

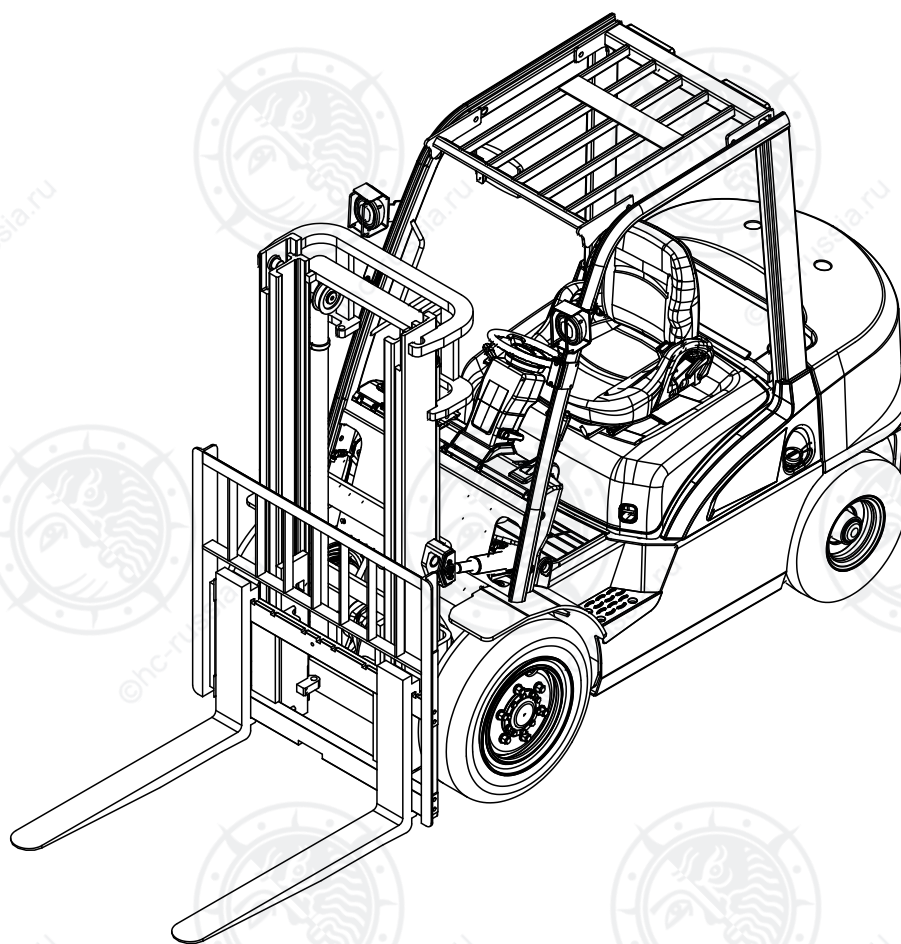


X series

**Internal Combustion Counterbalanced
Forklift Truck**

4.0t-X5.0t

SERVICE MANUAL



HANGCHA GROUP CO., LTD.

07/2025

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Foreword

Thank you very much for buying Hangzhou forklift.

4t-5t X series internal combustion forklift is our company's new product which is developed recently with using the newest appearance design method. The truck with smooth line and innervation comes up to the latest international appearance trends.

The optimized operate system with advanced man-machine engineering technology and the advanced technique of damping in our trucks make our trucks more comfortable to operate.

This manual instructs you the structure, principle and servicing methods on internal combustion forklift.

This manual also applies to container forklift truck and forklift truck assembled attachments.

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

It is forbidden anybody without training and qualification to maintain.

Only in the event that the truck manufacturer is no longer in business and there is no successor in the interest to the business, the user may arrange for a modification or alteration to a powered industrial truck provided, however, that the user shall:

- a) Arrange for the modification or alteration to be designed, tested and implemented by an engineer(s) expert in industrial trucks and their safety;
- b) Maintain a permanent record of the design, test(s) and implementation of the modification or alteration;
- c) Approve and make appropriate changes to the capacity plate(s), decals, tags and instruction handbook;
- d) Affix a permanent and readily visible label to the truck stating the manner in which the truck has been modified or altered together with the date of the modification or alteration, and the name and address of the organisation that accomplished the tasks.

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I . Power System

1.Engine for Forklift

Engine model	YC4DK-T304
Manufacturer	YUCHAI
Type	In-line, water cooled, four stroke, Direct injection
Air Intake method	Pressurized / pressurized cold
number of cylinders	4
Displacement	3.621L
Rated output	66kW/2200r/min)
Max. output torque	350N.m/1400-1700r/min)
Idling	725 r/min
Max. engine speed without load	2376 r/min
Flywheel turning direction	Anticlockwise (Face the power output)
Truck model	CPC40/45-XRG76, CPC50-XRXG76 CPCD40/45-XRG76, CPCD50-XRXG76

Engine model	CY4BG531-2
Manufacturer	CHAOCHAI
Type	In-line, water cooled, four stroke, Direct injection
Bore × Stroke	φ 102mm×118mm
Displacement	3.856L
Rated output	60kW/2200r/min)
Max. output torque	300N.m/1000-1800r/min)
Idling	800±50r/min
Max. engine speed without load	2400±20
Compression ratio	17:1
Flywheel turning direction	Anticlockwise (Face the power output)
Truck model	CPC40/45-XRG75, CPC50-XRXG75 CPCD40/45-XRG75, CPCD50-XRXG75 CPCD40/45-XRG75-GW, CPCD50-XRXG75-GW

Engine model	4D32RG30	
Manufacturer	XINCHAI	
Type	In-line, water cooled, four stroke, Direct injection	
Bore × Stroke	φ 98mm×105mm	
Displacement	3.17L	
Rated output	50kW/2300r/min	60kW/2200r/min
Rated torque	250kW/1500-1700r/min	320kW/1500-1700r/min
Idling	700±30	
Compression ratio	18:1	
Flywheel turning direction	Anticlockwise (seeing from the flywheel end)	
Truck model	CPC40/45-XRG73,	CPC50-XRXG73

Engine model	1104D-44T
Manufacturer	Britain PERKINS
Type	4 cylinders, In-line, four stroke, water cooled, turbo charged
Bore × Stroke	105mm×127mm
Displacement	4.41L
Rated output	56kW (2200r/min)
Rated torque	265N.m (1700r/min)
Idling	800r/min
Max. engine speed without load	2360r/min
Compression ratio	18.2:1
Flywheel turning direction	Anticlockwise (seeing from the flywheel end)
Truck model	CPCD40/45-XRW34, CPCD50-XRXW34

Engine model	1104D-44
Manufacturer	Britain PERKINS
Type	4 cylinders, In-line, four stroke, water cooled, naturally aspirated
Bore × Stroke	105mm×127mm
Displacement	4.41L
Rated output	56kW (2200r/min)
Rated torque	265N.m (1700r/min)
Idling	800r/min
Maximum engine speed without load	2360r/min
Compression ratio	18.2:1
Flywheel turning direction	Anticlockwise (seeing from the flywheel end)
Truck model	CPCD40/45-XW35、CPCD50/55-XXW35

Engine model	PSI 4.3
Manufacturer	PSI
Type	6 cylinders, 90°, V6,
Bore × Stroke	101.6mm×88.39mm
Displacement	4.3L
Rated output	LPG: 77kw / 2300r/min Gasoline: 76kw / 2300r/min
Max. output torque	LPG: 332.85N·m/1400 r/min Gasoline: 318N·m/2300 r/min
Idling	800r/min
Compression ratio	9.4:1
Flywheel turning direction	Anticlockwise (seeing from the flywheel end)
Truck model	CPQYD40/45-XRW57, CPQYD50-XRXW57

Engine model	S6S
Type	Water cooled, 4 stroke cycle diesel engine
No. of cylinders - arrangement	6 cylinder in-line
Cylinder bore × stroke	φ 94 × 120 mm
Displacement	4.996 L
Combustion type	Swirl chamber
Compression ratio	22 : 1
Direction of rotation	Counterclockwise as viewed from flywheel side
Dimensions (L x W x H)	1029 × 622 × 839 mm
Dry weight	345 kg
Fuel filter	Cartridge type pape-element (with water separator)
Fuel injection nozzle	Throttle type
Lubrication method	Forced circulation (pressure feed by oil pump)
Engine oil capacity	Whole engine: approx. 17.5 L Oil pan: approx. 16.5 L
Oil filter	Cartridge type paper-element
Oil cooler	Water cooled multi-plate (built-in crankcase)
Cooling method	Forced water cooling by centrifugal pump
Coolant capacity	Approx. 8 L (in engine only)
Truck model	CPCD40/45-XW76、CPCD50/55-XXW76 CPCD40/45-XW76BN、CPCD50/55-XXW76BN

Engine model	4D32RG30-017
Manufacturer	XINCHAI
Rated output	60kW/2200 r/min
Max. output torque	320N·m/(1500-1700) r/min
Truck model	CPCD55-XRXG73BN-S

Engine model	TD42AA
Manufacturer	NISSAN
Rated output	59kW/2300 r/min
Max. output torque	254N·m/1800r/min
Truck model	CPCD40/45-RW19, CPCD50-RXW19

Engine model	YCF3675-T480
Manufacturer	YuChai
Rated output	55kW/2200 r/min
Max. output torque	340N·m/ (1400-1600) r/min
Truck model	CPCD40/45-XRG82, CPCD50-XRXG82

Engine model	YC4DK75-T303
Manufacturer	YuChai
Rated output	55kW/2200 r/min
Max. output torque	315N·m/(1400-1700) r/min
Truck model	CPCD55-XRXG76BN-S

Engine model	4D35Y41
Manufacturer	XINCHAI
Rated output	55.8kW/2200 r/min
Max. output torque	320N·m/1600 r/min
Truck model	CPCD40/45-XRG93, CPCD50-XRXG93

Specifications, structure and maintenance methods :

4TNE92/98, Yanmar engine see ENGINE MAINTENANCE MANUAL.

QSF2.8 Cummins engine see ENGINE OWNERS MANUAL.

Check value of end gas after maintaining engine, and the value must be according to following figure:

Limits and 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(granule) (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

Limits and for exhaust pollutants from diesel engines of non-road mobile machinery

(CHINA IV)

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(granule) (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.Chinese IV exhaust system with tail gas treatment:

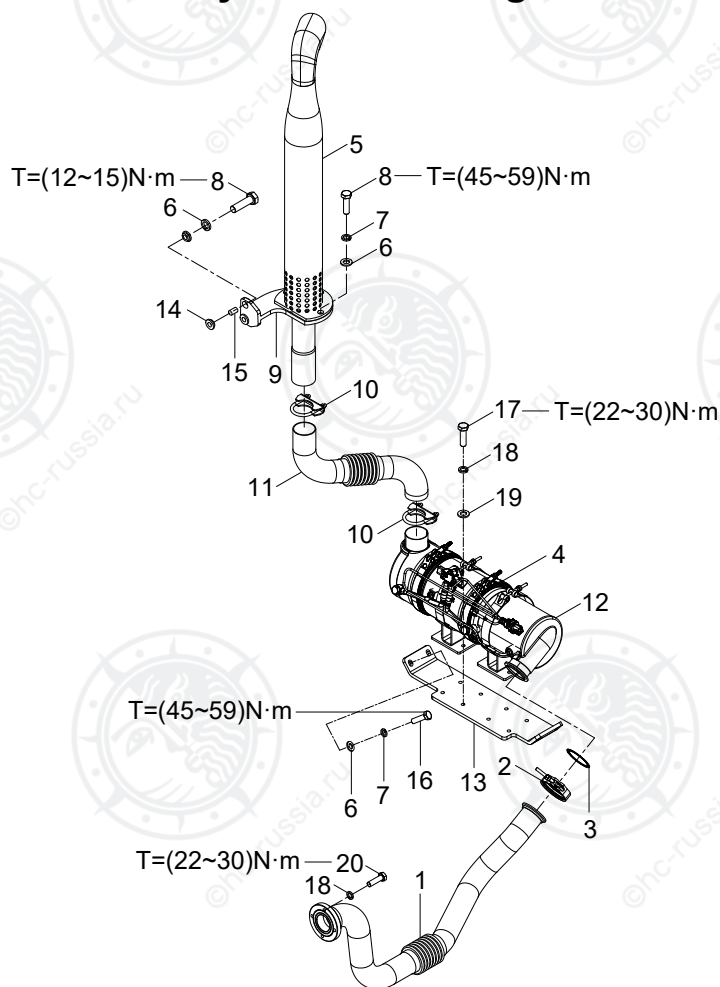


Fig. 1-1 exhaust system

Take the exhaust system of g82 engine as an example:

Regularly check the connection between exhaust pipe 1 and engine and DPF 12. If it is loose, tighten it.

Check whether the mounting bolt 8 of high-level exhaust pipe 5 is loose, otherwise it shall be tightened. Check the tightness of hoop 10.

Check whether DPF hoop 4 is loose, otherwise tighten it; Check whether the DPF fixing bolt 17 is loose, otherwise tighten it.

After the engine is started or the vehicle is running, if there is abnormal noise in this part, stop and check to determine whether the abnormal noise is caused by the looseness of the exhaust system, and then eliminate it.

Regularly check the integrity of the insulation material on the exhaust pipe. If it is found damaged, it shall be replaced in time.

Disassemble:

1. Turn off the engine and let the exhaust system cool naturally to room temperature;
2. First loosen the hoop 10, then loosen the bolt 8 on the fixing bracket 9 of the high-level exhaust pipe, and remove the high-level exhaust tailpipe;
3. Remove the balance weight, loosen the bolt 20 on the exhaust pipe 1, loosen the snap ring 2, and remove the exhaust pipe 1;

4. Loosen the hoop 10 and remove the exhaust pipe 11;
5. Loosen the sensor connector, loosen the bolt 17 on the DPF support 13, and remove dpf12 from the DPF support.

The installation process is the reverse of the removal process.

Be careful:

1. After the engine is shut down, the exhaust system still has extremely high temperature. Please wait for the exhaust system to cool to room temperature before carrying out relevant maintenance operations to prevent high-temperature scald;
2. Non after sales personnel shall not disassemble the DPF at will; Avoid DPF damage;
3. There are precision parts inside the DPF. Be careful to collide with the DPF during disassembly to prevent the DPF from falling.
4. During installation, the tightening torque must meet the requirements of the drawing.

3. Exhaust after treatment device (only for Chinese IV)

The working principle of exhaust after treatment: during the operation of diesel engine, exhaust flows through DOC and DPF in turn. The exhaust gas flows through doc, HC and CO in the exhaust gas are oxidized to CO_2 and H_2O under the catalysis of oxidation catalyst to realize the purification of CO and HC, and no in the exhaust gas is oxidized to NO_2 under the catalysis of oxidation catalyst. The exhaust gas flows through the DPF, and the particles in the exhaust gas are captured and intercepted by the wall flow DPF, so as to realize the purification of particles. With the increase of particles in the DPF channel, the exhaust resistance of DPF will increase, which will affect the fuel consumption and even the normal operation of the engine. In order to avoid this situation, the DPF system must burn the soot in the intercepted particles, that is regeneration. The NO_2 generated by Doc oxidation can react with the carbon particles in the particles intercepted by DPF above 250°C to burn off the soot and realize the continuous (passive) regeneration of DPF. If the vehicle runs at low speed and light load for a long time, the exhaust temperature is low and the continuous regeneration fails, and the DPF resistance increases to the set value, the engine will automatically inject diesel in cylinder (or use HC injector to inject in the exhaust pipe) to increase the temperature of DPF and carry out active regeneration.

◆DPF cleaning

Since DPF regeneration will leave burning ash, vehicles should regularly go to the maintenance station to remove the dust accumulated inside DPF unit. If the engine fails, such as burning oil, causing a complete blockage of DPF, it is also necessary to go to the service station for maintenance. In both cases, it is necessary to remove the clamps at both ends of the DPF, remove the DPF, and use special equipment to remove more than 90% of the ash or carbon deposit.

If XINCHAI diesel engine has an alarm or every 4000 operating hours, the DPF needs to be cleaned.

If YUCHAI engine has alarm or works every 2000 ~ 3000 hours, it needs to clean DPF once.

For this service or agency, please contact the sales company or agent of HangCha Group Co., Ltd.



吹灰设备



清灰前DPF



清灰后DPF

II .Drive system

1. Summarize

Driving system is composed of drive axle, final drive, drive shaft, hydraulic transmission box and cooling pipeline etc. The power from engine acts on hydraulic transmission box, through drive shaft transfers to final drive, and then the power come to axle shaft by differential, axle shaft drive tires to run.

Hydraulic transmission box can change the rotated direction of output shaft to drive truck to move forward and backward.

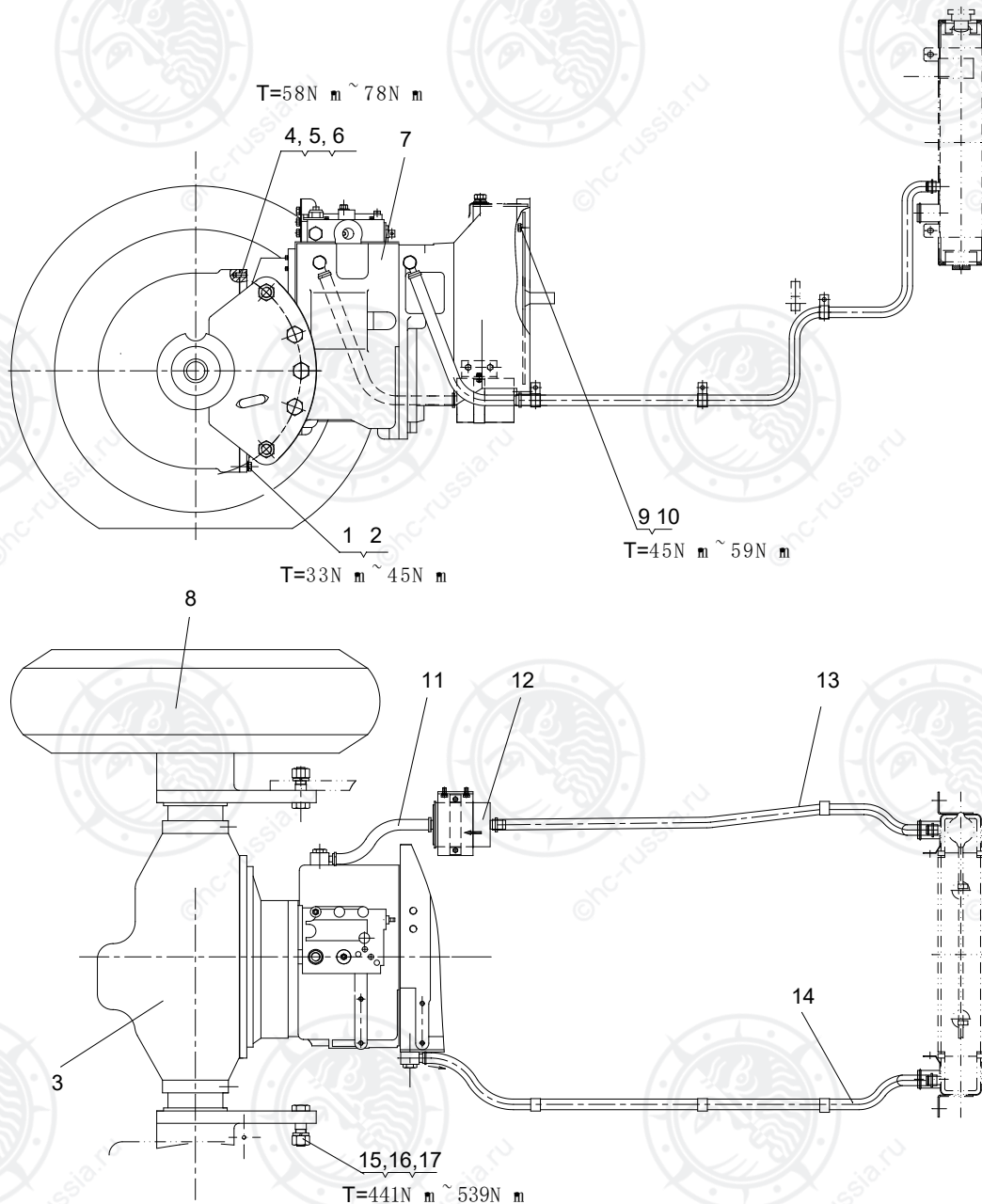


Fig. 2-1-1 Hydraulic Forklift Drive system

- | | | | | |
|-----------------|--------------------------|------------------|-----------------|------------|
| 1. Bolt | 2. Washer | 3. Drive axle | 4. pin | 5. Stud |
| 6. Nut | 7. Hydraulic gearbox | 8. Tire assembly | 9. Washer | 10. Bolt |
| 11. Rubber hose | 12. Hydraulic Filtration | 13. Rubber hose | 14. Rubber hose | 15. Washer |
| 16. Nut | 17. Bolt | | | |

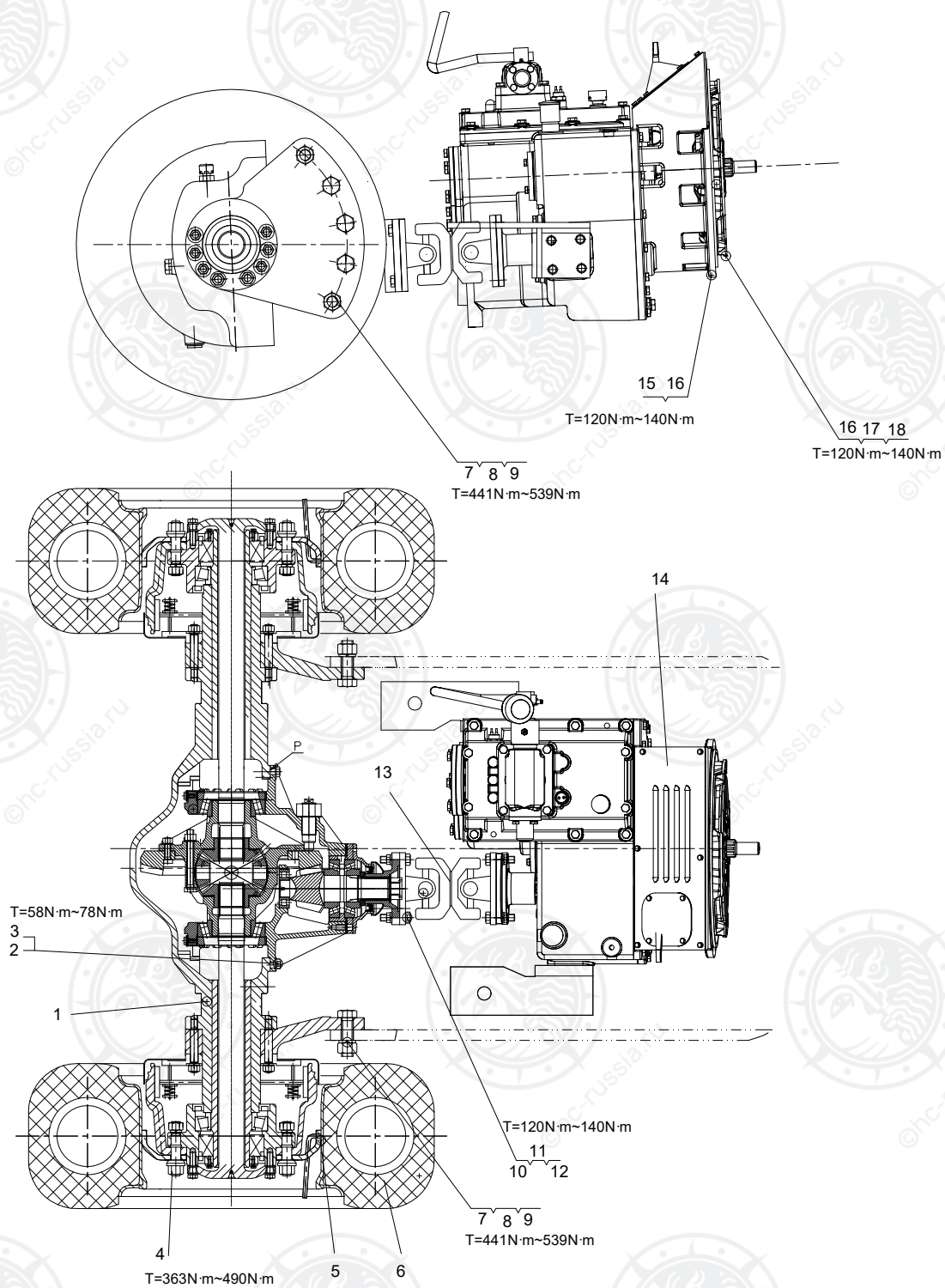


图 2-1-2 机械车

- | | | | | |
|---------------|-----------|--------------------------|------------------------|-------------|
| 1. Drive axle | 2. Washer | 3. Bolt | 4. Nuts | 5. Rim-assy |
| 6. Tyre | 7. Washer | 8. Nuts | 9. Bolt | 10. Nuts |
| 11. Washer | 12. Bolt | 13. Drive shaft assembly | 14. Mechanical gearbox | 15. Bolt |
| 16. Washer | 17. Bolt | 18. Pin | | |

2. Hydrodynamic power transmission gear-box

1.Domestic hydrodynamic power transmission gear-box:

1.1. Data

Model		XYQXD45
Hydrodynamic torque converter	Type	Single stage, two phase, three-element
	Max. Torque converter ratio K_0	3.0~3.3
	Diameter of circulating chamber D (mm)	315
	Max. Efficiency $\eta_{\max}$	≥ 0.78
Oil-supply pump	Type	Inner-mesh gear mode
	Flow capacity	42 l/min(2000r/min、1.5MPa)
Hydrodynamic power gear-box	Variety	Electromagnetic shift (12V or 24V)
	Transmission gear ratio	Forward I
		Forward II
		Reverse I
Hydrodynamic power clutch	Adjusted pressure	1.2MPa ~1.5MPa
Reduction transmission and differential	Reduction gear	Helical bevel gear
	Reduction ratio	6.182
	Differential gear	Straight bevel gear
Mass (kg)		388
Oil capacity (L)		12
Using oil type		6# hydrodynamic power transmission oil

1.2. Trouble diagnoses and corrections

Condition	Probable cause	Corrective action
Inefficient or oil over temperature	1、 Dragging of moveable piece or wear	Check frictional clutch whether glued, contact unbalanced and warped.
	2、 Torque converter oil not enough	check oil pump whether damaged and fill oil whether at normal level
	3、 Damage of bearing	Replace bearing
	4、 Check lubricant oil tube be jammed	Dredge oil tube
	5、 Torque converter stator wheel be locked	Replace torque converter
Oil leakage	1、 Oil seal damaged	Replace oil seal
	2、 Rubber parts aging or damaged	Replace the part
	3、 There is crack on parts	Replace
Clutch lower oil pressure or great vibration	1、 Abnormal oil level	Inspect oil level , fill the oil to normal level
	2、 The rotate oil seal on clutch axle or piston wearing or when assemble the key too tighten	Replace the rotate oil seal and when assemble make sure the key is right
	3、 Pump wearing	Replace oil pump
	4、 Oil filter plugged	Replace or clean oil filter

1.3. Summary

XYQXD45 model hydrodynamic transmission gearbox consists of hydrodynamic torque converter and power shift, which has two forward shifts and one backward shift. (See fig. 2-1). It has virtues as follows:

1) Hydrodynamic torque converter make the hydrodynamic transmission gearbox has automatic adaptability for hydrodynamic transmission output, it can change its output torque and rotation speed according to the change of external load;

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

3) Inching valve can make the truck to remove a little when the engine in either low speed or high speed, make the operation easy, convenient, start stable, reduce the labor intension of operators.

1.4. Working principles

Hydrodynamic torque converter is driven by engine through an elastic plate, it rotate the impeller wheel, in this way, the fluid flows at high speed into the turbine wheel and rotates the impeller wheel. Stator wheel make the torque converter effective, through turbine shaft 25, it transmit the torque to hydrodynamic power transmission gear-box two direction clutch drum 5.

1.4.1 Power transmit (See fig. 2-1)

Forward I shift: when at forward I shift, forward I shift clutch at work, forward II shift clutch, reverse clutch at idle motion, transmit order is:

25→5→8→18→19→11→13, drives the differential 15 to output the torque.

Forward II shift: when at forward II shift, forward II shift clutch at work, forward I shift clutch, reverse clutch at idle motion, transmit order is:

25→5→23→22→19→11→13, drives the differential 15 to output the torque.

Backward I shift: when at backward shift, reverse clutch at work, forward I and II shift at idle motion, transmit order is:

25→5→3→19→11→13, drives the differential 15 to output the torque.

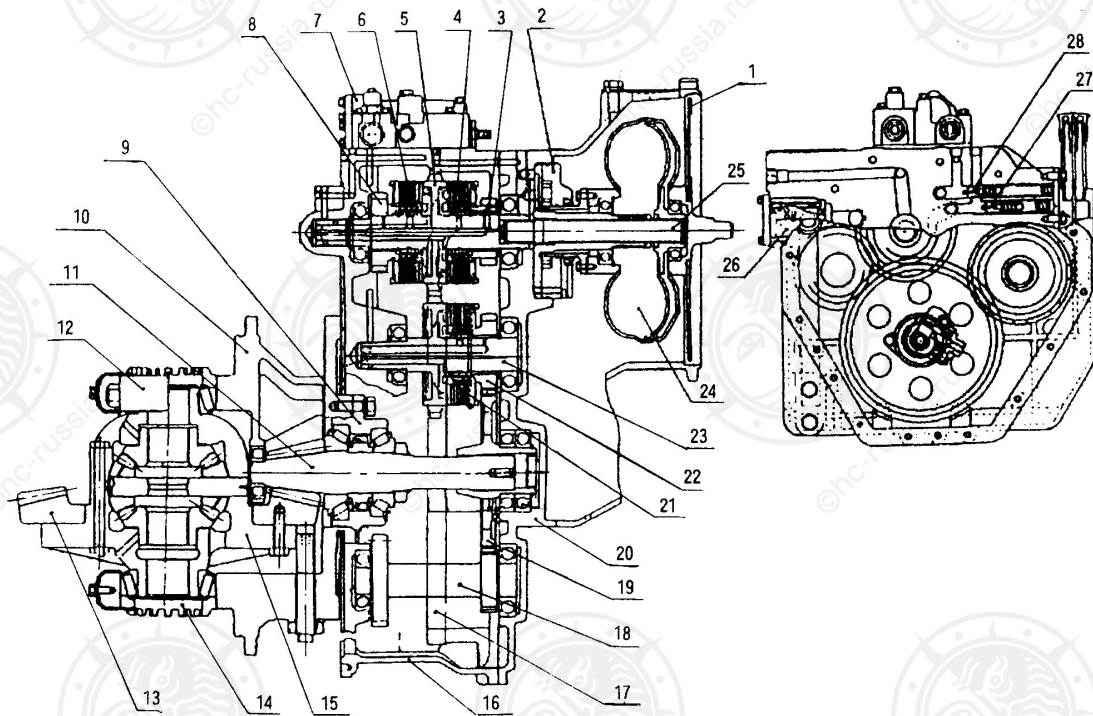


Fig.2-2-1 structure chart of XYQX45 model hydrodynamic transmission gearbox

- | | | |
|--------------------------------------|---------------------------------|---|
| 1.Elastic plate assembly | 2.Oil-supply pump | 3.Backward shift gear |
| 4.Backward shift clutch | 5.Two direction clutch drum | 6.Forward I shift clutch |
| 7.Control valve assembly | 8.Forward I shift gear | 9.Bearing bracket |
| 10.Differential assembly | 11.Active gear | 12.Bearing cover |
| 13.Passive gear | 14.Adjusting nut | 15.Differential shell assembly |
| 16.Box | 17.Oil tube | 18.Idler wheel axle |
| 19.Output gear | 20.Torque converter box | 21.Forward II shift clutch |
| 22.Forward II shift gear | 23.Single direction clutch drum | 24.Hydrodynamic torque converter |
| 25.Swirl shaft | 26.Oil filter | 27.Torque converter oil intake relief valve |
| 28.Main oil pressure adjusting valve | | |

1.4.2 Oil pipes principles (Refer to fig. 2-2-2)

After engine starts, oil-supply pump absorbs 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(F1、F2、R) flows into main-pressure valve 4 (pressure at 1.2-1.5Mpa), then separate itself into two parts, the one part into inching valve 8 and shift-control valve 13, the others into overflow valve 5 (pressure at 0.5-0.7Mpa) 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(include frictional piece, bearing and gears).The oil pipe principle for hydrodynamic power transmission gear-box can be seen in fig. 2-2-2.

1.4.3 Attentions

- Main pressure, that is the main pressure regulating valve pressure, is 1.2~1.5MPa. Torque converter inlet pressure is 0.5~0.7MPa, and return pressure is 0.1~0.15MPa.
- Normal working oil temperature is 70~95°C, maximum temperature is not over 120°C and the duration shall not exceed 5 minutes.
- Working oil should be kept clean and no other impurities. Replace new oil after using for 1000 hours or when to restart after long-term storage.
- Check the oil level after driving for 5 minutes, which should be within the stipulated range.
- Shut down inching valve for gear shifting or braking to avoid clutch damage or brake malfunction.

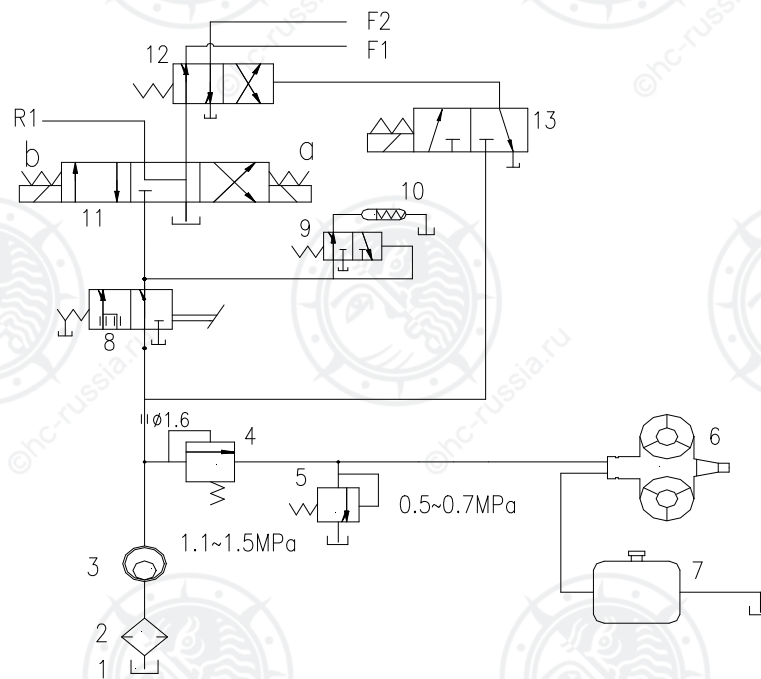


Fig.2-2-2 Oil route principle chart of XYQX45D model hydrodynamic power transmission gear-box

- | | | |
|----------------------------------|--------------------------------|----------------------------|
| 1. Oil tank | 2.Oil strainer | 3.Oil pump |
| 4.Main adjustment pressure valve | 5.Overflow relief valve | |
| 6.Torque converter | 7.Radiator | 8.Inching valve |
| 9.Buffer valve | 10. Accumulator | 11.magnetic exchange valve |
| 12.shuttle valve | 13.electromagnetic shift valve | |

1.5. Hydrodynamic torque converter (refer to fig. 2-3)

Torque converter consists of three parts: Pump wheel, turbine wheel and stator wheel. JYH315 model hydrodynamic torque converter is weld parts, it cannot be disassembled.

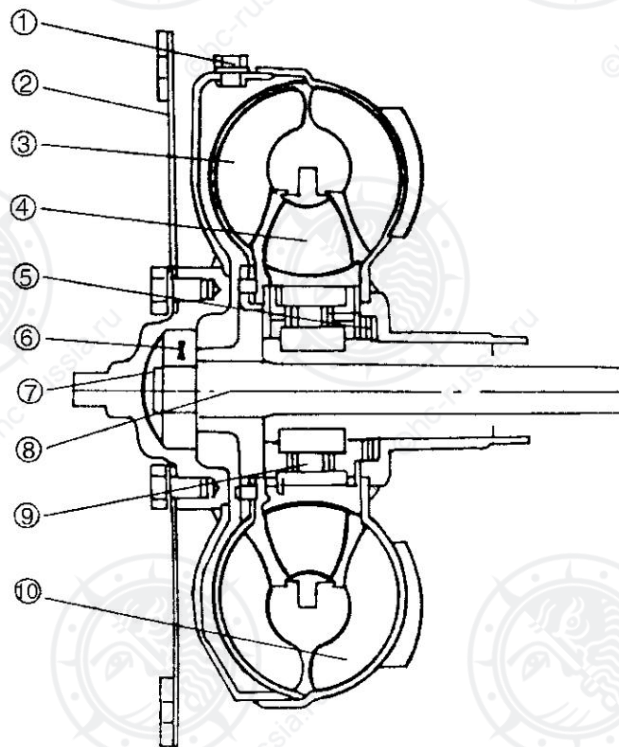


Fig. 2-2-3 Torque converter

- | | | | |
|-----------------------|-----------------|-----------------|-----------------|
| 1.Drain plug | 2.Elastic plate | 3.Turbine wheel | 4.Stator wheel |
| 5.Thrust ball bearing | 6.Ball bearing | 7.Snap ring | 8.Turbine shaft |
| 9.One-way valve | 10. Pump wheel | | |

Pump wheel is driven by input shaft, the fluid impacts blades of the turbine wheel along with blades of the pump wheel (mechanical energy is converted into fluid kinetic energy) by the effect of the centrifugal effect, 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 converted-effect torque to drive the stator wheel, so as to make the output torque increased a value of converted-effect torque than the input torque. When the rotation speed of turbine wheel 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 converted direction, make the original converted torque have a converted effect, hence, the output shaft torque is less than the input, 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.

1.6. Bidirectional clutch and single direction clutch

1.6.1 Summarize

Wet and multi-blade bidirectional clutch is installed on the input shaft of the hydrodynamic gearbox, single direction clutch is installed on the other input shaft, the clutch drums are mesh-always by ring gear of the drum.

Bidirectional -clutch's forward I shift and reverse clutch assembly consists of 6 pieces of interphase-installed septa viz. active frictional clutch disk (external frictional clutch disk), passive frictional clutch disk (internal frictional clutch disk), and a piston. There is a ring installed on the outer rounder of the piston, O-ring in the input shaft, for ensuring be airproofed when the piston is working. When at neutral shift, the piston doesn't work, the active and passive frictional clutch disk is separated. When shift gear, the oil pressure makes the piston, make the active and passive frictional clutch disk impacted, transmit the power from the torque converter to the forward-gear-ratio shift I gear or the reverse gear depending on friction. (Refer to fig.2-2-4)

The structure of single direction forward II shift gear is familiars to two-direction-clutch forward I shift gear or backward shift gear. (Refer to fig.2-2-5)

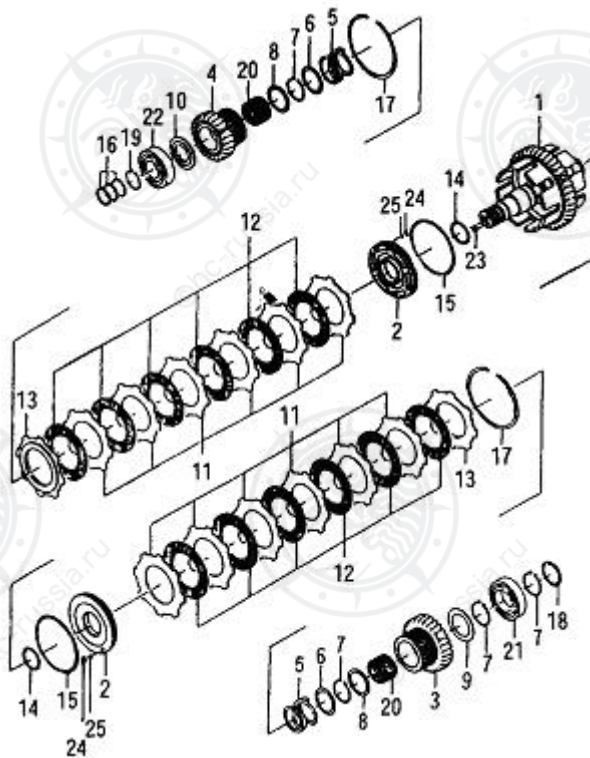


Fig. 2-2-4 Bidirectional clutch assy.

