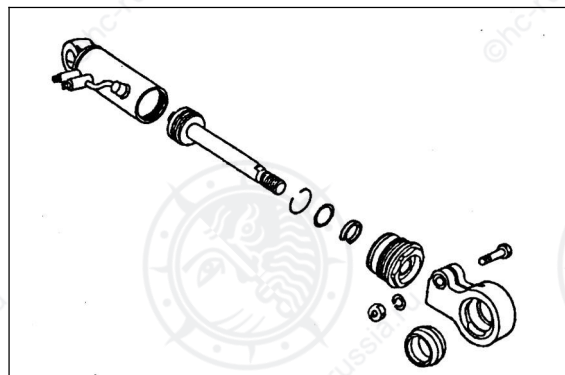
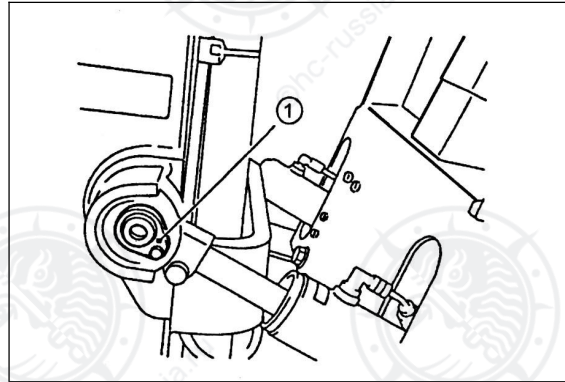
CAUTION : The end of cylinder body mast slick and clean, installation must set center, avoid scratching Y-ring.

7) Install replacing dust gasket ring and Y-ring in guiding bush and cylinder head.

NOTICE: Apply hydraulic pressure grease which trademark is the same as tank on guide sleeve installed gasket ring

8) Rip cylinder head into piston rod, screw down cylinder body.

5) The order of installation is reverse the order of disassembly.



6 . Disassembly and installation of tilting cylinder

WARNING

Noticing proceedings when removing cylinders.

·Attach wire rope to outer mast, avoiding mast fall down after removing tilting cylinder.

·Keep body away from equipment, no standing under the fork arm carrier.

1) Lay down fork arm carrier completely.

2) Remove bolt on the left and right bracket of outer mast, moreover pull axis out.

3) Remove oil pipe to the inlet of tilting cylinder.

4) Remove bolt on the bracket of Chassis, and pull pin out, then move tilting cylinder.

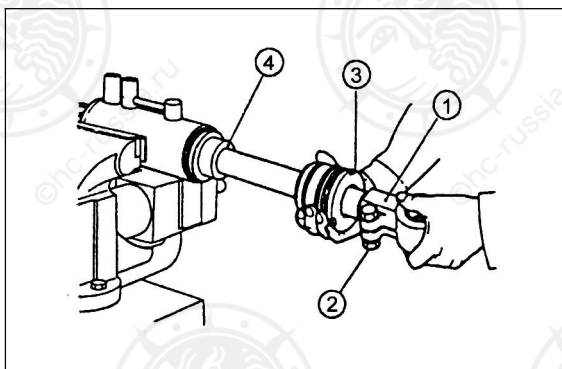
6.1 Disassembly of parts

1) Squeeze tilting cylinder with pliers, then pull piston rod come-and-go as opening of inlet and outlet on the tilting cylinder, so remaining oil is discharged tilting cylinder.

2) Screw earring bolts 2 loosely, and screw earring 1 out.

3) Remove cylinder head guiding bush 3;

4) Draw out piston rod assembly 4 (see as follows).



5) Remove all dust gasket rings, O-ring and Y-ring.

6) Remove dust gasket ring in the cylinder head. Means is the same as discharging of dust gasket ring in the cylinder head of lifting jack (see disassembly and installation of lifting jack).

7) Remove O-ring outside in the guiding bush.



8) Remove O-ring and Y-ring in the inner hole of guiding bush (see Fig. disassembly and installation of lifting jack).

CAUTION : No using dust gasket ring and Y-ring removed.

6.2 Install tilting cylinder after replacing ring

The order of installation is reverse

to the order of disassembly, but should notice follow proceedings:

1) Lubricate parts with clean hydraulic pressure oil.

2) Avoid dust and oil dirty dropping into tilting cylinder.

3) Avoid scratching the end of cylinder body, and inlet and outlet for oil.

4) Push piston rod to cylinder body when setting center, especially avoid scratching Y-ring.

5) Before installing guiding bush, wipe hydraulic pressure oil backing boardched with employment oil trademark in the middle of O-ring and Y-ring in the inner hole of guiding bush.

6) Don't scratch O-ring outside in the guiding bush when installing.

7) Remember install nylon stopper and tighten screw after screw cylinder head.

7. Noticing proceeding of debugging

1) Adjust Forward and BackWard of the mast

Place fork lift truck on the level ground, operate control lever to realize that mast inclined forward or backWard extremely. As assembly debugging data required, adjust combined screw thread length till according with data of BackWard. Then lock earring ring close.(please see foregoing table if you want know tightening torque of M10 bolt)

2) Adjust installation position of left and right lifting jack again

a. Adjust washer in the middle of piston rod and inner mast bracket if one lifting jack is not synchronization with the others when rising or falling, and if one lifting jack is different height from the others.

b. Loose two nuts on the U-bolt. Mast is not rise and lower until relative position of U-bolt and lifting jack is suitable. Then screw down nuts and tightening screw on the U-bolt. Thus lifting jack can be used longer and wear of piston rod can be reduced.

3) Please see foregoing table if you want know tightening force of bolt or screw. Please refer to common bolt tightening torque prescribed in our company if you want know other tightening force of bolt or screw.(refer to OPERATION AND MAINTAIN MANUAL backing boardched with it).

XII. Electrical system



WARNING:

Before starting to work on any parts of electrical system, remove rings and jewelry to prevent an accidental short circuit, and turn off ignition switch and then disconnect battery ground cable.

DESCRIPTION

Cables are covered with color-coded vinyl for easy identification. In the wiring diagram, colors are indicated by one or two alphabetical letters.

It is recommended that the battery be disconnected before performing any electrical service.

CABLE COLORS

Cable colors are indicated by one or two alphabetical letters:

B: black, BR: brown, G: green, L: blue, LG: Light green, R: red, W: white, Y: yellow, S: gray, P: purple

The main cable is generally coded with a single color. The others are coded with a two-tone color as below: B/W Black with white stripe G/Y: Green with yellow stripe

INSPECTION

Inspect all electrical circuit, referring to wiring diagrams. Circuits should be tested for continuity or short circuit with a conventional test lamp or circuit tester. Before inspecting circuit, ensure that:

1. Each electrical component part or cable is securely fastened to its connector or terminal.
2. Each connection is firmly in place and free from rust and dirt.
3. No cable covering shows any evidence of cracks, deterioration or other damage.
4. Each terminal is a safe distance away from any adjacent metal parts.
5. Each cable is fastened to its proper connector or terminal.
6. Wiring is kept away from any adjacent parts with sharp edges.
7. Wiring is kept away from any rotating or moving parts.
8. Cables between fixed portions and moving parts are long enough to withstand shocks and vibrations.
9. The wiring keeps a safety distance with the high temperature thing such as the vent-pipe.

Control box

Component removal

1. Turn key switch "OFF";
2. Press lock buckle on control box and open the cover;
3. Remove fuse and relay from box.

INSPECTION:

If fuse is broken, replace with new one. Refer to figure as follow:

(Specific see a forklift control box inner)

- a. If fuse is blown, be sure to eliminate cause of problem before installing new fuses.
- b. Never use fuse higher than specified rating.

Fusible links

A melting fusible links can be watched or touched easily, if it is not uncertain of melting, use multimeter or lamp to test.

Note :

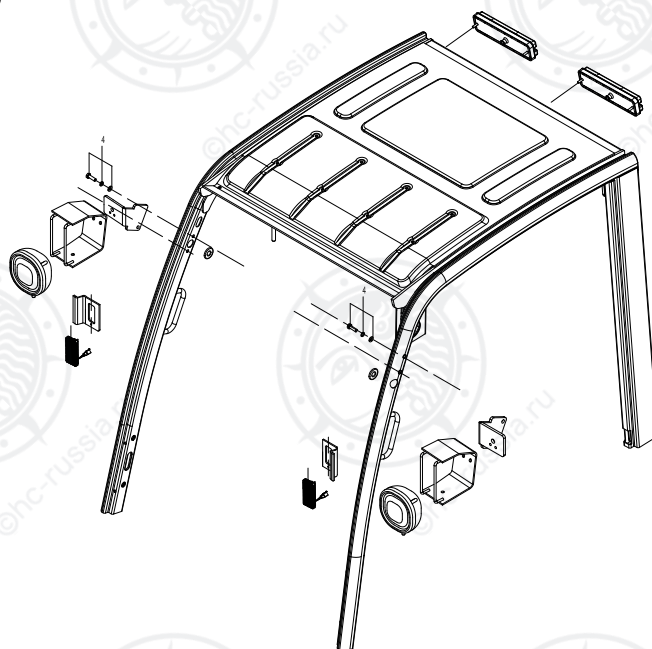
- ① If fusible links is melted, maybe because of short circuit(current is too high).
No matter which reason, please check and eliminate fault.
- ② Fusible links can cause heat, do not enlace with adhesive tape . do not put fusible near other rubber or wiring assembly.