- | | | | |
|------------------------------------|-------------------|-----------------------------------|------------------------|
| 1. Bidirectional clutch drum assy. | 2. Piston | 3. Reverse gear | 4. Forward I gear |
| 5. Spring | 6. Spring bracket | 7. Snap ring for axle | 8. Snap ring |
| 9. Snap ring | 10. Stopper | 11. Active frictional clutch disk | |
| 12. Passive frictional clutch disk | 13. Cover | 14. Seal ring | 15. Seal ring |
| 16. Seal ring | 17. Snap ring | 18. Seal ring | 19. Snap ring for hole |
| 20. Needle bearing | 21. Bearing | 22. Bearing | 23. Plug |
| 24. Drain Plug | | | |
| 25. Steel ball | | | |

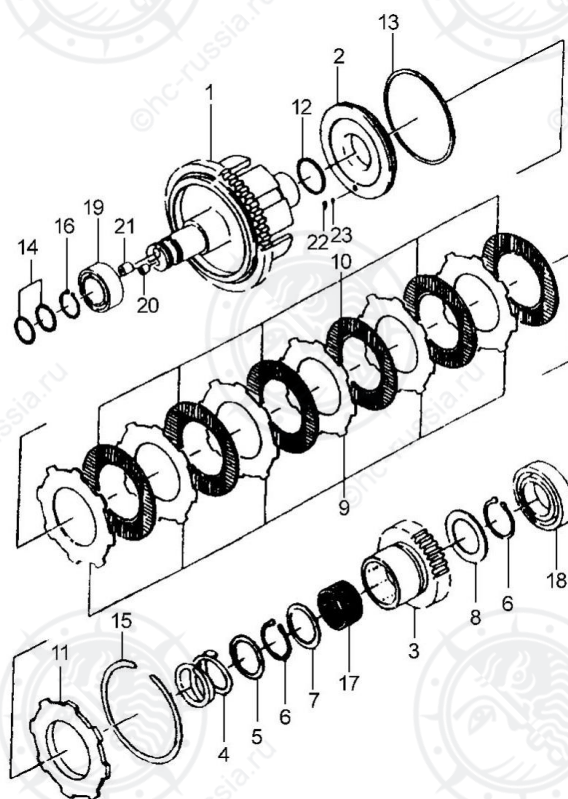


Fig.2-2-5 Single direction clutch assembly

1.Single direction clutch drum assy.	2.Piston	3.Forward II gear	4.Spring
5.Spring bracket	6. Axial spring collar	7.Snap ring	8. closing ring
9.Active frictional clutch disk	10.Passive frictional clutch disk	11.Cover	
12.Seal ring	13.Seal ring	14.Seal ring	15. closing ring
16. Axial spring collar	17.Needle bearing	18.Bearing	19.Bearing
20.Screw	21.Plug	22.Drain plug	23.Steel ball

1.6.2 Disassembly and assembly

Bidirectional clutch assembly

- Take off the bearing on the left, right sides;
- Separately take off the forward I gear, reverse gear and active, passive frictional clutch disk;
- Separately compress the spring, take off the snap ring and remove piston and spring.

Assembly procedures are on the contrary of those disassembly procedures.

Disassembly and assembly of the single direction clutch are similar to two direction clutch.

1.6.3 Attention

- Flush the piston cavity of the clutch drum assy. , oil tube, clean the other parts.
- Replace the seal ring 16.17 of the two direction clutch and 13.14 of the single direction clutch if damaged.

- Usually replace snap ring for hole.
- Replace rubber seal ring.
- Restrained ring (slotted side) should face to gears.
- After assembled, rotate the gears with hands, it should be freely rather than locked.

1.7. Control valve assembly, main pressure regulating valve and relief valve

1.7.1 Control valve assembly

It is installed on the gearbox cover, and is composed of inching valve, electromagnetic directional valve, electromagnetic shift valve, shuttle valve, selector slide valve and cushion valve. See Fig 2-7.

Inching valve: inching valve rod 9 is connected to inching pedal linkage, when depressing inching pedal, inching valve rod is pulled out, which reduces the clutch oil pressure in short time, and the truck reaches inching effect by clutch friction plate sliding.

Electromagnetic directional valve: it is used to distribute pressure oil to selector slide valve or reverse gear clutch, thus realize the forward or reverse shift of gearbox.

Electromagnetic shift valve: provide signal to selector slide valve.

Selector slide valve: distribute pressure oil from electromagnetic directional valve to forward I gear clutch or forward II clutch according to the signal of electromagnetic shift valve.

Cushion valve: that is regulating valve, which is between inching valve and electromagnetic shift valve. When electromagnetic shift valve is fully open, the valve works to reduce impact when clutch engaging.

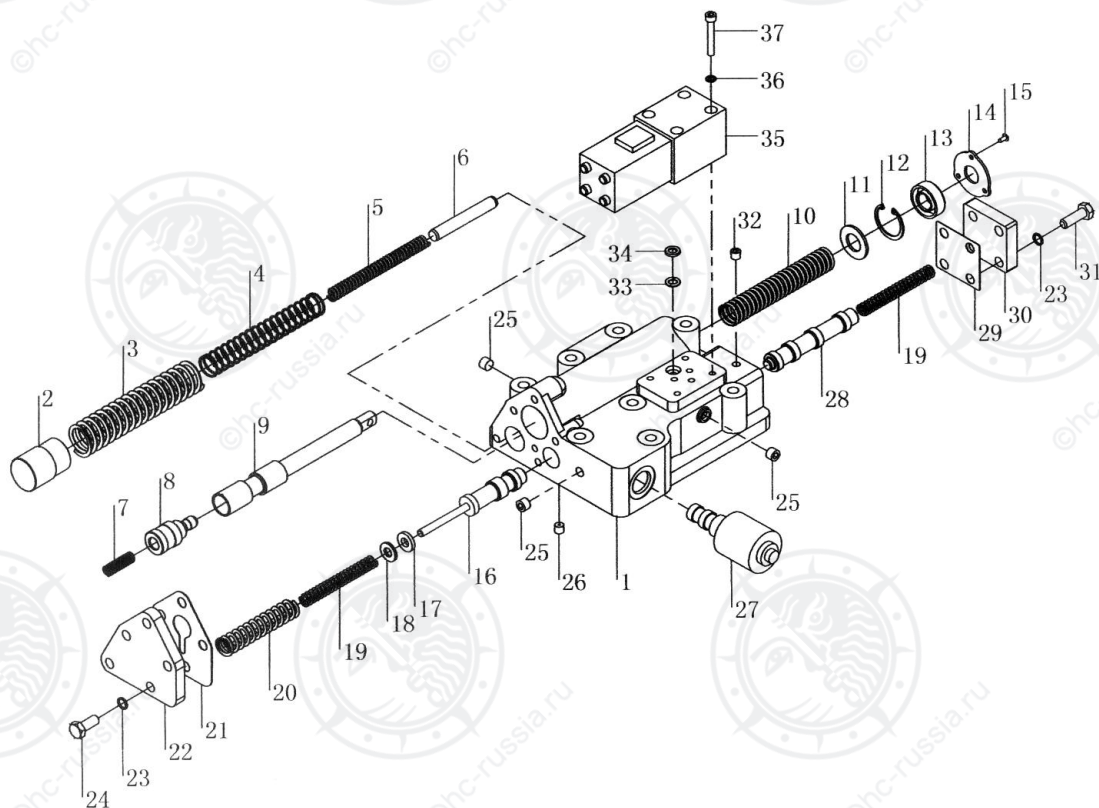


Fig. 2-2-6 Control valve

- | | | | | |
|---------------|-----------|----------------|----------------------|------------|
| 1. Valve body | 2. Piston | 3. Spring | 4. Spring | 5. Spring |
| 6. Round pin | 7. Spring | 8. Slide valve | 9. Inching valve rod | 10. Spring |

11. Gasket	12. Check ring	13. Oil seal	14. Gland	15. Screw
16. Inching valve element	17. Adjusting shim	18. Gasket	19. Spring	20. Spring
21. Gasket	22. Cover	23. Gasket	24. Bolt	25. Taper plug
26 Plug	27. Electromagnetic shift valve	28. Slide valve	29. Gasket	30. Cover
31. Bolt	32. Taper plug	33. O-ring	34. Strainer	35. Electromagnetic directional valve
36. Gasket	37. Screw			

1.7.2 Main pressure regulating valve (Refer to fig.2-2-1)

Main pressure regulating valve 28 is installed inside the gearbox shell body, the oil pressure for controlling the hydrodynamic clutch is at 1.2Mpa -1.5Mpa, assigns the oil to the relief valve, then to torque converter.

1.7.3 Relief valve (Refer to fig.2-2-1)

Relief valve 27 connects to gearbox shell body, keep the oil pressure for torque converter between 0.5Mpa -0.7Mpa, prevent the air erode, prevent the air erode.

1.8. Oil-supply pump

Oil-supply pump is installed on the turbine shaft. Driving gear 6 is connected to the impeller wheel of the torque converter, driven by engine, drive passive gear 7 and supply oil for the torque converter、hydrodynamic gear box. (Refer to fig. 2-2-7)

1.9. Reducer and differential

1.9.1. Reducer

The reducer consists of an active helical bevel gear and a passive helical bevel gear. This reduces the rotated speed and increases the torque, the active helical bevel gear mounted on differential bracket, and the other side mounted on the gearbox shell. The passive helical bevel gear mounted on the differential.

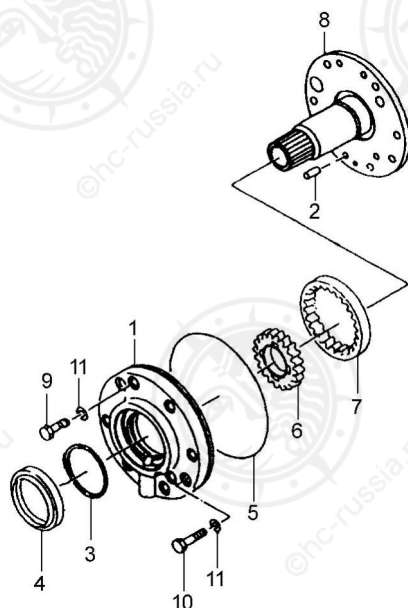


Fig.2-2-7 Oil supply pump

- | | | | | |
|-------------------|----------------|-------------|-------------|---------------|
| 1.Pump housing | 2.Staight pin | 3.Seal ring | 4.Seal ring | 5.O seal ring |
| 6.Active gear ass | 7.Passive gear | 8.Stator | 9.Bolt | 10.Bolt |
| 11.Washer | | | | |

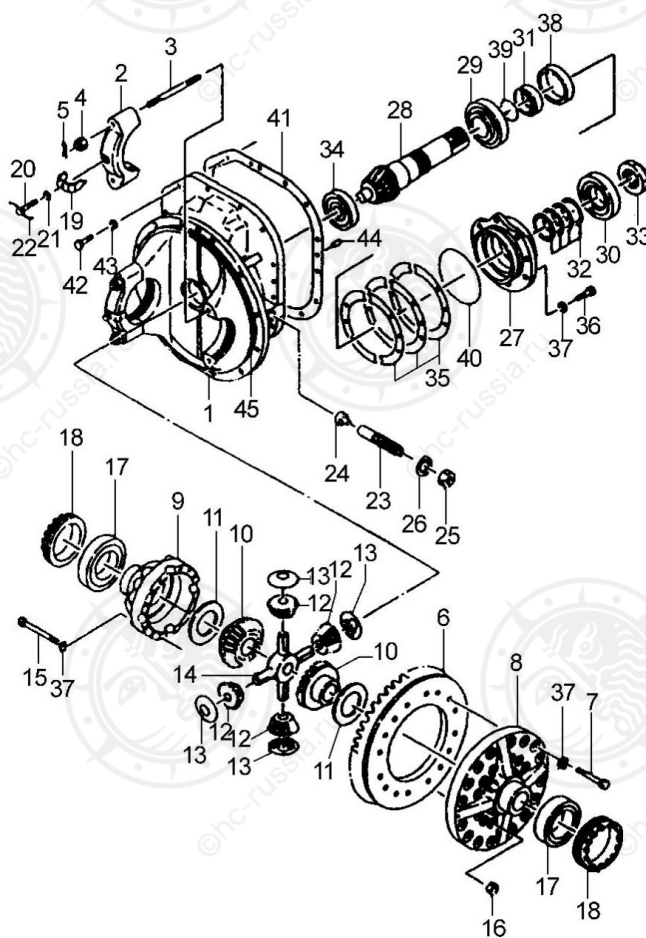


Fig. 2-2-8 Reducer and differential

- | | | |
|--------------------------------|---------------------------------|-----------------------------|
| 1. Differential velocity frame | 2. Bearing cover | 6. Passive helical gear |
| 8. Left differential gear case | 9. Right differential gear case | 11. Washer |
| 12. Planetary pinion | 3. Thrust bearing | 14. Coarse axle |
| 17. Tapered roller bearings | 18. Adjusting nut | 19. Lock shim |
| 20. Bolt with hole | 22. Steel wire | 23. Bolt |
| 24. Slide piece | 25. Nut | 26. Stop shim |
| 27. Bearing bracket | 28. Active helical gear | 29. Tapered roller bearings |
| 30. Tapered roller bearings | 31. sleeve gasket | 32. Adjusting nut |
| 33. Nut | 34. Tapered roller bearings | 35. Adjusting shim |
| 38. Bidirectional seal ring | 39. O ring | 40. O ring |
| 41. Paper shim | | |

1.9.2 Differential case

Differential case is installed on the rack of differential by bearing holder through ball bearing on both ends. 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 gears is braced by coarse axle, passive helical bevel gear is installed on differential shell by bolt.

1.9.3 Disassembly

Disassembly Procedure

- ① Remove the bearing bracket, take out the active helical gear and detach the active gear assy.
- ② Detach the bearing bracket (2 pieces), take off the differential assy.
- ③ Detach the differential assy.

Caution

Pay attention to reassemble:

- ① It can adjust the meshing area and height of the active and passive helical gears by additions and deletions adjusting shims 35 and adjust adjusting nut 18.
- ② Pre-tighten of the tapered roll bearings 17, you can adjust the adjusting nut.
- ③ When bolt 23 is tighten to withstand the passive helical gear, loosen the nut 1/6-1/4 round.
- ④ At active helical gear assy., you can adjust Pre-tighten of the bearing 29, 30 by additions and deletions adjusting shims 32.
- ⑤ Usually replace O-rings.
- ⑥ After assembly, it is forbidden for parts interfere or there is abnormal noise.

1.10. Disassembly of hydrodynamic power transmission gear-box, hydrodynamic torque converter

Open the oil plug, and drain the oil, detach the parts as following sequence:

Differential → oil pump assy. → suck oil pipe assy. → idle pinion shaft, output gear → torque

converter shell assy. → single direction clutch assy. → two direction clutch assy. → control valve assy.

3. Mechanical gearbox

1. Parameter

Gearbox type		HC450
item		
Gearbox weight (kg)		225
Match the engine rated power (kW)		45-71
Match engine rated speed (r/min)		2200~2650
Match the engine maximum torque (N.m)		191-370
Gear ratio	Forwards	F1=9.333 F2=4.973 F3=2.504
	Backwards	R1=8.487 R2=4.68
Synchronizer type		Inertia lock ring
Shift type		Manual shift
direction of rotation (face to input terminal)		Clockwise
Using oil type		Vehicle gear oil GL-5 85 W /90
Capacity (L)		≈8.5 (To drive the oil hole on the bridge shall prevail)
Working oil temperature (°C)		60~80
The highest oil temperature (°C)		120(not exceeding 5min)
overall dimension (length×width×height) mm×mm×mm		550×510×570.5

Caution:

- Add grease from tank
- Use the genuine grease assigned by HC

2. Trouble diagnoses and corrections

Condition	Probable cause	Adjust measures
Great vibration	• Tight bolts at each assemble joints are loosed	Tighten
Oil over temperature	• Gear oil deteriorate • Abnormal oil level • Movement parts stick	Replace Add or reduce Adjust
Oil leakage	• The bolt of joint flat loosed • Seal ring damaged	Tighten Replace
Noise	• Damage of rotate gear • Damage of bearing	Replace Replace

3. Summary

The mechanical gearbox of 4 ton -5 ton mechanical forklift has shift and transmit functions. The mechanical gearbox adopt three forward shifts, two backward shifts, it is reasonable for Transmission ratio, the forklift can obtain more traction force when it is at low range, high range has high drive speed, it can promote forklift's performance parameter and efficiency.

On structure, adopt the structure that output from the tank with universal joint, it overcome the phenomenon that engine, gearbox and driving axle rigid coupling vibrate effectively, the whole longitudinal dimension of tank is compact. It is installed synchronizer, it can avoid ram at gear when shift, especially when change direction, it can make shift soft, stable and reduce noise of shift, improve gear life-span. Refer to fig. 2-3-1.

Gear-change part is consisted of the following components: one input shaft、one output shaft、one 2-shaft、one countershaft、one idler shaft(use in reverse gear). Every shaft has one type or several types gears that have different tooth number, 2-shaft is installed two meshed synchronizers and one slip gear cover, use shift shaft to shift, transmit engine power to driving wheel by output shaft through universal joint.

Transmit process refer to fig. 2-3-2.

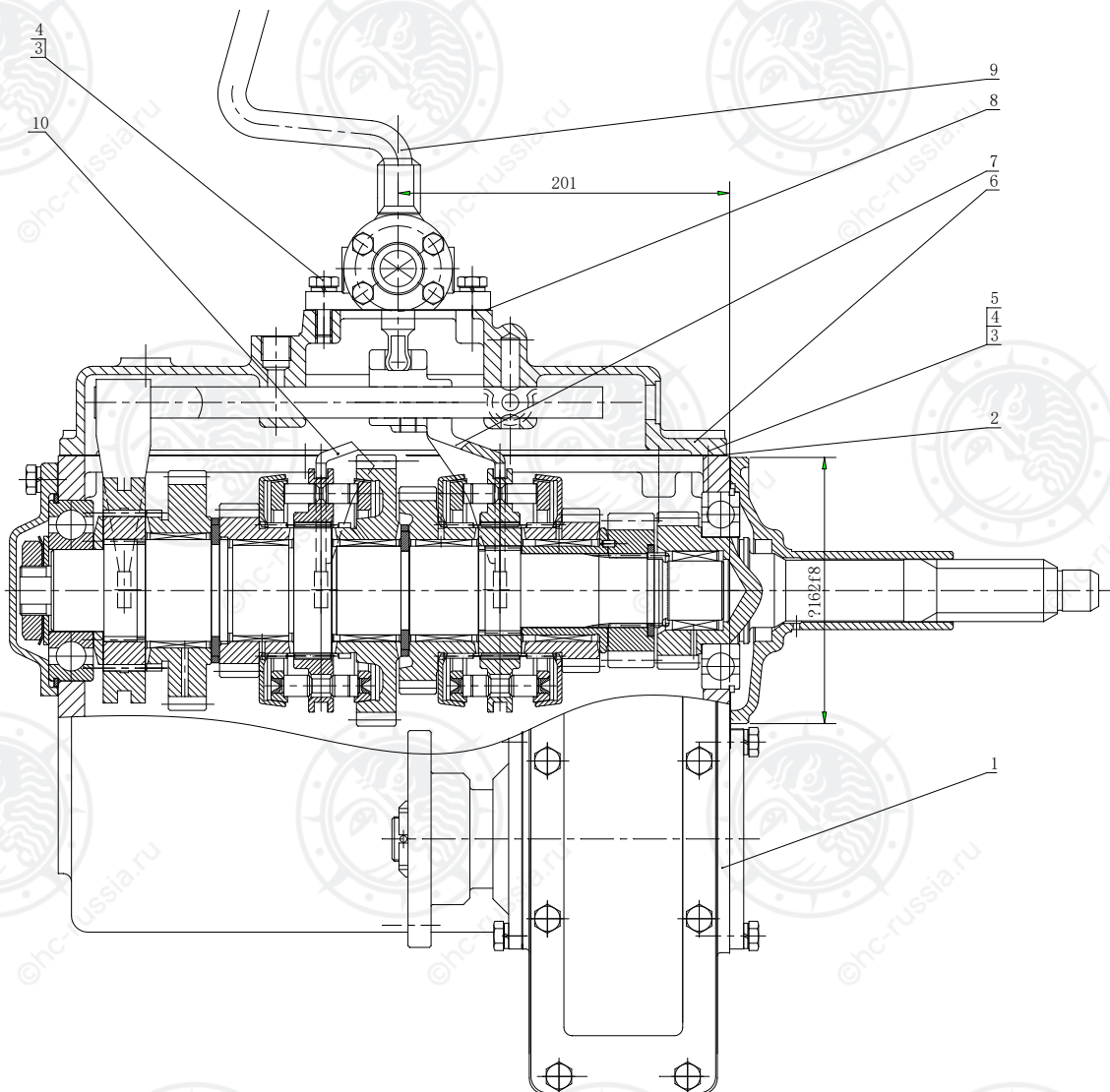


Fig. 2-3-1 Mechanical gearbox

- | | | | |
|---------------|----------------------|---|-----------|
| 1. Gearbox | 2. Paper shim | 3. Bolt | 4. Washer |
| 5. Pin | 6. Gearbox top cover | 7. Forward II 、 III shifting fork | |
| 8. Paper shim | 9. Shift | 10. Forward I , backward II shifting fork | |

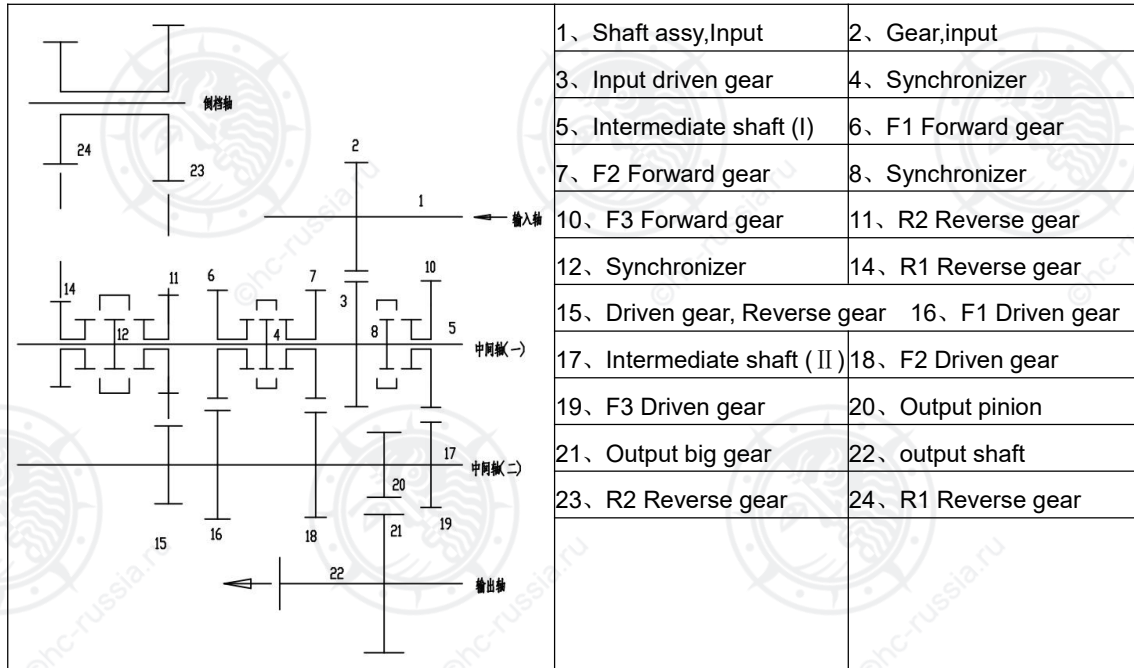


Fig. 2-3-2 4-X5t Mechanical gearbox Transmit process

Pay attention to assemble:

- 1) Prevent assemble flat and gear tooth profile flat from striking.
- 2) Bearings, gears, seal rings, and parts' working surface that have relative motion, should add little gear oil when assemble, to prevent instantaneous dry friction.
- 3) All parts should assemble correctly.
- 4) All motion parts should be freely rather than locked.

Bolts joint should tighten and be solid.

4、Clutch

Mechanical Forklift

4.1. Data

Forklift Parameter		4 t ---4.5t	5t
Model		Single-chip and dry-type	
Frictional clutch disk dimension	External diameter	12 Inch	13 Inch
	Depth of press-tight	9	10.4
Weight kg		About11	About18
Mode of operate		pedal	

4.2. Test and Adjustment

Clearance between diaphragm spring and release bearing (mm)	1.8-2.3
Frictional piece limit of wear (to rivet head) (mm)	>0.3

4.3. Trouble diagnoses and corrections

Condition	Probable cause	Measures
Clutch slipping	• There have oil or dirt on frictional clutch disk. • There is no free play at clutch pedal. • The wheel pump dust shield is split open or fall off, the pump piston can not free return	Polish with sandpaper after wipe with gasoline. Adjust Clean the pump and install new dust shield.
Clutch shaking	• Overload • Frictional piece split open or severe wear.	Reduce load. Replace the frictional piece assy.
Pedal lacking force	• Leak gas or lack oil. • Master pump leak oil. • Wheel pump leak oil.	Check seal effects of all joints, make brake fluid enough. Replace the master pump leather collar. Replace the Wheel pump leather collar.

4.4. Clutch

The diaphragm spring clutch (push mode) which is installed on forklift is an advanced clutch. Pressure plate and cover assy. are fixed on pressure plate cover by diaphragm spring, and make the external rim impact pressure plate. Diaphragm spring is pressure element and separate element. Because diaphragm spring has a good non-linear characteristic, use the new part until friction piece wear, pressure of the diaphragm spring keep invariable, transmit engine torque stable. In addition, detaching force is low, more save effort after installed hydrodynamic operate system

Diaphragm spring can not disassemble, it doesn't need to disassemble and adjust when used, so it is convenient for use and maintain.

The clearance between diaphragm spring and release bearing is 1.8mm -2.3mm when at clutch engage mode, it can prevent clutch release bearing damage and frictional piece lightening fried.

Release bearing flat and radial thrust bearing is seal-type, it doesn't need to fill oil, the clearance can automatic disappear after they are worn.

4.5. Check and adjust

Clutch release means the clearance between clutch release bearings' transverse is 1.8mm -2.3mm, the clearance can prevent clutch release bearing damage and frictional piece lightening fried. Because forklift usually lies in accelerate and change direction, use clutch frequently, frictional piece wear is fast, it should pay attention to adjust the clearance frequently.

4.6. Replacement of frictional piece assembly

Open machine shield ----disassemble drive axle universal joint bolt ---- disassemble clutch piping ---- disassemble gearbox's brace and bolt-----loosen engine's brace and bolt-----push engine flywheel bottom with solid woodblock or jack-----hang the gearbox and clutch housing-----disassemble clutch pressure plate-----install new frictional piece ----press the pressure plate, don't tighten bolt ---- disassemble clutch housing windows of observation----put gearbox and clutch housing into----aim at frictional piece and input shaft spline, adjust to suitable position, tighten the pressure plate ----the following assemble steps are opposite to disassemble.

Adjust the clearance of releasing bearings' transverse to 1.8mm -2.3mm when assemble, at the same time, apply car in common use grease to the place which has relative motion, but the surface of frictional piece can not have grease. In the mean time vent piping' air

3. Driving axle

1). Data

Driving axle type	Full floating, axle and truck body direct install, front wheel driving	
Wheel hub rotation starting torque at hub blot N	10~29	
Axial gap of wheel bearing mm	less than 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 spline. ·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.

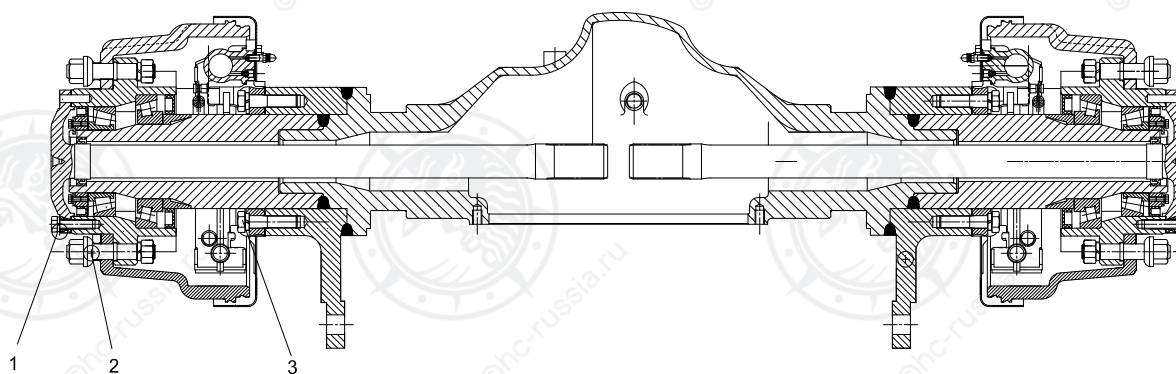


Fig. 2-4-1 Drive axles

	Tighten torque: N·m
--	---------------------

1. Half shaft bolt	110-130
2. Wheel hub nut	324-373
3. Brake base plate bolt	260-300

3). Driving axle assembly removal and installation



WARNING

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

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

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

- 6) Disconnect brake cable at hand brake lever.
- 7) Remove front wheels.
- 8) Remove axle shaft.
- 9) Support driving axle with wire ropes and lifting device.
- 10) Remove bolts securing axle mounting bracket to frame. (see fig.2-4-3) .
- 11) Remove nuts securing axle case to differential gear carrier. (see fig.2-4-4) .
- 12) Remove driving axle assemble.

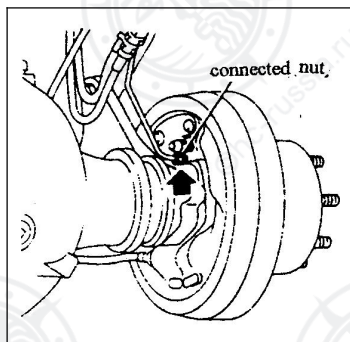


Fig.2-4-2

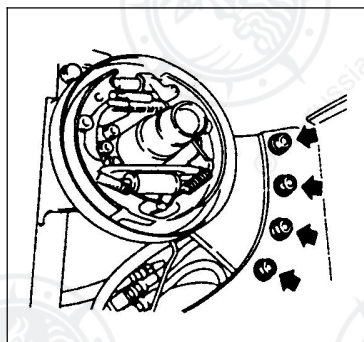


Fig.2-4-3

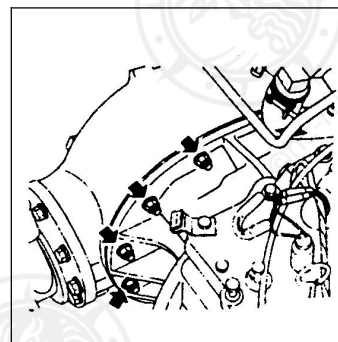


Fig.2-4-4

- 13) Remove locknut and lock sheet.
- 14) Remove wheel hub (together with brake drum) .
- 15) Remove axle mounting bracket and brake component from axle tube.
- 16) Remove oil seal from axle tube.
- 17) 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.
- ⑥ Fabrication mill finish directs to bearing when installing locknut.
- ⑦ When installing component 17, please smear LOCTITE 222 mucilage (or 242 mucilage) at screw thread position(above 2/3) and then loosen.

Ton Models	4-5t	Remark
Fill in drive axle (L)		
Vehicle gear oil GL-5 85W/90	5.8L	Hydraulic Forklift

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.2-4-5) ;

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.2-4-6) . b. Evenly tapping on brake drum with brass bar or wooden mallet.

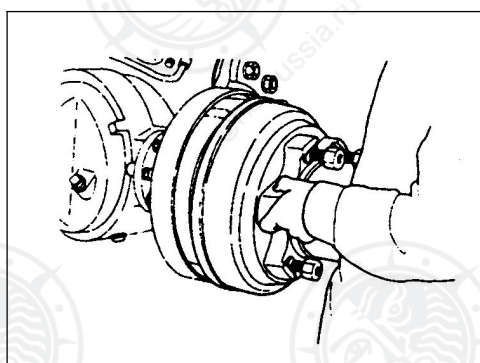


Fig.2-4-5

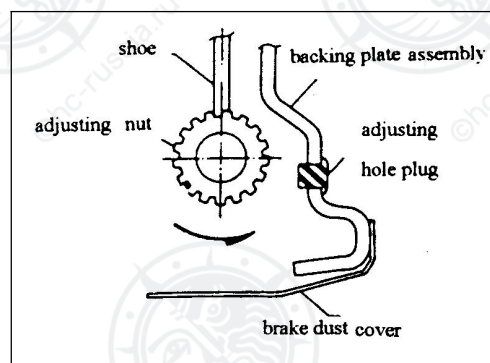


Fig.2-4-6

- 5) Remove oil seal and inner bearing as an assembly by evenly tapping on periphery of seal with a wooden mallet and brass bar.
- 6) 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: $10\sim 29\text{N}$ (refer to Fig.2-4-7) ;
- 8) Measure axial play of wheel hub to see if it is within specification. Axial play is less than 0.08mm (refer to Fig.2-4-8) .

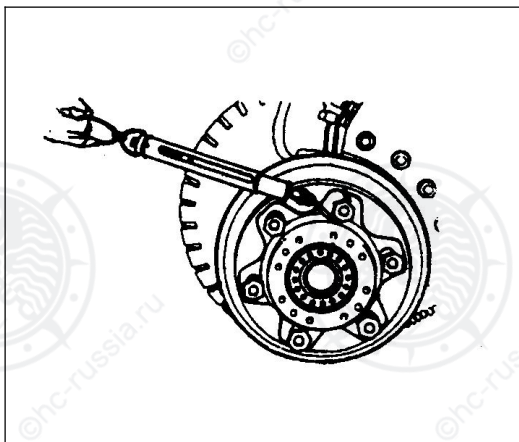


Fig.2-4-7

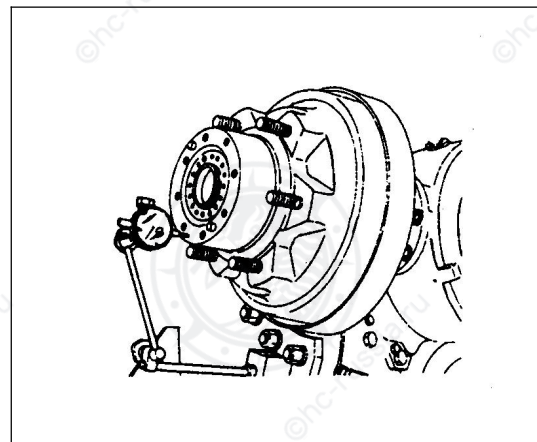


Fig.2-4-8

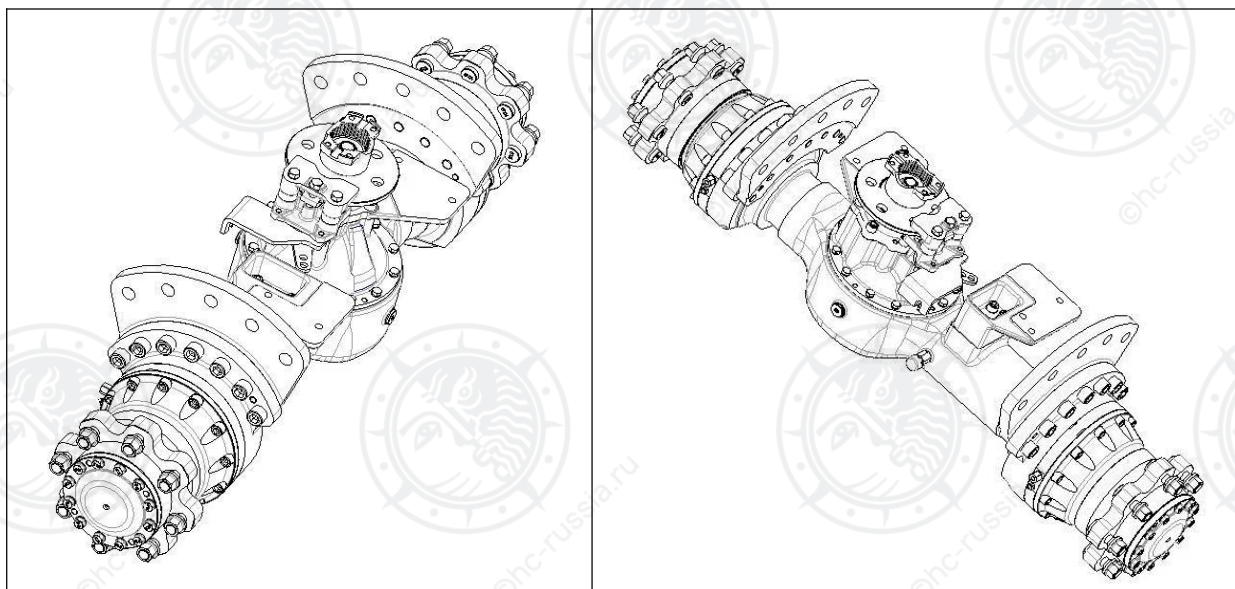
Wet drive axle (W76BN、G73BN-S)

1 General

The drive axle assembly mainly consists of final drive, axle housing assembly, left and right hub reduction gears, as well as left and right wet brakes. See the figure below for details:

The reduction gearbox uses the two-stage reduction in which the stage-one cylindric spiral gear reduction and the stage-two planetary reduction are available.

With the wet brake used, the drive axle can work reliably and efficiently. The brake system is free from maintenance in its whole service life.



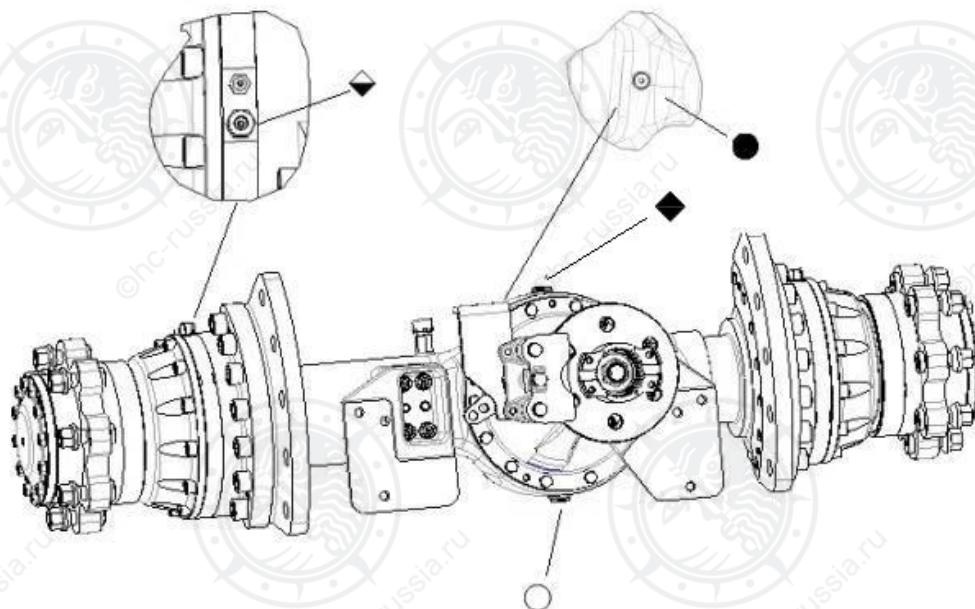
2 Technical performance parameters

Drive axle type	Wet brake drive axle; the axle is directly connected to the frame.	
Reduction ratio	Total reduction ratio	15.836
	Final drive reduction ratio	2.917
	Hub planetary reduction ratio	5.429
Brake	The maximum braking torque of the brake	27000 N.m
	The maximum pressure	6.2MPa
	Hand braking force	900N
	Hand braking torque of the whole axle	12000N.m
Lubricating oil	Type	Mobil 424 hydrodynamic drive oil
	Oil level	It is stated that the lower oil level limit is 8mm away from
Weight	296kg	

3 Change the gear oil.

Change the gear oil for a new car after 100h run-in period. After that, change the gear oil every half a year or 1000h (whichever comes first).

Gear oil	Type	Mobil 424 hydrodynamic drive oil
	Capacity	It is stated that the lower oil level limit is 8mm away from the lower generatrix of the oil level hole.



◆	Oil plugs for inlet tubes of left and right brakes of the drive axle	●	Oil level hole for the drive axle
◇	Oil drain plugs for left and right hub reduction gears of the drive axle	○	Oil drain plug for the drive axle

Precautions:

- 1) Drain the lubricating oil into a suitable container and dispose of it according to the local laws/standards.
- 2) Check the oil level plug and the oil drain plug to see whether there are many metal particles accumulated; clean or replace the oil plugs.
- 3) After the lubricating oil is totally drained, the drain plug shall be tightened to the specified torque.
- 4) The amount of injected oil shall be subject to the lower generatrix of the oil level hole. A bit of overflow of oil is allowed. After the injection of the gear oil is completed, all oil plugs shall be tightened again to the specified torque.

4 Disassembly/assembly of the drive axle

When the drive axle is to be disassembled or assembled, it is needed to first remove it from the forklift. Please follow the steps below:

Correctly hoist the drive axle by using appropriate equipment and then disconnect all lines connected to it. Remove all bolts connected to the forklift; remove the drive axle from the forklift as a whole and then put it on a flat surface.

Totally drain the gear oil in the drive axle.



Notice:

As this part is heavier, please use appropriate hoisting equipment and (or) lifting system for operation.

Disassembly of the final drive

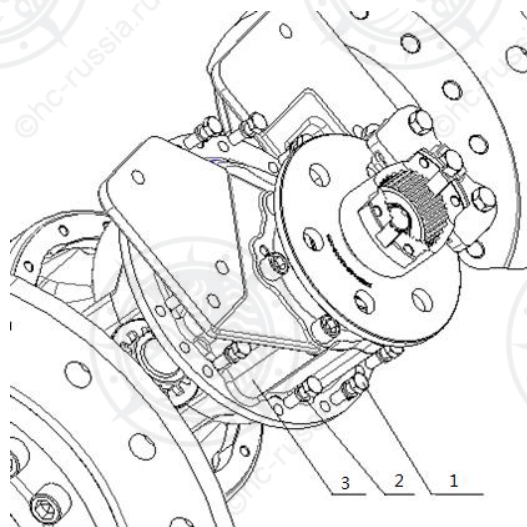
- 1 From the drive axle assembly, remove 13 full thread hexagon head bolts M10×40 (1) and standard spring washers (2); remove the final drive casing (3) (with the cylindric spiral gear reducer and the hand brake).



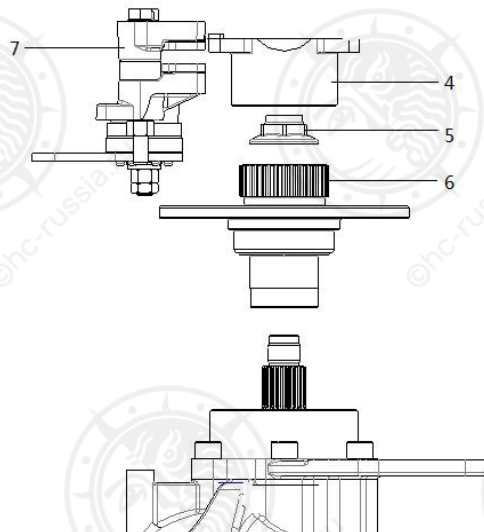
Notice:

When installing the full thread hexagon head bolts(1), apply the Loctite 222 glue at the thread parts to prevent looseness.

When installing the final drive, align it with the location pin holes.



- 2 Remove the following parts in order from the casing (3) (with the cylindric spiral gear reducer and the hand brake):
input flanged shaft (4)
hexagon nut with flange M24×1.5 (5)
hand brake disc (6)
hand brake assy (7)

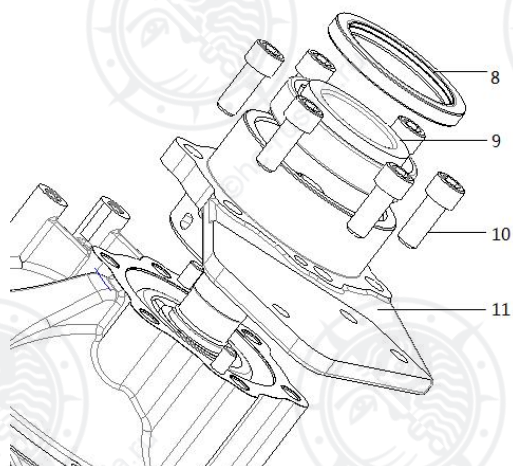


- 3** Remove the following parts in order from the casing (3):
 oil seal FB80×100×10 (8)
 single-row tapered roller bearing 32211(9)
 hexagon socket head cap screw 10)
 Bearing seat (11)

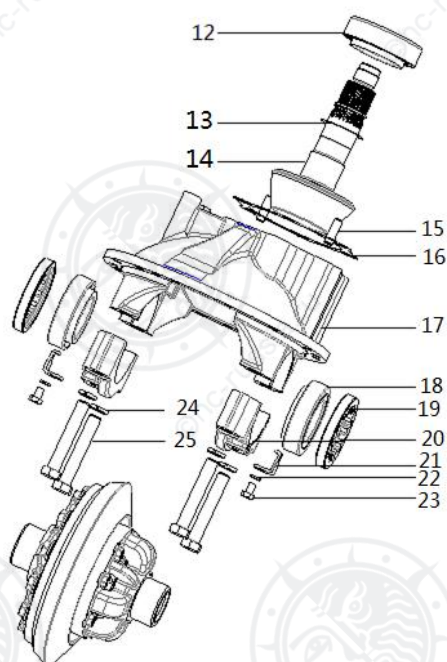


Notice:

- **Be careful to avoid damages to the O-shaped seal ring and the oil seal. When installing the oil seal, make the oil seal surface with words face toward the inside of the drive axle, to prevent scratches on the oil seal.**



- 4** Remove the following parts in order from the casing (3):
 single-row tapered roller bearing HM803146/10 (12)
 adjusting shim (13)
 spiral bevel driving gear (14)
 Cylindrical pin (15)
 adjusting shim (16)
 final drive casing (17)
 single-row tapered roller bearing 33110 (18)
 adjusting nut (19)
 reducer bearing cap (20)
 lock sheet (21)
 standard spring washer 14 (22)
 full thread hexagon head bolt M8×12 (23)
 standard spring washer 8 (24)
 bearing cap nut (25)



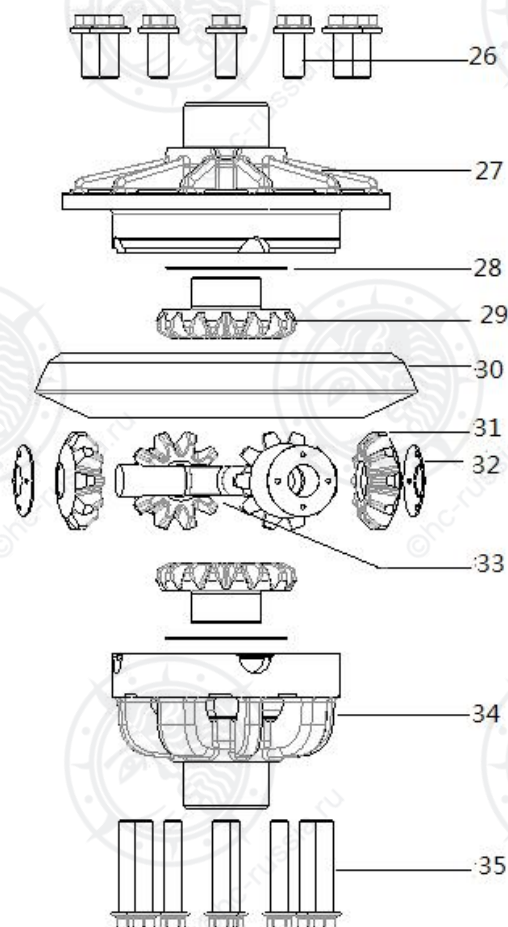
5 Remove the following parts in order from the differential assembly:

- bolt M12×1.25×27(26)
- left casing of the differential (27)
- axle shaft gear gasket (28)
- axle shaft gear (29)
- spiral bevel driven gear(30)
- planetary gear (31)
- planetary gear gasket (32)
- universal joint (33)
- right casing of the differential (34)
- hexagon bolt with flange (35)



Notice:

The tightening torque 60~75Nm shall be used for installing hexagon bolt (35). For installation of the bolts (26), apply the Loctite 262 glue at the thread parts to prevent looseness; the tightening torque is 105~115Nm.



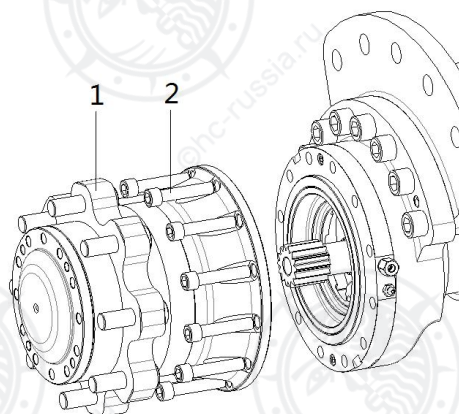
Disassembly of the left/right hub reduction gears

1 From the drive axle assembly, remove 12 hexagon socket head cap screws (2) and remove the hub assembly (1) (with the planetary reduction gear and the stud shaft).



Notice:

When installing the hexagon socket head cap screws (2), apply the Loctite 222 glue at the thread parts to prevent looseness.



2 Remove the following parts in order from the hub assembly (1) (with the planetary reduction gear and the stud shaft):

planetary carrier assembly (3)

Supporting shell (4)

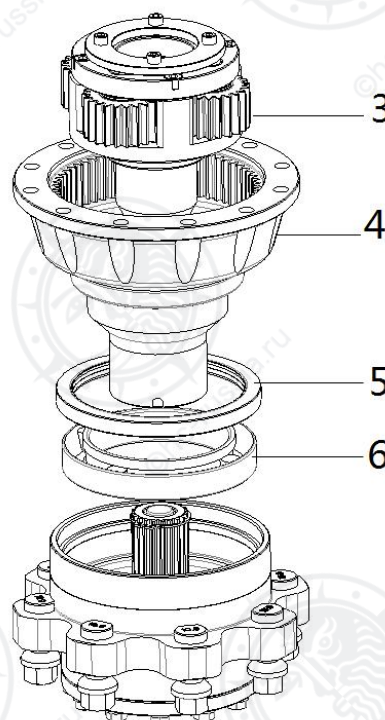
Oil seal FB160×190×15 (5)

single-row tapered roller bearing 32926 (6)



Notice:

When installing the oil seal, apply a bit of lithium lubricating grease onto its lip.



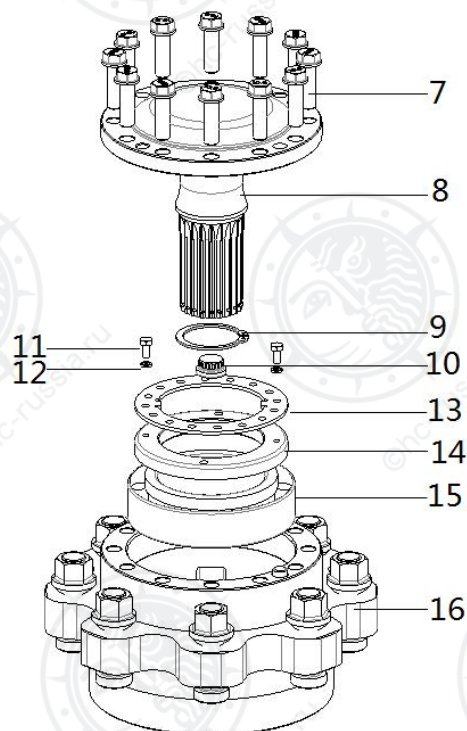
3 Remove the following parts from the hub assembly (1) :

- axle shaft bolt M12×1.25×40 (7)
- stub shaft (8)
- type circlip for shaft 52 (9)
- Limit block (10)
- full thread hexagon head bolt M6×12 (11)
- spring washer 6 (12)
- lock sheet (13)
- lock nut M90×2 (14)
- single-row tapered roller bearing 33018 (15)
- hub (16)



Notice:

- The hub bolt is already pressed into the hub by using a professional tool. Unless otherwise specially required, do not remove it by yourself.
- The Loctite 598 sealant shall be used for sealing the junction surface between the stub shaft and the hub.
- For installation of the axle shaft bolts, apply the Loctite 262 glue at the thread parts to prevent looseness; the tightening torque is 105~115Nm.
- Pre-tighten the hub bearing: screw the lock nut while you rotate the hub, until it is difficult to rotate the hub; then unscrew the lock nut until the hub start torque reaches 3.5~6.3Nm (the hub can rotate when you apply 30~55N tangential force onto the hub bolt) and the hole for lock sheet is aligned with the threaded hole for the lock nut.



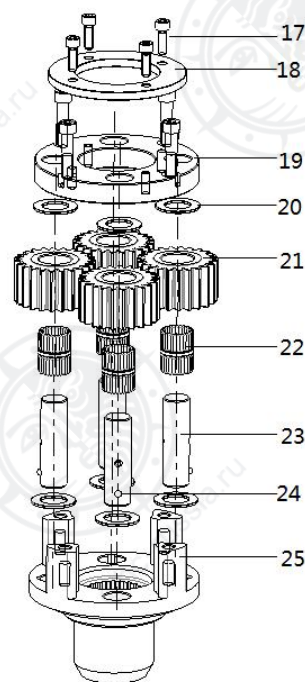
4 Remove the following parts from the hub assembly②:

- hexagon socket head cap screw M8×25(17)
- pressing plate (18)
- planetary gear carrier (19)
- planetary gear gasket(20)
- planetary gear (21)
- roller pin(22)
- planetary shaft (23)
- steel ball(24)
- planetary carrier (25)



Notice:

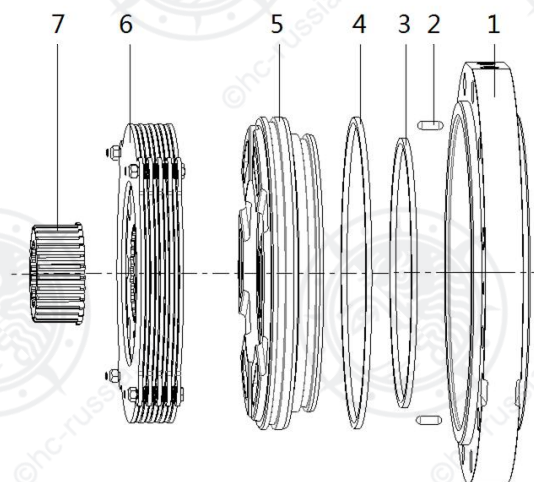
- For installing the bolts, apply the Loctite 262 glue at the thread parts to prevent looseness; the tightening torque is 28~32Nm.



Disassembly of the brake part

1 Remove the following parts in order from the brake assembly:

- Cylinder (1)
- roller pin 5×15.8 (2)
- rectangular seal ring $161.97 \times 3.53 \times 3.53$ (3)
- rectangular seal ring $187.52 \times 3.53 \times 3.53$ (4)
- piston (5)
- friction plate assembly (6)
- driving gear (7)

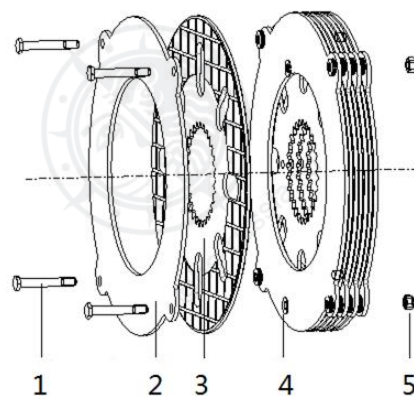


Notice:

- Be careful to avoid scratches or damages when disassembling or installing the rectangular seal ring

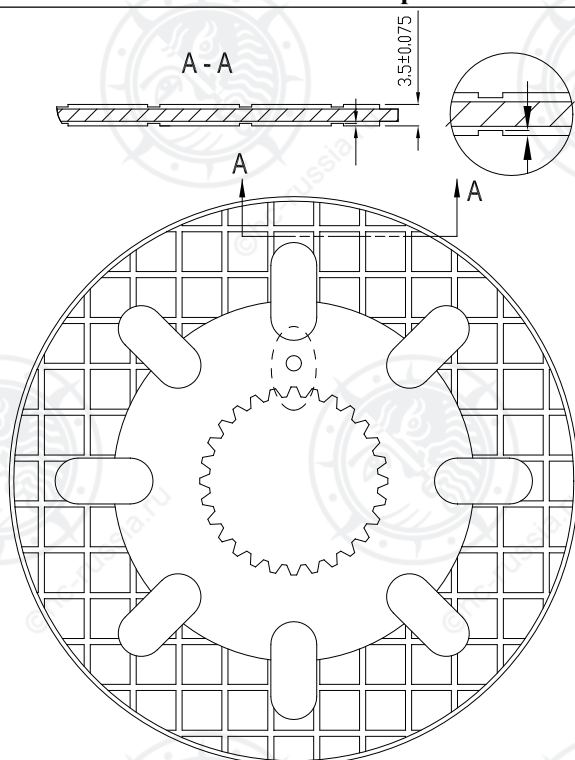
2 Remove the following parts in order from the friction plate assembly (6) :

- hexagon head bolt $M5 \times 35$ (1)
- braking steel disc (2)
- friction plate (3)
- HW6011 belleville spring (4)
- I-type all-metal hexagon lock nut M5 (5)



Notice:

- Install two HW6011 belleville springs between one steel disc and one friction plate.



Notice:

- When the friction plate is worn to the bottom of the grid pattern groove, replace the friction plate.

5 Troubleshooting

Symptom	Possible Cause	Correction
There is abnormal noise during working.	Loose connecting bolts between the supporting bush of the drive axle and the frame.	Tighten them.
	Loose nuts on the wheel.	Tighten them.
	The bearing inside the hub is worn or damaged.	Change it.
	The bearing inside the hub is not properly adjusted.	Adjust it.
	The spline for the axle shaft is worn.	Change it.
	There are worn parts.	Make an overhaul after disassembly or change
	Poor gear engagement.	Re-assemble and adjust it
	Inadequate lubrication.	Inject the lubricating grease.
Unstable running	Loose nuts on the wheel.	Tighten them.
	The wheel is deformed.	Change it.
	The bearing inside the hub is worn or damaged.	Change it.
	Loose connecting bolts between the supporting bush of the drive axle and the frame.	Tighten them.
	The bearing inside the hub is incorrectly adjusted.	Adjust it.
	Tire pressure is incorrect	Adjust it.
Oil leakage	The oil seal is damaged or aged.	Change the oil seal
	Loose bolts	Tighten them.
	Inadequate lubrication	Improve the lubrication.
	The oil drain plug is loose.	Tighten it.
Too high temperature on the axle housing	Inadequate lubrication	Improve the lubrication.
	The gear and the bearing are not properly assembled.	Adjust them as required in the drawing
Poor braking effect	The friction plate is worn.	Change the friction plate assembly.

III Steering system

1 Structure introduction

Steering system is mainly composed of steering device and steering axle, refer to fig. 3-1.

Steering device consists of steering wheel, steering column device, locking handle, full hydraulic steering gear, refer to fig.3-1. Steering wheel and steering column is adjustable, and the adjusting angle is 6° to adapt different drivers' needs.

Steering axle assembly is mainly composed of steering axle, knuckle, steering hub, steering wheel and steering cylinder etc., refer to fig.3-3.

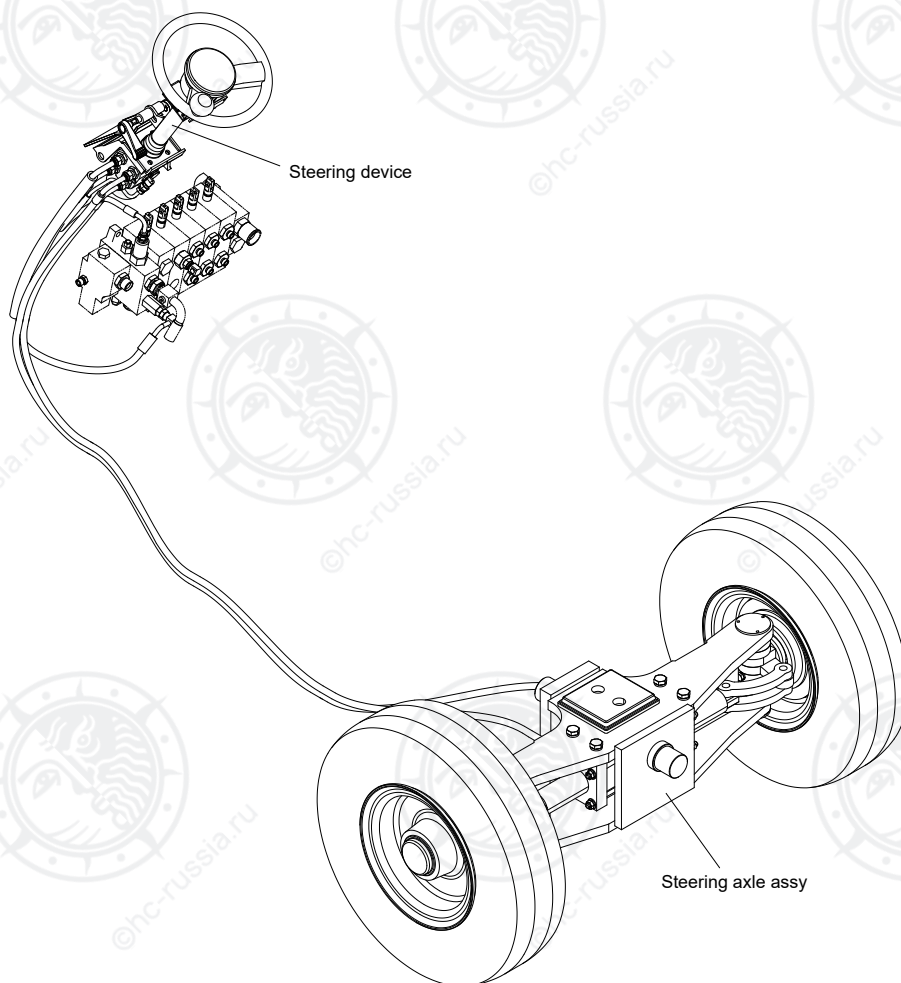
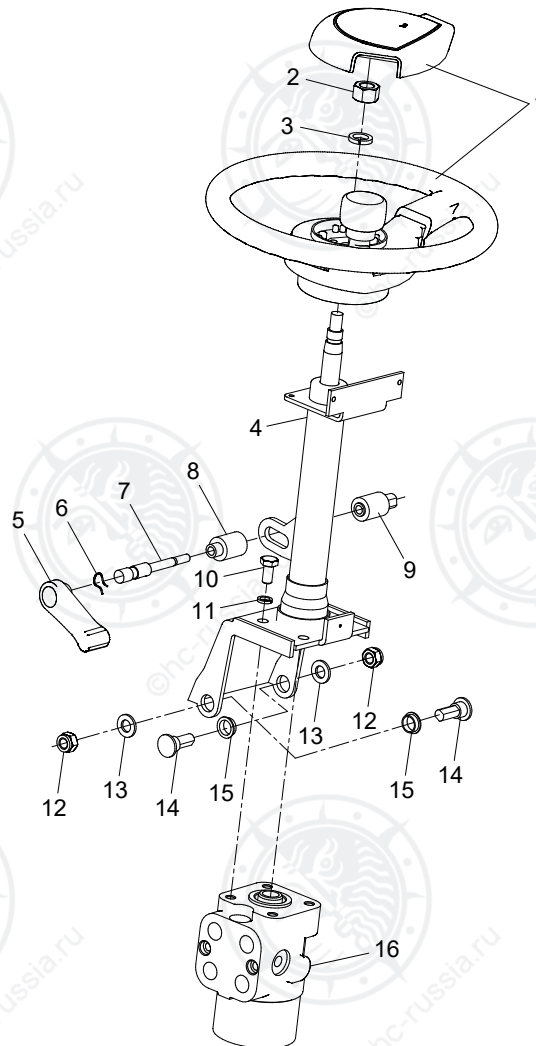


Fig.3-1 Steering system drawing

Steering device structure

Steering device mainly includes cycloidal hydraulic redirector, steering string and steering wheel. Steering string and steering wheel can be adjust back or forth to fit all driver, and its angle is 8° .

When the engine is in flameout, the steering wheel will return back about 10° automatically after turning the steering wheel lightly with the power of 1kg and releasing.



- | | | | |
|----------------------------|-----------------------|------------------|-----------------------------|
| 1. Steering wheel assembly | 2. Steering wheel nut | 3. Washer | 4. Steering pipe device |
| 5. Locking handle | 6. Snap spring | 7. Locking shaft | 8. Locking shaft sleeve I |
| 9. Locking shaft sleeve II | 10. Bolt | 11. Washer | 12. Nut |
| 13. Washer | 14. Bolt | 15. Bush | 16. Hydraulic steering gear |

Fig.3-2 Steering device structure

This exploded view diagram illustrates the assembly of a wheel hub. The components are numbered as follows:

- 1-10:** Various bolts, nuts, and washers for the hub assembly.
- 11-19:** Components of the hub and axle assembly, including a hub (11), axle (12), and various bushings and spacers (13-19).
- 20-23:** Additional fasteners and components for the hub.
- 24-27:** Components of the wheel hub, including a hub (24), axle (25), and various bushings and spacers (26-27).
- 28-32:** Components of the wheel hub, including a hub (28), axle (29), and various bushings and spacers (30-32).
- 33-46:** Components of the wheel hub, including a hub (33), axle (34), and various bushings and spacers (35-46).

The diagram shows the assembly of the wheel hub, including the hub, axle, and various bushings and spacers. The components are numbered 1 through 46. The diagram is a technical drawing with a watermark 'chc-russia.ru'.

- | | | | | |
|----------------------------|-------------------|-------------------|--------------------|---------------------------|
| 1. Nut M40×1.5 | 2. Gasket | 3. Hub cover | 4. Bolt | 5. Nut |
| 6. Bush | 7. Adjusting shim | 8. Bolt | 9. Washer 16 | 10. Steering axle body |
| 11. Steering cylinder | 12. Grease nipple | 13. Pin shaft | 14. Tie-rod bar | 15. Snap ring |
| 16. Bearing | 17. Tie-rod bar | 18. Nut | 19. Pin | 20. Bolt |
| 21. Washer | 22. Cover | 23. Gasket | 24. Oil seal | 25. Bearing |
| 26. Hub bolt | 27. Steering hub | 28. Nut | 29. Steering wheel | 30. Bearing |
| 31. Washer | 32. Nut | 33. Grease nipple | 34. Oil seal | 35. Bearing |
| 36. Dust proof bush | 37. Bearing | 38. Pin | 39. Adjusting shim | 40. Left steering knuckle |
| 41. Right steering knuckle | 42. Washer | 43. Screw | 44.. Bearing | 45. Liner I |
| 46. Liner II | | | | |

44

2 Technical parameters

Steering axle

Axle type	Center bearing, rotary type	
Steering angle	Inner max. steering angle	79.2°
	Outer max. steering angle	58°

Axial clearance (F/R)	0mm / ≤1.0mm
End axle Adjusting shim thickness	0.5,1.0,1.6,3.0 mm
Part No.	R450-220013-000

Kingpin

Axial clearance of kingpin	≤0.20mm
Adjusting shim of kingpin	
Thickness (mm)	Part No.
0.1,0.5,0.7,1.0	R450-220008-000

Hub bearing

Pre-tension	Tighten the knuckle nut until the hub cannot be turned by hand, and then release 1/6 ring. Or the initial turning force for hub connecting bolt is 7.8~23.6N.
Axial clearance	0mm

3 Steering system installation notes

- Hydraulic tie-in, blots and piping must be cleaned while installing;
- Check oil lines arrangement for properness, whether it is reverse order of steering direction or not;
- Turn the steer wheel to end and to make sure whether it is equably of steering force on left and right, and steering is smooth.
- Jack up rear wheel and turn the steering wheel left and right slowly, repeat for several times. Bleed air of hydraulic lines and cylinder.
- When engine stops running, rotate steering wheel with 1kg force slightly, after releasing hands, steering wheel should return 10° automatically..

4 Fault diagnoses and corrections

condition	Probable cause	Corrective action
Failure to rotate steering wheel	Damage or trouble of oil pump	Replace
	Priority valve(multi-way valve) is clogged or damaged.	Clean or replace
	Damaged hose or connector, block lines	Replace or clean
Laborious operation for steering	Steering overflow value pressure too low.	Adjust pressure.
	Air in oil lines.	Exhaust air
	Control oil pipe is blocked	Clean or replace
	Priority valve(multi-way valve) fault	Check or replace
	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
Abnormal noise	Oil is not sufficient in oil tank.	Add oil.
	Suction piping or filter clogged.	Clean or replace.
Oil leakage	Damaged guide sleeve sealing of steering cylinder or hose or connector.	Replace

5 Hydraulic steering gear

The hydraulic redirector is a resistance-insensitive steering gear, shown in Fig.7-2. The rotor (9) and stator (10) are a pair of cycloidal needle gears (internally engaged), which act as a metering servo valve in case of power steering. It is connected between the priority dividing valve and the steering cylinder. The oil directed to or out of the steering cylinder must flow past the metering servo valve. Therefore, this valve opens to supply oil flow, coming from the priority dividing valve, to the steering cylinder in proportion to the angle the steering wheel is turned. The rotary valve (valve spool 4 and valve guide 11) is connected to coupling block (8) and is used to distribute oil, making the output changed in synchronism with the angle of rotor.

When the steering wheel is not turning the valve spool (4) and the valve guide (11) are situated in neutral position under the action of spring flat (5), and closes the connection to the steering cylinder, by that time, oil returns to oil tank directly.

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 (4), valve guide (11), coupling block (2), and to actuate the rotor (9) to feed oil into steering cylinder, in this case, rotor (9) and stator (10) act as a hand pump, making manual steering possible.

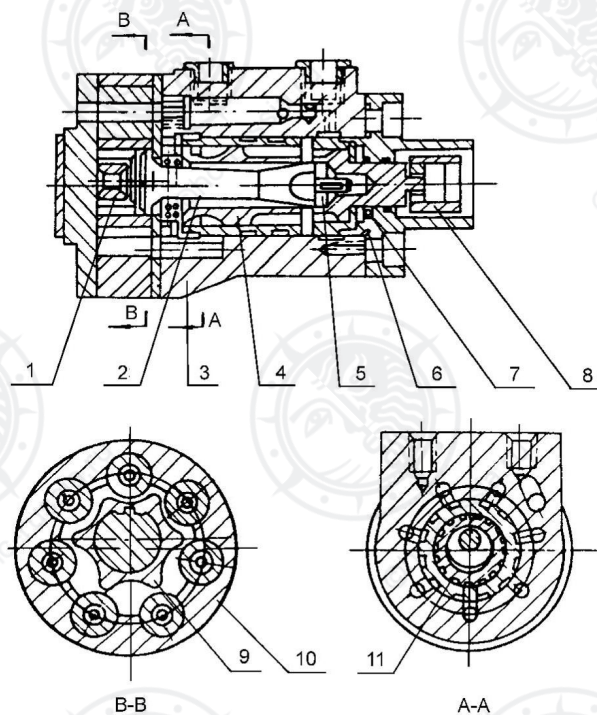


Fig.3-4 Cycloidal hydraulic redirector

- | | | | | |
|----------------------------|----------------|-------------------|---------------|----------------|
| 1. Location limited string | 2. Shaft | 3. Valve body | 4. Valve core | 5. Flat spring |
| 6. O-ring | 7. Y-seal ring | 8. Coupling block | 9. Rotor | 10. Stator |
| 11. Valve guide | | | | |

3.3 Steering cylinder (refer to Fig.7-3)

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 hydraulic power steering gear make piston rod to move left and right so as to turn truck left and right. The steering cylinder adopts the new structure with its left guide and right guide and the cylinder joined together through screw. So it is easy to repair and disassemble.

Notice of maintenance:

1. Keep clean and make sure its surface without scathe. Any element for seal with scathe must not use for assembly.
2. When assembling, the four screws should be tightened in turn, and the moment ranges from 100N·m to 120N·m.

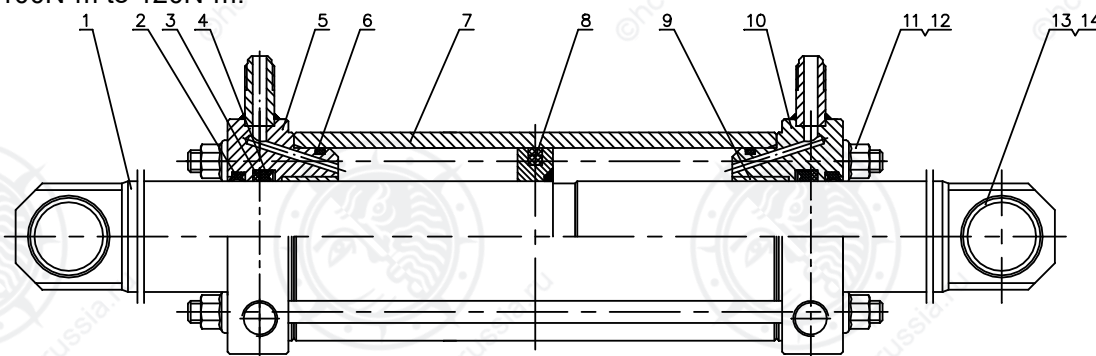


Fig.3-5 Steering cylinder

- | | | | | |
|---------------|-----------------------|-----------------|------------------|-----------------|
| 1. Piston rod | 2. LBH dustproof ring | 3. Shield ring | 4. ISI seal ring | 5. Left guide |
| 6. O-ring | 7. Cylinder body | 8. Glay ring | 9. compound bush | 10. Right guide |
| 11. Screw | 12. Nut | 13. Shield ring | 14. Bearing | |

Fault diagnosis and corrections

Fault	Probable reason	Phenomenon	Corrective action
Oil leakage	Combined part bolt loosen		Screw down bolt
	Combine face or journal sealing ring damage		Replace sealing ring
	Gasket damage		Replace gasket
Hard steering	Insufficient oil supply to oil pump	Turn steering wheel slowly is light and fast is heavy..	Check if oil pump works normal
	Air in the steering system	Foam in the oil and give out irregular noise, rotate the steering wheel but the cylinder works sometimes and stop for a while.	Eliminate air in the system and check if oil suction pipe leaks
	Oil level is lower than specified position		Add oil to specified height
	Oil viscosity is too big		Use specified oil
	Ball check valve invalid.	Steering wheel is heavy when fast steer or slow steer, and no steering pressure	If steer ball losses, install the ball; if steel ball is blocked by dirt, clean it.
	Steering system pressure is lower than working pressure	No load or light load steering is light, but much load steering is heavy.	Check out the reason, recover or improve system pressure(not exceed 16Mpa)
Steering failure	Spring leaf break off	Steering wheel cannot automatically return in middle	Replace spring leaf
	Pin or universal driving shaft open break or deformation	No obvious pressure runout or cannot turn	Replace pin or universal driving shaft
	Rotor or universal driving shaft open break or deformation	Steering wheel cannot rotate or move from side to side	Tooth space engagement between compact point teeth on universal driving shaft and on the rotor
No human steering	Overlarge stator radial clearance or axial clearance	Steer after misfire, steering wheel turns but the cylinder keep still.	Replace stator

6 Steering axle

6.1 Dismantle and assemble

Hub dismantle

- Jack-up the forklift and support with blocks;
- Dismantle wheel assembly (29) ;
- Dismantle hub cover (34) ;
- Dismantle knuckle locknut, thrust washer and adjusting nut;
- Pull out hub assembly;
- Dismantle inner ring of the bearing

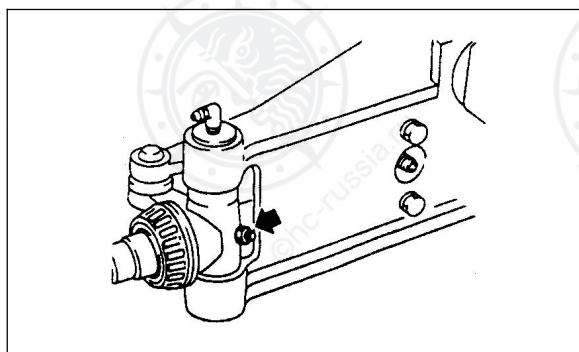


Caution

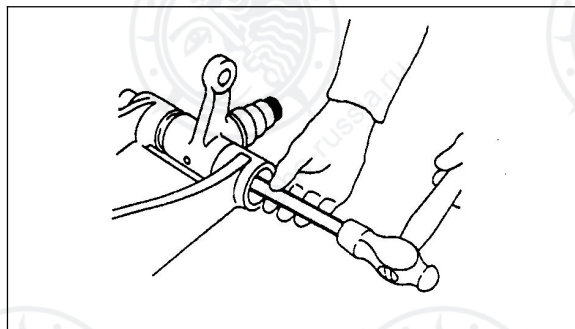
- Do not drop taper bearing.
- Be caution not damage the seal element.

Steering king pin and knuckle

- Dismantle nut(18) in the joint of knuckle and draw bar device, disassemble draw bar device;
- Loose the fixed screw (47) ;



- Dismantle oil cup of steering king pin; (37) ;
- Dismantle steering king pin (42) ;



Caution

- Push steering king pin to avoid drop.

- Take down the whole set of knuckle (including thrust bearing, dustproof shell, shim)

Inspect:

- Replace knuckle if cracked;
- Replace bearing if its rollers or roller surfaces are rusted or nicked;
- Replace needle bearing if it damaged;
- Replace thrust bearing and dust cap if they damaged.

Installation:

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

- Always insert kingpin from lower side;
- Install thrust bearing, set the tighten-ring below the support and loosen-ring. Adjust axial clearance to specification with shims. Axial clearance is less than 0.2mm.



Caution

- Thrust ball bearing is installed on the upper knuckle, and the adjusting shim is installed on the down knuckle.
- Apply grease between inner dust proof, loosen-ring, and tighten-ring.

- Do not apply grease to the of needle bearing outer ring and knuckle faying surface
- Apply grease to roller of roller bearing and ball of thrust bearing;
- Apply sufficient grease into the oil cup.

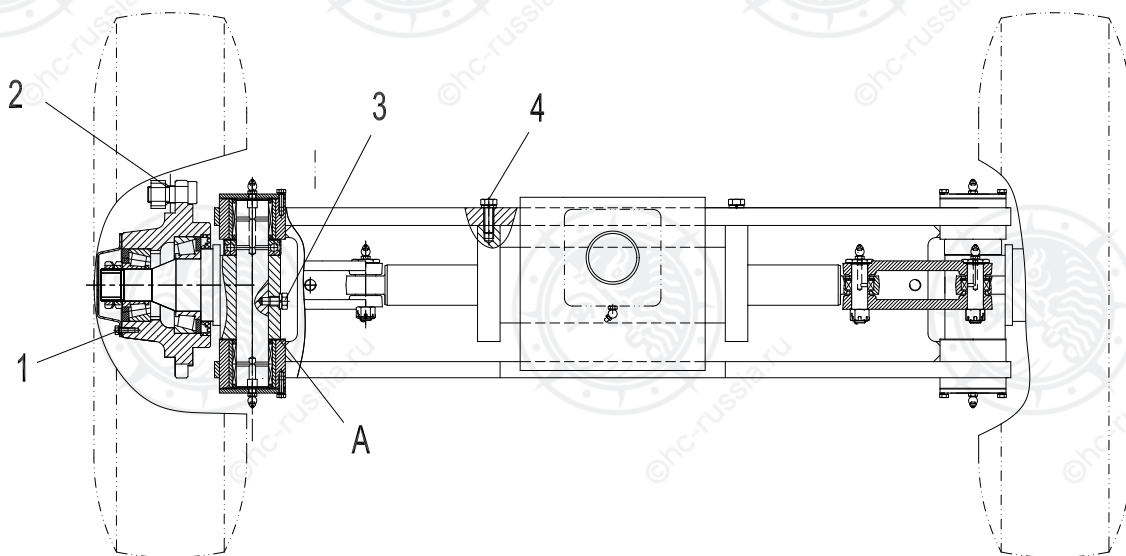
Hub bearing installation and adjustment explanation

- Apply rust preventive oil on contact area of nut (32) and bearing (30);
- Slowly rotate hub(27) with one hand. Tighten locknut with the other hand until it is hard to rotate steering hub(27), and then rotate the nut(32) about 60° in reverse direction;
- Rotate steering hub(27) 2~3 cycles, and rotate the bearing roller in place;
- Rotate the steering hub(27) with one hand, and screw down the nut(32) with the other hand, rotation initial torque: $T=0.88 \sim 2.65\text{N.m}$.
- Place the protruding part of washer (31) into the knuckle groove, adjust the outer nut (32), align the notch at the outer protruding part of washer (31), then put the protruding part of washer (31) into the nut notch.
- Rotate the steering hub(27) for 2 cycles, measure the rotation initial force ($7.8 \sim 23.6\text{N}$) and if axial clearance (no clearance in axial direction) meets stand, and adjust if necessary.