Lighting System

Bulb Specifications

Lamp	W
Headlight	9V-36V, 15W
Small headlight	LED
Steering lamp	12V
Width lamp	
Combined back lamp	LED
Brake and width lamp	
Steering lamp	12V
Reverse lamp	
Combined meter	12V-2W
Floodlight	12V-2W
Caution light	

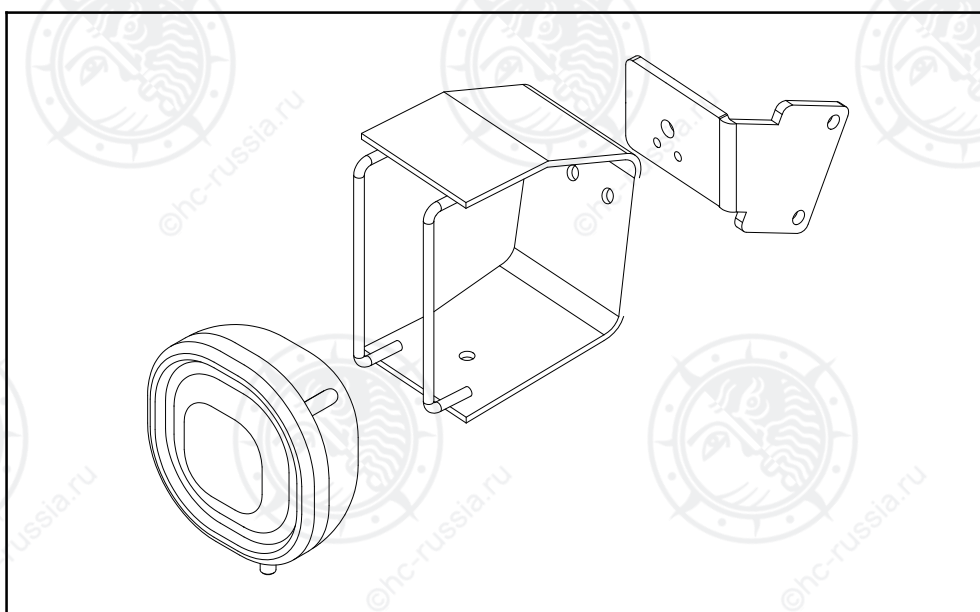
Location of light



Front headlight

Disassembly

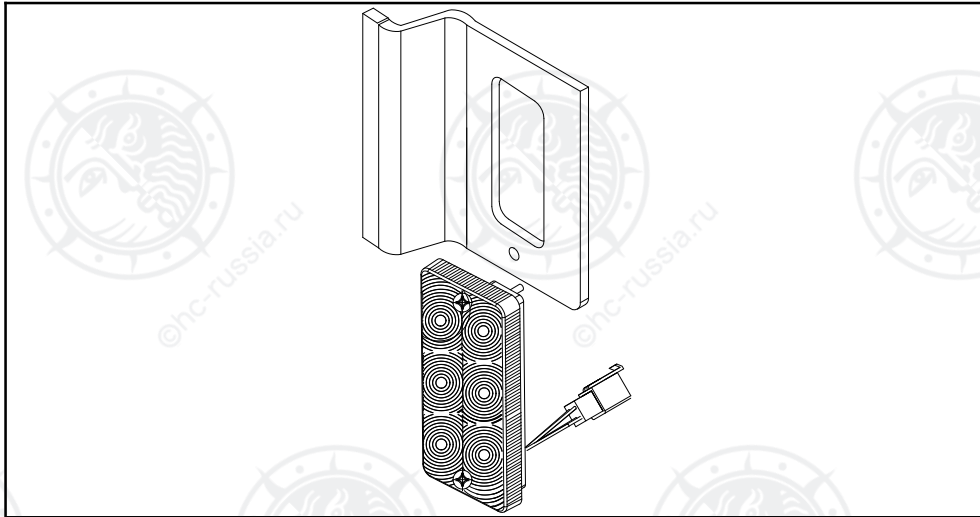
1. Remove securing nuts of the big-little lamp.
2. Take apart the wiring connector.
3. Remove bolt, lens, then replace faulty LED with new one.
4. Assembly is the opposite procedures.



Front combination lamp

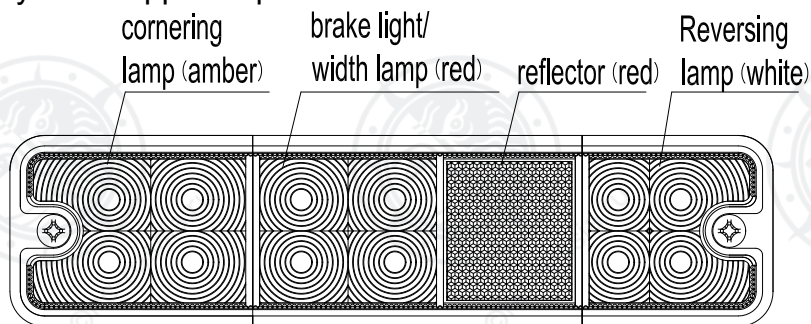
Disassembly and assembly

1. Remove fixing bolt of bracket.
2. Disconnect the wiring connector.
3. Remove bolt、astigmatism glass, then replace faulty LED with new one.
4. Assembly is the opposite procedures.

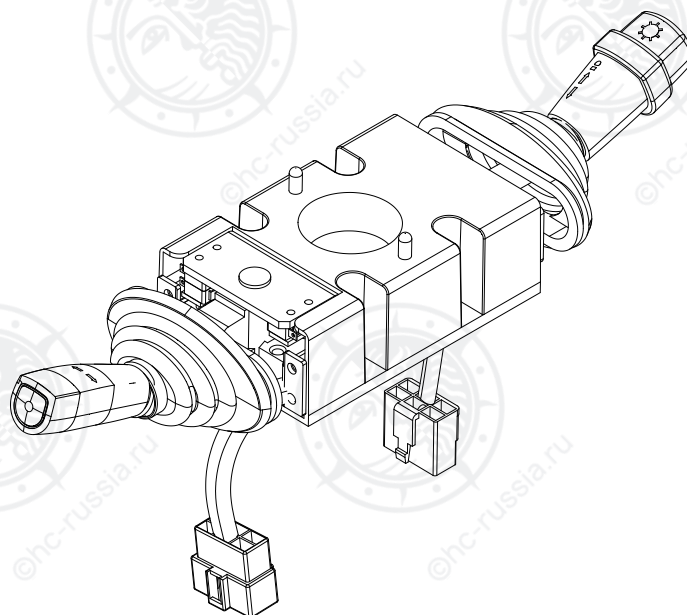


REAR COMBINATION LAMP

1. Remove fixing bolt of bracket.
2. Disconnect the wiring connector.
3. Remove bolt、astigmatism glass, then replace faulty bulb with new one.
4. Assembly is the opposite procedures.



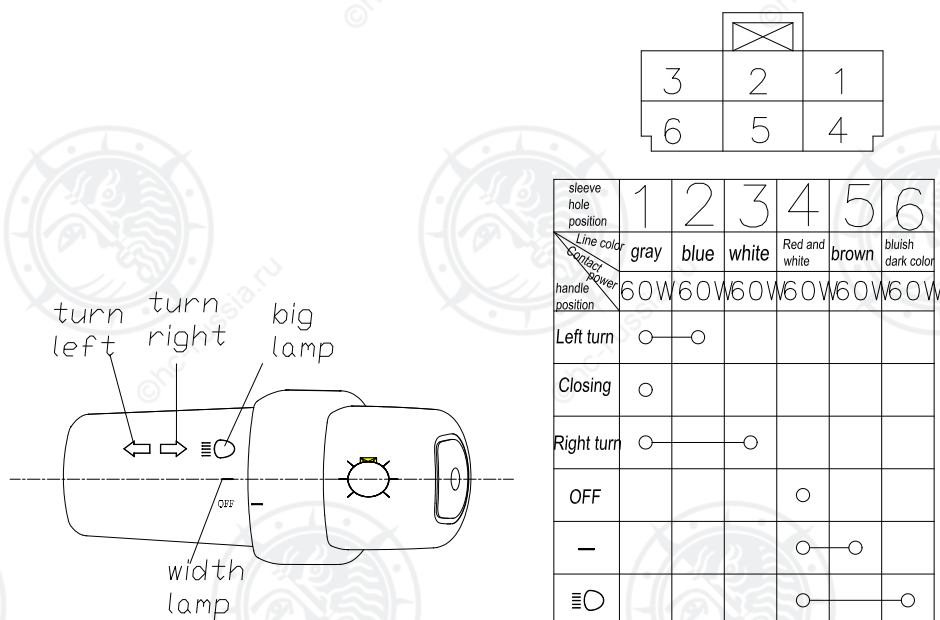
Combination switch (Electric commutation)



Lighting switch and steering switch

Disassembly

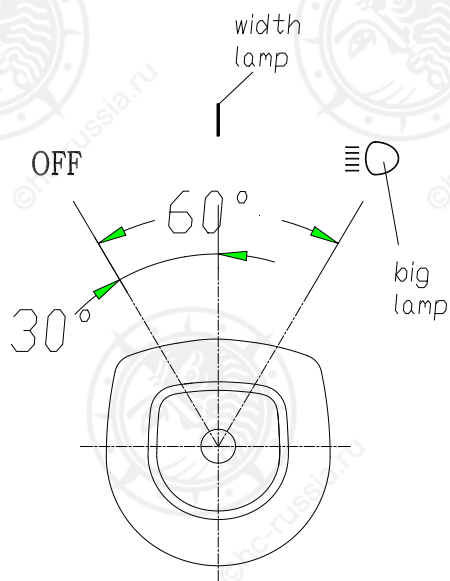
- 1、 Remove combination meter;
- 2、 Remove bolt, disconnect wire of inserted and connected part;
- 3、 To install, reverse removal procedures.



Inspect lighting switch

Disconnect switch connector, and check whether each connection point is on.

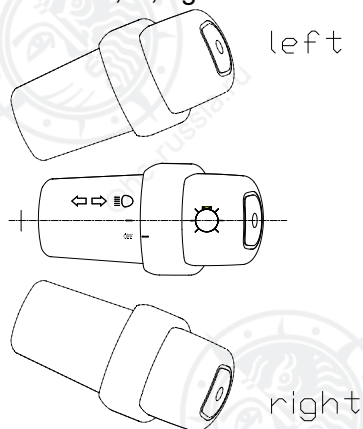
Use multimeter (with ohm) to inspect whether it is on when lighting switch is on these positions: headlight, width lamp, OFF.



Headlight	4-6
Width lamp	4-5
OFF	OFF

Inspect steering lamp

Use multimeter(with ohm) to inspect whether it is on when lighting switch is on these positions: left turn, N, right turn.

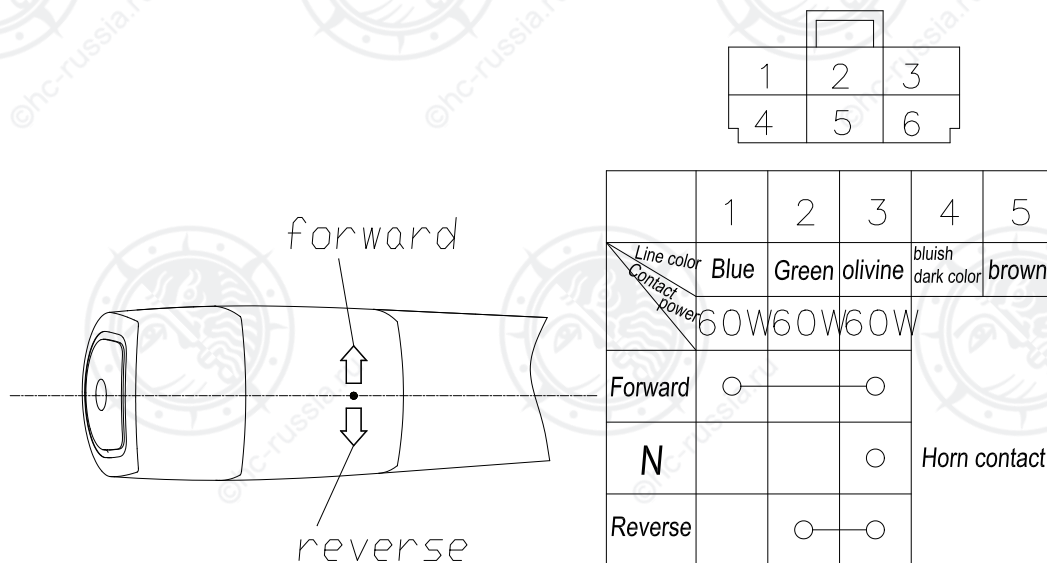


Switch position	Connection point
Left turn	1-2
N	OFF
Right left	1-3

Direction switch

Removal

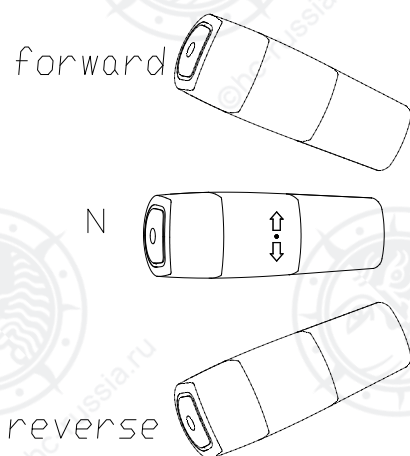
- 1、 Remove combination meter;
- 2、 Screw off bolt, disconnect connector of wiring;
- 3、 To install, reverse removal procedures.



Inspect direction switch

Disconnect switch connector, and check whether each connection point is on.

Use multimeter(with ohm) to inspect whether it is on when lighting switch is on these positions:forward , N, reverse.



Switch position	Connection point
Forward	1-3
N	OFF
Reverse	2-3

Instrument, sensor and relay

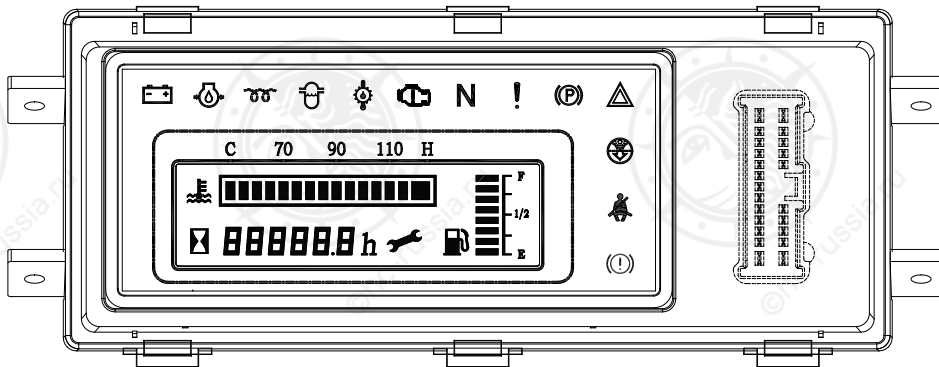
Inspect whether relay circuit is on, connect or disconnect coil with proper

voltage(supplied by battery), and then use multimeter(with ohm) to check whether contactor is on.

Disassembly and installation

Combination meter assembly

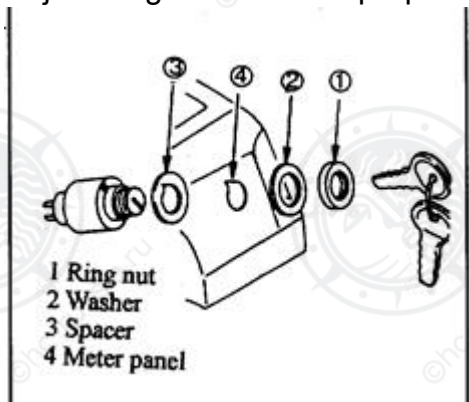
- 1.Remove 4 fixed bolt from meter crust. Notice that when installing and removing ,please make instrument surface tilt an angle to avoid damaging the screw thread of fixed parts on truck.
- 2.Take out wiring harness from sleeve, and then instrument can be brought out.
- 3.There is transparent plastic cover to cover, so it can prevent dust and water, and it is fixed by 6 plastic clip buckle, please press down plastic buckles lightly to take out plastic cover when removing.
- 4.To install, reverse removal procedures.



Key (start) switch

- 1、 Remove combination meter.
- 2、 Disconnect connector of wiring.
- 3、 Remove nuts, washers, spacers and instrument plate.
- 4、 To install, reverse removal procedures.

Adjust ledge of switch to proper length when installing.



Inspect

Use multimeter (with ohm) to check key switch whether it is on at each position.

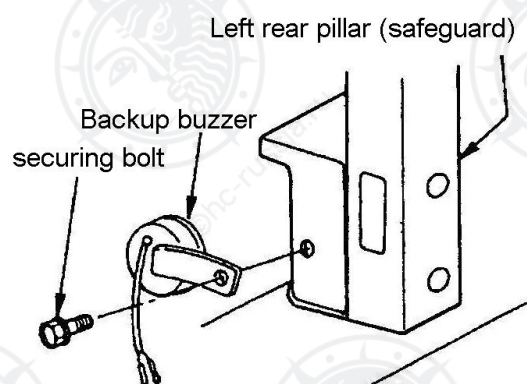
Switch position	Terminal
OFF	OFF
ON	B1-B2-Acc on
START	B1-B2-Acc-C-R2 on

Principle diagram of preheat start switch

Connection point	B1	B2	Acc	C	R1	R2
Position						
Preheat	O	O			O	
Close	O	O				
Run	O	O	O			
Start	O	O	O	O		O

REVERSE BUZZER

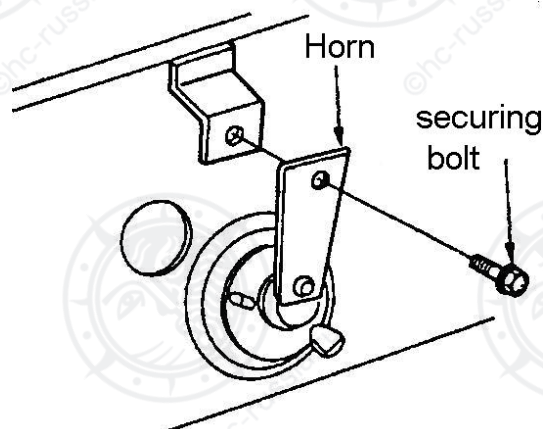
- 1.Remove the wiring terminal , then unscrew the bolt.
- 2.To install, reverse removal procedure.



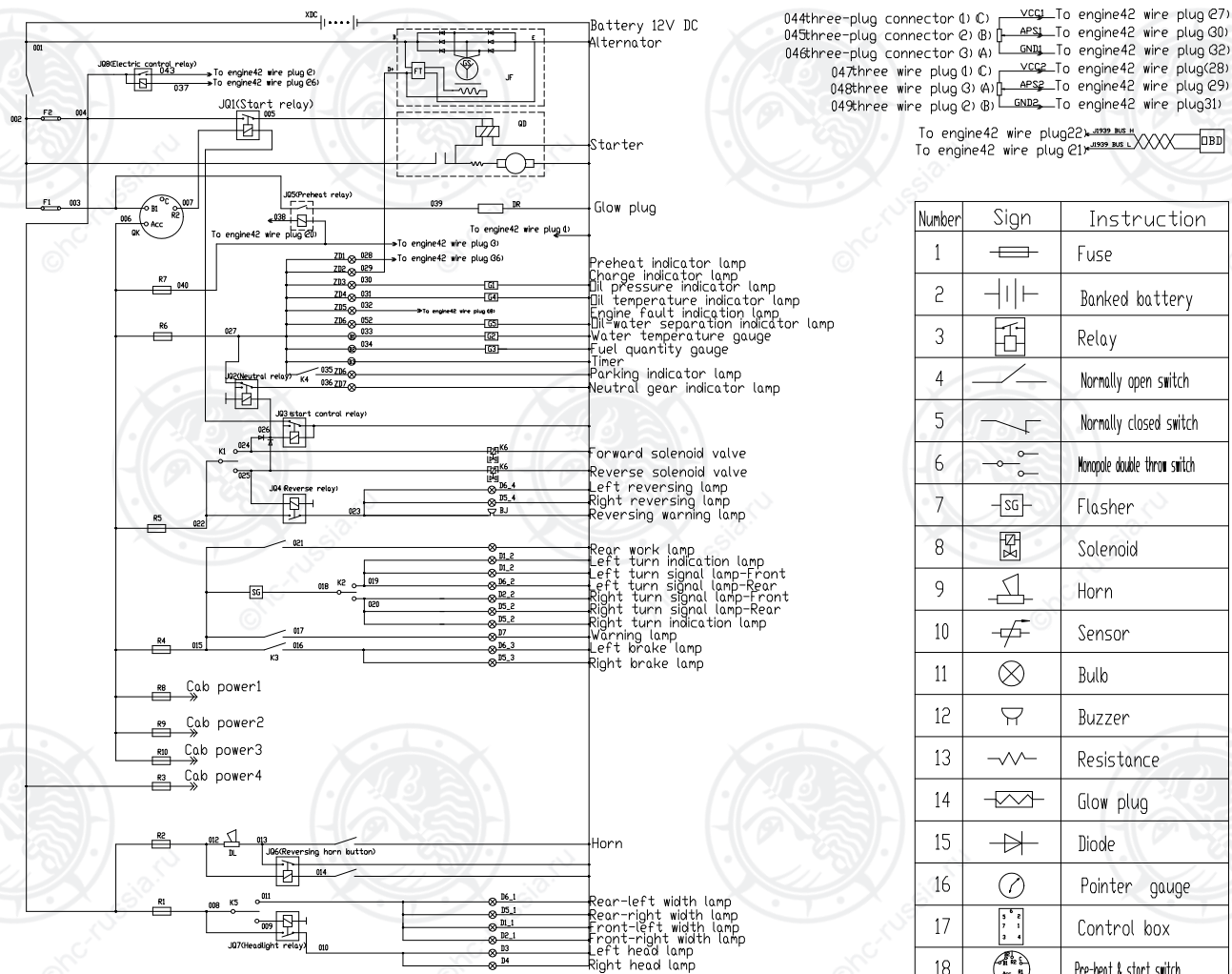
HORN

REMOVAL AND INSTALLATION

- 1.Disconnect horn harness connector.
- 2.Remove bolt and horn.
- 3.To install, reverse removal procedure.







preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	○	○			○		
close	○	○					
run	○	○	○				
start	○	○	○	○		○	

Note: "O" means ON.