6.2 Fault diagnoses and corrections

condition	Probable cause	Corrective action
Unstable travel	Wheel nuts loosens	Tighten
	Wheel bearing exceeds adjusting scope	Adjust
	Incorrect installation of end axle adjusting shim	Adjust
	Steering system failure	Refer to the "steering system trouble diagnoses and corrections"
Noise	Insufficient lubrication	Apply and fill lithium base grease
	Bolt or nut loosens	Tighten
	Incorrect adjustment of end axle adjusting shim	Adjust
	Knuckle bearing on two ends of connecting rod damaged	Replace

Steering axle



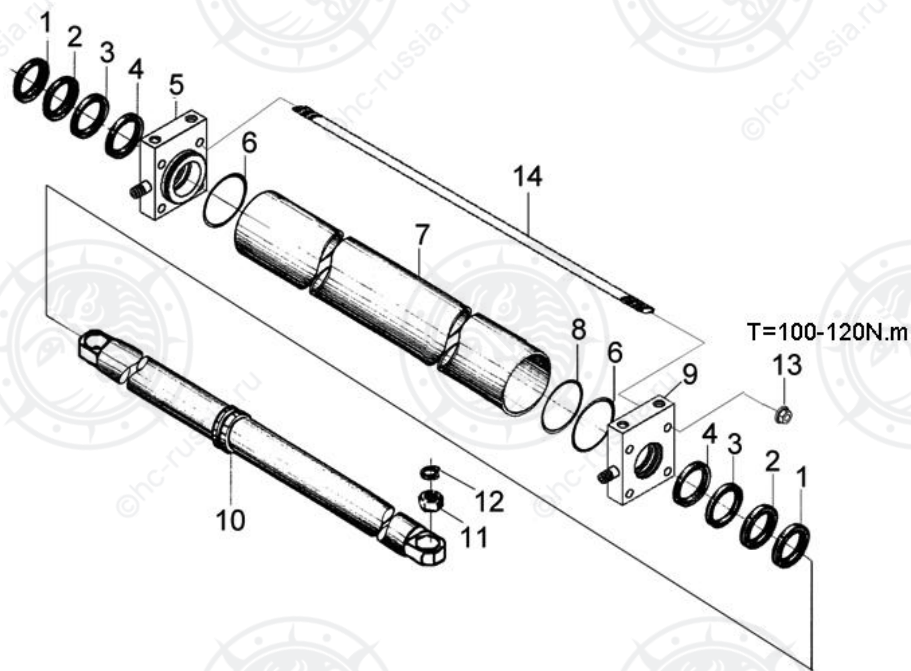
A: Insert proper 0.1mm gasket between 2 thick gasket to make axial clearance less than 0.2mm.

	Tightening torque: N·m		Tightening torque: N·m
1. Nut	363-490	2. Bolt M6×10	3.7-5
3 screw	25-35	4. Bolt M16×1.5×45	193-257

7 Steering cylinder

Steering cylinder is of double-acting piston type. The two end of piston is connected with knuckle through rod. The pressure oil from hydraulic steering gear makes piston rod to move

left and right so as to turn truck left and right. Refer to 3-6.



- | | | | | |
|-----------------|-------------------|--------------------|---------------------|----------------------|
| 1.LBH Dust ring | 2.Guard circle | 3.ISI Sealing ring | 4. Composite bush | 5.Right guide sleeve |
| 6.O-ring | 7.Cylinder barrel | 8. Glyd ring | 9.Left guide sleeve | 10.Piston rod |
| 11.Bearing | 12.Check ring | 13.Nut | 14.Screw | |

Fig.3-6 Steering cylinder structure

Disassembly procedures:

- Loosen nut(13), and remove screw(14);
- Dismantle left guide sleeve(9) and right two sides of guide sleeve(6);
- Dismantle LBH dust ring(1), guard circle(2), ISI sealing ring(3), composite bush(4). O-ring(6) sequently;
- Dismantle piston rod(10) and Glyd ring(8).
- Check: replace if component damaged.

To install, reverse removal procedure.

Attentions to dismantle steering cylinder:

- Lubricate each part with clean hydraulic oil.
- Prevent dust and oil coming into the cylinder.
- Avoid scraping on cylinder mouth, inlet and outlet.
- ISI sealing ring lip is inward; LBH dust ring inlet is outward.
- Do not damage O-ring on the outer ring when installing.
- Be careful to centering, push the guide sleeve into cylinder barrel, avoid to damage O-ring on the outer ring and sealing ring on inner ring.
- Apply the same brand grease with working oil between sealing ring.

IV.Brake system

1 Summary

Brake system is composed of service brake system and parking brake system. Service brake is front dual wheels vacuum booster or hydraulic boosting brake, park brake is Mechanical pull-type brake, both works on the shoe brakes which are installed on left and right front wheels. Refer to fig. 4-1 or fig. 4-2.

Service brake realizes truck braking through foot stepping and vacuum booster or hydraulic boosting. This mechanism is mainly composed of brake inching bracket, brake inching pedal mechanism, vacuum booster or hydraulic boosted braking assembly, brake line, brake oiler, left/right shoe brake etc..

Hydraulic boosting brake assembly is composed by the joint of hydraulic boosted brake and brake master cylinder, makes foot stepping easier and comfort, thus reduce operator's fatigue. Even in the event that the hydraulic boosting is invalid, it can use hydraulic braking to brake.

Parking brake mechanism is mainly composed of parking brake, left/right brake cable and brake etc.

Brake owns hydraulic drive and automatic mechanism.

Use foot brake when to brake the truck during travelling. Hand brake is only used for daily truck parking. It is prohibited to use hand brake as foot brake. If foot brake malfunctions during travelling, use hand brake for emergency braking.

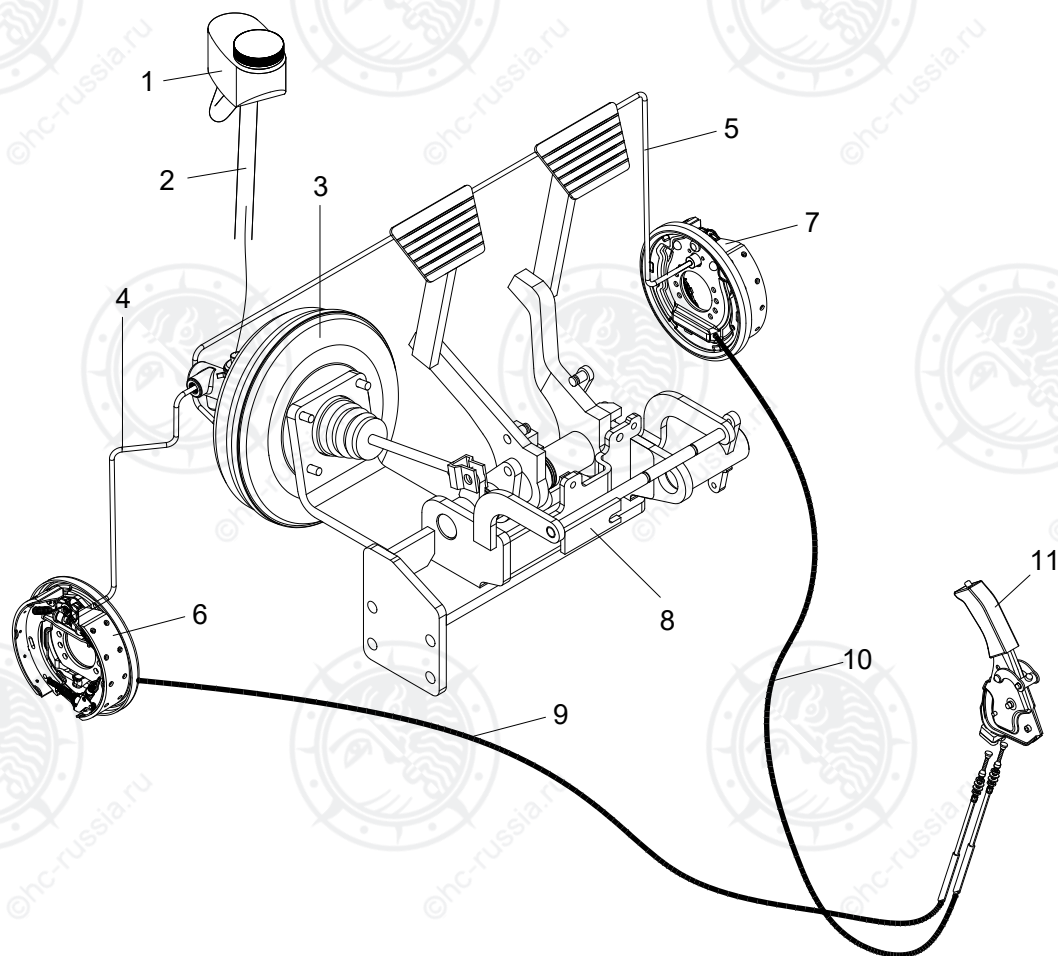


Fig.4-1 Brake system (China engine)

1. Brake oiler 2. Rubber hose 3. vacuum booster 4. Left brake pipe 5. Right brake pipe
6. Left brake 7. Right brake 8. Pedal assy 9. Left brake cable assy
10. Right brake cable assy 11. Parking brake

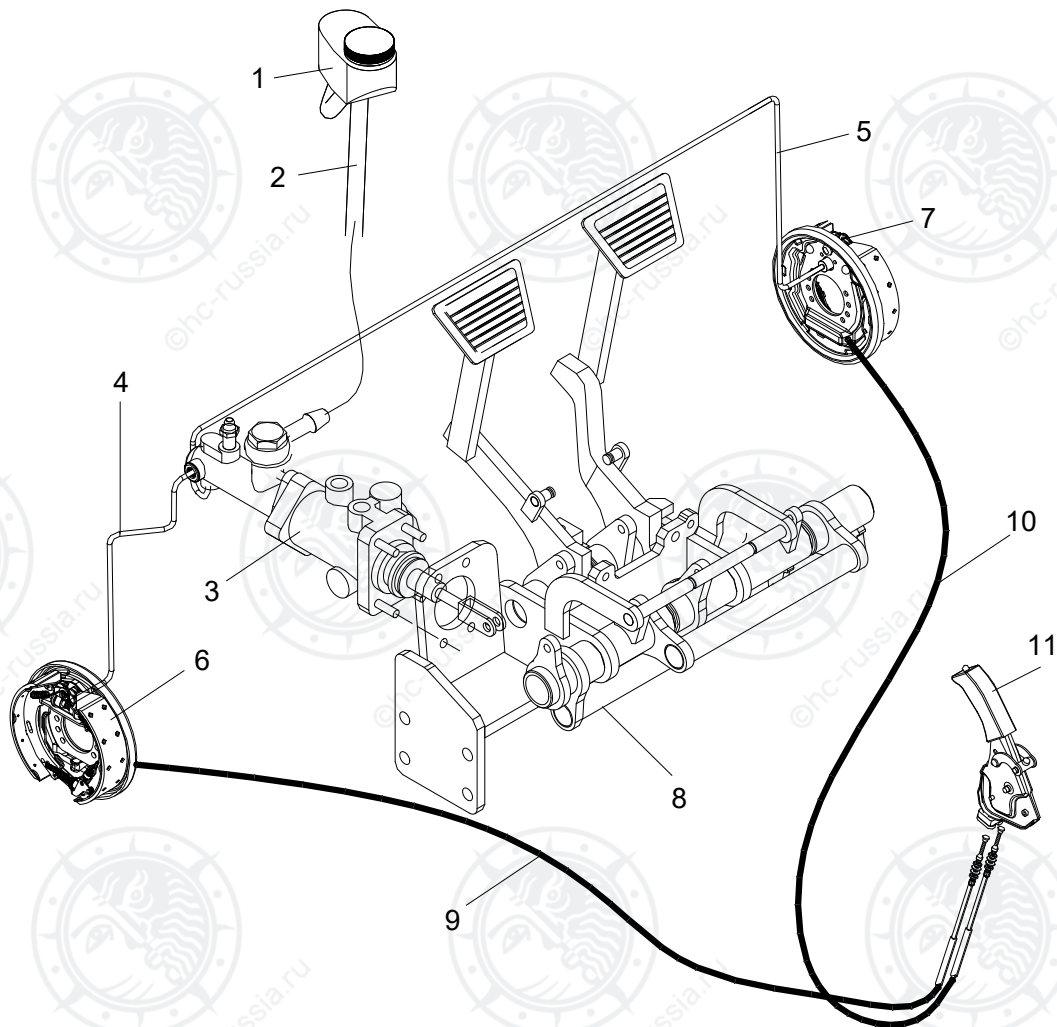


Fig.4-2 Brake system (Imported engine)

1. Brake oiler 2. Rubber hose 3. Hydraulic booster brake master pump 4. Left brake pipe
5. Right brake pipe 6. Left brake 7. Right brake 8. Pedal assy
9. Left brake cable assy 10. Right brake cable assy
11. Parking brake

2 Data

Brake master cylinder diameter mm		22"
Piston stroke mm		35
Vacuum booster	Membrane diameter Inch	8
	Power ratio	4 ± 0.15

Brake	Type	Oil pressure, internal expanding front-wheel mechanical brake
	Clearance between friction plate and drum brake	0.4~0.6 mm
	Wear limit of friction plate(to the rivet head)	Larger than 0.5 mm
Parking brake Travel		Less than 80 mm (With 147N tension force, at hand brake handle)

3 Brake inching pedal adjustment

Brake pedal adjustment:

- Adjust brake pedal stop bolt at A, make the pedal pad point P $145\pm 5\text{mm}$ from the front base plate and screw down the bolt nut.
- Adjust Brake Pump push rod length, and make the spare travel of the point P to point Q is $5\sim 15\text{mm}$ (just as $1\sim 3\text{mm}$ spare travel of push rod), and lock the nut;
- When step the brake pedal $10\sim 20\text{mm}$ gradually, the brake light switch is completely connected, and release the foot to this state, brake light switch should disconnect.

Inching pedal adjustment:

- Adjust inching pedal stop bolt at C, make the pedal pad point P $145\pm 5\text{mm}$ from the front base plate and screw down the bolt nut.
- After adjusting the brake pedal, adjust the bolt at B and make the joint clearance between inching pedal and brake pedal 0 mm , then tighten.

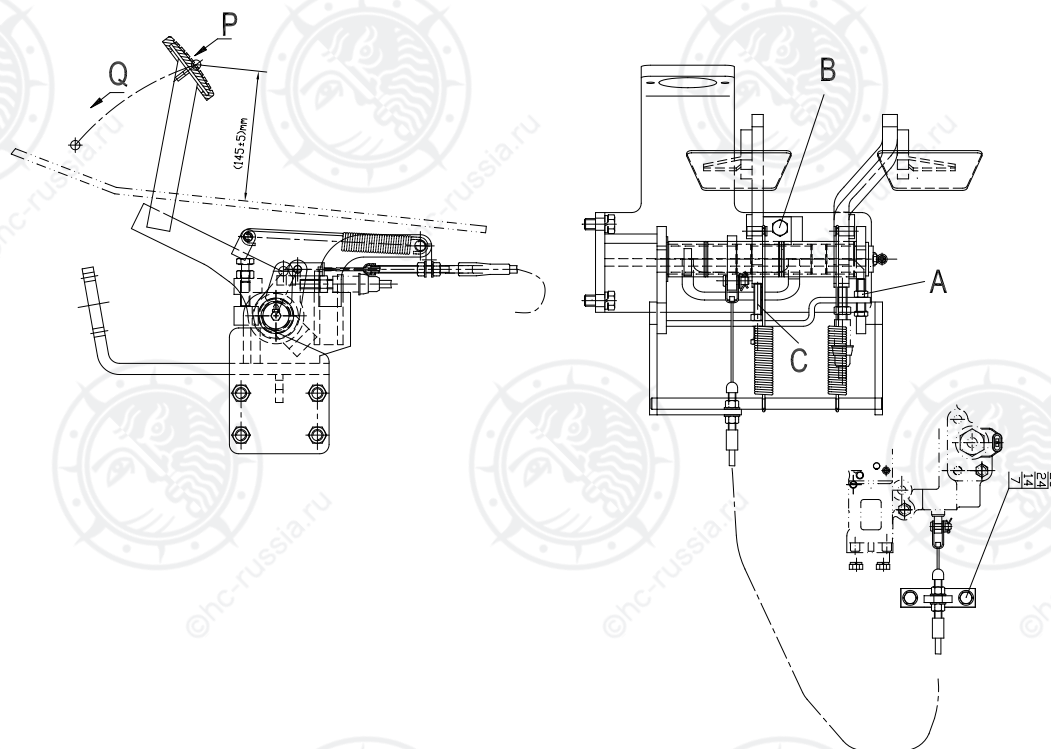


Fig.4-2 Brake inching pedal adjustment

4 Parking brake adjustment

When it is found out that the free travel of parking brake handle is too large or brake effect is worse after it is used for some time, please adjust it in time. Adjusting way is as follows:

- Before adjusting parking brake, check and adjust the shoe brakes on both sides of driving wheel;
- Tighten nut B;
- Adjust nut A until handle force(P on Q direction) is 15~20kg when locking handle.
- Release pull rod of parking brake, and make sure wheel brake is completely released.

Note: Apply proper lithium base grease to guide rail, and keep applying frequently.

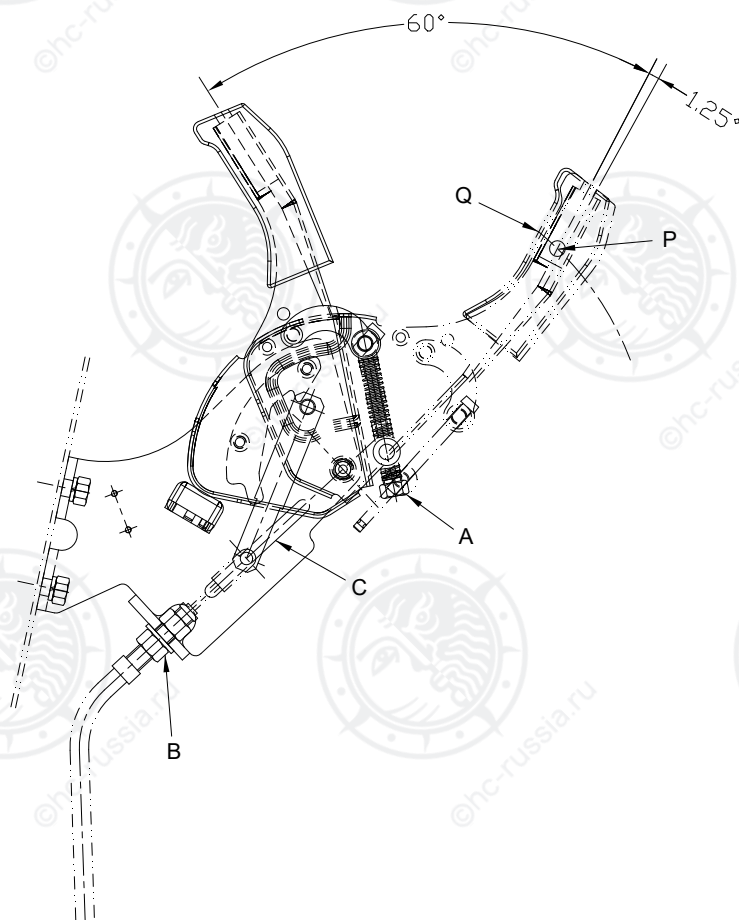


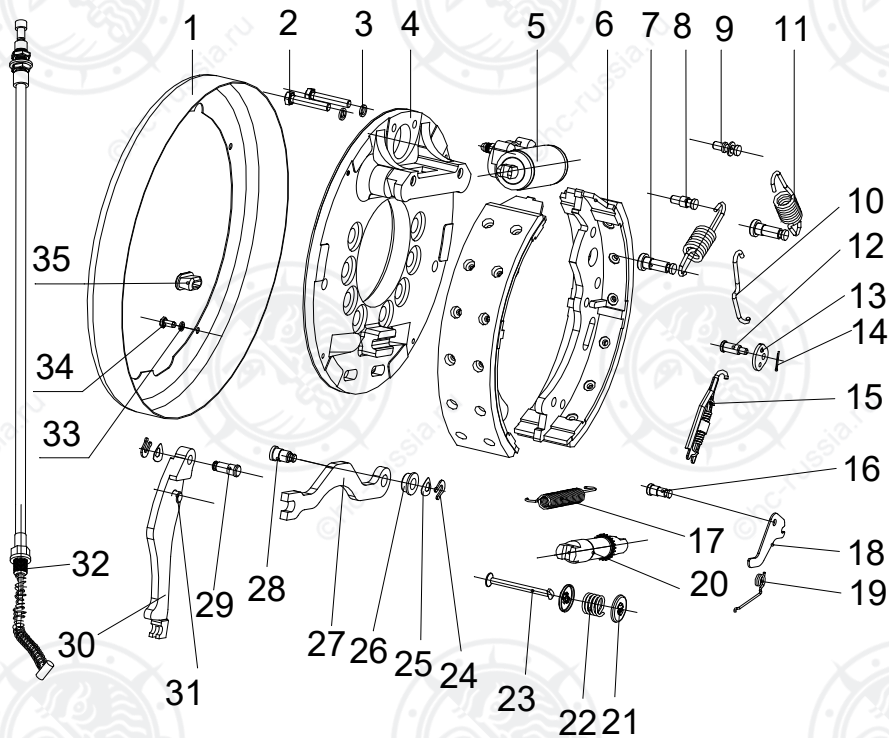
Fig.4-3 Parking brake adjustment

5 Brake

Adopted shoe brake is mainly composed of brake pad, brake shoe, brake cylinder and brake pad adjusting mechanism.

When brake connects with drive axle, according to marks (left, right) on brake, bleeder screw is on the slight upper, oil line should be cleaned before connecting.

When brake shoe does not work and lies in original position, there should be proper clearance between friction plate and drum brake, and adjust the brake clearance to 0.25~0.5mm. Adjust clearance in time after friction plate wears. If friction plate wears severely, (distance between rivet head and friction plate is less than 0.5mm) replace it in pairs.



- | | | | |
|-----------------------------|--|------------------------------|-------------------------|
| 1.Housing | 2.Bolt | 3.Spring washer | 4. Brake bottom plate |
| 5.Brake cylinder | 6. Brake shoe with friction plate assembly | 7.Return spring pin | 8.Pin |
| 9.Pin | 10. Upper pull rod | 11.Return spring | 12.Rocker pin |
| 13.Rocker | 14.Cotter pin | 15.Spring riveting device | 16.Torsional spring pin |
| 17. Lower tension spring | 18.Pawl | 19. Torsional spring | 20.Adjuster assembly |
| 21 Pressure spring pedestal | 22. Pressure spring | 23. Pressure spring pull rod | 24.Check ring |
| 25. Resilient pad | 26.Bush | 27.Hand pushrod | 28.Pushrod pin |
| 29. Pull rod pin | 30. Hand brake lever | 31.Pin | 32.Hand brake cable |
| 33. Spring washer | 34.Bolt | 35.Rubber plug | |

Fig.4-4 Brake

Replace brake shoe

- Place the forklift truck on level concrete.
- Start engine and raise forks about 100mm.
- Place chocks behind rear wheels to prevent movement of forklift truck.
- Loosen wheel nuts two or three turns each.
- 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.**

- Tilt mast forward until front tires are raised from ground.



Warning

- **Do not unscrew the wheel nut before the wheel rise from the ground.**

- Support forklift truck by putting additional wooden blocks under each side of front-end frame.
- Stop engine.
- Remove wheel tire nuts and brake drum. Remove axle shaft, lock nut, and lock sheet.
- Remove wheel hub and brake drum.
- Replace brake shoes with new ones.
- Reinstall hub, brake drum, locknut and lock sheet. Adjust bearing clearance.
- Adjust shoe to drum clearance: rotate wheel counterclockwise and at the time press down brake pedal several times.
- Take out every padding block: take out according to reverse procedures when inserting.
- Make sure no person or obstacle is around forklift, then operate forklift in reverse at 2 km/h to 3 km/h, set foot on brake pedal 2~3 times.

6. Vacuum booster(Truck with Chinese engine)

1. To use foot brake, when depressing the brake pedal, the vacuum booster pushrod is pushed by pushrod directly, brake master cylinder pushrod power is increased due to the vacuum booster, and then brake master cylinder main piston is pushed to get the master cylinder brake fluid into the right brake cylinder and push the brake cylinder piston, thus the brake shoe is pressed on the brake drum and the wheel is braked.

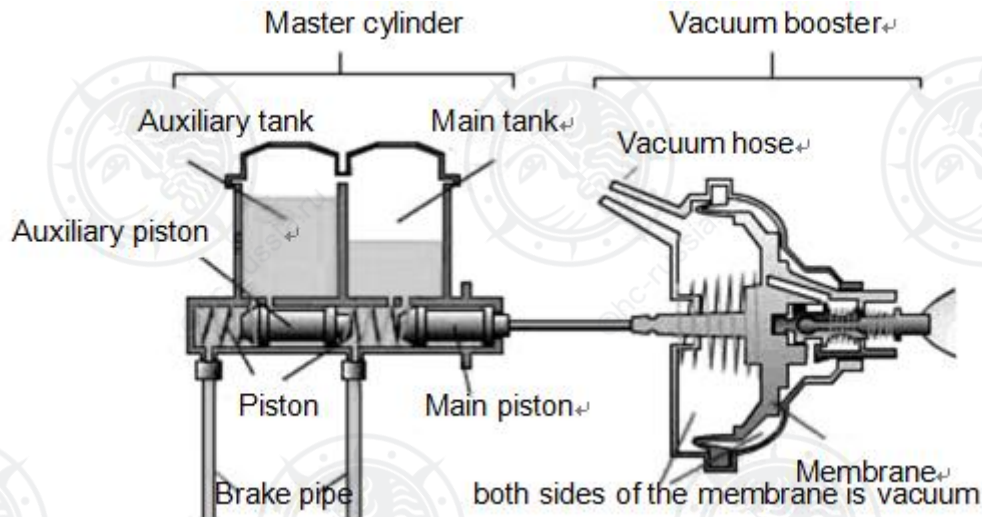


Fig.8-1 Working principle of vacuum booster

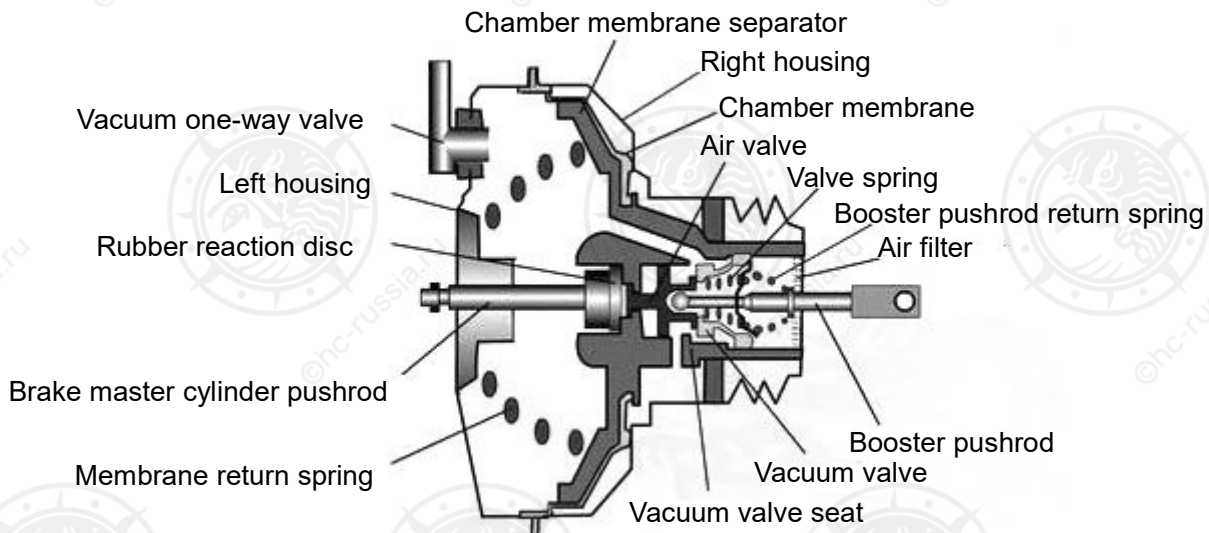


Fig.8-2 Vacuum booster structure

Brake pedal free travel is 5mm-15mm, please check when the brake pedal is too low:

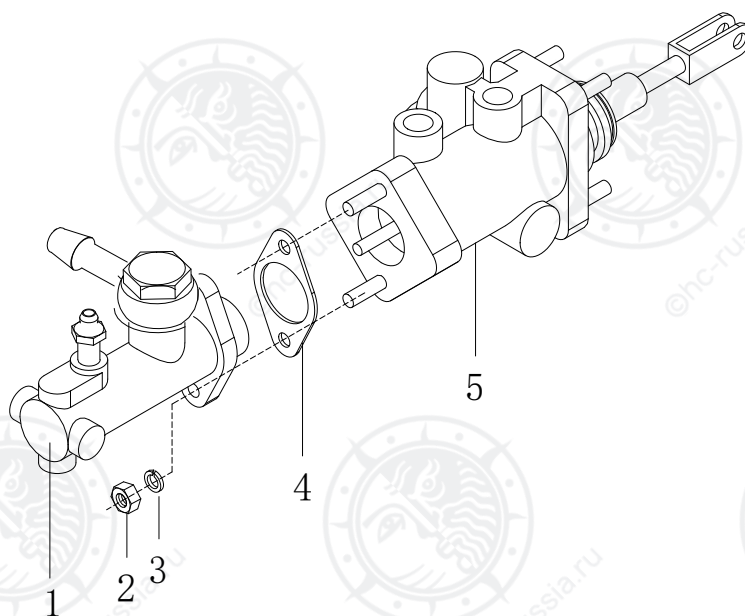
- (1) If oil leakage in the pipe;
- (2) If air in the pipe;
- (3) If brake adjusting mechanism malfunctions, or the clearance between disc and drum is too large.
- (4) If brake booster function is invalid.

7. Hydraulic boosted braking assembly (Imported engine type)

Hydraulic boosted braking assembly refers to fig.4-5. It is composed by the joint of hydraulic booster and brake master cylinder, boosted part is applied hydraulic oil, and brake master cylinder applied brake fluid.

Boosted part uses power from multi-way valve to pressurize master cylinder part. Hydraulic feedback system in the component feeds back to operator a pedal force that is directly proportional to brake pressure, so it is easy to do braking control adjustment.

Brake master cylinder can be operated manually at any time through assisted part. Brake pressure formed by manual operation depends on the applied pushrod force.

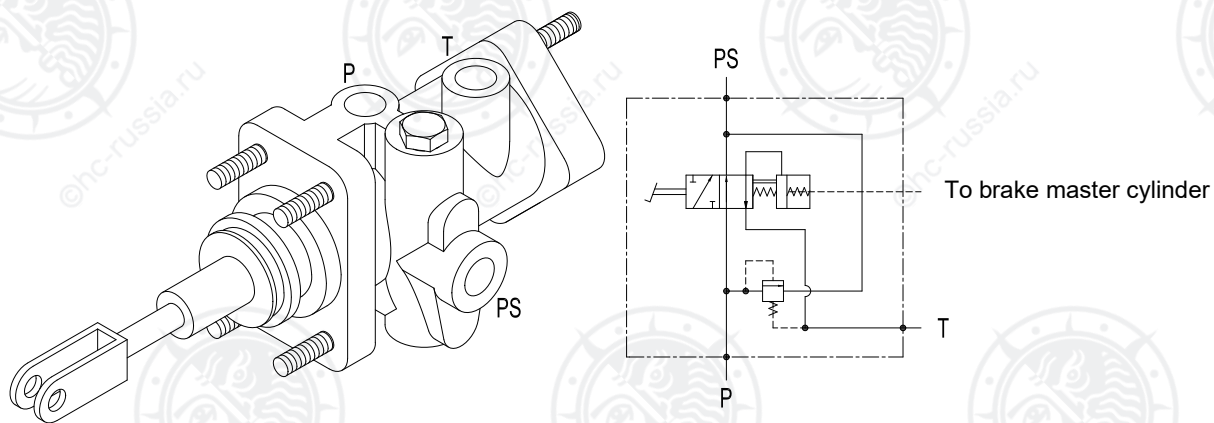


1. brake master cylinder assy 2. Nut M8 3. Washer 4. Shim 5. Hydraulic booster

Fig.4-5 Hydraulic boosted braking assembly

7.1 Hydraulic booster

Hydraulic booster and steering system share the same hydraulic oil, they can work separately, or joint to use when necessary, but do not intervene mutually.



Oil port connection: P: Connect the oil-out of steering gear pump

T: Connect oil return pipe of hydraulic oil tank

PS: Connect P port of hydraulic steering gear

Fig.4-6 Hydraulic booster shape and working principle

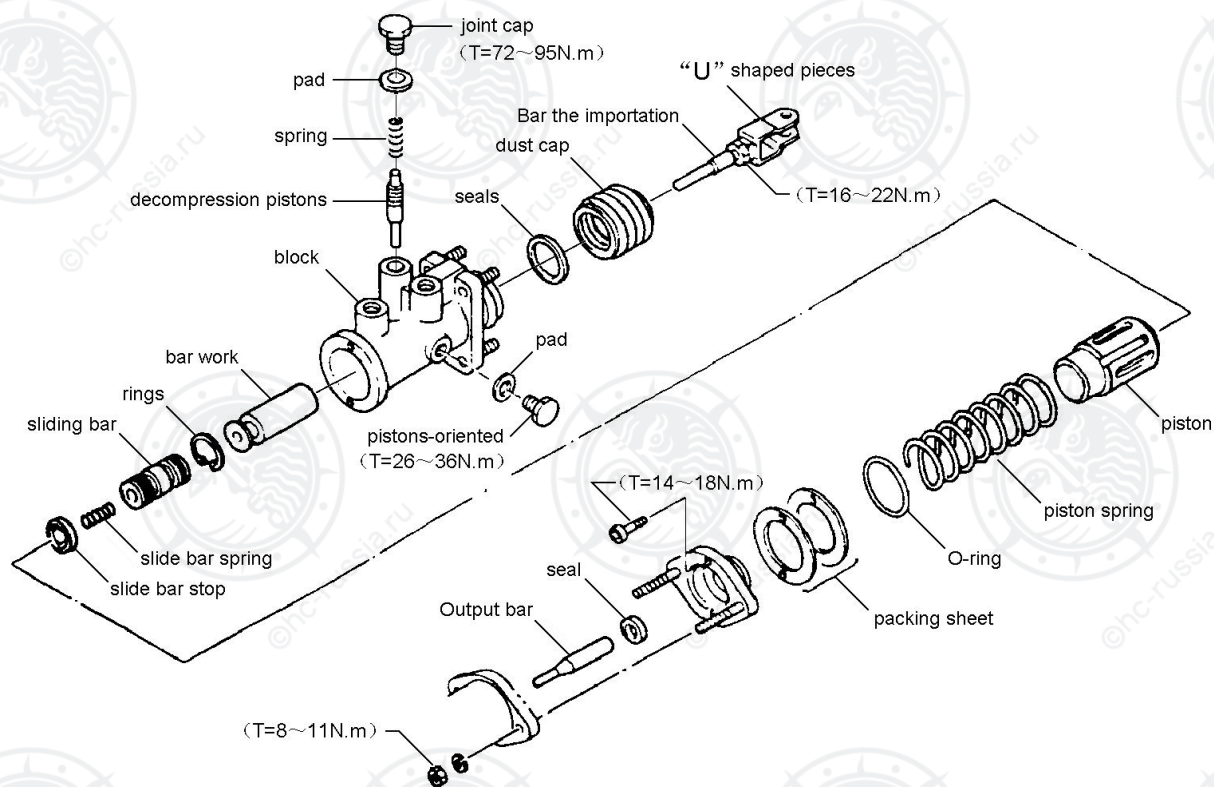


Fig. 4-7 Hydraulic booster structure

Hydraulic booster dismantle

- Dismantle rod connector and input rod.
- Remove the brake booster nuts from pedal bracket.
- Dismantle the pipeline from brake master cylinder to brake booster.
- Take down brake booster and brake master cylinder.
- Separate brake booster and brake master cylinder.

To install, reverse removal procedures.

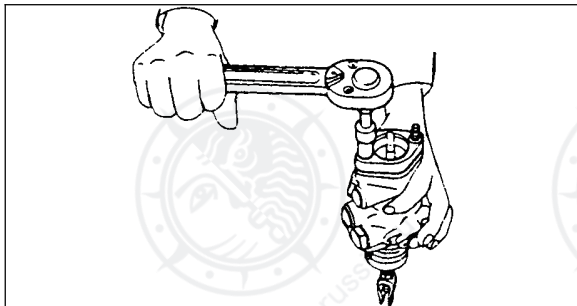


Caution

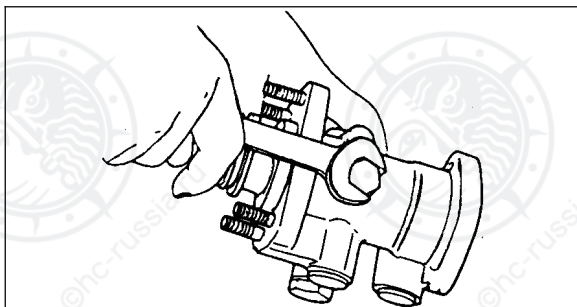
- After dismantling pipeline, avoid dust and impurity getting into inner cavity.

Hydraulic booster disassembly

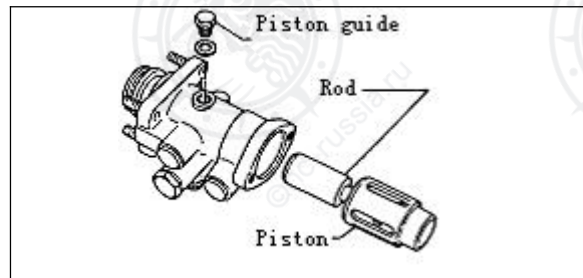
- Remove dust cap and input rod.
- Remove guiding rod and output rod.



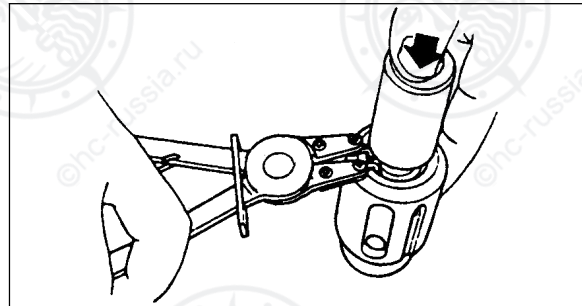
- Remove O-ring, piston spring and washer.
- Dismantle piston guiding.



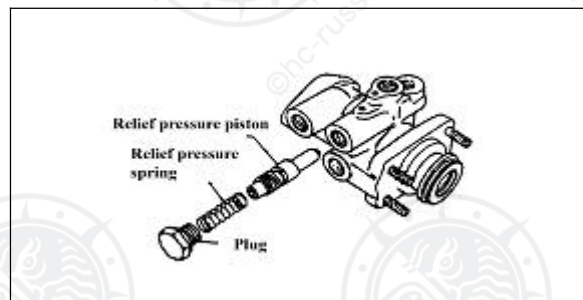
- Remove piston and working beam.



- Remove snap ring and pull out slide bar, spring and baffle plate from piston.



- Remove plug, reducing valve and spring, do not disassemble reducing valve assembly.



To reinstall spare parts, reverse the disassembly procedure.

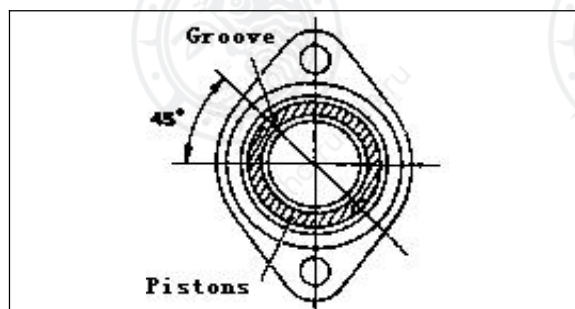
Inspect

- Check sealing gasket and replace if damaged.
- Replace damaged O-ring.
- Check if there is scratch or wear on cylinder body, piston, slide bar, working beam, output rod, guiding rod, reducing valve assembly and piston guiding sliding surface, replace if necessary.