Fig. 1-1 CPD15/18/20/25/30/35-XRG71、CPD20/25/30/35-XRG72、CPD20/25/30/35-XRG72F、CPD15/18-XRG71J、CPD15/18-XRG71JF
 CPD15/18-XRG91、CPD20/25/30/35/38-XRG92 Electrical system diagram

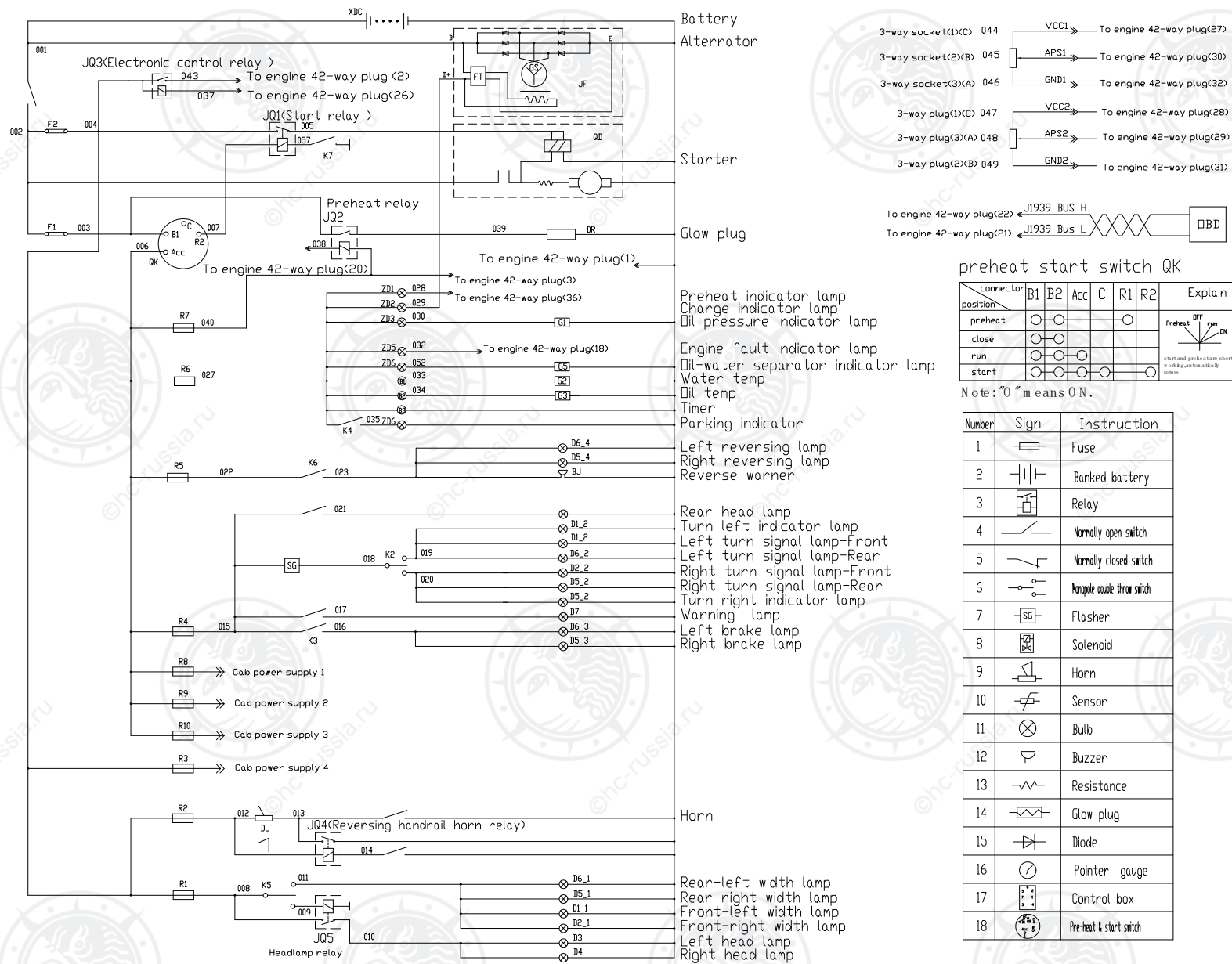
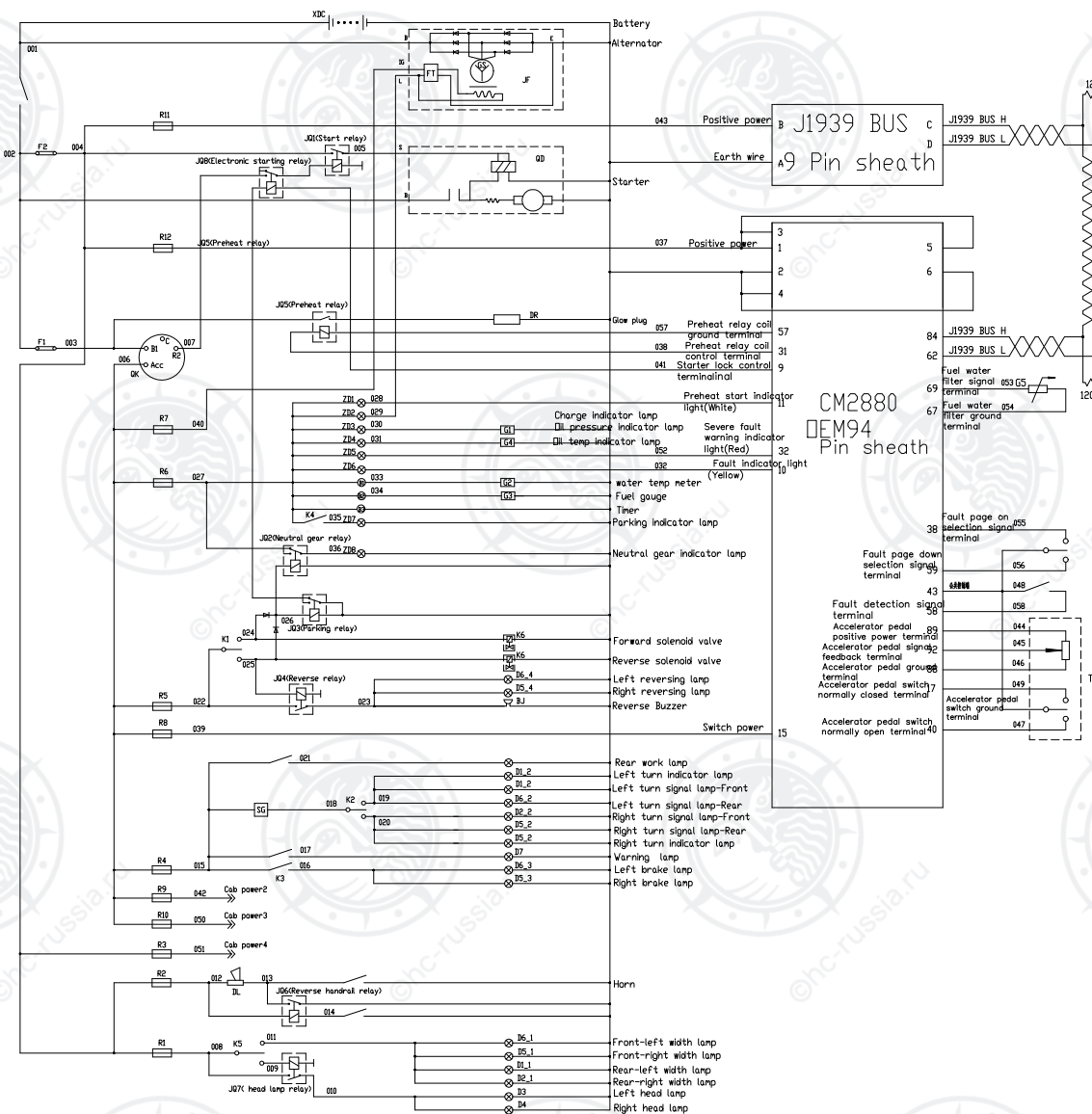


Fig. 1-2 CPC15/18/20/25/30/35-XRG71, CPC20/25/30/35-XRG72, CPC15/18-XRG91, CPC20/25/30/35/38-XRG92 Electrical system diagram



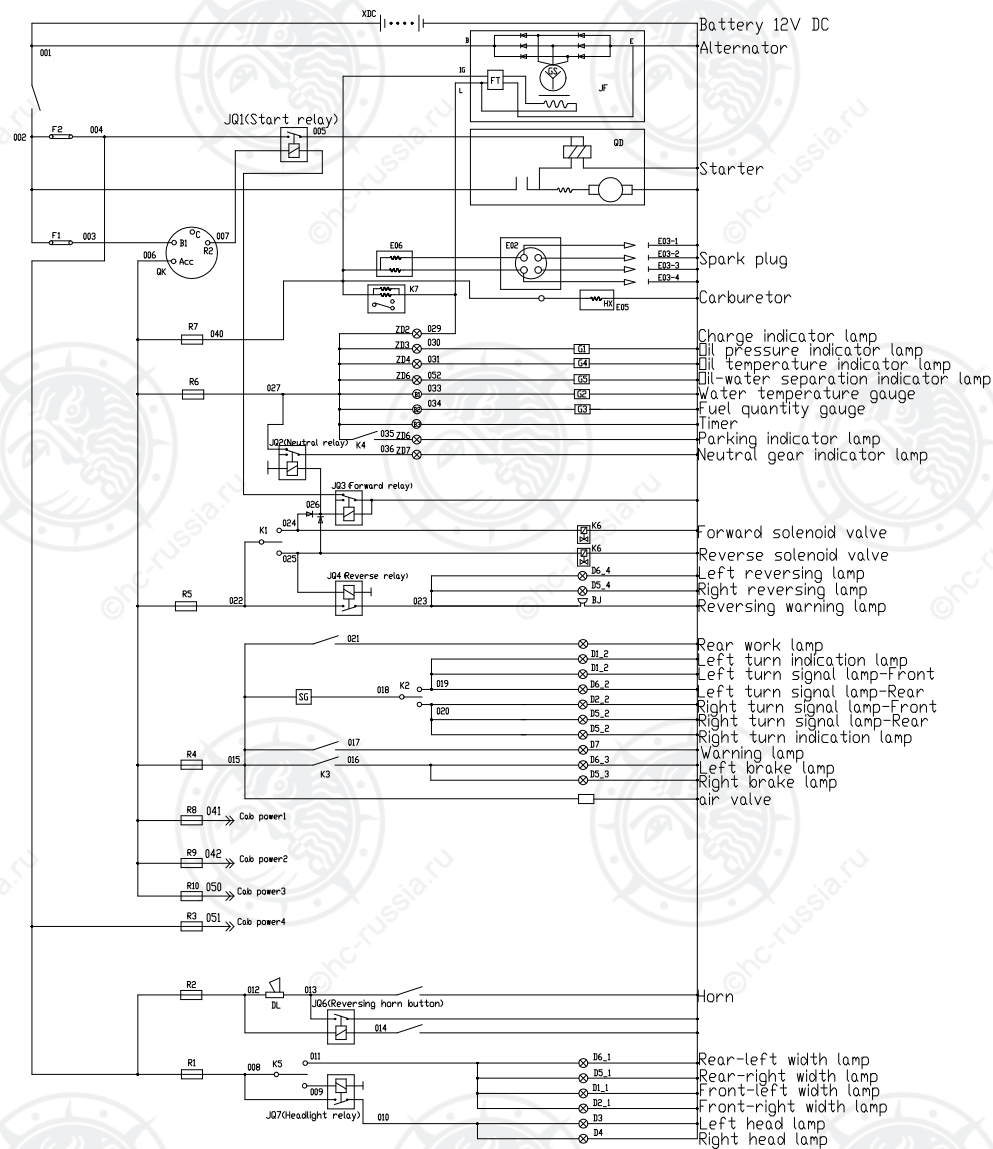
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	○	○			○		
close	○	○					
run	○	○	○				
start	○	○	○	○			