Attention to reinstall hydraulic booster:

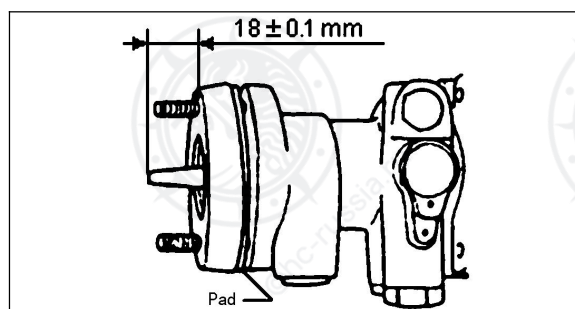
- Use light oil(not gasoline) to clean parts.

- Avoid impurity get into parts inner cavity.
- Apply hydraulic oil to the moving part surface before assembling.
- Pay attention to the direction when assembling reducing valve assembly and slide bar.
- Do not install the slide bar reversely.
- Install the snap ring in place.



- Insert piston and working beam into cylinder body and make sure piston groove direction. The below figure shows the mounting position of brake master cylinder and tightening position of piston guide. Piston guide tightening torque is 26~36N·m.

- Install guide rod to downward the air vent.
- Install dust cover to downward the air vent.
- After installing cylinder body, piston, output rod or guide rod, adjust the projected length of output rod with shim. Projected length is 18 ± 0.1 mm.



Hydraulic booster fault diagnoses and corrections

condition	Probable cause	Corrective action
Brake does not work efficiently	Oil leakage	Repair or add oil
	Oil pump or priority valve failure	Repair or add oil
	Impurity in the slide bar valve	Clean or replace
	Impurity in the reducing valve	Clean or replace
	Oil seal wear or leakage	Replace
Hard brake	Slide bar valve failure	Replace
Brake locking Oil pressure is not zero when releasing the pedal)	Impurity in the slide valve	Clean or replace
	Output rod absorbs impurity	Clean or replace

7.2 Brake master cylinder

Brake master cylinder structure refers to fig. 4-8. End part is fixed with internal circlip, and the master cylinder piston operates with the help of controlling brake pedal through hydraulic booster output rod.

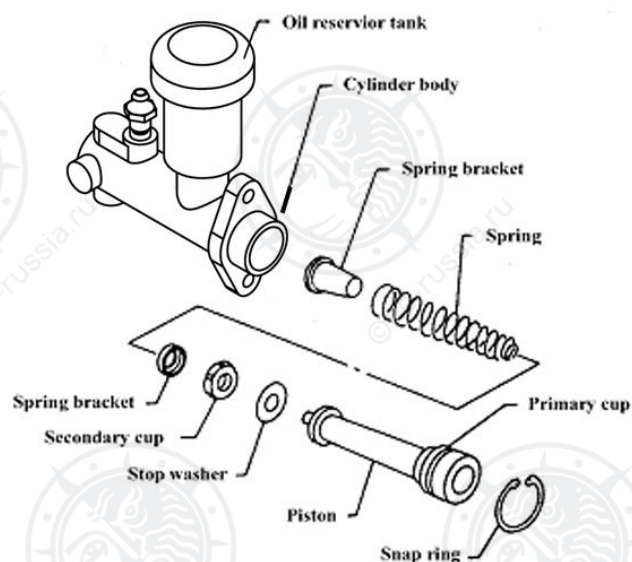


Fig. 4-8 Brake master cylinder

7.2.1 Remove

- 1) Take apart brake master cylinder and brake booster.
- 2) Take apart snap ring, piston, stop washer, spring bracket and spring.

7.2.3 Inspection

Check the master cylinder's parts in brake fluid for damage and deformation.

Num.	Condition	Method
1	There is excessive wear or damage on the surface of piston or cylinder	Replace
2	The clearance between piston and cylinder is bigger than 0.15mm	Replace
3	The leather bowl is weak and damaged	Replace
4	Spring loosen or damage	Replace
5	Reservoir oil tank deformation or damage	Replace



Caution:

- Throw away the primary cup and replace a new one.
- Keep the work plane clean.
- You can't use other fluid or oil but brake fluid.

7.2.3 Assembly

To install, reverse the order of removal.

Caution:

- 1) Clean the parts in brake fluid.
- 2) Daub brake fluid on the frictional surface of piston and cylinder.
- 3) It is forbidden to cut and damage the surface of the piston.
- 4) The position of the piston cup and spring bracket must be correct (refer to fig.4-9)

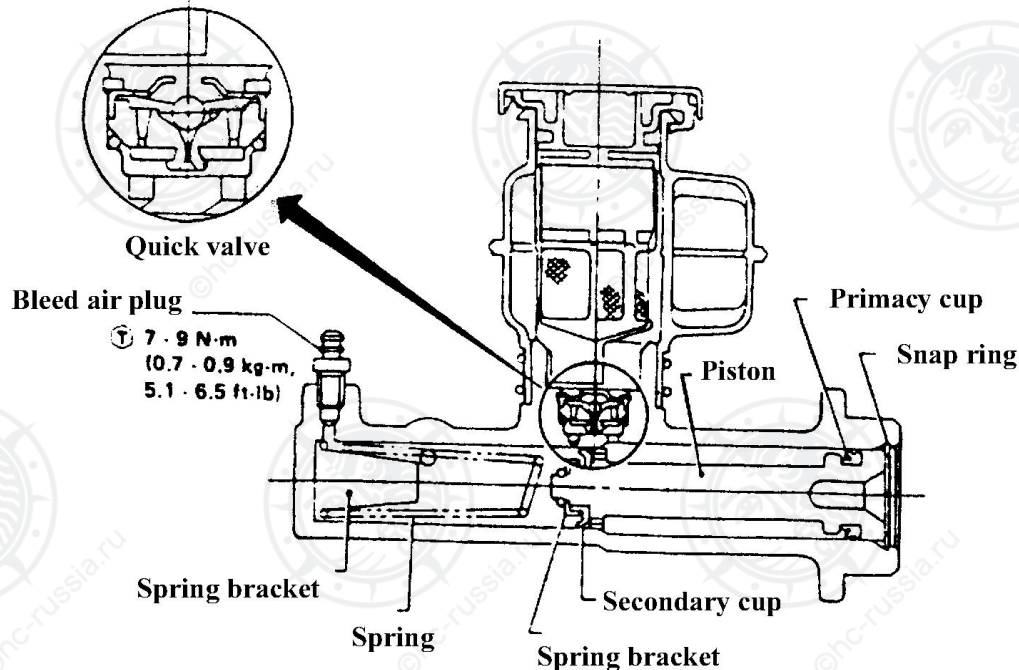


Fig. 4-9 Cup, spring bracket position

Brake master cylinder disassembly

- Separate brake master cylinder and brake pedal.
- Take down snap ring, remove piston, insulation pad, spring seat and return spring.

Check

Clean all parts in the brake fluid and check their condition.

Serial No.	Check condition	Corrective action
1	Obvious scratch or wear on moving surface of cylinder and piston	Replace
2	Clearance between cylinder body and piston should not exceed 0.15mm.	Replace
3	Weak and damaged auxiliary leather collar and pressure leather collar	Replace
4	Weak and damaged spring	Replace



Caution

- Throw away the removed leather collar, and replace with new one.
- Remove the parts in clean ground and place them in sequence neatly.
- Do not use other cleaning agent to clean parts.

8. Fault diagnoses and corrections

Fault	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 linings Improper functioning of brake valve 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. Improper brake adjustment Water or oil on brake linings Foreign pieces in brake drum Damage on friction lining Improper contact of friction linings Worn friction lining Worn, warped, rusted or damaged brake drums Improper operation of brake cylinder Incorrect brake shoe sliding Guard plate bolt looseness Guard plate warp Improperly adjusted wheel bearing Clogged oil lines	Adjust Adjust Wipe 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. Incorrect brake shoe sliding Incorrect brake cylinder operation Damage piston cup Weak or broken return springs Back-flow hole of brake master cylinder blockage Clogged oil lines. Incorrect wheel bearing adjustment	Adjust Adjust Adjust or replace Replace Replace Clean Clean Adjust or replace
Brake noise	Lining surface harden or foreign pieces on it. Warped back plates or loosed bolts. Brake shoes warped or improper install. Worn linings. Loose wheel bearing.	Repair or replace Repair or replace Repair or replace Replace Repair

9. Brake schematic

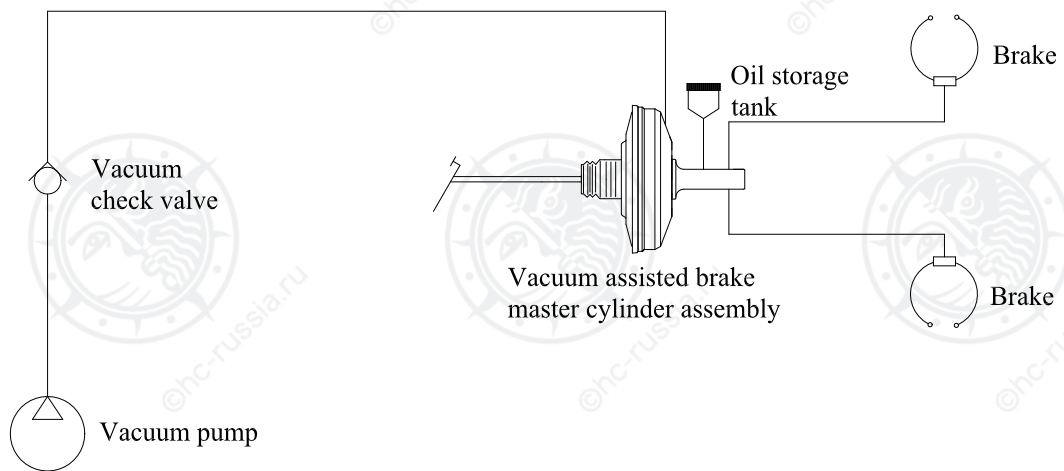


Fig. 4-9 Drum brake (Vacuum boost)

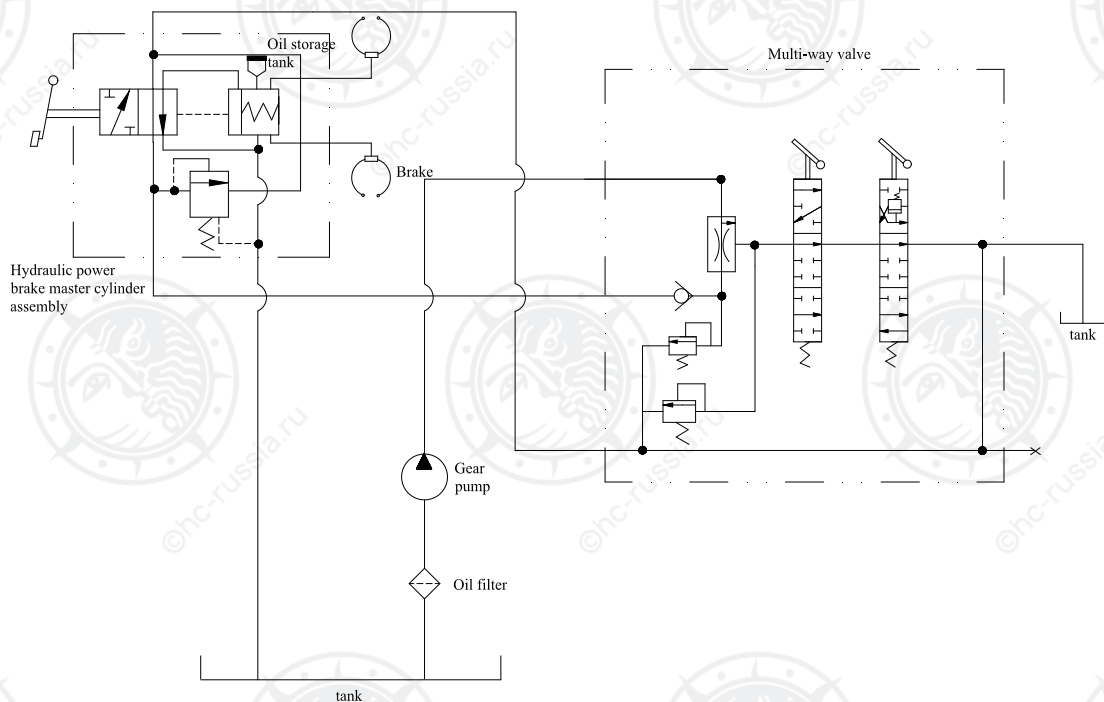


Fig. 4-10 Drum brake (Hydraulic boost)

V.Hydraulic system

1.Data

Main pump

Model	CBQ-F550-AFHL
Type	Gear
Driving	Engine power output gear transmit
Displacement (ml/r)	50
Rotated Speed (r/min)	600~3000
Output pressure (Rated/Max) MPa	20/25

多路阀

公称压力	20MPa
额定流量	160L/min
主安全阀调定压力	19±0.25 MPa
转向安全阀调定压力	9±0.25 MPa
过载发调定压力	15±0.25 Mpa
单稳分流阀分流量	13 L/min ~16L/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.
	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	Cavitations 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.
	Cavitations 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 re-tighten.
	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 tilting lock 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 distance of mast is big when spool valve is in the centre.	Valve body and spool valve is worn and clearance between them is too great.	Replace spool valve with 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 blots.
	Loosed lock-nut of relief valve and connect-nut between plate and plate.	Tighten.
Steering is heavy.	Valve disk of priority is blocked.	Adjust.
	Signal port is jammed.	Clean

3.Main pump

The 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.

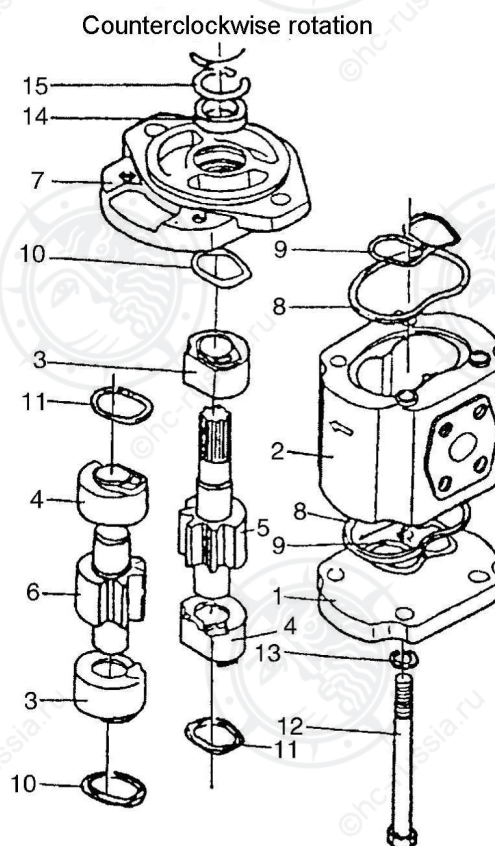


Fig. 6-1 Anti-clockwise rotation gear pump

- | | | | |
|-----------------|----------------|----------------------|--------------|
| 1. End cover | 2. Pump body | 3. Bearing | 4. Bearing |
| 5. Drive gear | 6. Driven gear | 7. Forward end cover | 8. Seal ring |
| 9. Seal ring | 10. Seal ring | 11. Seal ring | 12. Bolt |
| 13. Lock washer | 14. Seal | 15. Locking | |

4. Multi-pathway valve

4.1 Summary

Two pieces type multi-pathway valve consists of inlet, outlet and slide valve. Dividing valve and main safety valve are installed at the inlet.

The main safety valve can adjust oil pressure of the control oil pipe. Its pressure has been adjusted when it is on sale, please don't adjust it without permission.

Steering safety valve is used to adjust the oil pressure of power steering oil pipe.

Slide valve controls the raise, tilt oil cylinder. It makes the oil flux changed by operating raise and tilt valve stems in order to control the oil cylinders.

Tilt slide valve is equipped with front-tilt self-lock valve. oil from hydro cylinder returns to oil box from output, and every piece of valve is sealed by maneuver "O" ring. At the same time, there are installed a single direction valve. Refer to fig. 7-2.

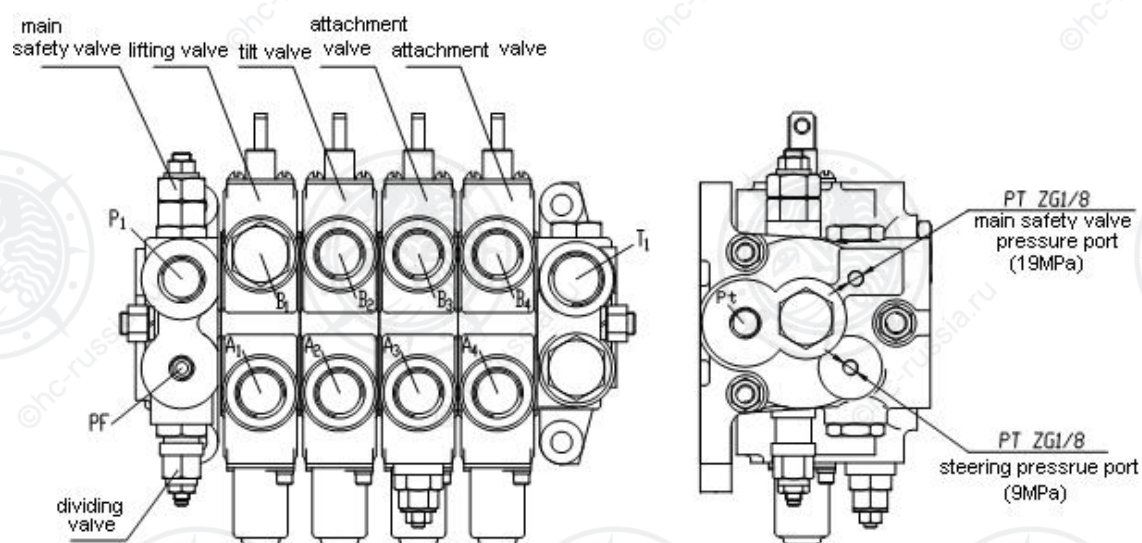
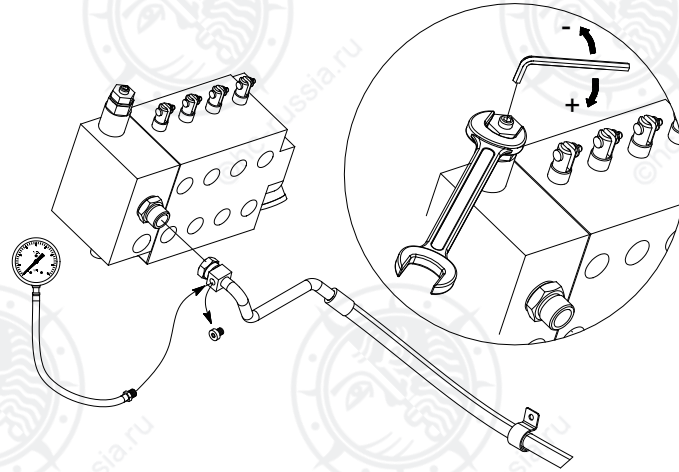


Fig. 6-2 Multi-pathway valve

4.2 Adjusting the pressure of the main 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 20-22N•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.

4.0t~X5t: 19.5MPa±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 20-22N•m. Drop the mast to the ground and tilt backward to end.

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

5. Hydraulic system circuit

Imports of engine forklift truck

The high pressure oil from main pump goes to control valve and divide it to two parts by dividing valve inside control valve: one of them goes to control valve and then goes to lifting cylinder or tilting cylinder, another part goes to steering gear to control steering cylinder. When lifting and tilting spools are in neutral, high pressure oil returns oil tank directly from passway. 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.

When press the brake pedal, the rod of the brake booster be pushed, the slide valve open, the high-pressure oil goes into piston and push the piston to push the brake master cylinder, and make the function of brake booster. The structure of brake booster, please see the chapter about brake system.

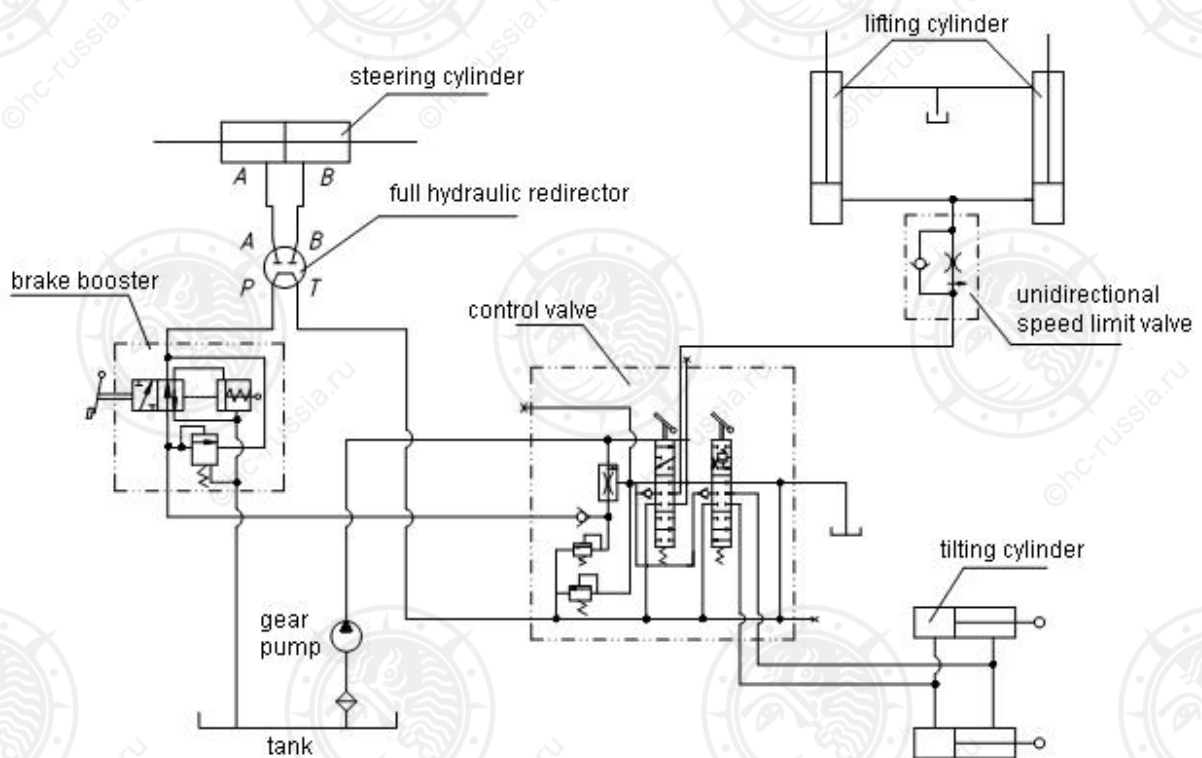


Fig. 6-3 Hydraulic system principle diagram

Domestic engine forklift truck

The high pressure oil from main pump goes to control valve and divide it to two parts by dividing valve inside control valve: one of them goes to control valve and then goes to lifting cylinder or tilting cylinder, another part goes to steering gear to control steering cylinder. When lifting and tilting spools are in neutral, high pressure oil returns 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.

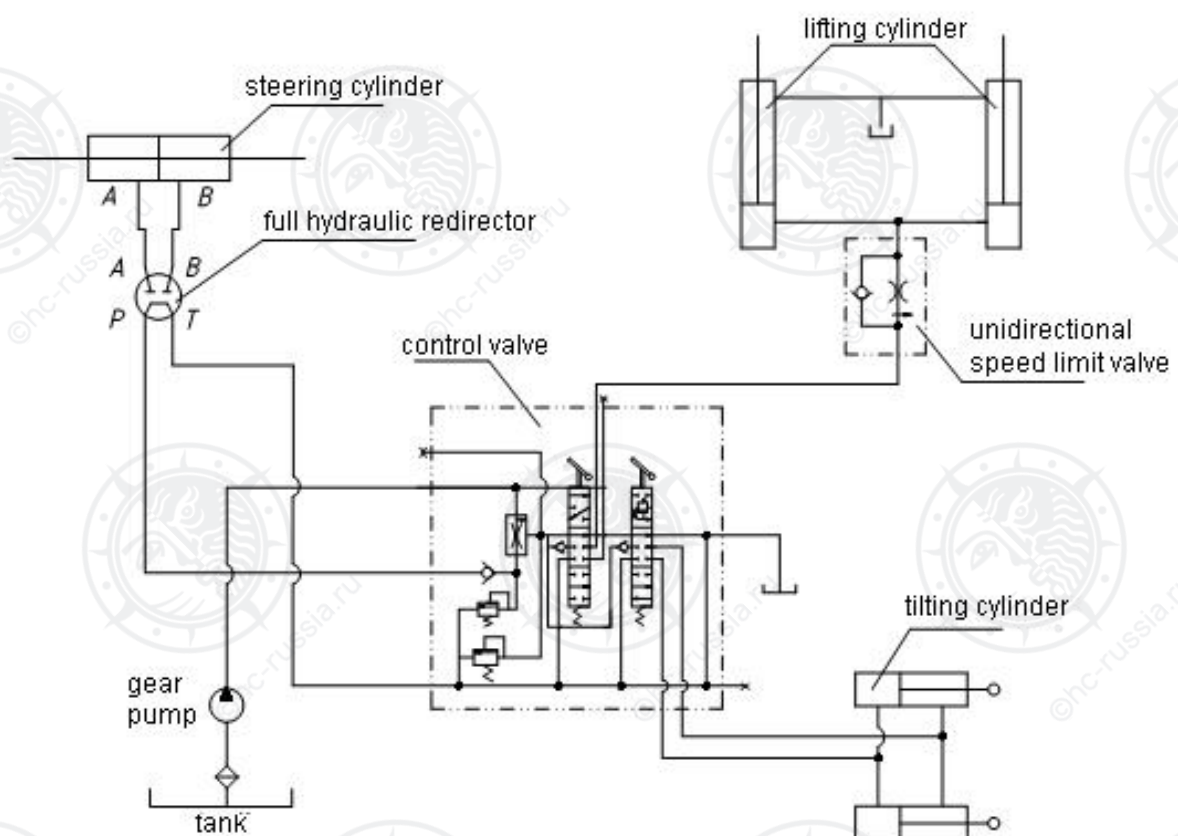


Fig. 6-4 Hydraulic system principle diagram

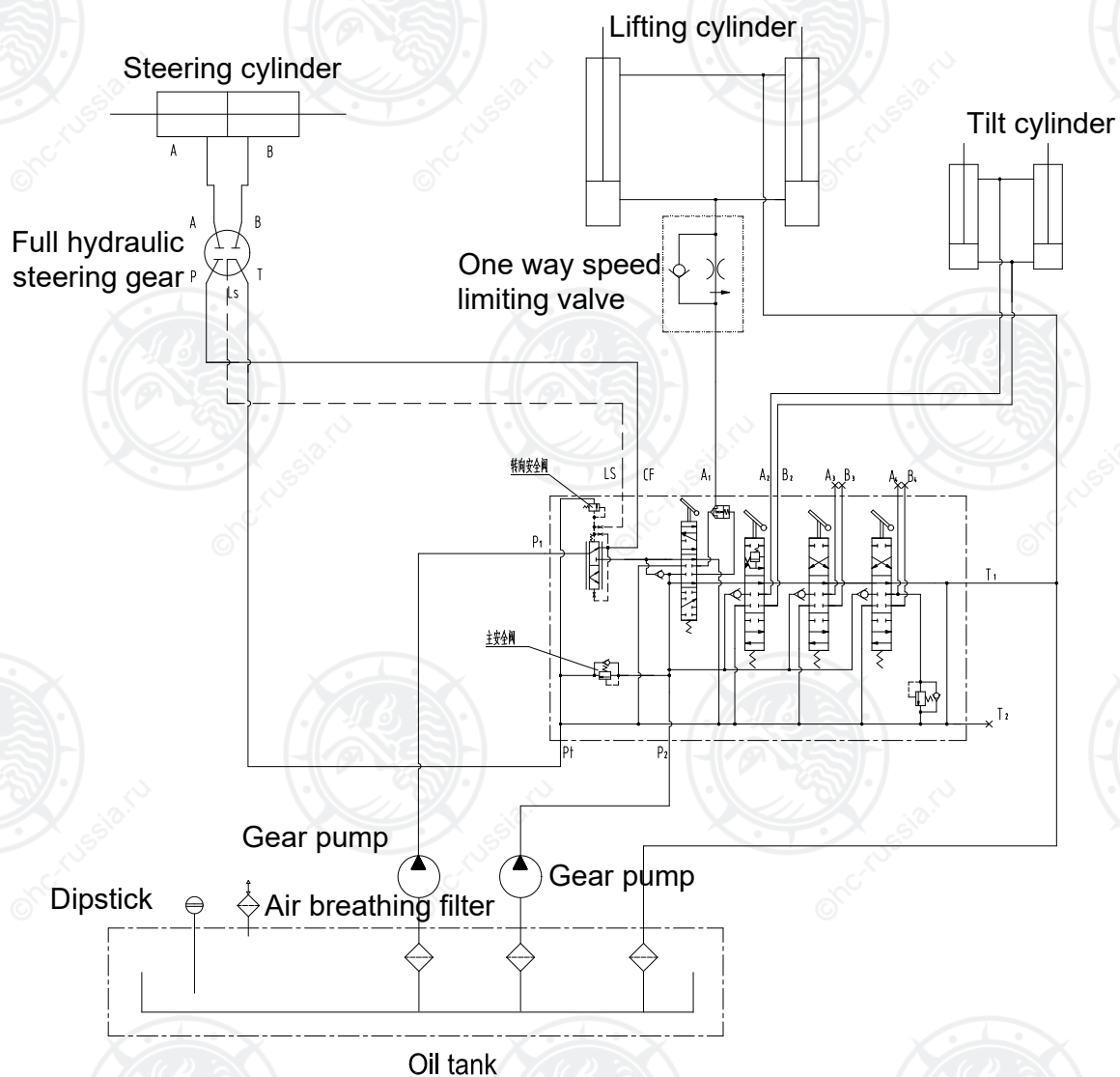


Fig. 6-5 Stone forklift Hydraulic system principle diagram

VI. Lifting system

1. 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 mast has 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.

Double high visibility mast

Double 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 pin. 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 100 mm ~145mm, which is difference with different tonnage. Two lifting jacks (fig.7-5 is right) are laid out back of outer mast to realize high visibility; two lifting jacks are laid outside of outer mast.

Fork arm is hung on fork arm carrier by hook. Roller, combined roller (side roller is installed middle of roller outside) and side roller (It is adopted combined roller in 1-1.8 tonnage fork lift truck) is installed on fork arm carrier. Combined roller is installed on below of inner mast.

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.

Basic truck mast supplied by our company is 3M, and special order is as follows:

Duplex wide view mast: 2.5M to 6M

Duplex full free lift mast: 2.5M to 3.7M

Triplex full free lift mast: 4M to 7M

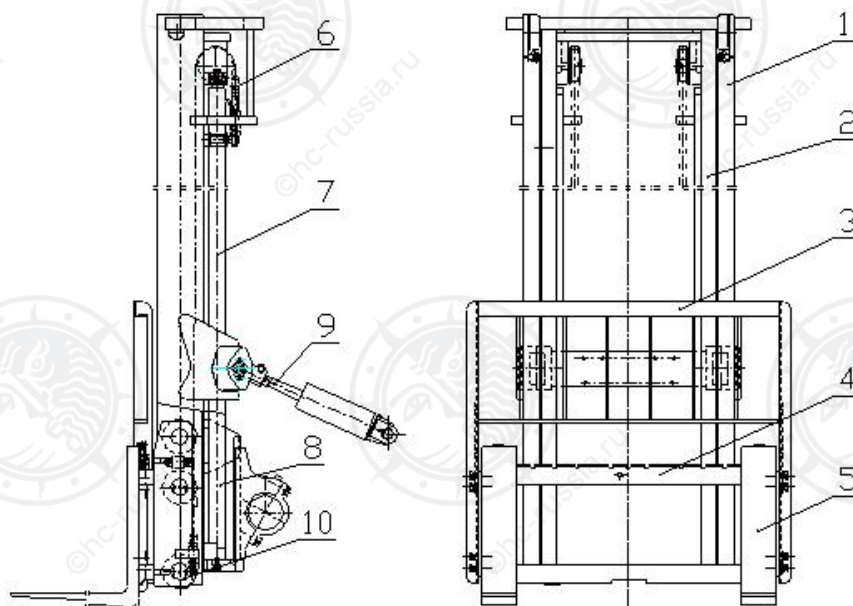


Fig. 7-1 Double stage wide view mast

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 10.Roller

2. 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	Lifting height > 5~6 meter
Mast tilt angle	For-ward	6°	6°	3°
	Back-ward	12°	6°	6°
Fork arm carrier roller		Adopt combination roller and side roller if rated capacity is less than 3 .5t.		

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	0.5,1.0,2.0	
Inner mast to carriage side roller	0.1~0.6	0.2~1
Shims	0.5,1.0,1.5	
Lift chain deflection	25~30	

Tightening torque

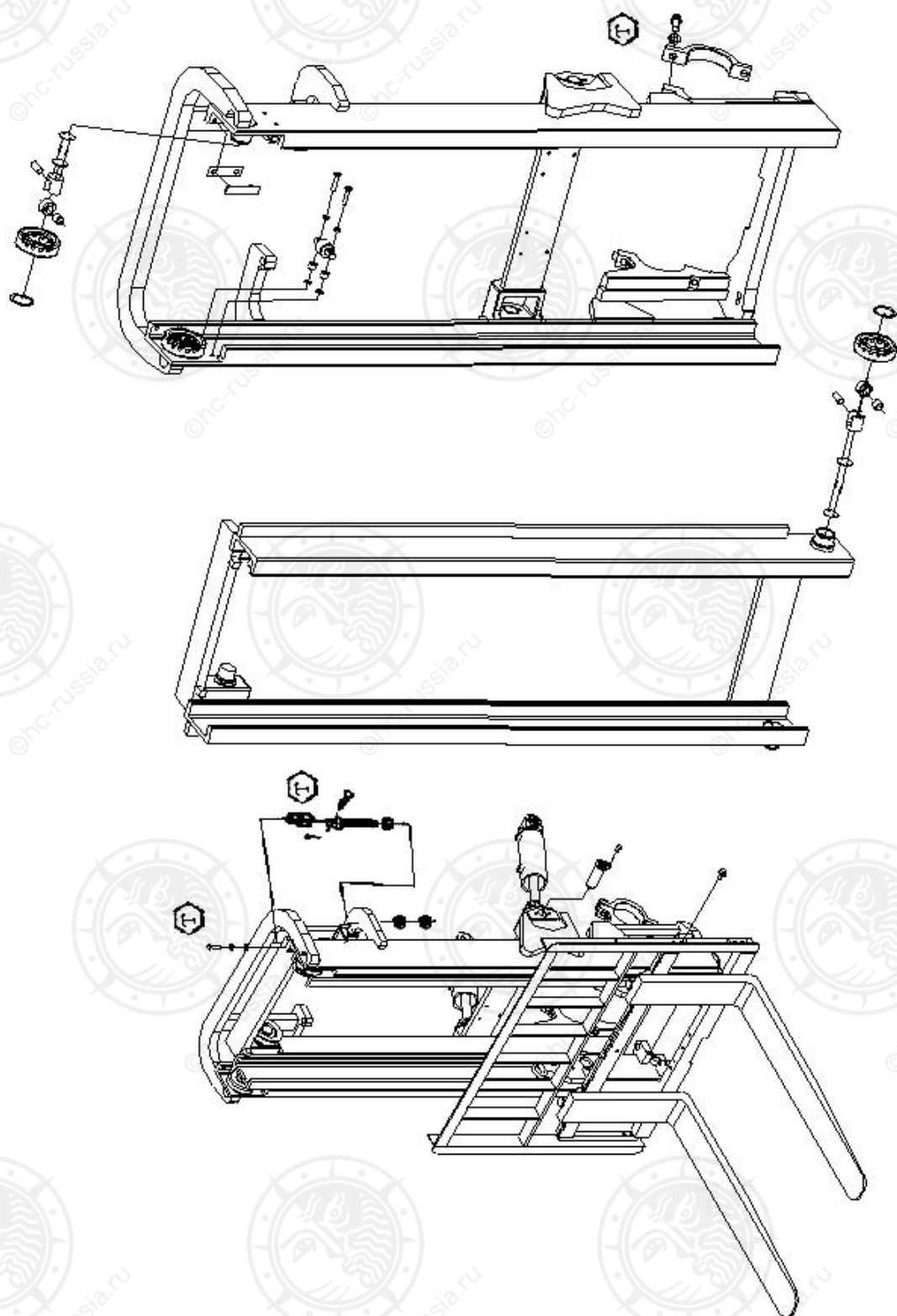
Place	Model or Lifting capacity	N·m
Lift chain lock nut	1t-1.8t	193-257 (M16)
	2t~3.5t	245-314 (M20)
Mast support cap blot	1t-1.8t	124-165 (M14)
	2t~3.5t	176-216 (M18)
Tilt cylinder lock nut	1t-1.8t	89-118 (M14)
	2t~3.5t	
Lift cylinder bolt(top)	1t-1.8t	76-107 (M12)
	2t~3.5t	
Lift cylinder bolt(bottom)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

Place	Tightening torque (N·m)
Lifting chain locknut	441~539(M24×2)
Bearing cap of mast and drive axle	245~314(M20×1.5)
Tilting cylinder locknut	49~64(M12)
Lifting cylinder bolt	127~157(M16)
Lifting cylinder fixing bolt (U-bolt)	10~12(M8)

3. 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.
	3. Rubber pad on lower of outer mast is useless for container fork lift truck.	By adjusting shims and rubber pad, piston rod is in touch with bottom of cylinder body after inner mast is in touch with rubber pad.

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 valves 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.



Lifting assembly

T—Tightening torque refer to foregoing table

4. Removal and adjustment

WARNING

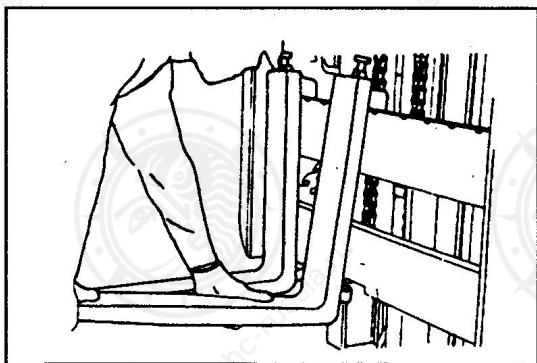
Be careful when removing and installing the forks, carriage and mast as they are heavy.

4.1 Remove forks and mast assembly

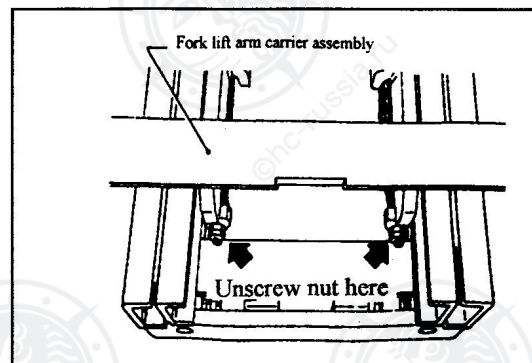
- 1) Unlock fork lock pins by pulling them and move forks to cutout portion in the middle of carriage bracket assembly.
- 2) Pull lower portion of fork to remove its lower jaw and lift it out.

WARNING

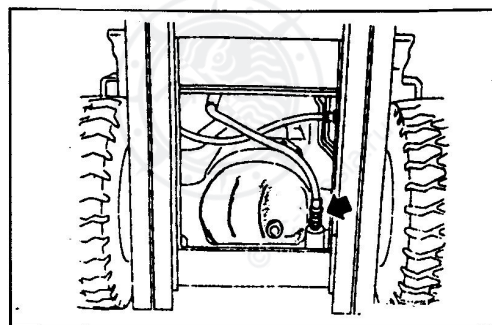
- a. Keep hands and feet away from forks. When removing and installing forks carefully, keep feet and hands clear.
- b. Do not remove forks from the end of the fork bar. Severe injury can result if the fork is dropped.



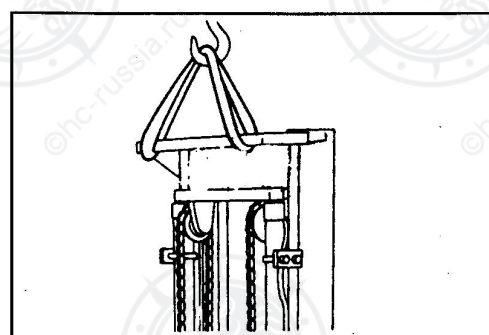
- 1) Attach wire ropes to carriage bracket assembly and lift carriage bracket assembly up with a lifting device.
- 2) Remove chain attaching nuts, and detach chains from carriage bracket assembly.



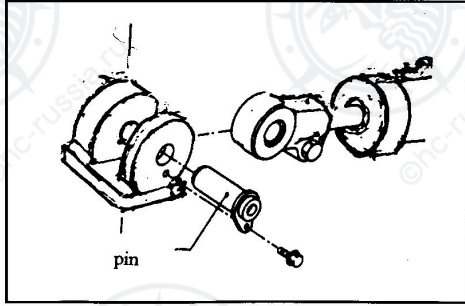
- 3) Remove carriage bracket assembly from inner mast.
- 4) Detach high pressure hose, lift hose and low pressure hose.



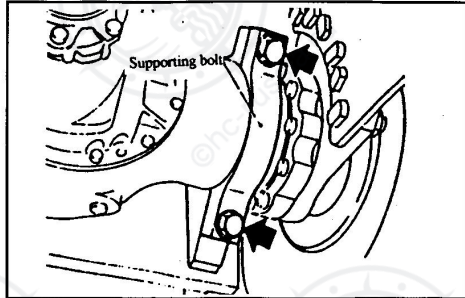
- 5) Support mast assembly with wire ropes.



- 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

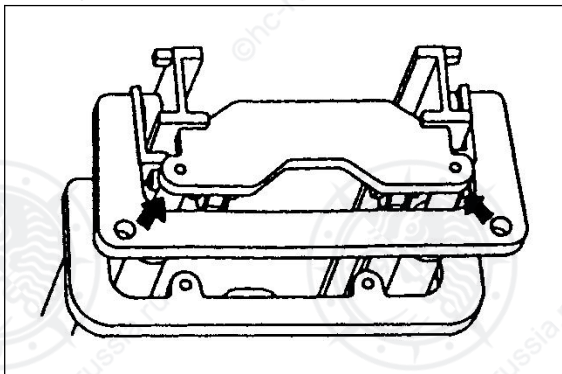


WARNING

Be careful when disassembling the masts as they are heavy.

Remove lifting jack

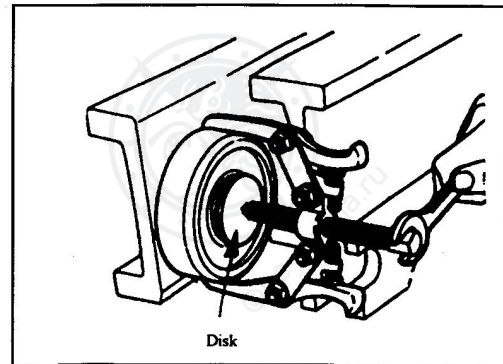
- 1) Place mast flat on ground. Remove lifting jack attaching bolts-bolts and tighten screw.



- 2) Slide inner mast, then remove lifting cylinders.

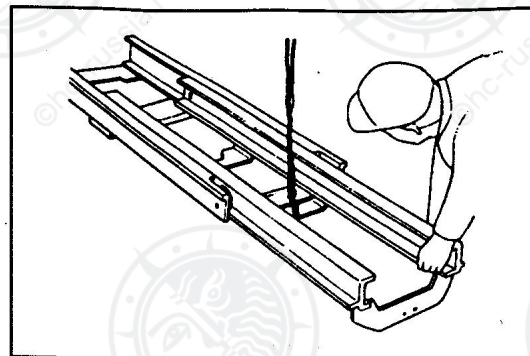
Remove roller

- 1) Slide inner mast out until rollers are exposed and remove little rollers with bearing puller. Make two pieces of round board about 10mm thick and their diameter are $\Phi 53$ and $\Phi 58$, covered on the seat of roller. Then remove the compound roller and main roller with bearing puller.
2) Unclench rollers carefully if no bearing puller or rollers would be smashed.



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.

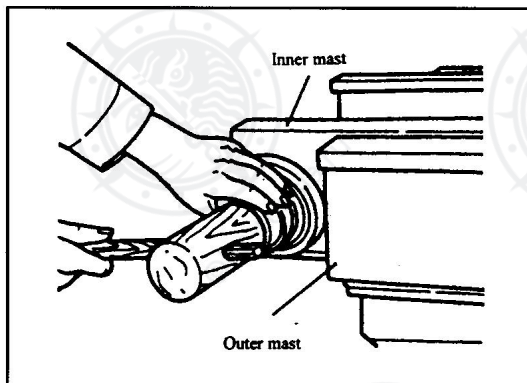
4.3 Assembly and adjustment

⚠ WARNING

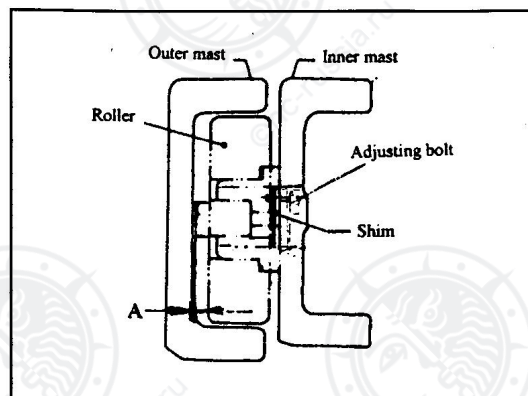
Be careful when assembling the masts as they are heavy.

Lift roller

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

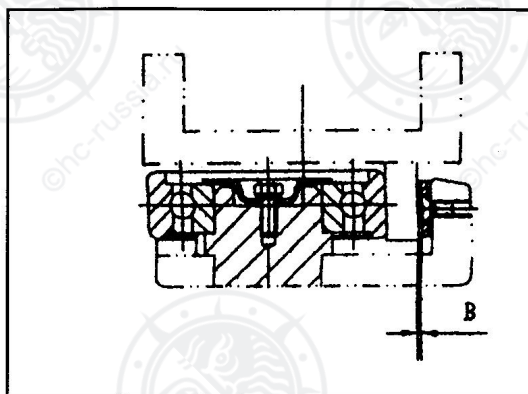
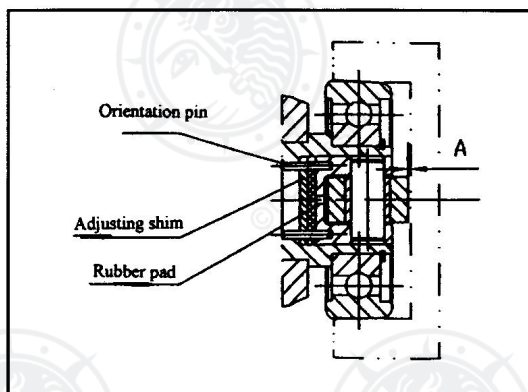


a. Dimension: 0.1mm ~ 0.6mm. (≤ 2 t)



b. Dimension: 0mm ~ 0.5mm (2.5t ~ 3 t). One or two may not using rubber pad; Dimension: 0.1mm ~ 0.6mm if no rubber pad.

Orientation pin ensure that side roller is vertical to inner mast track.

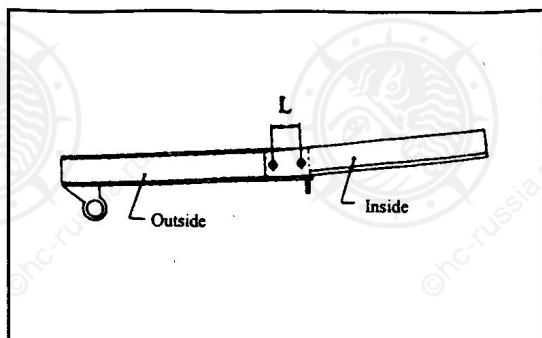


Lift roller-to-mast clearance adjustment

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	368	328
3600	388	348
4000	418	378
4500	443	403

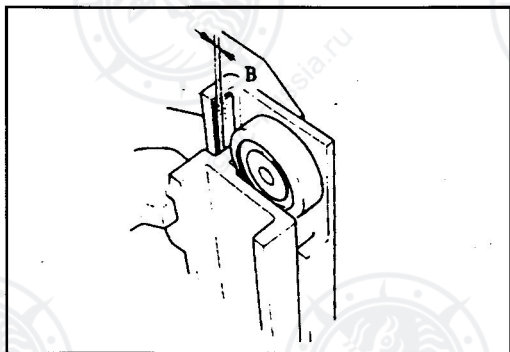


2) Adjustable range "A" with shims:

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

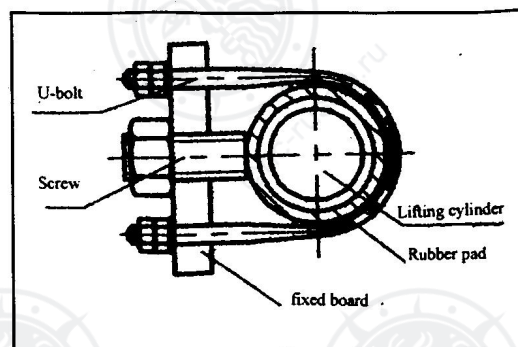
Adjust clearance "B" to 0.1mm ~ 0.8mm with shims, which may not use. Thickness of shim is 0.5mm or 1mm.



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

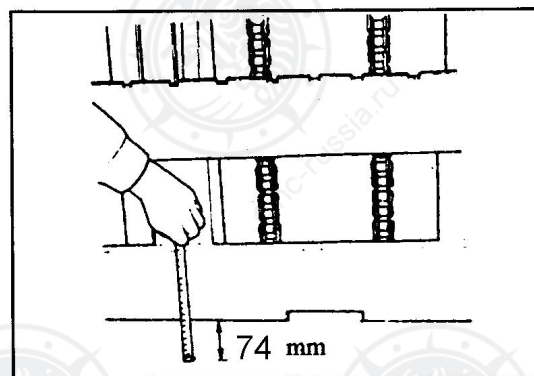
4.4 Left and right cylinder height adjustment.

- 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.



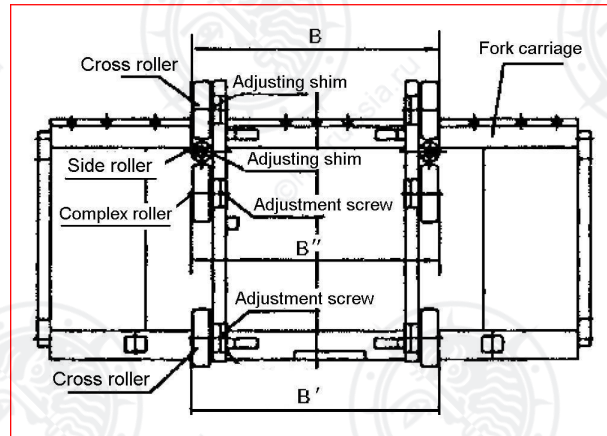
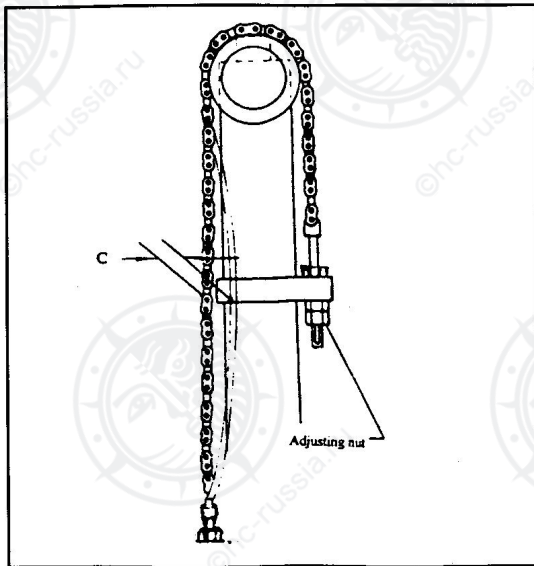
4.5 Lifting chain adjustment

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.

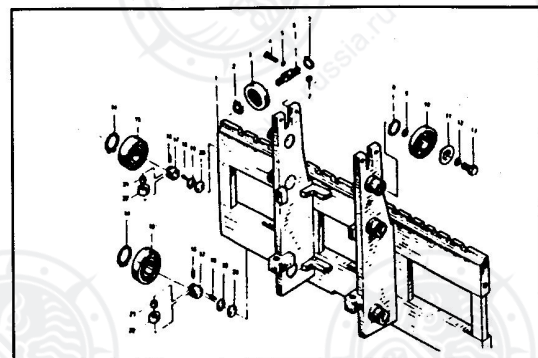
Dimension C: 25 mm ~30 mm



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

- Measure inside width "A" between inner masts. Make measurements at the top, bottom and center (cross beam) sections.
- Measure right and left pitches, B, B', B" of carriage side roller, carriage roller and thrust metal.
- Calculate A-B, A-B' and A- B". Each result shows clearances between each roller and inner mast. Adjust shims of each roller evenly on the left and right and make clearances, between smallest part of inner mast and carriage side roller.

$$A-B = 0.2\text{mm} \sim 1\text{ mm}$$

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

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

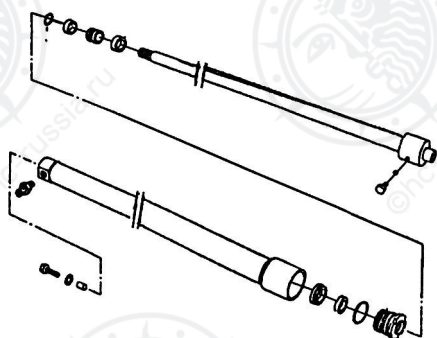
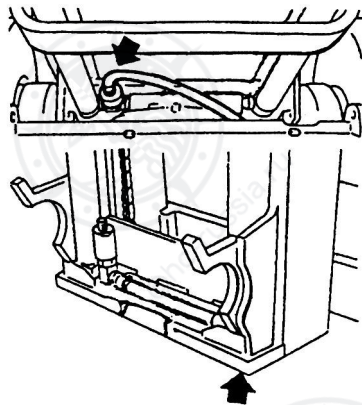
5. Disassembly and installation of lifting jack

⚠ WARNING

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.
- Unscrew piston rod and bolt.
- 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

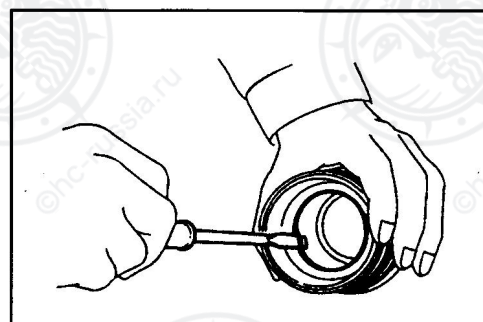
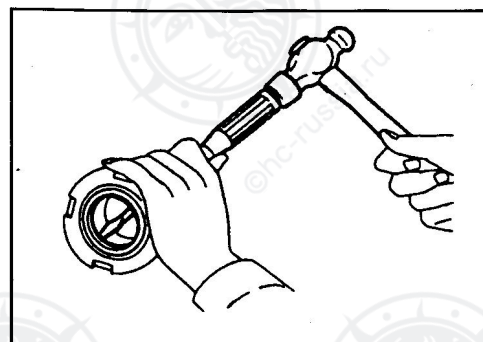
Rated capacity is less than 2.5 t

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 must 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.

6. Disassembly and installation of tilting cylinder



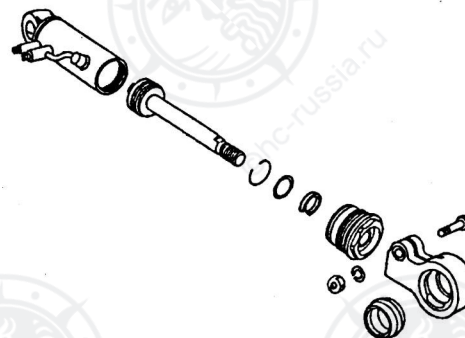
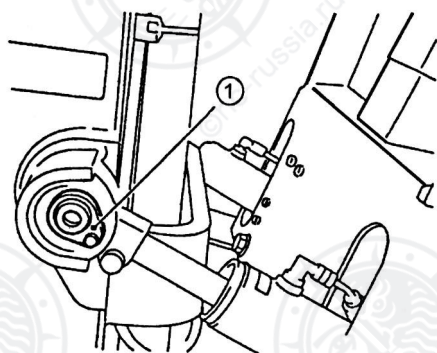
WARNING

Notices proceedings when removing cylinders.

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

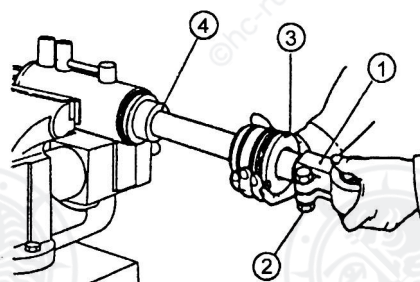
· Keep body away from equipment, no standing under the fork arm carrier.

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

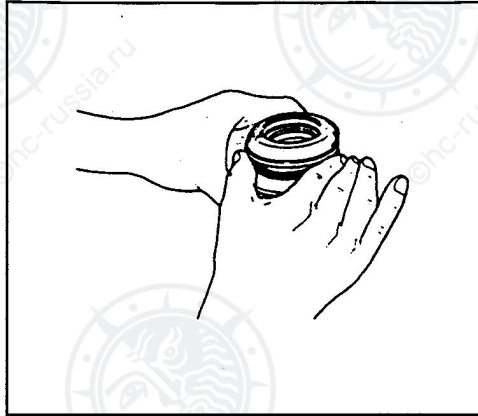


6.1 Disassembly of parts

- 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) .

VII. Electrical system



Warning

- Before checking any parts of electrical system, remove rings and jewelry to prevent short circuit, and turn off ignition switch and then disconnect battery ground cable.
- Before doing any electrical maintenance, make sure battery cable has been disconnected.

Description

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

Letter	B	N	G	U	O	R	W	Y	S	P	B/W	G/Y
Meaning	Black	Brown	Green	Blue	Orange	Red	White	Yellow	Grey	Purple	Black white	Green yellow

Inspect

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:

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

1 Control box assembly

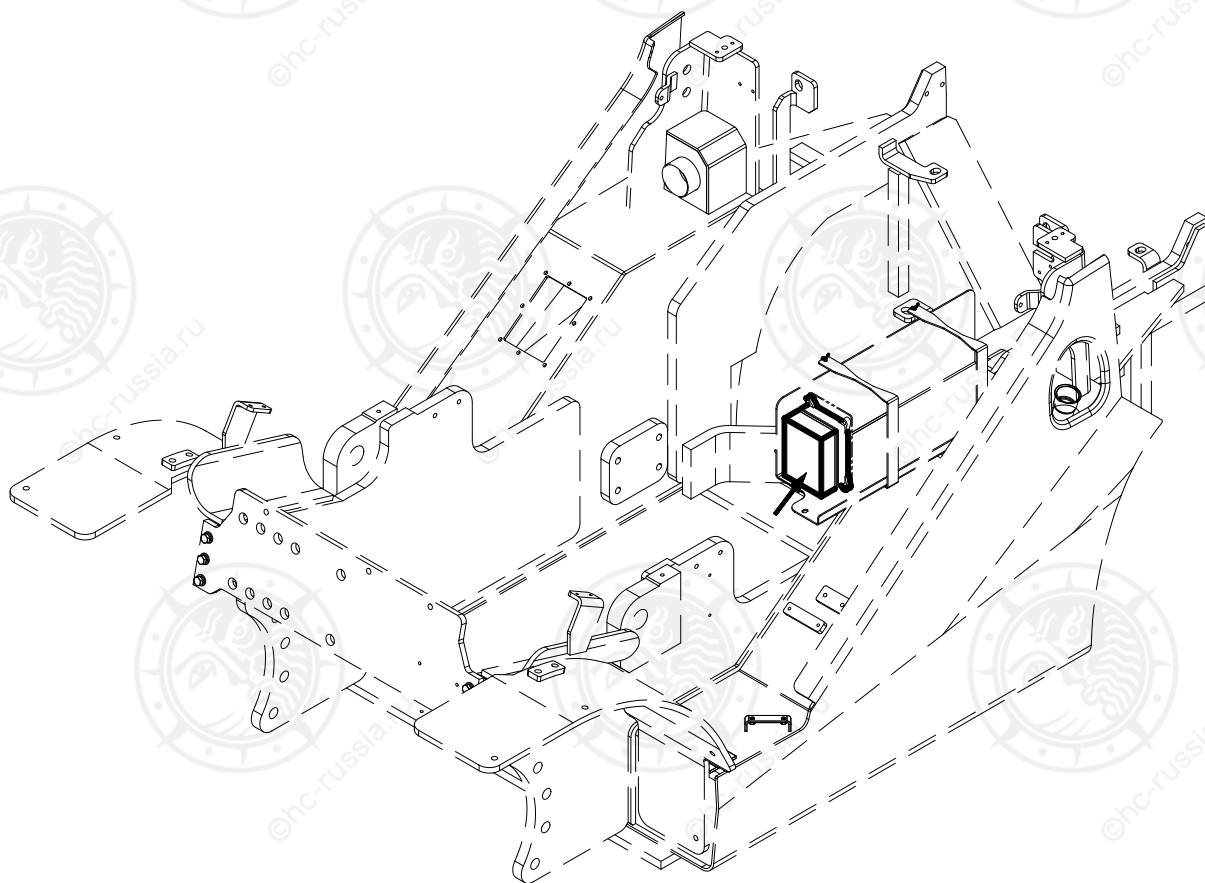
Component removal

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

Explanation

If fuse or relay is broken, replace with new one.

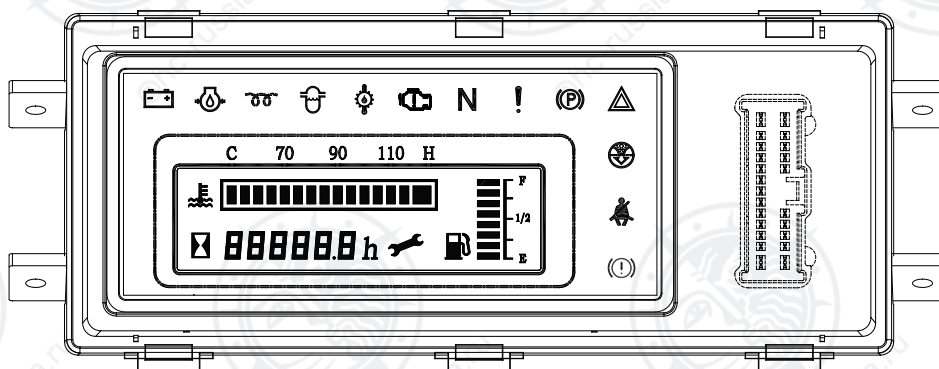
- ① If fuse is damaged, be sure to eliminate cause of problem before installing new fuses.
- ② Never use fuse higher than specified rating.



2 Instrument, sensor and relay

Combination instrument assembly

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



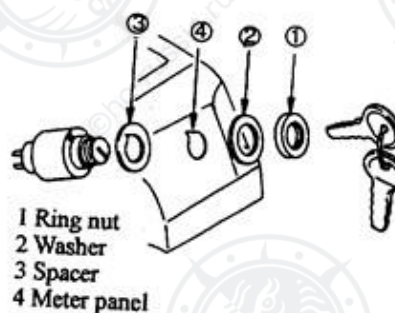
Key (start) switch

Disassemble and install

- Remove combination meter.
- Disconnect connector of wiring.
- Remove nuts, washers, spacers and instrument plate.

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

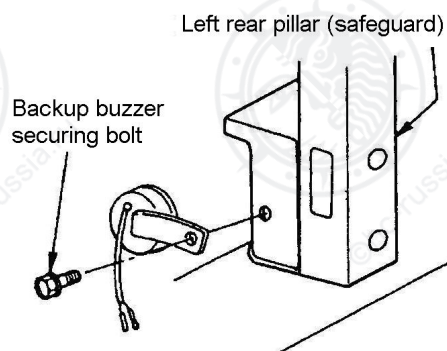
Principle diagram of preheat start switch

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

Backup buzzer disassemble and install

- Remove the wiring terminal, then unscrew the bolt.

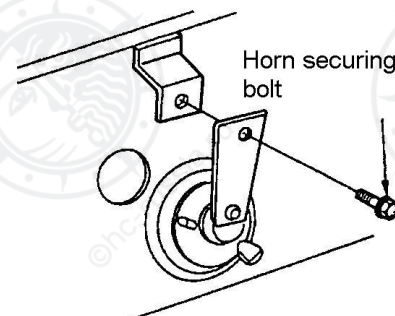
To install, reverse removal procedure



Horn disassemble and install

- Disconnect horn harness connector.
- Remove bolt and horn.

To install, reverse removal procedure.

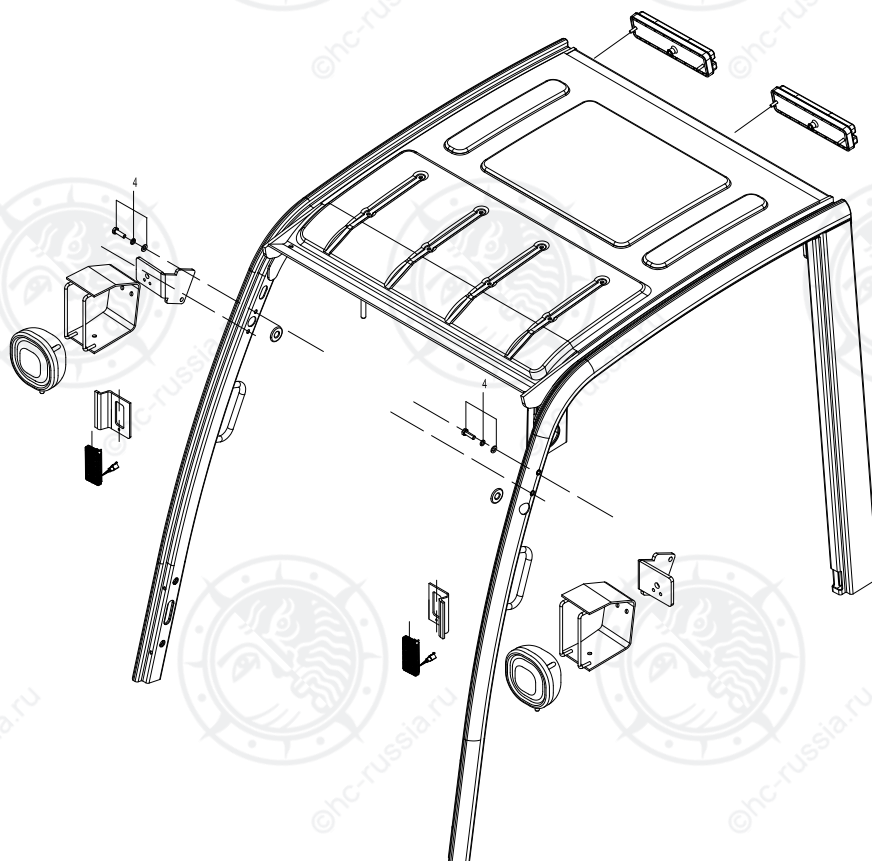


3 Lighting system

Bulb specification

Forklift truck	W57 engine	Except W57 engine
Bulb	Wattage	
Headlamp	9V-36V, 15W	
Front small lamp	12V-21W	24V-21W
Turn signal lamp	12V-10W	24V-10W
width guide lamp		
Assembled back lamp	12V-21W/5W	24V-21W/5W
Brake signal lamp	12V-21W/5W	24V-21W/5W
width guide lamp	12V-21W	24V-21W
Turn signal lamp	12V-10W	24V-10W
reversing lamp		
Assembled instrument	12V-2W	24V-2W
Head lamp	12V-2W	24V-2W
Warn-up lamp		

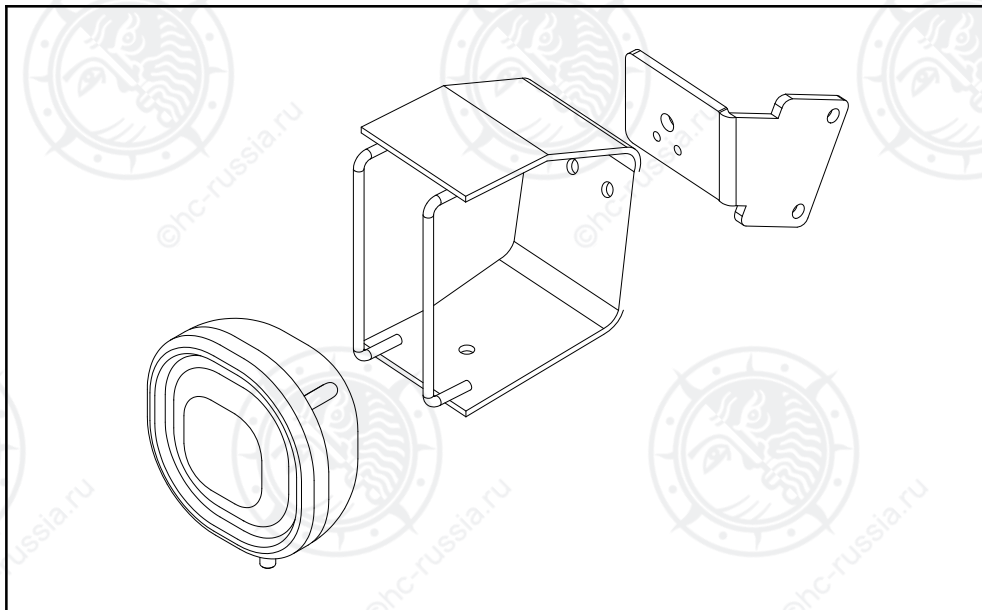
Location of light



Front headlight

Disassembly

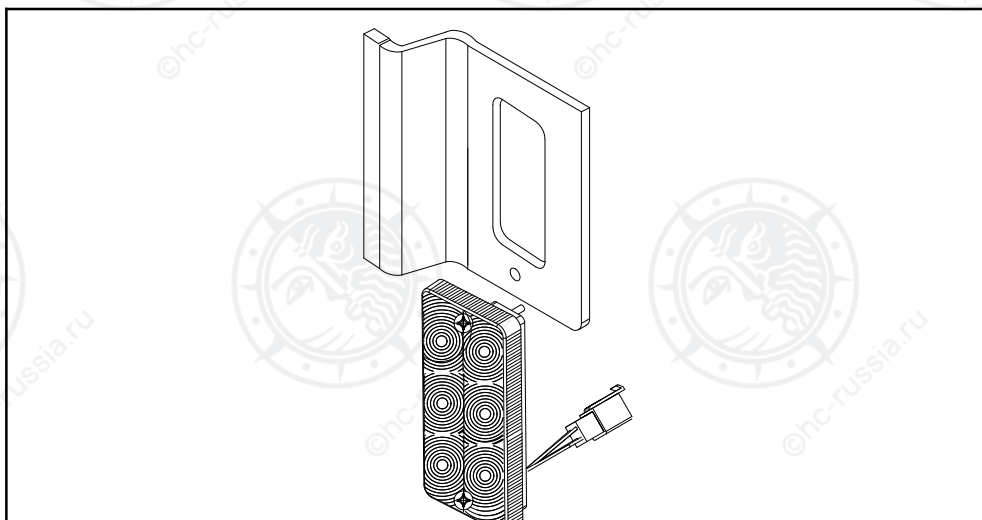
1. Remove securing nuts of the big-little lamp.
2. Take apart the wiring connector.
3. Remove bolt, lens, then replace faulty LED with new one.
- 7) Assembly is the opposite procedures.



Front combination lamp

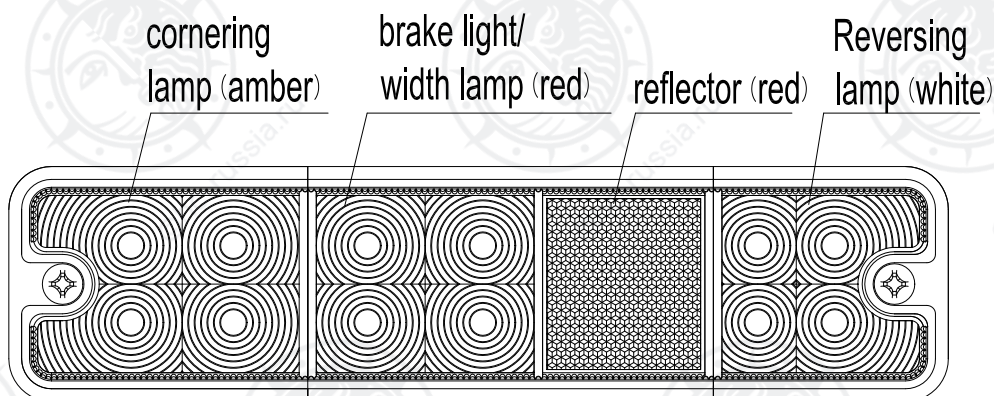
Disassembly and assembly

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.



Disassembly and installation of rear combination lamp

- Take down rear combination lamp from overhead guard;
- Bring the whole rear combination lamp to maintain location, remove rear lamp cover, and remove 4 bolts from back of cover;
- Remove LED panel , loosen 2 bolts from fixed connector, disconnect connector, replace new LED panel
- To install, reverse removal procedures.

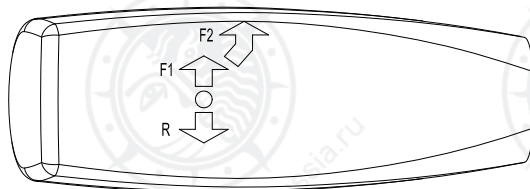


Direction switch

Disassemble

- 1.Remove combined switch
2. Unscrew the screws, and disconnect the wiring connector.

To install, reverse the order of removal.



F1—Forward 1 gear

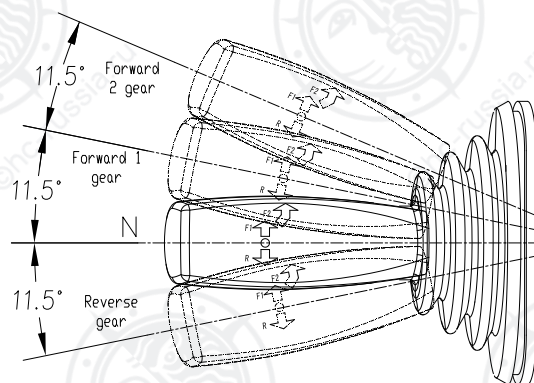
F2—Forward 2 gears

R—Reverse gear

Sleeve hole	1	2	3	4	5	6
Color	Yellow green	White red	Brown white	Pink	Brown	Blue
Power	60W	60W	60W	60W	60W	60W
Handle position						
F2			○			○
F1		○				○
N	○					○
R				○		○

Direction switch check

- Disconnect switch connector clip, and check if each point is connected.
- Use multimeter (with ohm) to inspect whether each position is connected: F1, F2, N, R.



Position	Contact
F1	2—6
F2	3—6
N	1—6
R	4—6

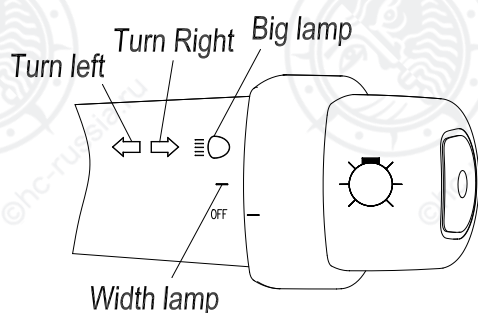
Light switch Turn signal switch

Dismantle

29. Dismantle combination instrument.

30. Unscrew screw, disconnect wiring connector

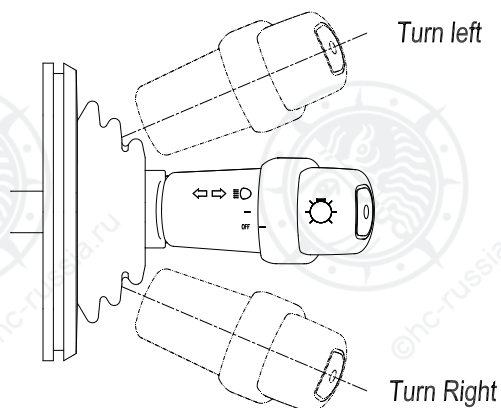
To install, reverse removal procedure



Sleeve hole	1	2	3	4	5	6
Color	White green	Blue	White	White black	Green	Blue black
Power	60W	60W	60W	60W	60W	60W
Handle position	60W	60W	60W	60W	60W	60W
Turn left	○	○				
Neutral position	○					
Turn right	○		○			
OFF				○		
—				○	○	
Power				○	○	○

Turn light check

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

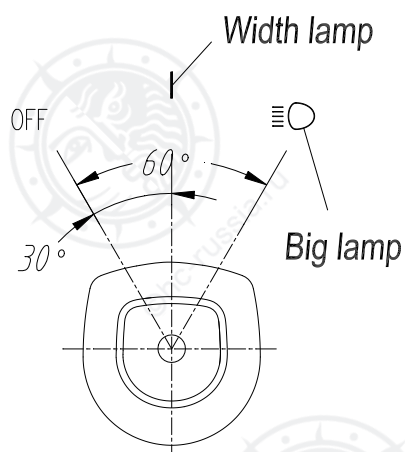


Position	Contact
Left turn	1-2
N	OFF
Right left	1-3

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: head lamp, width lamp, OFF.