Note: "O" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 2 CPCD10/15/18/20/25/30/35-XRW43 、CPCD20/25/30/35-XRW43B、CPCD20/25/30/35-XRW43F Electrical system diagram



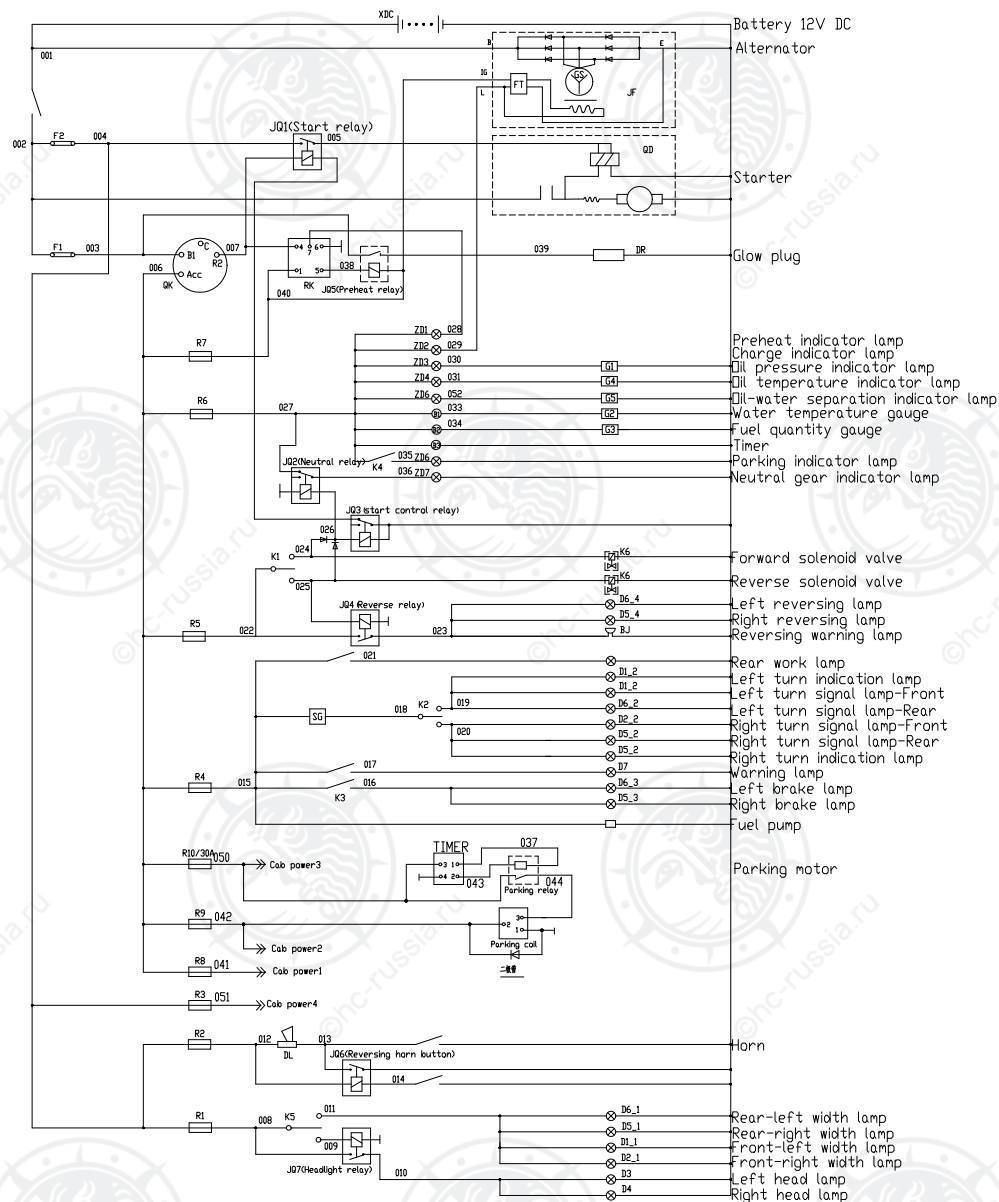
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	☐	☐			☐		
close	☐	☐					
run	☐	☐	☐				start and preheat are short working, automatically return
start	☐	☐	☐	☐			

Note: "O" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig.3 W21/W22/W52 engine Electrical system diagram



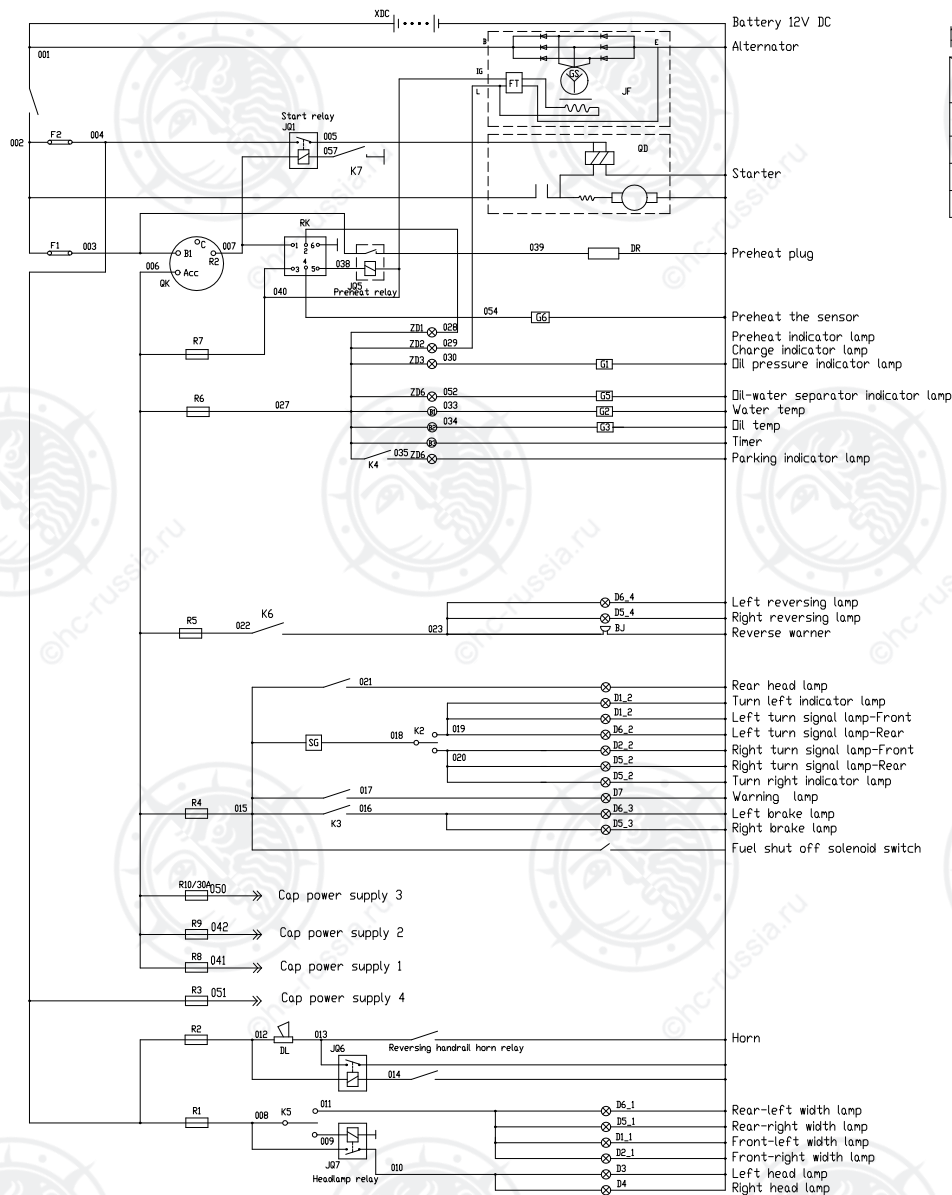
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	○	○			○		
close	○	○					
run	○	○	○				
start	○	○	○	○		○	start and preheat are short working, automatically return.

Note: "O" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 4 CPCD20/25/30/35-XRW56、CPCD20/25/30/35-XRW56B(1)、CPCD20/25/30/35-XRW56F Electrical system diagram



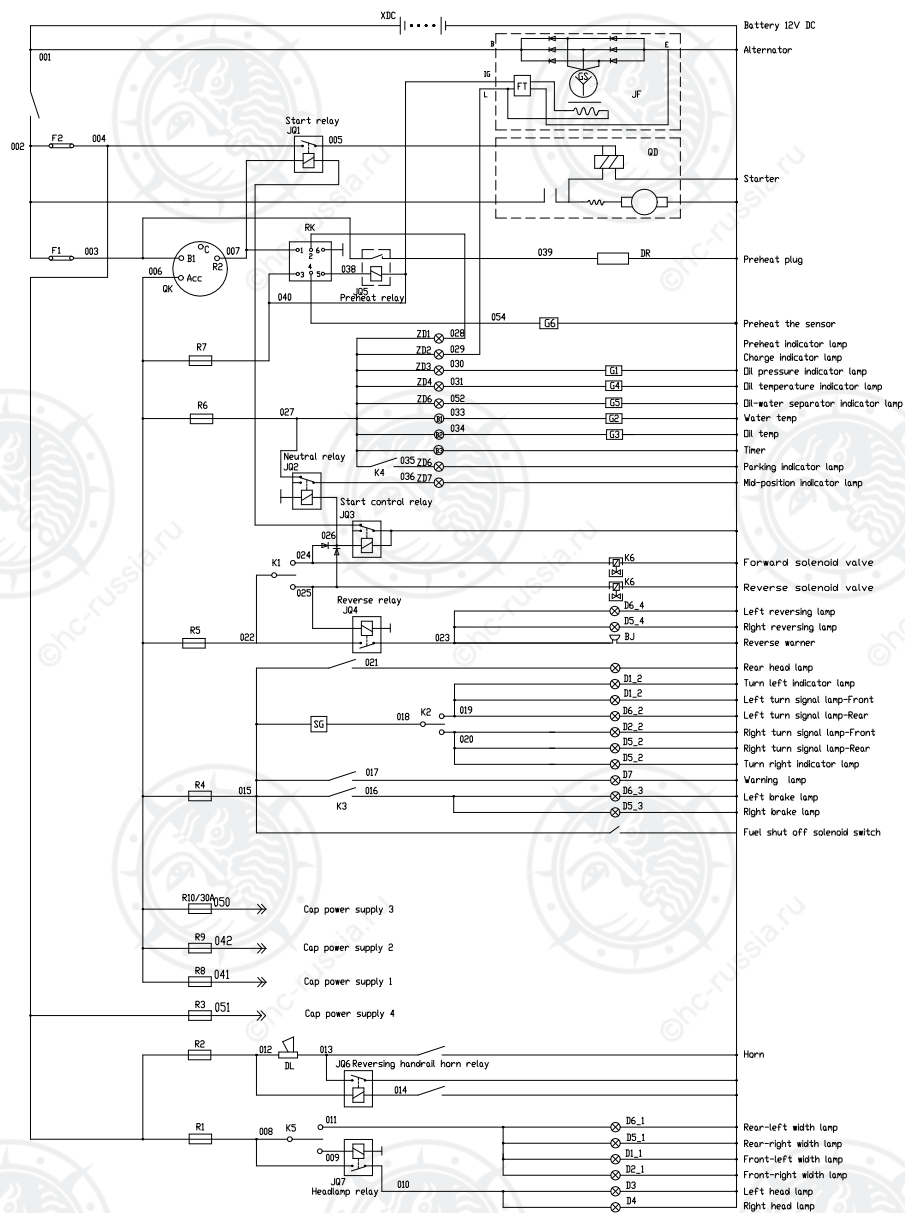
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	○	○			○		Preheat OFF run DN start and preheat short working, start a fully run.
close	○	○					
run	○	○	○				
start	○	○	○	○		○	

Note: "0" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 5 CPC15/18-XRW10,CPC20/25/30-XRW10 Electrical system diagram



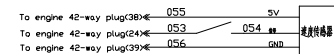
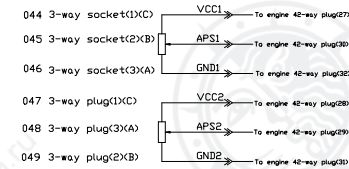
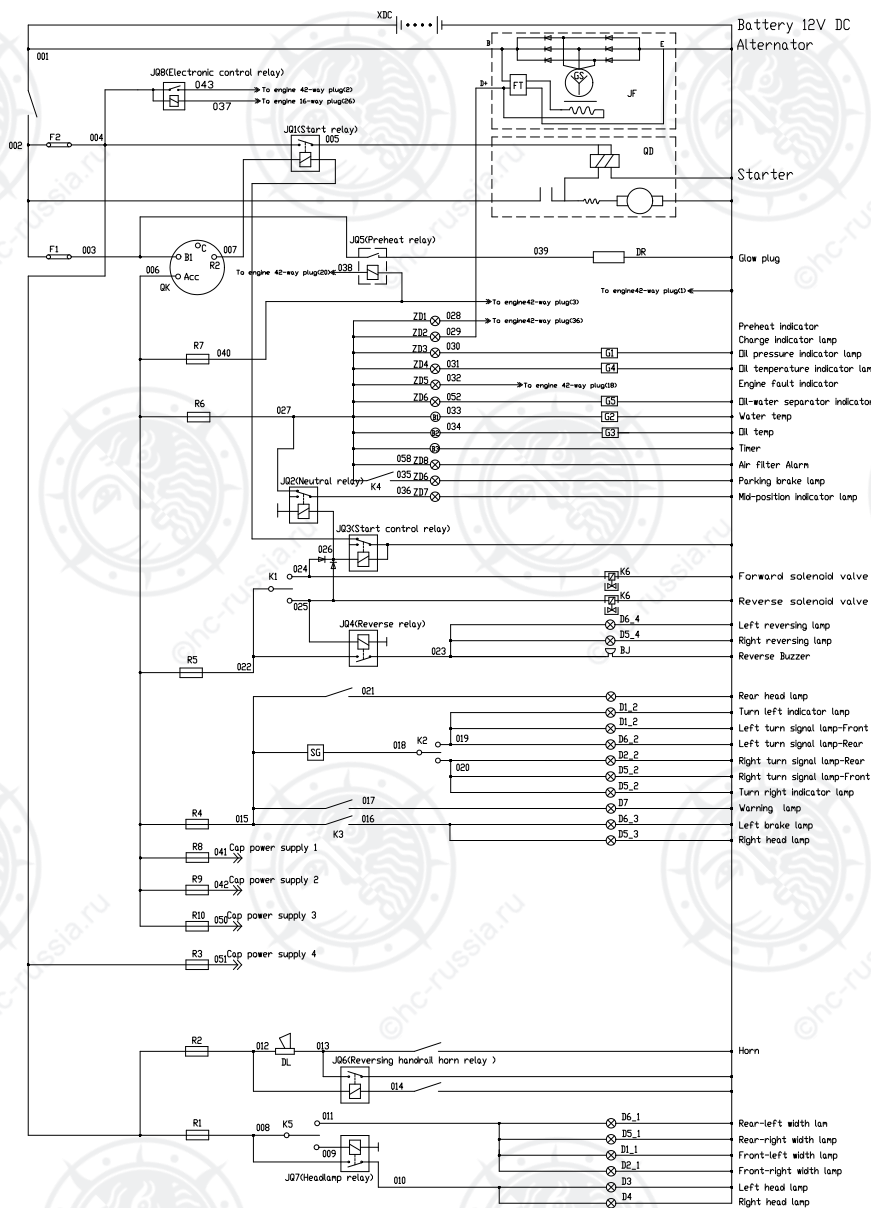
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	☐	☐			☐		
close	☐	☐					
run	☐	☐	☐				
start	☐	☐	☐	☐			

Note: "0" means 0N.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 6 CPCD15/18-XRW10,CPCD20/25/30-XRW10,CPCD20/25/30-XRW10B(B1),CPCD20/25/30-XRW10F Electrical system diagram



preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	X	X			X		
close	X	X					
run	X	X	X				
start	X	X	X	X		X	

Note: "X" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 7 CPCD15/18-XRW91F,CPCD20/25/30/35/38-XRW92F Electrical system diagram