View from "C"



Position	Contact
Head lamp	4-6
Width lamp	4-5
OFF	OFF

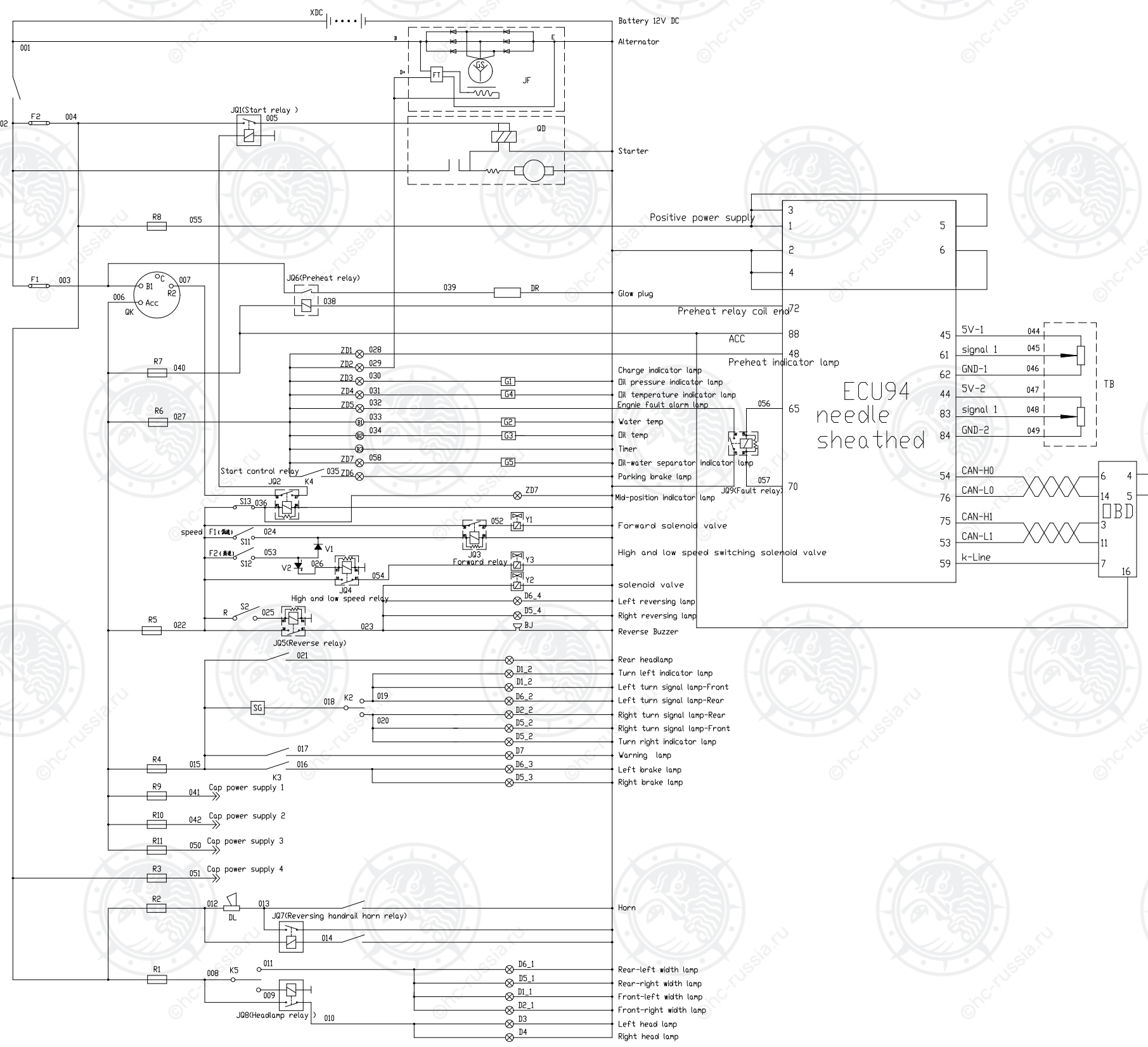


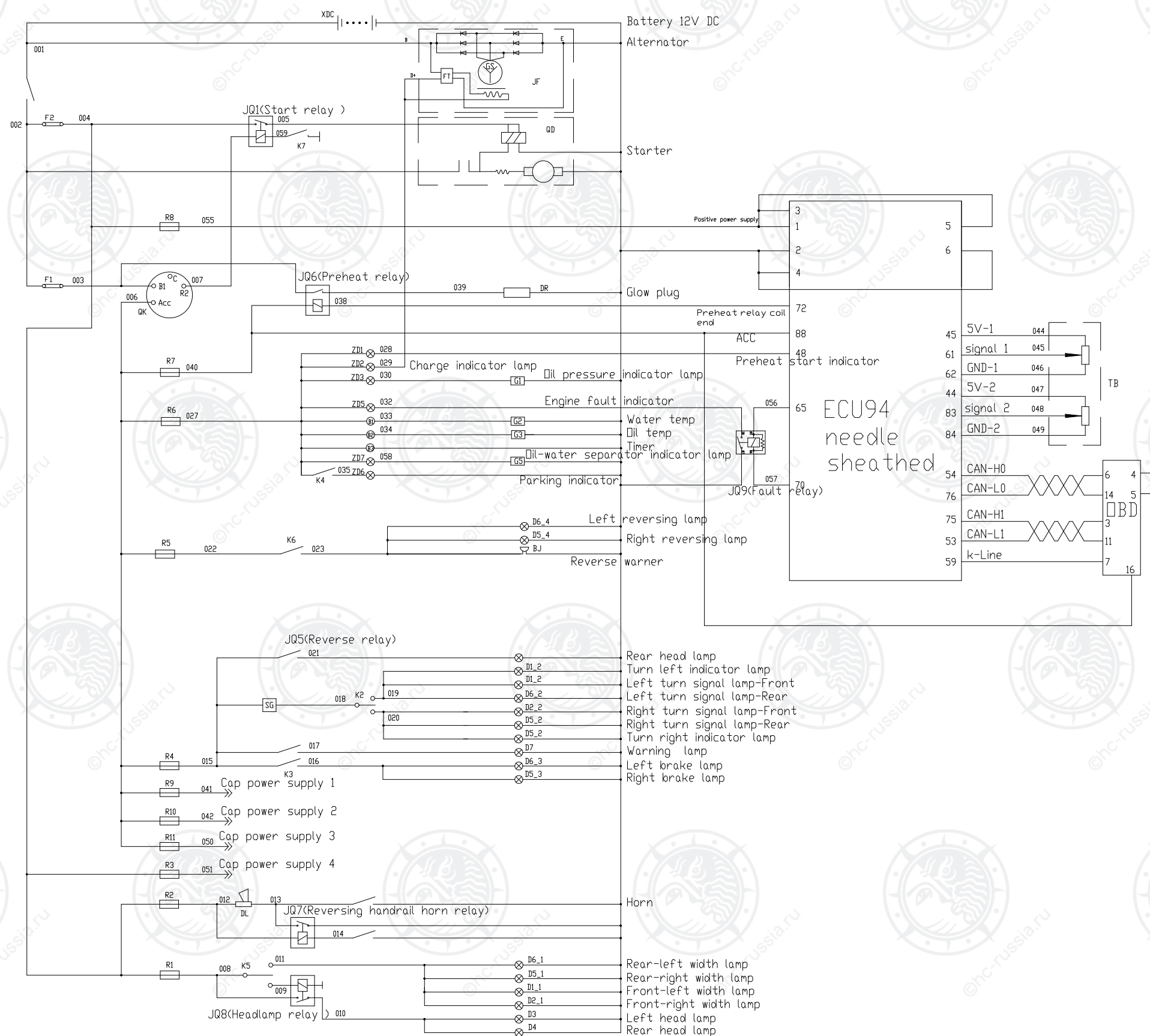
Fig.1-1 CPCD40/45-XRG76,CPCD50-XRXG76 Electrical system diagram

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



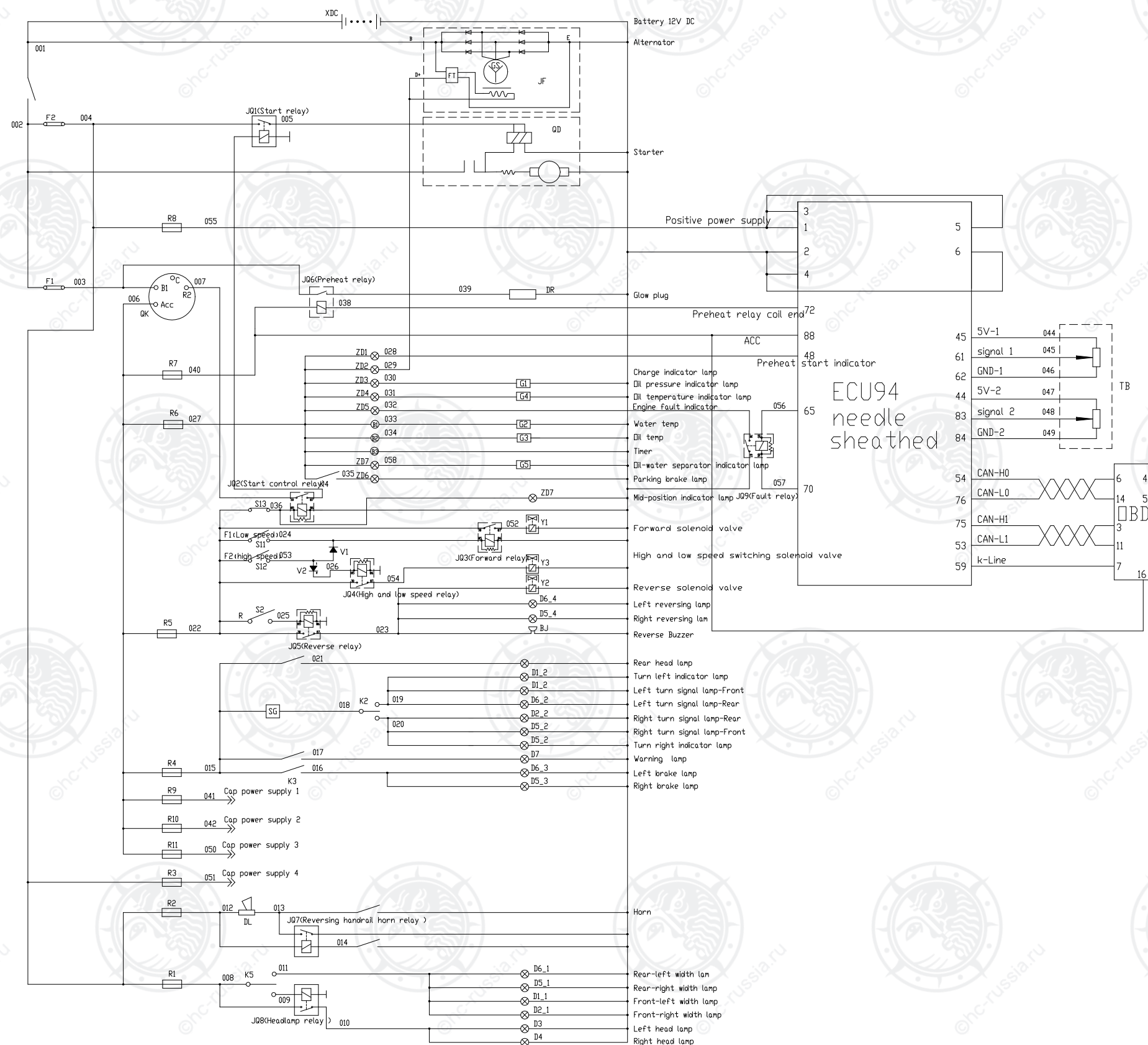
preheat start switch QK

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.1-2 CPC40/45-XRG76,CPC50-XRXG76 Electrical system diagram



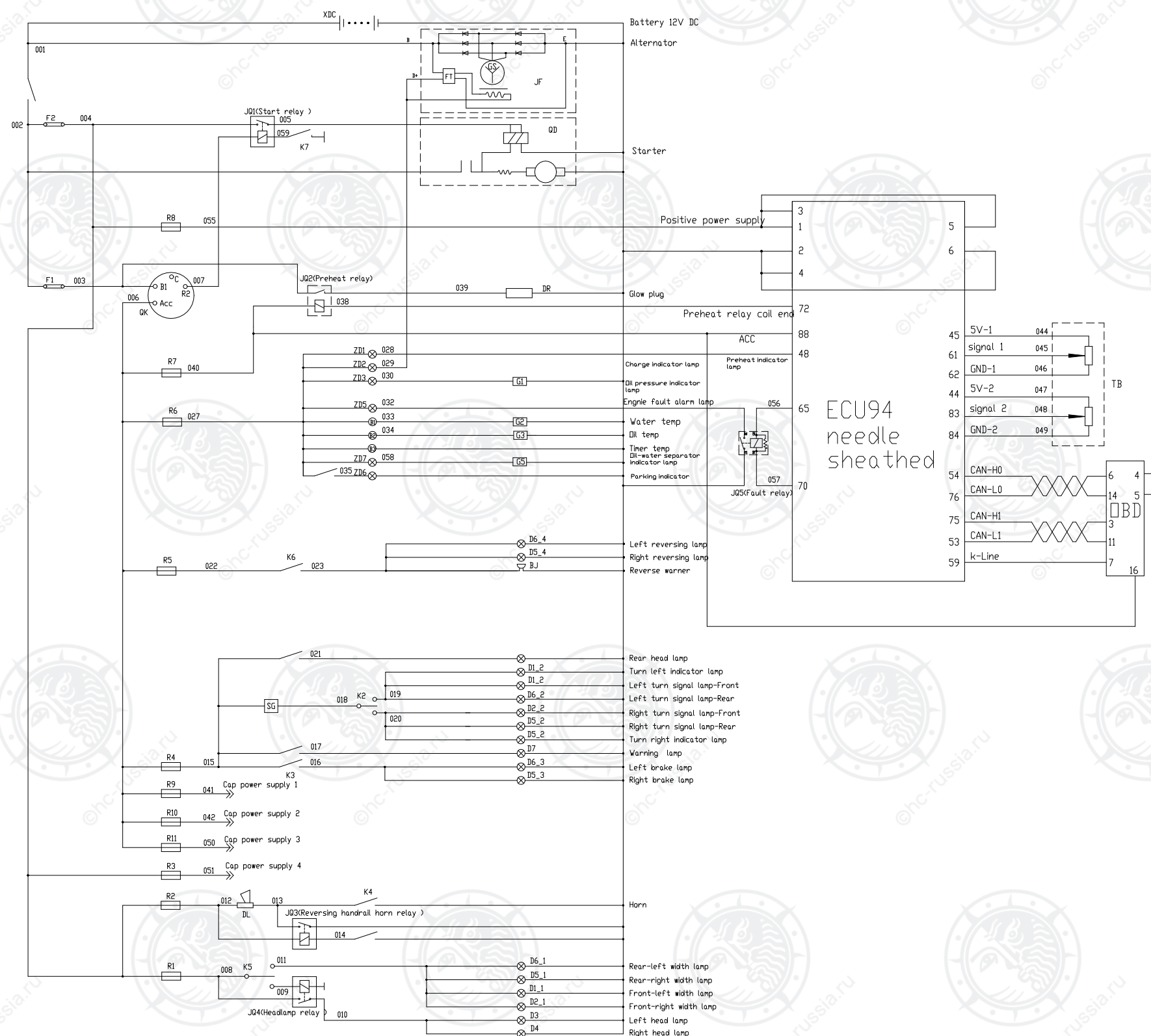
preheat start switch QK

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.2-1 CPCD40/45-XRG75,CPCD50-XRXG75,CPCD40/45-XRG75-GW,CPCD50-XRXG75-GW Electrical system diagram



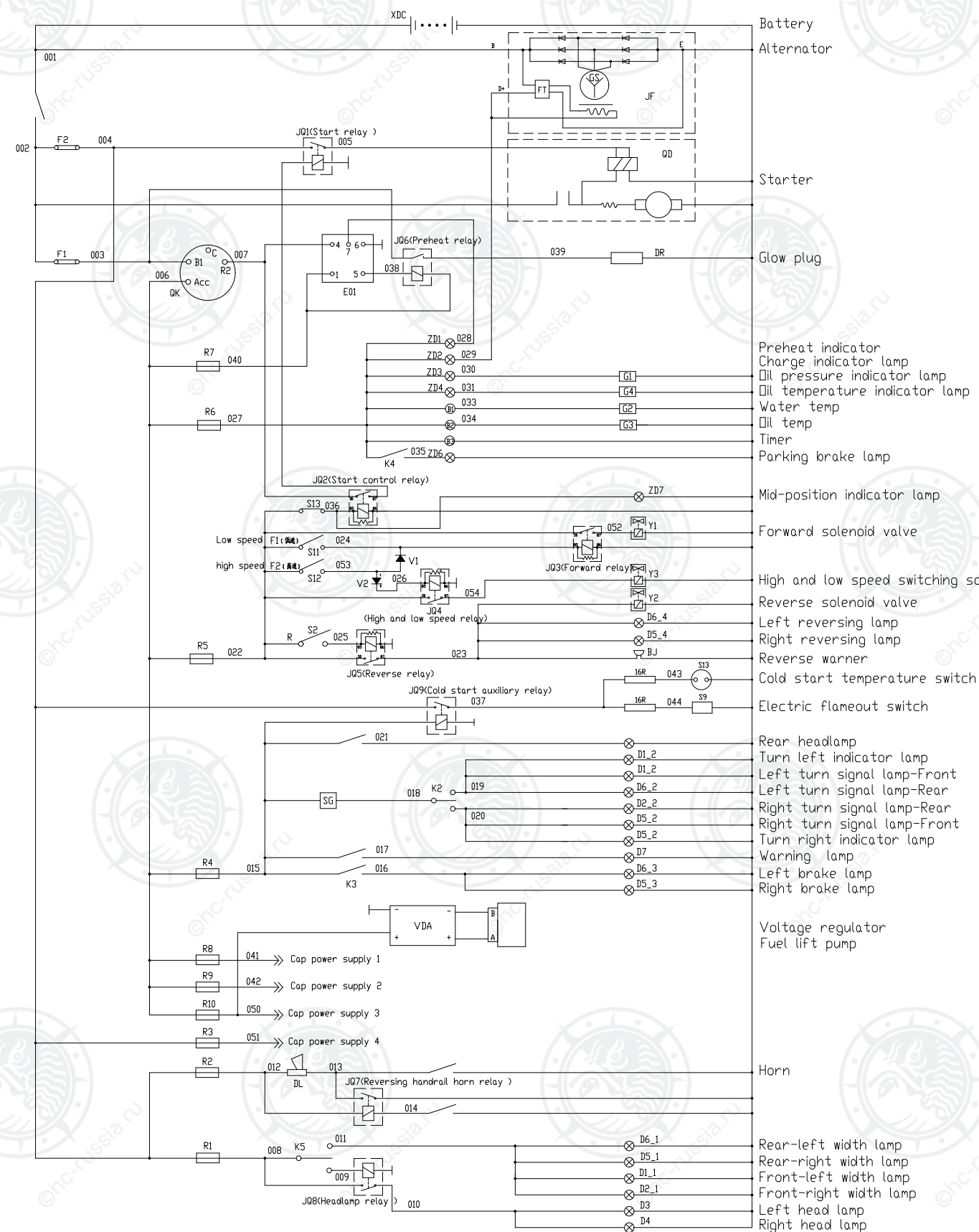
preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	X	X			X		Preheat OFF ON run start and preheat are short working, automatically return.
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.2-2 CPC40/45-XRG75, CPC50-XRXG75 Electrical system diagram



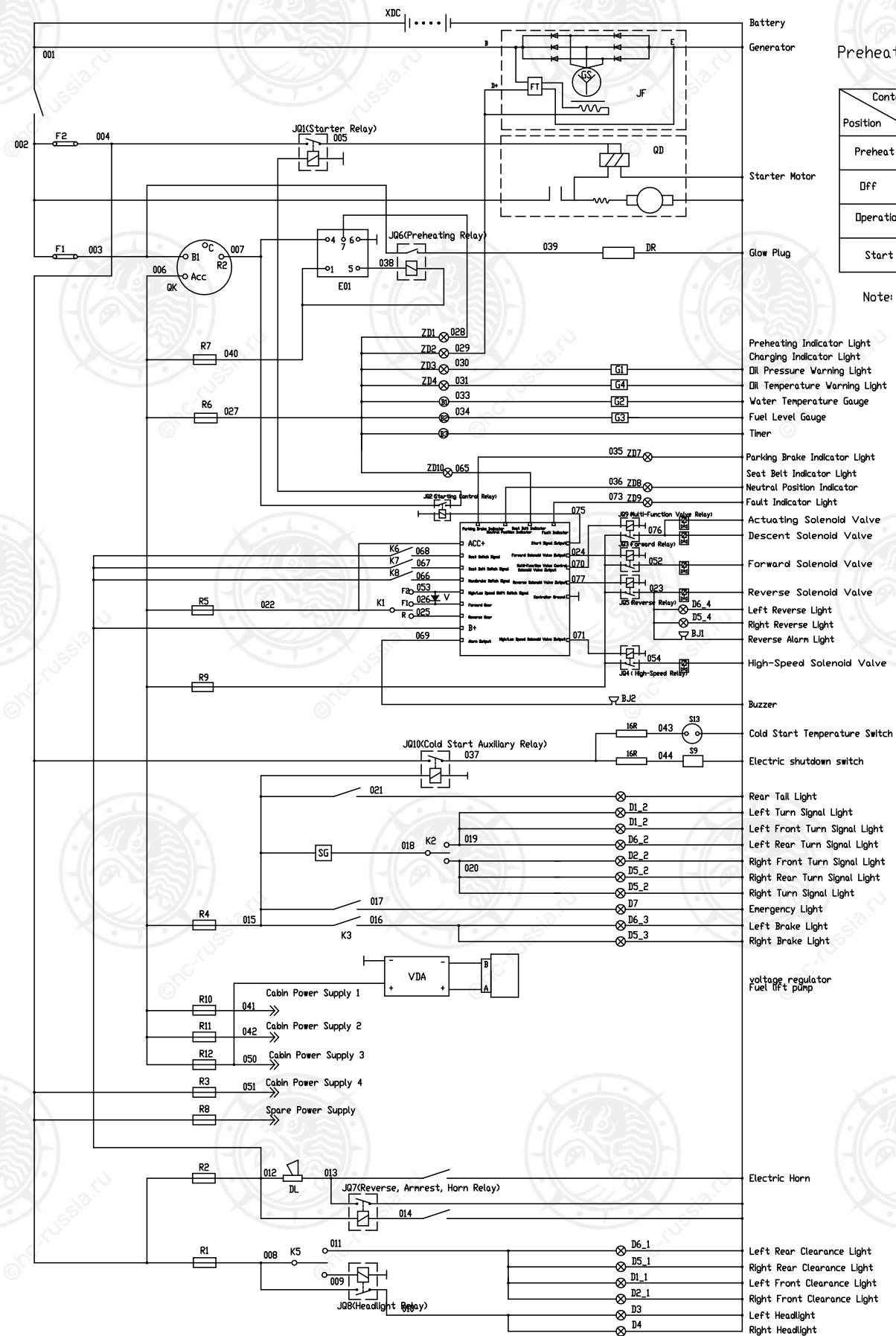
preheat start switch QK

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 DN.

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 CPCD40/45-XRW35, CPCD50-XRXW35, CPCD40/45-XRW34, CPCD50-XRXW34 Electrical system diagram (without OPS)



Preheating Start Switch QK

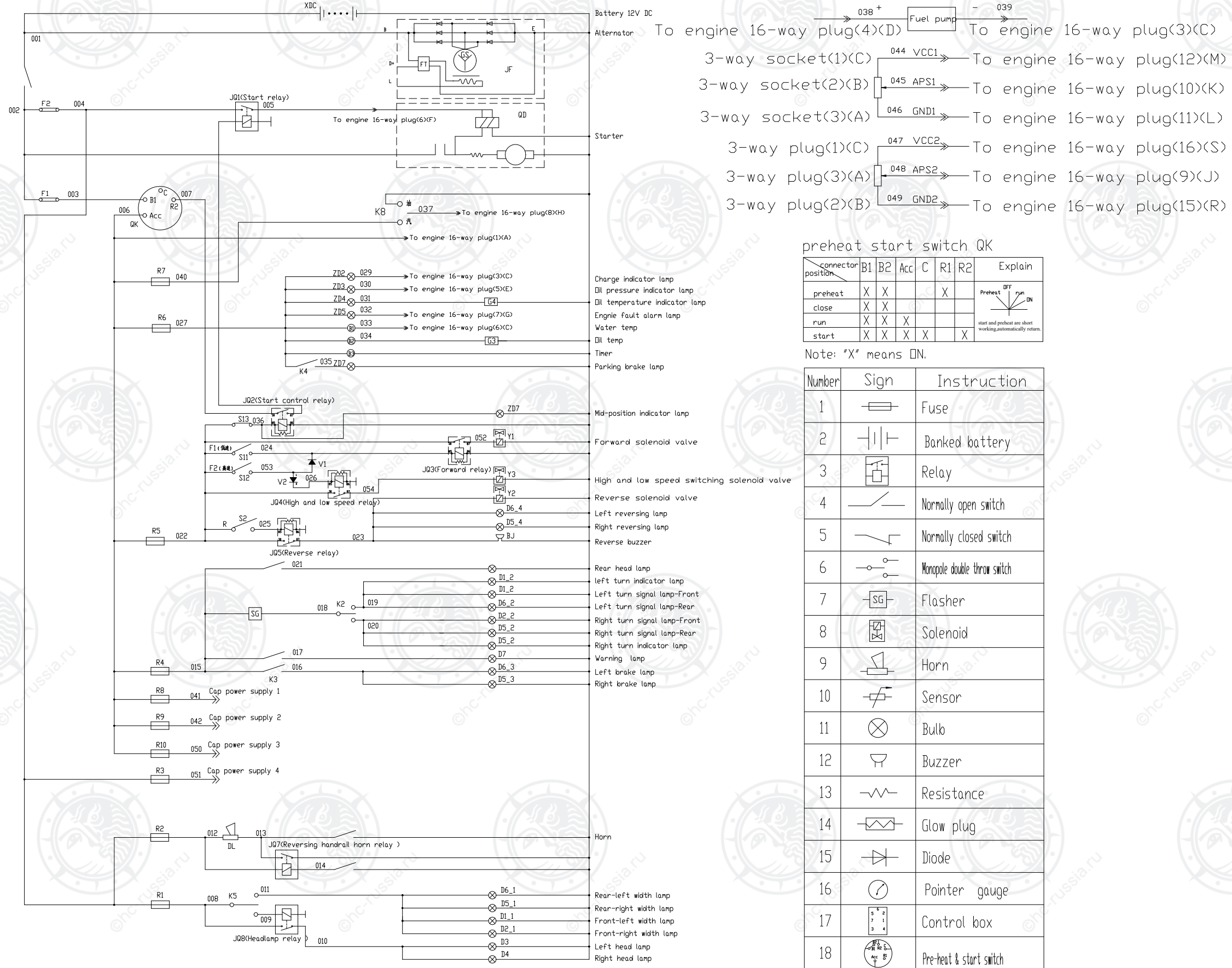
Contact Point Position	B1	B2	Acc	C	R1	R2	Description
Preheat	X	X			X		
Off	X	X					
Operation	X	X	X				
Start	X	X	X	X		X	

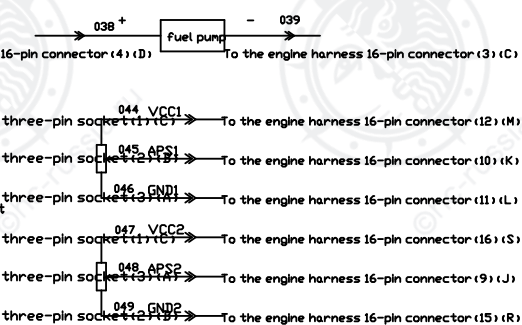
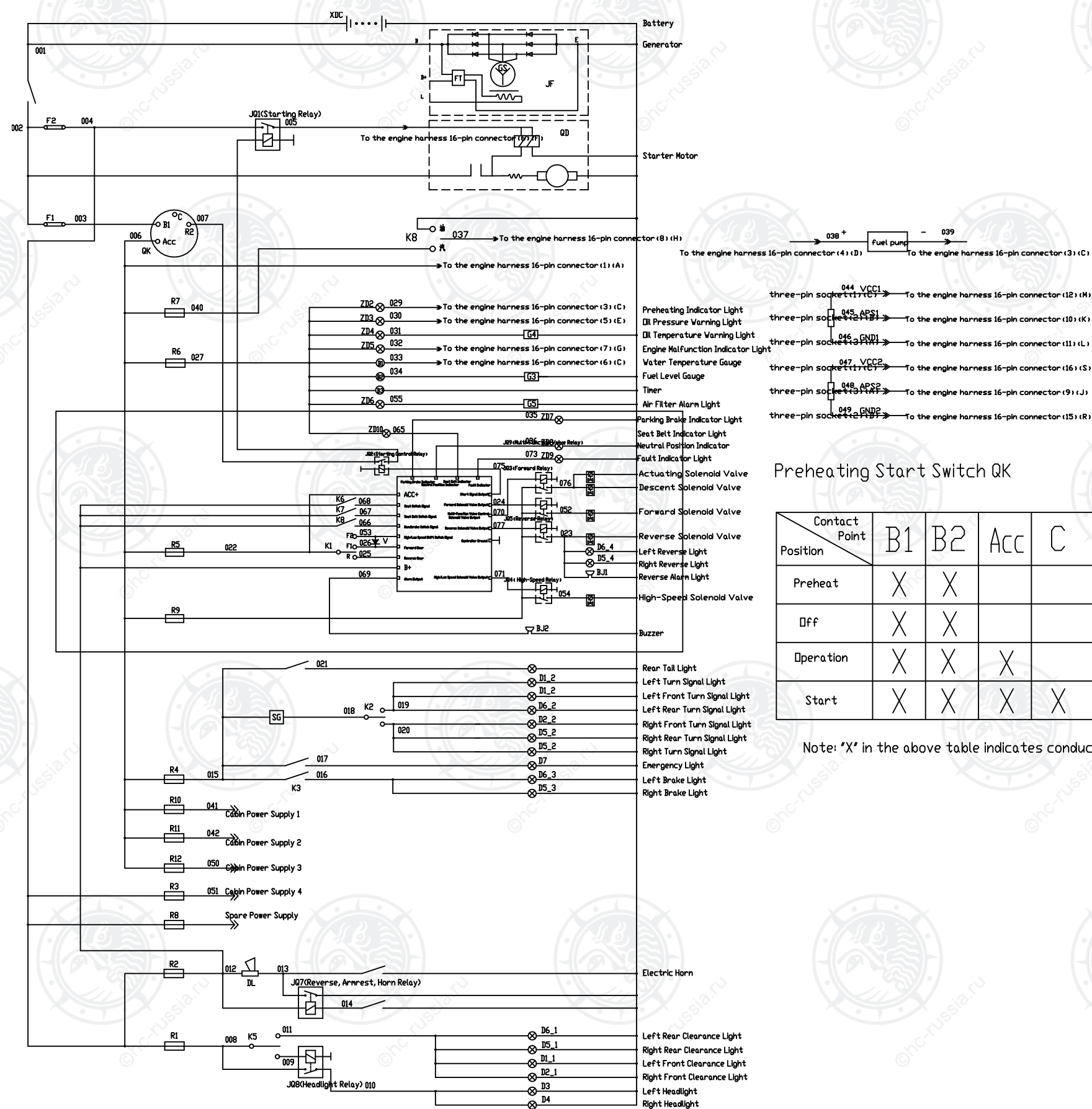
Note: 'X' in the above table indicates conduction.

Fig.3-1 CPCD40/45-XRW35,CPCD50-XRW35 Electrical system diagram (with OPS)

NO.	Symbol	Name	QTY	Remarks
1	XDC	Less maintenance of battery 12V 60Ah	2	
2	JF	generator	-1	Engine matching
3	QD	starter	-1	Engine matching
4	QK	Preheat Starter Switch	-1	Combination instrument matching
5	K1	Combination switch (direction switch)	1	
6	K2	Combination switch (turn signal switch)	1	
7	K3	brake light switch	1	
8	K4	Horn button	-1	Steering wheel matching
9	K5	Combination switch (light switch)		
10	B1	Water temperature gauge 24V	-1	Combination instrument matching
11	B2	Oil gauge 24V	-1	Combination instrument matching
12	B3	Timer 24V	-1	Combination instrument matching
13	ZD1-ZD5	Alarm light 24V 2W	-5	Combination instrument matching
14	G1	Oil pressure alarm	-1	Engine matching
15	G2	Water Temperature Sensor	-1	Combination instrument matching
16	G3	Oil quantity sensor	-1	Combination instrument matching
17	G4	Oil temperature alarm	1	
18	D1 D2	Front small light 21W 10W	2	
19	D3 D4	Front headlight 15W	2	
20	D5 D6	Combination rear light 21W21W/5W10W	2	
21	DR	GLOW PLUG	-1	Engine matching
22	E01	Preheating timer 24V	-1	Control box matching
23	BJ	Reverse alarm 24V	1	
24	DL	Electric horn 24V	1	
25	SG	Flasher 24V	1	Control box matching
26	JQ1	Starting relay 24V	1	Control box matching
27	JQ2	Starting control relay 24V	1	Control box matching
28	JQ3	Forward relay 24V	1	Control box matching
29	JQ4	High speed relay 24V	1	Control box matching
30	JQ5	Reverse gear relay 24V	1	Control box matching
31	JQ6	Preheating relay 24V	1	Control box matching
32	JQ7	Reverse armrest horn relay 24V	1	Control box matching
33	JQ8	Headlight relay 24V	1	Control box matching
34	JQ9	Multi way valve relay 24V	1	Control box matching
35	JQ10	Cold start auxiliary relay 24V	1	Control box matching
36	R1-R12	fuse	1	Control box matching
37	F1-F2	fuse	1	

Fig.3-2 CPCD40/45-XRW35,CPCD50-XRXW35 Electrical system diagram (with OPS)





Preheating Start Switch QK

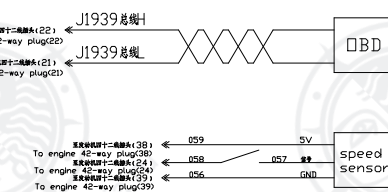
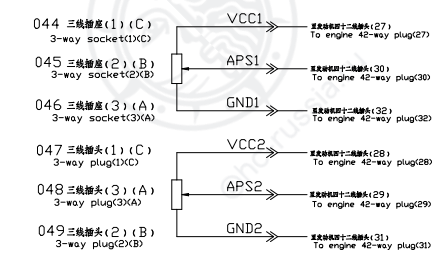
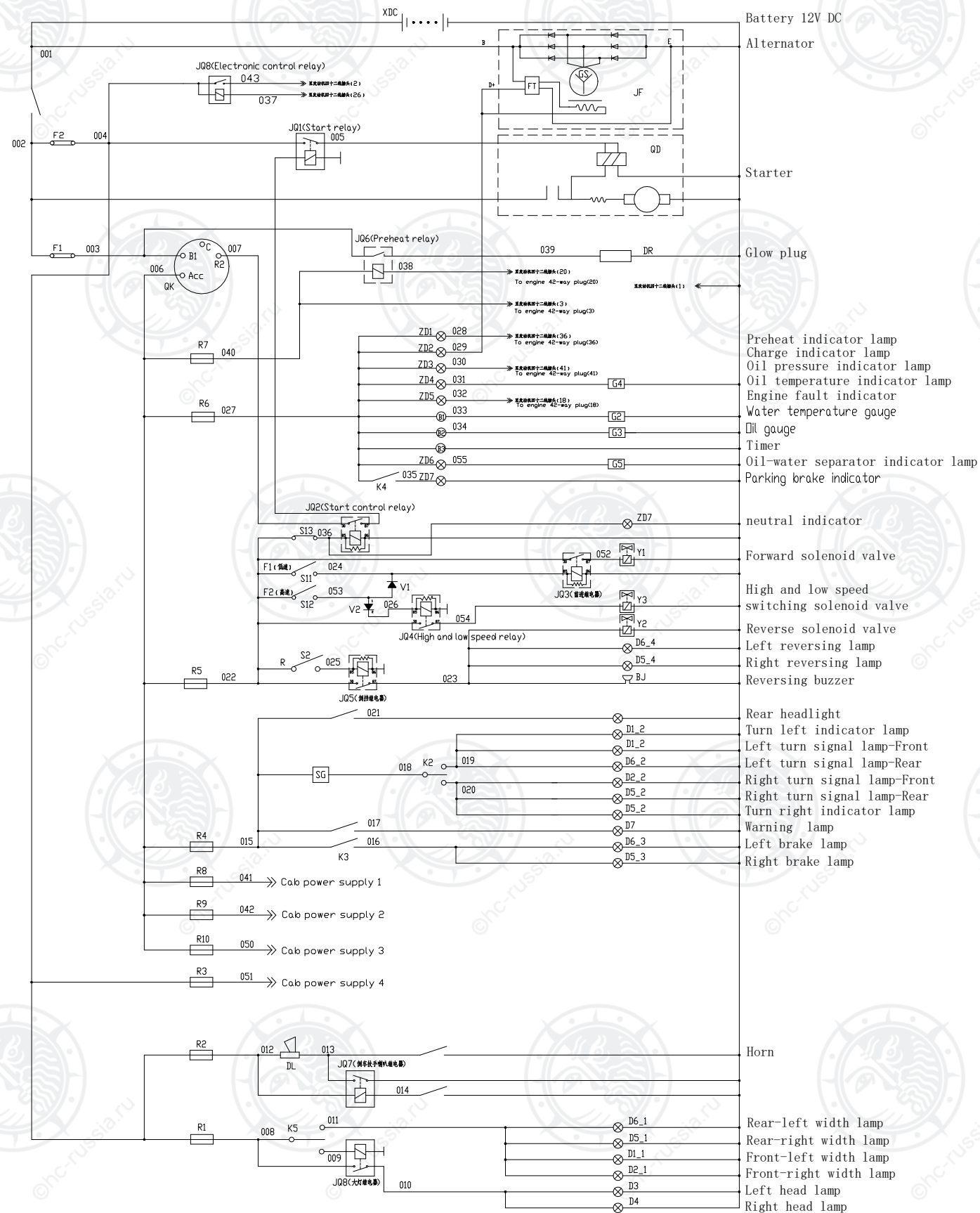
Contact Point	B1	B2	Acc	C	R1	R2	Description
Preheat	X	X			X		Start, The preheat gear is for short-time operation and automatically resets.
Off	X	X					
Operation	X	X	X				
Start	X	X	X	X		X	

Note: "X" in the above table indicates conduction.

Fig.4-1 CPQYD40/45-XRW57, CPQYD50-XRXW57 Electrical system diagram (with OPS)

NO.	Symbol	Name	QTY	Remarks
1	XDC	Less maintenance of battery 12V 60Ah	1	
2	JF	generator	-1	Engine matching
3	QD	starter	-1	Engine matching
4	QK	Preheat Starter Switch	-1	Combination instrument matching
5	K1	Combination switch (direction switch)	1	
6	K2	Combination switch (turn signal switch)	1	
7	K3	brake light switch	1	
8	K4	Horn button	-1	Steering wheel matching
9	K5	Combination switch (light switch)		
10	B1	Water temperature gauge 12V	-1	Combination instrument matching
11	B2	Fuel gauge 12V	-1	Combination instrument matching
12	B3	Timer 12V	-1	Combination instrument matching
13	ZD1-ZD5	Alarm light 12V 2W	-5	Combination instrument matching
14	G3	Fuel quantity sensor	-1	Engine matching
15	G4	Oil temperature alarm	1	
16	G5	Air filter alarm switch	1	
17	D1 D2	Front small light 21W 10W	2	
18	D3 D4	Front headlight 15W	2	
19	D5 D6	Combination rear light 21W/21W/5W/10W	2	
20	BJ	Reverse alarm 12V	1	
21	DL	Electric horn 12V	1	
22	SG	Flasher 12V	1	Control box matching
23	JQ1	Starting relay 12V	1	Control box matching
24	JQ2	Starting control relay 12V	1	Control box matching
25	JQ3	Forward relay 12V	1	Control box matching
26	JQ4	High speed relay 12V	1	Control box matching
27	JQ5	Reverse gear relay 12V	1	Control box matching
28	JQ6	Preheating relay 12V	1	Control box matching
29	JQ7	Reverse armrest horn relay 12V	1	Control box matching
30	JQ8	Headlight relay 12V	1	Control box matching
31	JQ9	Multi way valve relay 12V	1	Control box matching
32	R1-R12	fuse	1	Control box matching
33	F1-F2	Easy fuse	1	

Fig.4-2 CPQYD40/45-XRW57, CPQYD50-XRXW57 Electrical system diagram (with OPS)



preheat start switch QK

connector position	B1	B2	Acc	C	R1	R2	Explain
preheat	X	X			X		Preheat
close	X	X					start and preheat are short working automatically system.
run	X	X	X	X	X		
start	X	X	X	X	X	X	

Note: "X" means ON.