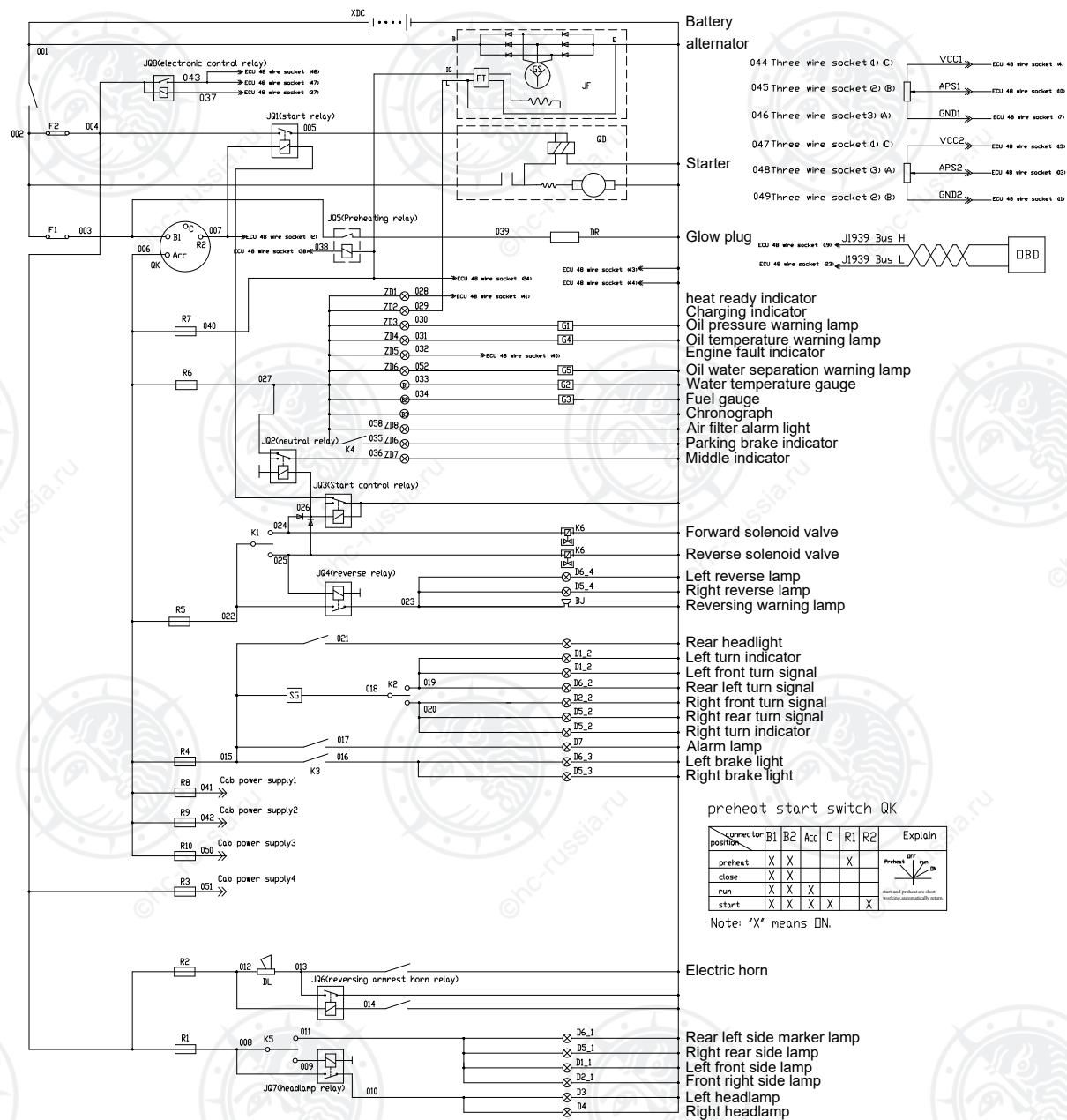


Fig. 8 CPCD20/25/30/35-XRG59、CPCD20/25/30/35-XRG60 Electrical system diagram

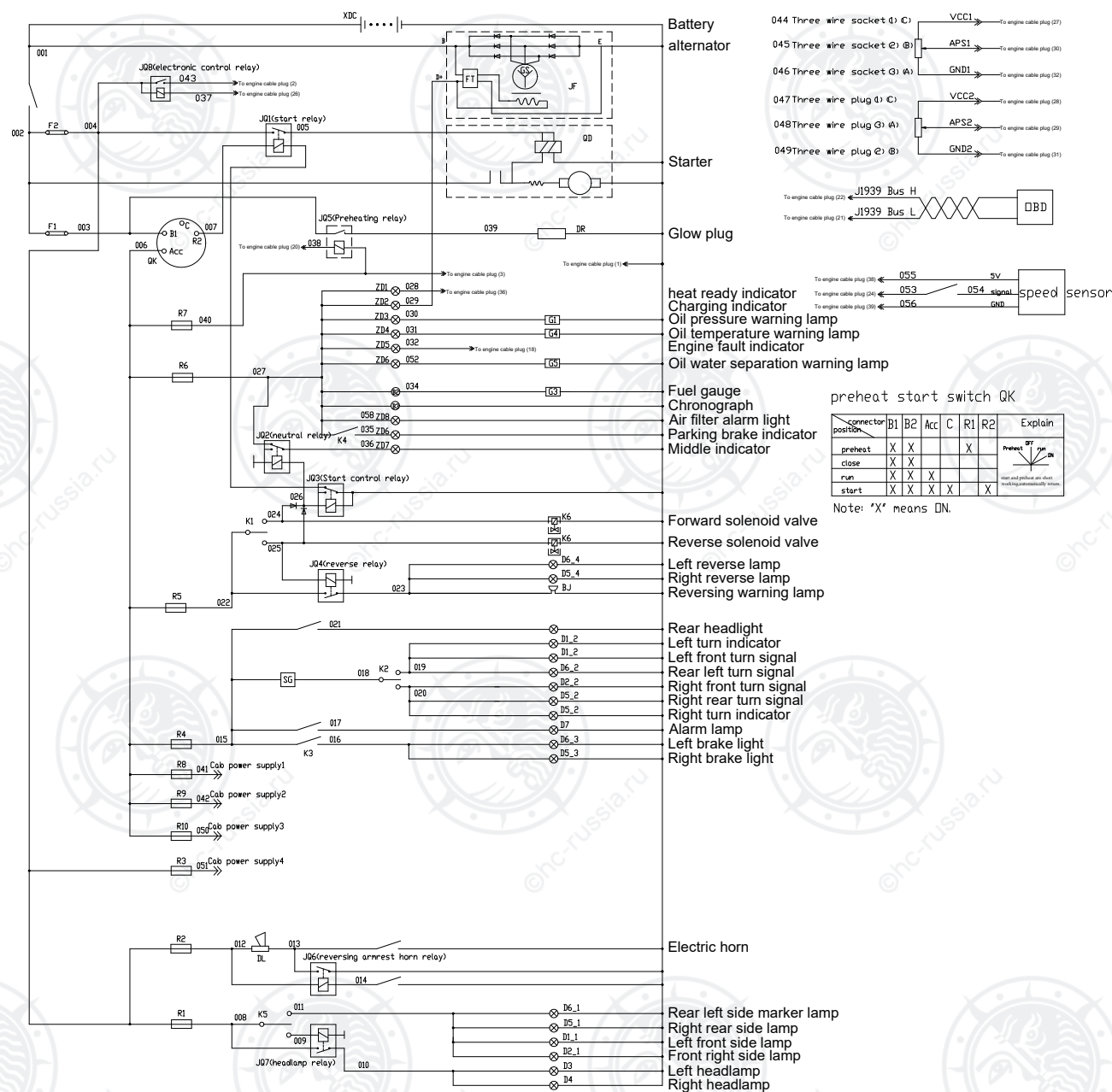


Fig. 9 CPCD15/18-XRG98、CPCD15/18-XRG98F、CPCD20/25/30/35/38-XRG92F Electrical system diagram

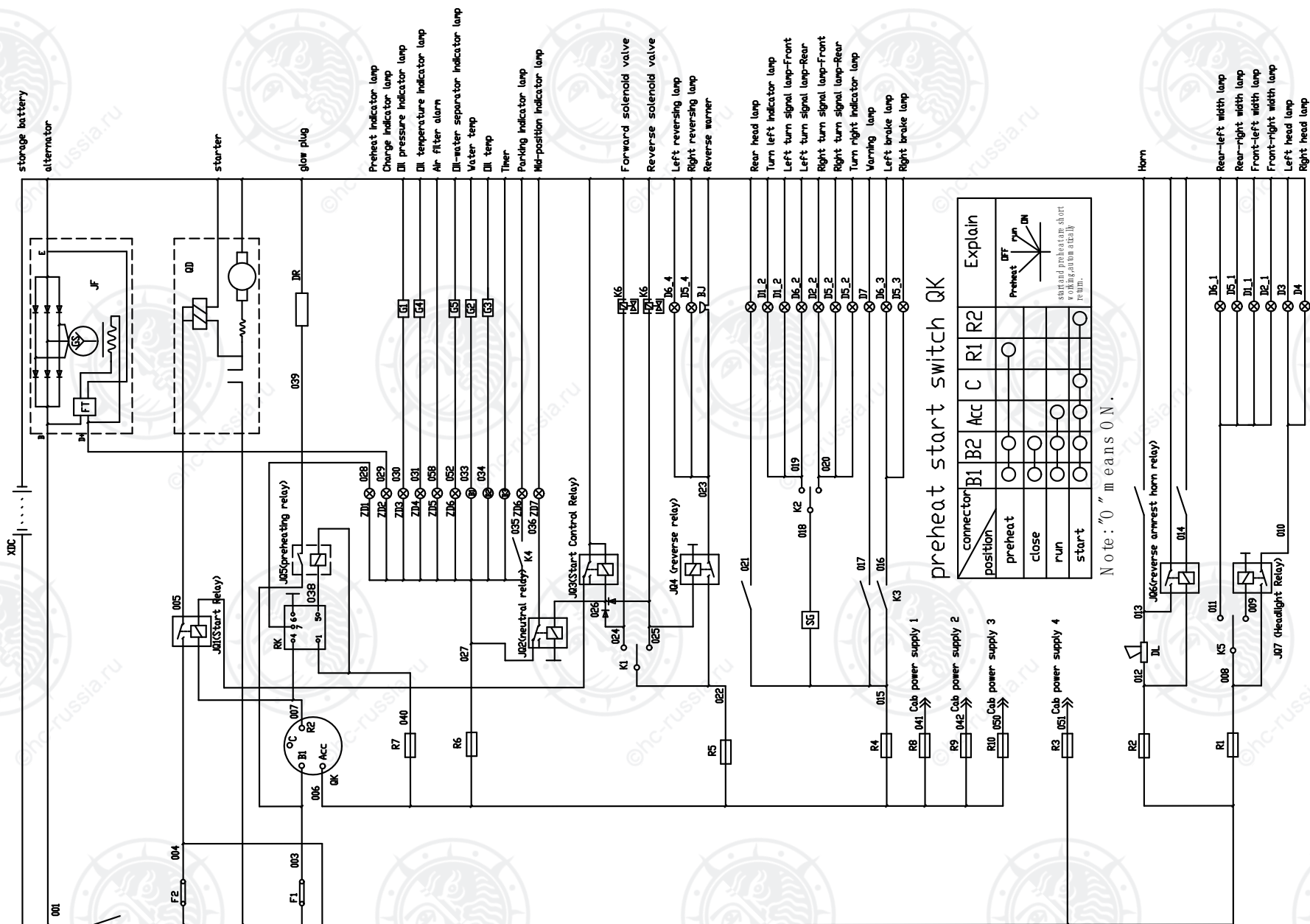


Fig. 10 CPCD20/25/30/35/38-XRG2 Electrical system diagram

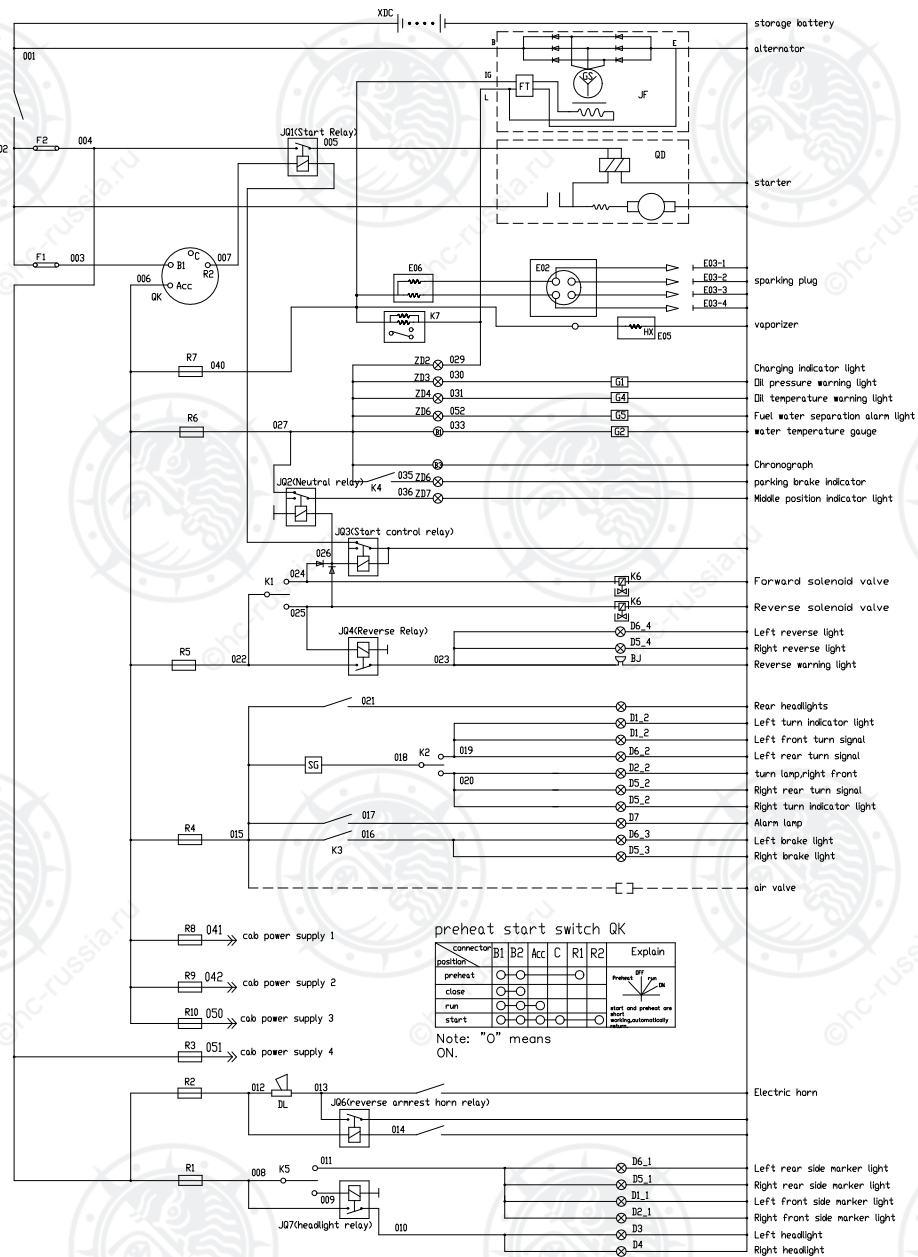


Fig. 11 CPYD20/25/30/35/38-XRW52F、CPYD20/25/30/35/38-XRW52B(B1) Electrical system diagram

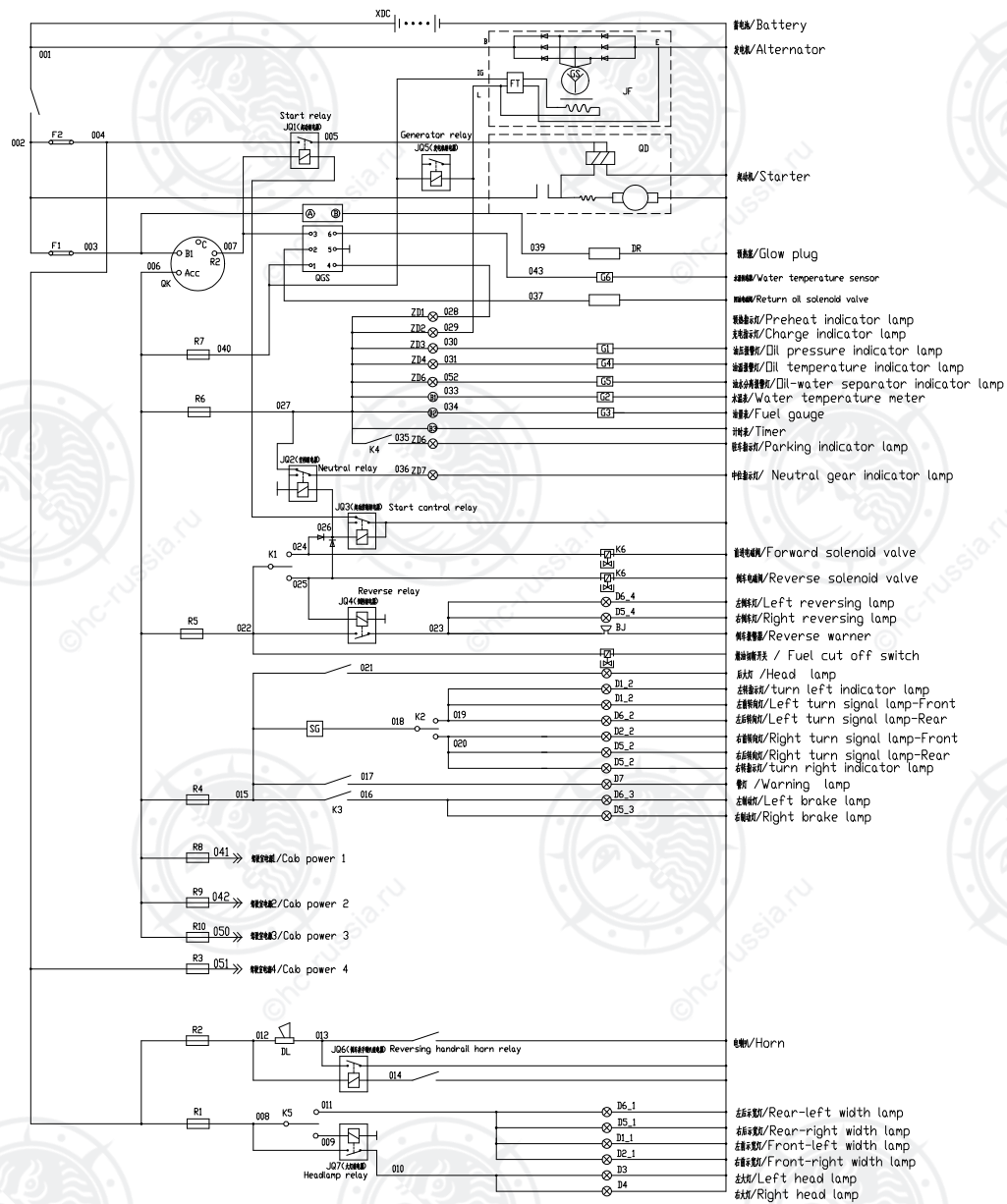
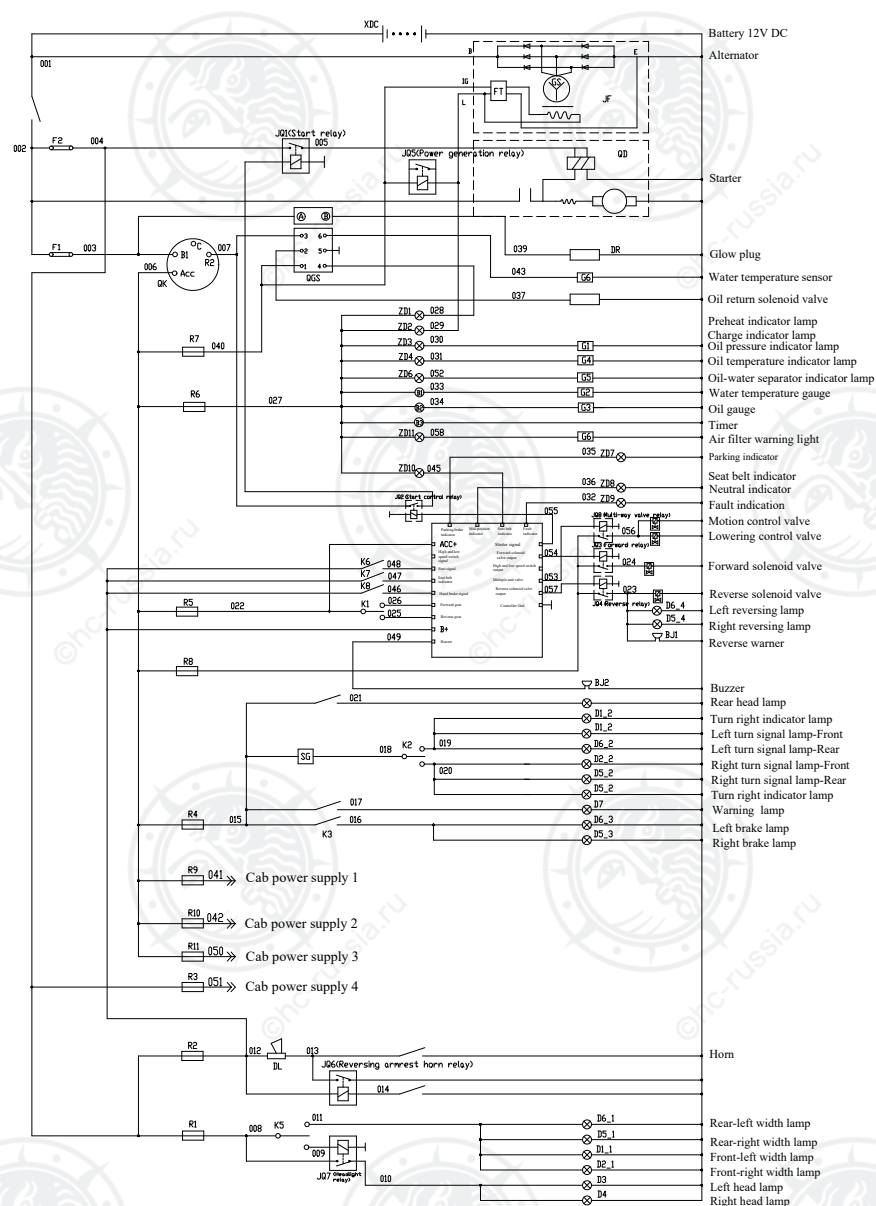


Fig. 12 CPCD15/18-XRW32F、CPCD15/18-XRW32B、CPCD15/18-XRW32B1、CPCD20/25/30/35-XRW33、CPCD20/25/30/35-XRW33B、CPCD20/25/30/35-XRW33F
Electrical system diagram (No OPS forklift truck)



preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	X	X			X		
close	X	X					
run	X	X	X				
start	X	X	X	X		X	

Note: "X" means ON.

Number	Sign	Instruction
1		Fuse
2		Banked battery
3		Relay
4		Normally open switch
5		Normally closed switch
6		Monopole double throw switch
7		Flasher
8		Solenoid
9		Horn
10		Sensor
11		Bulb
12		Buzzer
13		Resistance
14		Glow plug
15		Diode
16		Pointer gauge
17		Control box
18		Pre-heat & start switch

Fig. 13 CPCD15/18-XRW32F、CPCD15/18-XRW32B、CPCD15/18-XRW32B1、CPCD20/25/30/35-XRW33、CPCD20/25/30/35-XRW33B、CPCD20/25/30/35-XRW33F
Electrical system diagram (OPS forklift truck)

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