Number	Sign	Instruction
1		Fuse
2		Batteried 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.6-1 CPCD40/45-XRG73, CPCD50-XRXG73 Electrical system diagram

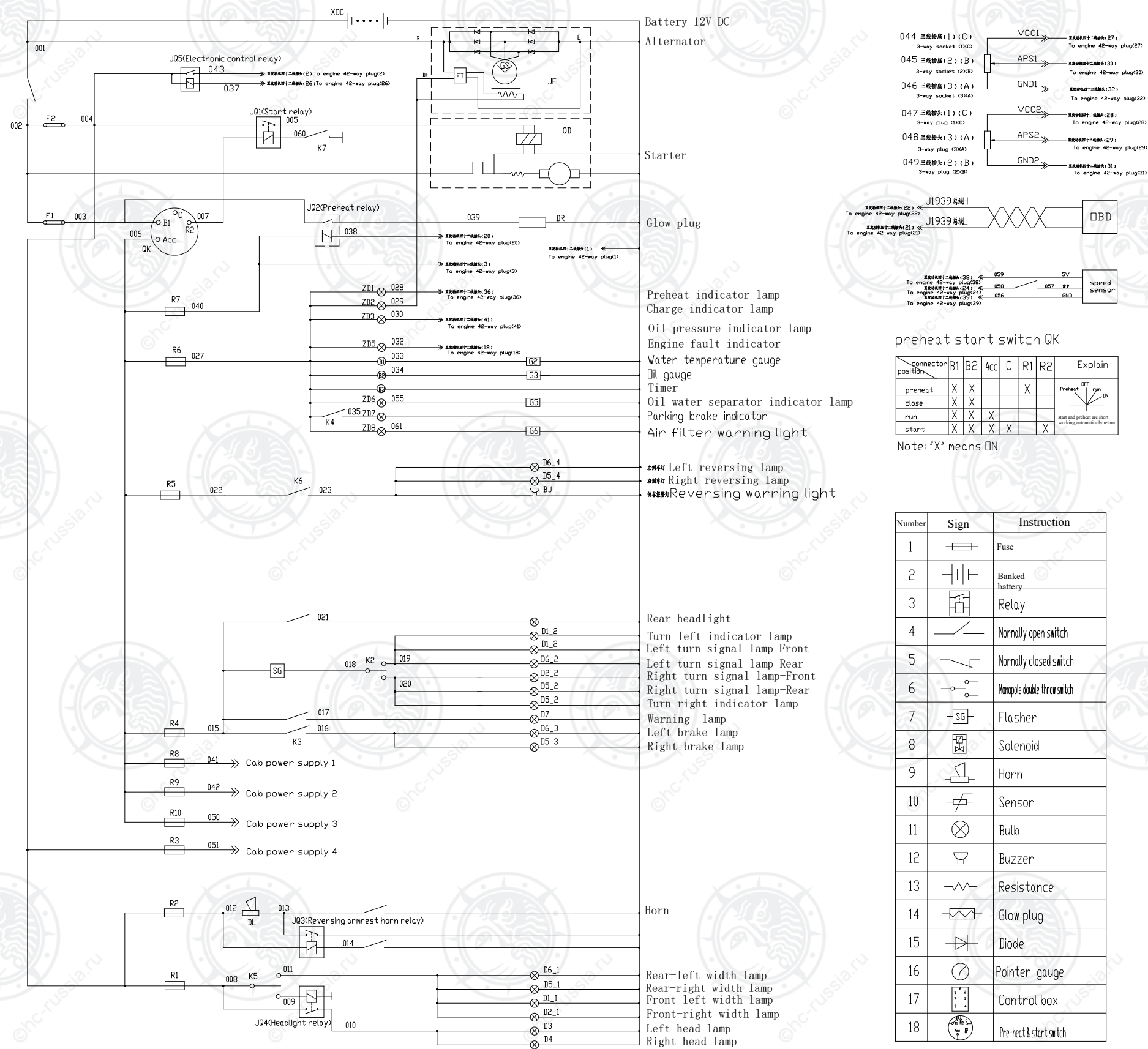


Fig.6-2 CPC40/45-XRG73, CPC50-XXRG73 Electrical system diagram

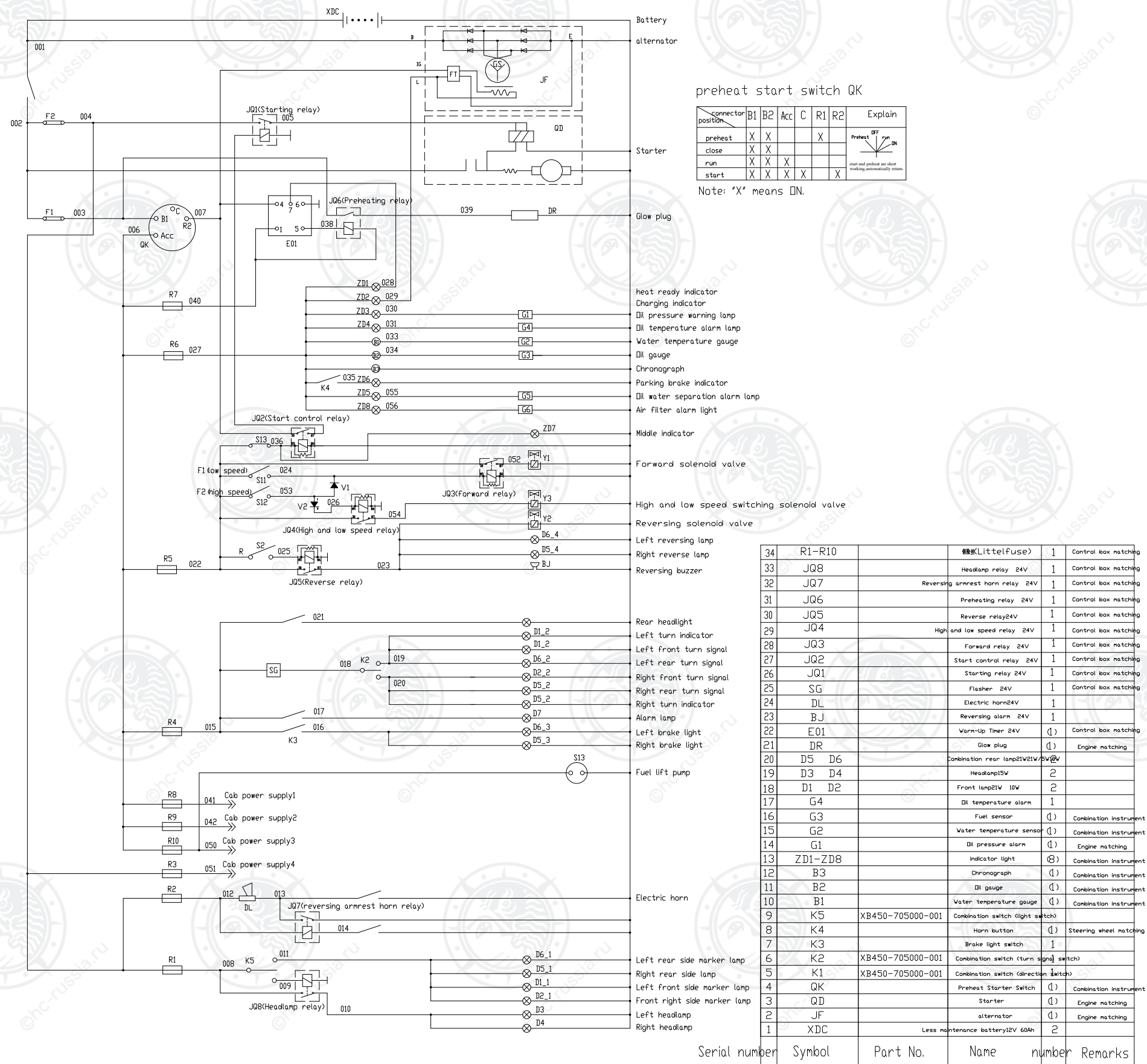


Fig.7 CPCD40/45-XRW76, CPCD50-XRXW76 Electrical system diagram (without OPS)

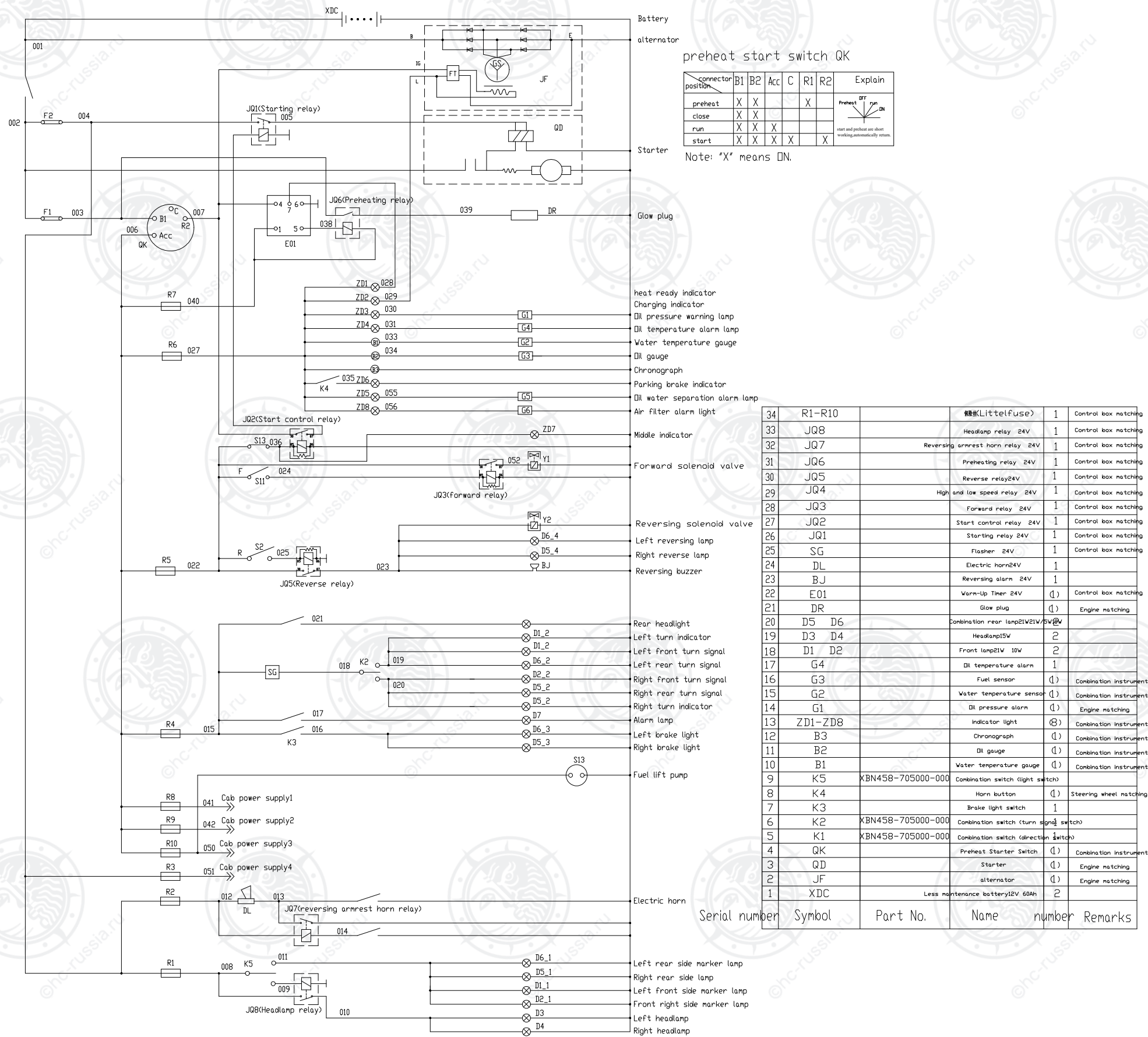


Fig.8 CPCD40/45-XRW76BN, CPCD50-XRXW76BN Electrical system diagram (without OPS)

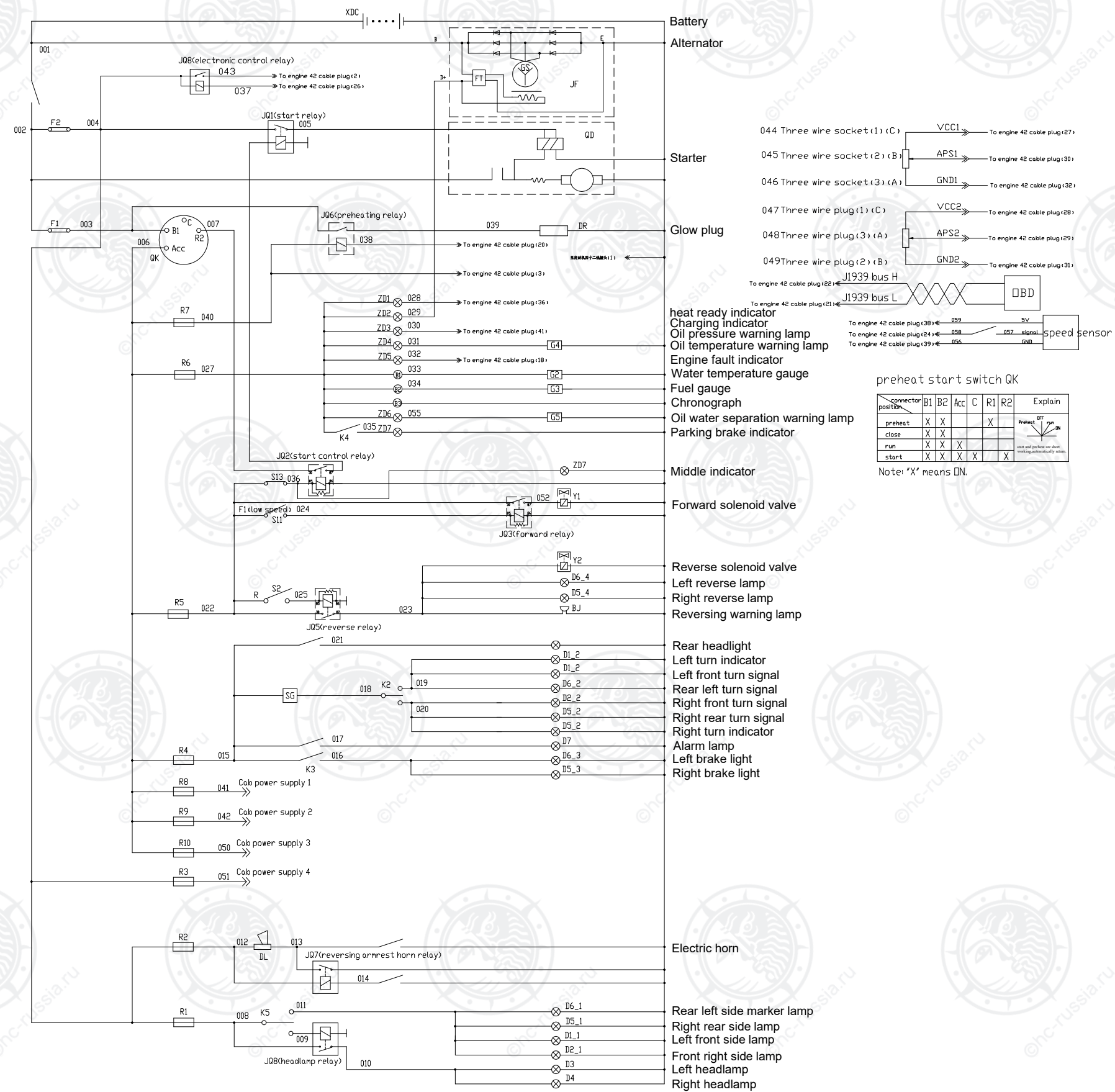
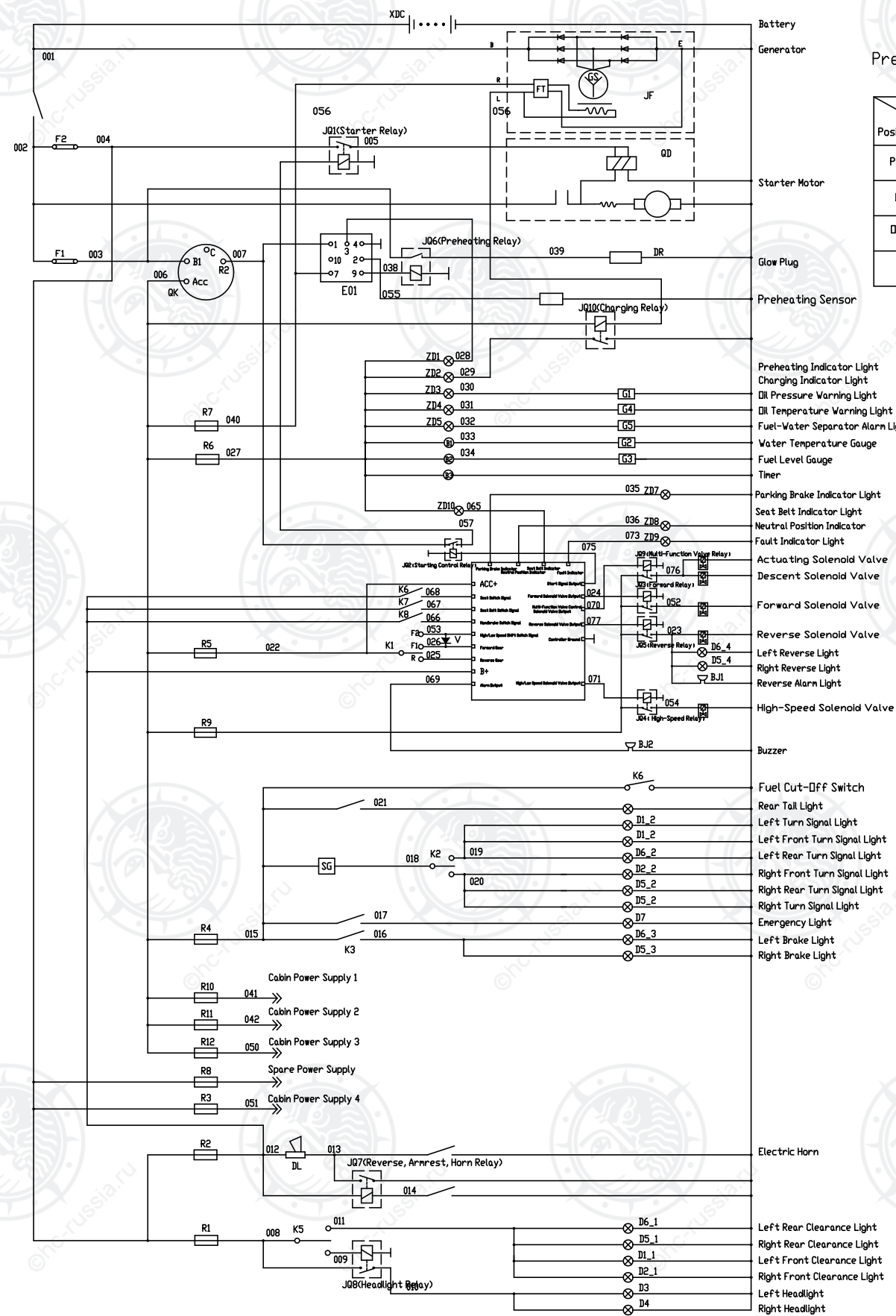


Fig.9 CPCD55-XRXG73BN-S Electrical system diagram



Preheating Start Switch QK

Contact Point	B1	B2	Acc	C	R1	R2	Description
Preheat	X	X			X		
Off	X	X					
Operation	X	X	X				
Start	X	X	X	X		X	

Note: 'X' in the above table indicates conduction.

Fig.10-1 CPCD40/45-XRW19,CPCD50-XRXW19Electrical system diagram (with OPS)

NO.	Symbol	Name	QTY	Remarks
1	XDC	Less maintenance of battery 12V 60Ah	2	
2	JF	generator	-1	Engine matching
3	QD	starter	-1	Engine matching
4	QK	Preheat Starter Switch	-1	Combination instrument matching
5	K1	Combination switch (direction switch)	1	
6	K2	Combination switch (turn signal switch)	1	
7	K3	brake light switch	1	
8	K4	Horn button	-1	Steering wheel matching
9	K5	Combination switch (light switch)		
10	B1	Water temperature gauge 24V	-1	Combination instrument matching
11	B2	Oil gauge 24V	-1	Combination instrument matching
12	B3	Timer 24V	-1	Combination instrument matching
13	ZD1-ZD5	Alarm light 24V 2W	-5	Combination instrument matching
14	G1	Oil pressure alarm	-1	Engine matching
15	G2	Water Temperature Sensor	-1	Combination instrument matching
16	G3	Oil quantity sensor	-1	Combination instrument matching
17	G4	Oil temperature alarm	1	
18	D1 D2	Front small light 21W 10W	2	
19	D3 D4	Front headlight 15W	2	
20	D5 D6	Combination rear light 21W21W/5W10W	2	
21	DR	GLOW PLUG	-1	Engine matching
22	E01	Preheating timer 24V	-1	Control box matching
23	BJ	Reverse alarm 24V	1	
24	DL	Electric horn 24V	1	
25	SG	Flasher 24V	1	Control box matching
26	JQ1	Starting relay 24V	1	Control box matching
27	JQ2	Starting control relay 24V	1	Control box matching
28	JQ3	Forward relay 24V	1	Control box matching
29	JQ4	High and low speed relay 24V	1	Control box matching
30	JQ5	Reverse gear relay 24V	1	Control box matching
31	JQ6	Preheating relay 24V	1	Control box matching
32	JQ7	Reverse armrest horn relay 24V	1	Control box matching
33	JQ8	Headlight relay 24V	1	Control box matching
34	JQ9	Cold start auxiliary relay 24V	1	Control box matching
35	R1-R11	fuse	1	Control box matching

Fig.10-2 CPCD40/45-XRW19,CPCD50-XXRW19Electrical system diagram (with OPS)

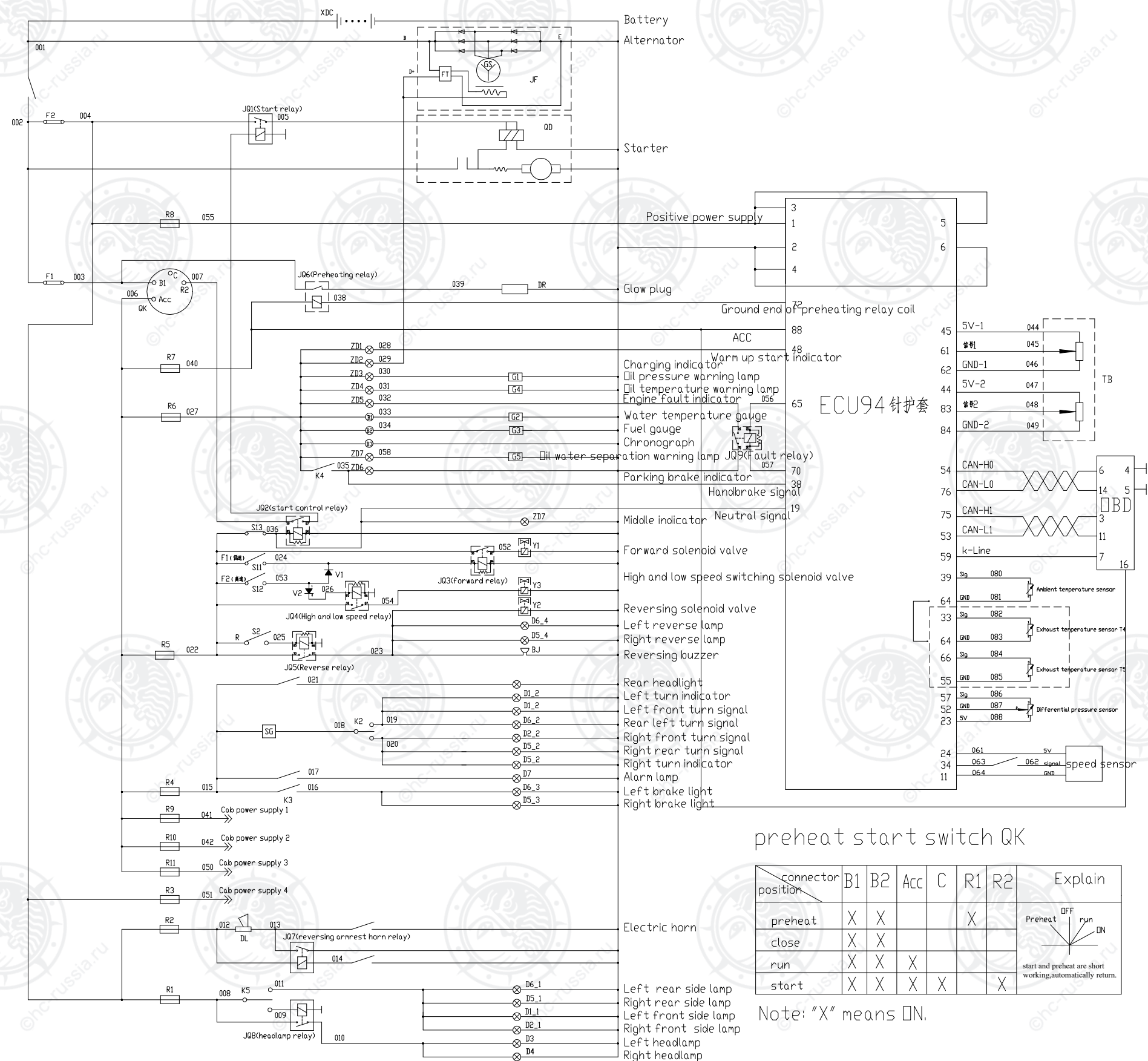


Fig.11 CPCD40/45-XRG82,CPCD50-XRXG82Electrical system diagram

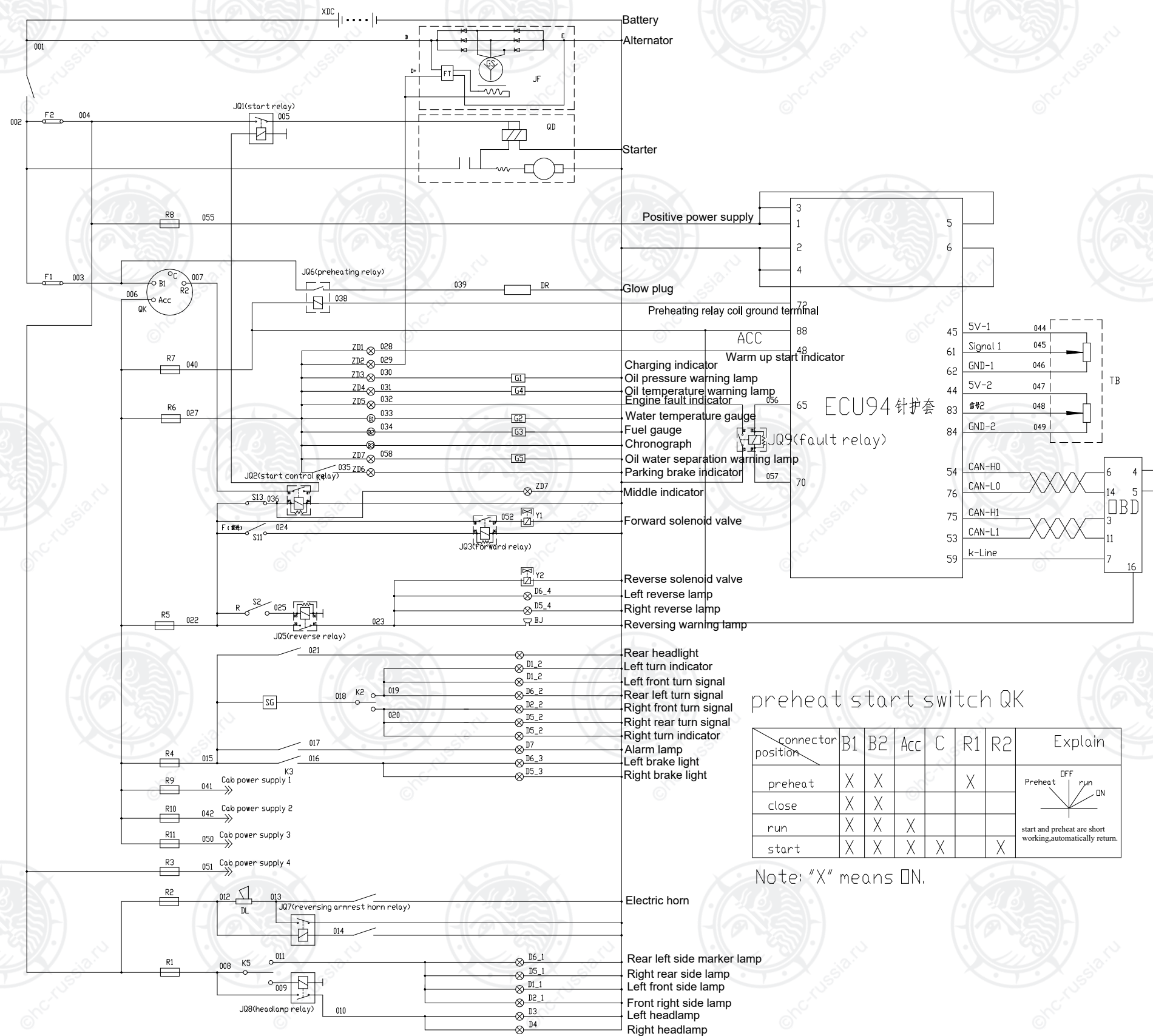


Fig.12 CPCD55-XRXG76BN-S Electrical system diagram

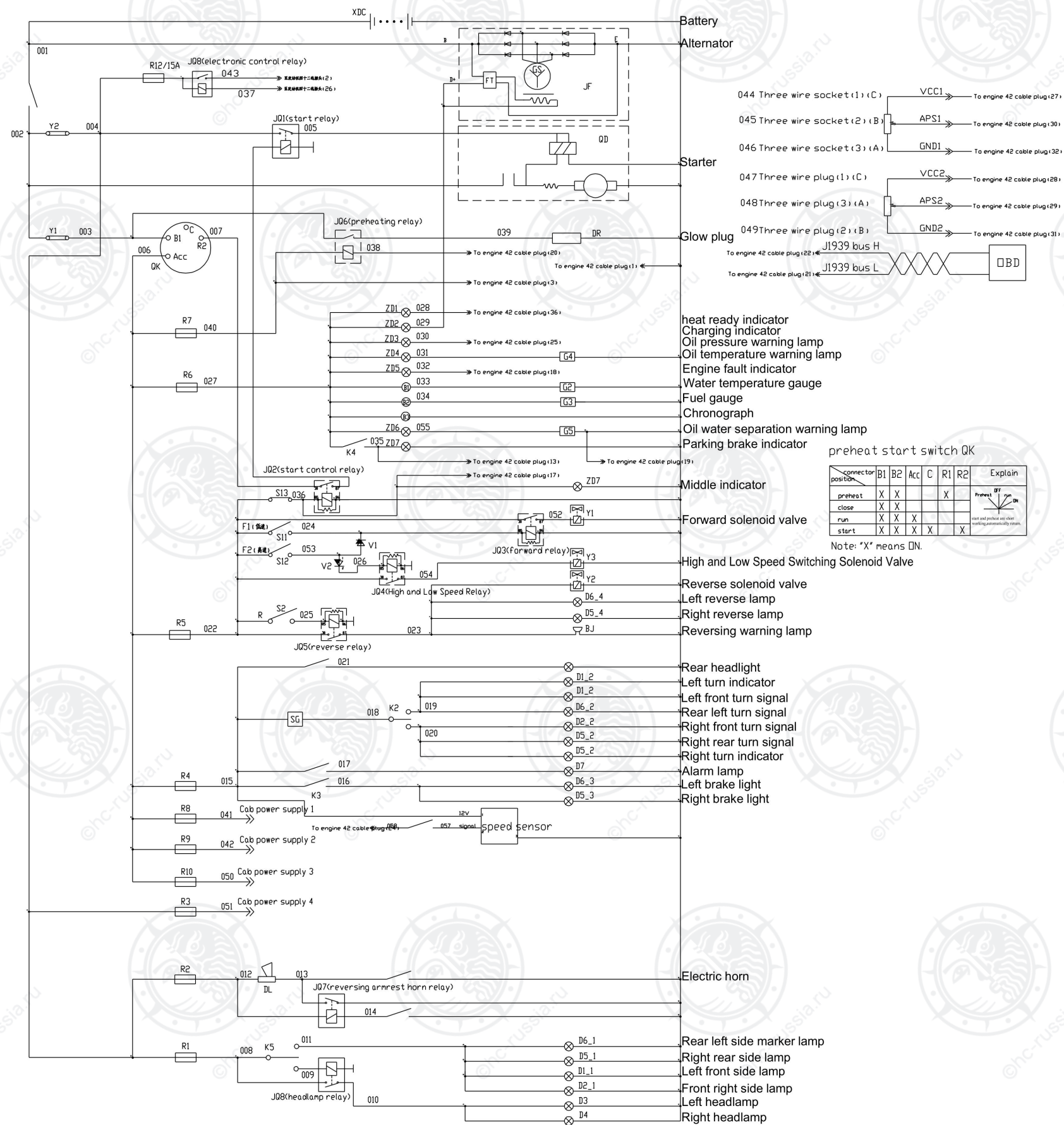


Fig.13 CPCD40/45-XRG93, CPCD50-XRXG93

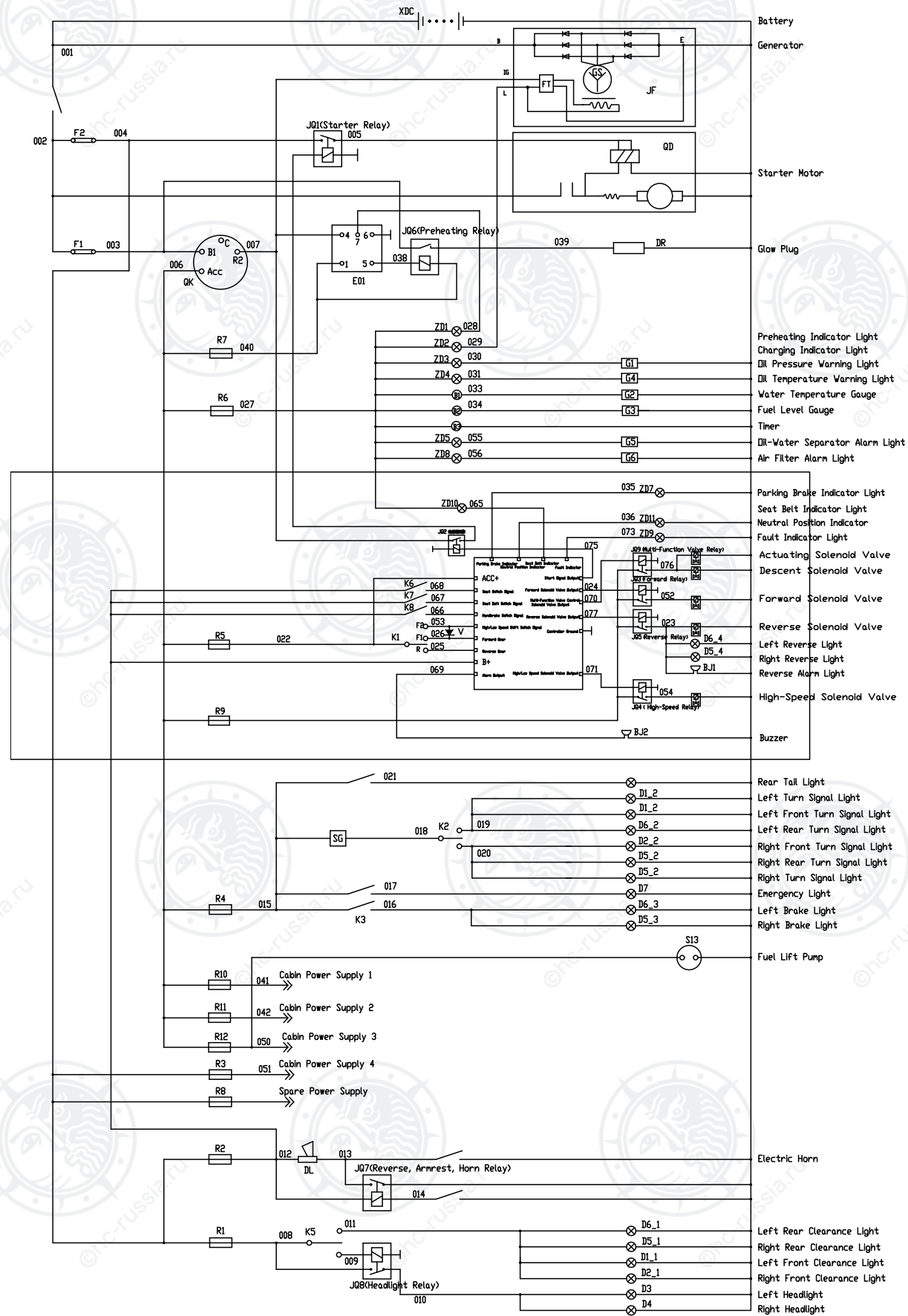
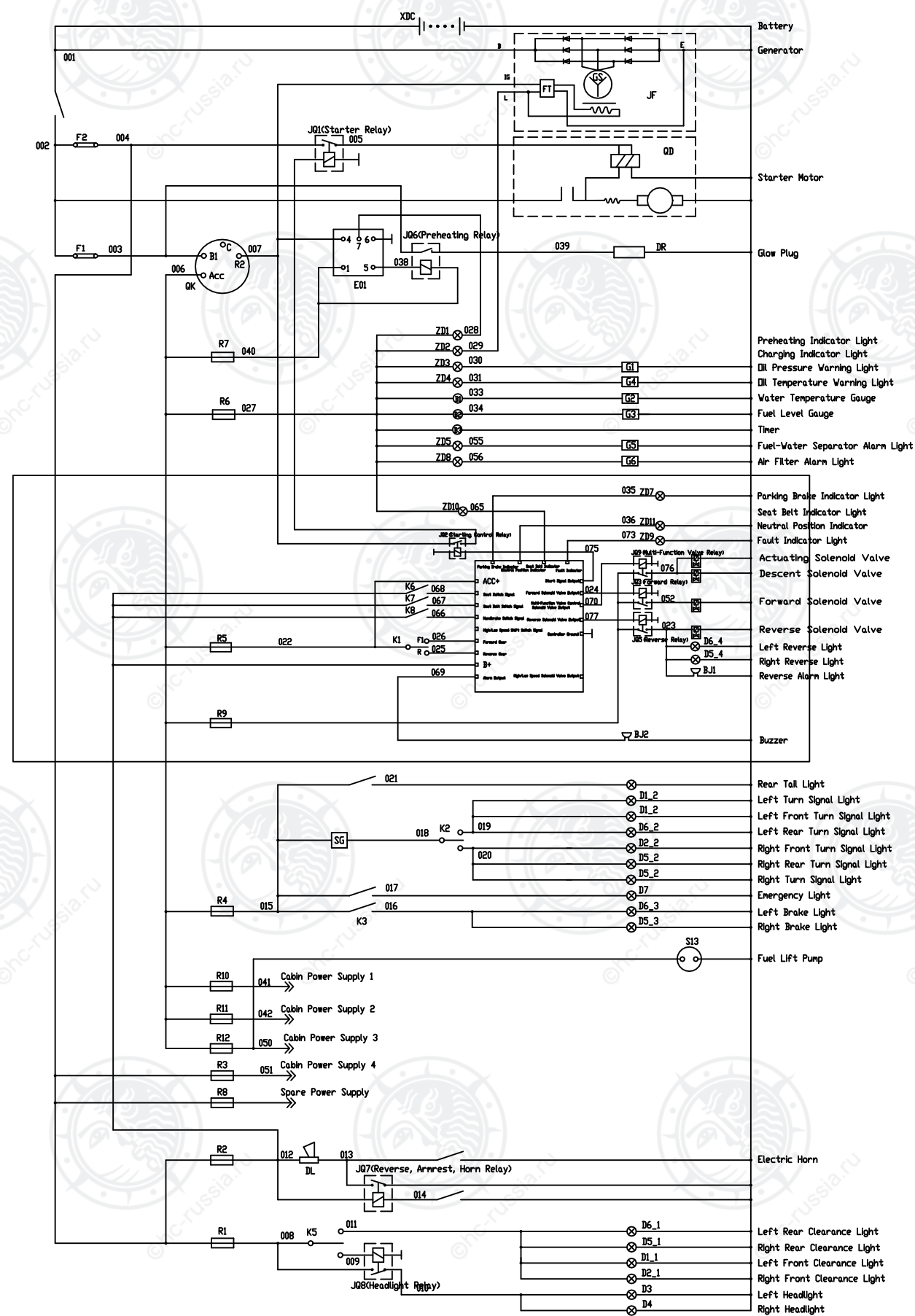


Fig.7 CPCD40/45-XRW76, CPCD50-XRXW76 Electrical system diagram (OPS)



Preheating Start Switch QK

Contact Point Position	B1	B2	Acc	C	R1	R2	Description
Preheat	X	X			X		
Off	X	X					
Operation	X	X	X				
Start	X	X	X	X		X	

Note: "X" in the above table indicates conduction.

Fig.8-1 CPCD40/45-XRW76BN, CPCD50-XRXW76BN Electrical system diagram (OPS)

NO.	Symbol	Name	QTY	Remarks
1	XDC	Less maintenance of battery 12V 60Ah	2	
2	JF	generator	1	Engine matching
3	QD	starter	1	Engine matching
4	QK	Preheat Starter Switch	1	Combination instrument matching
5	K1	Combination switch (direction switch)	1	
6	K2	Combination switch (turn signal switch)	1	
7	K3	brake light switch	1	
8	K4	Horn button	1	Steering wheel matching
9	K5	Combination switch (light switch)	1	
10	B1	water temperature gauge	1	Combination instrument matching
11	B2	fuel gauge	1	Combination instrument matching
12	B3	Chronograph	1	Combination instrument matching
13	ZD1-ZD8	pilot lamp	8	Combination instrument matching
14	G1	Oil pressure alarm	1	Engine matching
15	G2	Water Temperature Sensor	1	Combination instrument matching
16	G3	Oil quantity sensor	1	Combination instrument matching
17	G4	Oil temperature alarm	1	
18	D1 D2	Front small light 21W 10W	2	
19	D3 D4	Front headlight 15W	2	
20	D5 D6	Combination rear light 21W/21W/5W/10W	2	
21	DR	GLOW PLUG	1	Engine matching
22	E01	Preheating timer 24V	1	Control box matching
23	BJ	Reverse alarm 24V	1	
24	DL	Electric horn 24V	1	
25	SG	Flasher 24V	1	Control box matching
26	JQ1	Starting relay 24V	1	Control box matching
27	JQ2	Starting control relay 24V	1	Control box matching
28	JQ3	Forward relay 24V	1	Control box matching
29	JQ4	High and low speed relay 24V	1	Control box matching
30	JQ5	Reverse gear relay 24V	1	Control box matching
31	JQ6	Preheating relay 24V	1	Control box matching
32	JQ7	Reverse armrest horn relay 24V	1	Control box matching
33	JQ8	Headlight relay 24V	1	Control box matching
34	R1-R12	fuse	1	Control box matching

Fig.8-2 CPCD40/45-XRW76BN, CPCD50-XRXW76BN Electrical system diagram (OPS)